JEE Main 2021

(February, March, July & August Attempt)

Instructions

- This question paper contains of 30 Questions of Chemistry, divided into two Sections : **Section A** Objective Type Questions and **Section B** Numerical Type Questions.
- Section A contains 20 questions and all Questions are compulsory (**Marking Scheme :** Correct + 4, Incorrect –1) .
- Section B contains 10 questions out of which only 5 questions are to be attempted (**Marking Scheme :** Correct + 4, Incorrect 0) .

24 FEBRUARY SHIFT I

Section A : Objective Type Questions

1. Which of the following are isostructural pairs ?

A. SO_4^{2-} and CrO_4^{2-}

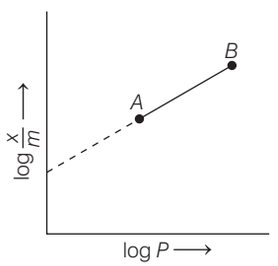
B. $SiCl_4$ and $TiCl_4$

C. NH_3 and NO_3^-

D. BCl_3 and $BrCl_3$

a. A and B only **b.** A and C only
c. B and C only **d.** C and D only

2. In Freundlich adsorption isotherm, slope of *AB* line is



a. n with ($n = 0.1$ to 0.5) **b.** $\log n$ with ($n > 1$)
c. $\log \frac{1}{n}$ with ($n < 1$) **d.** $\frac{1}{n}$ with $\left(\frac{1}{n} = 0 \text{ to } 1\right)$

3. Consider the elements Mg, Al, S, P and Si, the correct increasing order of their first ionisation enthalpy is

a. Al < Mg < Si < S < P **b.** Mg < Al < Si < P < S
c. Mg < Al < Si < S < P **d.** Al < Mg < S < Si < P

4. Which of the following ore is concentrated using group 1 cyanide salt ?

a. Calamine **b.** Malachite
c. Siderite **d.** Sphalerite

5. (A) $HOCl + H_2O_2 \longrightarrow H_3O^+ + Cl^- + O_2$

(B) $I_2 + H_2O_2 + 2OH^- \longrightarrow 2I^- + 2H_2O + O_2$

Choose the correct option.

a. H_2O_2 acts as oxidising agent in equations (A) and (B).
b. H_2O_2 acts as reducing agent in equations (A) and (B).
c. H_2O_2 act as oxidising and reducing agent respectively in equations (A) and (B).
d. H_2O_2 acts as reducing and oxidising agent respectively in equations (A) and (B).

6. Al_2O_3 was leached with alkali to get *X*. The solution of *X* on passing of gas *Y*, forms *Z*. *X*, *Y* and *Z* respectively are

a. $X = Na[Al(OH)_4]$, $Y = SO_2$, $Z = Al_2O_3$
b. $X = Al(OH)_3$, $Y = SO_2$, $Z = Al_2O_3 \cdot xH_2O$
c. $X = Al(OH)_3$, $Y = CO$, $Z = Al_2O_3$
d. $X = Na[Al(OH)_4]$, $Y = CO_2$, $Z = Al_2O_3 \cdot xH_2O$

7. The electrode potential of M^{2+}/M of 3*d*-series elements shows positive value for

a. Fe **b.** Co
c. Zn **d.** Cu

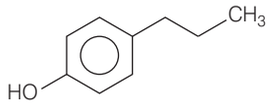
8. The major components in Gun metal are

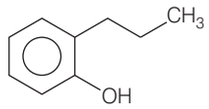
a. Cu, Sn and Zn **b.** Cu, Zn and Ni
c. Cu, Ni and Fe **d.** Al, Cu, Mg and Mn

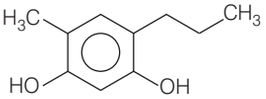
9. The gas released during anaerobic degradation of vegetation may lead to

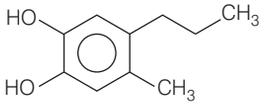
a. acid rain **b.** global warming and cancer
c. corrosion of metals **d.** ozone hole

10. Which of the following compound gives pink colour on reaction with phthalic anhydride in conc. H_2SO_4 followed by treatment with NaOH?

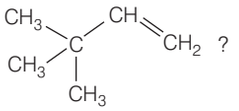
a. 

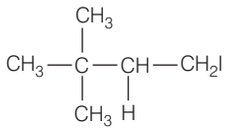
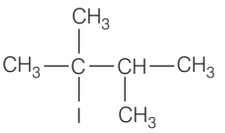
b. 

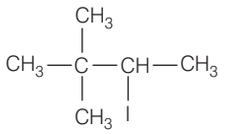
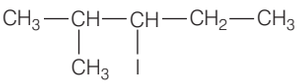
c. 

d. 

11. What is the major product formed by HI on reaction with



a.  **b.** 

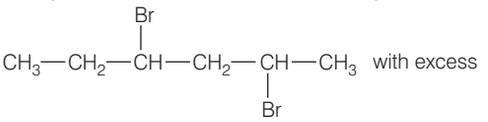
c.  **d.** 

12. Which of the following reagent is used for the following reaction ?

$CH_3CH_2CH_3 \xrightarrow{?} CH_3CH_2CHO$

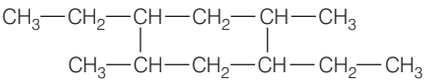
a. Copper at high temperature and pressure
b. Molybdenum oxide
c. Manganese acetate
d. Potassium permanganate

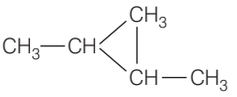
13. The product formed in the first step of the reaction of

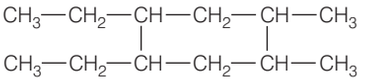


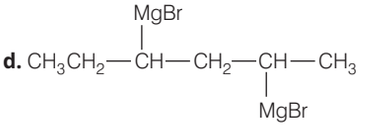
with excess

Mg/Et_2O (Et = C_2H_5) is

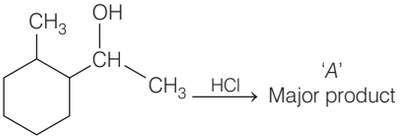
a. 

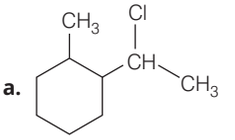
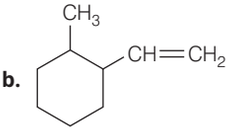
b. 

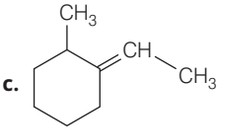
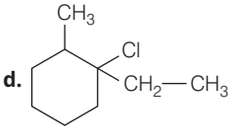
c. 

d. 

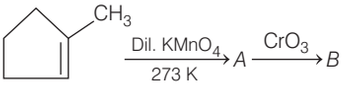
14. What is the final product (major) '*A*' in the given reaction ?

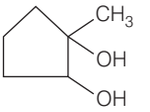
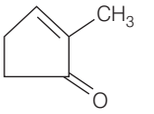


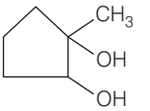
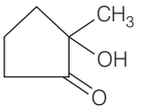
a.  **b.** 

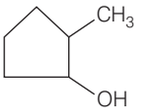
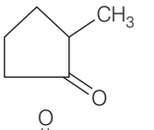
c.  **d.** 

15. Identify products *A* and *B*.



a. A :  B : 

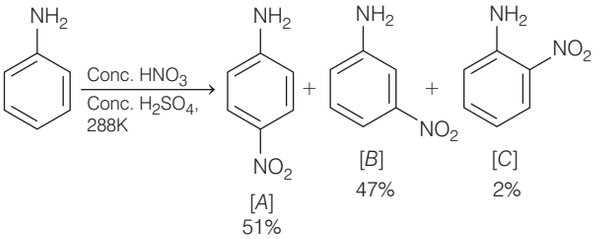
b. A :  B : 

c. A :  B : 

d. A : $OHC—CH_2CH_2CH_2—\overset{O}{\overset{\|}{C}}—CH_3$

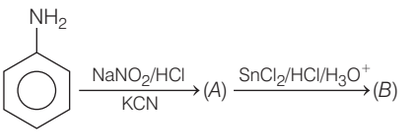
B : $HOOC—CH_2CH_2CH_2—\overset{O}{\overset{\|}{C}}—CH_3$

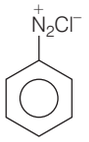
16. In the following reaction the reason why *meta*-nitro product also formed is

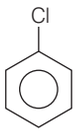


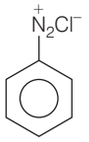
a. $—NH_2$ group is highly *meta*-directive
b. $—NO_2$ substitution always takes place at *meta*-position
c. Formation of anilinium ion
d. Low temperature

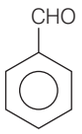
17. '*A*' and '*B*' in the following reaction are

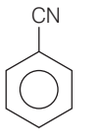


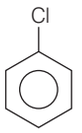
a. (A) 

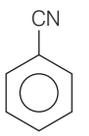
(B) 

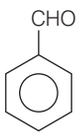
b. (A) 

(B) 

c. (A) 

(B) 

d. (A) 

(B) 

18. Match List-I with List-II.

	List-I (Monomer Unit)		**List-II** (Polymer)
A.	Caprolactum	1.	Natural rubber
B.	2-chloro buta-1,3-diene	2.	Buna-N
C.	Isoprene	3.	Nylon-6
D.	Acrylonitrile	4.	Neoprene

Choose the correct answer from the options given below

	A	B	C	D		A	B	C	D
a.	1	2	3	4	**b.**	4	3	2	1
c.	2	1	4	3	**d.**	3	4	1	2

19. Out of the following, which type of interaction is responsible for the stabilisation of α-helix structure of proteins ?

a. van der Waals' forces **b.** Covalent bonding
c. Ionic bonding **d.** Hydrogen bonding

20. Given below are two statements.

Statement I Colourless cupric metaborate is reduced to cuprous metaborate in a luminous flame.

Statement II Cuprous metaborate is obtained by heating boric anhydride and copper sulphate in a non-luminous flame.

In the light of the above statements, choose the most appropriate answer from the options given below.

a. Both statement I and statement II are true.
b. Both statement I and statement II are false.
c. Statement I is true but statement II is false.
d. Statement I is false but statement II is true.

Section B : Numerical Type Questions

21. 4.5 g of compound *A* (MW = 90) was used to make 250 mL of its aqueous solution. The molarity of the solution in *M* is $x \times 10^{-1}$. The value of *x* is ..... . (Rounded off to the nearest integer).

22. The coordination number of an atom in a body centered cubic structure is ..... .

[Assume that the lattice is made up of atoms.]

23. A proton and a Li^{3+} nucleus are accelerated by the same potential. If λ_{Li} and λ_P denote the de-Broglie wavelengths of Li^{3+} and proton respectively, then the value of $\frac{\lambda Li}{\lambda_P}$ is $x \times 10^{-1}$. The value of *x* is ..... .

(Rounded off to the nearest integer)

(Mass of Li^{3+} = 8.3 mass of proton)

24. For the reaction, $A(g) \longrightarrow B(g)$, the value of the equilibrium constant at 300 K and 1 atm is equal to 100.0. The value of $\Delta_r G$ for the reaction at 300 K and 1 atm in J mol^{-1} is $-xR$, where *x* is ..... . (Rounded off to the nearest integer)

($R = 8.31$ J mol^{-1} K^{-1} and ln10 = 2.3)

25. When 9.45 g of $ClCH_2COOH$ is added to 500 mL of water, its freezing point drops by 0.5°C. The dissociation constant of $ClCH_2COOH$ is $x \times 10^{-3}$. The value of *x* is ..... .

(Rounded off to the nearest integer)

[$K_{f(H_2O)} = 1.86$ K kg mol^{-1}]

26. At 1990 K and 1 atm pressure, there are equal number of Cl_2 molecules and Cl atoms in the reaction mixture. The value of k_p for the reaction $Cl_2(g) \rightleftharpoons 2Cl(g)$ under the above conditions is $x \times 10^{-1}$. The value of *x* is ..... .

(Rounded off to the nearest integer)

27. The reaction of sulphur in alkaline medium is given below

$$S_8(s) + aOH^-(aq) \longrightarrow bS^{2-}(aq) + cS_2O_3^{2-}(aq) + dH_2O(l)$$

The value of '*a*' is ..... . (Integer answer)

28. Gaseous cyclobutene isomerises to butadiene in a first order process which has a '*k*' value of 3.3×10^{-4} s^{-1} at 153°C. The time in minutes it takes for the isomerisation to proceed 40 % to completion at this temperature is ..... .

(Rounded off to the nearest integer)

29. Number of amphoteric compounds among the following is ..... .

a. BeO **b.** BaO **c.** $Be(OH)_2$ **d.** $Sr(OH)_2$

30. The stepwise formation of $[Cu(NH_3)_4]^{2+}$ is given below

$$Cu^{2+} + NH_3 \overset{K_1}{\rightleftharpoons} [Cu(NH_3)]^{2+}$$

$$[Cu(NH_3)]^{2+} + NH_3 \overset{K_2}{\rightleftharpoons} [Cu(NH_3)_2]^{2+}$$

$$[Cu(NH_3)_2]^{2+} + NH_3 \overset{K_3}{\rightleftharpoons} [Cu(NH_3)]^{2+}$$

$$[Cu(NH_3)_3]^{2+} + NH_3 \overset{K_4}{\rightleftharpoons} [Cu(NH_3)_4]^{2+}$$

The value of stability constants K_1, K_2, K_3 and K_4 are 10^4, 1.58×10^3, 5×10^2 and 10^2 respectively. The overall equilibrium constants for dissociation of $[Cu(NH_3)]^{2+}$ is $x \times 10^{-12}$. The value of *x* is ..... . (Rounded off to the nearest integer)

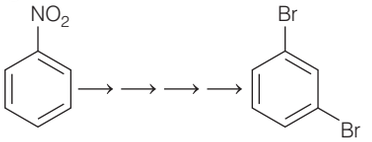
Answers

1. *(a)*	2. *(d)*	3. *(a)*	4. *(d)*	5. *(b)*	6. *(d)*	7. *(d)*	8. *(a)*	9. *(b)*	10. *(b)*
11. *(b)*	12. *(b)*	13. *(d)*	14. *(d)*	15. *(d)*	16. *(c)*	17. *(d)*	18. *(d)*	19. *(d)*	20. *(b)*
21. *(2)*	22. *(8)*	23. *(2)*	24. *(1380)*	25. *(34.4)*	26. *(5)*	27. *(12)*	28. *(26)*	29. *(2)*	30. *(1.26)*

24 FEBRUARY SHIFT II

Section A : Objective Type Questions

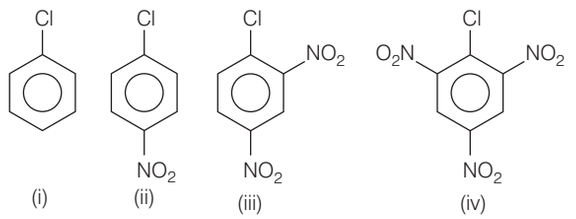
1. What is the correct sequence of reagents used for converting nitrobenzene into *m*-dibromobenzene?



a. $\xrightarrow{NaNO_2}$ / $\xrightarrow{HCl}$ / $\xrightarrow{KBr}$ / $\xrightarrow{H^+}$
b. $\xrightarrow{Br_2/Fe}$ / $\xrightarrow{Sn/HCl}$ / $\xrightarrow{NaNO_2/HCl}$ / $\xrightarrow{CuBr/HBr}$
c. $\xrightarrow{Sn/HCl}$ / $\xrightarrow{KBr}$ / $\xrightarrow{Br_2}$ / $\xrightarrow{H^+}$
d. $\xrightarrow{Sn/HCl}$ / $\xrightarrow{Br_2}$ / $\xrightarrow{NaNO_2}$ / $\xrightarrow{NaBr}$

2. Most suitable salt which can be used for efficient clotting of blood will be
a. $NaHCO_3$ **b.** $FeSO_4$
c. $Mg(HCO_3)_2$ **d.** $FeCl_3$

3. The correct order of the following compounds showing increasing tendency towards nucleophilic substitution reaction is



a. (iv) < (iii) < (ii) < (i) **b.** (iv) < (i) < (ii) < (iii)
c. (iv) < (i) < (iii) < (ii) **d.** (i) < (ii) < (iii) < (iv)

4. According to Bohr's atomic theory,
I. kinetic energy of electron is $\propto \frac{Z^2}{n^2}$
II. the product of velocity (v) of electron and principal quantum number (n), 'vn' $\propto Z^2$.
III. frequency of revolution of electron in an orbit is $\propto \frac{Z^3}{n^3}$
IV. coulombic force of attraction on the electron is $\propto \frac{Z^3}{n^4}$

Choose the most appropriate answer from the options given below.
a. Only III
b. Only I
c. I, III and IV
d. I and IV

5. Match List-I with List-II.

	List-I	List-II
A.	$R-\overset{O}{\overset{\|\|}{C}}-Cl \longrightarrow R-CHO$	1. Br_2 / NaOH
B.	$R-CH_2-COOH \longrightarrow R-\underset{Cl}{\underset{\|}{CH}}-COOH$	2. H_2 / Pd - $BaSO_4$
C.	$R-\overset{O}{\overset{\|\|}{C}}-NH_2 \longrightarrow R-NH_2$	3. Zn(Hg) / Conc.HCl
D.	$R-\overset{O}{\overset{\|\|}{C}}-CH_3 \longrightarrow R-CH_2-CH_3$	4. Cl_2 / Red P, H_2O

Choose the correct answer from the options given below.

	A	B	C	D
a.	2	1	4	3
b.	3	4	1	2
c.	2	4	1	3
d.	3	1	4	2

6. The calculated magnetic moments (spin only value) for species $[FeCl_4]^{2-}$, $[Co(C_2O_4)_3]^{3-}$ and MnO_4^{2-} respectively are
a. 5.82, 0 and 0 BM
b. 4.90, 0 and 1.73 BM
c. 5.92, 4.90 and 0 BM
d. 4.90, 0 and 2.83 BM

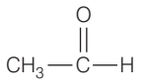
7. Match List-I with List-II.

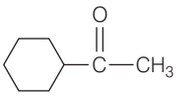
	List-I (Salt)		**List-II** (Flame colour wavelength)
A.	LiCl	1.	455.5 nm
B.	NaCl	2.	670.8 nm
C.	RbCl	3.	780.0 nm
D.	CsCl	4.	589.2 nm

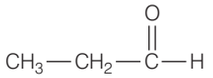
Choose the correct answer from the options given below.

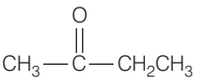
	A	B	C	D
a.	4	2	3	1
b.	2	1	4	3
c.	1	4	2	3
d.	2	4	3	1

8. Which one of the following carbonyl compounds cannot be prepared by addition of water on an alkyne in the presence of $HgSO_4$ and H_2SO_4?

a. 

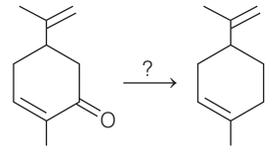
b. 

c. 

d. 

9. In polymer buna-S: 'S' stands for

a. sulphonation **b.** strength
c. sulphur **d.** styrene

10. 

Which of the following reagent is suitable for the preparation of the product in the above reaction?

a. $NaBH_4$ **b.** $NH_2—NH_2 / C_2H_5\overset{\ominus}{O}\overset{\oplus}{Na}$
c. Ni / H_2 **d.** Red P + Cl_2

11. Match List-I and List-II.

	List-I		List-II
A.	Valium	1.	Antifertility drug
B.	Morphine	2.	Pernicious anaemia
C.	Norethindrone	3.	Analgesic
D.	Vitamin B_{12}	4.	Tranquiliser

Choose the correct answer from the option given below.

	A	B	C	D
a.	4	3	2	1
b.	4	3	1	2
c.	2	4	3	1
d.	1	3	4	2

12. Match List-I with List-II.

	List I (Metal)		List II (Ores)
A.	Aluminium	1.	Siderite
B.	Iron	2.	Calamine
C.	Copper	3.	Kaolinite
D.	Zinc	4.	Malachite

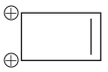
Choose the correct answer from the options given below.

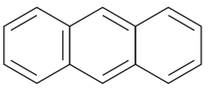
	A	B	C	D
a.	4	3	2	1
b.	2	4	1	3
c.	1	2	3	4
d.	3	1	4	2

13. Which one of the following compounds is non-aromatic?

a. 

b. 

c. 

d. 

14. What is the correct order of the following elements with respect to their density ?

a. Cr < Zn < Co < Cu < Fe **b.** Zn < Cu < Co < Fe < Cr
c. Zn < Cr < Fe < Co < Cu **d.** Cr < Fe < Co < Cu < Zn

15. Given below are two statements.

Statement I The value of the parameter "Biochemical Oxygen Demand (BOD)" is important for survival of aquatic life.

Statement II The optimum value of BOD is 6.5 ppm.

In the light of the above statements, choose the most appropriate answer from the options given below.

a. Statement I is false but statement II is true.
b. Both statements are true.
c. Statement I is true but statement II is false.
d. Both statements are false.

16. The incorrect statement among the following is

a. $VOSO_4$ is a reducing agent.
b. Cr_2O_3 is an amphoteric oxide.
c. RuO_4 is an oxidising agent.
d. Red colour of ruby is due to the presence of Co^{3+}.

17. The correct shape and I—I—I bond angles respectively in I_3^-, ion are

a. distorted trigonal planar, 135° and 90°
b. T-shaped, 180° and 90°
c. Trigonal planar, 120°
d. Linear, 180°

18. Given below are two statements.

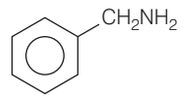
One is labelled as Assertion A and the other is labelled as Reason R.

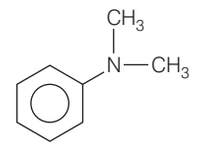
Assertion A Hydrogen is the most abundant element in the universe, but it is not the most abundant gas in the troposphere.

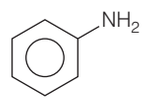
Reason R Hydrogen is the lightest element. In the light of the above statements, choose the correct answer from the options given below.

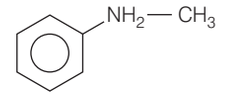
a. A is true but R is false.
b. Both A and R are true and R is the correct explanation of A.
c. A is false but R is true.
d. Both A and R are true but R is not the correct explanation of A.

19. The diazonium salt of which of the following compounds will form a coloured dye on reaction with β-naphthol in NaOH ?

a. 

b. 

c. 

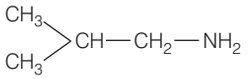
d. 

20. The correct set from the following in which both pairs are in correct order of melting point is

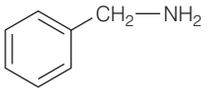
a. LiF > LiCl, MgO > NaCl **b.** LiCl > LiF, NaCl > MgO
c. LiF > LiCl, NaCl > MgO **d.** LiCl > LiF, MgO > NaCl

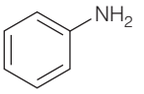
Section B : Numerical Type Questions

21. The total number of amines among the following which can be synthesised by Gabriel synthesis is ..... .

a. 

b. $CH_3CH_2NH_2$

c. 

d. 

22. Among the following allotropic forms of sulphur, the number of allotropic forms, which will show paramagnetism is ..... .

a. α-sulphur **b.** β-sulphur **c.** S_2-form

23. The formula of a gaseous hydrocarbon, which requires 6 times of its own volume of O_2 for complete oxidation and produces 4 times its own volume of CO_2 is C_xH_y. The value of y is ..... .

24. The volume occupied by 4.75 g of acetylene gas at 50°C and 740 mm Hg pressure is .....L (Rounded off to the nearest integer).

[Given, $R = 0.0826$ L atm K^{-1} mol^{-1}]

25. C_6H_6 freezes at 5.5°C. The temperature at which a solution 10 g of C_4H_{10} in 200 g of C_6H_6 freeze is .....°C. (The molal freezing point depression constant of C_6H_6 is 5.12°C/m.)

26. The magnitude of the change in oxidising power of the MnO_4^- / Mn^{2+} couple is $x \times 10^{-4}$ V, if the H^+ concentration is decreased from 1 M to 10^{-4} M at 25°C. (Assume concentration of MnO_4^- and Mn^{2+} to be same on change in H^+ concentration). The value of x is ..... (Rounded off to the nearest integer).

$\left[\text{Given, } \frac{2.303\,RT}{F} = 0.059\right]$

27. The solubility product of PbI_2 is 8.0×10^{-9}. The solubility of lead iodide in 0.1 molar solution of lead nitrate is $x \times 10^{-6}$ mol/L. The value of x is ..... (Rounded off to the nearest integer).

[Given, : $\sqrt{2} = 1.41$]

28. Sucrose hydrolyses in acid solution into glucose and fructose following first order rate law with a half-life of 3.33 h at 25°C. After 9 h, the fraction of sucrose remaining is f. The value of $\log_{10}(1/f)$ is ..... $\times 10^{-2}$ (Rounded off to the nearest integer).

[Assume, ln 10 = 2.303, ln 2 = 0.693]

29. 1.86 g of aniline completely reacts to form acetanilide. 10% of the product is lost during purification. Amount of acetanilide obtained after purification (in g) is ..... $\times 10^{-2}$.

30. Assuming ideal behaviour, the magnitude of log K for the following reaction at 25ºC is $x \times 10^{-1}$. The value of x is ..... (Integer answer)

$$3HC \equiv CH(g) \rightleftharpoons C_6H_6(l)$$

[Given, $\Delta_f G^\circ(HC \equiv CH) = -2.04 \times 10^5$ J mol^{-1}, $\Delta_f G^\circ(C_6H_6) = -1.24 \times 10^5$ J mol^{-1}, $R = 8.314$ J K^{-1} mol^{-1}]

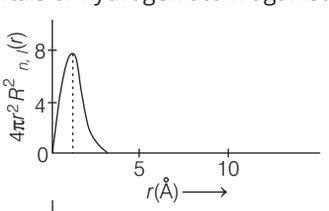
Answers

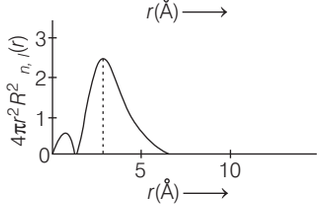
1. *(b)*	2. *(d)*	3. *(d)*	4. *(d)*	5. *(c)*	6. *(b)*	7. *(d)*	8. *(c)*	9. *(d)*	10. *(b)*
11. *(b)*	12. *(d)*	13. *(a)*	14. *(c)*	15. *(c)*	16. *(d)*	17. *(d)*	18. *(b)*	19. *(c)*	20. *(a)*
21. *(3)*	22. *(1)*	23. *(8)*	24. *(5)*	25. *(1)*	26. *(3776)*	27. *(141)*	28. *(81)*	29. *(243)*	30. *(855)*

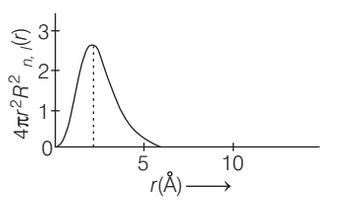
25 FEBRUARY SHIFT I

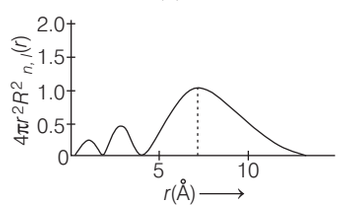
Section A : Objective Type Questions

1. The plots of radial distribution functions for various orbitals of hydrogen atom against 'r' are given below.

(A) 

(B) 

(C) 

(D) 

The correct plot for 3s–orbital is

a. (A) **b.** (B) **c.** (C) **d.** (D)

2. According to molecular orbital theory, the species among the following that does not exist is

a. O_2^{2-} **b.** He_2^- **c.** Be_2 **d.** He_2^+

3. The solubility of AgCN in a buffer solution of pH = 3 is x. The value of x is..... .

[Assume : No cyano complex is formed; $K_{sp}(AgCN) = 2.2 \times 10^{-16}$ and $K_a(HCN) = 6.2 \times 10^{-10}$]

a. 0.625×10^{-6} **b.** 1.6×10^{-6}
c. 2.2×10^{-16} **d.** 1.9×10^{-5}

4. In Freundlich adsorption isotherm at moderate pressure, the extent of adsorption $\left(\frac{x}{m}\right)$ is directly proportional to p^x. The value of x is

a. 1 **b.** zero **c.** ∞ **d.** $1/n$

5. Ellingham diagram is a graphical representation of

a. ΔG *vs* T **b.** ΔH *vs* T
c. ΔG *vs* p **d.** $(\Delta G - T\Delta S)$ *vs* T

6. Which of the following equation depicts the oxidising nature of H_2O_2?

a. $KIO_4 + H_2O_2 \longrightarrow KIO_3 + H_2O + O_2$
b. $I_2 + H_2O_2 + 2OH^- \longrightarrow 2I^- + 2H_2O + O_2$
c. $2I^- + H_2O_2 + 2H^+ \longrightarrow I_2 + 2H_2O$
d. $Cl_2 + H_2O_2 \longrightarrow 2HCl + O_2$

7. The correct statement about B_2H_6 is

(a) all B—H—B angles are of 120°
(b) the two B—H—B bonds are not of same length
(c) terminal B—H bonds have less *p*-character when compared to bridging bonds
(d) Its fragment, BH_3, behaves as a Lewis base

8. Given below are two statements:

Statement I CeO_2 can be used for oxidation of aldehydes and ketones.

Statement II Aqueous solution of $EuSO_4$ is a strong reducing agent.

In the light of the above statements, choose the correct answer from the options given below.

(a) Both statement I and statement II are true.
(b) Both statement I and statement II are false.
(c) Statement I is true but statement II is false.
(d) Statement I is false but statement II is true.

9. In which of the following pairs, the outer most electronic configuration will be the same?

a. V^{2+} and Cr^+ **b.** Cr^+ and Mn^{2+}
c. Ni^{2+} and Cu^+ **d.** Fe^{2+} and Co^+

10. The hybridisation and magnetic nature of $[Mn(CN)_6]^{4-}$ and $[Fe(CN)_6]^{3-}$, respectively are

a. d^2sp^3 and paramagnetic **b.** sp^3d^2 and diamagnetic
c. d^2sp^3 and diamagnetic **d.** sp^3d^2 and paramagnetic

11. Given below are two statements:

Statement I An allotrope of oxygen is an important intermediate in the formation of reducing smog.

Statement II Gases such as oxides of nitrogen and sulphur present in troposphere contribute to the formation of photochemical smog.

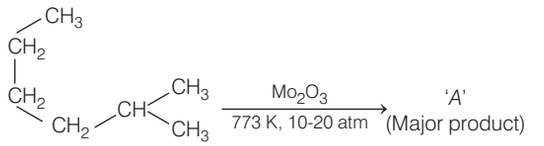
In the light of the above statements, choose the correct answer from the options given below.

(a) Both statement I and statement II are true.
(b) Both statement I and statement II are false.
(c) Statement I is true but statement II is false.
(d) Statement I is false but statement II is true.

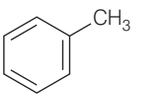
12. Complete combustion of 1.80 g of an oxygen containing compound ($C_xH_yO_z$) gave 2.64 g of CO_2 and 1.08 g of H_2O. The percentage of oxygen in the organic compound is

a. 50.33 **b.** 53.33
c. 63.53 **d.** 51.63

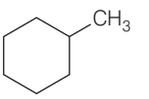
13. Identify *A* in the given chemical reaction.



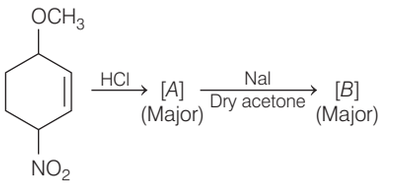
a. 

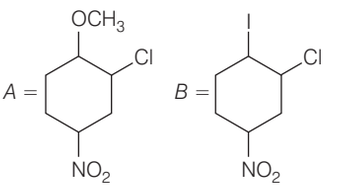
b. 

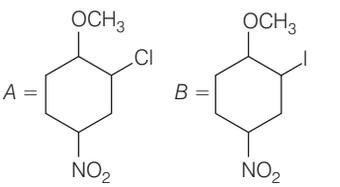
c. 

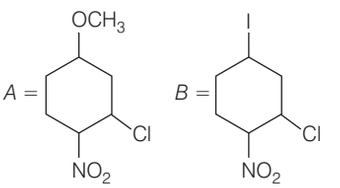
d. 

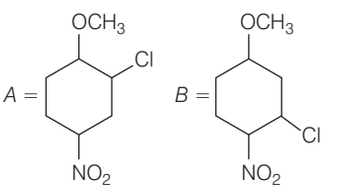
14. Identify *A* and *B* in the chemical reaction.



a. 

b. 

c. 

d. 

15. The major product of the following chemical reaction is

$$CH_3CH_2CN \xrightarrow[\text{(iii) Pd/BaSO}_4\text{, H}_2]{\text{(i) H}_3\text{O}^+\text{, }\Delta \text{ (ii) SOCl}_2} ?$$

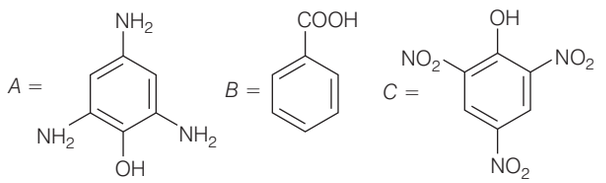
a. $CH_3CH_2CH_2OH$ **b.** $(CH_3CH_2CO)_2O$
c. $CH_3CH_2CH_3$ **d.** CH_3CH_2CHO

16. Which one of the following reactions will not form acetaldehyde?

a. $CH_2{=}CH_2 + O_2 \xrightarrow[H_2O]{\text{Pd (II)/ Cu (II)}}$ **b.** $CH_3CH_2OH \xrightarrow{CrO_3\text{-}H_2SO_4}$

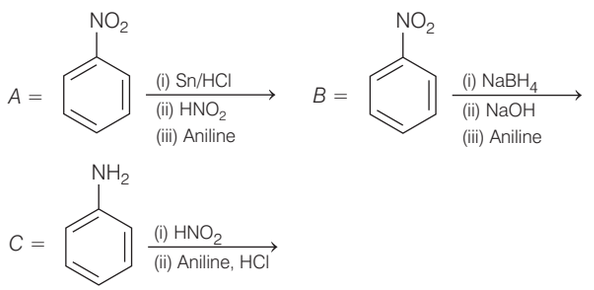
c. $CH_3CN \xrightarrow[\text{(ii) } H_2O]{\text{(i) DIBAL -H}}$ **d.** $CH_3CH_2OH \xrightarrow[573\text{ K}]{\text{Cu}}$

17. Compound(s) which will liberate carbon dioxide with sodium bicarbonate solution is/are



a. *A* and *B* only **b.** *C* only
c. *B* and *C* only **d.** *B* only

18. Which of the following reaction(s) will not give *p*-aminoazobenzene?



a. *A* only **b.** *C* only **c.** *B* only **d.** *A* and *B*

19. Which statement is correct?

a. Buna-N is a natural polymer.
b. Buna-S is a synthetic and linear thermosetting polymer.
c. Neoprene is an addition copolymer used in plastic bucket manufacturing.
d. Synthesis of buna-S needs nascent oxygen.

20. Which of the glycosidic linkage between galactose and glucose is present in lactose?

a. C-1 of galactose and C-4 of glucose
b. C-1 of galactose and C-6 of glucose
c. C-1 of glucose and C-4 of galactose
d. C-1 of glucose and C-6 of galactose

Section B : Numerical Type Questions

21. 0.4 g mixture of NaOH, Na_2CO_3 and some inert impurities was first titrated with N / 10 HCl using phenolphthalein as an indicator, 17.5 mL of HCl was required at the end point. After this methyl orange was added and titrated. 1.5 mL of same HCl was required for the next end point. The weight percentage of Na_2CO_3 in the mixture is ..... (Rounded off to the nearest integer).

22. A car tyre is filled with nitrogen gas at 35 psi at 27°C. It will burst if pressure exceeds 40 psi. The temperature in °C at which the car tyre will burst is ..... (Rounded-off to the nearest integer).

23. The reaction of cyanamide, $NH_2CN(s)$ with oxygen was run in a bomb calorimeter and ΔU was found to be –742.24 kJ mol^{-1}. The magnitude of ΔH_{298} for the reaction

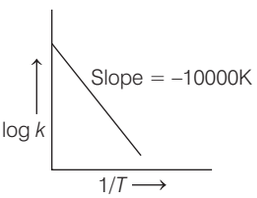
$$NH_2CN(s) + \frac{3}{2}O_2(g) \longrightarrow N_2(g) + O_2(g) + H_2O(l) \text{ is ..... kJ}$$

(Rounded off to the nearest integer). [Assume ideal gases and R = 8.314 J mol^{-1} K^{-1}]

24. 1 molal aqueous solution of an electrolyte A_2B_3 is 60% ionised. The boiling point of the solution at 1 atm is ..... K (Rounded off to the nearest integer). [Given, K_b for (H_2O) = 0.52 K kg mol^{-1}]

25. In basic medium CrO_4^{2-} oxidises $S_2O_3^{2-}$ to form SO_4^{2-} and itself changes into $Cr(OH)_4^-$. The volume of 0.154 M CrO_4^{2-} required to react with 40 mL of 0.25 M $S_2O_3^{2-}$ is ..... mL (Rounded off to the nearest integer).

26. For the reaction, $aA + bB \rightarrow cC + dD$, the plot of $\log k$ *vs* $\frac{1}{T}$ is given below



The temperature at which the rate constant of the reaction is $10^{-4}s^{-1}$ is ..... K (Rounded off to the nearest integer).

[Given : The rate constant of the reaction is $10^{-5}s^{-1}$ at 500 K]

27. The ionisation enthalpy of Na^+ formation from Na*(g)* is 495.8 kJ mol^{-1}, while the electron gain enthalpy of Br is –325.0 kJ mol^{-1}. Given, the lattice enthalpy of NaBr is –728.4 kJ mol^{-1}. The energy for the formation of NaBr ionic solid is (–) ..... × 10^{-1} kJ mol^{-1}.

28. Among the following, the number of halide(s) which is/are inert to hydrolysis is ..... .

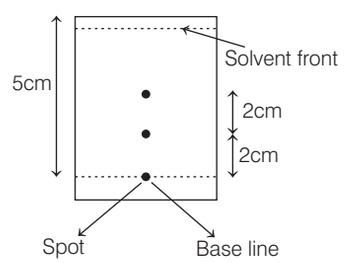
a. BF_3 **b.** $SiCl_4$ **c.** PCl_5 **d.** SF_6

29. Consider the following chemical reaction.

$$CH{\equiv}CH \xrightarrow[\text{(2) CO, HCl, AlCl}_3]{\text{(1) Red hot Fe tube, 873 K}} \text{Product}$$

The number of sp^2 hybridised carbon atom(s) present in the product is ..... .

30. Using the provided information in the following paper chromatogram.



Paper chromatography for compounds *A* and *B*

The calculated R_f value of *A* ..... × 10^{-1}.

Answers

1. *(d)*	2. *(c)*	3. *(d)*	4. *(d)*	5. *(a)*	6. *(c)*	7. *(c)*	8. *(a)*	9. *(b)*	10. *(a)*
11. *(d)*	12. *(b)*	13. *(b)*	14. *(b)*	15. *(d)*	16. *(b)*	17. *(c)*	18. *(c)*	19. *(d)*	20. *(a)*
21. *(4)*	22. *(70)*	23. *(741)*	24. *(375)*	25. *(173)*	26. *(526)*	27. *(5576)*	28. *(1)*	29. *(7)*	30. *(4)*

25 FEBRUARY SHIFT II

Section A : Objective Type Questions

1. Which among the following species has unequal bond lengths ?

a. XeF_4 **b.** SiF_4 **c.** SF_4 **d.** BF_4^-

2. The solubility of $Ca(OH)_2$ in water is

[Given: The solubility product of $Ca(OH)_2$ in water = 5.5×10^{-6}]

a. 1.11×10^{-2} **b.** 1.11×10^{-6}
c. 1.77×10^{-2} **d.** 1.77×10^{-6}

3. Which one of the following statements is false for hydrophilic sols ?

a. They do not require electrolytes for stability.
b. These sols are reversible in nature.
c. Their viscosity is of the order of that of H_2O.
d. The sols cannot be easily coagulated.

4. The correct order of bond dissociation enthalpy of halogens is

a. $F_2 > Cl_2 > Br_2 > I_2$ **b.** $I_2 > Br_2 > Cl_2 > F_2$
c. $Cl_2 > Br_2 > F_2 > I_2$ **d.** $Cl_2 > F_2 > Br_2 > I_2$

5. The method used for the purification of indium is

a. van-Arkel method **b.** liquation
c. zone refining **d.** vapour phase refining

6. Water does not produce CO on reacting with

a. CH_4 **b.** C **c.** CO_2 **d.** C_3H_8

7. Given below are two statements.

Statement I α and β-forms of sulphur can change reversibly between themselves with slow heating or slow cooling.

Statement II At room temperature, the stable crystalline form of sulphur is monoclinic sulphur.

In the light of the above statements, choose the correct answer from the options given below.

a. Both statements I and II are true.
b. Both statements I and II are false.
c. Statement I is true but statement II is false.
d. Statement I is false but statement II is true.

8. The major components of German silver are

a. Cu, Zn and Ag **b.** Cu, Zn and Ni
c. Ge, Cu and Ag **d.** Zn, Ni and Ag

9. In which of the following order the given complex ions are arranged correctly with respect to their decreasing spin only magnetic moment?

(i) $[FeF_6]^{3-}$ (ii) $[Co(NH_3)_6]^{3+}$
(iii) $[NiCl_4]^{2-}$ (iv) $[Cu(NH_3)_4]^{2+}$

a. (i) > (iii) > (iv) > (ii) **b.** (ii) > (iii) > (i) > (iv)
c. (iii) > (iv) > (ii) > (i) **d.** (ii) > (i) > (iii) > (iv)

10. Given below are two statements.

Statement I The pH of rain water is normally ~5.6.
Statement II If the pH of rain water drops below 5.6, it is called acid rain.

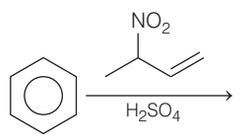
In the light of the above statements, choose the correct answer from the options given below.

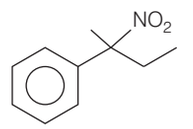
a. Both statements I and II are true.
b. Both statements I and II are false.
c. Statement I is true but statement II is false.
d. Statement I is false but statement II is true.

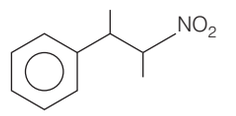
11. Which of the following compound is added to the sodium extract before addition of silver nitrate for testing of halogens?

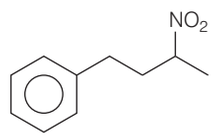
a. Hydrochloric acid **b.** Sodium hydroxide
c. Nitric acid **d.** Ammonia

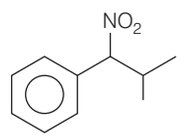
12. The major product of the following reaction is



a.


b.


c.


d.


13. The major product of the following reaction is

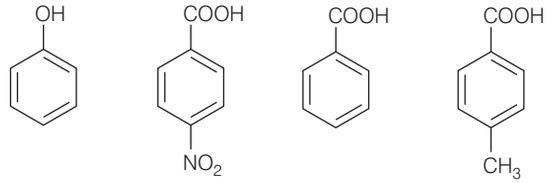
$$CH_3CH_2CH = CH_2 \xrightarrow[\text{Rh catalyst}]{H_2/CO}$$

a. $CH_3CH_2CH_2CH_2CHO$ **b.** $CH_3CH_2CH_2CHO$
c. $CH_3CH_2CH = CH - CHO$ **d.** $CH_3CH_2\underset{\underset{CHO}{|}}{C} = CH_2$

14. The correct sequence of reagents used in the preparation of 4-bromo-2-nitroethyl benzene from benzene is

a. CH_3COCl / $AlCl_3$, Br_2 / $AlBr_3$, HNO_3 / H_2SO_4, Zn/HCl
b. CH_3COCl / $AlCl_3$, Zn-Hg/HCl, Br_2 / $AlBr_3$, HNO_3 / H_2SO_4
c. Br_2 / $AlBr_3$, CH_3COCl / $AlCl_3$, HNO_3 / H_2SO_4, Zn/HCl
d. HNO_3 / H_2SO_4, Br_2 / $AlCl_3$, CH_3COCl / $AlCl_3$, Zn-Hg/HCl

15. The correct order of acid character of the following compounds is



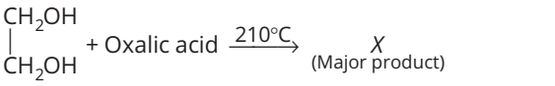
I II III IV

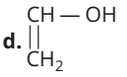
Options

a. I > II > III > IV **b.** III > II > I > IV

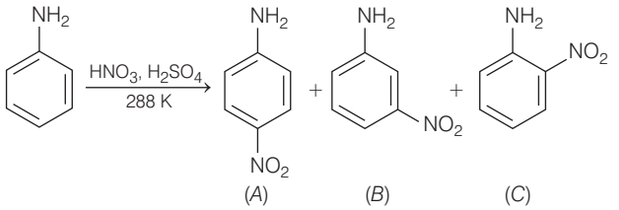
c. II > III > IV > I **d.** IV > III > II > I

16. What is '*X*' in the given reaction?



a.  **b.**  **c.**  **d.** 

17.



(*A*) (*B*) (*C*)

Correct statement about the given chemical reaction is

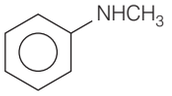
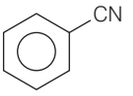
a. $-\ddot{N}H_2$ group is *ortho* and *para* directing, so product (*B*) is not possible.

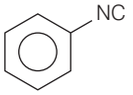
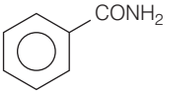
b. reaction is possible and compound (*B*) will be the major product.

c. the reaction will form sulphonated product instead of nitration.

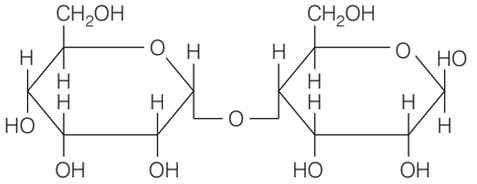
d. reaction is possible and compound (*A*) will be major product.

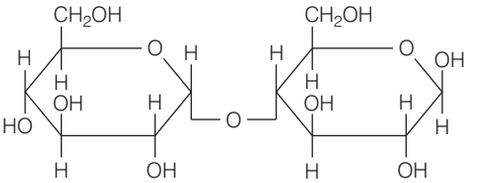
18. Carbylamine test is used to detect the presence of primary amino group in an organic compound. Which of the following compound is formed when this test is performed with aniline?

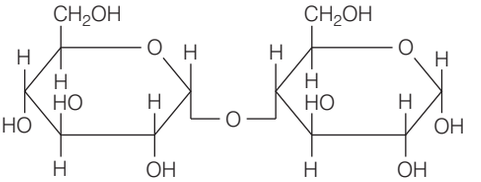
a.  **b.** 

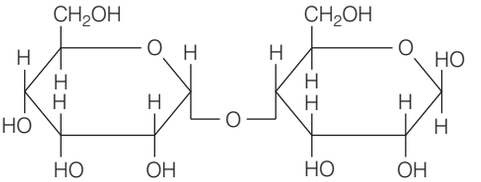
c.  **d.** 

19. Which of the following is correct structure of α-anomer of maltose?

a. 

b. 

c. 

d. 

20. Given below are two statements.

Statement I The identification of Ni^{2+} is carried out by dimethyl glyoxime in the presence of NH_4OH.

Statement II The dimethyl glyoxime is a bidentate neutral ligand.

In the light of the above statements, choose the correct answer from the options given below.

a. Both statements I and II are true.

b. Both statements I and II are false.

c. Statement I is true but statement II is false.

d. Statement I is false but statement II is true.

Section B : Numerical Type Questions

21. Consider titration of NaOH solution *versus* 1.25 M oxalic acid solution. At the end point following burette readings were obtained.

(i) 4.5 mL (ii) 4.5 mL

(iii) 4.4 mL (iv) 4.4 mL

(v) 4.4 mL

If the volume of oxalic acid taken was 10.0 mL, then the molarity of the NaOH solution is ..... M. (Rounded off to the nearest integer)

22. The unit cell of copper corresponds to a face centered cube of edge length 3.596 Å with one copper atom at each lattice point. The calculated density of copper in kg/m^3 is ..... . [Molar mass of Cu = 63.54 g ; Avogadro number = 6.022×10^{23}]

23. Electromagnetic radiation of wavelength 663 nm is just sufficient to ionise the atom of metal *A*. The ionisation energy of metal *A* in kJ mol^{-1} is ..... . (Rounded off to the nearest integer)

[$h = 6.63 \times 10^{-34}$ J-s, $c = 3.00 \times 10^8$ ms^{-1}, $N_A = 6.02 \times 10^{23}$ mol^{-1}]

24. Five moles of an ideal gas at 293 K is expanded isothermally from an initial pressure of 2.1 MPa to 1.3 MPa against at constant external pressure 4.3 MPa. The heat transferred in this process is ..... kJ mol^{-1}. (Rounded off to the nearest integer)
[R = 8.314 J $mol^{-1}K^{-1}$]

25. If a compound *AB* dissociates to the extent of 75% in an aqueous solution, the molality of the solution which shows a 2.5 K rise in the boiling point of the solution is ..... molal. (Rounded off to the nearest integer)
[K_b = 0.52 K kg mol^{-1}]

26. Copper reduces NO_3^- into NO and NO_2 depending upon the concentration of HNO_3 in solution. (Assuming fixed [Cu^{2+}] and $p_{NO} = p_{NO_2}$), the HNO_3 concentration at which the thermodynamic tendency for reduction of NO_3^- into NO and NO_2 by copper is same is 10^x M. The value of $2x$ is ..... . (Rounded off to the nearest integer)
[Given, $E^\circ_{Cu^{2+}/Cu}$ = 0.34 V, $E^\circ_{NO_3^-/NO}$ = 0.96 V, $E^\circ_{NO_3^-/NO_2}$ = 0.79 V and at 298 K, $\frac{RT}{F}(2.303) = 0.059$]

27. The rate constant of a reaction increases by five times on increase in temperature from 27°C to 52°C. The value of activation energy in kJ mol^{-1} is ..... (Rounded off to the nearest integer)
[R = 8.314 J K^{-1} mol^{-1}]

28. Among the following, number of metal(s) which can be used as electrodes in the photoelectric cell is .....
(Integer answer)
(i) Li (ii) Na (ii) Rb (iv) Cs

29. The spin only magnetic moment of a divalent ion in aqueous solution
(atomic number = 29) is ..... BM.

30. The number of compound(s) given below which contain(s) — COOH group is ..... .
(i) Sulphanilic acid
(ii) Picric acid
(iii) Aspirin
(iv) Ascorbic acid

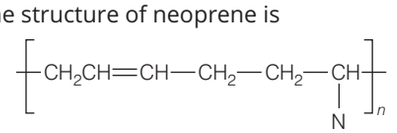
Answers

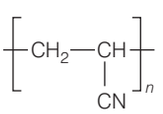
1. *(c)*	2. *(a)*	3. *(c)*	4. *(c)*	5. *(c)*	6. *(c)*	7. *(c)*	8. *(b)*	9. *(a)*	10. *(a)*
11. *(c)*	12. *(b)*	13. *(a)*	14. *(b)*	15. *(c)*	16. *(c)*	17. *(d)*	18. *(c)*	19. *(c)*	20. *(a)*
21. *(6)*	22. *(9077)*	23. *(180)*	24. *(15)*	25. *(3)*	26. *(4)*	27. *(52)*	28. *(1)*	29. *(2)*	30. *(1)*

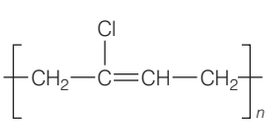
26 FEBRUARY SHIFT I

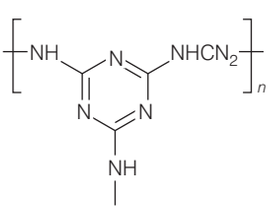
Section A : Objective Type Questions

1. The structure of neoprene is

a. 

b. 

c. 

d. 

2. Find *A, B* and *C* in the following reactions:
$NH_3 + A + CO_2 \longrightarrow (NH_4)_2CO_3$
$(NH_4)_2CO_3 + H_2O + B \longrightarrow NH_4HCO_3$
$NH_4HCO_3 + NaCl \longrightarrow NH_4Cl + C$
a. $A - O_2$, $B - CO_2$, $C - Na_2CO_3$
b. $A - H_2O$, $B - O_2$, $C - Na_2CO_3$
c. $A - H_2O$, $B - O_2$, $C - NaHCO_3$
d. $A - H_2O$, $B - CO_2$, $C - NaHCO_3$

3. The presence of ozone in troposphere
a. protects us from the UV radiation
b. protects us from the X-ray radiation
c. protects us from green house effect
d. generates photochemical smog

4. Match List-I with List-II.

	List-I (Electronic configuration of elements)		**List-II** (Δ_i in kJ mol^{-1})
A.	$1s^2 2s^2$	(i)	801
B.	$1s^2 2s^2 2p^4$	(ii)	899
C.	$1s^2 2s^2 2p^3$	(iii)	1314
D.	$1s^2 2s^2 2p^1$	(iv)	1402

Choose the most appropriate answer from the options given below.

	A	B	C	D
a.	(ii)	(iii)	(iv)	(i)
b.	(i)	(iv)	(iii)	(ii)
c.	(i)	(iii)	(iv)	(ii)
d.	(iv)	(i)	(ii)	(iii)

5. Given below are two statements: One is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) Dipole-dipole interactions are the only non-covalent interactions, resulting in hydrogen bond formation.

Reason (R) Fluorine is the most electronegative element and hydrogen bonds in HF are symmetrical.

In the light of the above statements, choose the most appropriate answer from the options given below.

(a) A is false but R is true.
(b) Both A and R are true and R is the correct explanation of A.
(c) A is true R is false.
(d) Both A and R are true but R is not the correct explanation of A.

6. Statements about heavy water are given below.

A. Heavy water is used in exchange reactions for the study of reaction mechanisms.
B. Heavy water is prepared by exhaustive electrolysis of water.
C. Heavy water has higher boiling point than ordinary water.
D. Viscosity of H_2O is greater than D_2O.

Whic oc the given statement are correct.

a. A, B and C **b.** Only A and B
c. Only A and D **d.** Only A and C

7. The orbital having two radial as well as two angular nodes is

a. 3*p* **b.** 4*f* **c.** 4*d* **d.** 5*d*

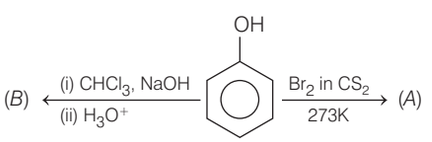
8. Match List-I with List-II.

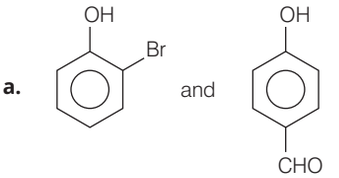
	List-I (Ore)		**List-II** (Element present)
A.	Kernite	(i)	Tin
B.	Cassiterite	(ii)	Boron
C.	Calamine	(iii)	Fluorine
D.	Cryolite	(iv)	Zinc

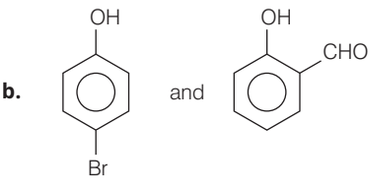
Choose the most appropriate answer from the options given below.

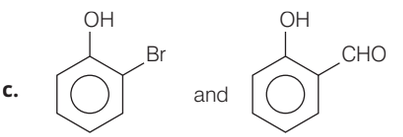
	A	B	C	D
a.	(i)	(iii)	(iv)	(ii)
b.	(ii)	(i)	(iv)	(iii)
c.	(ii)	(iv)	(i)	(iii)
d.	(iii)	(i)	(ii)	(iv)

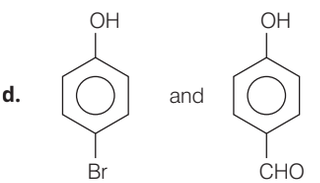
9. Identify the major products *A* and *B* respectively in the following reactions of phenol.



a. 

b. 

c. 

d. 

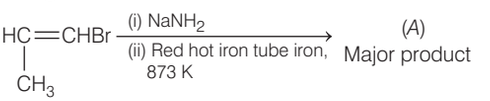
10. Given below are two statements :

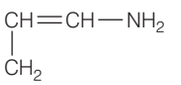
Statement I A mixture of chloroform and aniline can be separated by simple distillation.

Statement II When separating aniline from a mixture of aniline and water by steam distillation aniline boils below its boiling point. In the light of the above statements, choose the most appropriate answer from the options given below.

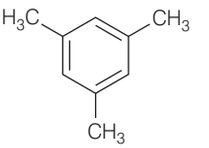
a. Statement I is false but statement II is true
b. Both statement I and statement II are false
c. Statement I is true but statement II is false
d. Both statement I and statement II are true

11. For the given reaction



a. $CH_3CH_2CH_2NH_2$ **b.** 

c. 

d. 

12. On treating a compound with warm dil. H_2SO_4, gas *X* is evolved, which turns $K_2Cr_2O_7$ paper acidified with dil. H_2SO_4 to a green compound *Y*. *X* and *Y* respectively are

a. $X = SO_2, Y = Cr_2O_3$ **b.** $X = SO_3, Y = Cr_2O_3$
c. $X = SO_2, Y = Cr_2(SO_4)_3$ **d.** $X = SO_3, Y = Cr_2(SO_4)_3$

13. Which of the following is a false statement?

(a) Carius tube is used in the estimation of sulphur in an organic compound

(b) Carius method is used for the estimation of nitrogen in an organic compound
(c) Phosphoric acid produced on oxidation of phosphorus present in an organic compound is precipitated as $Mg_2P_2O_7$ by adding magnesia mixture
(d) Kjeldahl's method is used for the estimation of nitrogen in an organic compound

14. Which of the following vitamin is helpful in delaying the blood clotting ?
a. Vitamin C **b.** Vitamin B
c. Vitamin E **d.** Vitamin K

15. $\underset{(C_4H_8Cl_2)}{A} \xrightarrow[373\ K]{\text{Hydrolysis}} \underset{(C_4H_8O)}{B}$

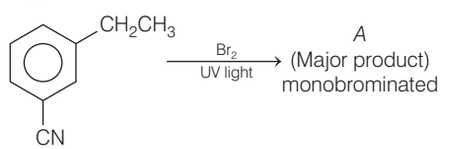
B reacts with hydroxyl amine but does not give Tollen's test. Identify *A* and *B*.
a. 1,1-dichlorobutane and 2-butanone
b. 2,2-dichlorobutane and butanal
c. 1,1-dichlorobutane and butanal
d. 2,2-dichlorobutane and 2-butan-one

16. Compound *A* used as a strong oxidising agent is amphoteric in nature. It is the part of lead storage batteries. Compound *A* is
a. PbO_2 **b.** PbO **c.** $PbSO_4$ **d.** Pb_3O_4

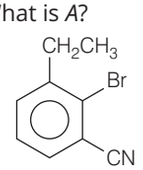
17. Which one of the following lanthanoids does not form MO_2? [*M* is lanthanoid metal]
a. Pr **b.** Dy **c.** Nd **d.** Yb

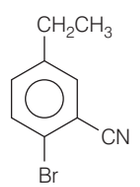
18. Given below are two statements:
Statement I *o*-nitrophenol is steam volatile due to intramolecular hydrogen bonding.
Statement II *o*-nitrophenol has high melting due to hydrogen bonding.
In the light of the above statements, choose the most appropriate answer from the options given below.
a. Statement I is false but statement II is true
b. Both statement I and statement II are true
c. Both statement I and statement II are false
d. Statement I is true but statement II is false

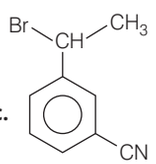
19. For the given reaction,

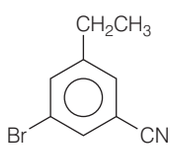


What is *A*?

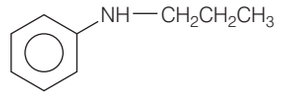
a. 

b. 

c. 

d. 

20. An amine on reaction with benzene sulphonyl chloride produces a compound insoluble in alkaline solution. This amine can be prepared by ammonolysis of ethyl chloride. The correct structure of amine is

a. 

b. $CH_3CH_2NH_2$
c. $CH_3CH_2CH_2NHCH_3$
d. $CH_3CH_2CH_2\overset{H}{N}—CH_2CH_3$

Section B : Numerical Type Questions

21. For a chemical reaction, $A + B \rightleftharpoons C + D$ ($\Delta_rH° = 80$ kJ mol^{-1}) the entropy change $\Delta_rS°$ depends on the temperature *T* (in K) as $\Delta_rS° = 2T$ (JK^{-1} mol^{-1}). Minimum temperature at which it will become spontaneous is ..... K.

22. The number of significant figures in 50000.020×10^{-3} is ..... .

23. An exothermic reaction $X \rightarrow Y$ has an activation energy 30 kJ mol^{-1}. If energy change ΔE during the reaction is –20 kJ mol^{-1}, then the activation energy for the reverse reaction in kJ is ..... .

24. Consider the following reaction,
$MnO_4^- + 8H^+ + 5e^- \longrightarrow Mn^{2+} + 4H_2O, \quad E° = 1.51$ V.
The quantity of electricity required in Faraday to reduce five moles of MnO_4^- is ..... .

25. A certain gas obeys $p(V_m - b) = RT$. The value of $\left(\frac{\partial Z}{\partial p}\right)_T$ is xb / RT. The value of *x* is ..... .
(Z = compressibility factor)

26. A homogeneous ideal gaseous reaction $AB_2(g) \rightleftharpoons A(g) + 2B(g)$ is carried out in a 25 L flask at 27°C. The initial amount of AB_2 was 1 mole and the equilibrium pressure was 1.9 atm. The value of K_p is $x \times 10^{-2}$. The value of *x* is ..... .

27. Dichromate ion is treated with base, the oxidation number of Cr in the product formed is ..... .

28. 224 mL of $SO_2(g)$ at 298 K and 1 atm is passed through 100 mL of 0.1 M NaOH solution. The non-volatile solute produced is dissolved in 36 g of water. The lowering of vapour pressure of solution (assuming the solution is dilute), ($p_{(H_2O)}$ = 24 mm of Hg) is $x \times 10^{-2}$ mm of Hg, the value of *x* is ..... .

29. 3.12 g of oxygen is adsorbed on 1.2 g of platinum metal. The volume of oxygen adsorbed per gram of the adsorbent at 1 atm and 300 K in L is ..... .
[R = 0.0821 L atm K^{-1} mol^{-1}]

30. Number of bridging CO ligands in $[Mn_2(CO)_{10}]$ is ..... .

Answers

1. *(c)*	2. *(d)*	3. *(d)*	4. *(a)*	5. *(a)*	6. *(a)*	7. *(d)*	8. *(b)*	9. *(b)*	10. *(d)*
11. *(d)*	12. *(c)*	13. *(b)*	14. *(d)*	15. *(d)*	16. *(a)*	17. *(d)*	18. *(d)*	19. *(c)*	20. *(d)*
21. *(200)*	22. *(7)*	23. *(50)*	24. *(25)*	25. *(1)*	26. *(73)*	27. *(6)*	28. *(18)*	29. *(2)*	30. *(0)*

26 FEBRUARY SHIFT II

Section A : Objective Type Questions

1. Which of the following forms of hydrogen emits low energy β^- particles ?

a. Deuterium ^2_1H **b.** Tritium ^3_1H
c. Protium ^1_1H **d.** Proton H^+

2. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) In TlI_3, isomorphous to CsI_3, the metal is present in $+1$ oxidation state.

Reason (R) Tl metal has fourteen *f*-electrons in the electronic configuration.

In the light of the above statements, choose the most appropriate answer from the options given below.

a. A is correct but R is not correct.
b. Both A and R are correct and R is the correct explanation of A.
c. A is not correct but R is correct
d. Both A and R are correct but R is not correct explanation of A.

3. Match List-I with List-II.

	List-I		List-II
A.	Sucrose	(i)	β-D-galactose and β-D-glucose
B.	Lactose	(ii)	α-D-glucose and β-D-fructose
C.	Maltose	(iii)	α-D-glucose and α-D-glucose

Choose the correct answer from the options given below.

a. A → (i), B → (iii), C → (ii)
b. A → (iii), B → (i), C → (iii)
c. A → (ii), B → (i), C → (iii)
d. A → (iii), B → (ii), C → (i)

4. A. phenyl methanamine
B. N,N-dimethylaniline
C. N-methyl aniline
D. Benzenamine

Choose the correct order of basic nature of the above amines.

a. A > C > B > D **b.** D > C > B > A
c. D > B > C > A **d.** A > B > C > D

5. The correct order of electron gain enthalpy is

a. S> Se> Te> O **b.** Te > Se > S > O
c. O > S > Se > Te **d.** S > O > Se > Te

6. In $\overset{1}{C}H_2 = \overset{2}{C} = \overset{3}{C}H - \overset{4}{C}H_3$ molecule,
the hybridisation of carbon 1, 2, 3 and 4 respectively are

a. sp^3, sp, sp^3, sp^3
b. sp^2, sp^2, sp^2, sp^3
c. sp^2, sp, sp^2, sp^3
d. sp^2, sp^3, sp^2, sp^3

7. Seliwanoff test and xanthoproteic test are used for the identification of ..... and ..... respectively.

a. aldoses, ketoses **b.** proteins, ketoses
c. ketoses, proteins **d.** ketoses, aldoses

8. 2,4-DNP test can be used to identify

a. amine **b.** aldehyde
c. ether **d.** halogens

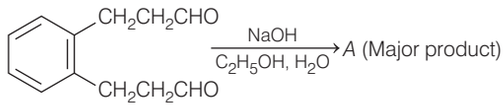
9. Ceric ammonium nitrate and $CHCl_3$ /alc. KOH are used for the identification of functional groups present in ..... and ..... respectively.

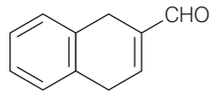
a. alcohol, phenol
b. amine, alcohol
c. alcohol, amine
d. amine, phenol

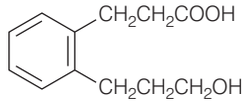
10. Which pair of oxides is acidic in nature?

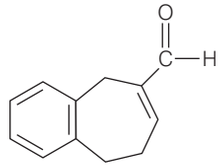
a. B_2O_3, CaO **b.** B_2O_3, SiO_2
c. N_2O, BaO **d.** CaO, SiO_2

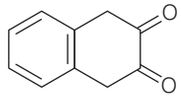
11. Identify *A* in the given chemical reaction,



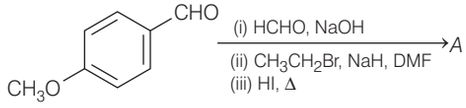
a.


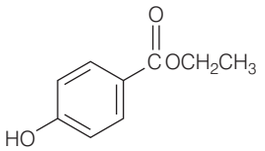
b.


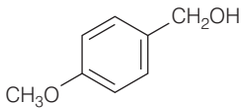
c.


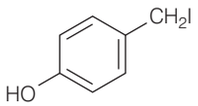
d.


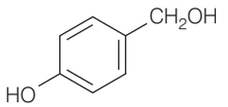
12. Identify *A* in the following chemical reaction.



a. 

b. 

c. 

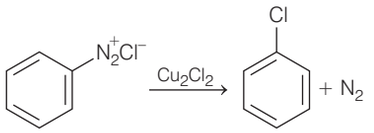
d. 

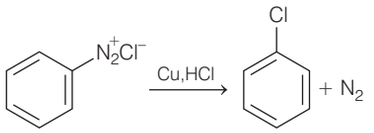
13. Calgon is used for water treatment. Which of the following statement is not true about Calgon?

a. Calgon contains the 2nd most abundant element by weight in the Earth's crust.
b. It is polymeric compound and is water soluble.
c. It is also known as Graham's salt.
d. It does not remove Ca^{2+} ion by precipitation.

14. Match List-I with List-II.

List-I

A. 

B. 

C. $2CH_3CH_2Cl + 2Na \xrightarrow{Ether} C_2H_5 — C_2H_5 + 2NaCl$

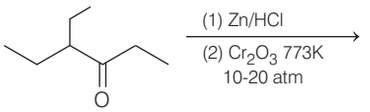
D. $2C_6H_5Cl + 2Na \xrightarrow{Ether} C_6H_5 — C_6H_5 + 2NaCl$

List-II

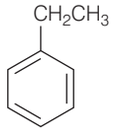
(i) Wurtz reaction (ii) Sandmeyer reaction
(iii) Fittig reaction (iv) Gattermann reaction

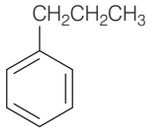
Choose the correct answer from the options given below.

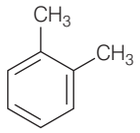
	A	B	C	D
a.	(iii)	(i)	(iv)	(ii)
b.	(ii)	(i)	(iv)	(iii)
c.	(ii)	(iv)	(i)	(iii)
d.	(iii)	(iv)	(i)	(ii)

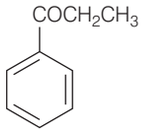
15. 

considering the above reaction, the major product among the following is

a. 

b. 

c. 

d. 

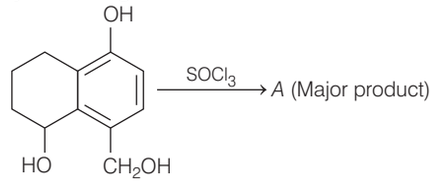
16. Match List-I with List-II

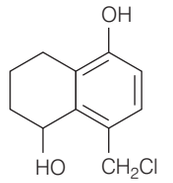
	List-I (Molecule)		**List-II** (Bond order)
A.	Ne_2	(i)	1
B.	N_2	(ii)	2
C.	F_2	(iii)	0
D.	O_2	(iv)	3

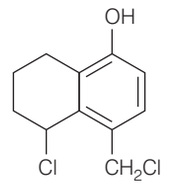
Choose the correct answer from the options given below.

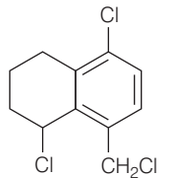
	A	B	C	D		A	B	C	D
a.	(iii)	(iv)	(i)	(ii)	**b.**	(i)	(ii)	(iii)	(iv)
c.	(ii)	(i)	(iv)	(iii)	**d.**	(iv)	(iii)	(ii)	(i)

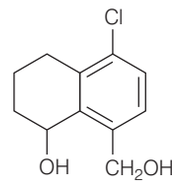
17. Identify *A* in the given reaction.



a. 

b. 

c. 

d. 

18. Match List-I with List-II.

	List-I		**List-II**
A.	Siderite	(i)	Cu
B.	Calamine	(ii)	Ca
C.	Malachite	(iii)	Fe
D.	Cryolite	(iv)	Al
		(v)	Zn

Chose the correct answer from the options given below.

	A	B	C	D		A	B	C	D
a.	(iii)	(i)	(v)	(ii)	**b.**	(i)	(ii)	(v)	(iii)
c.	(iii)	(v)	(i)	(iv)	**d.**	(i)	(ii)	(iii)	(iv)

19. The nature of charge on resulting colloidal particles when $FeCl_3$ is added to excess of hot water is

a. Positive
b. Sometimes positive and sometimes negative
c. Neutral
d. Negative

20. Match List-I with List-II

	List-I		List-II
A.	Sodium carbonate	(i)	Deacon
B.	Titanium	(ii)	Castner-Kellner
C.	Chlorine	(iii)	van-Arkel
D.	Sodium hydroxide	(iv)	Solvay

Choose the correct answer form the options given below.

	A	B	C	D
a.	(iv)	(iii)	(i)	(ii)
b.	(i)	(iii)	(iv)	(ii)
c.	(iv)	(i)	(ii)	(iii)
d.	(iii)	(ii)	(i)	(iv)

Section B : Numerical Type Questions

21. The $NaNO_3$ weighed out to make 50 mL of an aqueous solution containing 70.0 mg Na^+ per mL is ..... g. (Rounded off to the nearest integer)
[Given : Atomic weight in g mol^{-1}, –Na : 23 ; N : 14 ; O : 16].

22. Emf of the following cell at 298 K in V is $x \times 10^{-2}$,
Zn | Zn^{2+} (0.1 M) || Ag^+ (0.01 M) | Ag The value of x is ..... .
(Rounded off to the nearest integer).
[Given, $E^\circ_{Zn^{2+}/Zn} = -0.76$ V, $E^\circ_{Ag^+/Ag} = +0.80$ V, $\frac{2.303RT}{F} = 0.059$]

23. When 12.2 g of benzoic acid is dissolved in 100 g of water, the freezing point of solution was found to be –0.93°C ($K_f(H_2O)$ = 1.86 K kg mol^{-1}). The number (n) of benzoic acid molecules associated (assuming 100% association) is ..... .

24. The average S—F bond energy in kJ mol^{-1} of SF_6 is .....
(Rounded off to the nearest integer)
[Given, the values of standard enthalpy of formation of $SF_6(g)$, $S(g)$ and $F(g)$ are –1100, 275 and 80 kJ mol^{-1} respectively.]

25. A ball weighing 10 g is moving with a velocity of 90 ms^{-1}. If the uncertainty in its velocity is 5%, then the uncertainty in its position is ..... $\times 10^{-33}$ m (Rounded off to the nearest integer). [Given, $h = 6.63 \times 10^{-34}$ J-s]

26. The number of octahedral voids per lattice site in a lattice is ..... . (Rounded off to the nearest integer)

27. In mild alkaline medium, thiosulphate ion is oxidised by MnO_4^- to "A". The oxidation state of sulphur in "A" is ..... .

28. The number of stereoisomers possible for $[Co(ox)_2(Br)(NH_3)]^{2-}$ is ..... [ox = oxalate].

29. If the activation energy of a reaction is 80.9 kJ mol^{-1}, the fraction of molecules at 700 K, having enough energy to react to form products is e^{-x}. The value of x is .....
(Rounded off to the nearest integer)
[Use, R = 8.31 JK^{-1} mol^{-1}].

30. The pH of ammonium phosphate solution, if pK_a of phosphoric acid and pK_b of ammonium hydroxide are 5.23 and 4.75 respectively, is ..... .

Answers

1. *(b)*	2. *(b)*	3. *(c)*	4. *(d)*	5. *(a)*	6. *(c)*	7. *(c)*	8. *(b)*	9. *(c)*	10. *(b)*
11. *(c)*	12. *(c)*	13. *(a)*	14. *(c)*	15. *(a)*	16. *(a)*	17. *(b)*	18. *(c)*	19. *(a)*	20. *(a)*
21. *(13)*	22. *(147)*	23. *(2)*	24. *(309)*	25. *(1)*	26. *(1)*	27. *(6)*	28. *(3)*	29. *(14)*	30. *(7)*

16 MARCH SHIFT I

Section A : Objective Type Questions

1. Given below are two statements. One is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) Size of Bk^{3+} ion is less than Np^{3+} ion.

Reason (R) The above is a consequence of the lanthanoid contraction.

In the light of the above statements, choose the correct answer from the options given below

a. A is false but R is true.
b. Both A and R are true but *R* is not the correct explanation of A.
c. Both A and R are true and R is the correct explanation of A.
d. A is true but R is false.

2. Which among the following pair of vitamins is stored in our body relatively for longer duration ?

a. Thiamine and vitamin A **b.** Vitamin A and vitamin D
c. Thiamine and ascorbic acid **d.** Ascorbic acid and vitamin D

3. Given below are two statements.

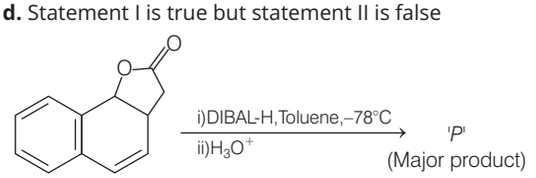
Statement I Both $CaCl_2 \cdot 6H_2O$ and $MgCl_2 \cdot 8H_2O$ undergo dehydration on heating.

Statement II BeO is amphoteric, whereas the oxides of other elements in the same group are acidic.

In the light of the above statements, choose the correct answer from the options given below.

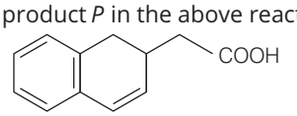
a. Statement I is false but statement II is true
b. Both statement I and statement II are false
c. Both statement I and statement II are true
d. Statement I is true but statement II is false

4.

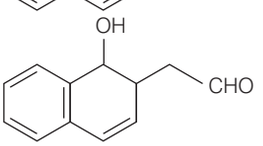


The product *P* in the above reaction is

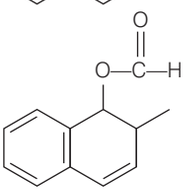
a.



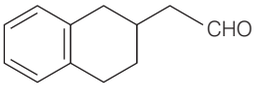
b.



c.



d.



5. Match List -I with List II.

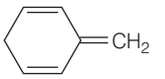
	List-I (Industrial process)		List-II (Application)
A.	Haber's process	(i)	HNO_3 synthesis
B.	Ostwald's process	(ii)	Aluminium extraction
C.	Contact process	(iii)	NH_3 synthesis
D.	Hall-Heroult process	(iv)	H_2SO_4 synthesis

Choose the correct answer from the options given below :

a. A-(ii), B-(iii), C-(iv), D-(i) **b.** A-(iii), B-(iv), C-(i), D-(ii)
c. A-(iii), B-(i), C-(iv), D-(ii) **d.** A-(iv), B-(i), C-(ii), D-(iii)

6. Among the following, the aromatic compounds are

A.



B.

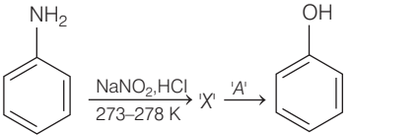
C.

D.

Choose the correct answer from the following options.

a. Only (A) and (B) **b.** Only (B) and (C)
c. (B), (C) and (D) **d.** (A), (B) and (C)

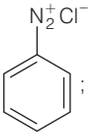
7.



(Major product)

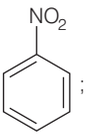
In the above chemical reaction, intermediate *X* and reagent / condition *A* are

a. *X*-



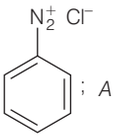
; *A* -H_2O/NaOH

b. *X*-



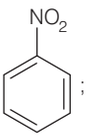
; *A* -H_2O/Δ

c. *X*-



; *A* -H_2O/Δ

d. *X*-



; *A* -H_2O/NaOH

8. Given below are two statements.

Statement I The E° value of Ce^{4+}/Ce^{3+} is +1.74 V.

Statement II Ce is more stable in Ce^{4+} state than Ce^{3+} state.

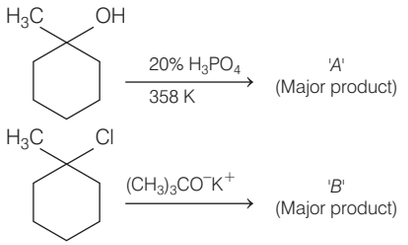
In the light of the above statements, choose the most appropriate answer from the options given below.

a. Both statement I and statement II are correct.
b. Statement I is incorrect but statement II is correct.
c. Both statement I and statement II are incorrect.
d. Statement I is correct but statement II is incorrect.

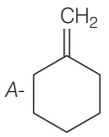
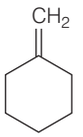
9. The functions of antihistamine are
a. antiallergic and analgesic
b. antacid and antiallergic
c. analgesic and antacid
d. antiallergic and antidepressant

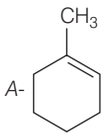
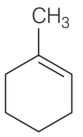
10. Which of the following is Lindlar catalyst ?
a. Zinc chloride and HCl
b. Cold dilute solution of $KMnO_4$
c. Sodium and liquid NH_3
d. Partially deactivated palladised charcoal

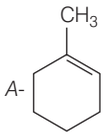
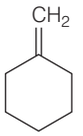
11.

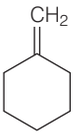
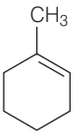


The product *A* and *B* formed in above reactions are

a. *A*-  *B*- 

b. *A*-  *B*- 

c. *A*-  *B*- 

d. *A*-  *B*- 

12. Given below are two statements.

Statement I H_2O_2 can act as both oxidising and reducing agent in basic medium.

Statement II In the hydrogen economy, the energy is transmitted in the form of dihydrogen. In the light of the above statements, choose the correct answer from the options given below :
a. Both statement I and statement II are false.
b. Both statement I and statement II are true.
c. Statement I is true but statement II is false.
d. Statement I is false but statement II is true.

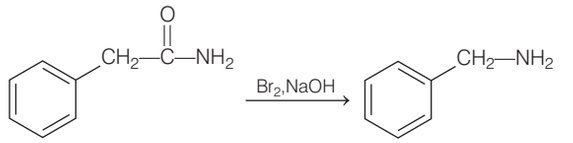
13. The type of pollution that gets increased during the day time and in the presence of O_3 is
a. reducing smog **b.** oxidising smog
c. global warming **d.** acid rain

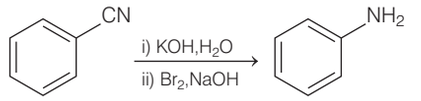
14. **Assertion (A)** Enol form of acetone $[CH_3COCH_3]$ exists in < 0.1% quantity. However, the enol form of acetyl acetone $[CH_3COCH_2OCCH_3]$ exists in approximately 15% quantity.

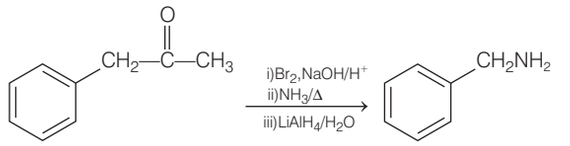
Reason (R) Enol form of acetyl acetone is stabilised by intramolecular hydrogen bonding, which is not possible in enol form of acetone.

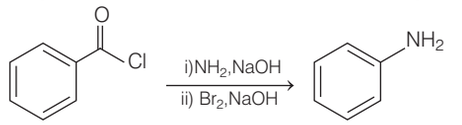
Choose the correct statement.
a. A is false but R is true.
b. Both A and R are true and R is the correct explanation of A.
c. Both A and R are true but R is not the correct explanation of A.
d. A is true but R is false.

15. Which of the following reaction does not involve Hoffmann bromamide degradation?

a. 

b. 

c. 

d. 

16. The process that involves the removal of sulphur from the ores is
a. smelting **b.** roasting
c. leaching **d.** refining

17. Match List-I with List-II.

	List-I (Name of oxo acid)		**List-II** (Oxidation state of P)
A.	Hypophosphorus acid	(i)	+5
B.	Orthophosphoric acid	(ii)	+4
C.	Hypophosphoric acid	(iii)	+3
D.	Orthophosphorus acid	(iv)	+2
		(v)	+1

Choose the correct answer from the options given below :
a. A-(v), B-(i), C-(ii), D-(iii) **b.** A-(iv), B-(i), C-(ii), D-(iii)
c. A-(iv), B-(v), C-(ii), D-(iii) **d.** A-(v), B-(iv), C-(ii), D-(iii)

18. Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) The H—O—H bond angle in water molecule is 104.5°.

Reason (R) The lone pair - lone pair repulsion of electrons is higher than the bond pair - bond pair repulsion.
a. A is false but R is true.
b. Both A and R are true, but R is not the correct correct explanation of A.
c. A is true but R is false.
d. Both A and R are true, and R is the correct explanation of A.

19. In chromatography technique, the purification of compound is independent of

a. mobility or flow of solvent system
b. solubility of the compound
c. length of the column or TLC plate
d. physical state of the pure compound

20. A group 15 element, which is a metal and forms a hydride with strongest reducing power among group 15 hydrides. The element is

a. Sb **b.** P **c.** As **d.** Bi

Section B : Numerical Type Questions

21. For the reaction, $A(g) \rightleftharpoons B(g)$ at 495 K, $\Delta_r G^\circ = -9.478$ kJ mol^{-1}.

If we start the reaction in a closed container at 495 K with 22 millimoles of A, the amount of B is the equilibrium mixture is .....

millimoles (Round off to the nearest integer).

[$R = 8.314$ J mol^{-1} K^{-1}, ln10 = 2.303]

22. Complete combustion of 750 g of an organic compound provides 420 g of CO_2 and 210 g of H_2O. The percentage composition of carbon and hydrogen in organic compound is 15.3 and ..... respectively (Round off to the nearest integer).

23. $2MnO_4^- + bC_2O_4^{2-} + cH^+ \longrightarrow x\,Mn^{2+} + yCO_2 + zH_2O$

If the above equation is balanced with integer coefficients, the value of c is ..... .

24. AB_2 is 10% dissociated in water to A^{2+} and B^-. The boiling point of a 10.0 molal aqueous solution of AB_2 is ..... °C (Round off to the nearest integer).

[Given, molal elevation constant of water $K_b = 0.5$K kg mol^{-1} boiling point of pure water = 100° C]

25. The equivalents of ethylene diamine required to replace the neutral ligands from the coordination sphere of the *trans*-complex of $COCl_3 \cdot 4NH_3$ is ..... (Round off to the nearest integer).

26. A 6.50 molal solution of KOH (*aq*) has a denisity of 1.89 g cm^{-3}. The molarity of the solution is ..... mol dm^{-3} (Round off to the nearest integer).

[Atomic masses: K : 39.0 u, O : 16.0u, H : 1.0 u]

27. When light of wavelength 248 nm falls on a metal of threshold energy 3.0 eV, the de- Broglie wavelength of emitted electrons is ..... Å.

[Round off to the nearest integer]

[Use: $\sqrt{3} = 1.73$, $h = 6.63 \times 10^{-34}$ Js $m_e = 9.1 \times 10^{-31}$ kg, $c = 3.0 \times 10^8$ ms^{-1}, 1 eV = 1.6×10^{-19} J]

28. Two salts A_2X and MX have the same value of solubility product of 4.0×10^{-12}. The ratio of their molar solubilities i.e $\frac{S(A_2X)}{S(MX)} = ...$

(Round off to the nearest integer)

29. A certain element crystallises in a bcc lattice of unit cell edge length 27Å. If the same element under the same conditions crystallises in the fcc lattice, the edge length of the unit cell in Å will be .....

(Round off to the nearest integer)

[Assume each lattice point has a single atom]

[Assume $\sqrt{3} = 1.73$, $\sqrt{2} = 1.41$]

30. The decomposition of formic acid on gold surface follows first order kinetics. If the rate constant at 300K is 1.0×10^{-3}s^{-1} and the activation energy, $E_a = 11.488$ kJ mol^{-1}, the rate constant at 200 K is ..... $\times 10^{-5}$s^{-1} (Round off to the nearest integer).

[Given, $R = 8.314$ J mol^{-1} K^{-1}]

Answers

1. *(d)*	2. *(b)*	3. *(b)*	4. *(b)*	5. *(c)*	6. *(b)*	7. *(c)*	8. *(d)*	9. *(b)*	10. *(d)*
11. *(c)*	12. *(b)*	13. *(b)*	14. *(b)*	15. *(c)*	16. *(b)*	17. *(a)*	18. *(d)*	19. *(d)*	20. *(d)*
21. *(20)*	22. *(3)*	23. *(16)*	24. *(106)*	25. *(2)*	26. *(9)*	27. *(9)*	28. *(50)*	29. *(33)*	30. *(10)*

16 MARCH SHIFT II

Section A : Objective Type Questions

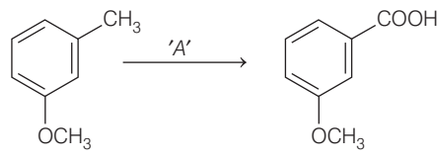
1. The green house gas/es is (are)

(A) carbon dioxide (B) oxygen
(C) water vapour (D) methane

Choose the most appropriate answer from the options given below.

a. Only (A) and (C) **b.** Only (A)
c. (A), (C) and (D) **d.** Only (A) and (B)

2.



In the above reaction, the reagent 'A' is

a. $NaBH_4$, H_3O^+ **b.** $LiAlH_4$
c. Alkaline $KMNO_4$, H^+ **d.** HCl, Zn - Hg

3. Which of the following reduction reaction cannot be carried out with coke?

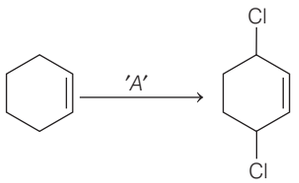
a. $Al_2O_3 \longrightarrow Al$ **b.** $ZnO \longrightarrow Zn$
c. $Fe_2O_3 \longrightarrow Fe$ **d.** $Cu_2O \longrightarrow Cu$

4. Identify the elements *X* and *Y* using the ionisation energy values given below.

	Ionisation energy (Ist)	**kJ/mol** (IInd)
X	495	4563
Y	731	1450

a. *X* = Na, *Y* = Mg **b.** *X* = Mg, *Y* = F
c. X = Mg, *Y* = Na **d.** *X* = F, *Y* = Mg

5.



Identify the reagent(s) '*A*' and condition(s) for the reaction:

a. *A* = HCl, anhydrous $AlCl_3$
b. *A* = HCl, $ZnCl_2$
c. *A* = Cl_2, UV light
d. *A* = Cl_2, dark, anhydrous $AlCl_3$

6. The secondary structure of protein is stabilised by

a. peptide bond **b.** glycosidic bond
c. hydrogen bonding **d.** van der Waals' forces

7. Fex_2 and Fey_3 are known when *x* and *y* are

a. *x* = F, Cl, Br, I and *y* = F, Cl and Br
b. *x* = F, Cl, Br and *y* = F, Cl, Br and I
c. *x* = Cl, Br, I and *y* = F, Cl, Br and I
d. *x* = F, Cl, Br, I and *y* = F, Cl, Br and I

8. Which of the following polymer is used in the manufacture of wood laminates ?

a. *cis*-polyisoprene
b. Melamine formaldehyde resin
c. Urea formaldehyde resin
d. Phenol and formaldehyde resin

9. **Statement I** Sodium hydride can be used as an oxidising agent.

Statement II The lone pair of electrons on nitrogen in pyridine makes it basic.

Choose the correct answer from the options given below.

a. Both statement I and statement II are true
b. Both statement I and statement II are false
c. Statement I is true but statement II is false
d. Statement I is false but statement II is true

10. The incorrect statement regarding the structure of C_{60} is

a. the six-membered rings are fused to both six and five-membered rings
b. each carbon atom forms three sigma bonds
c. the five-membered rings are fused only to six-membered rings
d. it contains 12 six-membered rings and 24 five-membered rings

11. The correct statements about H_2O_2 are

a. used in the treatment of effluents.
b. used as both oxidising and reducing agents.
c. the two hydroxyl groups lie in the same plane.
d. miscible with water.

Choose the correct answer from the options given below.

a. (A), (B), (C) and (D) **b.** (A), (B) and (D)
c. (B), (C) and (D) **d.** (A), (C) and (D)

12. Ammonolysis of alkyl halides followed by the treatment with NaOH solution can be used to prepare primary, secondary and tertiary amines. The purpose of NaOH in the reaction is

a. to remove basic impurities
b. to activate NH_3 used in the reaction
c. to remove acidic impurities
d. to increase the reactivity of alkyl halide

13. An unsaturated hydrocarbon *X* on ozonolysis gives *A*. Compound *A* when warmed with ammonical silver nitrate forms a bright silver mirror along the sides of the test tube. The unsaturated hydrocarbon *X* is

a. $CH_3-\underset{\underset{CH_3}{|}}{C}=\underset{\underset{CH_3}{|}}{C}-CH_3$ **b.** $CH_3-\overset{\overset{CH_3}{|}}{C}=$ 

c. $HC\equiv C-CH_2-CH_3$ **d.** $CH_3-C\equiv C-CH_3$

14. Which of the following is least basic?

a. $(CH_3CO)\ddot{N}HC_2H_5$ **b.** $(C_2H_5)_3\ddot{N}$
c. $(CH_3CO)_2\ddot{N}H$ **d.** $(C_2H_5)_2\ddot{N}H$

15. The characteristics of elements *X*, *Y* and *Z* with atomic numbers, respectively, 33, 53 and 83 are

a. *X* and *Y* are metalloids and *Z* is a metal
b. *X* is a metalloid, *Y* is a non-metal and *Z* is a metal
c. *X*, *Y* and *Z* are metals
d. *X* and *Z* are non-metals and *Y* is a metalloid

16. Match List-I with List-II.

	List-I (Test / Reagents / Observation(s))		**List-II** (Species detected)
A.	Lassaigne's test	(i)	Carbon
B.	Cu(II) oxide	(ii)	Sulphur
C.	Silver nitrate	(iii)	N, S, P, and halogen
D.	The sodium fusion extract gives black precipitate with acetic acid and lead acetate	(iv)	Halogen specifically

The correct match is

a. A-(iii), B-(i), C-(ii), D-(iv) **b.** A-(i), B-(iv), C-(iii), D-(ii)
c. A-(iii), B-(i), C-(iv), D-(ii) **d.** A-(i), B-(ii), C-(iv), D-(iii)

17. The incorrect statements below regarding colloidal solutions is

a. a colloidal solution shows colligative properties
b. an ordinary filter paper can stop the flow of colloidal particles

c. the flocculating power of Al^{3+} is more than that of Na^{+}

d. a colloidal solution shows Brownian motion of colloidal particles

18. Arrange the following metal complex/compounds in the increasing order of spin only magnetic moment. Presume all the three, high spin system.

(Atomic numbers Ce = 58, Gd = 64 and Eu = 63.)

A. $(NH_4)_2[Ce(NO_3)_6]$

B. $Gd(NO_3)_3$ and

C. $Eu(NO_3)_3$

a. (B) < (A) < (C) **b.** (C) < (A) < (B)

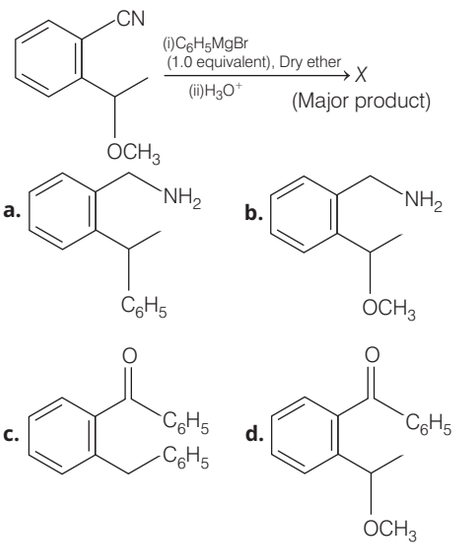
c. (A) < (B) < (C) **d.** (A) < (C) < (B)

19. The exact volumes of 1 M NaOH solution required to neutralise 50 mL of 1 M H_3PO_3 solution and 100 mL of 2 M H_3PO_2 solution, respectively, are

a. 100 mL and 100 mL **b.** 100 mL and 50 mL

c. 100 mL and 200 mL **d.** 50 mL and 50 mL

20.



Section B : Numerical Type Questions

21. Ga (atomic mass 70 u) crystallises in a hexagonal close packed structure. The total number of voids in 0.581 g of Ga is ..... $\times 10^{21}$. (Round off to the nearest integer).

22. A 5.0 m mol dm^{-3} aqueous solution of KCl has a conductance of 0.55 mS when measured in a cell constant 1.3 cm^{-1}.
The molar conductivity of this solution is ..... $mSm^2\ mol^{-1}$. (Round off to the nearest integer)

23. *A* and *B* decompose *via* first order kinetics with half-lives 54.0 min and 18.0 min respectively. Starting from an equimolar non-reactive mixture of *A* and *B*, the time taken for the concentration of *A* to become 16 times that of *B* is ..... min.
(Round off to the nearest integer).

24. In Duma's method of estimation of nitrogen, 0.1840 g of an organic compound gave 30 mL of nitrogen collected at 287 K and 758 mm of Hg pressure. The percentage composition of nitrogen in the compound is ..... .
(Round off to the nearest integer).

[Given: Aqueous tension at 287 K = 14 mm of Hg]

25. The number of orbitals with $n = 5$, $m_l = +2$ is ..... .
(Round off to the nearest integer).

26. At 363 K, the vapour pressure of *A* is 21 kPa and that of *B* is 18 kPa. One mole of *A* and 2 moles of *B* are mixed. Assuming that this solution is ideal, the vapour pressure of the mixture is ..... kPa. (Round off to the nearest integer).

27. Sulphurous acid (H_2SO_3) has $K_{a_1} = 1.7 \times 10^{-2}$ and $K_{a_2} = 6.4 \times 10^{-8}$. The pH of 0.588 M is .....
(Round off to the nearest integer)

28. When 35 mL of 0.15 M lead nitrate solution is mixed with 20 mL of 0.12 M chromic sulphate solution, ... $\times 10^{-5}$ moles of lead sulphate precipitate out. (Round off to the nearest integer).

29. At 25°C, 50 g of iron reacts with HCl to form $FeCl_2$. The evolved hydrogen gas expands against a constant pressure of 1 bar. The work done by the gas during this expansion is ..... J. (Round off to the nearest integer)

[Given, $R = 8.314\ J\ mol^{-1}\ K^{-1}$. Assume, hydrogen is an ideal gas]

[Atomic mass off Fe is 55.85 u]

30. $[Ti(H_2O)_6]^{3+}$ absorbs light of wavelength 498 nm during a *d-d* transition. The octahedral splitting energy for the above complex is ..... $\times 10^{-9}$ J (Round off to the nearest intger). [$h = 6.626 \times 10^{-34}$ Js, $c = 3 \times 10^8 ms^{-1}$]

Answers

1. *(c)*	2. *(c)*	3. *(a)*	4. *(a)*	5. *(c)*	6. *(c)*	7. *(a)*	8. *(c)*	9. *(c)*	10. *(d)*
11. *(b)*	12. *(c)*	13. *(c)*	14. *(c)*	15. *(b)*	16. *(c)*	17. *(b)*	18. *(d)*	19. *(c)*	20. *(d)*
21. *(15)*	22. *(14)*	23. *(108)*	24. *(19)*	25. *(3)*	26. *(19)*	27. *(1)*	28. *(525)*	29. *(2218)*	30. *(4)*

17 MARCH SHIFT I

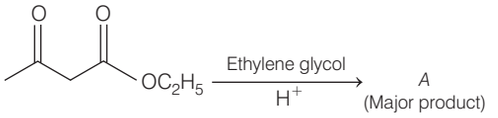
Section A : Objective Type Questions

1. With respect to drug-enzyme interaction, identify the wrong statement

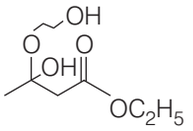
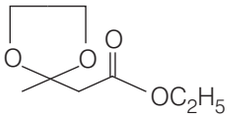
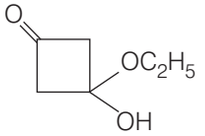
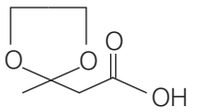
a. Non-competitive inhibitor binds to the allosteric site.
b. Allosteric inhibitor changes the enzyme's active site.
c. Allosteric inhibitor competes with the enzyme's active site.
d. Competitive inhibitor binds to the enzyme's active site.

2. Which of the following is an aromatic compound?

a. 
b. 
c. 
d. 

3. 

The product *A* in the above reaction is

a. 
b. 
c. 
d. 

4. A central atom in a molecule has two lone pairs of electrons and forms three single bonds. The shape of this molecule is

a. *see-saw*
b. planar triangular
c. T-shaped
d. trigonal pyramidal

5. Given below are two statements.

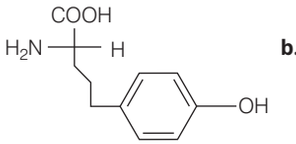
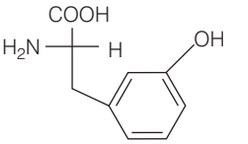
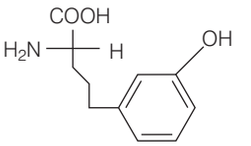
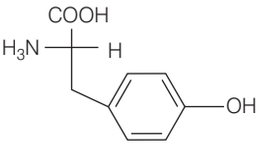
Statement I Potassium permanganate on heating at 573 K forms potassium manganate.

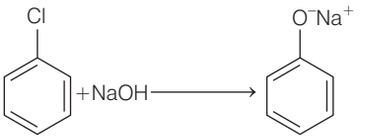
Statement II Both potassium permanganate and potassium manganate are tetrahedral and paramagnetic in nature.

In the light of the above statements, choose the most appropriate answer from the options given below

a. Statement I is true but statement II is false
b. Both statement I and statement II are true
c. Statement I is false but statement II is true
d. Both statement I and statement II are false

6. Which of the following is correct structure of tyrosine?

a. 
b. 
c. 
d. 

7. 

The above reaction requires which of the following reaction conditions?

a. 573 K, Cu, 300 atm
b. 623 K, Cu, 300 atm
c. 573 K, 300 atm
d. 623 K, 300 atm

8. The absolute value of the electron gain enthalpy of halogens satisfies

a. I > Br > Cl > F
b. Cl > Br > F > I
c. Cl > F > Br > I
d. F > Cl > Br > I

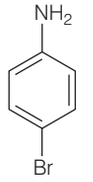
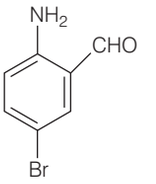
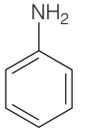
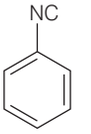
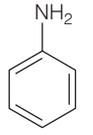
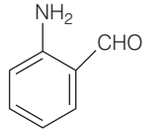
9. Which of the following compound cannot act as a Lewis base?

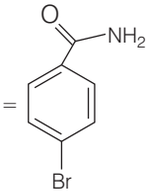
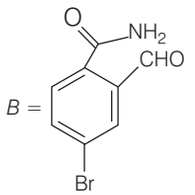
a. NF_3
b. PCl_5
c. SF_4
d. ClF_3

10. Reducing smog is a mixture of

a. smoke, fog and O_3
b. smoke, fog and SO_2
c. smoke, fog and $CH_2=CH—CHO$
d. smoke, fog and N_2O_3

11. Hofmann bromamide degradation of benzamide gives product *A*, which upon heating with $CHCl_3$ and NaOH gives product *B*. The structures of *A* and *B* are

a. *A* =  *B* = 
b. *A* =  *B* = 
c. *A* =  *B* = 

d. $A =$  $B =$ 

12. Mesityl oxide is a common name of

a. 2,4-dimethyl pentan-3-one
b. 3-methyl cyclohexane carbaldehyde
c. 2-methyl cyclohexanone
d. 4-methyl pent-3-en-2-one

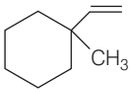
13. Which of the following reaction is an example of ammonolysis?

a. $C_6H_5COCl + C_6H_5NH_2 \longrightarrow C_6H_5CONHC_6H_5$

b. $C_6H_5CH_2CN \xrightarrow{[H]} C_6H_5CH_2CH_2NH_2$

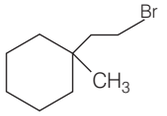
c. $C_6H_5NH_2 \xrightarrow{HCl} C_6H_5\overset{+}{N}H_3Cl^-$

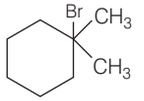
d. $C_6H_5CH_2Cl + NH_3 \longrightarrow C_6H_5CH_2NH_2$

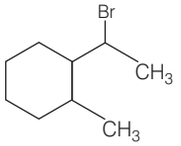
14. 

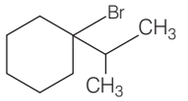
$\xrightarrow[CCl_4]{Br}$ *A* (Major product)

Product *A* is

a. 

b. 

c. 

d. 

15. A colloidal system consisting of a gas dispersed in a solid is called a/an

a. solid sol **b.** gel
c. aerosol **d.** foam

16. The incorrect statement(s) about heavy water is (are)

(A) used as a moderator in nuclear reactor.
(B) obtained as a by-product in fertiliser industry.
(C) used for the study of reaction mechanism.
(D) has a higher dielectric constant than water.

Choose the correct answer from the options given below :

a. (B) only **b.** (C) only
c. (D) only **d.** (C) and (D) only

17. The correct order of conductivity of ions in water is

a. $Na^+ > K^+ > Rb^+ > Cs^+$ **b.** $Cs^+ > Rb^+ > K^+ > Na^+$
c. $K^+ > Na^+ > Cs^+ > Rb^+$ **d.** $Rb^+ > Na^+ > K^+ > Li^+$

18. What is the spin-only magnetic moment value (BM) of a divalent metal ion with atomic number 25, in it's aqueous solution?

a. 5.92 **b.** 5.0
c. zero **d.** 5.26

19. Given below are two statements.

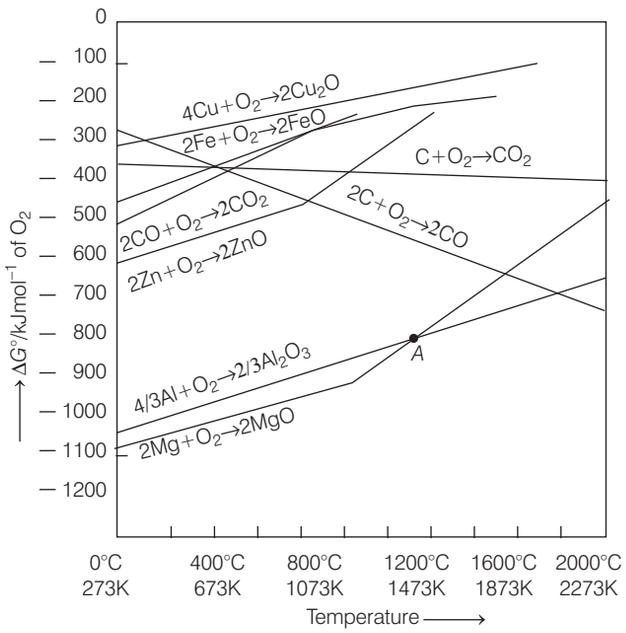
Statement I Retardation factor (R_f) can be measured in metre/centimetre.

Statement II R_f value of a compound remains constant in all solvents.

Choose the most appropriate answer from the options given below

a. Statement I is true but statement II is false.
b. Both statement I and statement II are true.
c. Both statement I and statement II are false.
d. Statement I is false but statement II is true.

20. The point of intersection and sudden increase in the slope, in the diagram given below, respectively, indicates.



a. $\Delta G = 0$ and melting or boiling point of the metal oxide
b. $\Delta G > 0$ and decomposition of the metal oxide
c. $\Delta G < 0$ and decomposition of the metal oxide
d. $\Delta G = 0$ and reduction of the metal oxide

Section B : Numerical Type Questions

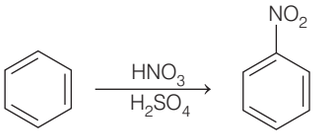
21. The reaction of white phosphorus on boiling with alkali in inert atmosphere resulted in the formation of product *A*. The reaction of 1 mol of *A* with excess of $AgNO_3$ in aqueous medium gives ..... mol(s) of Ag (Round off to the nearest integer).

22. 0.01 moles of a weak acid H*A* ($K_a = 2.0 \times 10^{-6}$) is dissolved in 1.0 L of 0.1 M HCl solution. The degree of dissociation of H*A* is ..... $\times 10^{-5}$ (Round off to the nearest integer).

[Neglect volume change on adding H*A*. Assume degree of dissociation << 1]

23. A certain orbital has $n = 4$ and $m_l = -3$. The number of radial nodes in this orbital is ..... (Round off to the nearest integer).

24.



In the above reaction 3.9 g of benzene on nitration gives 4.92 g of nitrobenzene. The percentage yield of nitrobenzene in the above reaction is ..... % (Round off to the nearest integer).

(Given, atomic mass C : 12.0 u, H : 1.0 u, O : 16.0 u, N : 14.0 u)

25. The mole fraction of a solute in a 100 molal aqueous solution ..... $\times 10^{-2}$

(Round off to the nearest integer).

[Given, atomic masses H : 1.0 u, O : 16.0 u]

26. For a certain first order reaction 32% of the reactant is left after 570 s. The rate constant of this reaction is ..... $\times 10^{-3} s^{-1}$. (Round off to the nearest integer).

[Given, $\log_{10} 2 = 0.301$, $\ln 10 = 2.303$]

27. The standard enthalpies of formation of Al_2O_3 and CaO are -1675 kJ mol^{-1} and -625 kJ mol^{-1} respectively.

For the reaction,

$3CaO + 2Al \longrightarrow 3Ca + Al_2O_3$ the standard reaction enthalpy $\Delta_r H^\circ$ ..... kJ.

(Round off to the nearest integer).

28. 15 mL of aqueous solution of Fe^{2+} in acidic medium completely reacted with 20 mL of 0.03 M aqueous $Cr_2O_7^{2-}$. The molarity of the Fe^{2+} solution is ..... $\times 10^{-2}$ M (Round off to the nearest integer).

29. The oxygen dissolved in water exerts a partial pressure of 20 kPa in the vapour above water. The molar solubility of oxygen in water is ..... $\times 10^{-5}$ mol dm^{-3}.

(Round off to the nearest integer).

[Given, Henry's law constant (K_H) = 8.0×10^4 kPa for O_2, density of water with dissolved oxygen = 1.0 kg dm^{-3}].

30. The pressure exerted by a non-reactive gaseous mixture of 6.4 g of methane and 8.8 g of carbon dioxide in a 10L vessel at 27°C is ..... kPa (Round off to the nearest integer)

(Assume gases are ideal, $R = 8.314$ J mol^{-1} K^{-1} Atomic mass, C : 12.0 u, H : 1.0 u, O : 16.0 u)

Answers

1. *(c)*	2. *(a)*	3. *(b)*	4. *(c)*	5. *(a)*	6. *(d)*	7. *(d)*	8. *(c)*	9. *(b)*	10. *(b)*
11. *(b)*	12. *(d)*	13. *(d)*	14. *(d)*	15. *(a)*	16. *(c)*	17. *(b)*	18. *(a)*	19. *(c)*	20. *(a)*
21. *(4)*	22. *(2)*	23. *(0)*	24. *(80)*	25. *(64)*	26. *(2)*	27. *(230)*	28. *(24)*	29. *(25)*	30. *(150)*

17 MARCH SHIFT II

Section A : Objective Type Questions

1. Fructose is an example of

a. pyranose **b.** ketohexose
c. aldohexose **d.** heptose

2. The set of elements that differ in mutual relationship from those of the other sets is

a. Li-Mg **b.** B-Si
c. Be-Al **d.** Li-Na

3. The functional groups that are responsible for the ion-exchange property of cation and anion exchange resins, respectively, are

a. —SO_3H and —NH_2 **b.** — SO_3H and —COOH
c. —NH_2 and —COOH **d.** — NH_2 and — SO_3H

4. Match List-I and List-II.

	List-I		List-II
A.	Haematite	1.	$Al_2O_3 \cdot x\,H_2O$
B.	Bauxite	2.	Fe_2O_3
C.	Magnetite	3.	$CuCO_3 \cdot Cu(OH)_2$
D.	Malachite	4.	Fe_3O_4

Choose the correct answer from the options given below.

	A	B	C	D		A	B	C	D
(a)	2	3	1	4	(b)	4	1	2	3
(c)	1	3	2	4	(d)	2	1	4	3

5. The correct pair(s) of the ambident nucleophiles is(are)

A. AgCN/KCN B. *R*COOAg/*R*COOK
C. $AgNO_2/KNO_2$ D. AgI/KI

a. B and C **b.** Only A
c. A and C **d.** Only B

6. The set that represents the pair of neutral oxides of nitrogen is

a. NO and N_2O **b.** N_2O and N_2O_3
c. N_2O and NO_2 **d.** NO and NO_2

7. Match List-I and List-II.

	List-I		List-II
A.	$[Co(NH_3)_6][Cr(CN)_6]$	1.	Linkage isomerism
B.	$[Co(NH_3)_3(NO_2)_3]$	2.	Solvate isomerism
C.	$[Cr(H_2O)_6]Cl_3$	3.	Co-ordination isomerism
D.	*cis*-$[CrCl_2(ox)_2]^{3-}$	4.	Optical isomerism

Choose the correct answer from the options given below.

	A	B	C	D
(a)	3	1	2	4
(b)	4	2	3	1
(c)	2	1	3	4
(d)	1	2	3	4

8. Primary, secondary and tertiary amines can be separated using

a. *para*-toluene sulphonyl chloride
b. chloroform and KOH
c. benzene sulphonic acid
d. acetyl amide

9. The common positive oxidation states for an element with atomic number 24, are

a. + 2 to + 6 **b.** + 1 and + 3 to + 6
c. + 1 and + 3 **d.** + 1 to + 6

10. Match List-I and List-II.

	List-I (Chemical compound)		**List-II** (Used as)
A.	Sucralose	1.	Synthetic detergent
B.	Glyceryl ester of stearic acid	2.	Artificial sweetener
C.	Sodium benzoate	3.	Antiseptic
D.	Bithionol	4.	Food preservative

Choose the correct match.

	A	B	C	D
a.	4	3	2	1
b.	2	1	4	3
c.	3	2	4	1
d.	1	2	4	3

11. Given below are two statements.

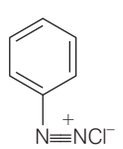
Statement-I 2-methylbutane on oxidation with $KMnO_4$ gives 2-methylbutan-2-ol.

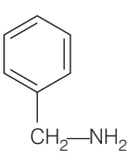
Statement-II *n*-alkanes can be easily oxidised to corresponding alcohols with $KMnO_4$.

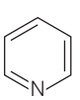
Choose the correct option.

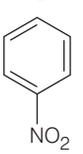
(a) Both statements I and II are correct.
(b) Both statements I and II are incorrect.
(c) Statement I is correct but statement II is incorrect.
(d) Statement I is incorrect but statement II is correct.

12. Nitrogen can be estimated by Kjeldahl's method for which of the following compound ?

a. 

b. 

c. 

d. 

13. Amongst the following, the linear species is

a. NO_2 **b.** Cl_2O
c. O_3 **d.** N_3^-

14. $\underset{\text{Sucrose}}{C_{12}H_{22}O_{11}} + H_2O \xrightarrow{\text{Enzyme } A} \underset{\text{Glucose}}{C_6H_{12}O_6} + \underset{\text{Fructose}}{C_6H_{12}O_6}$

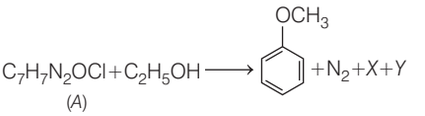
$\underset{\text{Glucose}}{C_6H_{12}O_6} \xrightarrow{\text{Enzyme } B} \underset{\text{Ethanol}}{2C_2H_5OH} + 2CO_2$

In the above reactions, the enzyme *A* and enzyme *B* respectively are

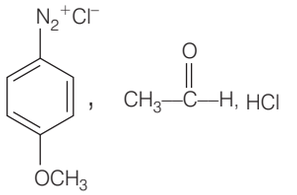
a. amylase and invertase **b.** invertase and amylase
c. invertase and zymase **d.** zymase and invertase

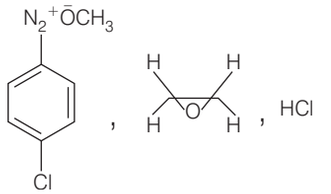
15. One of the by-products formed during the recovery of NH_3 from solvay process is

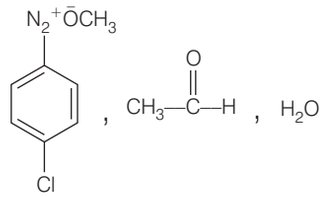
a. $Ca(OH)_2$ **b.** $NaHCO_3$ **c.** $CaCl_2$ **d.** NH_4Cl

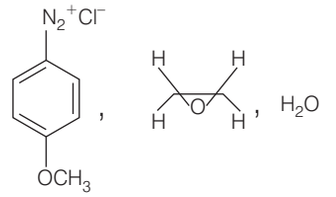
16. 

In the above reaction, the structural formula of (*A*), *X* and *Y* respectively are

a. 

b. 

c. 

d. 

17. For the coagulation of a negative sol, the species below, that has the highest flocculating power is

a. SO_4^{2-} **b.** Ba^{2+} **c.** Na^+ **d.** PO_4^{3-}

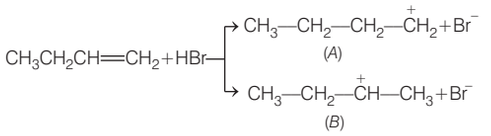
18. Which of the following statement(s) is (are) incorrect reason for eutrophication ?

A. Excess usage of fertilisers.
B. Excess usage of detergents.
C. Dense plant population in water bodies.
D. Lack of nutrients in water bodies that prevent plant growth.

Choose the most appropriate answer from the options given below.

a. Only A **b.** Only C **c.** B and D **d.** Only D

19. Choose the correct statement regarding the formation of carbocations *A* and *B*.



(a) Carbocation *B* is more stable and formed relatively at faster rate.
(b) Carbocation *A* is more stable and formed relatively at slow rate.
(c) Carbocation *B* is more stable and formed relatively at slow rate.
(d) Carbocation *A* is more stable and formed relatively at faster rate.

20. During which of the following processes, does entropy decrease ?

A. Freezing of water to ice at 0°C.
B. Freezing of water to ice at –10°C.
C. $N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$
D. Adsorption of CO(*g*) and lead surface.
E. Dissolution of NaCl in water.

a. A, B, C and D **b.** B and C **c.** A and E **d.** A, C and E

Section B : Numerical Type Questions

21. A KCl solution of conductivity 0.14 S m^{-1} shows a resistance of 4.19 Ω in a conductivity cell. If the same cell is filled with an HCl solution, the resistance drops to 1.03 Ω. The conductivity of the HCl solution is ..... $\times 10^{-2}$ S m^{-1} (Round off to the nearest integer)

22. On complete reaction of $FeCl_3$ with oxalic acid in aqueous solution containing KOH, resulted in the formation of product *A*. The secondary valency of Fe in the product *A* is ..... .

(Round off to the nearest integer).

23. The reaction $2A + B_2 \longrightarrow 2AB$ is an elementary reaction. For a certain quantity of reactants, if the volume of the reaction vessel is reduced by a factor of 3, the rate of the reaction increases by a factor of ..... . (Round off to the nearest integer).

24. The total number of C—C sigma bond/s in mesityl oxide ($C_6H_{10}O$) is ..... . (Round off to the nearest integer).

25. A 1 molal $K_4Fe(CN)_6$ solution has a degree of dissociation of 0.4. Its boiling point is equal to that of another solution which contains 18.1 weight per cent of a non-electrolytic solute *A*. The molar mass of *A* is ..... u. (Round off to the nearest integer).

[Density of water = 1.0 g cm^{-3}]

26. In the ground state of atomic Fe(Z = 26), the spin-only magnetic moment is ..... $\times 10^{-1}$ BM. (Round off to the nearest integer).

[Given : $\sqrt{3} = 1.73$, $\sqrt{2} = 1.41$]

27. The number of chlorine atoms in 20 mL of chlorine gas at STP is _____ 10^{21}. (Round off to the nearest integer).

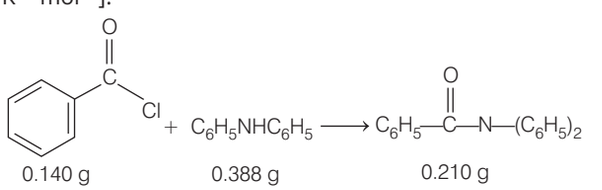
[Assume chlorine is an ideal gas at STP
$R = 0.083$ L bar mol^{-1} K^{-1}, $N_A = 6.023 \times 10^{23}$]

28. KBr is doped with 10^{-5} mole per cent of $SrBr_2$. The number of cationic vacancies in 1 g of KBr crystal is ..... 10^{14} (Round off to the nearest integer). [Atomic mass : K = 39.1 u, Br = 79.9 u, $N_A = 6.023 \times 10^{23}$]

29. Consider the reaction, $N_2O_4(g) \rightleftharpoons 2NO_2(g)$. The temperature at which $K_C = 20.4$ and $K_p = 600.1$, is ..... K. (Round off to the nearest integer).

[Assume all gases are ideal and $R = 0.0831$ L bar, K^{-1} mol^{-1}].

30.



Consider the above reaction. The percentage yield of amide product is ..... . (Round off to the nearest integer).

(Given : Atomic mass : C : 12.0 u, H : 1.0 u, N : 14.0 u, O : 16.0 u, Cl : 35.5 u)

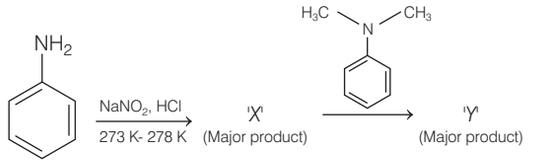
Answers

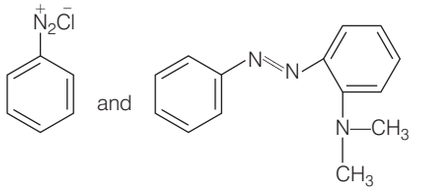
1. *(b)*	2. *(d)*	3. *(a)*	4. *(d)*	5. *(c)*	6. *(a)*	7. *(a)*	8. *(a)*	9. *(a)*	10. *(b)*
11. *(c)*	12. *(b)*	13. *(d)*	14. *(c)*	15. *(c)*	16. *(a)*	17. *(b)*	18. *(d)*	19. *(a)*	20. *(a)*
21. *(57)*	22. *(6)*	23. *(27)*	24. *(5)*	25. *(85)*	26. *(49)*	27. *(1)*	28. *(5)*	29. *(354)*	30. *(77)*

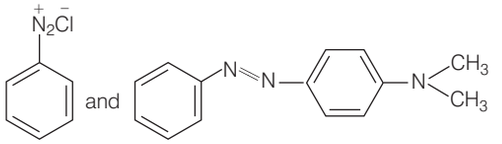
18 MARCH SHIFT I

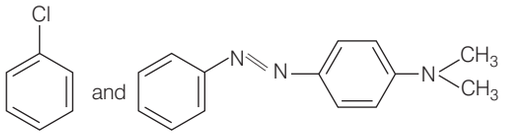
Section A : Objective Type Questions

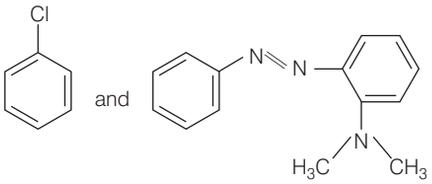
1.



a. 

b. 

c. 

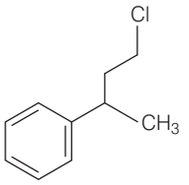
d. 

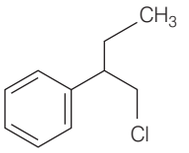
2. The ionic radius of Na^+ ions is 1.02 Å. The ionic radii (in Å) of Mg^{2+} and Al^{3+}, respectively, are

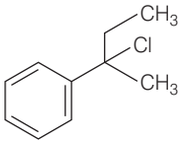
a. 1.05 and 0.99 **b.** 0.72 and 0.54
c. 0.85 and 0.99 **d.** 0.68 and 0.72

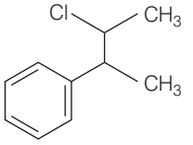
3. Reaction of Grignard reagent, C_2H_5MgBr with C_8H_8O followed by hydrolysis gives compound '*A*' which reacts instantly with Lucas reagent to give compound *B*, $C_{10}H_{13}Cl$.

The compound *B* is

a. 

b. 

c. 

d. 

4. Reagent, 1-naphthylamine and sulphanilic acid in acetic acid is used for the detection of

a. N_2O **b.** NO_3^-
c. NO **d.** NO_2^-

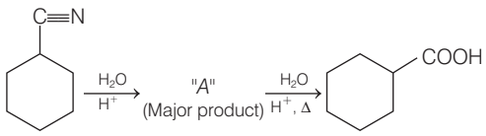
5. A non-reducing sugar "*A*" hydrolyses to give two reducing monosaccharides. Sugar *A* is

a. fructose **b.** galactose
c. glucose **d.** sucrose

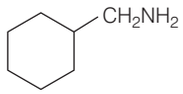
6. Match the List-I with List- II.

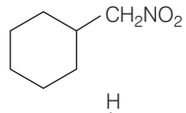
	List-I (Class of drug)		List-II (Example)
(A)	Antacid	(i)	Novestrol
(B)	Artificial sweetener	(ii)	Cimetidine
(C)	Antifertility	(iii)	Valium
(D)	Tranquilizers	(iv)	Alitame

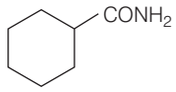
	A	B	C	D		A	B	C	D
a.	(ii)	(iv)	(i)	(iii)	**b.**	(iv)	(i)	(ii)	(iii)
c.	(iv)	(iii)	(i)	(ii)	**d.**	(ii)	(iv)	(iii)	(i)

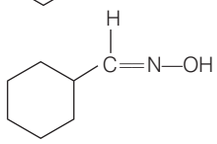
7. 

Consider the above chemical reaction and identify product "*A*".

a. 

b. 

c. 

d. 

8. Match the list-I with list- II

	List-I		List-II
(A)	Chlorophyll	(i)	Ruthenium
(B)	Vitamin-B_{12}	(ii)	Platinum
(C)	Anticancer drug	(iii)	Cobalt
(D)	Grubbs catalyst	(iv)	Magnesium

Choose the most appropriate answer from the options given below

	A	B	C	D
a.	(iii)	(ii)	(iv)	(i)
b.	(iv)	(iii)	(ii)	(i)
c.	(iv)	(iii)	(i)	(ii)
d.	(iv)	(ii)	(iii)	(i)

9. Match List-I with List-II.

	List-I (Chemicals)		**List-II** (Use / Preparation / Constituent)
(A)	Alcoholic potassium hydroxide	(i)	Electrodes in batteries
(B)	Pd/$BaSO_4$	(ii)	Obtained by addition reaction
(C)	BHC (Benzene hexachloride)	(iii)	Used for β-elimination reaction
(D)	Polyacetylene	(iv)	Lindlar catalyst

Choose the most appropriate match.

	A	B	C	D
a.	(ii)	(i)	(iv)	(iii)
b.	(iii)	(iv)	(ii)	(i)
c.	(iii)	(i)	(iv)	(ii)
d.	(ii)	(iv)	(i)	(iii)

10. The statements that are true.

(A) Methane leads to both global warming and photochemical smog.

(B) Methane is generated from paddy fields.

(C) Methane is a stronger global warming gas than CO_2.

(D) Methane is a part of reducing smog.

Choose the most appropriate answer from the options given below

a. (A), (B), (C) only **b.** (A) and (B) only

c. (B), (C), (D) only **d.** (A), (B), (D) only

11. Match List-I with List-II.

	List-I		**List-II**
(A)	$Ca(OCl)_2$	(i)	Antacid
(B)	$CaSO_4 \cdot \frac{1}{2}H_2O$	(ii)	Cement
(C)	CaO	(iii)	Bleach
(D)	$CaCO_3$	(iv)	Plaster of Paris

Choose the most appropriate answer from the options given below.

	A	B	C	D		A	B	C	D
a.	(i)	(iv)	(iii)	(ii)	**b.**	(iii)	(ii)	(iv)	(i)
c.	(iii)	(iv)	(ii)	(i)	**d.**	(iii)	(ii)	(i)	(iv)

12. Compound with molecular formula C_3H_6O can show

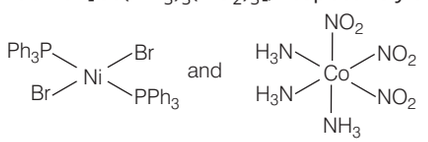
a. positional isomerism

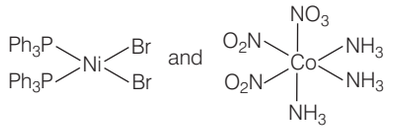
b. both positional isomerism and metamerism

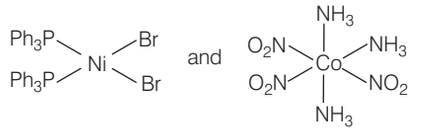
c. metamerism

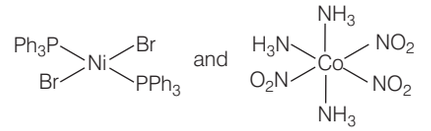
d. functional group isomerism

13. The correct structures of *trans*-$[NiBr_2(PPh_3)_2]$ and meridonial-$[Co(NH_3)_3(NO_2)_3]$, respectively are

a. 

b. 

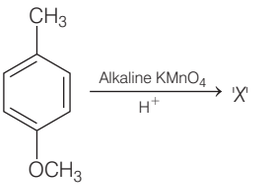
c. 

d. 

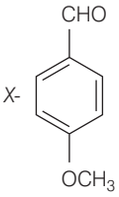
14. A certain orbital has no angular nodes and two radial nodes. The orbital is

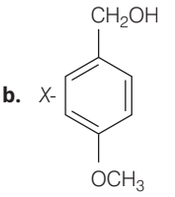
a. 2*s* **b.** 3*s*

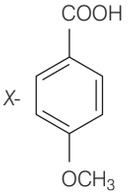
c. 3*p* **c.** 2*p*

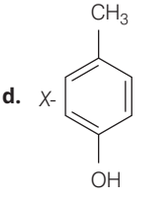
15. 

Considering the above chemical reaction, identify the product '*X*'.

a. 

b. 

c. 

d. 

16. Match List-I with List-II.

	List-I (Process)		**List-II** (Catalyst)
(A)	Deacon's process	(i)	ZSM-5
(B)	Contact process	(ii)	$CuCl_2$
(C)	Cracking of hydrocarbons	(iii)	Particles 'Ni'
(D)	Hydrogenation of vegetable oils	(iv)	V_2O_5

Choose the most appropriate answer from the options given below

	A	B	C	D		A	B	C	D
a.	(ii)	(iv)	(i)	(iii)	**b.**	(i)	(iii)	(ii)	(iv)
c.	(iii)	(i)	(iv)	(ii)	**d.**	(iv)	(ii)	(i)	(iii)

17. Given below are two statements : One is labelled as Assertion A and the other labelled as Reason R.

Assertion A During the boiling of water having temporary hardness, $Mg(HCO_3)_2$ is converted to $MgCO_3$.

Reason R The solubility product of $Mg(OH)_2$ is greater than that of $MgCO_3$.

In the light of the above statements, choose the most appropriate answer from the options given below

a. Both A and R are true but R is not the correct explanation of A.
b. A is true but R is false.
c. Both A and R are true and R is the correct explanation of A.
d. A is false but R is true.

18. The number of ionisable hydrogens present in the product obtained from a reaction of phosphorus trichloride and phosphonic acid is

a. 3 **b.** 0 **c.** 2 **d.** 1

19. In a binary compound, atoms of element *A* form a hcp structure and those of element *M* occupy 2/3 of the tetrahedral voids of the hcp structure. The formula of the binary compound is

a. M_2A_3 **b.** M_4A_3 **c.** M_4A **d.** MA_3

20. The chemical that is added to reduce the melting point of the reaction mixture during the extraction of aluminium is

a. cryolite **b.** bauxite
c. calamine **d.** kaolite

Section B : Numerical Type Questions

21. *AX* is a covalent diatomic molecule, where *A* and *X* are second row elements of periodic table. Based on molecular orbital theory, the bond order of *AX* is 2.5. The total number of electrons in *AX* is ..... . (Round off to the nearest integer).

22. In order to prepare a buffer solution of pH 5.74, sodium acetate is added to acetic acid. If the concentration of acetic acid in the buffer is 1.0 M, the concentration of sodium acetate in the buffer is ..... M. (Round off to the nearest integer).

[Given : pK_a (acetic acid = 4.74]

23. $2\,NO(g) + Cl_2(g) \rightleftharpoons 2\,NOCl(s)$

This reaction was studied at –10°C and the following data was obtained run

	$[NO]_0$	$[Cl_2]_0$	r_0
1	0.10	0.10	0.18
2	0.10	0.20	0.35
3	0.20	0.20	1.40

$[NO]_0$ and $[Cl_2]_0$ are the initial concentrations and r_0 is the initial reaction rate.

The overall order of the reaction is ..... .

(Round off to the nearest integer).

24. For the reaction,

$$C_2H_6 \longrightarrow C_2H_4 + H_2$$

the reaction enthalpy $\Delta_r H$ = ... kJ mol^{-1}

(Round off to the nearest integer).

[Given : Bond enthalpies in kJ mol^{-1} :
C—C = 347, C═C = 611; C—H = 414; H—H = 436]

25. ..... grams of 3-hydroxy propanal (MW = 74) must be dehydrated to produce 7.8 g of acrolein (MW= 56) (C_3H_4O), if the percentage yield is 64 (Round off to the nearest integer).

[Given : Atomic masses : C = 12.0 u, H = 1.0 u, O = 16.0 u]

26. A reaction of 0.1 mole of benzylamine with bromomethane gave 23 g of benzyl trimethyl ammonium bromide. The number of moles of bromomethane consumed in this reaction are $n \times 10^{-1}$, when n = ... (Round off to the nearest integer).

(Given : Atomic masses : C = 12.0 u, H = 1.0 u, N = 14.0 u, Br = 80.0 u]

27. The total number of unpaired electrons present in the complex K_3 [Cr(oxalate)$_3$] is ..... .

28. 2 molal solution of a weak acid H*A* has a freezing point of 3.885°C. The degree of dissociation of this acid is _____ $\times 10^{-3}$. (Round off to the nearest integer).

[Given : Molal depression constant of water = 1.85 K kg mol^{-1}, freezing point of pure water = 0°C]

29. For the reaction,

$$2Fe^{3+}(aq) + 2I^-(aq) \longrightarrow 2Fe^{2+}(aq) + I_2(s)$$

The magnitude of the standard molar Gibbs free energy change, $\Delta_r G^\circ_m$ = – ..... kJ (Round off to the nearest integer).

$$\left[\begin{array}{ll} E^\circ_{Fe^{2+}/Fe(s)} = -0.440\ V; & E^\circ_{Fe^{3+}/Fe(s)} = -0.036\ V \\ E^\circ_{I_2/2I^-} = 0.539\ V; & F = 96500\ C \end{array}\right]$$

30. Complete combustion of 3 g of ethane gives $x \times 10^{22}$ molecules of water. The value of x is ..... . (Round off to the nearest integer).

[Use : $N_A = 6.023 \times 10^{23}$; Atomic masses in u : C = 12.0 ; O = 16.0 ; H = 1.0]

Answers

1. *(b)*	2. *(b)*	3. *(c)*	4. *(d)*	5. *(d)*	6. *(a)*	7. *(c)*	8. *(b)*	9. *(b)*	10. *(a)*
11. *(c)*	12. *(d)*	13. *(d)*	14. *(b)*	15. *(c)*	16. *(a)*	17. *(d)*	18. *(c)*	19. *(b)*	20. *(a)*
21. *(15)*	22. *(10)*	23. *(3)*	24. *(128)*	25. *(16)*	26. *(3)*	27. *(3)*	28. *(50)*	29. *(45)*	30. *(18)*

18 MARCH SHIFT II

Section A : Objective Type Questions

1. The oxidation states of nitrogen in NO, NO_2, N_2O and NO_3^- are in the order of

a. $NO_3^- > NO_2 > NO > N_2O$ **b.** $NO_2 > NO_3^- > NO > N_2O$
c. $N_2O > NO_2 > NO > NO_3^-$ **d.** $NO > NO_2 > N_2O > NO_3^-$

2. In basic medium, H_2O_2 exhibits which of the following reactions ?

A. $Mn^{2+} \rightarrow Mn^{4+}$
B. $I_2 \rightarrow I^-$
C. $PbS \rightarrow PbSO_4$

Choose the most appropriate answer from the options given below.

a. A and C **b.** Only A
c. B Only **d.** A and B

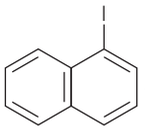
3. In the reaction of hypobromite with amide, the carbonyl carbon is lost as

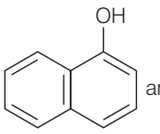
a. CO_3^{2-} **b.** HCO_3^- **c.** CO_2 **d.** CO

4. The oxide that shows magnetic property is

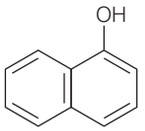
a. SiO_2 **b.** Mn_3O_4 **c.** Na_2O **d.** MgO

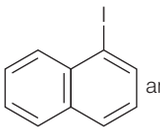
5. Main products formed during a reaction of 1-methoxy naphthalene with hydroiodic acid are

a. 

and CH_3OH **b.** 

and CH_3I

c. 

and CH_3OH **d.** 

and CH_3I

6. Deficiency of vitamin K causes

a. increase in blood clotting time
b. increase in fragility of RBC's
c. cheilosis
d. decrease in blood clotting time

7. An organic compound "*A*" on treatment with benzene sulphonyl chloride gives compound *B*. *B* is soluble in dil. NaOH solution. Compound *A* is

a. $C_6H_5 - N - (CH_3)_2$ **b.** $C_6H_5 - NHCH_2CH_3$
c. $C_6H_5 - CH_2NHCH_3$ **d.** $C_6H_5 - CH(CH_3) - NH_2$

8. The first ionisation energy of magnesium is smaller as compared to that of elements *X* and *Y*, but higher than that of *Z*. The elements *X*, *Y* and *Z*, respectively, are

a. chlorine, lithium and sodium
b. argon, lithium and sodium
c. argon, chlorine and sodium
d. neon, sodium and chlorine

9. The secondary valency and the number of hydrogen bonded water molecule(s) in $CuSO_4 \cdot 5H_2O$, respectively, are

a. 6 and 4 **b.** 4 and 1 **c.** 6 and 5 **d.** 5 and 1

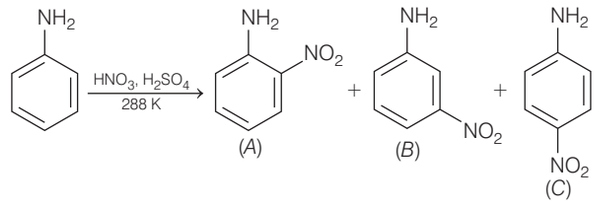
10. Given below are two statements.

Statement I Bohr's theory accounts for the stability and line spectrum of Li^+ ion.

Statement II Bohr's theory was unable to explain the splitting of spectral lines in the presence of a magnetic field.

In the light of the above statements, choose the most appropriate answer from the options given below :

a. Both statements I and II are true.
b. Statement I is false but statement II is true.
c. Both statements I and II are false.
d. Statement I is true but statement II is false.

11. 

Consider the given reaction, percentage yield of

a. (*C*) > (*A*) > (*B*) **b.** (*B*) > (*C*) > (*A*)
c. (*A*) > (*C*) > (*B*) **d.** (*C*) > (*B*) > (*A*)

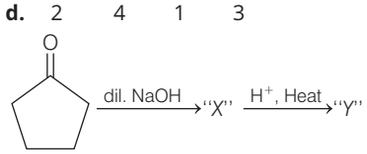
12. The charges on the colloidal CdS sol and TiO_2 sol are, respectively

a. positive and positive **b.** positive and negative
c. negative and negative **d.** negative and positive

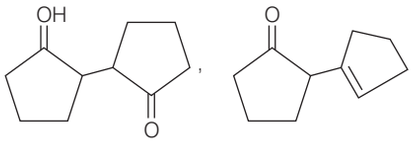
13. Match List-I with List-II.

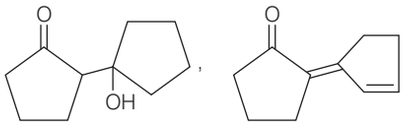
	List-I (Class of chemicals)		List-II (Example)
A.	Antifertility drug	1.	Meprobamate
B.	Antibiotic	2.	Alitame
C.	Tranquilizer	3.	Norethindrone
D.	Artificial sweetener	4.	Salvarsan

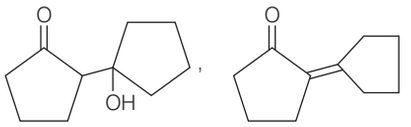
	A	B	C	D
a.	2	3	4	1
b.	4	3	2	1
c.	3	4	1	2
d.	2	4	1	3

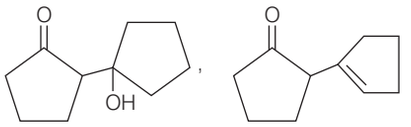
14. 

Consider the above reaction, the product '*X*' and '*Y*' respectively are

a. 

b. 

c. 

d. 

15. Match List-I with List-II

	List-I		List-II
A.	Be	1.	Treatment of cancer
B.	Mg	2.	Extraction of metals
C.	Ca	3.	Incendiary bombs and signals
D.	Ra	4.	Windows of X-ray tubes
		5.	Bearings for motor engines.

Choose the most appropriate answer the option given below.

	A	B	C	D		A	B	C	D
a.	4	3	1	2	**b.**	4	3	2	1
c.	3	4	5	2	**d.**	3	4	2	5

16. Given below are two statements.

Statement I C_2H_5OH and AgCN both can generate nucleophile.

Statement II KCN and AgCN both will generate nitrile nucleophile with all reaction conditions.

Choose the most appropriate option.

a. Statement I is true but statement II is false.
b. Both statements I and II are true.
c. Statement I is false but statement II is true.
d. Both statements I and II are false.

17. Given below are two statements

Statement I Non-biodegradable wastes are generated by the thermal power plants.

Statement II Bio-degradable detergents leads to eutrophication.

In the light of the above statements, choose the most appropriate answer from the option given below.

a. Both statements I and II are false.
b. Statement I is true but statement II is false.
c. Statement I is false but statement II is true.
d. Both statements I and II are true.

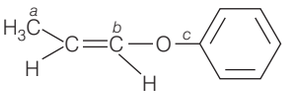
18. Match List-I with List-II.

	List-I		List-II
A.	Mercury	1.	Vapour phase refining
B.	Copper	2.	Distillation refining
C.	Silicon	3.	Electrolytic refining
D.	Nickel	4.	Zone refining

Choose the most appropriate answer the option given below

	A	B	C	D
a.	1	4	2	3
b.	2	3	1	4
c.	2	3	4	1
d.	2	4	3	1

19. In the following molecules,



hybridisation of carbon *a*, *b* and *c* respectively are

a. sp^3, sp, sp **b.** sp^3, sp^2, sp
c. sp^3, sp^2, sp^2 **d.** sp^3, sp, sp^2

20. A hard substance melts at high temperature and is an insulator in both solid and in molten state.

This solid is most likely to be a/an

a. ionic solid **b.** molecular solid
c. metallic solid **d.** covalent solid

Numerical Type Questions

21. A reaction has a half-life of 1 min. The time required for 99.9% completion of the reaction is ..... min (Round off to the nearest integer).

[Use : ln 2 = 0.69, ln 10 = 2.3]

22. The molar conductivities at infinite dilution of barium chloride, sulphuric acid and hydrochloric acid are 280, 860 and 426 $Scm^2\ mol^{-1}$ respectively. The molar conductivity at infinite dilution of barium sulphate is ..... $S\ cm^2\ mol^{-1}$ (Round off to the nearest Integer).

23. The number of species below that have two lone pairs of electrons in their central atom is ..... . (Round off to the nearest integer)

SF_4, BF_4^-, ClF_3, AsF_3, PCl_5, BrF_5, XeF_4, SF_6

24. A xenon compound '*A*' upon partial hydrolysis gives XeO_2F_2. The number of lone pair of electrons present in compound *A* is ..... (Round off to the nearest integer).

25. The gas phase reaction

$$2A(g) \rightleftharpoons A_2(g)$$

at 400 K has $\Delta G^\circ = +25.2\ kJ\ mol^{-1}$.

The equilibrium constant K_C for this reaction is ..... $\times 10^{-2}$. (Round off to the nearest integer).

[Use : $R = 8.3$ J mol^{-1} K^{-1}, In 10 = 2.3]

$\log_{10} 2 = 0.30$, 1 atm = 1 bar]

[antilog (– 0.3) = 0.501]

26. In Tollen's test for aldehyde, the overall number of electron(s) transferred to the Tollen's reagent formula $[Ag(NH_3)_2]^+$ per aldehyde group to form silver mirror is ..... (Round off to the nearest integer).

27. The solubility of $CdSO_4$ in water is

8.0×10^{-4} mol L^{-1}. Its solubility in 0.01 M H_2SO_4 solution is ..... $\times 10^{-6}$ mol L^{-1}. (Round off to the nearest integer) (Assume that, solubility is much less than 0.01 M)

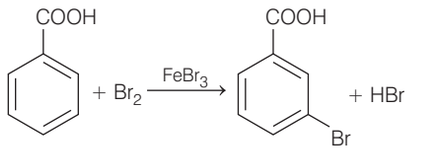
28. A solute a dimerises in water. The boiling point of a 2 molar solution of *A* is 100.52°C.

The percentage association of *A* is ..... . (Round off to the nearest integer)

[Use : K_b for water = 0.52 K kg mol^{-1}, boiling point of water = 100°C]

29. 10.0 mL of Na_2CO_3 solution is titrated against 0.2 M HCl solution. The following titre values were obtained in 5 readings. 4.8 mL, 4.9 mL, 5.0 mL, 5.0 mL and 5.0 mL based on these readings and convention of titrimetric estimation of concentration of Na_2CO_3 solution is ..... mM (Round off to the nearest integer).

30.



Consider the above reaction where 6.1 g of benzoic acid is used to get 7.8 g of *m*-bromo benzoic acid. The percentage yield of the product is ..... .

(Round off to the nearest integer).

[Given : Atomic masses : C = 12.0 u, H = 1.0 u, O = 16.0u, Br = 80.0 u]

Answers

1. *(a)*	2. *(d)*	3. *(a)*	4. *(b)*	5. *(b)*	6. *(a)*	7. *(d)*	8. *(c)*	9. *(b)*	10. *(b)*
11. *(d)*	12. *(d)*	13. *(c)*	14. *(c)*	15. *(b)*	16. *(a)*	17. *(d)*	18. *(c)*	19. *(c)*	20. *(d)*
21. *(10)*	22. *(288)*	23. *(2)*	24. *(19)*	25. *(1.66)*	26. *(2)*	27. *(64)*	28. *(100)*	29. *(50)*	30. *(78)*

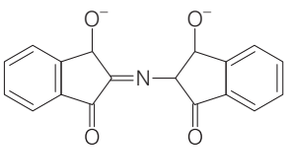
20 JULY SHIFT I

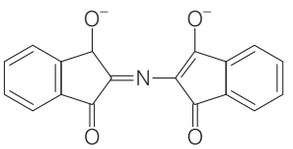
Section A : Objective Type Questions

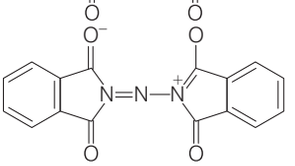
1. According to the valence bond theory the hybridisation of central metal atom is dsp^2 for which one of the following compounds?

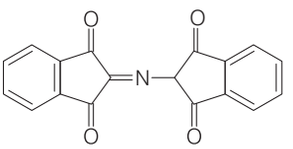
a. $NiCl_2 \cdot 6H_2O$ **b.** $K_2[Ni(CN)_4]$
c. $[Ni(CO)_4]$ **d.** $Na_2[NiCl_4]$

2. The correct structure of Rhumann's Purple, the compound formed in the reaction of ninhydrin with proteins is

a.


b.


c.


d.


3. Green chemistry in day–to–day life is in the use of

a. chlorine for bleaching of paper.
b. large amount of water alone for washing clothes.
c. Tetrachloroethene for laundry.
d. Liquified CO_2 for dry cleaning of clothes.

4. The correct order of intensity of colors of the compound is

a. $[Ni(CN)_4]^{2-} > [NiCl_4]^{2-} > [Ni(H_2O)_6]^{2+}$
b. $[Ni(H_2O)_6]^{2+} > [NiCl_4]^{2-} > [Ni(CN)_4]^{2-}$
c. $[NiCl_4]^{2-} > [Ni(H_2O)_6]^{2+} > [Ni(CN)_4]^{2-}$
d. $[NiCl_4]^{2-} > [Ni(CN)_4]^{2-} > [Ni(H_2O)_6]^{2+}$

5. The set in which compounds have different nature is

a. $B(OH)_3$ and H_3PO_3 **b.** $B(OH)_3$ and $Al(OH)_3$
c. NaOH and $Ca(OH)_2$ **d.** $Be(OH)_2$ and $Al(OH)_3$

6. The species given below that does not show disproportionation reaction is

a. BrO_4^- **b.** BrO^-
c. BrO_2^- **d.** BrO_3^-

7. Given below are two statements. One is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) Sharp glass edge becomes smooth on heating it upto its melting point.

Reason (R) The viscosity of glass decreases on melting.

Choose the most appropriate answer from the options given below.

a. A is true but R is false
b. Both A and R are true but R is not the correct explanation of A.
c. A is false but R is true.
d. Both A and R are true and R is the correct explanation of A.

8. Orlon fibres are made up of

a. polyacrylonitrile **b.** polyester
c. polyamide **d.** cellulose

9. Given below are two statements : One is labelled as Assertion A and other is labelled as Reason R.

Assertion A The dihedral angles in H_2O_2 in gaseous phase is 90.2° and in solid phase is 111.5°.

Reason R The change in dihedral angle in solid and gaseous phase is due to the difference in the intermolecular forces.

Choose the most appropriate answer from the options given below for A and R.

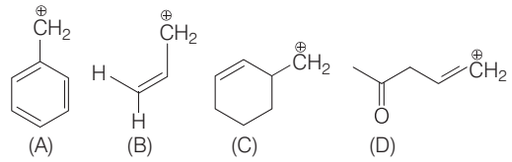
a. A is correct but R is not correct.
b. Both A and R are correct but R is not the correct explanation of A.
c. Both A and R are correct and R is the correct explanation of A.
d. A is not correct but R is correct.

10. Chemical nature of the nitrogen oxide compound obtained from a reaction of concentrated nitric acid and P_4O_{10} (in 4 : 1 ratio) is

a. acidic **b.** basic
c. amphoteric **d.** neutral

11. An inorganic compound '*X*' on treatment with concentrated H_2SO_4 produces brown fumes and gives dark brown ring with $FeSO_4$ in presence of concentrated H_2SO_4. Also compound '*X*' gives precipitate '*Y*', when its solution in dilute HCl is treated with H_2S gas. The precipitate '*Y*' on treatment with concentrated HNO_3 followed by excess of NH_4OH further gives deep blue coloured solution, compound '*X*' is

a. $Co(NO_3)_2$ **b.** $P(NO_2)_2$
c. $Cu(NO_3)_2$ **d.** $Pb(NO_3)_2$

12.


Among the given species the resonance stabilised carbocations are

a. (C) and (D) only **b.** (A), (B) and (D) only
c. (A) and (B) only **d.** (A), (B) and (C) only

13. A *s*-block element (*M*) reacts with oxygen to form an oxide of the formula MO_2. The oxide is pale yellow in colour and paramagnetic. The element (*M*) is

a. Mg **b.** Na **c.** Ca **d.** K

14. In the given reaction, 3-bromo-2, 2-dimethyl butane

$$\xrightarrow{C_2H_5OH} \underset{\text{Major product}}{A}.$$

Product *A* is

a. 2-ethoxy-3, 3-dimethyl butane
b. 1-ethoxy-3, 3-dimethyl butane
c. 2-ethoxy-2, 3-dimethyl butane
d. 2-hydroxy-3, 3-dimethyl butane

15. The metal that can be purified economically by fractional distillation method is

a. Fe **b.** Zn **c.** Cu **d.** Ni

16. Compound *A* is converted to *B* on reaction with $CHCl_3$ and KOH. The compound *B* is toxic and can be decomposed by *C*. *A*, *B* and *C* respectively are

a. primary amine, nitrile compound, conc. HCl
b. secondary amine, isonitrile compound, conc. NaOH
c. primary amine, isonitrile compound, conc. HCl
d. secondary amine, nitrile compound, conc. NaOH

17. The conditions given below are in the context of observing Tyndall effect in colloidal solutions

(A) The diameter of the colloidal particles is comparable to the wavelength of light used.
(B) The diameter of the colloidal particles is much smaller than the wavelength of light used.
(C) The diameter of the colloidal particles is much larger than the wavelength of light used.
(D) The refractive indices of the dispersed phase and the dispersion medium are comparable.
(E) The dispersed phase has a very different refractive index from the dispersion medium.

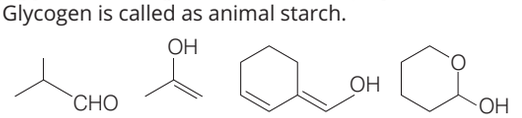
Choose the most appropriate conditions from the options given below.

a. (A) and (E) only **b.** (C) and (D) only
c. (A) and (D) only **d.** (B) and (E) only

18. Identify the incorrect statement from the following.

a. Amylose is a branched chain polymer of glucose.
b. Starch is a polymer of α-D-glucose .
c. β-glycosidic linkage makes cellulose polymer.
d. Glycogen is called as animal starch.

19.

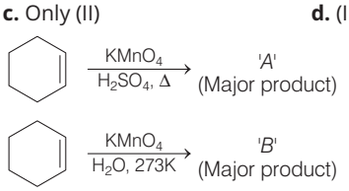


(I) (II) (III) (IV)

Which among the above compound/s does/do not form silver mirror when treated with Tollen's reagent?

a. (I), (III) and (IV) only **b.** Only (IV)
c. Only (II) **d.** (III) and (IV) only

20.



For above chemical reactions, identify the correct statement from the following

a. Both compound '*A*' and compound '*B*' are dicarboxylic acids.
b. Both compound '*A*' and compound '*B*' are diols.
c. Compound '*A*' is diol and compound '*B*' is dicarboxylic acid.
d. Compound '*A*' is dicarboxylic acid and compound '*B*' is diol.

Section B : Numerical Type Questions

21. The number of lone pairs of electron on the central I atom in I_3^- is ..... .

22. 250 mL of 0.5 M NaOH was added to 500 mL of 1 M HCl. The number of unreacted HCl molecules in the solution after complete reaction is ..... $\times 10^{21}$. (Nearest integer) ($N_A = 6.022 \times 10^{23}$)

23. The azimuthal quantum number for the valence electrons of Ga^+ ion is ..... .
(Atomic number of Ga = 31)

24. The spin only magnetic moment value for the complex $[Co(CN)_6]^{4-}$ is ..... BM.
[Atomic number of Co = 27]

25. $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$

In an equilibrium mixture, the partial pressures are

$p_{SO_3} = 45\text{kPa}$; $p_{O_2} = 530$ Pa and $p_{SO_2} = 45\text{kPa}$. The equilibrium constant K_p = ... $\times 10^{-2}$. (Nearest integer)

26. The number of nitrogen atoms in a semicarbazone molecule of acetone is ..... .

27. To synthesis 1.0 mole of 2-methylpropan -2-ol from ethylethanoate ..... equivalents of CH_3MgBr reagent will be required. (Integer value)

28. The inactivation rate of a viral preparation is proportional to the amount of virus. In the first minute after preparation, 10% of the virus is inactivated. The rate constant for viral inactivation is ..... $\times 10^{-3}\,\text{min}^{-1}$. (Nearest integer)
[Use: In 10 = 2.303; $\log_{10} 3 = 0.477$; property of logarithm : $\log x^y = y \log x$]

29. An average person needs about 10000 kJ energy per day. The amount of glucose (molar mass = $180.0\,\text{g mol}^{-1}$) needed to meet this energy requirement is ..... g.

[Use $\Delta_c H(\text{glucose}) = 2700\text{kJ mol}^{-1}$]

30. At 20°C, the vapour pressure of benzene is 70 torr and that of methyl benzene is 20 torr. The mole fraction of benzene in the vapour phase at 20°C above an equimolar mixture of benzene and methyl benzene is..... $\times 10^{-2}$. (Nearest integer)

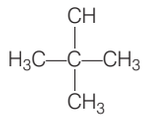
Answers

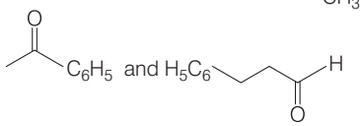
1. *(b)*	2. *(d)*	3. *(d)*	4. *(c)*	5. *(b)*	6. *(a)*	7. *(b)*	8. *(a)*	9. *(d)*	10. *(a)*
11. *(c)*	12. *(c)*	13. *(d)*	14. *(c)*	15. *(b)*	16. *(c)*	17. *(a)*	18. *(a)*	19. *(c)*	20. *(d)*
21. *(3)*	22. *(226)*	23. *(0)*	24. *(2)*	25. *(172)*	26. *(3)*	27. *(2)*	28. *(106)*	29. *(667)*	30. *(78)*

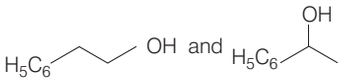
20 JULY SHIFT II

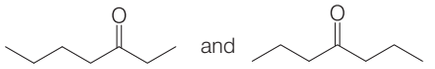
Section A : Objective Type Questions

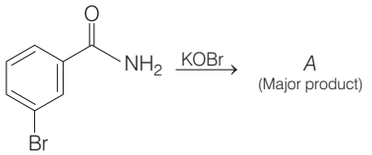
1. Which one of the following pairs of isomers is an example of metamerism?

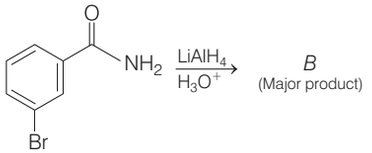
a. $CH_3CH_2CH_2CH_2CH_3$ and 

b. 

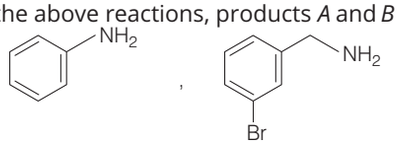
c. 

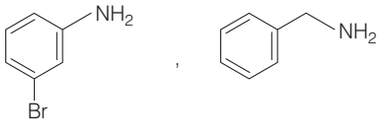
d. 

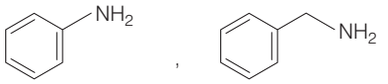
2. 

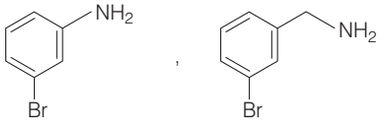


In the above reactions, products *A* and *B* respectively are

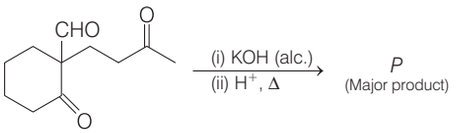
a. 

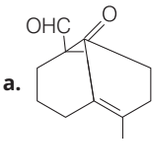
b. 

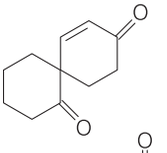
c. 

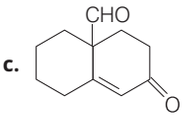
d. 

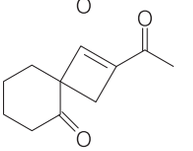
3. The major product *P* in the following reaction is



a. 

b. 

c. 

d. 

4. The single largest industrial application of dihydrogen is
- **a.** manufacture of metal hydrides
- **b.** rocket fuel in space research
- **c.** in the synthesis of ammonia
- **d.** In the synthesis of nitric acid

5. Consider two chemical reactions (*A*) and (*B*) that take place during metallurgical process :

(*A*) $ZnCO_3(s) \xrightarrow{\Delta} ZnO(s) + CO_2(g)$

(*B*) $2ZnS(s) + 3O_2(g) \xrightarrow{\Delta} 2ZnO(s) + 2SO_2(g)$

The correct option of names given to them respectively is
- **a.** (*A*) is calcination and (*B*) is roasting
- **b.** Both (*A*) and (*B*) are producing same product so both are roasting
- **c.** Both (*A*) and (*B*) are producing same product so both are calcination
- **d.** (*A*) is roasting and (*B*) is calcination

6. A solution is 0.1 M in Cl^- and 0.001 M in CrO_4^{2-}. Solid $AgNO_3$ is gradually added to it.

Assuming that the addition does not change in volume and $K_{sp}(AgCl) = 1.7 \times 10^{-10}\ M^2$ and $K_{sp}(Ag_2CrO_4) = 1.9 \times 10^{-12} M^3$

Select correct statement from the following
- **a.** AgCl precipitates first because its K_{sp} is high.
- **b.** Ag_2CrO_4 precipitates first as its K_{sp} is low.
- **c.** Ag_2CrO_4 precipitates first because the amount of Ag^+ needed is low.
- **d.** AgCl will precipitate first as the amount of Ag^+ needed to precipitate is low.

7. Outermost electronic configuration of a group-13 element *E* is $4s^2\ 4p^1$. The electronic configuration of an element of *p*-block period-five placed diagonally to element, *E* is
- **a.** $[Kr]3d^{10}4s^2 4p^2$
- **b.** $[Ar]3d^{10}4s^2 4p^2$
- **c.** $[Xe]5d^{10}6s^2 6p^2$
- **d.** $[Kr]4d^{10}5s^2 5p^2$

8. Metallic sodium does not react normally with
- **a.** gaseous ammonia
- **b.** but-2-yne
- **c.** ethyne
- **d.** *tert*-butyl alcohol

9. Spin only magnetic moment of an octahedral complex of Fe^{2+} in the presence of a strong field ligand in BM is
- **a.** 4.89
- **b.** 2.82
- **c.** 0
- **d.** 3.46

10. Which one of the following species doesn't have a magnetic moment of 1.73 BM (spin only value) ?

a. O_2^+ **b.** CuI
c. $[Cu(NH_3)_4]Cl_2$ **d.** O_2^-

11. Which one of the following statements is not true about enzymes ?

a. Enzymes are non-specific for a reaction and substrate.
b. Almost all enzymes are proteins.
c. Enzymes work as catalysts by lowering the activation energy of a biochemical reaction.
d. The action of enzymes is temperature and pH specific.

12. The hybridisations of the atomic orbitals of nitrogen in NO_2^-, NO_2^+ and NH_4^+ respectively are

a. sp^3, sp^2 and sp **b.** sp, sp^2 and sp^3
c. sp^3, sp and sp^2 **d.** sp^2, sp and sp^3

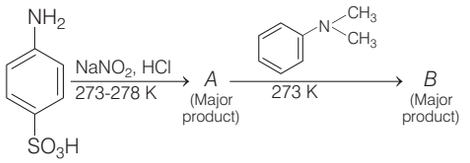
13. Bakelite is a cross-linked polymer of formaldehyde and

a. PHBV **b.** buna-S **c.** novolac **d.** dacron

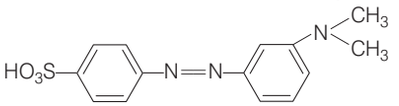
14. Benzene on nitration gives nitrobenzene in presence of HNO_3 and H_2SO_4 mixutre, where

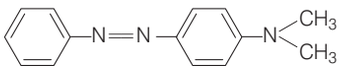
a. both H_2SO_4 and HNO_3 act as a bases
b. HNO_3 acts as an acid and H_2SO_4 acts as a base
c. both H_2SO_4 and NHO_3 act as an acids
d. HNO_3 acts as a base and H_2SO_4 acts as an acid

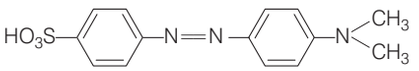
15.

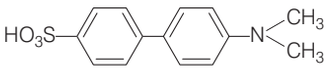


Consider the above reaction, compound *B* is

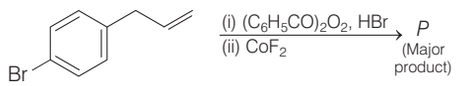
a.


b.


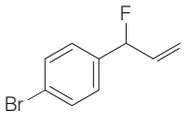
c.


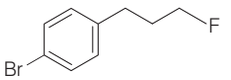
d.


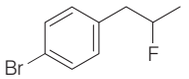
16.

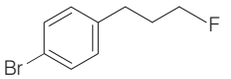


Major product *P* of above reaction is

a.


b.


c.


d.


17. Cu^{2+} salt reacts with potassium iodide to give

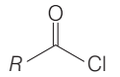
a. Cu_2I_2 **b.** Cu_2I_3 **c.** CuI **d.** $Cu(I_3)_2$

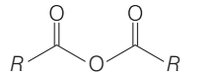
18. In Carius method, halogen containing organic compound is heated with fuming nitric acid in the presence of

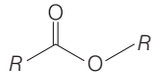
a. HNO_3 **b.** $AgNO_3$ **c.** $CuSO_4$ **d.** $BaSO_4$

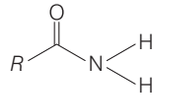
19. Which one of the following gases is reported to retard photosynthesis ?

a. CO **b.** CFCs
c. CO_2 **d.** NO_2

20. (A)


(B)


(C)


(D)


The correct order of their reactivity towards hydrolysis at room temperature is

a. (A) > (B) > (C) > (D) **b.** (D) > (A) > (B) > (C)
c. (D) > (B) > (A) > (C) **d.** (A) > (C) > (B) > (D)

Section B : Numerical Type Questions

21. For a given chemical reaction, $A \longrightarrow B$ at 300 K the free energy change is –49.4 kJ mol^{-1} and the enthalpy of reaction is 51.4 kJ mol^{-1} . The entropy change of the reaction is ..... $JK^{-1}mol^{-1}$.

22. The wavelength of electrons accelerated from rest through a potential difference of 40 kV is $x \times 10^{-12}$ m. The value of *x* is ..... (Nearest integer)

Given : Mass of electron $= 9.1 \times 10^{-31}$ kg

Charge on an electron $= 1.6 \times 10^{-19}$ C

Planck's constant $= 6.63 \times 10^{-34}$ Js

23. The vapour pressures of *A* and *B* at 25°C are 90 mm Hg and 15 mm Hg respectively. If *A* and *B* are mixed such that the mole-fraction of *A* in the mixture is 0.6, then the mole fraction of *B* in the vapour phase is $x \times 10^{-1}$. The value of *x* is ..... . (Nearest integer)

24. 4g equimolar mixture of NaOH and Na_2CO_3 contains *x* g of NaOH and *y* g of Na_2CO_3. The value of *x* is ..... g. (Nearest integer)

25. When 0.15 g of an organic compound was analysed using Carius method for estimation of bromine, 0.2397 g of AgBr was obtained. The percentage of bromine in the organic compound is ..... . (Nearest integer)

[Atomic mass : Silver = 108, bromine = 80]

26. 100 mL of 0.0018% (*w/v*) solution of Cl^- ion was the minimum concentration of Cl^- required to precipitate a negative sol in one h. The coagulating value of Cl^- ion is ..... (Nearest integer)

27. $PCl_5(g) \longrightarrow PCl_3(g) + Cl_2(g)$

In the above first order reaction, the concentration of PCl_5 reduces from initial concentration 50 mol L^{-1} to 10 mol L^{-1} in 120 minutes at 300 K. The rate constant for the reaction at 300 K is $x \times 10^{-2}$ min^{-1}. The value of *x* is ..... .

[Given, log 5 = 0.6989]

28. Diamond has a three dimensional structure of C atoms formed by covalent bonds. The structure of diamond has face centred cubic lattice, where 50% of the tetrahedral voids are also occupied by carbon atoms. The number of carbon atoms present per unit cell of diamond is ..... .

29. An aqueous solution of $NiCl_2$ was heated with excess sodium cyanide in presence of strong oxidising agent to form $[Ni(CN)_6]^{2-}$. The total change in number of unpaired electrons on metal centre is ..... .

30. Potassium chlorate is prepared by electrolysis of KCl in basic solution as shown by following equation

$$6OH^- + Cl^- \longrightarrow ClO_3^- + 3H_2O + 6e^-$$

A current of xA has to be passed for 10th to produce 10.0 g of potassium chlorate. The value of x is ..... . (Nearest integer)

(Molar mass of $KClO_3$ =122.6 g mol^{-1}, F = 96500 C)

Answers

1. *(d)*	2. *(d)*	3. *(b)*	4. *(c)*	5. *(a)*	6. *(d)*	7. *(d)*	8. *(b)*	9. *(c)*	10. *(b)*
11. *(a)*	12. *(d)*	13. *(c)*	14. *(d)*	15. *(c)*	16. *(d)*	17. *(a)*	18. *(b)*	19. *(d)*	20. *(a)*
21. *(360)*	22. *(6)*	23. *(1)*	24. *(1)*	25. *(68)*	26. *(1)*	27. *(1)*	28. *(8)*	29. *(2)*	30. *(1)*

22 JULY SHIFT II

Section A : Objective Type Questions

1. The water having more dissolved O_2 is

a. boiling water **b.** water at 80°C
c. polluted water **d.** water at 4° C

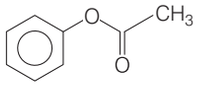
2. Which one of the following statements for D. Mendeleef, is incorrect ?

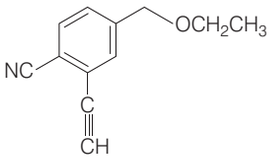
a. He authored the textbook - principles of chemistry.
b. At the time, he proposed periodic table of elements structure of atom was known.
c. Element with atomic number 101 is named after him.
d. He invented accurate barometer.

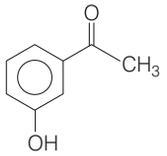
3. Which purification technique is used for high boiling organic liquid compound (decomposes near its boiling point)?

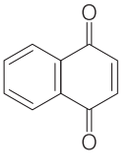
a. Simple distillation **b.** Steam distillation
c. Fractional distillation **d.** Reduced pressure distillation

4. Which of the following compounds will provide a tertiary alcohol on reaction with excess of CH_3MgBr followed by hydrolysis?

a. 

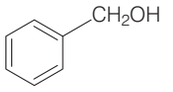
b. 

c. 

d. 

5. Which of the following compounds does not exhibit resonance ?

a. $CH_3CH_2OCH{=}CH_2$

b. 

c. $CH_3CH_2CH_2CONH_2$

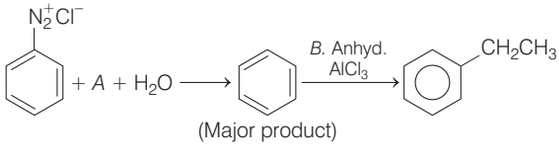
d. $CH_3CH_2CH{=}CHCH_2NH_2$

6. Match List I with List II.

	List-I (Elements)		**List-II** (Properties)
A.	Ba	(i)	Organic solvent soluble compounds
B.	Ca	(ii)	Outer electronic configuration $6s^2$
C.	Li	(iii)	Oxalate insoluble in water
D.	Na	(iv)	Formation of very strong monoacidic base

Choose the correct answer from the options given below

	A	B	C	D		A	B	C	D
a.	(ii)	(iii)	(i)	(iv)	**b.**	(iv)	(i)	(ii)	(iii)
c.	(iii)	(ii)	(iv)	(i)	**d.**	(i)	(iv)	(ii)	(iii)

7. 

In the chemical reactions given above *A* and *B* respectively are

a. H_3PO_2 and CH_3CH_2Cl **b.** CH_3CH_2OH and H_3PO_2
c. H_3PO_2 and CH_3CH_2OH **d.** CH_3CH_2Cl and H_3PO_2

8. Isotope(s) of hydrogen which emits low energy β^- particles with $t_{1/2}$ value > 12 years is/are

a. protium **b.** tritium
c. deuterium **d.** deuterium and tritium

9. Match List I and List II.

	List I (Species)		List II (Hybrid orbitals)
(A)	SF_4	(i)	sp^3d^2
(B)	IF_5	(ii)	d^2sp^3
(C)	NO_2^+	(iii)	sp^3d
(D)	NH_4^+	(iv)	sp^3
		(v)	sp

	A	B	C	D		A	B	C	D
a.	(i)	(ii)	(v)	(iii)	**b.**	(ii)	(i)	(iv)	(v)
c.	(iii)	(i)	(v)	(iv)	**d.**	(iv)	(iii)	(ii)	(v)

10. When silver nitrate solution is added to potassium iodide solution then the sol produced is

a. AgI / I^- **b.** AgI / Ag^+
c. KI/NO_3^- **d.** $AgNO_3 / NO_3^-$

11. Which of the following molecules does not show stereoisomerism ?

a. 3, 4 - dimethyl hex-3ene **b.** 3- methyl hex-1-ene
c. 3 - ethyl hex-3-ene **d.** 4- methyl hex-1-ene

12. Given below are the statements about diborane.

(A) Diborane is prepared by the oxidation of $NaBH_4$ and I_2.
(B) Each boron atom is in sp^2-hybridised state.
(C) Diborane has one bridged 3 centre -2 - electron bond.
(D) Diborane is a planar molecule.

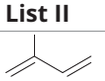
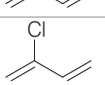
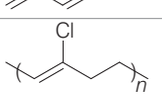
The option with correct statement(s) is

a. (C) and (D) only **b.** (A) only
c. (C) only **d.** (A) and (B) only

13. Which one of the following group-15 hydride is the strongest reducing agent ?

a. AsH_3 **b.** BiH_3 **c.** PH_3 **d.** SbH_3

14. Match List I with List II.

	List I		List II
(A)	Chloroprene	(i)	
(B)	Neoprene	(ii)	
(C)	Acryonitrile	(iii)	
(D)	Isoprene	(iv)	$CH_2 = CH—CN$

Choose the correct answer from the options given below.

	A	B	C	D		A	B	C	D
a.	(iii)	(iv)	(ii)	(i)	**b.**	(ii)	(iii)	(iv)	(i)
c.	(ii)	(i)	(iv)	(iii)	**d.**	(iii)	(i)	(iv)	(ii)

15. The set having ions which are coloured and paramagnetic both is

a. Cu^{2+}, Cr^{3+}, Sc^+ **b.** $Cu^{2+}, Zn^{2+}, Mn^{4+}$
c. Sc^{3+}, V^{5+}, Ti^{4+} **d.** $Ni^{2+}, Mn^{7+}, Hg^{2+}$

16. Thiamine and pyridoxine are also known respectively as

a. vitamin B_2 and vitamin E **b.** vitamin E and vitamin B_2
c. vitamin B_6 and vitamin B_2 **d.** vitamin B_1 and vitamin B_6

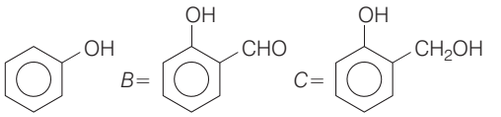
17. Sulphide ion is soft base and its ores are common for metals

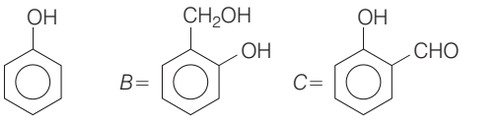
(A) Pb (B) Al (C) Ag (D) Mg

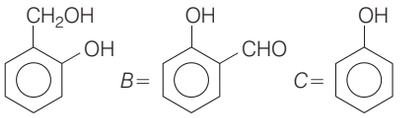
Choose the correct answer from the options given below

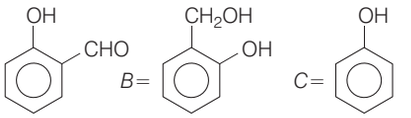
a. (A) and (C) only **b.** (A) and (D) only
c. (A) and (B) only **d.** (C) and (D) only

18. An organic compound A (C_6H_6O) gives dark green colouration with ferric chloride. On treatment with $CHCl_3$ and KOH, followed by acidification gives compound B. Compound B can also be obtained from compound C on reaction with pyridinium chlorochromate (PCC). Identify A, B and C.

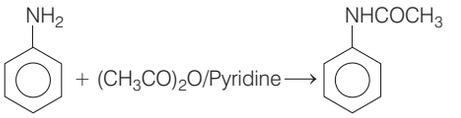
a. 

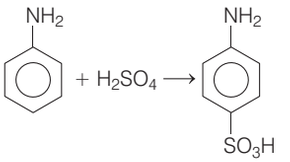
b. 

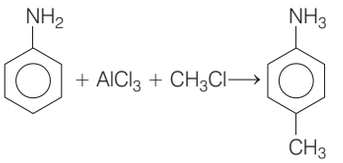
c. 

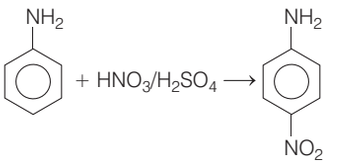
d. 

19. Which one of the following reactions does not occur?

a. 

b. 

c. 

d. 

20. Which one of the following 0.06 M aqueous solutions has lowest freezing point?

a. $Al_2(SO_4)_3$ **b.** $C_6H_{12}O_6$
c. KI **d.** K_2SO_4

Section B : Numerical Type Questions

21. The total number of unpaired electrons present in $[Co(NH_3)_6]Cl_2$ and $[Co(NH_3)_6]Cl_3$ is ..... .

22. Methylation of 10 g of benzene gave 9.2 g of toluene. Calculate the percentage yield of toluene ..... . (Nearest integer)

23. The number of acyclic structural isomers (including geometrical isomers) for pentene are ..... .

24. Assume a cell with the following reaction

$$Cu(s) + 2Ag^+(1\times10^{-3}M) \longrightarrow Cu^{2+}(0.250M) + 2Ag(s),\ E^{\ominus}_{cell} = 2.97\,V$$

E_{cell} for the above reaction is ..... V.
(Nearest integer)
[Given : $\log 2.5 = 0.3979$, $T = 298$ K]

25. Value of K_p for the equilibrium reaction

$N_2O_4(g) \rightleftharpoons 2NO_2(g)$ at 288 K is 47.9.

The K_C for this reaction at same temperature is .....
(Nearest integer)
($R = 0.083$ L bar $K^{-1}mol^{-1}$)

26. If the standard molar enthalpy change for combustion of graphite powder is -2.48×10^2 kJ mol^{-1}, the amount of heat generated on combustion of 1 g of graphite powder is ..... kJ. (Nearest integer)

27. A copper complex crystallising in a ccp lattice with a cell edge of 0.4518 nm has been revealed by employing X-ray diffraction studies. The density of a copper complex is found to be 7.62 g cm^{-3}.

The molar mass of copper complex is ..... g mol^{-1}.
(Nearest integer)
[Given : $N_A = 6.022\times10^{23}\,mol^{-1}$]

28. Number of electrons that vanadium ($Z = 23$) has in p-orbitals is equal to ..... .

29. $N_2O_5(g) \longrightarrow 2NO_2(g) + \frac{1}{2}O_2(g)$

In the above first order reaction the initial concentration of N_2O_5 is 2.40×10^{-2} mol L^{-1} at 318 K. The concentration of N_2O_5 after 1 hour was 1.60×10^{-2} mol L^{-1}. The rate constant of the reaction at 318 K is ..... $\times10^{-3}min^{-1}$.
(Nearest integer) [Given : $\log 3 = 0.477$, $\log 5 = 0.699$]

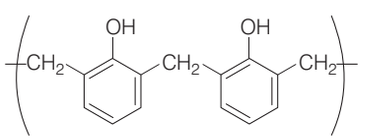
30. If the concentration of glucose ($C_6H_{12}O_6$) in blood is 0.72 gL^{-1}, the molarity of glucose in blood is ..... $\times10^{-3}$ M.
(Nearest integer)
[Given : Atomic mass of C = 12, H = 1, O = 16 u]

Answers

1. *(d)*	2. *(b)*	3. *(d)*	4. *(a)*	5. *(d)*	6. *(a)*	7. *(a)*	8. *(b)*	9. *(c)*	10. *(a)*
11. *(c)*	12. *(b)*	13. *(b)*	14. *(b)*	15. *(a)*	16. *(d)*	17. *(a)*	18. *(a)*	19. *(c)*	20. *(a)*
21. *(1)*	22. *(78)*	23. *(6)*	24. *(3)*	25. *(2)*	26. *(21)*	27. *(106)*	28. *(12)*	29. *(7)*	30. *(4)*

25 JULY SHIFT I

Section A : Objective Type Questions

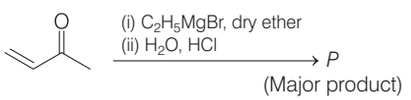
1. 

is a repeating unit for

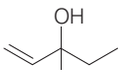
a. novolac **b.** buna-N
c. acrilan **d.** neoprene

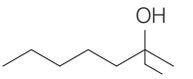
2. Which one of the following species responds to an external magnetic field

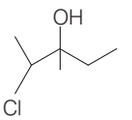
a. $[Fe(H_2O)_6]^{3+}$ **b.** $[Ni(CN)_4]^{2-}$
c. $[Co(CN)_6]^{3-}$ **d.** $[Ni(CO)_4]$

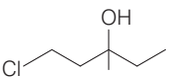
3. 

Consider the above reaction, the major product P is

a. 

b. 

c. 

d. 

4. Sodium stearate $CH_3(CH_2)_{16}COO^-Na^+$ is an anionic surfactant which forms micelles in oil.

Choose the correct statement for it from the following.

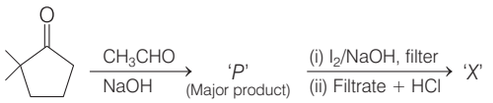
a. It forms spherical micelles with $CH_3(CH_2)_{16}^-$ group pointing towards the centre of sphere.
b. It forms non-spherical micelles with —COO^- group pointing outwards on the surface.
c. It forms spherical micelles with $CH_3(CH_2)_{16}^-$ group pointing outwards on the surface of sphere
d. It forms non–spherical micelles with $CH_3(CH_2)_{16}^-$ group pointing towards the centre.

5. The water soluble protein is

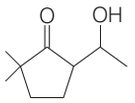
a. fibrin **b.** albumin
c. myosin **d.** collagen

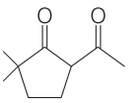
6. At 298.2 K the relationship between enthalpy of bond dissociation (in kJ mol^{-1}) for hydrogen (E_H) and its isotope, deuterium (E_D), is best described by

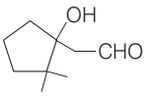
a. $E_H = \frac{1}{2}E_D$
b. $E_H = E_D$
c. $E_H \simeq E_D - 7.5$
d. $E_H = 2E_D$

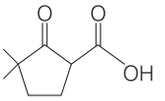
7. 

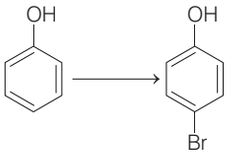
Consider the given reaction, the product *X* is

a. 

b. 

c. 

d. 

8. 

(Major product)

The given reaction can occur in the presence of
(A) bromine water
(B) Br_2 in CS_2, 273 K
(C) Br_2 / $FeBr_3$
(D) Br_2 in $CHCl_3$, 273 K

Choose the correct answer from the options given below
a. (B) and (D) only
b. (A) and (C) only
c. (B), (C) and (D) only
d. (A), (B) and (D) only

9. Given below are two statements, one is labelled as : Assertion (A) and other is labelled as Reason (R).

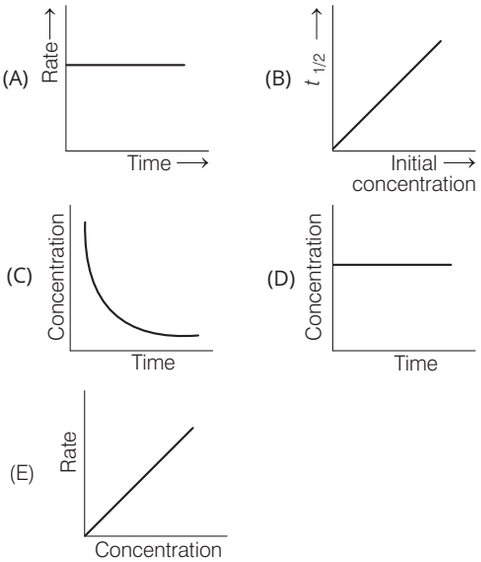
Assertion (A) Gabriel phthalimide synthesis cannot be used to prepare aromatic primary amines.

Reason (R) Aryl halides do not undergo nucleophilic substitution reaction.

In the light of the above statements, choose the correct answer from the options given below

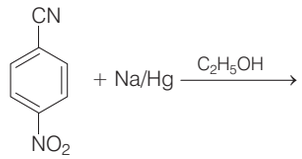
a. Both (A) and (R) true but (R) is not the correct explanation of (A).
b. (A) is false but (R) is true.
c. Both (A) and (R) true and (R) is correct explanation of (A).
d. (A) is true but (R) is false.

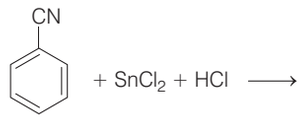
10. For the following graphs

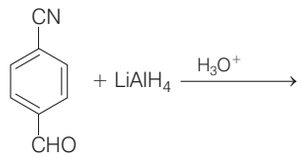


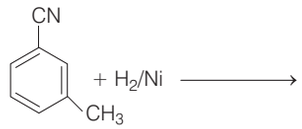
Choose from the options given below, the correct one regarding order of reaction is
a. (B) zero order (C) and (E) first order
b. (A) and (B) zero order (E) first order
c. (B) and (D) zero order (E) first order
d. (A) and (B) zero order (C) and (E) first order

11. Which one of the products of the following reactions does not react with Hinsberg reagent to form sulphonamide?

a. 

b. 

c. 

d. 

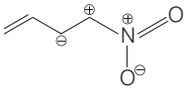
12. The ionic radii of K^+, Na^+, Al^{3+} and Mg^{2+} are in the order

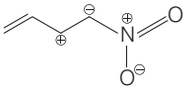
a. $Na^+ < K^+ < Mg^{2+} < Al^{3+}$ **b.** $Al^{3+} < Mg^{2+} < K^+ < Na^+$
c. $Al^{3+} < Mg^{2+} < Na^+ < K^+$ **d.** $K^+ < Al^{3+} < Mg^{2+} < Na^+$

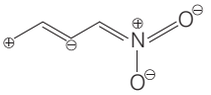
13. Which one of the following compounds of group-14 elements is not known?

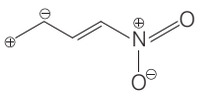
a. $[GeCl_6]^{2-}$ **b.** $[Sn(OH)_6]^{2-}$
c. $[SiCl_6]^{2-}$ **d.** $[SiF_6]^{2-}$

14. Which one among the following resonating structures is not correct ?

a. 

b. 

c. 

d. 

15. Given below are two statements.

Statement I None of the alkaline earth metal hydroxides dissolve in alkali.

Statement II Solubility of alkaline earth metal hydroxides in water increases down the group.

According the above statements, choose the most appropriate answer from the options given below

a. Statement I is correct but statement II is incorrect.
b. Statement I is incorrect but statement II is correct.
c. Statement I and statement II both are incorrect.
d. Statement I and statement II both are correct.

16. The correct order of following 3*d*-metal oxides, according to their oxidation numbers is

(A) CrO_3 (B) Fe_2O_3
(C) MnO_2 (D) V_2O_5
(E) Cu_2O

a. (D) > (A) > (B) > (C) > (E) **b.** (A) > (C) > (D) > (B) > (E)
c. (A) > (D) > (C) > (B) > (E) **d.** (C) > (A) > (D) > (E) > (B)

17. Which one of the following chemical agent is not being used for dry cleaning of clothes ?

a. H_2O_2 **b.** CCl_4 **c.** Liquid CO_2 **d.** $Cl_2C=CCl_2$

18. Which one of the following compounds will liberate CO_2, when treated with $NaHCO_3$?

a. $(CH_3)_3\overset{\oplus}{N}H\overset{\ominus}{Cl}$ **b.** $(CH_3)_3\overset{\oplus}{N}\overset{\ominus}{O}H$

c. $CH_3-\overset{O}{\overset{||}{C}}-NH_2$ **d.** CH_3NH_2

19. In the leaching of alumina from bauxite, the ore expected to leach out in the process by reacting with NaOH is

a. TiO_2 **b.** Fe_2O_3 **c.** ZnO **d.** SiO_2

20. An organic compound '*A*' C_4H_8 on treatment with $KMnO_4/H^+$ yield's compound '*B*' C_3H_6O.
Compound '*A*' also yields compound '*B*' an ozonolysis. Compound '*A*' is

a. 2-methylpropene **b.** 1-methylcyclopropane
c. but-2-ene **c.** cyclobutane

Section B : Numerical Type Questions

21. The number of sigma bonds in

$$H_3C-\underset{\underset{H}{|}}{C}=CH-C\equiv C-H \text{ is ..... .}$$

22. Three moles of AgCl get precipitated when one mole of an octahedral co-ordination compound with empirical formula $CrCl_3\cdot 3NH_3\cdot 3H_2O$ reacts with excess of silver nitrate. The number of chloride ions satisfying the secondary valency of the metal ion is ..... .

23. A source of monochromatic radiation of wavelength 400 nm provides 1000 J of energy in 10 seconds. When this radiation falls on the surface of sodium, $x\times10^{20}$ electrons are ejected per second. Assume that wavelength 400 nm is sufficient for ejection of electron from the surface of sodium metal. The value of *x* is ..... .
(Nearest integer)
($h = 6.626\times10^{-34}$ Js)

24. CO_2 gas is bubbled through water during a soft drink manufacturing process at 298 K. If CO_2 exerts a partial pressure of 0.835 bar then *x* m mol of CO_2 would dissolve in 0.9 L of water. The value of *x* is ..... .
(Nearest integer)
(Henry's law constant for CO_2 at 298 K is 1.67×10^3 bar)

25. For the reaction, $A + B \rightleftharpoons 2C$
The value of equilibrium constant is 100 at 298 K. If the initial concentration of all the three species is 1 M each, then the equilibrium concentration of *C* is $x\times10^{-1}$ M. The value of *x* is ..... . (Nearest integer)

26. Consider the cell at 25° C
$Zn|Zn^{2+}(aq), (1M)||Fe^{3+}(aq), Fe^{2+}(aq)|Pt(s)$
The fraction of total iron present as Fe^{3+} ion at the cell potential of 1.500 V is $x\times10^{-2}$. The value of *x* is ..... .
(Nearest integer)
(Given, $E^\circ_{Fe^{3+}/Fe^{2+}} = 0.77$ V, $E^\circ_{Zn^{2+}/Zn} = -0.76$ V)

27. At 298 K, the enthalpy of fusion of a solid (*X*) is 2.8 kJ mol^{-1} and the enthalpy of vaporisation of the liquid (*X*) is 98.2 kJ mol^{-1}. The enthalpy of sublimation of the substance (*X*) in kJ mol^{-1} is ..... . (Nearest integer)

28. A home owner uses $4.00\times10^3 m^3$ of methane (CH_4) gas, (assume CH_4 is an ideal gas) in a Year to heat his home. Under the pressure of 1.0 atm and 300 K, mass of gas used is $x\times10^5$ g. The value of *x* is ..... . (Nearest integer)
(Given, $R = 0.083$ L atm $K^{-1}mol^{-1}$)

29. When 10 mL of an aqueous solution of Fe^{2+} ions was titrated in the presence of dil. H_2SO_4 using diphenylamine indicator, 15 mL of 0.02 M solution of $K_2Cr_2O_7$ was required to get the end point. The molarity of the solution containing Fe^{2+} ions is $x\times10^{-2}$ M. The value of *x* is ..... . (Nearest integer)

30. Consider the complete combustion of butane, the amount of butane utilised to produce 72.0 g of water is ..... $\times10^{-1}$ g. (Nearest integer)

Answers

1. *(a)*	2. *(a)*	3. *(c)*	4. *(a)*	5. *(b)*	6. *(c)*	7. *(d)*	8. *(c)*	9. *(c)*	10. *(b)*
11. *(b)*	12. *(c)*	13. *(c)*	14. *(a)*	15. *(b)*	16. *(c)*	17. *(b)*	18. *(a)*	19. *(d)*	20. *(a)*
21. *(10)*	22. *(0)*	23. *(2)*	24. *(25)*	25. *(25)*	26. *(24)*	27. *(101)*	28. *(26)*	29. *(18)*	30. *(464)*

25 JULY SHIFT II

Setion A : Objective Type Questions

1. In the following the correct bond order sequence is

a. $O_2^{2-} > O_2^{+} > O_2^{-} > O_2$ **b.** $O_2^{+} > O_2^{-} > O_2^{2-} > O_2$
c. $O_2^{+} > O_2 > O_2^{-} > O_2^{2-}$ **d.** $O_2 > O_2^{-} > O_2^{2-} > O_2^{+}$

2. A biodegradable polyamide can be made from

a. glycine and isoprene
b. hexamethylene diamine and adipic acid
c. glycine and aminocaproic acid
d. styrene and caproic acid

3. Match List I with List II.

	List I (Elements)		**List II** (Properties)
(A)	Li	I.	Poor water solubility of I^- salt
(B)	Na	II.	Most abundant element in cell fluid
(C)	K	III.	Bicarbonate salt used in fire extinguisher
(D)	Cs	IV.	Carbonate salt decomposes easily on heating

Choose the correct answer from the options given below.

	A	B	C	D		A	B	C	D
a.	IV	III	II	I	**b.**	I	III	II	IV
c.	IV	II	III	I	**d.**	I	II	III	IV

4. Which one of the following metal complexes is most stable?

a. $[Co(en)(NH_3)_4]Cl_2$ **b.** $[Co(en)_3]Cl_2$
c. $[Co(en)_2(NH_3)_2]Cl_2$ **d.** $[Co(NH_3)_6]Cl_2$

5. Match List I with List II : (Both having metallurgical terms)

	List I		**List II**
(A)	Concentration of Ag ore	I.	Reverberatory furnace
(B)	Blast furnace	II.	Pig iron
(c)	Blister copper	III.	Leaching with dilute NaCN solution
(d)	Froth floatation method	IV.	Sulphide ores

Choose the correct answer from the options given below.

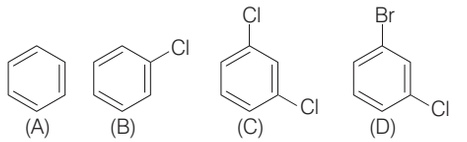
	A	B	C	D		A	B	C	D
a.	III	II	I	IV	**b.**	III	IV	I	II
c.	IV	I	III	II	**d.**	IV	III	II	I

6. The ionic radii of F^- and O^{2-} respectively are 1.33 Å and 1.4 Å while the covalent radius of N is 0.74Å

The correct statement for the ionic radius of N^{3-} from the following is

a. it is smaller than F^- and N
b. it is bigger than O^{2-} and F^-
c. it is bigger than F^- and N, but smaller than of O^{2-}
d. it is smaller than O^{2-} and F^-, but bigger than of N

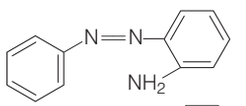
7. The correct decreasing order of densities of the following compounds is

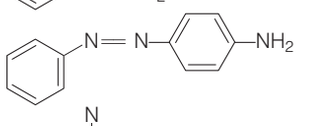


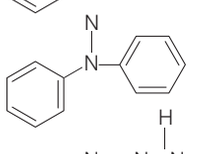
a. (D) > (C) > (B) > (A) **b.** (C) > (D) > (A) > (B)
c. (C) > (B) > (A) > (D) **d.** (A) > (B) > (C) > (D)

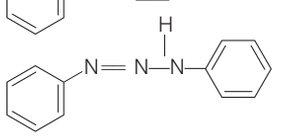
8. $C_6H_5NO_2 \xrightarrow{Sn+HCl} A \xrightarrow[H^+]{C_6H_5N_2^+Cl^-} P$ (Yellow coloured compound)

Consider the above reaction, the product *P* is

a. 

b. 

c. 

d. 

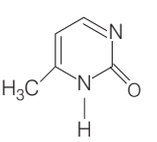
9. A reaction of benzonitrile with one equivalent CH_3MgBr followed by hydrolysis produces a yellow liquid *P*. The compound *P* will give positive

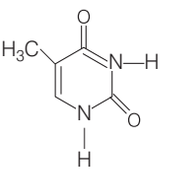
a. iodoform test **b.** Schiff's test
c. ninhydrin's test **d.** Tollen's test

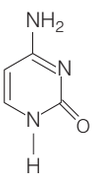
10. The spin only magnetic moments (in BM) for free Ti^{3+}, V^{2+}, and Sc^{3+} ions respectively are
(Atomic number: Sc = 21, Ti = 22, V = 23)

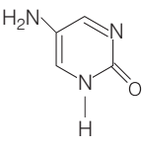
a. 3.87, 1.73, 0 **b.** 1.73, 3.87, 0
c. 1.73, 0, 3.87 **d.** 0, 3.87, 1.73

11. Which one of the following is correct structure for cytosine?

a. 

b. 

c. 

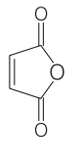
d. 

12. Identify the species having one π - bond and maximum number of canonical forms from the following

a. SO_3 **b.** O_2
c. SO_2 **d.** CO_3^{2-}

13. Which one of the following metals forms interstitial hydride easily ?

a. Cr **b.** Fe
c. Mn **d.** Co

14. 

(Maleic anhydride)

Maleic anhydride can be prepared by

a. heating *trans*-but-2-enedioic acid
b. heating *cis*-but-2-enedioic acid
c. treating *cis*-but-2-enedioic acid with alcohol and acid
d. treating *trans*-but-2-enedioic acid with alcohol and acid

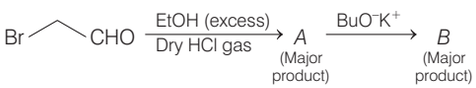
15. Given below are two statements :

Statement I Chlorofluoro carbons break down by radiation in the visible energy region and release chlorine gas in the atmosphere which then reacts with stratospheric ozone.

Statement II Atmospheric ozone reacts with nitric oxide to give nitrogen and oxygen gases, which add to the atmosphere.

For the above statements choose the correct answer from the options given below :

a. Statement I is incorrect but statement II is true
b. Both statement I and II are false
c. Statement I is correct but statement II is false
d. Both statement I and II are correct

16. 

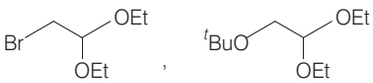
[where, Et = C_2H_5, $^tBu = (CH_3)_3C—$]

Consider the above reaction sequence, product *A* and product *B* formed respectively are

a. 

b. 

c. 

d. 

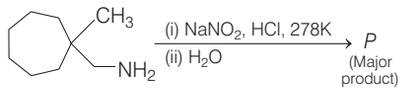
17. Match List I with List II.

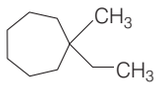
	List I		List II
(A)	Cheese	I.	Dispersion of liquid in liquid
(B)	Pumice stone	II.	Dispersion of liquid in gas
(C)	Hair cream	III.	Dispersion of gas in solid
(D)	Cloud	IV.	Dispersion of liquid in solid

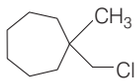
Choose the most appropriate answer from the options given below.

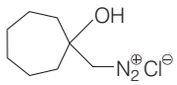
	A	B	C	D		A	B	C	D
a.	IV	III	II	I	**b.**	IV	I	III	II
c.	III	IV	I	II	**d.**	IV	III	I	II

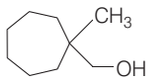
18. What is the major product *P* of the following reaction ?



a. 

b. 

c. 

d. 

19. Identify the process in which change in the oxidation state is five

a. $Cr_2O_7^{2-} \longrightarrow 2Cr^{3+}$ **b.** $MnO_4^- \longrightarrow Mn^{2+}$
c. $CrO_4^{2-} \longrightarrow Cr^{3+}$ **d.** $C_2O_4^{2-} \longrightarrow 2CO_2$

20. Which among the following is the strongest acid ?

a. $CH_3CH_2CH_2CH_3$ **b.** 

c.  **d.** 

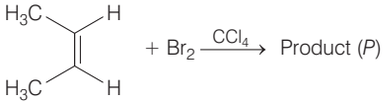
Section B : Numerical Type Questions

21. A system does 200 J of work and at the same time absorbs 150 J of heat. The magnitude of the change in internal energy is ..... J. (Nearest integer)

22. An accelerated electron has a speed of $5 \times 10^6 ms^{-1}$ with an uncertainty of 0.02%. The uncertainty in finding its location while in motion is $x \times 10^{-9}$m. The value of x is ..... . (Nearest integer)

[Use mass of electron $= 9.1 \times 10^{-31}$ kg, $h = 6.63 \times 10^{-34}$ Js, $\pi = 3.14$]

23. Number of electrons present in $4f$ orbital of Ho^{3+} ion is ..... . (Given, atomic number of Ho = 67)

24. 

Consider the above chemical reaction. The total number of stereoisomers possible for product *P* is .....

25. For a chemical reaction $A \longrightarrow B$, it was found that concentration of B is increased by 0.2 mol L^{-1} in 30 min. The average rate of the reaction is .....$\times 10^{-1}$ mol L^{-1} h^{-1}. (Nearest integer)

26. The number of significant figures in 0.00340 is ..... .

27. Assuming that $Ba(OH)_2$ is completely ionised in aqueous solution under the given conditions the concentration of H_3O^+ ions in 0.005 M aqueous solution of $Ba(OH)_2$ at 298 K is ..... $\times 10^{-12}$ mol L^{-1}. (Nearest integer)

28. 0.8 g of an organic compound was analysed by Kjeldahl's method for the estimation of nitrogen. If the percentage of nitrogen in the compound was found to be 42%, then ..... mL of 1 M H_2SO_4 would have been neutralised by the ammonia evolved during the analysis.

29. When 3.00 g of a substance 'X' is dissolved in 100 g of CCl_4, it raises the boiling point by 0.60 K. The molar mass of the substance 'X' is ..... g mol^{-1}. (Nearest integer)
[Given, K_b for CCl_4 is 5.0 K kg mol^{-1}]

30. An LPG cylinder contains gas at a pressure of 300 kPa at 27°C. The cylinder can withstand the pressure of 12×10^6 Pa. The room in which the cylinder is kept catches fire. The minimum temperature at which the bursting of cylinder will take place is ..... °C. (Nearest integer)

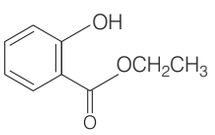
Answers

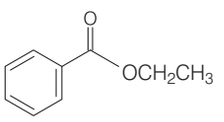
1. *(c)*	2. *(c)*	3. *(a)*	4. *(b)*	5. *(a)*	6. *(b)*	7. *(a)*	8. *(b)*	9. *(a)*	10. *(b)*
11. *(c)*	12. *(d)*	13. *(a)*	14. *(b)*	15. *(b)*	16. *(a)*	17. *(d)*	18. *(d)*	19. *(b)*	20. *(d)*
21. *(50)*	22. *(58)*	23. *(10)*	24. *(2)*	25. *(4)*	26. *(3)*	27. *(1)*	28. *(12)*	29. *(250)*	30. *(927)*

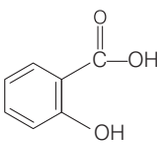
27 JULY SHIFT I

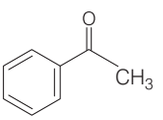
Section A : Objective Type Questions

1. Which one of the following compounds will give orange precipitate when treated with 2, 4 dinitrophenyl hydrazine?

a. 

b. 

c. 

d. 

2. The product obtained from the electrolytic oxidation of acidified sulphate solutions, is
a. HSO_4^- **b.** HO_3SOOSO_3H
c. HO_2SOSO_2H **d.** HO_3SOSO_3H

3. The parameters of the unit cell of a substance are $a = 2.5$, $b = 3.0$, $c = 4.0$, $\alpha = 90°$, $\beta = 120°$, $\gamma = 90°$. The crystal system of the substance is
a. hexagonal **b.** orthorhombic
c. monoclinic **d.** triclinic

4. The oxidation states of 'P' in $H_4P_2O_7$, $H_4P_2O_5$ and $H_4P_2O_6$, respectively are
a. 7, 5 and 6 **b.** 5, 4 and 3
c. 5, 3 and 4 **d.** 6, 4 and 5

5. For a reaction of order n, the unit of the rate constant is
a. $mol^{1-n}\ L^{1-n}\ s$ **b.** $mol^{1-n}\ L^{2n}\ s^{-1}$
c. $mol^{1-n}\ L^{n-1}\ s^{-1}$ **d.** $mol^{1-n}\ L^{1-n}\ s^{-1}$

6. Given below are two statements.
Statement I Aniline is less basic than acetamide.
Statement II In aniline, the lone pair of electrons on nitrogen atom is delocalised over benzene ring due to resonance and hence less available to a proton.
Choose the most appropriate option :
a. Statement I is true but statement II is false.
b. Statement I is false but statement II is true.
c. Both statement I and statement II are true.
d. Both statement I and statement II are false.

7. The type of hybridisation and magnetic property of the complex $[MnCl_6]^{3-}$, respectively, are
a. sp^3d^2 and diamagnetic
b. d^2sp^3 and diamagnetic
c. d^2sp^3 and paramagnetic
d. sp^3d^2 and paramagnetic

8. The number of geometrical isomers found in the metal complexes $[PtCl_2(NH_3)_2]$, $[Ni(CO)_4]$, $[Ru(H_2O)_3Cl_3]$ and $[CoCl_2(NH_3)_4]^+$ respectively, are
a. 1, 1, 1, 1 **b.** 2, 1, 2, 2
c. 2, 0, 2, 2 **d.** 2, 1, 2, 1

9. Which one of the following statements is not correct ?
a. Eutrophication indicates that water body is polluted.
b. The dissolved oxygen concentration below 6 ppm inhibits fish growth.
c. Eutrophication leads to increase in the oxygen level in water.
d. Eutrophication leads to anaerobic conditions.

10. Given below are two statements :

Statement I Rutherford's gold foil experiment cannot explain the line spectrum of hydrogen atom.

Statement II Bohr's model of hydrogen atom contradicts Heisenberg's uncertainty principle.

In the light of the above statements, choose the most appropriate answer from the options given below :

a. Statement I is false but statement II is true.
b. Statement I is true but statement II is false.
c. Both statement I and statement II are false.
d. Both statement I and statement II are true.

11. Presence of which reagent will affect the reversibility of the following reaction, and change it to a irreversible reaction :

$$CH_4 + I_2 \underset{\text{Reversible}}{\overset{h\nu}{\rightleftharpoons}} CH_3{-}I + HI$$

a. HOCl
b. dilute HNO_2
c. Liquid NH_3
d. Concentrated HIO_3

12. Which one among the following chemical tests is used to distinguish monosaccharide from disaccharide ?

a. Seliwanoff's test **b.** Iodine test
c. Barfoed test **d.** Tollen's test

13. Match List-I with List-II.

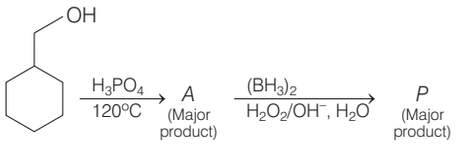
	List-I (Drug)		**List-II** (Class of drug)
A.	Furacin	I.	Antibiotic
B.	Arsphenamine	II.	Tranquilisers
C.	Dimetone	III.	Antiseptic
D.	Valium	IV.	Synthetic antihistamines

Choose the most appropriate match :

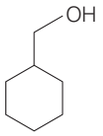
	A	B	C	D
a.	I	III	IV	II
b.	III	IV	II	I
c.	II	I	III	IV
d.	III	I	IV	II

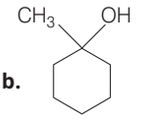
14. The statement that is incorrect about Ellingham diagram is

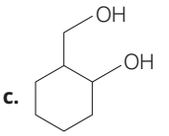
a. provides idea about the reaction rate.
b. provides idea about free energy change.
c. provides idea about changes in the phases during the reaction.
d. provides idea about reduction of metal oxide.

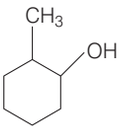
15. 

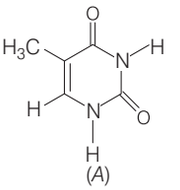
Consider the above reaction and identify the product (*P*).

a. 

b. 

c. 

d. 

16. 

The compound '*A*' is a complementary base of ..... in DNA stands.

a. uracil **b.** guanine
c. adenine **d.** cytosine

17. Staggered and eclipsed conformers of ethane are

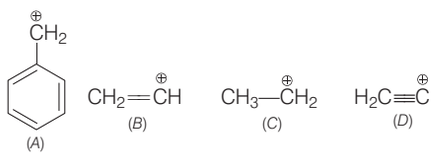
a. polymers **b.** rotamers
c. enantiomers **d.** mirror images

18. Match List-I with List-II.

	List-I		**List-II**
A.	NaOH	I.	Acidic
B.	$Be(OH)_2$	II.	Basic
C.	$Ca(OH)_2$	III.	Amphoteric
D.	$B(OH)_3$		
E.	$Al(OH)_3$		

Choose the most appropriate answer from the options given below

	A	B	C	D	E
a.	II	II	III	II	III
b.	II	III	II	I	III
c.	II	II	III	I	III
d.	II	I	II	III	III

19. 

The correct order of stability of given carbocation is

a. $A > C > B > D$ **b.** $D > B > C > A$
c. $D > B > A > C$ **d.** $C > A > D > B$

20. Given below are two statements.

One is labelled as Asseriton A and the other labelled as Reason R.

Assertion A Lithium halides are some what covalent in nature.

Reason R Lithium possess high polarisation capability.

According the above statements, choose the most appropriate answer from the options given below

a. A is true but R is false
b. A is false but R is true
c. Both A and R are true but R is not the correct explanation of A
d. Both A and R are true and R is the correct explanation of A

Section B : Numerical Type Questions

21. The density of NaOH solution is 1.2 g cm^{-3}. The molality of this solution is ..... m.
(Round off to the nearest integer)
[Use : Atomic masses : Na = 23.0 u, O = 16.0 u, H = 1.0 u, density of H_2O : 1.0g cm^{-3}]

22. CO_2 gas adsorbs on charcoal following Freundlich adsorption isotherm. For a given amount of charcoal, the mass of CO_2 adsorbed becomes 64 times when the pressure of CO_2 is doubled.
The value of n in the Freundlich isotherm equation is ..... $\times 10^{-2}$. (Round off to the nearest integer)

23. The conductivity of a weak acid HA of concentration 0.001 mol L^{-1} is 2.0×10^{-5} S cm^{-1}. If $\Lambda_m^\circ(HA) = 190$ S cm^2 mol^{-1}, the ionisation constant (K_a) of HA is equal to ..... $\times 10^{-6}$. (Round off to the nearest integer)

24. 1.46 g of a biopolymer dissolved in a 100 mL water at 300 K exerted an osmotic pressure of 2.42×10^{-3} bar.
The molar mass of the biopolymer is ..... $\times 10^4$ g mol^{-1}.
(Round off to the nearest integer)
[Use : $R = 0.083$ L bar mol^{-1} K^{-1}]

25. An organic compound is subjected to chlorination to get compound A using 5.0 g of chlorine. When 0.5 g of compound A is reacted with $AgNO_3$ [Carius method], the percentage of chlorine in compound A is ..... when it forms 0.3849 g of AgCl. (Round off to the nearest integer)
(Atomic masses of Ag and Cl are 107.87 and 35.5 respectively)

26. The number of geometrical isomers possible in triamminetrinitrocobalt (III) is X and in trioxalatochromate (III) is Y. Then, the value of $X + Y$ is ..... .

27. In gaseous triethyl amine the "—C—N—C—" bond angle is ..... degree.

28. For water at 100°C and 1 bar,
$\Delta_{vap}H - \Delta_{vap}U =$ ..... $\times 10^2$ J mol^{-1}.
(Round off to the nearest integer)
[Use : $R = 8.31$ J mol^{-1} K^{-1}]
[Assume volume of $H_2O(l)$ is much smaller than volume of $H_2O(g)$. Assume $H_2O(g)$ treated as an ideal gas]

29. $PCl_5 \rightleftharpoons PCl_3 + Cl_2$, $K_c = 1.844$
3.0 moles of PCl_5 is introduced in a 1 L closed reaction vessel at 380 K. The number of moles of PCl_5 at equilibrium is ..... $\times 10^{-3}$.
(Round off to the nearest integer)

30. The difference between bond orders of CO and $NO^{\oplus}$ is $X/2$. where, $x =$ ..... .
(Round off to the nearest integer).

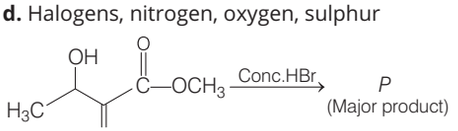
Answers

1. *(d)*	2. *(b)*	3. *(c)*	4. *(c)*	5. *(c)*	6. *(b)*	7. *(d)*	8. *(c)*	9. *(c)*	10. *(d)*
11. *(d)*	12. *(c)*	13. *(d)*	14. *(a)*	15. *(d)*	16. *(c)*	17. *(b)*	18. *(b)*	19. *(a)*	20. *(d)*
21. *(5)*	22. *(17)*	23. *(12)*	24. *(15)*	25. *(19)*	26. *(2)*	27. *(108)*	28. *(31)*	29. *(1400)*	30. *(0)*

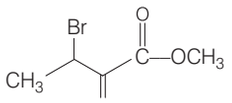
27 JULY SHIFT II

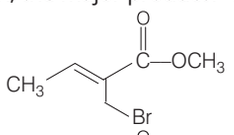
Section A : Objective Type Questions

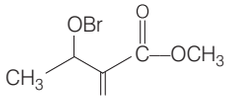
1. Which one of the following set of elements can be detected using sodium fusion extract ?
a. Sulphur, nitrogen, phosphorus, halogens
b. Phosphorus, oxygen, nitrogen, halogens
c. Nitrogen, phosphorus, carbon, sulphur
d. Halogens, nitrogen, oxygen, sulphur

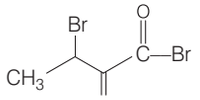
2.


Consider the above reaction, the major product P formed is

a.


b.


c.


d.


3. The number of neutrons and electrons, respectively, present in the radioactive isotope of hydrogen is
a. 1 and 1 **b.** 3 and 1
c. 2 and 1 **d.** 2 and 2

4. Match List I with List II.

	List I		List II
A.	Li	I.	Photoelectric cell
B.	Na	II.	Absorbent of CO_2
C.	K	III.	Coolant in fast breeder nuclear reactor
D.	Cs	IV.	Treatment of cancer
		V.	Bearings for motor engines

Choose the correct answer from the options given below.

	A	B	C	D
a.	V	I	II	IV
b.	V	II	IV	I
c.	IV	III	I	II
d.	V	III	II	I

5. Given below are two statement : one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) $SO_2(g)$ is adsorbed to a large extent than $H_2(g)$ on activated charcoal.

Reason (R) $SO_2(g)$ has a higher critical temperature than $H_2(g)$.

In the light of the above statements, choose the most appropriate answer from the options given below.

a. Both A and R are correct but R is not the correct explanation of A
b. Both A and R are correct and R is the correct explanation of A.
c. A is not correct but R is correct.
d. A is correct but R is not correct.

6. The correct order of first ionisation enthalpy is

a. Mg < S < Al < P **b.** Mg < Al < S < P
c. Al < Mg < S < P **d.** Mg < Al < P < S

7. Given below are two statements.

Statement I Hyperconjugation is a permanent effect.

Statement II Hyperconjugation in ethyl cation ($CH_3—\overset{+}{C}H_2$) involves the overlapping of $C_{sp^2}—H_{1s}$ bond with empty 2*p* orbital of other carbon.

Choose the correct option :

a. Both statement I and statement II are false.
b. Statement I is incorrect but statement II is true.
c. Statement I is true but statement II is false.
d. Both Statement I and statement II are true.

8. Given below are two statements.

Statement I $[Mn(CN)_6]^{3-}$, $[Fe(CN)_6]^{3-}$ and $[Co(C_2O_4)_3]^{3-}$ are d^2sp^3 hybridised.

Statement II $[MnCl_6]^{3-}$ and $[FeF_6]^{3-}$ are paramagnetic and have 4 and 5 unpaired electrons, respectively.

In the light of the above statements, choose the correct answer from the options given below

a. Statement I is true but statement II is false
b. Both statement I and statement II are false
c. Statement I is false but statement II is true
d. Both statement I and statement II are true

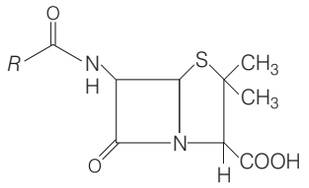
9. To an aqueous solution containing ions such as Al^{3+}, Zn^{2+}, Ca^{2+}, Fe^{3+}, Ni^{2+}, Ba^{2+} and Cu^{2+} conc. HCl, was added followed by H_2S. The total number of cations precipitated during this reaction is/are

a. 1 **b.** 3 **c.** 4 **d.** 2

10. Given below are two statements.

Statement I Penicillin is a bacteriostatic type antibiotic.

Statement II The general structure of penicillin is



Choose the correct option.

a. Both statement I and statement II are false
b. Statement I is false but statement II is true
c. Both statement I and statement II are true
d. Statement I is true but statement II is false

11. Compound *A* gives D-galactose and D-glucose on hydrolysis. The compound *A* is

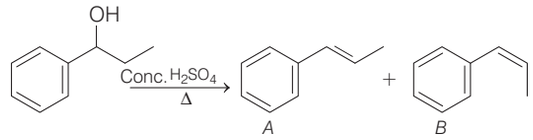
a. amylose **b.** sucrose **c.** maltose **d.** lactose

12. $R—CN \xrightarrow[\text{(ii) } H_2O]{\text{(i) DIBAL–H}} R—Y$

Consider the above reaction and identify *Y*.

a. $—CH_2NH_2$ **b.** $—CONH_2$ **c.** —CHO **d.** —COOH

13.



Consider the above reaction, and choose the correct statement.

a. The reaction is not possible in acidic medium.
b. Both compounds *A* and *B* are formed equally.
c. Compound *A* will be the major product.
d. Compound *B* will be the major product.

14. Match List I with List II.

	List I (Compound)		**List II** (Effect/affected species)
A.	Carbon monoxide	I.	Carcinogenic
B.	Sulphur dioxide	II.	Metabolised by pyrus plants
C.	Polychlorinated biphenyls	III.	Haemoglobin
D.	Oxides of nitrogen	IV.	Stiffness of flower buds

Choose the correct answer from the options given below :

	A	B	C	D		A	B	C	D
a.	III	IV	I	II	**b.**	IV	I	III	II
c.	I	II	III	IV	**d.**	III	IV	II	I

15. If the Thomson model of the atom was correct, then the result of Rutherford's gold foil experiment would have been

a. all of the α-particles pass through the gold foil without decrease in speed.
b. α-particles are deflected over a wide range of angles.
c. all α-particles get bounced back by 180°.
d. α-particles pass through the gold foil deflected by small angles and with reduced speed.

16. Number of Cl═O bonds in chlorous acid, chloric acid and perchloric acid respectively are

a. 3, 1 and 1 **b.** 4, 1 and 0 **c.** 1, 1 and 3 **d.** 1, 2 and 3

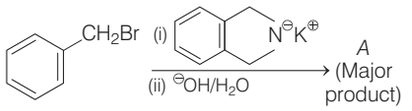
17. Select the correct statements.

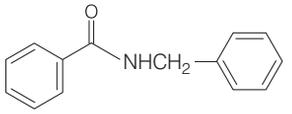
(A) Crystalline solids have long range order.
(B) Crystalline solids are isotropic.
(C) Amorphous solids are sometimes called pseudo solids.
(D) Amorphous solids soften over a range of temperatures.
(E) Amorphous solids have a definite heat of fusion.

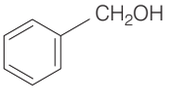
Choose the most appropriate answer from the options given below.

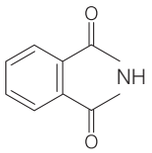
a. (A), (B), (E) only **b.** (B), (D) only
c. (C), (D) only **d.** (A), (C), (D) only

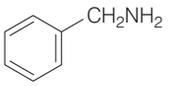
18. What is *A* in the following reaction?



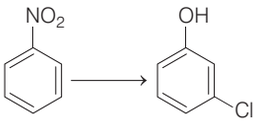
a. 

b. 

c. 

d. 

19. The correct sequence of correct reagents for the following transformation is



a. (i) Fe, HCl (ii) Cl_2, HCl
(iii) $NaNO_2$, HCl, 0°C (iv) H_2O / H^+
b. (i) Fe, HCl (ii) $NaNO_2$, HCl, 0°C
(iii) H_2O / H^+ (iv) Cl_2, $FeCl_3$
c. (i) Cl_2, $FeCl_3$ (ii) Fe, HCl
(iii) $NaNO_2$, HCl, 0°C (iv) H_2O / H^+
d. (i) Cl_2, $FeCl_3$ (ii) $NaNO_2$, HCl, 0°C
(iii) Fe, HCl (iv) H_2O / H^+

20. The addition of silica during the extraction of copper from its sulphide ore

a. converts copper sulphide into copper silicate
b. converts iron oxide into iron silicate
c. reduces copper sulphide into metallic copper
d. reduces the melting point of the reaction mixture

Section B : Numerical type Questions

21. The equilibrium constant for the reaction

$$A(s) \rightleftharpoons M(s) + \frac{1}{2}O_2(g)$$

is $K_p = 4$. At equilibrium, the partial pressure of O_2 is ..... atm. (Round off to the nearest integer)

22. When 400 mL of 0.2 M H_2SO_4 solution is mixed with 600 mL of 0.1 M NaOH solution, the increase in temperature of the final solution is ..... $\times 10^{-2}$ K. (Round off to the nearest integer).

[Use : $H^+(aq) + OH^+(aq) \longrightarrow H_2O$; $\Delta_y H = -57.1$ kJ mol^{-1}]
Specific heat of $H_2O = 0.18$ J K^{-1} g^{-1},
density of $H_2O = 1.0$ g cm^{-3}.
Assume no change in volume of solution on mixing.

23. $2\,SO_2(g) + O_2(g) \longrightarrow 2SO_3(g)$

The above reaction is carried out in a vessel starting with partial pressure p_{SO_2} = 250 m bar, p_{O_2} = 750 m bar and p_{SO_3} = 0. When the reaction is complete, the total pressure in the reaction vessel is ..... m bar. (Round off of the nearest integer).

24. 10.0 mL of 0.05 M $KMnO_4$ solution was consumed in a titration with 10.0 mL of given oxalic acid dihydrate solution. The strength of given oxalic acid solution is ..... $\times 10^{-2}$ g/L.

(Round off to the nearest integer)

25. The total number of electrons in all bonding molecular orbitals of O_2^{2-} is ..... .

(Round off to the nearest integer)

26. 3 moles of metal complex with formula $Co(en)_2Cl_3$ gives 3 moles of silver chloride on treatment with excess of silver nitrate. The secondary valency of Co in the complex is ..... .

(Round off to the nearest integer)

27. In a solvent 50% of an acid H*A* dimerises and the rest dissociates. The van't Hoff factor of the acid is ..... $\times 10^{-2}$.

(Round off to the nearest integer)

28. The dihedral angle in staggered form of Newman projection of 1, 1, 1-trichloro ethane is ..... degree. (Round off to the nearest integer)

29. For the first order reaction, $A \longrightarrow 2B$, 1 mole of reactant *A* gives 0.2 moles of *B* after 100 minutes. The half-life of the reaction is ..... min. (Round off to the nearest integer). [Use : ln 2 = 0.69, ln 10 = 2.3

properties of logarithms : $\ln x^y = y \ln x$;

$\ln\left(\frac{x}{y}\right) = \ln x - \ln y$]

30. For the cell

$Cu(s)|Cu^{2+}(aq)\,(0.1\text{ M})\,||\,Ag^+(aq)\,(0.01\text{ M})|\,Ag(s)$

the cell potential, $E_1 = 0.3095$ V

For the cell,

$Cu(s)|Cu^{2+}(aq)\,(0.01\text{ M})\,||\,Ag^+(aq)\,(0.001\text{ M})|\,Ag(s)$

the cell potential = ... $\times 10^{-2}$ V.

(Round off the nearest integer).

$\left[\text{Use : } \frac{2.303\,RT}{F} = 0.059\right]$

Answers

1. *(a)*	2. *(b)*	3. *(c)*	4. *(d)*	5. *(b)*	6. *(c)*	7. *(c)*	8. *(d)*	9. *(a)*	10. *(b)*
11. *(d)*	12. *(c)*	13. *(c)*	14. *(a)*	15. *(d)*	16. *(d)*	17. *(d)*	18. *(d)*	19. *(c)*	20. *(b)*
21. *(16)*	22. *(82)*	23. *(875)*	24. *(1575)*	25. *(10)*	26. *(6)*	27. *(125)*	28. *(60)*	29. *(656)*	30. *(28)*

26 AUGUST SHIFT I

Section A : Objective Type Questions

1. Which one of the following complexes is violet in colour?

a. $[Fe(CN)_6]^{4-}$ **b.** $[Fe(SCN)_6]^{4-}$
c. $Fe_4[Fe(CN_6)]_3.H_2O$ **d.** $[Fe(CN)_5NOS]^{4-}$

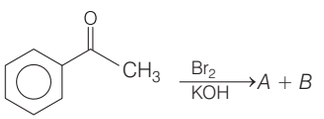
2. Which one of the following is correct for the adsorption of a gas at a given temperature on a solid surface?

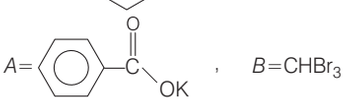
a. $\Delta H > 0, \Delta S > 0$ **b.** $\Delta H > 0, \Delta S < 0$
c. $\Delta H < 0, \Delta S < 0$ **d.** $\Delta H < 0, \Delta S > 0$

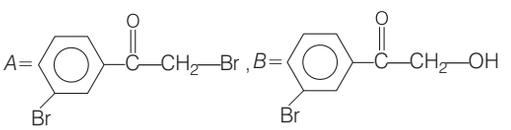
3. Which one of the following when dissolved in water gives coloured solution in nitrogen atmosphere?

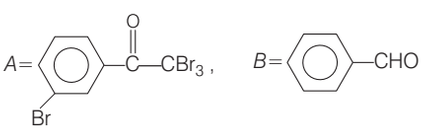
a. $CuCl_2$ **b.** AgCl
c. $ZnCl_2$ **d.** Cu_2Cl_2

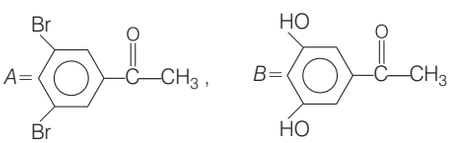
4. The major products formed in the following reaction sequence *A* and *B* are



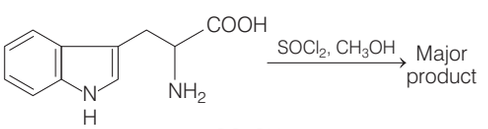
a. 

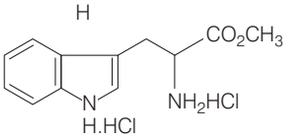
b. 

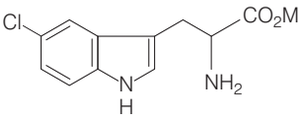
c. 

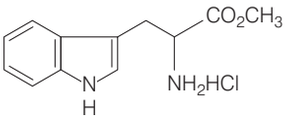
d. 

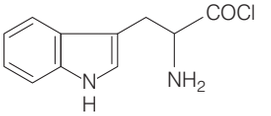
5. The major product formed in the following reaction is



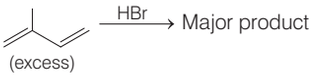
a. 

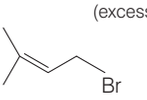
b. 

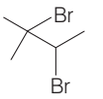
c. 

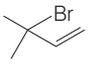
d. 

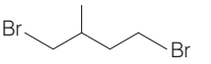
6. The major product formed in the following reaction is



a. 

b. 

c. 

d. 

7. The polymer formed on heating novolac with formaldehyde is

a. bakelite **b.** polyester
c. melamine **d.** nylon 6,6

8. Given below are two statements.

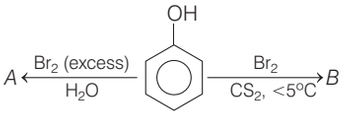
Statement I The limiting molar conductivity of KCl (strong electrolyte) is higher compared to that of CH_3COOH (weak electrolyte).

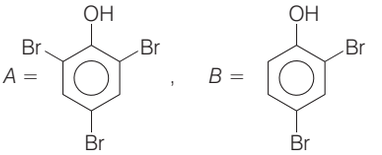
Statement II Molar conductivity decreases with decrease in concentration of electrolyte.

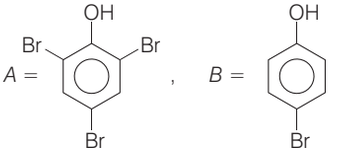
In the light of the above statements, choose the most appropriate answer from the options given below

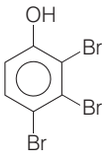
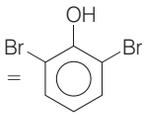
a. Statement I is true but statement II is false.
b. Statement I is false but statement II is true.
c. Both statement I and statement II are true.
d. Both statement I and statement II are false.

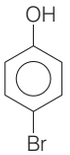
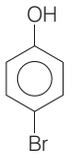
9. The correct options for the products *A* and *B* of the following reactions are



a. 

b. 

c. $A =$  , $B =$ 

d. $A =$  , $B =$ 

10. The conversion of hydroxyapatite occurs due to presence of F^- ions in water. The correct formula of hydroxyapatite is

a. $[3Ca_3(PO_4)_2Ca(OH)_2]$ **b.** $[3Ca(OH)_2CaF_2]$
c. $[Ca_3(PO_4)_2CaF_2]$ **d.** $[3Ca_3(PO_4)_2CaF_2]$

11. Given below are two statements.

Statement I In the titration between strong acid and weak base methyl orange is suitable as an indicator.

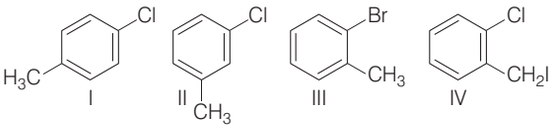
Statement II For titration of acetic acid with NaOH phenolphthalein is not a suitable indicator.

In the light of the above statements, choose the most appropriate answer from the options given below.

a. Statement I is false but statement II is true.
b. Statement I is true but statement II is false.
c. Both statement I and statement II are true.
d. Both statement I and statement II are false.

12. Among the following compounds I-IV, which one forms a yellow precipitate on reacting sequentially with

(i) NaOH (ii) dil. HNO_3
(iii) $AgNO_3$?



a. II **b.** IV **c.** I **d.** III

13. Which one of the following methods is most suitable for preparing deionised water?

a. Synthetic resin method **b.** Clark's method
c. Calgon's method **d.** Permutit method

14. Given below are two statements.

Statement I The choice of reducing agent for metals extraction can be made by using Ellingham diagram, a plot of ΔG *vs* temperature.

Statement II The value of ΔS increases from left to right in Ellingham diagram.

In the light of the above statements, choose the most appropriate answer from the options given below.

a. Both statement I and statement II are true.
b. Statement I is false but statement II is true.
c. Both statement I and statement II are false.
d. Statement I is true but statement II is false.

15. What are the products formed in sequence when excess of CO_2 is passed in slaked lime?

a. $Ca(HCO_3)_2, CaCO_3$ **b.** $CaCO_3, Ca(HCO_3)_2$
c. $CaO, Ca(HCO_3)_2$ **d.** $CaO, CaCO_3$

16. Given below are two statements.

Statement I According to Bohr's model of an atom, qualitatively the magnitude of velocity of electron increases with decrease in positive charges on the nucleus as there is no strong hold on the electron by the nucleus.

Statement II According to Bohr's model of an atom, qualitatively the magnitude of velocity of electron increases with decrease in principal quantum number.

In the light of the above statements, choose the most appropriate answer from the options given below.

a. Both statement I and statement II are false.
b. Both statement I and statement II are true.
c. Statement I is false but statement II is true.
d. Statement I is true but statement II is false.

17. The correct sequential addition of reagents in the preparation of 3-nitrobenzoic acid from benzene is

a. Br_2 /$AlBr_3$, HNO_3 /H_2SO_4, Mg /ether, CO_2, H_3O^+
b. Br_2 / $AlBr_3$, NaCN, H_3O^+, HNO_3 / H_2SO_4
c. Br_2 /$AlBr_3$, HNO_3 /H_2SO_4, NaCN, H_3O^+
d. HNO_3 /H_2SO_4, Br_2 / $AlBr_3$, Mg/ether, CO_2, H_3O^+

18. Given below are two statements.

Statement I Frenkel defects are vacancy as well as interstitial defects.

Statement II Frenkel defect leads to colour in ionic solids due to presence of F-centres.

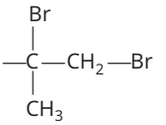
Choose the most appropriate answer for the statements from the options given below.

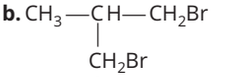
a. Statement I is false but Statement II is true.
b. Both statement I and statement II are true.
c. Statement I is true but statement II is false.
d. Both Statement I and statement II are false.

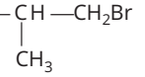
19. Choose the incorrect statement.

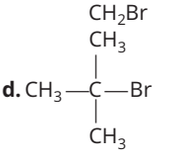
a. Cl_2 is more reactive than ClF.
b. F_2 is more reactive than ClF.
c. On hydrolysis ClF froms HOCl and HF.
d. F_2 is a stronger oxidising agent than Cl_2 in aqueous solution.

20. Excess of isobutane on reaction with Br_2 in presence of light at 125°C gives which one of the following, as the major product?

a. 

b. 

c. 

d. 

Section B : Numerical Type Questions

21. AB_3 is an interhalogen *T*-shaped molecule. The number of lone pairs of electron on *A* is ..... . (Integer answer)

22. These are physical properties of an element.

A. Sublimation enthalpy B. Ionisation enthalpy

C. Hydration enthalpy D. Electron gain enthalpy

The total number of above properties that affect the reduction potential is ..... (Integer answer)

23. Of the following four aqueous solutions, total number of those solutions whose freezing point is lower than that of 0.10 M C_2H_5OH is ..... . (Integer answer)

(i) 0.10 M $Ba_3(PO_4)_2$ (ii) 0.10 M Na_2SO_4

(iii) 0.10 M KCl (iv) 0.10 M Li_3PO_4

24. The OH^- concentration in a mixture of 5.0 mL of 0.0504 M NH_4Cl and 2 mL of 0.0210 M NH_3 solution is $x \times 10^{-6}$ M. The value of *x* is ..... . (Nearest integer)

[Given, $K_w = 1 \times 10^{-14}$ and $K_b = 1.8 \times 10^{-5}$]

25. The number of 4*f* electrons in the ground state electronic configuration of Gd^{2+} is

[Atomic number of Gd is 64.]

26. The ratio of number of water molecules in Mohr's salt and potash alum is ..... $\times 10^{-1}$.

(Integer answer)

27. The following data was obtained for chemical reaction given below at 975 K.

$2NO(g) + 2H_2(g) \longrightarrow N_2(g) + 2H_2O(g)$

	[NO] mol L^{-1}	[H_2] mol L^{-1}	Rate mol L^{-1}
A.	8×10^{-5}	8×10^{-5}	7×10^{-9}
B.	24×10^{-5}	8×10^{-5}	2.1×10^{-8}
C.	24×10^{-5}	32×10^{-5}	8.4×10^{-8}

The order of the reaction with respect to NO is ..... .

[Integer answer]

28. The Born-Haber cycle for KCl is evaluated with the following data :

$\Delta_f H^\circ$ for KCl = – 436.7 kJ mol^{-1}

$\Delta_{sub} H^\circ$ for K = 89.2 kJ mol^{-1},

$\Delta_{ionisation} H^\circ$ for K = 419.0 kJ mol^{-1}; $\Delta_{electron\ gain} H^\circ$ for Cl(g) = – 348.6 kJ mol^{-1}, $\Delta_{bond} H^\circ$ for Cl_2 = 243.0 kJ mol^{-1}

The magnitude of lattice enthalpy of KCl in kJ mol^{-1} is ..... (Nearest integer)

29. The total number of negative charge in the tetrapeptide, Gly-Glu-Asp-Tyr, at pH 12.5 will be ..... . (Integer answer)

30. An aqueous KCl solution of density 1.20gmL^{-1} has a molality of 3.30 mol kg^{-1}. The molarity of the solution in mol L^{-1} is ..... . (Nearest integer)

[Molar mass of KCl = 74.5]

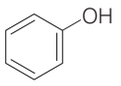
Answers

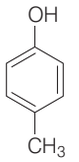
1. *(d)*	2. *(c)*	3. *(a)*	4. *(a)*	5. *(c)*	6. *(a)*	7. *(a)*	8. *(d)*	9. *(b)*	10. *(a)*
11. *(b)*	12. *(b)*	13. *(a)*	14. *(d)*	15. *(b)*	16. *(c)*	17. *(d)*	18. *(c)*	19. *(a)*	20. *(d)*
21. *(2)*	22. *(3)*	23. *(4)*	24. *(3)*	25. *(7)*	26. *(5)*	27. *(1)*	28. *(718)*	29. *(4)*	30. *(3)*

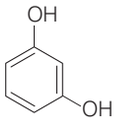
26 AUGUST SHIFT II

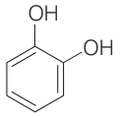
Section A : Objective Type Questions

1. Which one of the following phenols does not give colour when condensed with phthalic anhydride in presence of conc. H_2SO_4 ?

a. 

b. 

c. 

d. 

2. Given below are two statements. One is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) Photochemical smog causes cracking of rubber.

Reason (R) Presence of ozone, nitric oxide, acrolein, formaldehyde and peroxyacetyl nitrate in photochemical smog makes it oxidising.

Choose the most appropriate answer from the options given below.

a. Both (A) and (R) are true but (R) is not the correct explanation of (A).

b. Both (A) and (R) are true and (R) is the correct explanation of (A).

c. (A) is false but (R) is true.

d. (A) is true but (R) is false.

3. The interaction energy of London forces between two particles is proportional to r^x, where r is the distance between the particles. The value of x is

a. 3 **b.** – 3 **c.** – 6 **d.** 6

4. The number of non-ionisable hydrogen atoms present in the final product obtained from the hydrolysis of PCl_5 is

a. 0 **b.** 2 **c.** 1 **d.** 3

5. The bond order and magnetic behaviour of O_2^- ion are, respectively

a. 1.5 and paramagnetic **b.** 1.5 and diamagnetic
c. 2 and diamagnetic **d.** 1 and paramagnetic

6. Given below are two statements : One is labelled as Assertion (A) and other is labelled as Reason (R).

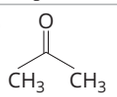
Assertion (A) Sucrose is a disaccharide and a non-reducing sugar.

Reason (R) Sucrose involves glycosidic linkage between C_1 of β-glucose and C_2 of α-fructose.

Choose the most appropriate answer from the options given below.

a. Both (A) and (R) are true but (R) is not the correct explanation of (A).
b. (A) is false but (R) is true.
c. (A) is true but (R) is false.
d. Both (A) and (R) are true and (R) is the correct explanation of (A).

7. Match List-I with List-II.

	List-I (Chemical reaction)		**List-II** (Reagent used)
A.	$CH_3COOC_2H_5 \longrightarrow C_2H_5OH$	1.	CH_3MgBr / H_3O^+ (1.equivalent)
B.	$CH_3COOCH_3 \longrightarrow CH_3CHO$	2.	H_2SO_4 / H_2O
C.	$CH_3C{\equiv}N \longrightarrow CH_3CHO$	3.	DIBAL - H / H_2O
D.	$CH_3C{\equiv}N \longrightarrow$ 	4.	$SnCl_2$, HCl / H_2O

Choose the most appropriate option given below.

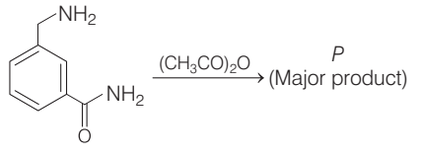
	A	B	C	D		A	B	C	D
a.	2	4	3	1	**b.**	4	2	3	1
c.	2	3	4	1	**d.**	3	2	1	4

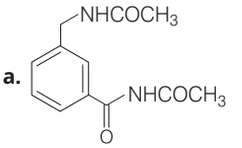
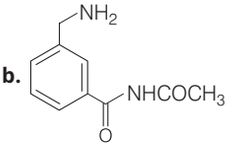
8. Given below are two statements : One is labelled as Assertion (A) and the other is labelled as Reason (R).

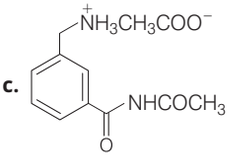
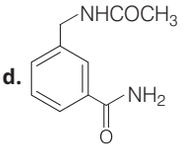
Assertion (A) Barium carbonate is insoluble in water and is highly stable.

Reason (R) The thermal stability of the carbonates increases with increasing cationic size.

a. Both (A) and (R) are true and (R) is the correct explanation of (A).
b. (A) is true but (R) is false.
c. Both (A) and (R) are true and (R) is not the true explanation of (A)
d. (A) is false but (R) is true.

9. 

a.  **b.** 

c.  **d.** 

10. Indicate the complex/complex ion which did not show any geometrical isomerism.

a. $[CoCl_2(en)_2]$ **b.** $[Co(CN)_5(NC)]^{3-}$
c. $[Co(NH_3)_3(NO_2)_3]$ **d.** $[Co(NH_3)_4Cl_2]^+$

11. The sol given below with negatively charged colloidal particles is

a. $FeCl_3$ added to hot water
b. KI added to $AgNO_3$ solution
c. $AgNO_3$ added to KI solution
d. $Al_2O_3 \cdot xH_2O$ in water

12. Given below are two statements.

Statement I Sphalerite is a sulphide ore of zinc and copper glance is a sulphide ore of copper.

Statement II It is possible to separate two sulphide ores by adjusting proportion of oil to water or by using 'depressants' in a froth flotation method.

Choose the most appropriate answer from the options given below.

a. Statement I is true but statement II is false.
b. Both statement I and statement II are true.
c. Statement I is false but statement II is true.
d. Both statement I and statement II are false.

13. Given below are two statements.
One is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) Heavy water is used for the study of reaction mechanism.

Reason (R) The rate of reaction for the cleavage of O—H bond is slower than that of O—D bond.

Choose the most appropriate answer from the options given below.

a. Both (A) and (R) are true but (R) is not the correnct explanation of (A).
b. Both (A) and (R) are true and (R) is the correct explanation of (A).
c. (A) is false but (R) is true.
d. (A) is true but (R) is false.

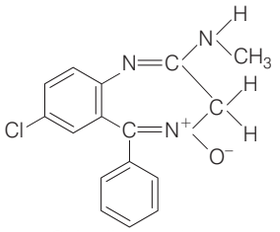
14. Arrange the following cobalt complexes in the order of increasing crystal field stabilisation energy (CFSE) value.
Complexes $\underset{(A)}{[CoF_6]^{3-}}$, $\underset{(B)}{[Co(H_2O)_6]^{3+}}$, $\underset{(C)}{[Co(NH_3)_6]^{3+}}$ and

$\underset{(D)}{[Co(en)_3]^{3+}}$

Choose the correct option.

a. $A < B < C < D$ **b.** $B < A < C < D$
c. $B < C < D < A$ **d.** $C < D < B < A$

15.



Chlordiazepoxide

The class of drug to which chlordiazepoxide with above structure belongs is

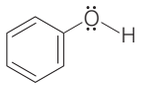
a. antacid **b.** analgesic **c.** tranquilizer **d.** antibiotic

16. Chalcogen group elements are

a. Se, Tb and Pu **b.** Se, Te and Po
c. S, Te and Pm **d.** O, Ti and Po

17. Which one of the following compounds is not aromatic?

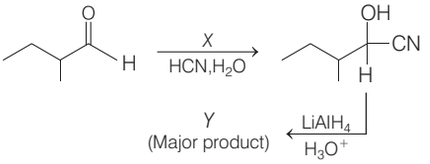
a.  **b.** 

c.  **d.** 

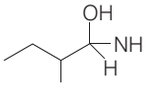
18. The number of stereoisomers possible for 1,2-dimethylcyclopropane is

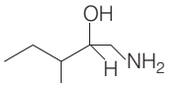
a. one **b.** four **c.** two **d.** three

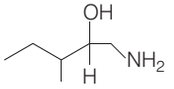
19.

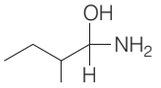


Consider the given reaction, identify X and Y.

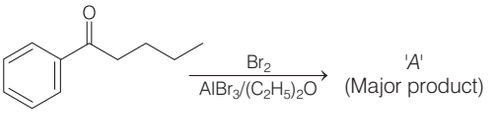
a. X = NaOH, Y = 

b. $X = HNO_3$, Y = 

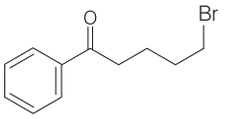
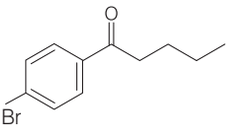
c. X = NaOH, Y = 

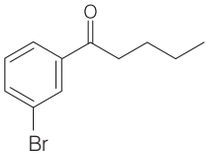
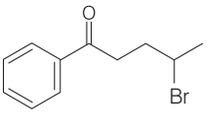
d. $X = HNO_3$, Y = 

20.



Consider the given reaction, the product A is

a.  **b.** 

c.  **d.** 

Section B : Numerical Type Questions

21. In the sulphur estimation, 0.471 g of an organic compound gave 1.44 g of barium sulphate. The percentage of sulphur in the compound is _____%. (Nearest integer)
(Atomic mass of Ba = 137 u)

22. The equilibrium constant K_C at 298 K for the reaction $A + B \rightleftharpoons C + D$ is 100. Starting with an equimolar solution with concentrations of A, B, C and D all equal to 1M, the equilibrium concentration of D is ..... $\times 10^{-2}$ M. (Nearest integer)

23. For water $\Delta_{vap}H = 41 \text{ kJ mol}^{-1}$ at 373 K and 1 bar pressure. Assuming that water vapour is an ideal gas that occupies a much larger volume than liquid water, the internal energy change during evaporation of water is ..... kJ mol^{-1}.
[Use $R = 8.3 \text{ J mol}^{-1} \text{ K}^{-1}$]

24. A metal surface is exposed to 500 nm radiation. The threshold frequency of the metal for photoelectric current is
4.3×10^{14} Hz. The velocity of ejected electron is ..... $\times 10^5 \text{ ms}^{-1}$. (Nearest integer)
[Use $h = 6.63 \times 10^{-34}$ Js, $m_e = 9.0 \times 10^{-31}$ kg]

25. For the galvanic cell,
$Zn(s) + Cu^{2+}(0.02 \text{ M}) \longrightarrow Zn^{2+}(0.04\text{M}) + Cu(s)$,
E_{Cell} = ... $\times 10^{-2}$ V. (Nearest integer)
[Use $E^\circ_{Cu/Cu^{2+}} = -0.34$ V, $E^\circ_{Zn/Zn^{2+}} = +0.76$ V,

$\frac{2.303\,RT}{F} = 0.059$ V]

26. 100 mL of Na_3PO_4 solution contains 3.45 g of sodium. The molarity of the solution is .....$\times 10^{-2}$ mol L^{-1}. (Nearest integer)
[Atomic masses - Na = 23.0 u, O = 16.0 u, P = 31.0 u]

27. The overall stability constant of the complex ion $[Cu(NH_3)_4]^{2+}$ is 2.1×10^{13}. The overall dissociations constant is $y \times 10^{-14}$. Then, y is ..... . (Nearest integer)

28. 83 g of ethylene glycol dissolved in 625 g of water. The freezing point of the solution is .....K. (Nearest integer)

[Use, molal freezing point depression constant of water = 1.86 K kg mol^{-1},

Freezing point of water = 273 K and

Atomic masses : C = 12.0 u, O = 16.0 u, H = 1.0 u]

29. The reaction rate for the reaction

$[PtCl_4]^{2-} + H_2O \rightleftharpoons [Pt(H_2O)Cl_3]^- + Cl^-$

was measured as a function of concentrations of different species. It was observed that

$$\frac{-d[(PtCl_4)^{2-}]}{dt} = 4.8 \times 10^{-5}\,[(PtCl_4)^{2-}]$$

$$= 2.4 \times 10^{-3}[\{Pt(H_2O)Cl_3\}^-][Cl^-]$$

where, square brackets are used to denote molar concentrations. The equilibrium constant, K_C = ... (Nearest integer)

30. A chloro compound *A*,

(i) Forms aldehydes on ozonolysis followed by the hydrolysis.

(ii) When vaporised completely, 1.53 g of *A* gives 448 mL of vapour at STP.

The number of carbon atoms in a molecule of compound *A* is ..... .

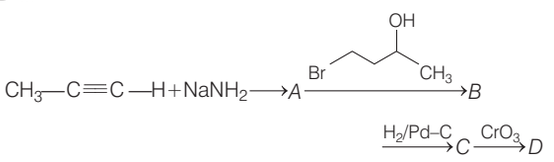
Answers

1. *(b)*	2. *(b)*	3. *(c)*	4. *(a)*	5. *(a)*	6. *(c)*	7. *(c)*	8. *(a)*	9. *(d)*	10. *(b)*
11. *(c)*	12. *(b)*	13. *(d)*	14. *(a)*	15. *(c)*	16. *(b)*	17. *(c)*	18. *(d)*	19. *(c)*	20. *(c)*
21. *(42)*	22. *(182)*	23. *(38)*	24. *(5)*	25. *(109)*	26. *(50)*	27. *(5)*	28. *(269)*	29. *(50)*	30. *(3)*

27 AUGUST SHIFT I

Section A : Objective Type Questions

1. In the following sequence of reactions, the final product *D* is



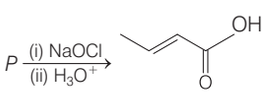
a. $H_3C—CH_2—CH_2—CH_2—CH_2—\overset{\overset{O}{\|}}{C}—H$

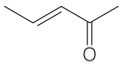
b. $CH_3—CH=CH—CH_2—CH_2—CH_2—COOH$

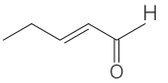
c. $H_3C—CH=CH—CH(OH)—CH_2—CH_2—CH_3$

d. $CH_3—CH_2—CH_2—CH_2—CH_2—\overset{\overset{O}{\|}}{C}—CH_3$

2. The structure of the starting compound *P* used in the reaction given below is



a. 

b. 

c. 

d. 

3. Match List-I with List-II.

	List-I (Species)		**List-II** (Number of lone pair of electrons on the central atom)
A.	XeF_2	1.	0
B.	XeO_2F_2	2.	1
C.	XeO_3F_2	3.	2
D.	XeF_4	4.	3

Choose the most appropriate answer from the options given below :

	A	B	C	D		A	B	C	D
a.	4	1	2	3	**b.**	3	4	2	1
c.	3	2	4	1	**d.**	4	2	1	3

4. In which one of the following molecules strongest back donation of an electron pair from halide to boron is expected?

a. BCl_3 **b.** BF_3 **c.** BBr_3 **d.** BI_3

5. Deuterium resembles hydrogen in properties but

a. reacts slower than hydrogen

b. reacts vigorously than hydrogen

c. reacts just as hydrogen

d. emits β^+ particles

6. Which refining process is generally used in the purification of low melting metals ?

a. Chromatographic method **b.** Liquation

c. Electrolysis **d.** Zone refining

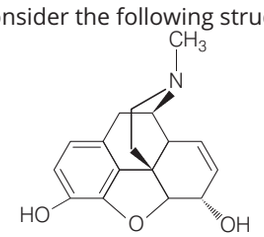
7. Match List-I with List-II.

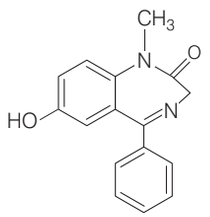
	List-I (Property)		**List-II** (Example)
A.	Diamagnetism	1.	MnO
B.	Ferrimagnetism	2.	O_2
C.	Paramagnetism	3.	NaCl
D.	Antiferromagnetism	4.	Fe_3O_4

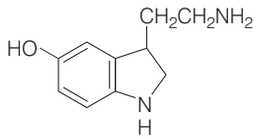
Choose the most appropriate answer from the options given below.

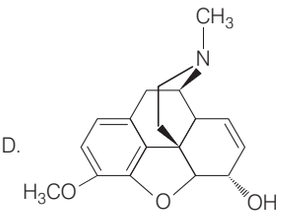
	A	B	C	D		A	B	C	D
a.	2	1	3	4	**b.**	1	3	4	2
c.	3	4	2	1	**d.**	4	2	1	3

8. Consider the following structures :

A. 

B. 

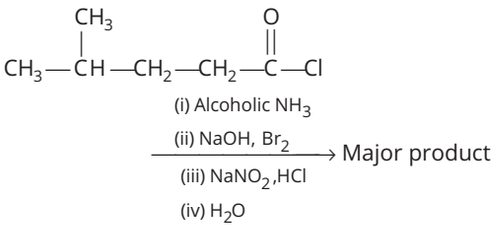
C. 

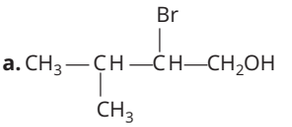
D. 

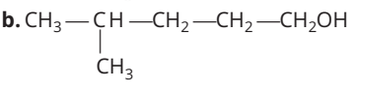
The correct statement about (A), (B), (C) and (D) is

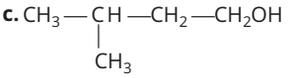
a. (A), (B) and (C) are narcotic analgesics
b. (B), (C) and (D) are tranquillizers
c. (A) and (D) are tranquillizers
d. (B) and (C) are tranquillizers

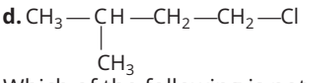
9. The major product of the following reaction is



a. 

b. 

c. 

d. 

10. Which of the following is not a correct statement for primary aliphatic amines?

a. The intermolecular association in primary amines is less than the intermolecular association in secondary amines.
b. Primary amines on treating with nitrous acid solution form corresponding alcohols except methyl amine.
c. Primary amines are less basic than the secondary amines.
d. Primary amines can be prepared by the gabriel phthalimide synthesis.

11. Acidic ferric chloride solution on treatment with excess of potassium ferrocyanide gives a prussian blue coloured colloidal species. It is

a. $Fe_4[Fe(CN)_6]_3$ **b.** $K_5Fe[Fe(CN)_6]_2$
c. $HFe[Fe(CN)_6]$ **d.** $KFe[Fe(CN)_6]$

12. The gas '*A*' is having very low reactivity reaches to stratosphere. It is non-toxic and non-flammable but dissociated by UV-radiations in stratosphere. The intermediates formed initially from the gas '*A*' are

a. $\dot{C}lO + \dot{C}F_2Cl$ **b.** $\dot{C}lO + C\dot{H}_3$
c. $\dot{C}H_3 + C\dot{F}_2Cl$ **d.** $\dot{C}l + C\dot{F}_2Cl$

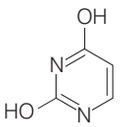
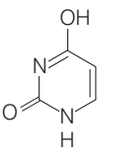
13. The number of water molecules in gypsum, dead burnt plaster and plaster of Paris, respectively are

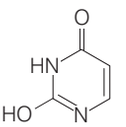
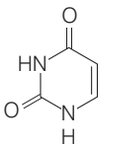
a. 2, 0 and 1 **b.** 0.5, 0 and 2
c. 5, 0 and 0.5 **d.** 2, 0 and 0.5

14. The nature of oxides V_2O_3 and CrO is indexed as '*X*' and '*Y*' type respectively. The correct set of *X* and *Y* is

a. *X* = basic, *Y* = amphoteric
b. *X* = amphoteric, *Y* = basic
c. *X* = acidic, *Y* = acidic
d. *X* = basic, *Y* = basic

15. Out of the following isomeric forms of uracil, which one is present in RNA ?

a.  **b.** 

c.  **d.** 

16. Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).

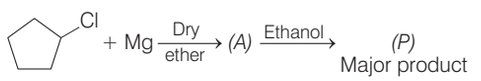
Assertion (A) Synthesis of ethyl phenyl ether may be achieved by Williamson synthesis.

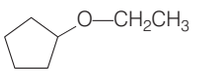
Reason (R) Reaction of bromobenzene with sodium ethoxide yields ethyl phenyl ether.

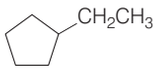
In the light of the above statements, choose the most appropriate answer from the options given below

a. Both (A) and (R) are correct and (R) is the correct explanation of (A)
b. (A) is correct but (R) is incorrect
c. (A) is incorrect but (R) is correct
d. Both (A) and (R) are correct but (R) is not the correct explanation of (A)

17. In the following sequence of reactions the *P* is



a. 
b. 

c. 

d. 

18. The unit of the van der Waals' gas equation parameter 'a' in $\left(p + \frac{an^2}{V^2}\right)(V - nb) = nRT$ is

a. kg ms^{-2} **b.** dm^3 mol^{-1}
c. kg ms^{-1} **d.** atm $dm^6 mol^{-2}$

19. In polythionic acid, $H_2S_xO_6$(x = 3 to 5) the oxidation state(s) of sulphur is/are

a. only + 5 **b.** only + 6
c. + 3 and + 5 **d.** 0 and + 5

20. Tyndall effect is more effectively shown by

a. true solution **b.** lyophilic colloid
c. lyophobic colloid **d.** suspension

Section B : Numerical Type Questions

21. In carius method for estimation of halogens, 0.2 g of an organic compound gave 0.188 g of AgBr. The percentage of bromine in the compound is ..... (Nearest integer)
[Atomic mass; Ag = 108, Br = 80]

22. The reaction that occurs in a breath analyser, a device used to determine the alcohol level in a person's blood stream is

$$2K_2Cr_2O_7 + 8H_2SO_4 + 3C_2H_6O \longrightarrow 2Cr_2(SO_4)_3 + 3C_2H_4O_2 + 2K_2SO_4 + 11H_2O$$

If the rate of appearance of $Cr_2(SO_4)_3$ is 2.67 mol min^{-1} at a particular time, the rate of disappearance of C_2H_6O at the same time is ..... mol min^{-1}. (Nearest integer)

23. The kinetic energy of an electron in the second Bohr orbit of a hydrogen atom is equal to $\frac{h^2}{xma_0^2}$. The value of $10x$ is ..... .
(a_0 is radius of Bohr's orbit) (Nearest integer)
[Given, π = 3.14]

24. 1 kg of 0.75 molal aqueous solution of sucrose can be cooled up to – 4°C before freezing. The amount of ice (in g) that will be separated out is ..... . (Nearest integer)
[Given, $K_f(H_2O)$ = 1.86 K kg mol^{-1}]

25. 1 mol of an octahedral metal complex with formula $MCl_3 \cdot 2L$ on reaction with excess of $AgNO_3$ gives 1 mol of AgCl. The denticity of ligand L is ..... . (Integer answer)

26. The number of moles of CuO, that will be utilised in Dumas method for estimation nitrogen in a sample of 57.5 g of N, N-dimethylaminopentane is ..... $\times 10^{-2}$. (Nearest integer)

27. The number of f-electrons in the ground state electronic configuration of Np (Z = 93) is ..... . (Nearest integer)

28. 200 mL of 0.2 M HCl is mixed with 300 mL of 0.1 M NaOH. The molar heat of neutralisation of this reaction is – 57.1 kJ. The increase in temperature in °C of the system on mixing is $x \times 10^{-2}$.
The value of x is ..... (Nearest integer)
[Given, specific heat of water = 4.18 J $g^{-1}K^{-1}$
Density of water = 1.00 g cm^{-3}]
(Assume no volume change on mixing)

29. The number of moles of NH_3, that must be added to 2 L of 0.80 M $AgNO_3$ in order to reduce the concentration of Ag^+ ions to 5.0×10^{-8} M ($K_{formation}$ for $[Ag(NH_3)_2]^+ = 1.0 \times 10^8$) is ..... (Nearest integer)
[Assume no volume change on adding NH_3]

30. When 10 mL of an aqueous solution of $KMnO_4$ was titrated in acidic medium, equal volume of 0.1 M of an aqueous solution of ferrous sulphate was required for complete discharge of colour.
The strength of $KMnO_4$ in g/L is
..... $\times 10^{-2}$. (Nearest integer)
[Atomic mass of K = 39, Mn = 55, O = 16]

Answers

1. *(d)*	2. *(a)*	3. *(d)*	4. *(b)*	5. *(a)*	6. *(b)*	7. *(c)*	8. *(d)*	9. *(c)*	10. *(a)*
11. *(a)*	12. *(d)*	13. *(d)*	14. *(d)*	15. *(d)*	16. *(b)*	17. *(a)*	18. *(d)*	19. *(d)*	20. *(c)*
21. *(40)*	22. *(4)*	23. *(3155)*	24. *(518)*	25. *(2)*	26. *(1125)*	27. *(18)*	28. *(82)*	29. *(4)*	30. *(316)*

27 AUGUST SHIFT II

Section A : Objective Type Questions

1. Choose the correct statement from the following.

a. The standard enthalpy of formation for alkali metal bromide becomes less negative on descending the group.

b. The low solubility of CsI in water is due to its high lattice enthalpy.

c. Among the alkali metal halides, LiF is least soluble in water.

d. LiF has least negative standard enthalpy of formation among alkali metal fluorides.

2. The addition of dilute NaOH to Cr^{3+} salt solution will give

a. a solution of $[Cr(OH)_4]^-$ **b.** precipitate of $Cr_2O_3(H_2O)_n$

c. precipitate of $[Cr(OH)_6]^{3-}$ **d.** precipitate of $Cr(OH)_3$

3. Given below are two statements.

Statement I Ethyl pent–4–yn–oate on reaction with CH_3MgBr gives a 3° alcohol.

Statement II In this reaction, one mole of ethyl pent–4–yn–oate utilizes two moles of CH_3MgBr.

In the light of the above statements, choose the most appropriate answer from the options given below.

a. Both statement I and statement II are false.

b. Statement I is false but statement II is true.

c. Statement I is true but statement II is false.

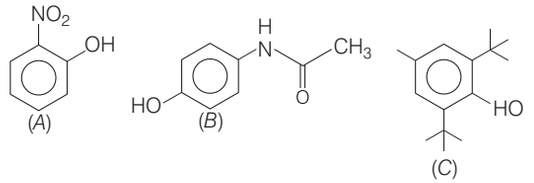
d. Both statement I and statement II are true.

4. In stratosphere most of the ozone formation is assisted by

a. cosmic rays **b.** γ–rays

c. ultraviolet radiations **d.** visible radiations

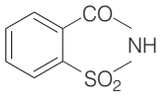
5. The compound/s which will show significant intermolecular H–bonding is/are

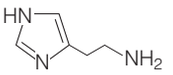


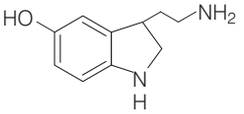
a. (B) only **b.** (C) only

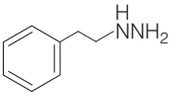
c. (A) and (B) **d.** (A), (B) and (C)

6. Which one of the following chemicals is responsible for the production of HCl in the stomach leading to irritation and pain?

a. 

b. 

c. 

d. 

7. The oxide that gives H_2O_2 most readily on treatment with H_2O is

a. PbO_2 **b.** Na_2O_2 **c.** SnO_2 **d.** $BaO_2 \cdot 8H_2O$

8. Which one of the following reactions will not yield propionic acid?

a. $CH_3CH_2COCH_3 + OI^- / H_3O^+$

b. $CH_3CH_2CH_3 + KMnO_4$ (Heat), OH^- / H_3O^+

c. $CH_3CH_2CCl_3 + OH^- / H_3O^+$

d. $CH_3CH_2CH_2Br + Mg, CO_2$, dry ether/$H_3O^+$

9. The correct order of ionic radii for the ions, P^{3-}, S^{2-}, Ca^{2+}, K^+, Cl^- is

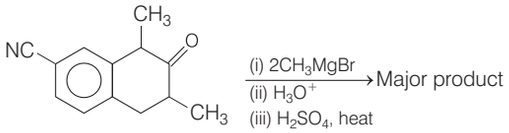
a. $P^{3-} > S^{2-} > Cl^- > K^+ > Ca^{2+}$

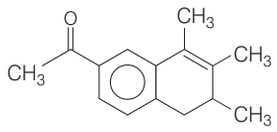
b. $Cl^- > S^{2-} > P^{3-} > Ca^{2+} > K^+$

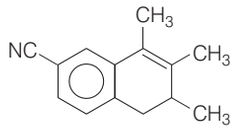
c. $P^{3-} > S^{2-} > Cl^- > Ca^{2+} > K^+$

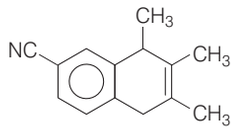
d. $K^+ > Ca^{2+} > P^{3-} > S^{2-} > Cl^-$

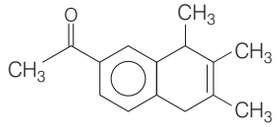
10. Which one of the following is the major product of the given reaction?



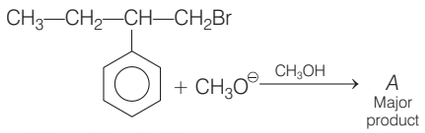
a. 

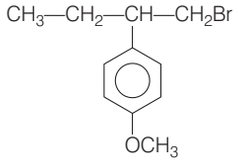
b. 

c. 

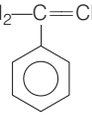
d. 

11. The major product (*A*) formed in the reaction given below is

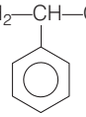


a. 

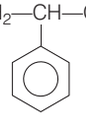
b. $CH_3—CH_2—C{=}CH_2$



c. $CH_3—CH_2—CH—CH_2—OH$



d. $CH_3—CH_2—CH—CH_2—OCH_3$



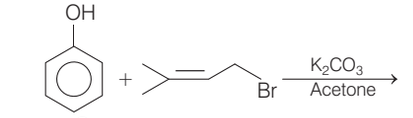
12. Which one of the following is used to remove most of plutonium from spent nuclear fuel?

a. ClF_3 **b.** O_2F_2 **c.** I_2O_5 **d.** BrO_3

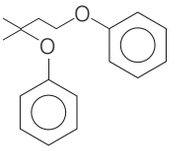
13. Lyophilic sols are more stable than lyophobic sols because

a. there is a strong electrostatic repulsion between the negatively charged colloidal particles.
b. the colloidal particles have positive charge.
c. the colloidal particles have no charge.
d. the colloidal particles are solvated.

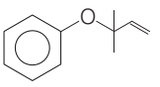
14. The major product of the following reaction, if it occurs by S_N2 mechanism is



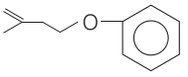
a.



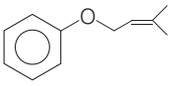
b.



c.



d.



15. Potassium permanganate on heating at 513 K gives a product which is

a. paramagnetic and colourless
b. diamagnetic and green
c. diamagnetic and colourless
d. paramagnetic and green

16. Which one of the following tests used for the identification of functional groups in organic compounds does not use copper reagent ?

a. Barfoed's test **b.** Seliwanoff's test
c. Benedict's test **d.** Biuret test for peptide bond

17. Hydrolysis of sucrose gives

a. α-D-(–)-glucose and β-D-(–)-fructose
b. α-D-(+)-glucose and β-D-(+)-fructose
c. α-D-(–)-glucose and β-D-(+)-fructose
d. α-D-(+)-glucose and β-D-(–)-fructose

18. Match List-I with List-II.

	List-I (Name of ore/mineral)		**List-I** (Chemical formula)
A.	Calamine	1.	ZnS
B.	Malachite	2.	$FeCO_3$
C.	Siderite	3.	$ZnCO_3$
D.	Sphalerite	4.	$CuCO_3 \cdot Cu(OH)_2$

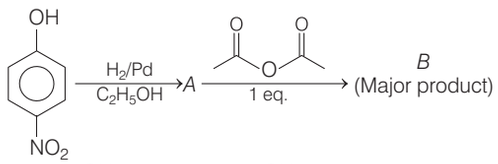
Choose the most appropriate answer from the options given below

	A	B	C	D		A	B	C	D
a.	3	4	2	1	**b.**	3	4	1	2
c.	4	3	1	2	**d.**	3	2	4	1

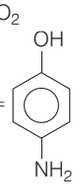
19. Which one of the following is formed (mainly) when red phosphorus is heated in a sealed tube at 803 K ?

a. White phosphorus **b.** Yellow phosphorus
c. β-black phosphorus **d.** α-black phosphorus

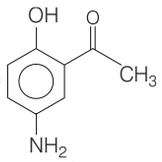
20. The correct structures of *A* and *B* formed in the following reactions are



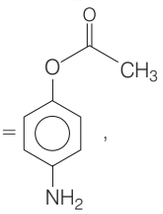
a. *A* =



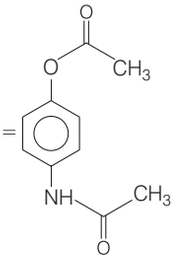
, *B* =



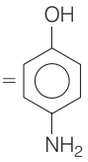
b. *A* =



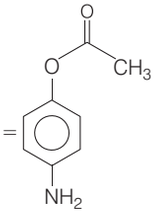
, *B* =



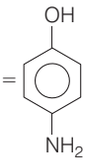
c. *A* =



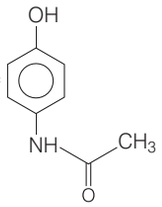
, *B* =



d. *A* =



, *B* =



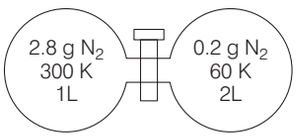
Section B : Numerical Type Questions

21. The first order rate constant for the decomposition of $CaCO_3$ at 700 K is $6.36 \times 10^{-3}\ s^{-1}$ and activation energy is 209 kJ mol^{-1}. Its rate constant (in s^{-1}) at 600 K is $x \times 10^{-6}$. The value of x is ..... . (Nearest integer)

[Given, $R = 8.31\ JK^{-1}mol^{-1}$, $\log 6.36 \times 10^{-3} = -2.19$, $10^{-4.79} = 1.62 \times 10^{-5}$]

22. The number of optical isomers possible for $[Cr(C_2O_4)_3]^{3-}$ is ...

23. Two flasks I and II shown below are connected by a valve of negligible volume.



When the valve is opened, the final pressure of the system in bar is $x \times 10^{-2}$. The value of x is ..... . (Integer answer)

[Assume, Ideal gas, 1 bar = 10^5 Pa, molar mass of N_2 = 28.0 g mol^{-1}; $R = 8.31\ J\ mol^{-1}\ K^{-1}$]

24. 100 g of propane is completely reacted with 1000 g of oxygen. The mole fraction of carbon dioxide in the resulting mixture is $x \times 10^{-2}$. The value of x is ..... . (Nearest integer)

[Atomic weight : H = 1.008, C = 12.00, O =16.00]

25. 40 g of glucose (Molar mass = 180) is mixed with 200 mL of water. The freezing point of solution is ..... K. (Nearest integer)

[Given, K_f = 1.86 K kg mol^{-1}, density of water = 1.00 g cm^{-3}, freezing point of water = 273.15 K]

26. The resistance of a conductivity cell with cell constant 1.14 cm^{-1}, containing 0.001 M KCl at 298 K is 1500 Ω. The molar conductivity of 0.001 M KCl solution at 298 K in S cm^2mol^{-1} is ..... . (Integer answer)

27. The number of photons emitted by a monochromatic (single frequency) infrared range finder of power 1 mW and wavelength of 1000 nm, in 0.1 second is $x \times 10^{13}$. The value of x is ..... . (Nearest integer)

($h = 6.63 \times 10^{-34}$ Js, $c = 3.00 \times 10^8\ ms^{-1}$)

28. When 5.1 g of solid NH_4HS is introduced into a two litre evacuated flask at 27°C, 20% of the solid decomposes into gaseous ammonia and hydrogen sulphide. The K_p for the reaction at 27°C is $x \times 10^{-2}$. The value of x is ..... . (Integer answer)

[Given, $R = 0.082$ L atm K^{-1} mol^{-1}]

29. The number of species having non–pyramidal shape among the following is

(i) SO_3 (ii) NO_3^- (iii) PCl_3 (iv) CO_3^{2-}

30. Data given for the following reaction is as follows.

$FeO(s) + C_{(graphite)} \longrightarrow Fe(s) + CO(g)$

Substance	ΔH° (kJ mol^{-1})	ΔS° (J mol^{-1} K^{-1})
FeO(*s*)	– 266.3	57.49
$C_{(graphite)}$	0	5.74
Fe(*s*)	0	27.28
CO(*g*)	– 110.5	197.6

The minimum temperature in K at which the reaction becomes spontaneous is ..... (Integer answer)

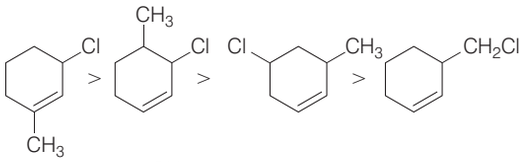
Answers

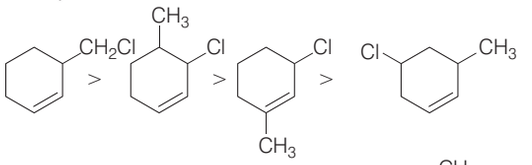
1. *(c)*	2. *(b)*	3. *(c)*	4. *(c)*	5. *(a)*	6. *(b)*	7. *(b)*	8. *(d)*	9. *(a)*	10. *(a)*
11. *(b)*	12. *(b)*	13. *(d)*	14. *(d)*	15. *(d)*	16. *(b)*	17. *(d)*	18. *(a)*	19. *(d)*	20. *(d)*
21. *(16)*	22. *(2)*	23. *(84)*	24. *(19)*	25. *(271)*	26. *(760)*	27. *(50)*	28. *(6)*	29. *(3)*	30. *(964)*

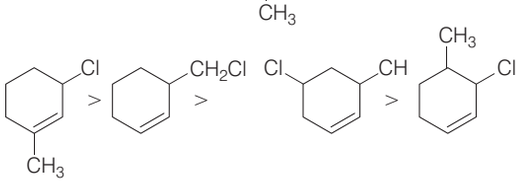
31 AUGUST SHIFT I

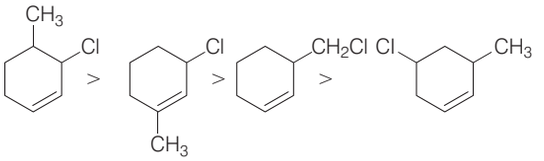
Section A : Objective Type Questions

1. The correct order of reactivity of the given chlorides with acetate in acetic acid is

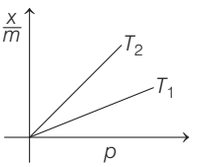
a. 

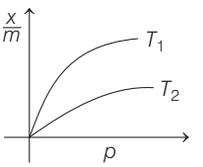
b. 

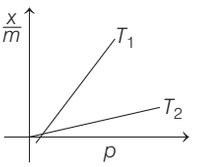
c. 

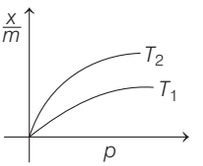
d. 

2. Select the graph that correctly describes the adsorption isotherms at two temperatures T_1 and T_2 ($T_1 > T_2$) for a gas. (x = mass of the gas adsorbed ; m = mass of adsorbent ; p = pressure)

a. 

b. 

c. 

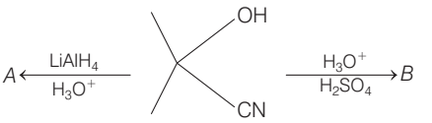
d. 

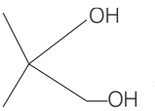
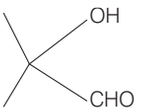
3. The major component/ingredient of Portland cement is
a. tricalcium aluminate
b. tricalcium silicate
c. dicalcium aluminate
d. dicalcium silicate

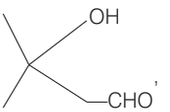
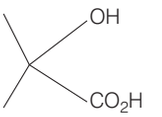
4. In the structure of the dichromate ion, there is a
a. linear symmetrical Cr—O—Cr bond.
b. non-linear symmetrical Cr—O—Cr bond.
c. linear unsymmetrical Cr—O—Cr bond.
d. non-linear unsymmetrical Cr—O—Cr bond.

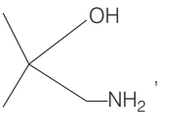
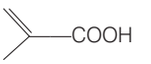
5. Which one of the following compounds contain β-C_1—C_4 glycosidic linkage ?
a. Lactose **b.** Sucrose
c. Maltose **d.** Amylose

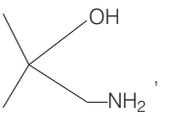
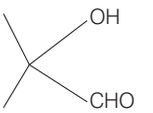
6. The major products A and B in the following set of reactions are



a. A =  , B = 

b. A =  , B = 

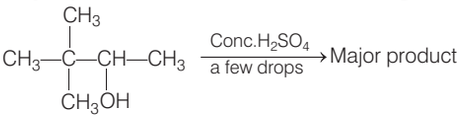
c. A =  , B = 

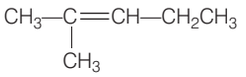
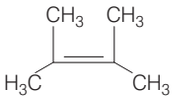
d. A =  , B = 

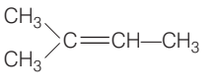
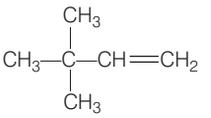
7. Which one of the following lanthanides exhibits + 2 oxidation state with diamagnetic nature ?
(Given, Z for Nd = 60, Yb = 70, La= 57, Ce = 58)
a. Nd **b.** Yb **c.** La **d.** Ce

8. Given below are two statements.
One is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A) Aluminium is extracted from bauxite by the electrolysis of molten mixture of Al_2O_3 with cryolite.
Reason (R) The oxidation state of Al in cryolite is + 3 .
In the light of the above statements, choose the most appropriate answer from the options given below.
a. (A) is true but (R) is false
b. (A) is false but (R) is true.
c. Both (A) and (R) are true and (R) is the correct explanation of (A).
d. Both (A) and (R) are true but (R) is not the correct explanation of (A).

9. The major product formed in the following reaction is



a.  **b.** 

c.  **d.** 

10. Monomer of novolac is
a. 3-hydroxybutanoic acid
b. phenol and melamine
c. *o*-hydroxymethylphenol
d. 1,3-butadiene and styrene

11. Given below are two statements.

Statement I The process of producing *syn*-gas is called gasification of coal.

Statement II The composition of *syn*-gas is $CO + CO_2 + H_2$ (1 : 1 : 1)

In the light of the above statements, choose the most appropriate answer from the options given below.
a. Statement I is false but statement II is true.
b. Statement I is true but statement II is false.
c. Both statement-I and statement II are false.
d. Both statement-I and statement II are true.

12. Given below are two statements.
One is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) Treatment of bromine water with propene yields 1-bromopropan-2-ol.

Reason (R) Attack of water on bromonium ion follows Markownikoff rule and results in 1-bromopropan-2-ol.

In the light of the above statements, choose the most appropriate answer from the options given below.
a. Both (A) and (R) are true but (R) is not the correct explanation of (A).
b. (A) is false but (R) is true.
c. Both (A) and (R) are true and (R) is the correct explanation of (A).
d. (A) is true but (R) is false

13. The denticity of an organic ligand, biuret is
a. 2 **b.** 4 **c.** 3 **d.** 6

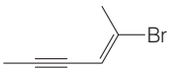
14. Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) Metallic character decreases and non-metallic character increases on moving from left to right in a period.

Reason (R) It is due to increase in ionisation enthalpy and decrease in electron gain enthalpy, when one moves from left to right in a period.

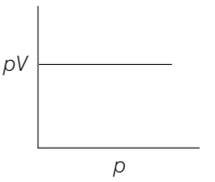
In the light of the above statements, choose the most appropriate answer from the options given below.
a. (A) is false but (R) is true.
b. (A) is true but (R) is false
c. Both (A) and (R) are correct and (R) is the correct explanation of (A).
d. Both (A) and (R) are correct but (R) is not the correct explanation of (A).

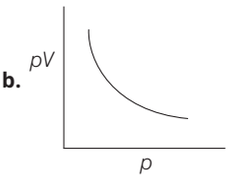
15. Choose the correct name for compound given below

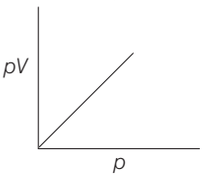


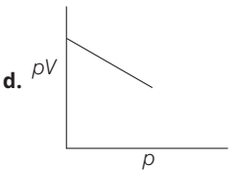
a. (4E)-5-bromohex-4-en-2-yne
b. (2E)-2-bromohex-4-yn-2-ene
c. (2E)-2-bromohex-2-en-4-yne
d. (4E)-5-bromohex-2-en-4-yne

16. Which one of the following is the correct *pV vs p* plot at constant temperature for an ideal gas ? (*p* and *V* stand for pressure and volume of the gas respectively)

a. 

b. 

c. 

d. 

17. Given below are two statements.
One is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) A simple distillation can be used to separate a mixture of propanol and propanone.

Reason (R) Two liquids with a difference of more than 20°C in their boiling points can be separated by simple distillations.

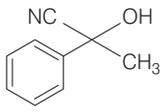
In the light of the above statements, choose the most appropriate answer from the options given below.
a. (A) is false but (R) is true.
b. Both (A) and (R) are correct but (R) is not the correct explanation of (A).
c. (A) is true but (R) is false
d. Both (A) and (R) are correct and (R) is the correct explanation of (A).

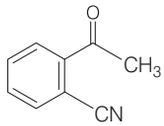
18. Which one of the following 0.10 M aqueous solutions will exhibit the largest freezing point depression ?
a. Hydrazine **b.** Glucose
c. Glycine **d.** $KHSO_4$

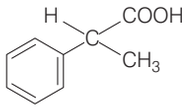
19. BOD values (in ppm) for clean water (*A*) and polluted water (*B*) are expected respectively
a. $A > 50, B < 27$ **b.** $A > 25, B < 17$
c. $A < 5, B > 17$ **d.** $A > 15, B > 47$

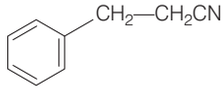
20. The structure of product *C*, formed by the following sequence of reactions is

$$CH_3COOH + SOCl_2 \longrightarrow A \xrightarrow[AlCl_3]{Benzene} B \xrightarrow[-OH]{KCN} C$$

a. 

b. 

c. 

d. 

Section B : Numerical Type Questions

21. Consider the following cell reaction,

$$Cd(s) + Hg_2SO_4(s) + \frac{9}{5}H_2O(l) \rightleftharpoons CdSO_4 \cdot \frac{9}{5}H_2O(s) + 2Hg(l)$$

The value of E°_{cell} is 4.315 V at 25°C. If $\Delta H^{\circ} = -825.2$ kJ mol^{-1}, the standard entropy change ΔS° in J K^{-1} is ..... (Nearest integer)

[Given, Faraday constant = 96487 C mol^{-1}]

22. The molarity of the solution prepared by dissolving 6.3 g of oxalic acid ($H_2C_2O_4 \cdot 2H_2O$) in 250 mL of water in mol L^{-1} is $x \times 10^{-2}$. The value of x is ..... (Nearest integer)

[Atomic mass H = 1.0, C = 12.0, O = 16.0]

23. Consider the sulphides HgS, PbS, CuS, Sb_2S_3, As_2S_3 and CdS. Number of these sulphides soluble in 50% HNO_3 is

24. The total number of reagents from those given below, that can convert nitrobenzene into aniline is ..... (Integer answer)

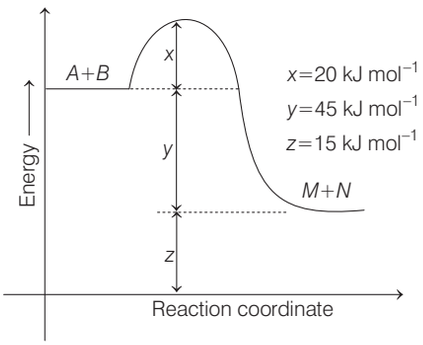
I. Sn - HCl	II. Sn - NH_4OH
III. Fe - HCl	IV. Zn - HCl
V. H_2 - Pd	VI. H_2-Raney nickel

25. The number of halogen (s) forming halic (V) acid is

26. For a first order reaction, the ratio of the time for 75% completion of a reaction to the time for 50% completion is ..... (Integer answer)

27. The number of hydrogen bonded water molecule(s) associated with stoichiometry $CuSO_4 \cdot 5H_2O$ is/are.

28. According to the following figure, the magnitude of the enthalpy change of the reaction $A + B \rightarrow M + N$ in kJ mol^{-1} is equal to ..... (Integer answer)



29. Ge($Z = 32$) in its ground state electronic configuration has x completely filled orbitals with $m_l = 0$. The value of x is

30. A_3B_2 is a sparingly soluble salt of molar mass M (g mol^{-1}) and solubility x g L^{-1}. The solubility product satisfies $K_{sp} = a\left(\frac{x}{M}\right)^5$. The value of a is ..... (Integer answer)

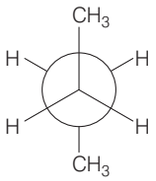
Answers

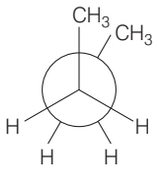
1. *(a)*	2. *(d)*	3. *(b)*	4. *(b)*	5. *(a)*	6. *(c)*	7. *(b)*	8. *(d)*	9. *(b)*	10. *(c)*
11. *(b)*	12. *(c)*	13. *(a)*	14. *(b)*	15. *(c)*	16. *(a)*	17. *(d)*	18. *(d)*	19. *(c)*	20. *(a)*
21. *(25)*	22. *(20)*	23. *(4)*	24. *(5)*	25. *(3)*	26. *(2)*	27. *(1)*	28. *(45)*	29. *(7)*	30. *(108)*

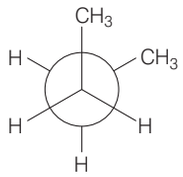
31 AUGUST SHIFT II

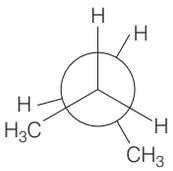
Section A : Objective Type Questions

1. Arrange the following conformational isomers of *n*-butane in order of their increasing potential energy

I. 

II. 

III. 

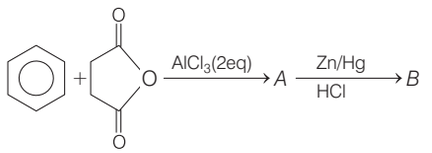
IV. 

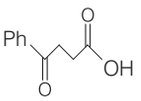
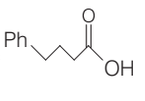
a. II < III < IV < I
b. I < IV < III < II
c. II < IV < III < I
d. I < III < IV < II

2. The Eu^{2+} ion is a strong reducing agent in spite of its ground state electronic configuration (outermost) : [Atomic number of Eu = 63]

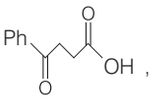
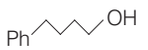
a. $4f^7 6s^2$ **b.** $4f^6$ **c.** $4f^7$ **d.** $4f^6 6s^2$

3. The structures of *A* and *B* formed in the following reaction are : [Ph = —C_6H_5]



a. *A* =  , *B* = 

b. *A* =  , *B* = 

c. *A* =  , *B* = 

d. *A* =  , *B* = 

4. In which one of the following sets all species show disproportionation reaction

a. ClO_2^-, F_2, MnO_4^{2-} and $Cr_2O_7^{2-}$

b. $Cr_2O_7^{2-}$, MnO_4^-, ClO_2^- and Cl_2

c. ClO_2^-, Cl_2 and Mn^{3+}

d. ClO_4^-, MnO_4^{2-}, ClO_2^- and F_2

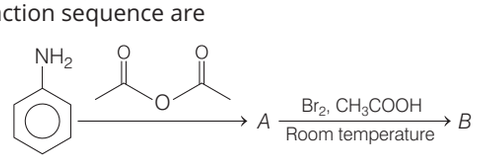
5. Match List-I with List-II.

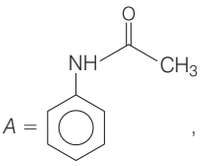
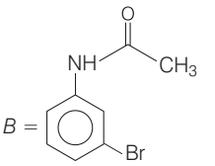
	List-I (Parameter)		**List-II** (Unit)
A.	Cell constant	1.	$S\ cm^2\ mol^{-1}$
B.	Molar conductivity	2.	Dimensionless
C.	Conductivity	3.	m^{-1}
D.	Degree of dissociation of electrolyte	4.	$\Omega^{-1}m^{-1}$

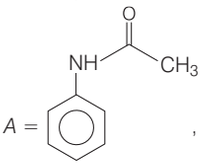
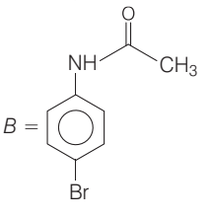
Choose the most appropriate answer from the options given below

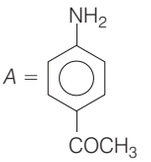
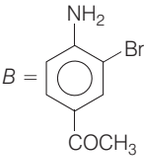
	A	B	C	D		A	B	C	D
a.	3	1	4	2	**b.**	3	1	2	4
c.	1	4	3	2	**d.**	2	1	3	4

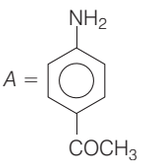
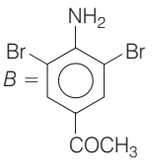
6. The major products *A* and *B* formed in the following reaction sequence are



a. *A* =  , *B* = 

b. *A* =  , *B* = 

c. *A* =  , *B* = 

d. *A* =  *B* = 

7. Which of the following is not an example of fibrous protein ?

a. Keratin **b.** Albumin

c. Collagen **d.** Myosin

8. The depositions of *X* and *Y* on ground surfaces is referred to as wet and dry depositions, respectively. *X* and *Y* are

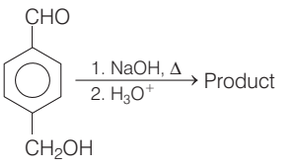
a. *X* = Ammonium salts, *Y* = CO_2

b. *X* = SO_2, *Y* = Ammonium salts

c. *X* = Ammonium salts, *Y* = SO_2

d. *X* = CO_2, *Y* = SO_2

9. For the reaction given below.



The compound which is not formed as a product in the reaction is a

a. compound with both alcohol and acid functional groups

b. monocarboxylic acid

c. dicarboxylic acid

d. diol

10. Spin only magnetic moment in BM of $[Fe(CO)_4(C_2O_4)]^+$ is

a. 5.92 **b.** 0 **c.** 1 **d.** 1.73

11. Given below are two statements : One is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) Lithium salts are hydrated.

Reason (R) Lithium has higher polarising power than other alkali metal group members.

In the light of the above statements, choose the most appropriate answer from the options given below

a. Both (A) and (R) are true but (R) is not the correct explanation of (A).

b. (A) is true but (R) is not true

c. (A) is false but (R) is ture.

d. Both (A) and (R) are true (R) is the correct explanation of (A).

12. The incorrect expression among the following is

a. $\frac{\Delta G_{System}}{\Delta S_{Total}} = -T$ (at constant p)

b. $\ln k = \frac{\Delta H^\circ - T\Delta S^\circ}{RT}$

c. $k = e^{-\frac{\Delta G^\circ}{RT}}$

d. For isothermal process, $W_{reversible} = -nRT \ln \frac{V_f}{V_i}$

13. Which one of the following statements is incorrect ?

a. Atomic hydrogen is produced when H_2 molecules at a high temperature are irradiated with UV radiation.

b. At around 2000 K, the dissociation of dihydrogen into its atoms is nearly 8.1%.

c. Bond dissociation enthalpy of H_2 is highest among diatomic gaseous molecules which contain a single bond .

d. Dihydrogen is produced on reacting zinc with HCl as well as NaOH(aq).

14. Which among the following is not a polyester ?

a. Novolac **b.** PHBV **c.** Dacron **d.** Glyptal

15. Which one of the following correctly represents the order of stability of oxides, X_2O (X = halogen) ?

a. Br > Cl > I **b.** Br > I > Cl **c.** Cl > I > Br **d.** I > Cl > Br

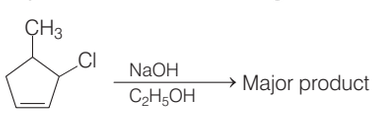
16. Match List-I with List-II.

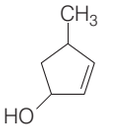
	List-I (Metal ion)		**List-II** (Group in qualitative analysis)
A.	Mn^{2+}	1.	Group - III
B.	As^{3+}	2.	Group - IIA
C.	Cu^{2+}	3.	Group - IV
D.	Al^{3+}	4.	Group - IIB

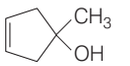
Choose the most appropriate answer from the options given below.

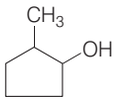
	A	B	C	D		A	B	C	D
a.	1	2	3	4	**b.**	3	4	2	1
c.	1	4	2	3	**d.**	4	2	3	1

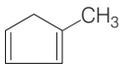
17. The major product of the following reaction is



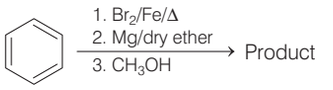
a. 

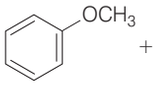
b. 

c. 

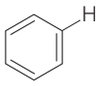
d. 

18. For the following

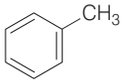


a. 

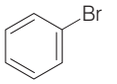
+ HMgBr

b. 

+ Mg^{OCH3}_{Br}

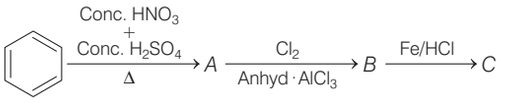
c. 

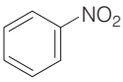
+ Mg^{OH}_{Br}

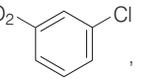
d. 

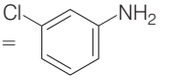
+ Mg^{OH}_{OCH3}

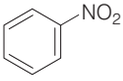
19. Identify correct A, B and C in the reaction sequence given below.

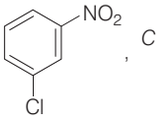


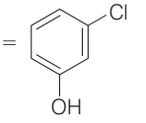
a. $A =$ 

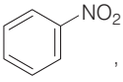
, $B =$ 

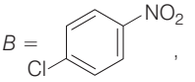
, $C =$ 

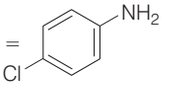
b. $A =$ 

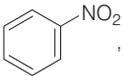
, $B =$ 

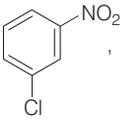
, $C =$ 

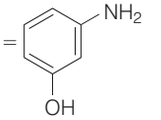
c. $A =$ 

, $B =$ 

, $C =$ 

d. $A =$ 

, $B =$ 

, $C =$ 

20. The number of S═O bonds present in sulphurous acid, peroxodisulphuric acid and pyrosulphuric acid, respectively are

a. 2, 3 and 4

b. 1, 4 and 3

c. 2, 4 and 3

d. 1, 4 and 4

Section B : Numerical Type Questions

21. CH_4 is adsorbed on 1 g charcoal at 0°C following the Freundlich adsorption isotherm. 10.0 mL of CH_4 is adsorbed at 100 mm of Hg, whereas 15.0 mL is adsorbed at 200 mm of Hg. The volume of CH_4 adsorbed at 300 mm of Hg is 10^x mL. The value of x is ..... $\times 10^{-2}$. (Nearest integer)

[Use $\log_{10} 2 = 0.3010, \log_{10} 3 = 0.4771$]

22. 1.22 g of an organic acid is separately dissolved in 100 g of benzene (K_b = 2.6 K kg mol^{-1}) and 100 g of acetone (K_b = 1.7 K kg mol^{-1}). The acid is known to dimerise in benzene but remain as a monomer in acetone. The boiling point of the solution in acetone increases by 0.17°C. The increase in boiling point of solution in benzene in °C is $x \times 10^{-2}$. The value of x is ..... (Nearest integer)

[Atomic mass : C = 12.0, H = 1.0, O= 16.0]

23. The value of magnetic quantum number of the outermost electron of Zn^+ ion is

24. The empirical formula for a compound with a cubic close packed arrangement of anions and with cations occupying all the octahedral sites in A_xB. The value of x is ..... (Integer answer)

25. In the electrolytic refining of blister copper, the total number of main impurities from the following, removed as anode mud is .....

Pb, Sb, Se, Te, Ru, Ag, Au and Pt

26. The pH of a solution obtained by mixing 50 mL of 1 M HCl and 30 mL of 1 M NaOH is $x \times 10^{-4}$. The value of x is ..... (Nearest integer) [log 2.5 = 0.3979]

27. For the reaction $A \rightarrow B$, the rate constant k (in s^{-1}) is given by $\log_{10} k = 20.35 - \frac{(2.47 \times 10^3)}{T}$.

The energy of activation in kJ mol^{-1} is ..... (Nearest integer)

[Given : R = 8.314 J K^{-1} mol^{-1}]

28. Sodium oxide reacts with water to produce sodium hydroxide. 20.0 g of sodium oxide is dissolved in 500 mL of water. Neglecting the change in volume, the concentration of the resulting NaOH solution is ..... $\times 10^{-1}$ M. (Nearest integer)

[Atomic mass : Na = 23.0, O = 16.0, H = 1.0]

29. According to molecular orbital theory, the number of unpaired electron(s) in O_2^{2-} is ..... .

30. The transformation occurring in Duma's method is given below

$$C_2H_7N + \left(2x + \frac{y}{2}\right) CuO \longrightarrow x CO_2 + \frac{y}{2} H_2O + \frac{z}{2} N_2 + \left(2x + \frac{y}{2}\right) Cu$$

The value of y is ..... . (Integer answer)

Answers

1. *(d)*	2. *(c)*	3. *(a)*	4. *(c)*	5. *(a)*	6. *(b)*	7. *(b)*	8. *(c)*	9. *(c)*	10. *(d)*
11. *(a)*	12. *(b)*	13. *(b)*	14. *(a)*	15. *(d)*	16. *(b)*	17. *(d)*	18. *(b)*	19. *(a)*	20. *(d)*
21. *(128)*	22. *(13)*	23. *(0)*	24. *(1)*	25. *(6)*	26. *(6021)*	27. *(47)*	28. *(13)*	29. *(0)*	30. *(7)*

1 SEPTEMBER SHIFT II

Section A : Objective Type Questions

1. Water sample is called cleanest on the basis of which one of the BOD values given below

a. 11 ppm **b.** 15 ppm **c.** 3 ppm **d.** 21 ppm

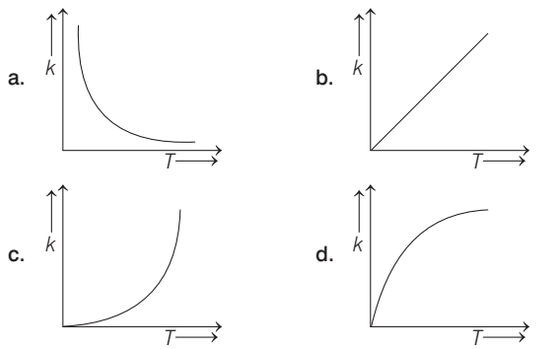
2. Calamine and malachite, respectively, are the ores of

a. nickel and aluminium **b.** zinc and copper
c. copper and iron **d.** aluminium and zinc

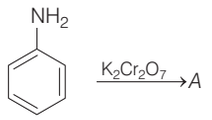
3. Experimentally reducing a functional group cannot be done by which one of the following reagents ?

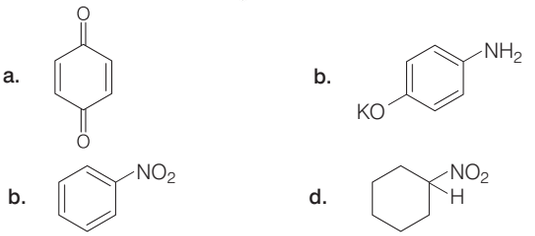
a. Pt-C/H_2 **b.** Na / H_2 **c.** Pd-C/H_2 **d.** Zn / H_2O

4. Which one of the following given graphs represents the variation of rate constant (k) with temperature (T) for an endothermic reaction?



5. Identify A in the following reaction.





6 In the following sequence of reactions a compound A, (molecular formula $C_6H_{12}O_2$) with a straight chain structure gives a C_4 carboxylic acid. A is

$$A \xrightarrow[H_3O^+]{LiAlH_4} B \xrightarrow{\text{Oxidation}} C_4 \text{ carboxylic acid}$$

a. $CH_3—CH_2—COO—CH_2—CH_2—CH_3$

b. $CH_3—CH_2—C(OH)H—CH_2—O—CH=CH_2$

c. $CH_3—CH_2—CH_2—COO—CH_2—CH_3$

d. $CH_3—CH_2—CH_2—O—CH=CH—CH_2—OH$

7. Match List-I with List-II.

	List-I (Colloid preparation method)		**List-II** (Chemical reaction)
A.	Hydrolysis	1.	$2AuCl_3 + 3HCHO + 3H_2O \rightarrow 2Au(sol) + 3HCOOH + 6HCl$
B.	Reduction	2.	$As_2O_3 + 3H_2S \rightarrow As_2S_3\,(sol) + 3H_2O$
C.	Oxidation	3.	$SO_2 + 2H_2S \rightarrow 3S\,(sol) + 2H_2O$
D.	Double Decomposition	4.	$FeCl_3 + 3H_2O \rightarrow Fe(OH)_3\,(sol) + 3HCl$

Choose the most appropriate answer from the options given below.

	A	B	C	D
a.	1	3	2	4
b.	4	1	3	2
c.	4	2	3	1
d.	1	2	4	3

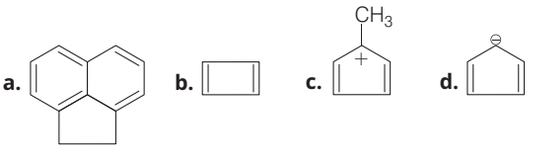
8. The crystal field stabilisation energy (CFSE) and magnetic moment (spin-only) of an octahedral aqua complex of a metal ion (M^+) are $-0.8\,\Delta_o$ and 3.87 BM, respectively. Identify (M^{2+}).

a. V^{3+} **b.** Cr^{3+} **c.** Mn^{4+} **d.** Co^{2+}

9. Monomer units of dacron polymer are

a. ethylene glycol and phthalic acid
b. ethylene glycol and terephthalic acid
c. glycerol and terephthalic acid
d. glycerol and phthalic acid

10. Which one of the following compounds is aromatic in nature ?



11. In the given chemical reaction, colours of the Fe^{2+} and Fe^{3+} ions, are respectively

$$5Fe^{2+} + MnO_4^- + 8H^+ \longrightarrow Mn^{2+} + 4H_2O + 5Fe^{3+}$$

a. yellow, orange **b.** yellow, green
c. green, orange **d.** green, yellow

12. The stereoisomers that are formed by electrophilic addition of bromine to *trans*-but-2-ene is/are

a. 2 enantiomers and 2 mesomers
b. 2 identical mesomers
c. 2 enantiomers
d. 1 racemic and 2 enantiomers

13. Hydrogen peroxide reacts with iodine in basic medium to give

a. IO_4^- **b.** IO^- **c.** I^- **d.** IO_3^-

14. In the following sequence of reactions,

$$C_3H_6 \xrightarrow{H^+/H_2O} A \xrightarrow[\text{dil. KOH}]{KIO} B + C$$

The compounds *B* and *C* respectively are

a. Cl_3COOK, HCOOH **b.** Cl_3COOK, CH_3I

c. CH_3I,HCOOK **d.** CHI_3, CH_3COOK

15. Given below are two statements.

Statement I The nucleophilic addition of sodium hydrogen sulphite to an aldehyde or a ketone involves proton transfer to form a stable ion.

Statement II The nucleophilic addition of hydrogen cyanide to an aldehyde or a ketone yields amine as final product.

In the light of the above statements, choose the most appropriate answer from the options given below.

a. Both statement I and statement II are true.

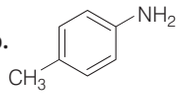
b. Statement I is false but statement II is true.

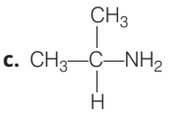
c. Statement I is true but statement II is false.

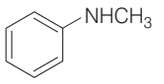
d. Both statement I and statement II are false.

16. Which one of the following gives the most stable diazonium salt ?

a. $CH_3—CH_2—CH_2—NH_2$

b. 

c. 

d. 

17. The potassium ferrocyanide solution gives a prussian blue colour, when added to

a. $CoCl_3$ **b.** $FeCl_2$ **c.** $CoCl_2$ **d.** $FeCl_3$

18. The oxide without nitrogen-nitrogen bond is

a. N_2O **b.** N_2O_4 **c.** N_2O_3 **d.** N_2O_5

19. Number of paramagnetic oxides among the following given oxides is Li_2O, Na_2O_2, KO_2, HgO and K_2O

a. 1 **b.** 2 **c.** 3 **d.** 0

20. Identify the element for which electronic configuration in +3 oxidation state is [Ar] $3d^5$.

a. Ru **b.** Mn **c.** Co **d.** Fe

Section B : Numerical Type Questions

21. An empty LPG cylinder weight 14.8 kg. When full, it weight 29.0 kg and shows a pressure of 3.47 atm. In the course of use at ambient temperature, the mass of the cylinder is reduced to 23.0 kg. The final pressure inside of the cylinder is ..... atm. (Nearest integer)
(Assume LPG of be an ideal gas)

22. The molar solubility of $Zn(OH)_2$ in 0.1 M NaOH solution is $x \times 10^{-18}$ M. The value of *x* is ..... (Nearest integer)
(Given; The solubility product of $Zn(OH)_2$ is 2×10^{-20}).

23. For the reaction, $2NO_2(g) \rightleftharpoons N_2O_4(g)$, when $\Delta S = -176.0\ JK^{-1}$ and $\Delta H = -57.8$ kJ mol^{-1}, the magnitude of ΔG at 298 K for the reaction is ..... kJ mol^{-1}. (Nearest integer)

24. The sum of oxidation states of two silver ions in $[Ag(NH_3)_2]$ $[Ag(CN)_2]$ complex is ..... .

25. The number of atoms in 8 g of sodium is $x \times 10^{23}$. The value of *x* is ..... . (Nearest integer)
[Given : $N_A = 6.02 \times 10^{23}$ mol^{-1}, Atomic mass of Na = 23.0 u]

26. If 80 g of copper sulphate $CuSO_4 \cdot 5H_2O$. is dissolved in deionised water to make 5 L of solution. The concentration of the copper sulphate solution is $x \times 10^{-3}$ mol L^{-1}. The value of *x* is ..... .
[Atomic masses Cu = 63.54 u, S = 32 u, O = 16 u, H = 1 u]

27. A 50 watt bulb emits monochromatic red light of wavelength of 795 nm. The number of photons emitted per second by the bulb is $x \times 10^{20}$. The value of *x* is ..... .
[Given, $h = 6.63 \times 10^{-34}$ Js and $c = 3.0 \times 10^8$ ms^{-1}]

28. The spin-only magnetic moment value of B_2^+ species is ..... $\times 10^{-2}$ BM. (Nearest integer)
[Given, $\sqrt{3} = 1.73$]

29. If the conductivity of mercury at 0°C is 1.07×10^6 S m^{-1} and the resistance of a cell containing mercury is 0.243 Ω, then the cell constant of the cell is $x \times 10^4$ m^{-1}. The value of *x* is ..... . (Nearest integer)

30. A peptide synthesised by the reactions of one molecule each of glycine, leucine, aspartic acid and histidine will have ..... peptide linkages.

Answers

1. *(c)*	2. *(b)*	3. *(b)*	4. *(c)*	5. *(a)*	6. *(c)*	7. *(b)*	8. *(d)*	9. *(b)*	10. *(a,d)*
11. *(d)*	12. *(b)*	13. *(c)*	14. *(d)*	15. *(c)*	16. *(b)*	17. *(d)*	18. *(d)*	19. *(a)*	20. *(d)*
21. *(2)*	22. *(2)*	23. *(5)*	24. *(2)*	25. *(2)*	26. *(64)*	27. *(2)*	28. *(173)*	29. *(26)*	30. *(3)*