Previous Years Paper

15th June 2023 (Shift 1)

Q1. Second most abundant element in alloy misch metal is:
(a) Fe
(b) Ce
(c) Al
(d) S

Q2. The correct increasing order of basic strength of amine is:
(A) $C_6H_5NH_2 < NH_3 < C_6H_5CH_2NH_2 < C_2H_5NH_2 < (C_2H_5)_2NH$
(B) $NH_3 < C_6H_5NH_2 < C_6H_5CH_2NH_2 < C_2H_5NH_2 < (C_2H_5)_2NH$
(C) $C_6H_5CH_2NH_2 < C_6H_5NH_2 < NH_3 < C_2H_5NH_2 < (C_2H_5)_2NH$
(D) $C_2H_5NH_2 < (C_2H_5)_2NH < C_6H_5NH_2 < NH_3$

Choose the **correct** answer from the options given below:
(a) (A) only
(b) (A) and (C) only
(c) (A) and (B) only
(d) (D) only

Q3. Match **List-I** with **List-II**:

List-I		List-II	
(A)	Diamagnetic solid	(I)	CrO_2
(B)	Ferromagnetic solid	(II)	$Fe3O_4$
(C)	Antiferomagnetic solid	(III)	NaCl
(D)	Ferrimagnetic solid	(IV)	MnO

Choose the **correct** answer from the options given below:
(a) (A)-(II), (B)-(IV), (C)-(I), (D)-(III)
(b) (A)-(III), (B)-(I), (C)-(IV), (D)-(II)
(c) (A)-(I), (B)-(III), (C)-(II), (D)-(IV)
(d) (A)-(IV), (B)-(II), (C)-(I), (D)-(III)

Q4. A reaction takes 30 minutes to complete 50% of the reaction and takes 45 minutes to complete 75% of the reaction. The order of the reaction is:
(a) First
(b) Second
(c) Third
(d) Zero

Q5. Which of the following haloalkanes reacts with aqueous KOH most easily?
(a) 1 - Bromobutane
(b) 2- Bromobutane
(c) 2-Bromo-2-methyl propane
(d) 2-Chlorobutane

Q6. When dilute aqueous solution of KI (excess) is added to $AgN0_3$ solution, the charge on the AgI colloidal, particles formed will be:
(a) Positive
(b) Negative
(c) Neutral
(d) Both positive and negative

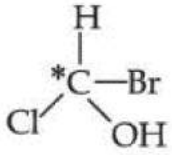
Q7. $[NiCl_2(PPh_3)_2]$ is named as:
(a) Dichloridobis (triphenyl phosphine) nickel (II)
(b) Nickel chlorido bis (triphenyl phosphine)
(c) Diphenyl phosphine Nickel (II) chloride
(d) Dichlorobis (Diphenyl phosphine) Nickel (Il)

Q8. Identify transition metal complexes which are not octahedral in shape.
(A) $[Co(NH_3)_6]^{3+}$
(B) $[Ni(CO)_4]$
(C) $[CoCl(NH_3)_5]^{2+}$
(D) $[CoCl_2(NH_3)_4]^{+}$
(E) $[PtCl_4]^{2-}$

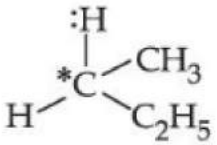
Choose the **correct** answer from the options given below:
(a) (A) and (B) only
(b) (B) and (E) only
(c) (C) and (D) only
(d) (D) and (E) only

Q9. E_{cell} for the given cell
[Given $E^{\circ}_{Br_2/Br^-} = +1.09\ V, E^{\circ}_{Cl_2/Cl^-} = +1.36\ V$] at 298 K is
(a) 0.1518 V
(b) 0.3291 V
(c) 0.3882 V
(d) 0.2109 V

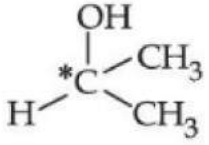
Q10. In which of the following molecules carbon atom marked with asterix (*) is a stereocentre or Chiral centre?
(a)



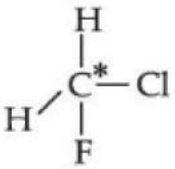
(b)



(c)



(d)



Q11. Match **List-I** with **List-II**:

List-I		List-II	
(A)	Urease	(I)	Maltose
(B)	Maltase	(II)	Glucose and fructose
(C)	Invertase	(III)	NH_3 and CO_2
(D)	Diastase	(IV)	Glucose

Choose the **correct** answer from the options given below:
(a) (A)-(III), (B)-(IV), (C)-(II), (D)-(I)
(b) (A)-(I), (B)-(IV), (C)-(II), (D)-(I II)
(c) (A)-(III), (B)-(II), (C)-(I), (D)-(IV)
(d) (A)-(III), (B)-(I), (C)-(IV), (D)-(II)

Q12. Match **List-I** with **List-II**:

List-I		List-II	
(A)	Gel	(I)	Hair cream
(B)	Foam	(II)	Dust
(C)	Emulsion	(III)	Cheese
(D)	Aerosol	(IV)	Whipped cream

Choose the **correct** answer from the options given below:
(a) (A)-(I), (B)-(IV), (C)-(III), (D)-(II)
(b) (A)-(IV), (B)-(I), (C)-(III), (D)-(II)
(c) (A)-(I), (B)-(II), (C)-(III), (D)-(IV)
(d) (A)-(III), (B)-(IV), (C)-(I), (D)-(II)

Q13. Match the ores in **List-I** with their chemical composition in **List-II**:

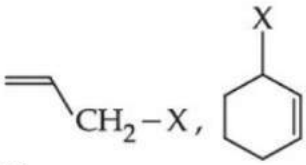
List-I		List-II	
(A)	Kaolinite	(I)	$FeCO_3$
(B)	Siderite	(II)	$ZnCO_3$
(C)	Malachite	(III)	$[Al_2(OH)4Si_2O_5]$
(D)	Colamine	(IV)	$CuCO_3.Cu(OH)_2$

Choose the **correct** answer from the options given below:
(a) (A)-(IV), (B)-(III), (C)-(II), (D)-(I)
(b) (A)-(II), (B)-(III), (C)-(IV), (D)-(I)
(c) (A)-(III), (B)-(I), (C)-(IV), (D)-(II)
(d) (A)-(III), (B)-(II), (C)-(IV), (D)-(I)

Q14. Rate of a reaction changes from 2.48×10^{-3} mol^{-1} sec^{-1} to $4.96 \times 10^{-3} mol^{-1}$ sec^{-1} when concentration of reactant, is changed from 0.6 M to 2.4 M respectively, the order of reaction is:
(a) 2
(b) zero
(c) 0.5
(d) 3

Q15. Ferric oxide in blast furnace's upper half is mainly reduced by:
(a) CO
(b) C
(c) CO_2
(d) H_2

Q16.



These structures represent which particular kind of halides:
(a) Alkyl halides
(b) Benzylic halides
(c) Vinyl halide
(d) Allylic halides

Q17. Which of the following compound will not undergo Azo coupling reaction?
(a) Aniline
(b) Phenol
(c) Anisole
(d) Nitrobenzene

Q18. Degree of dissociation, when molar conductivity of X at its concentration C is 24.14 and its limiting molar conductivity is 48.28 will be:
(a) 0.3
(b) 0.5
(c) 0.6
(d) 0.9

Q19. Phenol is brominated in solvent CS_2 at low temperature. The product formed are:
(a) Monobromophenols
(b) Dibromophenols
(c) Tribromophenols
(d) Tribromobenzene

Q20. Osmotic pressure of solution formed by mixing 50 ml of 0.2 M urea and 50 ml of 0.4 m glucose aqueous solution at 298 K will be : (R = 0.083 L atm K^{-1} mol^{-1})
(a) 14.84 atm
(b) 7.42 atm
(c) 11.13 atm
(d) 3.71 atm

Q21. Decreasing order of freezing point of 0.1 M aqueous solution of following will be:
(A) $K_4[Fe(CN)_6]$
(B) K_2SO_4
(C) NH_2CONH_2
(D) $AlCl_3$
(E) HCl

Choose the **correct** answer from the options given below:
(a) (A) > (D) > (B) > (E) > (C)
(b) (A) > (D) > (B) > (C) > (E)
(c) (C) > (E) > (B) > (D) > (A)
(d) (E) > (C) > (B) > (D) > (A)

Q22. When blood cells are placed in 1% (w/v) NaCl aquem solution:
(a) Cell will burst
(b) Cell will shrink
(c) Cell will swell

(d) Cell remains as such

Q23. A divalent ion of 'V' (Atomic no. - 23) in aqueous solution is:
(a) $\sqrt{24}$ BM
(b) $\sqrt{15}$ BM
(c) $\sqrt{12}$ BM
(d) $\sqrt{3}$ BM

Q24. Which of the following is incorrect?
(a)

$$CH_3-CH_2-OH \xrightarrow[Con/443\ K]{H_2SO_4} CH_2=CH_2+H_2O$$

(b)

$$CH_2-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}-OH \xrightarrow[573]{Cu} \underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\diagup}}C=O+CH_4$$

(c)

$$CH_3-\underset{\displaystyle OH}{\overset{\displaystyle |}{CH}}-CH_3 \xrightarrow[H_3PO_4]{85\%} CH_3-CH=CH_2+H_2O$$

(d)

$$CH_3-CH_2-OH \xrightarrow[573\ K]{Cu} CH_3CHO+H_2$$

Q25. What is the packing efficiency of simple cubic lattice?
(a) 69%
(b) 74%
(c) 52.4%
(d) 80.2%

Q26. Phenol is manufactured from hydrocarbon, Cumene. Cumene is chemically:
(a) tert. butyl benzene
(b) Isopropyl benzene
(c) Acetone
(d) isopropyl alcohol

Q27. Increasing order of oxidation states of transition metal oxides will be:
(A) TiO_2
(B) MnO_4^-
(C) VO_2^+
(D) CrO_4^{2-}
(E) Ni $(CO)_4$

Choose the **correct** answer from the options given below:
(a) (B) < (D) < (C) < (A) < (E)
(b) (E) < (C) < (A) < (D) < (B)
(c) (E) < (A) < (C) < (D) < (B)
(d) (B) < (A) < (C) < (D) < (E)

Q28. Match **List-I** with **List-II**:

	List-I		List-II
(A)	Buna-S	(I)	Vinyl chloride
(B)	Neoprene	(II)	1,3-Butadiene and styrene
(C)	PVC	(III)	Tetra flouroethene
(D)	Teflon	(IV)	Chloroprene

Choose the **correct** answer from the options given below:
(a) (A)-(II), (B)-(IV), (C)-(III), (D)-(I)
(b) (A)-(II), (B)-(IV), (C)-(I), (D)-(III)
(c) (A)-(II), (B)-(I), (C)-(IV), (D)-(III)
(d) (A)-(II), (B)-(I), (C)-(III), (D)-(IV)

Q29. Inner orbital complex among the following is:
(A) $[Co(NH3)_6]^{3+}$
(B) $[COF_6]^{3-}$
(D) $[MnC1_6]^{3-}$
(E) $[FeF_6]^{3-}$

Choose the **correct** answer from the options given below:
(a) (A) and (C) only
(b) (D) and (E) only
(c) (B) and (C) only
(d) (C) and (D) only

Q30. The presence or absence of hydroxyl group on which carbon atom of sugar differentiate RNA and DNA:
(a) 2^{nd}
(b) 4^{th}
(c) 3^{rd}
(d) 1^{st}

Q31. Coagulating power of an ion for a colloidal solution depends on:
(a) Its magnitude of charge only
(b) Its size only
(c) Its tendency to hydrate
(d) Its size and magnitude of charge both

Q32. Which of the following statements are correct?
(A) Glucocorticoids control the carbohydrate metabolism
(B) Testosterone is major female sex hormone
(C) Insulin is released in response to increase in blood sugar
(D) Hypothyroidism is caused by low level of thyroxine
(E) Mineralocorticoid is major male sex hormone

Choose the **correct** answer from the options given below:
(a) (A), (B), (C) and (D) only
(b) (A), (C), (D) and (E) only
(c) (A), (C) and (D) only
(d) (C), (D) and (E) only

Q33. Which of the following sols are correctly matched with their corresponding charges?
(A) $Cr(OH)_3$ sol : negatively changed sol
(B) TiO_2 sol : positively charged sol
(C) CdS sol : positively charged sol
(D) Gum : negatively charged sol
(E) Silver sol : positively charged sol

Choose the **correct** answer from the options given below:
(a) (C) and (E) only
(b) (A) and (C) only
(c) (B) and (E) only
(d) (B) and (D) only

Q34. Match **List-I** with **List-II**:

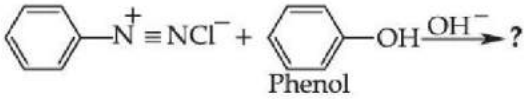
List-I	List-II

(A)	Antifreeze used in car engine	(I)	Phenol
(B)	Starting material for picric acid	(II)	Glycerol
(C)	Wood spirit	(III)	Ethylene glycol
(D)	By product of soap industry used in cosmetics	(IV)	Methanol

Choose the **correct** answer from the options given below:
(a) (A)-(IV), (B)-(I), (C)-(III), (D)-(II)
(b) (A)-(I), (B)-(II), (C)-(III), (D)-(IV)
(c) (A)-(III), (B)-(I), (C)-(II), (D)-(IV)
(d) (A)-(III), (B)-(I), (C)-(IV), (D)-(II)

Q35. $t_{99.9\%}$ with respect to $t_{90\%}$ for a first order reaction is:
(a) Two
(b) One
(c) Three
(d) Four

Q36. Predict the major product in the following reaction



(a) p-Aminoazobeneze
(b) p-Hydroxyozobenzene
(c) Sulphanilic acid
(d) Phenol

Q37. Which of the following are fat soluble vitamins:
(A) vit A
(B) vit B
(C) vit D
(D) vit E
(E) vit K

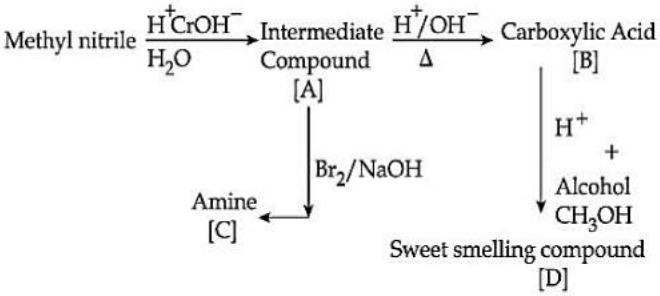
Choose the **correct** answer from the options given below:
(a) (A), (B), (D) and (E) only
(b) (A), (B), (C) and (D) only
(c) (A), (C), (D) and (E) only
(d) (B), (C), (D) and (E) only

Q38. In a reaction:
$MnO_4^- + 8H^+ + 5e \rightarrow$ ____A____ $+ H_2O$
A stands for:
(a) Mn^{3+}
(b) Mn^{4+}
(c) Mn^{2+}
(d) Mn^{+}

Q39. If we use molten NaCl, the products of electrolysis are _____.
(a) H_2 gas and Cl_2 gas
(b) NaOH and Cl_2 gas
(c) H2O and Cl_2 gas
(d) Sodium metal and Cl_2 gas

Q40. Which statement is not true for a detergent molecule?
(a) It is not biodegradable
(b) It is a surface active agent
(c) It has a non-polar organic part and a polar non organic part
(d) It is sodium salt of fatty acid

Direction for the question 41 to 45: Question is based on following passage:
Methyl nitrile is hydrolysed to carboxylic acid in the presence of H^+ or OH^- as catalyst. An intermediate compound [A] is formed during this reaction.



Q41. The intermediate compound [Al is:
(a) Methyl isocyanide
(b) Ethyl amine
(c) Ethan amide
(d) Methanamide

Q42. Converting [A] into [C] is called:
(a) Ammonolysis
(b) Hoffmann Degradation Reaction
(c) Carbylamine reaction
(d) Gabriel phthalamide reaction

Q43. The sweet smelling compound [D] is:
(a) Acid anhydride
(b) Acyl halide
(c) Aldehyde
(d) Ester

Q44. What is not true regarding compound [B]?
(A) They are higher boiling liquids than aldehydes and ketones due to extensive H Bonding
(B) They are soluble in Benzene
(C) They produce alkane when heated with soda lime
(D) Produces CO_2 when treated with $NaHCO_3$

Choose the **correct** answer from the options given below:
(a) (A) and (B) only
(b) (A) and (C) only
(c) (B) only
(d) (A) only

Q45. Which of the following is the correct statement for hybridization of C-atom and number of and Π bonds in the Carbonyl group?
(a) Sp^2, 3σ, 1 π
(b) Sp, 3σ, 1 π
(c) Sp^3, 3σ, 1 π
(d) Sp^2, 2σ, 2 π

Direction for the question 46 to 50: **Question is based on following passage:**
p-block elements are placed in groups 13 to 18 of the periodic table. Group 15 is nitrogen family. Nitrogen makes various compounds like NH_3, HNO_3, N_2O, NO_2 etc. Phosphorus exists in the form of white and red phosphorus. White phosphorus glows in dark. PH_3 gas is used as smoke screen. Group 16 is called oxygen family. Dry air contains 21% O_2 gas by volume. Combined sulphur exists as

sulphates such as gypsum, epsome salt, baryte etc. The allotropic forms of sulphur are Rhombic and monoclinic sulphur. S_2 is paramagnetic like O_2 and it stable at high temperature. Group 17 is Halogen family. F_2 is highly reactive, Cl_2 is greenish yellow gas. Both SO_2 and Cl_2 are used for bleaching. Group 18 is Noble gas family but some noble gases also form compounds. Complete hydrolysis of XeF_6 gives HF and XeO_3 as main products.

Q46. Match **List-I** with **List-II**:

List-I		**List-II**	
(A)	Ammonia	(I)	Rotten fish small
(B)	Nitric Acid	(II)	Detection of metal ions
(C)	Phosphene	(III)	Chemiluminescence
(D)	White Phosphorus	(IV)	Ostwald Process

Choose the **correct** answer from the options given below:
(a) (A)-(II), (B)-(IV), (C)-(I), (D)-(III)
(b) (A)-(IV), (B)-(II), (C)-(I), (D)-(III)
(c) (A)-(I), (B)-(IV), (C)-(III), (D)-(II)
(d) (A)-(I), (B)-(II), (C)-(IV), (D)-(III)

Q47. Sulphate of magnesium of the following is:
(a) Gypsum
(b) Epsom salt
(c) Baryte
(d) Galena

Q48. At elevated temperature (~1000 K) the dominant form of sulphur is:
(a) Rhombic Sulphur
(b) Monoclinic Sulphur
(c) S_8 molecules
(d) S_2

Q49. The permanent bleaching effect is caused by:
(a) Chlorine gas
(b) SO_2 gas
(c) Aqua Regia
(d) $COCl_2$

Q50. The product of complete hydrolysis of XeF_6 in the following reaction is
$XeF_6 + H_2O \rightarrow ?\ HF$
(a) $XeOF_4$
(b) XeO_2F_2
(c) xeO_3
(d) Xe

SOLUTIONS

S1. Ans. (a)

Sol. Misch metal contains Lanthanide metals (94-95)% + Iron (5)% + Traces of S, C, Si, Ca and Al. The maximum amount of Mischmetal is used to make Magnesium based alloy called pyrophoric alloy.

S2. Ans. (a)

Sol. Considering the inductive effect of alkyl groups, NH_3, $C_2H_5NH_2$, and $(C_2H_5)_2NH$ can be arranged in the increasing order of their basic strengths as:

$NH_3 < C_2H_5NH_2 < (C_2H_5)_2NH$

Again, C6H5NH2 has proton acceptability less than NH_3. Thus, we have:

$C_6H_5NH_2 < NH_3 < C_2H_5NH_2 < (C_2H_5)_2NH$

Due to the −I effect of C_6H_5 group, the electron density on the N-atom in $C_6H_5CH_2NH_2$ is lower than that on the N-atom in $C_2H_5NH_2$, but more than that in NH_3. Therefore, the given compounds can be arranged in the order of their basic strengths as:

$C_6H_5NH_2 < NH_3 < C_6H_5CH_2NH_2 < C_2H_5NH_2 < (C_2H_5)_2NH$

S3. Ans. (b)

Sol. CrO_2 is a ferromagnetic substance, which is attracted very strongly by a magnetic field.

MnO is an antiferromagnetic substance as its domains cancel out each other's magnetic moment.

Fe_3O_4 (magnetite) is a ferrimagnetic substance because in it the magnetic moments of the domains are aligned in parallel and anti-parallel direction in unequal number.

Na^+ has electronic configuration [Ne]

Cl^- has electronic configuration [Ar]

Thus, both cation and anion have an inert gas electronic configuration in which all the electrons are paired.

S4. Ans. (a)

Sol. For first order reaction, $t = 2.303/k \log [A_0]/[A]$

For 50% completion, $t = t_{1/2}$, $A_0 = 1$, $A = ½$

$t_{1/2} = 2.303/k \log(2/1)$

$t_{1/2} = 2.303/k \log 2$.(1)

for 75% completion, $t = t_{3/4}(75/100 = ¾)$

$A_0 = 1$, $A = 1-3/4 = ¼$

$t_{3/2} = 2.303/k \log (4)$

$t_{3/4} = 2(2.303/k \log 2)$ ..(2)

$t_{3/4} = 2t_{1/2}$

the above reaction holds true for 1st order reaction

S5. Ans. (c)

Sol. The tertiary carbocation formed in the reaction is stable in 2-Bromo-2-methylpropane. So these haloalkanes react with aqueous KOH most easily.

S6. Ans. (a)

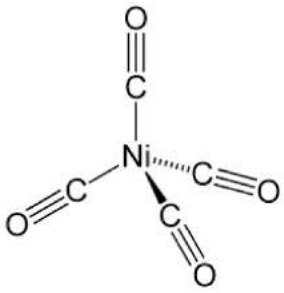
Sol. When KI is added in excess of $AgNO_3$, a positively charged sol of silver iodide is formed due to adsorption of Ag^+ from dispersion medium on the precipitate of silver iodide.

S7. Ans. (a)

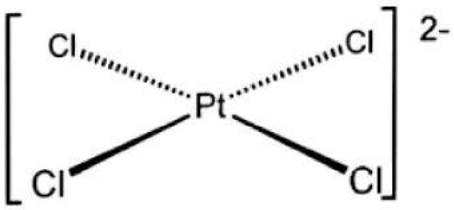
Sol. The IUPAC name of $[Ni(PPh_3)_2Cl_2]^{2+}$ is dichlorobis(triphenylphosphine)nickel(II) ion

S8. Ans. (b)

Sol. [B] In $Ni(CO)_4$, Ni is sp^3 hybridised and its geometry is tetrahedral



[E] $[PtCl_4]^{2-}$ has square planar



S9. Ans. (d)

Sol. The net reaction is: $Cl_2 + 2Br^- \rightarrow 2Cl^- + Br_2$

$E^0_{cell} = E^0_{cathode} - E^0_{anode} = 1.36 - 1.09 = 0.27$

$E = E^0 - 0.0591/n \log[\text{Product/Reactant}]$

S10. Ans. (a)

Sol. Asymmetric carbon is a sp^3 hybridised carbon which is attached to four different substituents. This is also called as the chiral centre. So by this definition, (I) is chiral centres.

S11. Ans. (a)

Sol. [A] Urease (urea amidohydrolase EC 3.5. 15) catalyzes the hydrolysis of urea to ammonia and carbon dioxide

[B] The maltase and diastase enzymes are used to convert maltose into glucose.

[C] Invertase (EC 3.2. 7.26) is an enzyme that catalyzes the hydrolysis reaction of sucrose to form glucose and fructose

[D] Diastase enzymes are used to convert maltose into glucose.

S12. Ans. (d)

Sol. [A] Some of the examples of gels are curd, cheese, butter, etc.

[B] Examples of foams formed by gases in liquids include whipped cream, fire retardant foam, and soap bubbles.

[C] In hair cream, both the dispersion medium and dispersed phase are liquids, hence it is an example of emulsion.

[D] Aerosols can be natural or artificial. Examples of natural aerosols are fog, forest exudates and geyser steam. Examples of artificial aerosols are haze, dust, particulate air pollutants and smoke.

S13. Ans. (c)

Sol. [A] The chemical formula for kaolinite as used in mineralogy is $Al_2Si_2O_5(OH)_4$

[B] Siderite is a mineral composed of iron(II) carbonate ($FeCO_3$)

[C] Malachite is another copper carbonate hydroxide mineral with chemical formula $[Cu_2CO_3(OH)_2]$ formed by the weathering of copper ore bodies in the vicinity.

[D] $ZnCO_3$ is the chemical formula of calamine.

S14. Ans. (c)

Sol. 0.5

S15. Ans. (a)

Sol. CO is the main reducing agent in the furnace. Iron oxide is reduced to iron by CO.

In a blast furnace, a substance called coke (mainly C) reacts with oxygen, O2, to form carbon monoxide, CO. The carbon monoxide (a strong reducing agent) then reacts with iron oxide (in the form of hematite or magnetite) to form pig iron (mainly Fe) and carbon dioxide.

S16. Ans. (d)

Sol. The compounds with halogen atoms bonded to sp^3-hybridised carbon to carbon-carbon double bond (C=C) i.e. to an allylic carbon.

S17. Ans. (d)

Sol. Diazonium cation is a weak electrophile and hence it reacts with electron-rich compounds containing electron-donating groups such as –OH, $-NH_2$ and OCH_3 groups and not with compounds containing electron-withdrawing groups such as $-NO_2$, etc.

S18. Ans. (b)

Sol. α= molar conductivity/limiting molar conductivity

$\alpha = 24.1/48.28 = 0.5$

S19. Ans. (b)

Sol. Phenol reacts with bromine in CS_2 at low temperature to give o and p-bromophenol.

S20. Ans. (b)

Sol. The molar mass of glucose and urea are 60 g/mol and 180 g/mol respectively.

The number of moles of urea = 50 x 0.2/100 x 60 = 0.002

The number of moles of glucose = 50 x 0.4/100 x 180 = 0.001

Total molar concentration = 0.0016 + 0.001/50 mL + 50 mL x 1000 mL/1L

= 0.03 M

The osmotic pressure is Π=CRT

= 0.03 x 0.083 x 298 = 0.742

S21. Ans. (a)

Sol. All are in aqueous solution.

Concentration is same for all i.e., 0.1

So their freezing point will depend on von't hoff factor.

(A) $K_4[Fe(CN)_6]$ (i = 5)

(B) K_2SO_4 (i = 3)

(C) NH_2CONH_2 (i = 1)

(D) $AlCl_3$ (i = 4)

(E) HCl – i = 2

S22. Ans. (b)

Sol. A 1% NaCl solution is a hypertonic solution that causes RBC cells to shrink.

S23. Ans. (b)

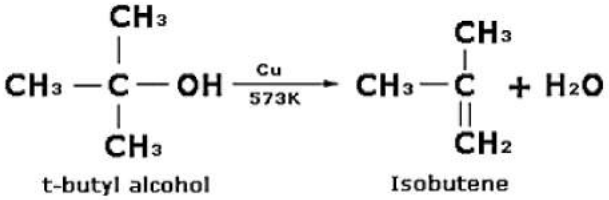
Sol. The atomic number is 23. The metal is vanadium with valence shell , V: $[Ar]4s^23d^3$.

The divalent ion V2+ has valence shell electronic configuration 3d3. It contains five unpaired electrons. n=3

It's spin only magnetic moment is $\sqrt{n(n+2)}$ = $\sqrt{3(3+2)} = \sqrt{15}$

S24. Ans. (b)

Sol.



t-butyl alcohol Isobutene

S25. Ans. (c)

Sol. The packing efficiencies of simple cubic and body-centered cubic lattices are 52.4% and 68% respectively.

S26. Ans. (b)

Sol. Cumene is isopropyl benzene. Cumene in presence of sodium carbonate is oxidised by passing air or oxygen. The catalyst is cobalt naphthenate.

S27. Ans.(c)

Sol. [A] The oxidation state of titanium in titanium dioxide is commonly assumed to be +4.

[B] MnO_4^- = x + 4(-2) = -1 = 7

[C] VO_2^+ = x + 2(-2) = 1 = 5

[D] CrO_4^{2-} = x + 4(-2) = - 2 => 6

[E] The oxidation number of Ni in $Ni(CO)_4$ is +2.

S28. Ans. (b)

Sol. [A] Monomers of BUNA-S: 1,3–butadiene and styrene

[B] We can write its structure as $-(CH_2-C(Cl)=CH-CH_2)_n-$

From the structure of Neoprene, we can understand that the polymer is formed from polymerization of Chloroprene, which is a chlorine-substituted diene molecule. Neoprene is also known as poly chloroprene.

[C] PVC is produced from its monomer, vinyl chloride.

[D] The monomer unit of Teflon is Tetrafluoro ethylene ($F_2C=CF_2$).

S29. Ans.(a)

Sol. [A] In the presence of NH_3 the 3d electrons pair up leaving two d-orbitals empty to be involved in d^2sp^3 hybridisation forming inner orbital complex in case of $[Co(NH_3)_6]^{3+}$

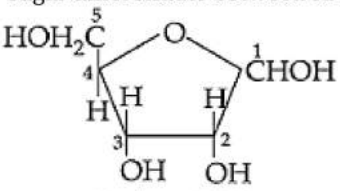
[C] In the complex $[Ni(CN)_4]^{2-}$, the central Ni metal has +2 oxidation state with outer electronic configuration $3d^8$. One 3d, one 4s and two 4p orbitals undergo dsp^2 hybridisation. Since, inner d orbital is used in the hybridsation, the complex

is inner orbital or low spin or spin paired complex.

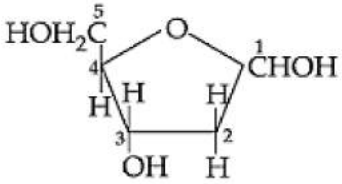
S30. Ans. (a)

Sol. RNA has a hydroxy group on the second carbon which is not present in DNA.

Thus, hydroxy group on a second carbon atom of the sugar differentiate between RNA and DNA.



D-ribose (RNA)



D-2-deoxyribose (DNA)

S31. Ans. (d)

Sol. The coagulating power of an ion depends on both magnitude and sign of the charge on the ion. The ions of the opposite sign of the charge to those present on the surface of the particles cause the precipitation of the particles.

S32. Ans.(c)

Sol. [A] They are anti-inflammatory in all tissues, and control metabolism in muscle, fat, liver and bone. Glucocorticoids also affect vascular tone, and in the brain influence mood, behaviour and sleep–wakefulness cycles.

[C] After a meal, when exogenous blood glucose levels are high, insulin is released to trigger glucose uptake into insulin-dependent muscle and adipose tissues as well as to promote glycogenesis.

[D] Primary hypothyroidism is due to decreased secretion of T_4 and T_3 from the thyroid. Serum T_4 and T_3 levels are low, and thyroid-stimulating hormone (TSH) is increased.

Incorrect statements

[B] Oestrogen is considered to be the 'female' hormone, whereas testosterone is considered the 'male' hormone.

[E] Testosterone is a male sex hormone that is important for sexual and reproductive development.

S33. Ans. (d)

Sol. (a) **Negatively charged colloids** • Metal sulphides: As_2S_3, CdS

Metal dispersions: Ag, Au, Pt

Sulphur sol

Sols of starch, gums, gold, gelatin etc

Positively charged colloids

Metal hydroxides: $Al(OH)_3$, $Fe(OH)_3$

Metal oxide: TiO_2

Positively charged sols are: $Fe(OH)_3$, $Al(OH)_3$, methyleneblue, Haemoglobin, $Cr(OH)_3$

S34. Ans. (d)

Sol. [A] An alcohol used as antifreeze compound is ethylene glycol

[B] Phenol is used as starting material in the manufacture of nylon, plastics, aspirin, picric acid, and salicylic acid, etc.

[C] Methyl alcohol or Methanol is obtained by the process of destructive distillation of wood. It leads to the degradation of unprocessed materials by heating. Hence, Methanol is called as "Wood spirit".

[D] Soaps are sodium or potassium salt of fatty acids, made by hydrolysis of fats and oils with bases. This process yields soap as a product and glycerol as by-product.

S35. Ans. (c)

Sol. For first order reaction:

$kt = \ln [A_0]/[A_t]$

at $t = 0$ A_0

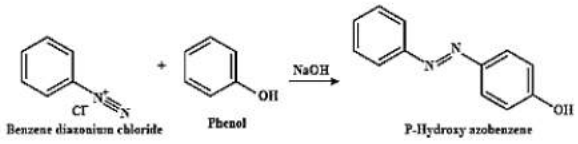
at $t = t_{0.999}$ $0.001A_0$

at $t = t_{0.90}$ $0.1\ A_0$

$t_{0.999}/t_{0.90} = \ln 10^3/\ln 10 = 3$

S36. Ans. (b)

Sol.



S37. Ans. (c)

Sol. Vitamins A, D, E, and K are called the fat-soluble vitamins, because they are soluble in organic solvents and are absorbed and transported in a manner similar to that of fats.

S38. Ans. (c)

Sol. $MnO_4^- + 8H^+ 5e^- \rightarrow Mn^{2+} + 4H_2O$,

S39. Ans. (d)

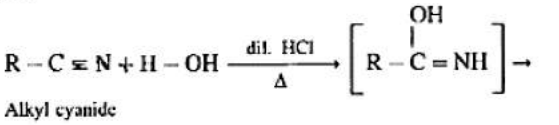
Sol. During electrolysis of molten NaCl, sodium metal is deposited at the cathode, whereas, chlorine is liberated at the anode.

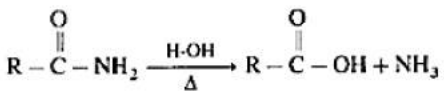
S40. Ans.(d)

Sol. Detergents are sodium salt of sulphonic acids.

S41. Ans. (c)

Sol.



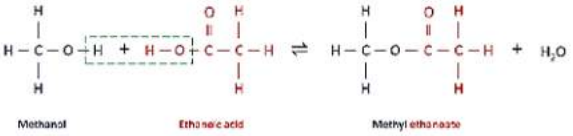


S42. Ans. (b)

Sol. Ethanamide is treated with bromine and boiled with NaOH produces methyl amine.
This is Hoffmann's bromamide reaction or Hoffmann's degradation reaction.

S43. Ans. (d)

Sol.

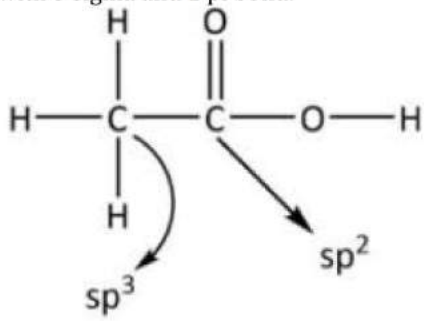


S44. Ans. (c)

Sol. Acetic acid is a polar molecule while benzene is a non-polar solvent. So, acetic acid cannot dissolve in benzene.

S45. Ans. (a)

Sol. The carbonyl carbon and oxygen are sp2-hybridized with 3 sigma and 1 pi bond.



S46. Ans. (a)

Sol. [A] Ammonia is used in the detection of Cu2+ ion
[B] The Ostwald process is a process used for manufacturing Nitric acid.
[C] Phosphine is a colourless gas with rotten fish smell and is highly poisonous.
[D] One of the oldest known chemiluminescent reactions is that of elemental white phosphorus oxidizing in moist air, producing a green glow.

S47. Ans. (b)

Sol. Epsom salt is also known as magnesium sulfate. It's a chemical compound made up of magnesium, sulfur, and oxygen.

S48. Ans. (d)

Sol. At elevated temperatures (~1000 K), S_2 is the dominant species and is paramagnetic like O_2.

S49. Ans. (a)

Sol. Chlorine's bleaching activity is permanent since it includes the oxidation process. Chlorine produces nascent oxygen when it combines with water. This oxygen reacts with the pigments in the substance, rendering it colourless. It has a strong oxidising effect.

S50. Ans. (c)

Sol. The complete hydrolysis of XeF_6 produces XeO_3 which is xenon trioxide.
XeF6 + 3H2O ⇒ XeO3 + 6HF