CHEMISTRY

1. How much water (in litre) is added to 1 litre of HCl solution of pH = 1 to make its pH = 2.

Ans. 9 litre

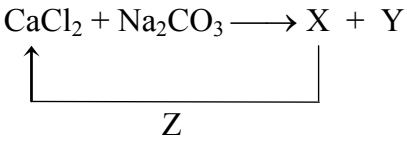
Sol. $M_1V_1 = M_2V_2$

$0.1 \times 1 = 0.01 \times V_2$

$V_2 = 10$ litre

Ans. $10 - 1 = 9$ litre

2. Consider the following reaction sequence



(A) X : $CaCO_3$, Y : NaCl, Z : HCl

(B) X : CaO, Y : NaCl + CO_2, Z : KCl

(C) X : CaO, Y : NaCl + CO_2, Z : NaCl

(D) X : $CaCO_3$, Y : NaCl, Z : KCl

Ans. **(A)**

Sol. $CaCl_2 + Na_2CO_3 \longrightarrow CaCO_3 + NaCl$

$CaCO_3 \xrightarrow{HCl} CaCl_2$

3.

Complex			**CFSE**
(P)	$[NiF_6]^{2-}$	(i)	$-2\Delta_0$
(Q)	$[Ti(H_2O)_6]^{3+}$	(ii)	$-2.4\Delta_0$
(R)	$[Fe(CN)_6]^{3-}$	(iii)	$-0.4\ \Delta_0$
(S)	$[Ni(NH_3)_6]^{2+}$	(iv)	$-1.2\ \Delta_0$

(1) P-(ii) ; Q-(iii) ; R-(i) ; S-(iv)

(2) P-(i) ; Q-(ii) ; R-(iii) ; S-(iv)

(3) P-(iii) ; Q-(ii) ; R-(iv) ; S-(i)

(4) P-(iv) ; Q-(iii) ; R-(ii) ; S-(i)

Ans. **(1)**

Sol. **(P)** $Ni^{+4} \rightarrow [Ar]3d^6$

$t_{2g}^{2,2,2} e_g^{0,0}$

CFSE = $-0.4 \times 6\Delta_0 = -2.4\Delta_0$

(Q) $[Ti(H_2O)_6]^{3+}$

$Ti^{+3} \rightarrow [Ar]\ 3d^1$

$t_{2g}^{1,0,0} e_g^{0,0}$

CFSE = $-0.4 \times 1\Delta_0 = -0.4\Delta_0$

(R) $[Fe(CN)_6]^{3-}$

$Fe^{+3} \rightarrow [Ar]3d^5$ $\quad CN^- = SFL$

$t_{2g}^{2,2,1} e_g^{0,0}$

CFSE = $-0.4 \times 5\Delta_0 = -2\Delta_0$

(S) $[Ni(NH_3)_6]^{2+}$

$Ni^{+2} \rightarrow [Ar]3d^8$

$t_{2g}^{2,2,2} e_g^{1,1}$

CFSE = $-0.4 \times 6\Delta_0 + 2 \times 0.6\Delta_0$

$= -2.4\ \Delta_0 + 1.2\ \Delta_0 = -1.2\Delta_0$

4.

Column-I	**Column-II**
(P) Electron precise	(i) B_2H_6
(Q) Electron rich	(ii) HF
(R) Electron deficient	(iii) MgH_2
(S) Saline Hydride	(iv) CH_4

(1) P-(iv) Q – (ii) R – (i) S – (iii)

(2) P-(ii) Q – (iii) R – (i) S – (iv)

(3) P-(iv) Q – (iii) R – (ii) S – (i)

(4) P-(ii) Q – (iv) R – (i) S – (iii)

Ans. (1)

Sol.

Electron precise	CH_4
Electron rich	HF
Electron deficient	B_2H_6
Saline Hydride	MgH_2

5. Statement-1 : 5f e^- can participate in bonding to a greater extent as compared to 4f electrons.

Statement-2 : Both resemble in their angular part of wave function but 5f is not as buried as 4f orbitals.

(1) Both statement-1 and statement-2 are correct and statement-2 is correct expalantion of statement-1

(2) Both statement-1 and statement-2 are correct but statement-2 is not correct expalantion of statement-1

(3) Statement-1 is correct and statement-2 is incorrect

(4) Statement-1 is incorrect and statement-2 is correct

Ans. **(1)**

6. C_2^{2-} has same magnetic property and bond order with :

(1) NO^+ (2) O_2^+ (3) N_2^+ (4) O_2

Ans. **(1)**

Sol. $C_2^{2-} \Rightarrow \sigma 1s^2\ \sigma^*1s^2, \sigma 2s^2, \sigma^*2s^2, \lceil \pi 2p_x^2 = \pi 2p_y^2 \rceil \sigma 2p_z^2$

$$\text{B.O.} = \frac{10-4}{2} = 3 \qquad \text{(Diamagnetic)}$$

$NO^{\oplus} \Rightarrow$ According N_2 like configuration

(No. of electrons = 7 + 8 – 1 = 14)

$\sigma 1s^2\ \sigma^*1s^2, \sigma 2s^2, \sigma^*2s^2, \left[\pi 2p_x^2 = \pi 2p_y^2 \right] \sigma 2p_z^2$

$$\text{B.O.} = \frac{10-4}{2} = 3 \qquad \text{(Diamagnetic)}$$

$O_2^{\oplus} \Rightarrow \sigma 1s^2\ \sigma^*1s^2, \sigma 2s^2, \sigma^*2s^2, \sigma 2p_z^2, \left[\pi 2p_x^2 = \pi 2p_y^2 \right] \left[\pi^* 2p_x^1 = \pi^* 2p_y^0 \right]$

(No. of electrons = 16 – 1 = 15)

$$\text{B.O.} = \frac{10-5}{2} = 2.5 \qquad \text{(Paramagnetic)}$$

7. Light of wavelengths 400 nm is used for photoelectric effect.

Metal	Li	Na	K	Mg	Cu
Work function	2.42	2.3	2.25	3.7	4.8

In how many of the following metals photoelectric is possible ?

Ans. **(3)**

Sol. **(Li, Na, K)**

$$E = \frac{1240}{\lambda} = \frac{1240}{400} = 3.1 \text{ eV}$$

Li, Na and K have less work function in comparison of energy of incident light.

So, Li, Na and K can show photoelectric effect but Mg and Cu can not show photoelectric effect.

8. Correct order of density for alkali metal

(1) Li < Na < K < Rb < Cs

(2) Li < K < Na < Rb < Cs

(3) Li > Na > K > Rb > Cs

(4) Li > K > Na > Rb > Cs

Ans. **(2)**

Sol. Order of density : Li < K < Na < Rb < Cs

9. **Statement-1 :** Boron is hard as it has high lattice energy.

Statement-2 : Boron has high melting and boiling point as compared to other group members.

(1) Both statements-1 and 2 are correct.

(2) Both statement-1 and 2 are incorrect.

(3) Statement-1 is correct and statement-2 is incorrect.

(4) Statement-1 is incorrect and statement-2 is correct.

Ans. **(1)**

10. **Statement-1 :** $SbCl_5$ is more covalent than $SbCl_3$.

Statement-2 : Higher oxidation state of halogens is more stable.

(1) Both statements-1 and 2 are correct.

(2) Both statement-1 and 2 are incorrect.

(3) Statement-1 is correct and statement-2 is incorrect.

(4) Statement-1 is incorrect and statement-2 is correct.

Ans. **(3)**

11. (A) During changing $PbSO_4$ is converted into PbO_2 at anode.

(B) During changing $PbSO_4$ is converted into at PbO_2 at cathode.

(C) In lead storage battery ~38% con. H_2SO_4 is used.

Correct statements are:

(1) A, B, C (2) A, B (3) A, C (4) B, C

Ans. **(3)**

12. Most probable speed of gas B at 90K is same as root mean square speed of gas A (Molar mass = 40) at 600K.

Calculate molar mass of gas B.

Ans. **4**

Sol. $$\sqrt{\frac{2R\times T_B}{M_B}} = \sqrt{\frac{3RT_A}{M_A}}$$

$$\frac{2\times 90}{M_B} = \frac{3\times 600}{40}$$

$M_B = 4$

13. An ideal gas in container with conducting walls is expanded isothermally from 2L to 3L against constant external pressure of 2 atm. Determine work done by the gas in Joule.

Ans. 200 to 203

Sol. $W = -P_{ext}(V_2-V_1)$

$= -2(3 - 2) = -2$ atm–L

$= -2 \times 101.3$

$= - 202.6$ J

14. A volatile chloride contains 55% chlorine by weight.

0.57 gm metal chloride vapour occupies 100 ml at STP.

Formula of metal chloride :

(1) MCl_2 (2) MCl_4 (3) MCl_3 (4) MCl

Ans. **(1)**

Sol. Molecular mass of metal chloride (MCl_x)

$$= 0.57 \times 227 = 129 = A + 35.5x$$

$$\frac{\text{Mass of Cl}}{\text{Mass of metal}} = \frac{55}{45} = \frac{35.5x}{A}$$

$A = 29x$

Molecular mass $= A + 35.5x = 127.5$

$$64.5x = 129$$

$$\Rightarrow \quad x = 2$$

Metal chloride is MCl_2

15.

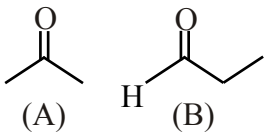
Column-I	**Column-II**
(i) Nylon-2, Nylon-6	(a) Polyester
(ii) Dacron	(b) Addition polymer
(iii) PAN	(c) Synthetic polymer
(iv) 2-chlorobuta-1,3-diene	(d) Biodegradable polymer

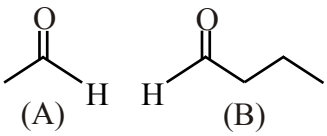
(1) (i)-(d); (ii)-(a); (iii)-(b); (iv)-(c)

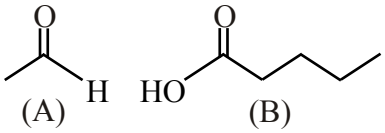
Ans. **(1)**

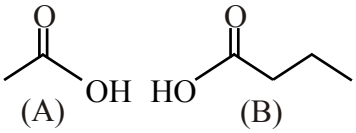
16. Find the products A and B in the given reaction :

Hex-2-ene $\xrightarrow[H_2O_2]{O_3}$ A + B

(1)  (A) (B)

(2)  (A) (B)

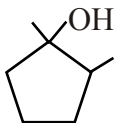
(3)  (A) (B)

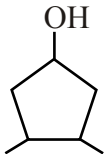
(4)  (A) (B)

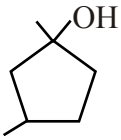
Ans. **(4)**

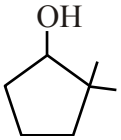
17. $CH_3-\overset{\overset{O}{\|}}{C}-CH_2-CH_2-CH_2-\underset{\underset{Br}{|}}{CH}-CH_3 \xrightarrow[(ii)\ H_2O]{(i)\ Mg/dry\ ether}$ Major product

Major product is :

(1) 

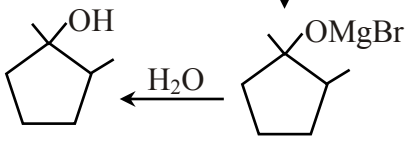
(2) 

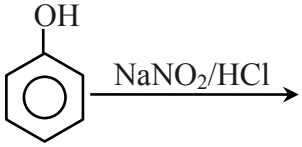
(3) 

(4) 

Ans. **(1)**

Sol. $CH_3-\overset{\overset{O}{\|}}{C}-CH_2-CH_2-CH_2-\underset{\underset{Br}{|}}{CH}-CH_3 \xrightarrow{(i)\ Mg/dry\ ether} CH_3-\overset{\overset{O}{\|}}{C}-CH_2-CH_2-\underset{\underset{MgBr}{|}}{CH}-CH_3$



18. 

Which is incorrect.

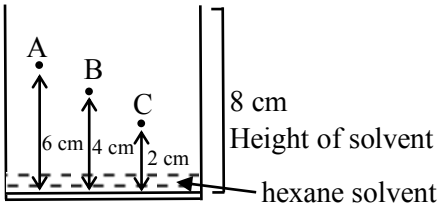
(1) $\overset{\oplus}{N}O$ is electrophile

(2) X is para nitroso phenol

(3) Y is para nitro phenol

(4) x is para nitro phenol

Ans. **(4)**

19. 

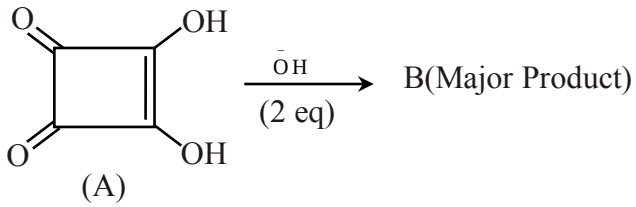
What will be the value of R_F of most polar component

If R_F is $x \times 10^{-2}$. What is x ?

Ans. **25**

Sol. $R_F = \frac{2}{8} = \frac{1}{4} = 0.25$

So, x = 25

20. 

(A)

(i) A show tautomerism

(ii) B is aromatic

(iii) All carbon bond length is equal in (B)

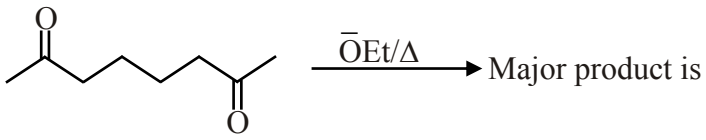
(iv) B is monoanion

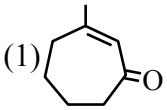
Which is/are correct statements :

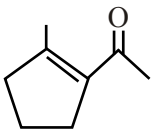
(1) (i), (ii), (iii) (2) (i), (ii), (iv)

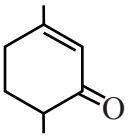
(3) (ii), (iii), (iv) (4) (i) & (iv)

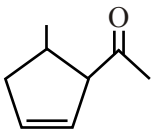
Ans. **(1)**

21. 

(1) 

(2) 

(3) 

(4) 

Ans. **(2)**

22. Match the column

Column-I	**Column-II**
(a) Acid rain	(p) Oxide of nitrogen
(b) CO_2	(q) Eutrophication
(c) CH_4	(r) Global warning
(d) Phosphate fertilizer	(s) Rain water at pH 5.6

Ans. (a)-(p); (b)-(s); (c)-(r); (d)-(q)