PART B – CHEMISTRY

1. The standard enthalpy of formation of NH_3 is –46.0 kJ/mol. If the enthalpy of formation of H_2 from its atoms is –436 kJ/mol and that of N_2 is –712 kJ/mol, the average bond enthalpy of N—H bond in NH_3 is :

(1) + 352 kJ/mol (2) – 964 kJ/mol

(3) – 1102 kJ/mol (4) + 1056 kJ/mol

Ans. (1)

Sol. Given :

$$\frac{1}{2}N_{2(g)} + \frac{3}{2}H_{2(g)} \longrightarrow NH_{3(g)}; \Delta H_g^\circ = -46$$

$$\frac{1}{2}\times 712 \quad \frac{3}{2}\times 436$$

$$N_{(g)} + 3H_{(g)}$$

Average bond enthalpy of N–H bond = + 352 kJ mol.

2. The correct statement about the magnetic properties of $[Fe(CN)_6]^{3-}$ and $[FeF_6]^{3-}$ is : (Z = 26).

(1) $[Fe(CN)_6]^{3-}$ is paramagnetic, $[FeF_6]^{3-}$ is diamagnetic.

(2) both are diamagnetic.

(3) $[Fe(CN)_6]^{3-}$ is diamagnetic, $[FeF_6]^{3-}$ is paramagnetic.

(4) both are paramagnetic

Ans. **(4)**

Sol. In $[FeF_6]^{3-}$, 5 unpaird electron present is

In $[Fe(CN)_6]^{3-}$ 1 unpaired electron present.

3. Allyl phenyl ether can be prepared by heating:

(1) $CH_2 = CH - CH_2 - Br + C_6H_5ONa$

(2) $C_6H_5 - CH = CH - Br + CH_3 - ONa$

(3) $C_6H_5Br + CH_2 = CH - CH_2 - ONa$

(4) $CH_2 = CH - Br + C_6H_5 - CH_2 - ONa$

Ans. **(1)**

Sol. $C_6H_5\overset{\ominus\ \oplus}{O}Na + CH_2{=}CH{-}CH_2{-}Br \longrightarrow$

$C_6H_5O{-}CH_2{-}CH{=}CH_2$

Allyl phenyl ether

4. In a nucleophilic substitution reaction :

$R - Br + Cl^- \xrightarrow{DMF} R - Cl + Br^-$,

which one of the following undergoes complete inversion of configuration?

(1) $C_6H_5CCH_3C_6H_5Br$

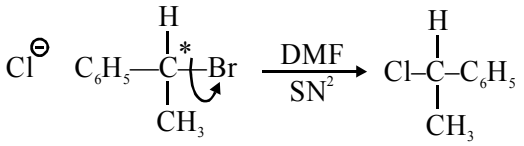
(2) $C_6H_5CHCH_3Br$

(3) $C_6H_5CHC_6H_5Br$

(4) $C_6H_5CH_2Br$

Ans. **(4)**

Sol.



inverted product

5. The number and type of bonds in C_2^{2-} ion in CaC_2 are:

(1) Two σ bonds and one π – bond

(2) Two σ bonds and two π – bonds

(3) One σ bond and two π – bonds

(4) One σ bond and one π – bond

Ans. **(3)**

Sol. $Ca^{+2}[C{\equiv}C]^{-2}$

6. In the following sets of reactants which two sets best exhibit the amphoteric character of $Al_2O_3.\ xH_2O$?

Set-1 : $Al_2O_3.xH_2O(s)$ and OH^- (aq)

Set-2 : $Al_2O_3.xH_2O(s)$ and H_2O (ℓ)

Set-3 : $Al_2O_3.xH_2O(s)$ and H^+ (aq)

Set-4 : $Al_2O_3.xH_2O(s)$ and NH_3 (aq)

(1) 1 and 2 (2) 2 and 4

(3) 1 and 3 (4) 3 and 4

Ans. (3)

Sol. In set 1 : $Al(OH)_4^-$ is formed

In set 2 : Al^{+3} & H_2O is formed

7. Dissolving 120 g of a compound of (mol. wt. 60) in 1000 g of water gave a solution of density 1.12 g/mL. The molarity of the solution is:

(1) 2.00 M (2) 2.50 M

(3) 4.00 M (4) 1.00 M

Ans. **(1)**

Sol. Molarity of solution $= \dfrac{\left(\frac{120}{60}\right)}{\frac{1120}{1.12}\times\frac{1}{1000}}$

$= 2$ M

8. The standard electrode potentials $\left(E^0_{M^+/M}\right)$ of four metals A, B, C and D are –1.2 V, 0.6 V, 0.85 V and – 0.76 V, respectively. The sequence of deposition of metals on applying potential is :

(1) D, A, B, C (2) C, B, D, A

(3) B, D, C, A (4) A, C, B, D

Ans. (2)

Sol. Higher the value of reduction potential more wil be the ease of deposition.

9. Which is the major product formed when acetone is heated with iodine and potassium hydroxide ?

(1) Iodoacetone (2) Acetic acid

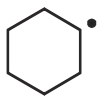
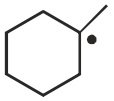
(3) Iodoform (4) Acetophenone

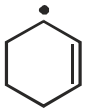
Ans. (3)

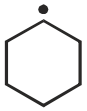
Sol. $CH_3-\overset{\overset{O}{\|}}{C}-CH_3 \xrightarrow[\text{Iodoform reaction}]{I_2 + KOH} \underset{\text{Iodoform}}{CHI_3} + CH_3-\overset{\overset{O}{\|}}{C}-\overset{\ominus\oplus}{O}K$

10. In which of the following pairs A is more stable than B ?

A B

(1)  , 

(2)  , 

(3)  , 

(4) $Ph_3C^{\bullet}$, $(CH_3)_3C^{\bullet}$

Ans. (4)

Sol. $Ph_3C^{\circ} > (CH_3)C^{\circ}$
due to resonance

11. In the hydroboration - oxidation reaction of propene with diborane, H_2O_2 and NaOH, the organic compound formed is :

(1) $CH_3CH_2CH_2OH$ (2) $(CH_3)_3COH$

(3) $CH_3CHOHCH_3$ (4) CH_3CH_2OH

Ans. (1)

Sol. $CH_3-CH=CH_2 \xrightarrow[H_2O_2/\bar{O}H]{B_2H_6/THF} CH_3-CH_2-\underset{\underset{OH}{|}}{CH_2}$

12. The form of iron obtained from blast furnace is :

(1) Steel (2) Wrought Iron

(3) Cast Iron (4) Pig iron

Ans. (4)

Sol. Iron obtained in blast furnance is known as pig iron.

13. Which one of the following reactions will not result in the formation of carbon-carbon bond?

(1) Cannizzaro reaction

(2) Friedel Craft's acylation

(3) Reimer-Tieman reaction

(4) Wurtz reaction

Ans. (1)

Sol. In cannizaro reaction carbon-carbon bond not formed

$2H-\overset{\overset{O}{\|}}{C}-H \xrightarrow{\text{conc. KOH}} H-\overset{\overset{O}{\|}}{C}-\overset{\ominus\oplus}{O}K + CH_2-OH$

14. The half-life period of a first order reaction is 15 minutes. The amount of substance left after one hour will be :

(1) $\frac{1}{4}$ of the original amount

(2) $\frac{1}{16}$ of the original amount

(3) $\frac{1}{32}$ of the original amount

(4) $\frac{1}{8}$ of the original amount

Ans. (2)

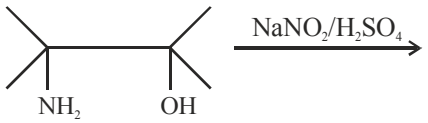
Sol. Since : $t_{1/2}$ = 15 min.

$\therefore$ No. of half lives = $\frac{60}{15} = 4$

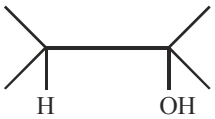
$\therefore$ Amount of substance left after one hour

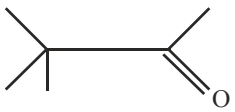
$$= \frac{A_0}{(2)^n} = \frac{A_0}{(2)^4} = \frac{A_0}{16}$$

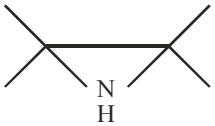
15. The major product of the reaction.



is:

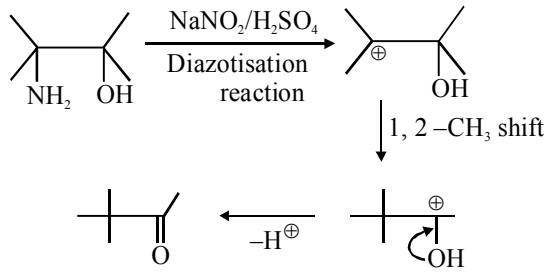
(1)  (2) 

(3) 

(4) 

Ans. (3)

Sol.



16. Vander Wall's equation for a gas is stated as,

$$p = \frac{nRT}{V - nb} - a\left(\frac{n}{V}\right)^2$$

This equation reduces to the perfect gas equation, $p = \frac{nRT}{V}$ when,

(1) both temperature and pressure are very low
(2) both temperature and pressure are very high
(3) temperature is sufficiently high and pressure is low
(4) temperature is sufficiently low and pressure is high.

Ans. (3)

17. The temperature at which oxygen molecules have the same root mean square speed as helium atoms have at 300 K is :
(Atomic masses : He = 4 u, O = 16 u)
(1) 1200 K (2) 600 K
(3) 300 K (4) 2400 K

Ans. (4)

Sol. $(U_{rms})_{o_2} = (U_{rms})_{He}$

$\Rightarrow \frac{3RTo_2}{32} = \frac{3R\ T_{He}}{4}$

$\Rightarrow T_{o_2} = 8 \times 300 = 2400$ K

18. For the compounds
CH_3Cl, CH_3Br, CH_3I and CH_3F,
the correct order of increasing C-halogen bond length is :
(1) $CH_3F < CH_3Br < CH_3Cl < CH_3I$
(2) $CH_3F < CH_3Cl < CH_3Br < CH_3I$
(3) $CH_3Cl < CH_3Br < CH_3F < CH_3I$
(4) $CH_3F < CH_3I < CH_3Br < CH_3Cl$

Ans. (2)

Sol. As the radius of halogen increases C—halogen bond length incread.

19. Chloro compound of Vanadium has only spin magnetic moment of 1.73 BM. This Vanadium chloride has the formula :
(at. no. of V = 23)
(1) VCl_4 (2) VCl_3 (3) VCl_2 (4) VCl_5

Ans. (1)

Sol. If the magnetic moment is 1.73 BM then the the number of unpaired e^- V^{4+} having our unpaired electron

20. A current of 10.0 A flows for 2.00 h through an electrolytic cell containing a molten salt of metal X. This results in the decomposition of 0.250 mol of metal X at the cathode. The oxidation state of X in the molten salt is :
(F = 96,500 C)
(1) 2 + (2) 3 + (3) 1 + (4) 4 +

Ans. (2)

Sol. $W = \frac{E}{96500} \times It$

$\Rightarrow$ No. of moles $= \frac{It}{96500 \times (n - factor)}$

$\Rightarrow 0.25 = \frac{10 \times 2 \times 60 \times 60}{96500 \times n - factor}$

$\Rightarrow n - factor = \frac{720 \times 4}{965} = 3$

$\therefore$ Oxidation state of molten salt is +3

21. Which of the following has unpaired electron(s) ?
(1) O_2^- (2) N_2^{2+} (3) O_2^{2-} (4) N_2

Ans. (1)

Sol. O_2^- has one unpaired electron is π^* MO.

22. The gas evolved on heating CaF_2 and SiO_2 with concentrated H_2SO_4, on hydrolysis gives a white gelatinous precipitate. The precipitate is:
(1) silica gel
(2) silicic acid
(3) hydrofluosilicic acid
(4) calciumfluorosilicate

Ans. (3)

Sol. $CaF_2 + H_2SO_4 \longrightarrow H_2F_2 + Ca(HSO_4)_2$
$SiO_2 + 2H_2F_2 \longrightarrow SiF_4 + 2H_2O$
$SiF_4 + H_2O \longrightarrow H_2[SiF_6]$

23. The amount of oxygen in 3.6 moles of water is:
(1) 28.8 g (2) 18.4 g (3) 115.2g (4) 57.6g

Ans. (4)

Sol. 3.6 moles of H_2O = 3.6 moles of O
= 3.6 × 16 gm of oxygen
= 57.6 gm

24. Which of the following is **not** formed when H_2S reacts with acidic $K_2Cr_2O_7$ solution ?

(1) K_2SO_4 (2) $Cr_2(SO_4)_3$

(3) S (4) $CrSO_4$

Ans. (4)

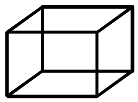
Sol. $K_2Cr_2O_7 + H_2S \rightarrow Cr_2(SO_4)_3 + S + K_2SO_4 + H_2O$

25. In a face centered cubic lattice atoms A are at the corner points and atoms B at the face centered points. If atom B is missing from one of the face centered points, the formula of the ionic compound is :

(1) AB_2 (2) A_2B_3 (3) A_5B_2 (4) A_2B_5

Ans. (4)

Sol.



$$A = 8 \times \frac{1}{8} = 1$$

$$B = 6 \times \frac{1}{2} - 1 \times \frac{1}{2} = \frac{5}{2}$$

A : B

$$1 : \frac{5}{2} \quad \Rightarrow \quad 2 : 5$$

26. An octahedral complex of Co^{3+} is diamagnetic. The hybridisation involved in the formation of the complex is :

(1) d^2sp^3 (2) dsp^3d (3) dsp^2 (4) sp^3d^2

Ans. (1)

Sol. Co^{+3} is diamagnetic & having d^6 by configuration under SFL.

27. At a certain temperature, only 50% HI is dissociated into H_2 and I_2 at equilibrium. The equilibrium constant is :

(1) 3.0 (2) 0.5 (3) 0.25 (4) 1.0

Ans. (3)

Sol.

$$\underset{1-\alpha}{2HI} \rightleftharpoons \underset{\frac{\alpha}{2}}{H_2} + \underset{\frac{\alpha}{2}}{I_2}$$

$$K_{eq} = \frac{\left(\frac{\alpha}{2}\right)^2}{(1-\alpha)^2} = \frac{\alpha^2}{4(1-\alpha)^2}$$

$$K_{eq} = \frac{\left(\frac{1}{2}\right)^2}{4(1/2)^2} = \frac{1}{4}$$

28. Which one of the following class of compounds is obtained by polymerization of acetylene ?

(1) Poly-ene (2) Poly-yne

(3) Poly-amide (4) Poly-ester

Ans. (2)

Sol. $\underset{\text{yne}}{nHC\equiv CH} \xrightarrow{\text{Polymerisation}} \underset{\text{poly-yne}}{-(CH=CH)_n-}$

29. Structure of some important polymers are given. Which one represents Buna-S ?

(1) $(-CH_2-\overset{\overset{CH_3}{|}}{C}=CH-CH_2-)_n$

(2) $(-CH_2-CH=CH-CH_2-\underset{\underset{C_6H_5}{|}}{CH}-CH_2-)_n$

(3) $(-CH_2-\overset{\overset{Cl}{|}}{C}=CH-CH_2-)_n$

(4) $(-CH_2-CH=CH-CH_2-\underset{\underset{CN}{|}}{CH}-CH_2-)_n$

Ans. (2)

Sol.

$$\underset{\text{Buta–1, 3-diene}}{CH_2=CH-CH=CH_2} + \underset{\text{styrene}}{CH_2=CH-C_6H_5} \xrightarrow{\text{Polymerisation}} \underset{\text{Buna-S}}{-(CH_2-CH=CH-CH_2-\underset{\underset{C_6H_5}{|}}{CH}-CH_2)_n-}$$

30. The energy of an electron in first Bohr orbit of H-atom is – 13.6 eV. The energy value of electron in the excited state of Li^{2+} is :

(1) –30.6 eV (2) –27.2 eV

(3) 27.2 eV (4) 30.6 eV

Ans. (1)

Sol. Energy of e^- in the excited state of Li^{+2}

$$E = -13.6 \frac{Z^2}{n^2}$$

$$= -13.6 \times \frac{(3)^2}{(2)^2} \text{ eV}$$

$$= -\frac{9}{4} \times 13.6 \text{ eV}$$

$$= -30.6 \text{ eN}$$