JEE Advanced (2022)

PAPER-II

Chemistry

SECTION 1 (Maximum Marks: 24)

- This section contains **EIGHT (08)** questions.
- The answer to each question is a **SINGLE DIGIT INTEGER ranging from 0 TO 9, BOTH INCLUSIVE.**
- For each question, enter the correct integer corresponding to the answer using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer.
- Answer to each question will be evaluated according to the following markeing scheme:

  Full Marks : +3 If **ONLY** the correct integer is entered;

  Zero Marks : 0 If the question is unanswered.

  Negative Marks : –1 In all other cases.

Q. 1. Concentration of H_2SO_4 and Na_2SO_4 in a solution is 1 M and 1.8×10^{-2} M, respectively. Molar solubility of $PbSO_4$ in the same solution is $X \times 10^{-Y}$ M (expressed in scientific notation). The value of Y is _____.

[Given: Solubility product of $PbSO_4$ (K_{sp}) = 1.6×10^{-8}. For H_2SO_4, K_{a1} is very large and $K_{a2} = 1.2 \times 10^{-2}$]

Q. 2. An aqueous solution is prepared by dissolving 0.1 mol of an ionic salt in 1.8 kg of water at 35° C. The salt remains 90% dissociated in the solution. The vapour pressure of the solution is 59.724 mm of Hg. Vapor pressure of water at 35° C is 60.000 mm of Hg. The number of ions present per formula unit of the ionic salt is _____.

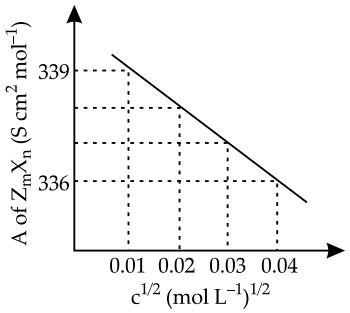
Q. 3. Consider the strong electrolytes Z_mX_n, U_mY_p and V_mX_n. Limiting molar conductivity (Λ^0) of U_mY_p and V_mX_n are 250 and 440 S cm^2 mol^{-1}, respectively. The value of (m + n + p) is _____.

Given :

Ion	Z^{n+}	U^{p+}	V^{n+}	X^{m-}	Y^{m-}
λ^0(S cm^2mol^{-1})	50.0	25.0	100.0	80.0	100.0

λ^0 is the limiting molar conductivity of ions

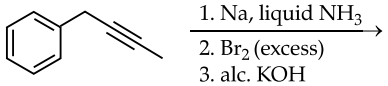
The plot of molar conductivity (Λ) of Z_mX_n *vs* $c^{1/2}$ is given below.



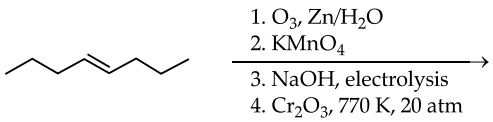
Q. 4. The reaction of Xe and O_2F_2 gives a Xe compound **P**. The number of moles of HF produced by the complete hydrolysis of 1 mol of **P** is _____.

Q. 5. Thermal decomposition of $AgNO_3$ produces two paramagnetic gases. The total number of electrons present in the antibonding molecular orbitals of the gas that has the higher number of unpaired electrons is _____.

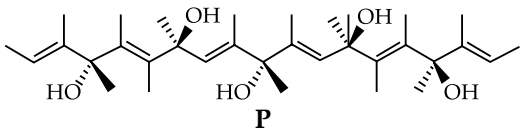
Q. 6. The number of isomeric tetraenes (**NOT** containing *sp*-hybridized carbon atoms) that can be formed from the following reaction sequence is _____.



Q. 7. The number of $-CH_2-$ (methylene) groups in the product formed from the following reaction sequence is _____.



Q. 8. The total number of chiral molecules formed from one molecule of **P** on complete ozonolysis (O_3, Zn/H_2O) _____.



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SECTION 2 (Maximum Marks: 24)

- This section contains **SIX (06)** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).
- For each question, choose the option(s) corresponding to (all) the correct answer(s).
- Answer to each question will be evaluated <u>according to the following markeing scheme:</u>

  Full Marks : +4 **ONLY** if (all) the correct option(s) is (are) chosen;

  Partial Marks : +3 If all the four options are correct but **ONLY** three options are chosen;

  Parital Marks : +2 If three or more options are correct but **ONLY** two options are chosen, both of which are correct;

  Parital Marks : +1 If two or more options are correct but **ONLY** one option is chosen and it is a correct option;

  Zero Marks : 0 If unanswered;

  Negative Marks : –2 in all other cases.

Q. 9. To check the principle of multiple proportions, a series of pure binary compounds (P_mQ_n) were analysed and their composition is tabulated below. The correct option(s) is(are)

Compound	Weight % of P	Weight % of Q
1	50	50
2	44.4	55.6
3	40	60

(A) If empirical formula of compound **3** is P_3Q_4, then the empirical formula of compound **2** is P_3Q_5.

(B) If empirical formula of compound **3** is P_3Q_2, and atomic weight of element P is 20, then the atomic weight of Q is 45.

(C) If empirical formula of compound **2** is PQ, then the empirical formula of the compound **1** is P_5Q_4.

(D) If atomic weight of P and Q are 70 and 35, respectively, then the empirical formula of compound **1** is P_2Q.

Q. 10. The correct option(s) about entropy (S) is(are)

[R = gas constant, F = Faraday constant, T = Temperature]

(A) For the reaction, $M(s) + 2H^+(aq) \rightarrow H_2(g) + M^{2+}(aq)$, if $\frac{dE_{cell}}{dT} = \frac{R}{F}$, then the entropy change of the reaction is R (assume that entropy and internal energy changes are temperature independent).

(B) The cell reaction, Pt(s) | H_2(g, 1bar) | H^+(aq, 0.01M) ||H^+(aq, 0.1M) | H_2(g, 1bar) | Pt(s), is an entropy driven process.

(C) For racemisation of an optically active compound, $\Delta S > 0$.

(D) $\Delta S > 0$, for $[Ni(H_2O)_6]^{2+} + 3$ en $[Ni(en)_3]^{2+} + 6H_2O$ (where en = ethylenediamine).

Q. 11. The compound(s) which reacts(s) with NH_3 to give boron nitride (BN) is(are):

(A) B (B) B_2H_6

(C) B_2O_3 (D) HBF_4

Q. 12. The correct option(s) related to the extraction of iron from its ore in the blast furnace operating in the temperature range 900 – 1500 K is(are)

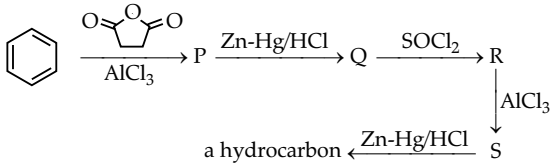
(A) Limestone is used to remove silicate impurity.

(B) Pig iron obtained from blast furnace contains about 4% carbon.

(C) Coke (C) converts CO_2 to CO.

(D) Exhaust gases consist of NO_2 and CO.

Q. 13. Considering the reaction sequence, the correct statement(s) is(are)



(A) Compounds **P** and **Q** are carboxylic acids.

(B) Compounds **S** decolorizes bromine water.

(C) Compounds **P** and **S** react with hydroxylamine to give the corresponding oximes.

(D) Compound **R** reacts with dialkylcadmium to give the corresponding tertiary alcohol.

Q. 14. Among the following, the correct statement(s) about polymers is(are)

(A) The polymerisation of chloroprene gives natural rubber.

(B) Teflon is prepared from tetrafluoroethene by heating it with persulphate catalyst at high pressures.

(C) PVC are thermoplastic polymers.

(D) Ethene at 350-570 K temperature and 1000-2000 atm pressure in the presence of a peroxide initiator yields high density polythene.

SECTION 3 (Maximum Marks: 12)

- This section contains **FOUR (04)** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.
- For each question, choose the option corresponding to the correct answer.
- Answer to each question will be evaluated <u>according to the following markeing scheme:</u>

Full Marks : +3 **ONLY** if the correct option is chosen;

Zero Marks : 0 If none of the options is chosen (i.e., the question is unanswered);

Negative Marks : –1 in all other cases.

Q. 15. Atom X occupies the fcc lattice sites as well as alternate tetrahedral voids of the same lattice. The packing efficiency (in %) of the resultant solid is closest to

(A) 25 **(B)** 35

(C) 55 **(D)** 75

Q. 16. The reaction of $HClO_3$ with HCl gives a paramagnetic gas, which upon reaction with O_3 produces

(A) Cl_2O **(B)** ClO_2

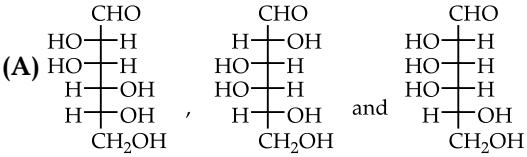
(C) Cl_2O_6 **(D)** Cl_2O_7

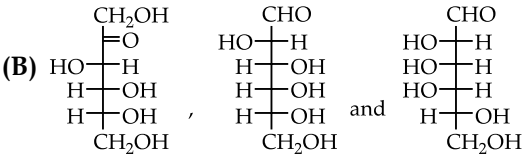
Q. 17. The reaction of $Pb(NO_3)_2$ and NaCl in water produces a precipitate that disolves upon the addition of HCl of appropriate concentration. The dissolution of the precipitate is due to the formation of

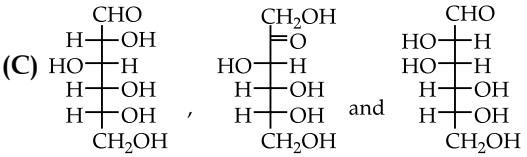
(A) $PbCl_2$ **(B)** $PbCl_4$

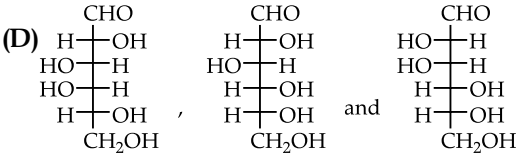
(C) $[PbCl_4]^{2-}$ **(D)** $[PbCl_6]^{2-}$

Q. 18. Treatment of D-glucose with aqueous NaOH results in a mixture of monosaccharides, which are

(A) 

(B) 

(C) 

(D) 

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Q.No.	Answer key	Topic's name	Chapter's name
Section -I			
1	6	Ionic equilibrium	Ionic equilibrium
2	5	Relative lowering of vapour pressure	Solutions
3	7	Molar conductivity	Electrochemistry
4	4	Chemical reactions of Xenon	*d*- and *f*- block elements
5	6	Chemical reactions of *d*- block elements and properties of *p*-block elements	*p*- block elements and *d*- and *f*- block elements
6	2	Chemical reactions of alkenes and alkynes	Hydrocarbon
7	0	Chemical reactions of alkenes	Hydrocarbon
8	2	Chirality and ozonolysis	Hydrocarbon and Stereochemistry
Section -II			
9	B,C	Some basic concepts of chemistry	Some basic concepts of chemistry
10	B,C,D	Temperature coefficient, entropy and electrode potential	Electrochemistry and thermodynamics
11	A,B,C	Compounds of boron	*p*- block elements
12	A,B,C	Extraction of iron	Extractive metallurgy
13	A,C	Reactions of benzene	Reactions of benzene
14	B,C	Polymers	Polymers
Section -III			
15	B	Packing efficiency	The solid state
16	C	Oxoacids of halogens	*p*-block elements
17	C	Chemical properties of lead	*p*-block elements
18	C	Chemical reactions of glucose	Biomolecules

Answers

1. Correct answer is [6]

Explanation: Conentration of H_2SO_4 = 1 M

Conentration of $Na2SO_4$ = 1.8×10^{-2} M

$$H_2SO_4 \rightleftharpoons HSO_4^- + H^+$$

At $t = 0$ 1 M — —

At $t = t$ — 1 M 1 M

$$Na_2SO_4 \rightleftharpoons 2Na^+ + SO_4^{2-}$$

At $t = 0$ 1.8×10^{-2} — —

at $t = t$ — $2(1.8 \times 10^{-2})$ 1.8×10^{-2}

From the above two equations, we get

$$[H^+] = 1 \text{ M and } [SO_4^{2-}] = 1.8 \times 10^{-2}$$

Now, $HSO_4^- \rightleftharpoons H^+ + SO_4^{2-}$

At $t = 0$ 1 M 1 M 1.8×10^{-2}

$$K_c = \frac{1.8 \times 10^{-2} \times 1}{1} = 1.8 \times 10^{-2}$$

and it is given that K_{a_2} (Q_c) = 1.2×10^{-2} M

Since, K_{a_2} (i.e., Q_c) > K_c,

So, the reaction will proved in backward reaction.

Now, again, $HSO_4^- \rightleftharpoons H^+ + SO_4^{2-}$

At $t = 0$ 1 M 1 M 1.8 × 10–2

At $t = t$ $1 + x$ $1 - x$ $1.8 \times 10^{-2} - x$

$$K_{a2} = \frac{[H^+][SO_4^{2-}]}{[HSO_4^-]}$$

$$1.2 \times 10^{-2} = \frac{(1-x)(1.8 \times 10^{-2} - x)}{(1+x)}$$

$\because x <<< 1$, so $(1 + x) \approx 1$ and $(1 - x) \approx 1$

$$1.2 \times 10^{-2} = 1.8 \times 10^{-2} - x$$

$$x = (1.8 \times 10^{-2}) - (1.2 \times 10^{-2})$$

$$x = 0.6 \times 10^{-2} \text{ M}$$

So, $[SO_4^{2-}] = 1.8 \times 10^{-2} - x$

$$[SO_4^{2-}] = (1.8 \times 10^{-2}) - (0.6 \times 10^{-2})$$

$$[SO_4^{2-}] = 1.2 \times 10^{-2} \text{ M}$$

Now, $PbSO_4 \rightleftharpoons Pb^{2+} + SO_4^{2-}$

At $t = 0$ y — 1.2×10^{-2} M

At $t = t$ — y $(1.2 \times 10^{-2} + y)$

Given, $K_{sp} = 1.6 \times 10^{-8}$

$y (1.2 \times 10^{-2} + y) = 1.6 \times 10^{-8}$

Since, $y <<< 1$, So $1.2 \times 10^{-2} + y \approx 1.2 \times 10^{-2}$

So, $y \times 1.2 \times 10^{-2} = 1.6 \times 10^{-8}$

$$y = \frac{1.6 \times 10^{-8}}{1.2 \times 10^{-2}}$$

$$y = 1.33 \times 10^{-6}$$

$$X \times 10^{-Y} \text{ M} = 1.33 \times 10^{-6} \text{ M}$$

So, Y = 6

Hence, the value of Y is 6.

2. Correct answer is [5]

Explanation: Vapour pressure of solution (P_A)

= 59.724 mm of Hg

Vapour pressure of pure water ($P°_A$)

= 60.000 mm of Hg

Also, 0.1 mol of an ionic solid is dissolved in 1.8 kg of water and salt remains 90% dissocated in the solution.

Let $Xa \longrightarrow aX$

At $t = 0$ 0.1 —

At $t = t$ 0.1 (1 – 0.9) $(0.1 \times 0 - 9) \times a$

= 0.01 $= 0.09\,a$

So, total number of moles = 0.01 + 0.09 a of non-volatile particles.

Now, mass of water = 1.8 kg = $1.8 \times 1.8 \times 1000$g

Molar mass of water = 18 g

$$\text{Moles of water} = \frac{1.8 \times 1000}{18} = 100 \text{ moles}$$

Using the colligative property, relative lowering in vapour pressure,

$$\frac{P_A^\circ - P_A}{P_A^\circ} = x_A$$

$$\frac{60 - 59.724}{60} = \frac{0.01 + 0.09\,a}{100}$$

$$\frac{0.276}{60} = \frac{0.01 + 0.09\,a}{100}$$

$$\frac{27.6}{60} = 0.01 + 0.09\,a$$

$$0.46 = 0.01 + 0.09\,a$$

$$0.09\,a = 0.45$$

$$a = \frac{0.45}{0.89}$$

$$a = 5$$

So, the number of ions present per formula unit of the ionic salt is 5.

3. Correct answer is [7]

Explanation: $\Lambda°_{V_mY_p} = 250 \text{ S cm}^2 \text{ mol}^{-1}$

$\Lambda_{V_mX_n} = 440 \text{ S cm}^2 \text{ mol}^{-1}$

It is also given that

$\lambda^\circ_{Z^{n+}} = 50\ S\ cm^2\ mol^{-1}$

$\lambda^\circ_{V^{p+}} = 250.0\ S\ cm^2\ mol^{-1}$

$\lambda^\circ_{V^{n+}} = 100.0\ S\ cm^2\ mol^{-1}$

$\lambda^\circ_{X^{m-}} = 80.0\ S\ cm^2\ mol^{-1}$

$\lambda^\circ_{Y^{m-}} = 100.0\ S\ cm^2\ mol^{-1}$

Now, $\Lambda_{V_mY_p} = m\lambda^\circ_{V^+} + p\lambda^\circ_{Y^-}$

$250 = 25\,m + 100p$

$10 = m + 4_p$ ...(1)

Also, $\Lambda_{V_mX_n} = m\lambda^\circ_{v^+} + n\lambda^\circ_{X^-}$

$440 = 100m + 80n$

$22 = 5m + 4n$ ...(2)

In the question, a graph of (Λ) of $Zm \times n$ Vs $C^{1/2}$ is given, If are extrapolate the curve towards y axis, then are will get

$\Lambda_{Z_mX_n} = 340\ S\ cm^2\ mol^{-1}$

So, $\Lambda_{Z_mX_n} = m\lambda^\circ_{Z^+} + n\lambda^\circ_{X^-}$

$340 = 50\,m + 80\,n$

$34 = 5\,m + 8\,n$ ...(3)

Solving eqn (2) and eqn (3),

$34 = 5m + 8n$

$-22 = 5m + 4n$

(–) (–) (–)

$12 = 4n$

$n = \frac{12}{4} = 3$

$n = 3$

Substituting the value of n in eqn (2), we get,

$22 = 5m + 4(3)$

$22 = 5m + 12$

$5m = 22 - 12 = 10$

$m = \frac{10}{5} = 2$

$m = 2$

Now, substituting the value of m is eqn (1) , we get

$10 = m + 4p$

$10 = 2 + 4p$

$8 = 4p$

$p = \frac{8}{4} = 2$

$p = 22$

So, $m + n + p = 2 + 3 + 2$

$m + n + p = 7$

Hence, the required value of $m + n + p$ is 7.

4. Correct answer is [4].

Explanation: The balanced reaction of Xe and O_2F_2 is given below:

$Xe + 2O_2F_2 \rightarrow XeF_4 + 2O_2$

(p)

Balanced hydrolysis reaction of XeF_4 is given as:

$3XeF_4 + 6H_2O \rightarrow 2Xe + XeO_3 + \frac{3}{2}O_2 + 12\ HF$

So, from the above reaction, it is clear that 3 moles of XeF_4 produces 12 moles of HF.

So, 1 mole of XeF4 will produce $\frac{12}{3}$ moles of HF, i.e., 4 moles of HF.

5. Correct answer is [6]

Explanation: Thermal decomposition of $AgNO_3$:

$AgNO_3 \rightarrow 2Ag + 2NO_2 + 1/2\ O_2$

The two paramagnetic gases are NO_2 and O_2.

Since, O_2 has two unpaired electrons while in NO_2, there is one unpaired electron.

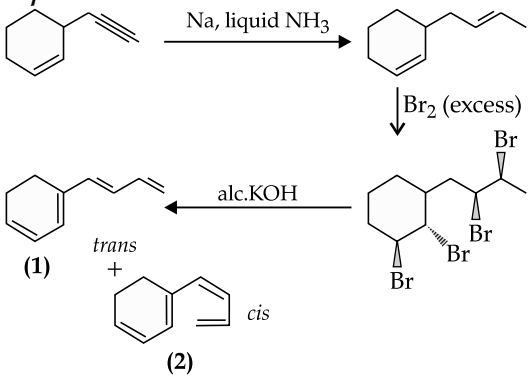
Electronic configuration of O_2 is :

$\sigma 1s^2\ \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, \sigma^2 p_z^2, \pi 2p_x^2 = \pi 2p_y^2, \pi^* 2p_x^2 = \pi^* 2p_y^2, \sigma^* 2p_z$

So, total number of electrons present in antibonding molecular orbital are 6.

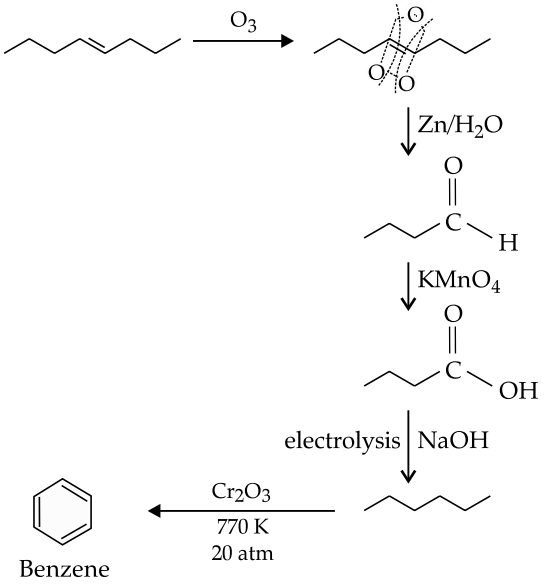
6. Correct answer is [2].

Explanation:



7. Correct answer is [0].

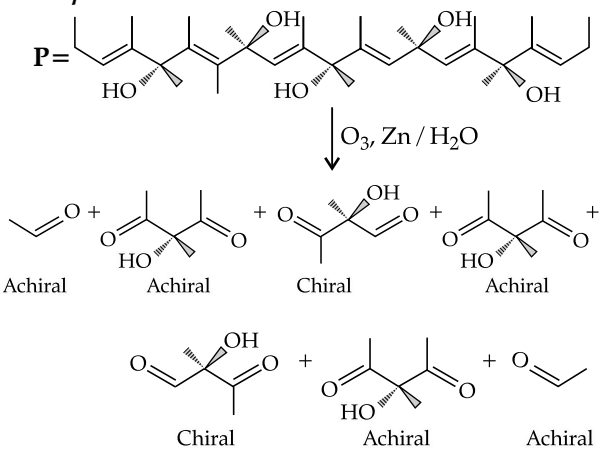
Explanation:



There are no methylene groups present in the product.

8. Correct answer is [2].

Explanation:



Section-2

9. Option (B, C) are correct.

Explanation:

Compound	Weight % of P	Weight % of Q
1	50	50
2	44.4	55.6
3	40	60

(A) If emperical formula of compound 3 is P_3Q_4 then its molar ratio will be $\frac{40}{3} \sqrt{\frac{60}{4}}$

$$= \frac{40}{3} \times \frac{4}{60} = \frac{16}{18} = 0.88$$

If empirical formula of compound 2 is P_3Q_5, then its molar ratio

$$= \frac{44.4}{2} \sqrt{\frac{55.6}{5}}$$

$$= \frac{44.4}{2} \times \frac{5}{55.6} = 2$$

Since molar ratio of both the compound is not equal

So, option (A) is not correct.

(B) If empirical formula of compound 3 is P_3Q_2, i.e.,

$$\frac{40}{M_P} : \frac{60}{M_Q} = \frac{3}{2}$$

$$\frac{40}{M_P} \times \frac{M_Q}{60} = \frac{3}{2}$$

$$\frac{4\,M_Q}{6\,M_P} = \frac{3}{2}$$

$$\frac{M_Q}{M_P} = \frac{3}{2} \times \frac{6^3}{4} = \frac{9}{4}$$

and $M_P = 20$ (given)

So, $$\frac{M_Q}{20} = \frac{9}{4}$$

$$M_Q = \frac{9 \times 20^5}{4}$$

$$M_Q = 45$$

So, option (B) is correct.

(C) If empirical formula of compound 2 is PQ, So the molar ratio is

$$\frac{44.4}{1} : \frac{55.6}{1} = \frac{44.4}{55.6} = 0.79 \sim 0.8$$

Empirical formula of compound 1 is P_5Q_4, so the molar ratio is $\frac{50}{5} \sqrt{\frac{50}{4}}$.

$$= \frac{50}{5} \times \frac{4}{50} = \frac{4}{5} = 0.8$$

Since, molar ratio of both the compound is equal hence, state (C) is correct.

So, option (C) is correct.

(D) $M_P = 70$, $M_Q = 35$

Molar ratio of compound 1 is

$$\frac{50}{M_P} : \frac{50}{M_Q} = \frac{50}{70} : \frac{50}{35}$$

$$= \frac{\cancel{50}}{\cancel{70}_2} \times \frac{\cancel{35}^1}{\cancel{50}} = \frac{1}{2}$$

Hence, empirical formula of compound PQ_2.

So, option (D) is incorrect.

10. Option (B), (C), (D) are correct.

Explanation:

(A) Given, Temperature coefficient $\frac{d\,E_{cell}}{dT} = \frac{R}{F}$

$M(s) + 2H^+ (aq) \rightarrow H_2(g) + M^{2+} (aq)$

Here, number of electron (n) = 2 transferred

Since, $$\Delta S = \left(\frac{dE_{cell}}{dT}\right) nF$$

$$\Delta S = \frac{R}{\cancel{F}} \times 2 \times \cancel{F}$$

$$\Delta S = 2R$$

Option (A) is incorrect.

(B) Given cell reaction,

$Pt(s)\ |H_2(g, 1\ bar)|\ H^+\ (aq, 0.01\ M)||H^+\ (aq, 0.1\ M)\ |H_2(g, 1\ bar)|\ Pt(s)$

Oxidation half reaction : $H_2 \rightarrow 2H^+_{(0.01)} + 2e^-$

Reduction half reaction : $2H^+_{(0.1)} + 2e^- \rightarrow H_2$

Net cell reaction : $2H^+_{(0.1)} \rightarrow 2H^+\ (0.01)$

Using nernst reaction,

$$E_{cell} = E°_{cell} - \frac{2.303\ RT}{nF} \log \frac{[H^+_{0.01}]^2}{[H^+_{0.1}]^2}$$

$$E_{cell} = 0 - \frac{0.0591}{2} 2 \log \frac{0.01}{0.1}$$

$$E_{cell} = -0.0591 \log \frac{10}{100}$$

$$E_{cell} = 0.0591\ V$$

Since, $E_{cell} > 0$

$\Rightarrow$ $\Delta G < 0$ and $\Delta S > 0$

Hence, the given cell reaction is an entropy driven proces.

Option (B) is correct.

(C) In the racemization of optically active compounds, an optically active compound is connected into racemic mixture results in the increase in disorderness and hence, the entropy increases. So, for racemization of an optically active compound, $\Delta S > 0$.

$\therefore$ Option (C) is correct.

(D) $[Ni(H_2))_6]^{2+} + 3\ en \rightarrow [Ni(en)_3]^{2+} + 6H_2O$

Since, in the above reaction ethylenediamine which is a bidentate ligand is replacing aqua group which is a monodentate ligand resulting in the increase of number of molecules on teh product side.

Hence, entropy increases

$\therefore$ $\Delta S > O$

$\therefore$ Option (D) is correct.

11. Option (A), (B), (C) are correct.

Explanation:

(A) The reaction of B with NH_3 gives :

$2B + 2NH_3 \rightarrow 2BN + 3H_2$

Boron nitride

Since, boron nitride (BN) is formed in the product, so, option (A) is correct.

(B) Reaction of B_2H_6 (diborone) with NH_3 gives:

$B_2H_6 + NH_3 \rightarrow 2B_3N_3H_6 + 12H_2$

$B_3N_3H_6 \xrightarrow[\text{Temperature}]{\text{High}} (BN)_x$

Option (B) is correct.

(C) Reaction of B_2O_3 with NH_3 gives :

$B_2O_3 + 2NH_3 \xrightarrow{900°C} 2BN + 3H_2O$

(Boric oxide) — Boron nitride

(D) Reaction of HBF_4 (fluoroboric acid) with NH_3 gives :

$HBF_4 + NH_3 \rightarrow [NH_4]\ [BF_4]^{\ominus}$

Here, a complex is obtained.

$\therefore$ Option (D) is incorrect.

12. Option (A), (B), (C) are correct.

Explanation:

(A) Limestone is a basic flux and silicate is an acidic impurity.

$CaCO_3 \rightarrow CaO + CO_2$

Limestone

$CaO + SiO_2 \rightarrow CaSiO_3$ (in temperature range 900 – 1500 K)

slag

Option (A) is correct.

(B) During the extraction of iron form its ore, at the temperature range 900 – 1500 K, pig iron is obtained from blast furnance which contains about 4% carbon.

Option (B) is correct.

(C) $C + CO_2 \xrightarrow{900 - 1500\ K} CO$

Coke

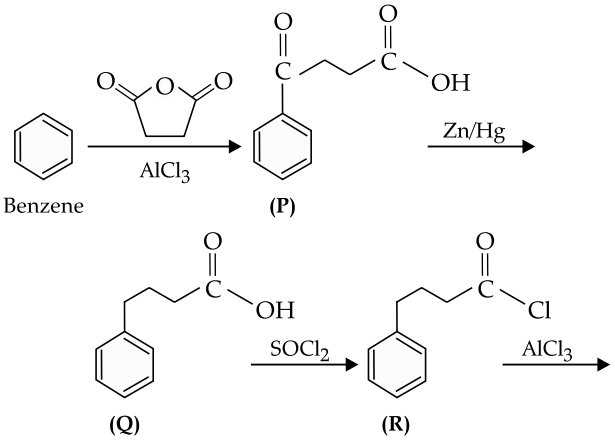
Option (C) is correct.

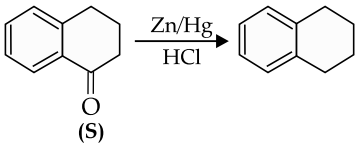
(D) Exhaust gases contains CO_2 and CO in the temperature range 500 – 800 K.

So, Option (D) is incorrect.

13. Option (A), (C) are correct.

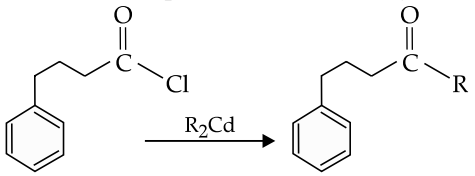
Explanation:





(S)

Reaction of compound (R) with dialkylcadmium:



From all the above reactions, it is clear that

(i) Compounds P and Q are carboxylic acids

(ii) In compound S, due to the presence of electron withdrawing group $\left(\rangle C=O\right)$, so the electron density in teh ring decreases and hence, the reaction will not take place with Br_2 water.

(iii) Compound P and S are ketones, so they will reacts with hydroxylamine (NH_2OH) to give the corresponding oximes.

(iv) Reaction of dialkycadmium with R gives ketone rather than tertiary alcohol.

So, option (A), (C) are correct.

14. Option (B), (C) are correct.

Explanation:

(A) The statement ''Polymerisation of chloroprene gives natural rubber'' is incorrect as the polymerisation of neoprene gives natural rubber.

Option (A) is incorrect.

(B) Teflon is monufactured by heating tetrafluoroethene with a free radical or persulphate catalyst at high pressures.

$$nCF_2=CF_2 \xrightarrow[\text{High Pressure}]{\text{Catalyst}} \left[CF_2-CF_2\right]_n$$

Tetrafluoro-ethene — Teflon

Option (B) is correct.

(C) Polyvinyl chloride (PVC) is made from the polymerization of vinyl chloride and it is a thermoplastic polymer.

Option (C) is correct.

(D) Ethene at 350-370 K temperature and 1000 – 2000 atm pressure in the presence of peroxide initiator yields a low density polythene,

So, option (D) is incorrect.

Section-3

15. Option (B) is correct.

Explanation: It is given that atom X occupies the *fcc* lattice sites as well as alternate tetrahedral voids of the same lattice.

Number of X atoms in *fcc* lattice

$$= 8\times\frac{1}{8}+6\times\frac{1}{2}$$

$$= 1+3$$

$$= 4$$

Number of X atoms in *fcc* unit all in alternate tetrahedral void

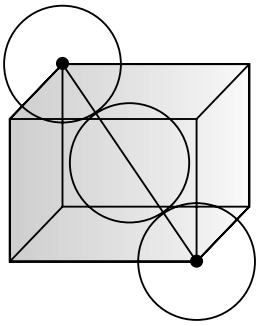
$$= \frac{1}{2}\times 4\times 2$$

$$= 4$$

So, total number of atom

$$X = 4+4 = 8$$

Now since, tetrahedral voids are present in body diagonal



Atom present body diagonal

and it is given that atom 'X' is present in alternate tetrahedral void. So,

$$\frac{\sqrt{3}a}{4} = 2r$$

$$a = \frac{8}{\sqrt{3}}r$$

Packing efficiency (%)

$$= \frac{\text{Volume occupied by atom 'X'}\times 2}{\text{Total volume of unit cell}}\times 100$$

$$= \frac{8\times\frac{4}{3}\pi(r)^3}{a^3}\times 100$$

$$= \frac{8\times\frac{4}{3}\pi r^3}{\left(\frac{8}{\sqrt{3}}r\right)^3}\times 100$$

$$= \frac{8 \times 4 \times \pi \times r^3 \times 3\sqrt{3}}{8 \times 8 \times 8 \times r^3 \times 3} \times 100$$

$$= \frac{\sqrt{3}}{16} \pi \times 100$$

$$= 33.99\%$$

$$\approx 34\%$$

Hence, option (B) is the most appropriate answer.

16. Option (C) is correct.

Explanation:

$$HClO_3 + HCl \rightarrow ClO_2 + \frac{1}{2} Cl_2 + H_2O$$

Here, ClO_2 is a paramagnetic gas

Reaction of ClO_2 with O_3 :

$$2ClO_2 + 2O_3 \rightarrow Cl_2O_6 + 2O_2$$

Option (C) is correct.

17. Option (C) is correct.

Explanation: Reaction of $Pb(NO_3)_2$ with NaCl produces while precipitate of $PbCl_2$.

$$Pb(NO_3)_2 + 2NaCl \rightarrow PbCl_2\downarrow + 2NaNO_3$$

$PbCl_2$ is dissolved upon the addition of HCl due to formation of a complex ion $[PbCl_4]$.

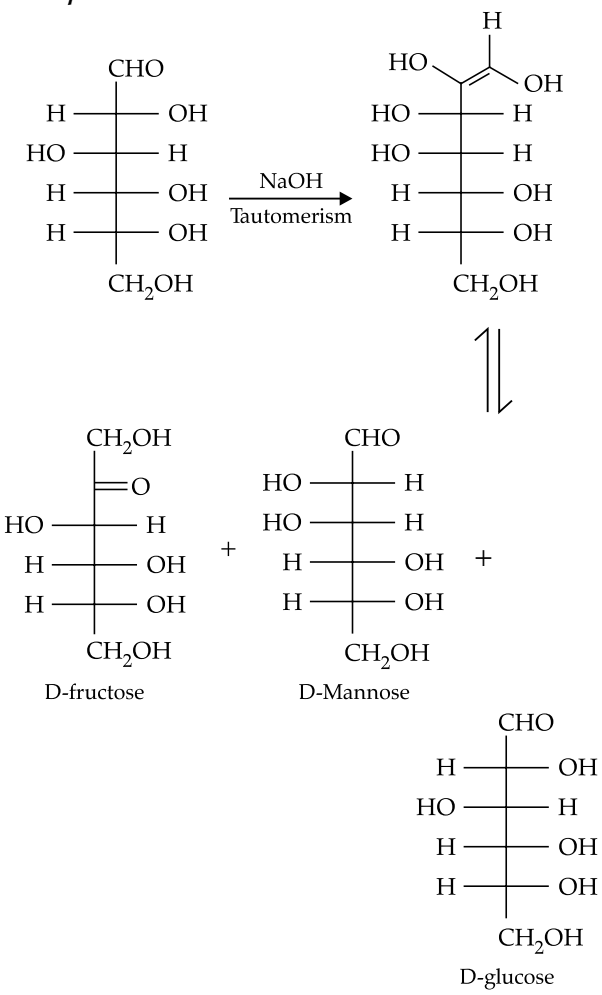
$$PbCl_2 + 2Cl^- \rightarrow [PbCl_4]^{2-}$$

(form HCl) complex ion

Option (C) is correct.

18. Option (C) is correct.

Explanation:



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