

Section - A

1. $\begin{array}{c}
A \\
(C_4H_8CI_2)
\end{array}
\xrightarrow{\text{Hydrolysis}}
\begin{array}{c}
B \\
(C_4H_8O)
\end{array}$ 1.

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 Butan-2-one
- c. 2,2- Dichlorobutane and Butanal
- d. 1,1- Dichlorobutane and Butanal

Ans: (b)

Solution:

$$C - C - C - C \xrightarrow{CI} C \xrightarrow{Hydrolysis} C - C - C - C \xrightarrow{OH} C - C - C - C$$

$$C - C - C - C \xrightarrow{Hydrolysis} C - C - C - C \xrightarrow{OH} C - C - C - C$$

$$OH \xrightarrow{CI} C - C - C - C - C - C - C$$

$$OH \xrightarrow{OH} C - C - C - C - C - C$$

$$OH \xrightarrow{OH} C - C - C - C - C - C$$

$$OH \xrightarrow{OH} C - C - C - C - C - C$$

$$OH \xrightarrow{OH} C - C - C - C - C - C - C$$

Compound 'B' does not give Tollen's test due to presence of kenotic group but react with hydroxyl amine

2. Match List-I with List-II.

List -I List-II

(Ore) (Element Present)

- (a) Kernite
- (i) Tin
- (ii) Boron
- (b) Cassiterite (c) Calamine
- (iii) Fluorine
- (d) Cryolite

- (iv) Zinc
- a. (a) (ii), (b) (iv), (c) (i), (d) (iii)
- b. (a) (ii), (b) (i), (c) (iv), (d) (iii)
- c. (a) (i), (b) (iii), (c) (iv), (d) (ii)
- d. (a) -(iii), (b) -(i), (c) -(ii), (d) -(iv)

Ans: (b)

Solution:

Fact



3. For the given reaction:

$$\begin{array}{c} & & & \\ & &$$

c.

d.

b. 4f

d. 4d



Ans: (d) Solution:

It is benzylic substitution reaction.

- 4. The orbital having two radial as well as two angular nodes is
 - a. 5d
 - c. 3p
 - Answer: (a)

Solution:

A.N. = 1

$$R.N = n - \ell - 1$$

Orbital	Angular	Radial
	Node	Node
5d	2	2
4f	3	0
3р	1	1
4d	0	1

5. Given below are two statement:

Statement I: o-Nitrophenol is steam volatile due to intramolecular hydrogen bonding Statement II: o-Nitrophenol has high melting point due to hydrogen bonding. 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. b. Statement I is false but Statement II is true
- c. c. Both Statement I and Statement II are true
- d. d. Statement I is true but Statement II is false

Ans: (d)

Solution:

o-Nitrophenol is steam volatile due to intramolecular hydrogen H-bonding. but m-Nitrophenol has more melting point due to its symmetry.



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

b. CH₃CH₂CH₂NHCH₃

Ans: (a) Solution:

R-NH - R
$$C_6H_5SO_2CI$$
 R-N - S - C_6H_5 0 R-N - S - 0 R-N - 0 R-N - S - 0 R-N - 0 R-N - S - 0 R-N - 0

According to the question the amine should be 2°- amine, in which one of the alkyl group should be ethyl, because it can be formed by ammonolysis of ethyl chloride

7. For the given reaction:

CH = CHBr
$$\begin{array}{c} 1. \text{ NaNH}_2 \\ \text{CH}_3 \end{array}$$
 2. Red hot iron tube, 873 K (A) (major product)

What is 'A'?



a.
$$CH = CH - NH_2$$
 $\begin{matrix} I \\ CH_3 \end{matrix}$

b.

d. CCH₃CH₂CH₂NH₂

Ans: (c)
Solution:

$$CH_3 - CH = CH \xrightarrow{NaNH_2} CH_3 - CH \equiv CH \xrightarrow{red hot Fe-tube} CH_3$$

(mesitylene)

- 8. Statement 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

a. A and B only

c. A, B and C only

b. A and D only

d. A and C only

Ans: (c)
Solution:
Fact



- 9. Which of the following is 'a' FALSE statement?
 - a. Carius tube used in the estimation of sulphur in an organic compound (i) and (iv) are isotopes
 - b. Kjedahl's method is used for the estimation of nitrogen in an organic compound (ii) and (iii) are isotopes
 - c. Phosphoric acid produced on oxidation of phosphorus present in an organic compound is precipitated as Mg₂P₂O₇ by adding magnesia mixture
 - d. Carius method is used for the estimation of nitrogen in an organic compound

Ans: d Solution: Fact

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 true, statement II is false
- b. Both Statement I and Statement II are true
- c. Both Statement I and Statement II are false
- d. d. Statement I is false, Statement II is true

Ans: (b) Solution:

A suitable method for separating a mixture of aniline and chloroform would be steam distillation. Steam distillation is the process used to separate aromatic compound from a mixture because of their temperature sensitivity. Therefore, steam distillation is an ideal method for their separation.

11. Which of the following vitamin is helpful in delaying the blood clotting?

a. Vitamin B

b. Vitamin C

c. Vitamin K

d. Vitamin E

Ans: (c)

Solution:

Vitamin K is used by the body to help blood clot.



- 12. The presence of ozone in troposphere:
 - a. Generates photochemical smog
 - b. Protects us from the UV radiation
- c. Protects us from the X-ray radiation
- d. Protects us from greenhouse effect

Ans: (b)

Solution:

The presence of ozone in troposphere protect earth from ultra violet ray

13. On treating a compound with warm dil. H₂SO₄, gas X is evolved which turns K₂Cr₂O₇ paper acidified with dil. H₂SO₄ to a green compound Y. X and Y respectively are:

a.
$$X = SO_2$$
, $Y = Cr_2(SO_4)_3$

b.
$$X = SO_2$$
, $Y = Cr_2O_3$

c.
$$X = SO_3$$
, $Y = Cr_2O_3$

d.
$$X = SO_3$$
, $Y = Cr_2(SO_4)_3$

Ans:(a)

Solution:

$$SO_2 + K_2Cr_2O_7 + H_2SO_4 \rightarrow Cr_2(SO_4)_3 + K_2SO_4 + H_2O_4$$

14. Find A, B and C in the following reaction:

$$NH_3 + A + CO_2 \rightarrow (NH_4)_2CO_3$$

$$(NH_4)_2CO_3 + H_2O + B \rightarrow NH_4HCO_3$$

$$NH_4HCO_3 + NaCl \rightarrow NH_4Cl + C$$

c.
$$A - O_2$$
; $B - CO_2$; $C - Na_2CO_3$

Ans: (a)

Solution:

(1)
$$NH_3 + {}^{(A)} + CO_2 \rightarrow (NH_4)_2CO_3$$

$$CO_2$$

(2)
$$(NH_4)_2CO_3 + H_2O + (B) \rightarrow NH_4HCO_3$$

(3)
$$NH_4HCO_3 + NaCl \rightarrow NH_4Cl +$$
 (C)



15. 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 but R is false
- d. Both A and R are true and R is not the correct explanation of A

Ans: (c)

Solution:

Fact

16. Match List-I with List-II.

Electronic configuration of elements $\Delta_i H$ in kJ mol⁻¹

(a)
$$1s^22s^2$$

(b)
$$1s^22s^22p^4$$

(c)
$$1s^22s^22p^3$$

(d)
$$1s^22s^22p^1$$

a. (a)
$$-$$
 (ii), (b) $-$ (iii), (c) $-$ (iv), (d) $-$ (i)

b. (a)
$$-$$
 (iv), (b) $-$ (i), (c) $-$ (ii), (d) $-$ (iii)

Ans: (a)

Solution:

Order of I.E. in second period:

Li < B < Be < C < 0 < N < F < Ne
$$2p^1 2s^2 2p^2 2p^4 2p^3$$



17. Which one of the following lanthanoids does not form MO₂?

[M is lanthanoid

metal]

a. Nd

b. Yb

c. Dy

d. Pr

Ans: (b)

Solution:

Fact

18. Identify the major products A and B respectively in the following reaction of phenol:

$$(i) CHCl_3, NaOH$$

$$(ii) H_3O^+$$

$$Br_2 in CS_2$$

$$273K$$

a.

b.

c.

d.

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Ans: (a) Solution:

19. The structure of Neoprene is:

a.
$$\begin{array}{ccc} & & + CH_2 - CH \\ & & - CN \end{array}$$

b.

$$\begin{array}{c} CI \\ -CH_2 - C = CH - CH_2 \end{array}$$

$$\begin{array}{c} CI \\ -CH_2 - C = CH - CH_2 \end{array}$$

$$\begin{array}{c} -CH_2 - CH_2 - CH_2 \end{array}$$

$$\begin{array}{c} -CH_2 - CH_2 - C$$

Ans: (b)

Solution:

$$\begin{array}{c} CI \\ -CH_2 -C = CH - CH_2 \end{array}$$

Neoprene



20. Compound A used as a strong oxidizing agent is amphoteric in nature. It is the part of lead storage batteries. Compound A is:

c. PbSO₄

d. PbO Solution:

Ans: (b)

Lead storage batteries PbO_2 is used. In this O.S. of Pb is +4 so it is always reduced and behaves as oxidizing agent

Section - B

1. 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(H₂O) = 24 mm of Hg) is $x \times 10^{-2} \text{ mm of Hg}$, the value of x is ____

Ans: (0.18)

Solution:

The balanced equation is

$$SO_2 + 2NaOH \rightarrow Na_2SO_3 + H_2O$$

moles of NaOH = molarity \times volume (in litre)

$$= 0.1 \times 0.1$$

= 0.01 moles

Here NaOH is limiting Reagent

 $2 \; mole \; NaOH {\:\longrightarrow\:} 1 \; mole \; Na_2SO_3$

$$0.01 \text{ mole NaOH} \longrightarrow \frac{1}{2} \times 0.01 \text{ mole Na2SO3}$$

Moles of $Na_2SO_3 \longrightarrow 0.005$ mole

$$Na_2SO_3 \longrightarrow 2Na^+ + SO_3^{2-}$$

i = 3



Moles of
$$H_2O = \frac{36}{18} = 2$$
 moles

Accoding to RLVP -

$$\frac{P_A^o - P_A}{P_A^o} = i X_B$$

$$\frac{P_{A}^{o} - P_{A}}{P_{A}^{o}} = \frac{in_{A}}{in_{A} + n_{B}} (in_{A}; 0)$$

 $n_B \ll n_A$

$$\{n_A + n_B ; n_A\}$$

$$\frac{P_A^o - P_A}{P_A^o} = i \times \frac{n_B}{n_A}$$

$$\frac{2H-P_A}{2H}=3\times\frac{0.005}{2}$$

$$\Rightarrow$$
 2H - P_A = 0.18

Lowering in pressure = 0.18 mm of Hg

lowering in pressure = 18×10^{-12} mm of H

$$x = 18$$

2. Consider the following reaction

$$MnO_{4^{-}} + 8H^{+} + 5e^{-} \rightarrow Mn^{+2} + 4H_{2}O, E^{\circ} = 1.51 \text{ V}.$$

The quantity of electricity required in Faraday to reduce five moles of MnO₄- is____.

Ans:(25)

Solution:

$$MnO_{4}^{-} + 8H^{+} + 5e^{-} \rightarrow Mn^{+2} + 4H_{2}O$$

1 mole of MnO_4 - require 5 faraday charge

5 moles of MnO_4 will require 25 faraday charge.



3. 3.12 g of oxygen is adsorbed on 1.2 g of platinum metal. The value of oxygen adsorbed per gram of the adsorbent at 1 atm and 300 K in L is _____. $[R = 0.0821 \text{ L atm } \text{K}^{-1} \text{ mol}^{-1}]$

Ans:(2)

Solution:

Moles of
$$O_2 = \frac{3.12}{32} = 0.0975$$

volume of $O_2 = \frac{nRT}{P} = \frac{0.0975 \times 0.082 \times 300}{1}$
volume of $O_2 = 2.3985L$; 2.4 L

volume of O_2 absorbed per gm of platinum = $\frac{2.4}{2}$ = 2

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

Ans:(7)

Solution:

 50000.020×10^{-3}

Number of significant figures = 7

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

Ans:(0)

Solution:

Fact

6. For a chemical reaction $A + B \rightleftharpoons C + D$

 $(\Delta_r H^\psi = 80 \text{ kJ mol}^{-1})$ the entropy change $\Delta_r S^\psi$ depends on the temperature T (in K) as $\Delta_r S^\psi = 2T$ (J K⁻¹ mol⁻¹).

Minimum temperature at which it will become spontaneous is _____K.

Answer (200)

Solution:

$$\Delta G^{\circ} = \Delta H^{\circ} - T\Delta S^{\circ}$$



To make the process spontaneous

$$\Delta G^{\circ} < 0$$

$$\Delta H^{\circ} - T\Delta S^{\circ} < 0$$

$$T > \frac{\Delta H^o}{\Delta S^o}$$

$$T > \frac{80000}{2T}$$

$$2T^2 > 80000$$

$$T^2 > 40000$$

The minimum temperature to make it spontaneous is 200 K.

7. An exothermic reaction $X \to Y$ has an activation energy 30 kJ mol⁻¹. If energy change ΔE during the reaction is -20 kJ, then the activation energy for the reverse reaction in kJ is .

Solution:

$$\Delta H = E_{a, f} - E_{a, b} = -20 = 30 - E_{a, b}$$

$$E_{a, b} = 50 \text{ kJ/mole}$$

8. A certain gas obeys $P(V_m - b) = RT$. The value of $\left(\frac{\partial Z}{\partial P}\right)_T$ is $\frac{xb}{RT}$. The value of x is _____. Ans:(1)

$$P(v - b) = RT$$

$$PV - Pb = RT$$

$$\frac{PV}{RT} - \frac{Pb}{RT} = 1$$

$$Z = 1 + \frac{PV}{RT}$$

$$\frac{dZ}{dP} = 0 + \frac{b}{RT}$$

$$\Rightarrow \frac{b}{RT} = \frac{xt}{RT}$$

$$x = 1$$



9. A homogeneous ideal gaseous reaction $AB_{2(g)} \rightleftharpoons A_{(g)} + 2B_{(g)}$ is carried out in a 25 liter 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 _____. [R = 0.08206 dm³ atm K^{-1} mol $^{-1}$]

Ans: (74)
Solution:

$$\begin{array}{cccc} & AB_{2(g)} \rightleftharpoons & A_{(g)} + & 2B_{(g)} \\ \text{Initial} & 1-x & x & 2x \\ & & \frac{1}{1+2x} & \frac{1}{1.9} \end{array}$$
 At eq.

By ratio of pressure & mole

$$\frac{1}{1+2x} = \frac{0.985}{1.9}$$

$$1.9 = 0.985 + 1.9 x$$

 $0.915 = 1.9 x$

$$\frac{0.915}{1.9} = x = \frac{4x^2 \cdot x}{(1-x)} \frac{P_{\text{total}}}{n_{\text{total}}}$$

$$P = \frac{4x^3}{(1-x)} \frac{RT}{V}$$

On substituting the values,

$$K_p = 74 \times 10^{-2}$$

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

Ans:(6)

Solution:

$$Cr_2O_7^{2-} + 2OH^- \rightleftharpoons 2CrO_4^{-2-} + H_2O$$

For CrO₄ ²⁻

$$x + (-2 \times 4) = -2$$

$$x = 6$$