



**JEE
MAIN
MARCH
2021**

**18th March 2021 | Shift - 1
CHEMISTRY**

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SELECTIONS SINCE 2007

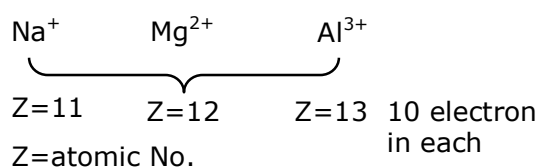
SECTION - A

1. The ionic radius of Na^+ ion is 1.02 Å. The ionic radii (in Å) of Mg^{2+} and Al^{3+} , respectively are :
- (1) 0.72 and 0.54 (2) 0.68 and 0.72
 (3) 1.05 and 0.99 (4) 0.85 and 0.99

Ans. (1)

Sol. For iso-electronic system

$$r \propto \frac{1}{Z_{\text{eff}}}$$



2. Match List-I with List-II :

List-I

(Chemicals)

- (a) Alcoholic potassium hydroxide
 (b) Pd/ BaSO_4
 (c) BHC (Benzene hexachloride)
 (d) Polyacetylene

Choose the most appropriate match :

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

List-II

(Use/Preparation/Constituent)

- (i) electrodes in batteries
 (ii) obtained by addition reaction
 (iii) used for β -elimination reaction
 (iv) Lindlar's Catalyst

- (2) (a)-(iii), (b)-(i), (c)-(iv), (d)-(ii)
 (4) (a)-(iii), (b)-(iv), (c)-(ii), (d)-(i)

Ans. (4)

Sol. a/c. KOH	⇒	Used for B. elimination reaction
Pd/ Ba son	⇒	Lindlar's catalyst
BHC (Benzon lexa chloride)	⇒	Addition product of benzen and chloride.
Poly actylene	⇒	Used in electrodos in batteries

3. The statements that are TRUE:

- (A) methane leads to both global warming and photochemical smog
 (B) methane is generated from paddy fields
 (C) methane is a stronger global warming gas than CO_2
 (D) methane is a part of reducing smog.

Choose the most appropriate answer from the option given below:

- (1) (B), (C), (D) only (2) (A), (B), (C) only
 (3) (A), (B), (D) only (4) (A) and (B) only

Ans. (2)

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Sol. Contribution of global warming gas
 $\text{CO}_2 > \text{CH}_4 > \text{CFC} > \text{O}_3 > \text{N}_2\text{O} > \text{H}_2\text{O}$
 But CH_4 is 40 times stronger green house gases than CO_2 its has more heating effect.

4. Compound with molecular formula $\text{C}_3\text{H}_6\text{O}$ can show :
 (1) Both positional isomerism and metamerism
 (2) Metamerism
 (3) Positional isomerism
 (4) Functional group isomerism

Ans. (4)

Sol. $\text{C}_6\text{H}_6\text{O}$ DOU = 1
 $\text{CH}_3 - \text{CH}_2 - \text{CH} = \text{O}$ & $\text{CH}_3 - \underset{\text{O}}{\underset{\parallel}{\text{C}}} - \text{CH}_3$ are functional isomer.

5. Match List-I with List-II :

List-I

- (a) $\text{Ca}(\text{OCl})_2$
 (b) $\text{CaSO}_4 \cdot \frac{1}{2} \text{H}_2\text{O}$
 (c) CaO
 (d) CaCO_3

List-II

- (i) Antacid
 (ii) Cement
 (iii) Bleach
 (iv) Plaster of Paris

Choose the most appropriate answer from the option given below:

- (1) (a)-(iii), (b)-(iv), (c)-(ii), (d)-(i) (2) (a)-(iii), (b)-(ii), (c)-(iv), (d)-(i)
 (3) (a)-(iii), (b)-(ii), (c)-(i), (d)-(iv) (4) (a)-(i), (b)-(iv), (c)-(iii), (d)-(ii)

Ans. (1)

Sol. $\text{Ca}(\text{OCl})_2$ \longrightarrow Bleaching power
 $\text{CaSO}_4 \cdot \frac{1}{2} \text{H}_2\text{O}$ \longrightarrow Plaster of paris
 CaO \longrightarrow cement
 CaCO_3 \longrightarrow Antacid

6. In a binary compound, atoms of element A form a hcp structure and those of element M occupy $\frac{2}{3}$ of the tetrahedral voids of the hcp structure. The formula of the binary compound is :

- (1) M_2A_3 (2) MA_3 (3) M_4A (4) M_4A_3

Ans. (4)

Sol. $\text{A} \rightarrow \text{hcp}$
 $\text{M} \rightarrow \frac{2}{3}^{\text{rd}}$ of tetrahedral
 $\text{M}_{2 \times \frac{12}{3}} \text{A}_6 = \text{M}_8\text{A}_6 = \text{M}_4\text{A}_3$

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7. Match List-I with List-II :

List-I

(Class of Drug)

- (a) Antacid
- (b) Artificial Sweetner
- (c) Antifertility
- (d) Tranquilizers

List-II

(Example)

- (i) Novestrol
- (ii) Cimetidine
- (iii) Valium
- (iv) Alitame

Choose the most appropriate answer from the option given below:

- (1) (a)-(iv), (b)-(iii), (c)-(i), (d)-(ii)
- (2) (a)-(ii), (b)-(iv), (c)-(i), (d)-(iii)
- (3) (a)-(ii), (b)-(iv), (c)-(iii), (d)-(i)
- (4) (a)-(iv), (b)-(i), (c)-(ii), (d)-(iii)

Ans. (2)

Sol. Antacid	—	Cinetidine
Artificial sweetener	—	Alitame
Antifertility	—	Novestrol
Tranquilizers	—	Valium

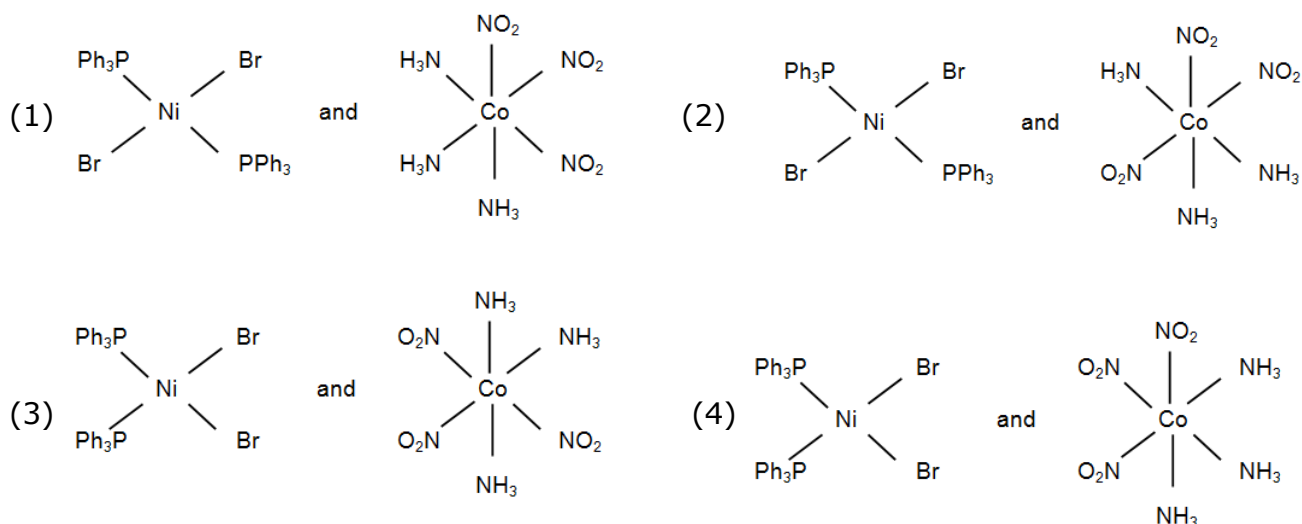
8. Reagent, 1-naphthylamine and sulphanilic acid in acetic acid is used for the detection of :

- (1) NO
- (2) N₂O
- (3) NO₃⁻
- (4) NO₂⁻

Ans. (4)

Based on NCERT

9. The correct structures of trans-[NiBr₂(PPh₃)₂] and meridional-[Co(NH₃)₃(NO₂)₃] respectively are :

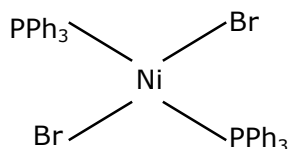


Ans. (2)

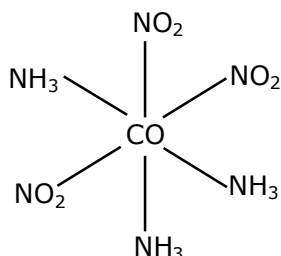
Sol. Trans [Ni Br₂(Pph₃)₂]

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Meridional $[\text{Co}(\text{NH}_3)_3(\text{NO}_2)_3]$



10. Match List-I with List-II :

List-I

- (a) Chlorophyll
- (b) Vitamin - B₁₂
- (c) Anticancer drug
- (d) Grubbs catalyst

List-II

- (i) Ruthenium
- (ii) Platinum
- (iii) Cobalt
- (iv) Magnesium

Choose the most appropriate answer from the option given below:

- (1) (a)-(iv), (b)-(iii), (c)-(i), (d)-(ii)
- (2) (a)-(iii), (b)-(ii), (c)-(iv), (d)-(i)
- (3) (a)-(iv), (b)-(iii), (c)-(ii), (d)-(i)
- (4) (a)-(iv), (b)-(ii), (c)-(iii), (d)-(i)

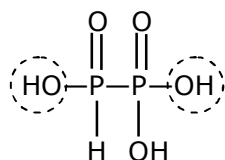
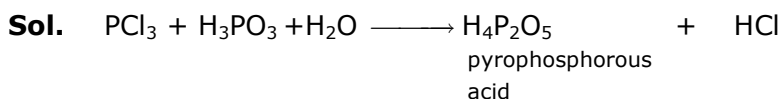
Ans. (3)

- Sol.** ⇒ Cis – Platin $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$ used in treatment of cancer.
 ⇒ Chlorophyll is complex of Mg
 ⇒ Vitamin B₁₂ is a complex of Co
 ⇒ Grubb's catalyst are a series of catalyst containing ruthenium

11. The number of ionisable hydrogens present in the product obtained from a reaction of phosphorus trichloride and phosphonic acid is :

- (1) 3
- (2) 1
- (3) 0
- (4) 2

Ans. (4)



Structure of pyrophosphorous acid shows that it has two acidic or ionisable hydrogen.

12. A certain orbital has no angular nodes and two radial nodes. The orbital is:

- (1) 2p (2) 3p (3) 2s (4) 3s

Ans. (4)

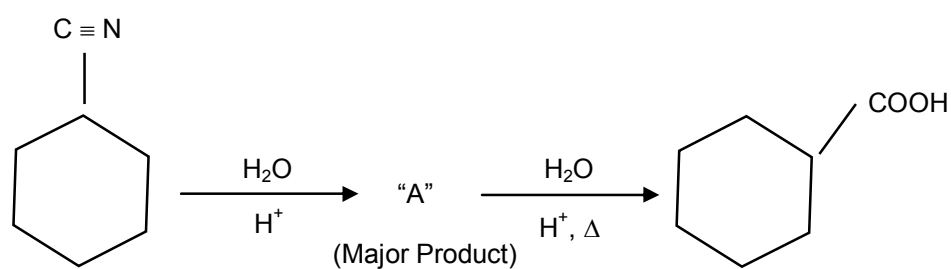
Sol. No angular nodes $\Rightarrow l = 0$

$$\text{Radial nodes} = n - l - 1 = n - 0 - 1 = 2$$

$$n = 3$$

Ans. 3S

13.

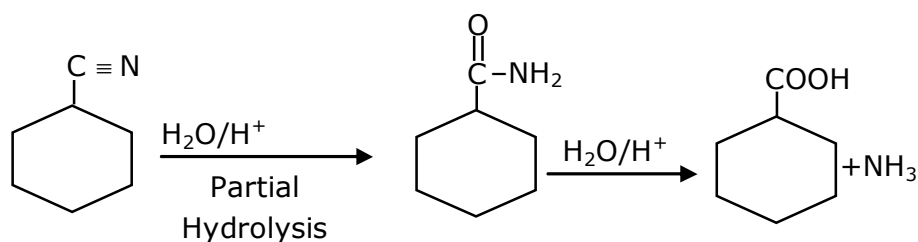


Consider the above chemical reaction and identify product "A" :

- (1)
- (2)
- (3)
- (4)

Ans. (3)

Sol.



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14. Given below are two statements: One is labelled as Assertion A and the other is labeled as Reason R:

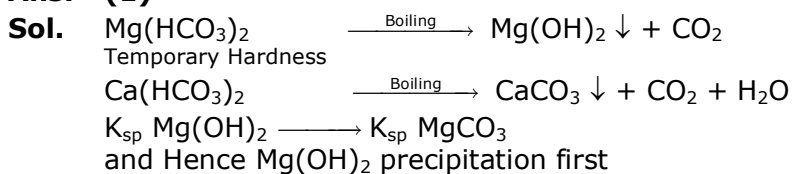
Assertion A: During the boiling of water having temporary hardness, $\text{Mg}(\text{HCO}_3)_2$ is converted to MgCO_3 .

Reason R: The solubility product of $\text{Mg}(\text{OH})_2$ is greater than that of MgCO_3 .

In the light of the above statements, choose the most appropriate answer from the options given below.

- (1) A is false but R is true
(2) Both A and R are true and R is the correct explanation of A.
(3) Both A and R are true but R is NOT the correct explanation of A
(4) A is true but R is false.

Ans. (1)



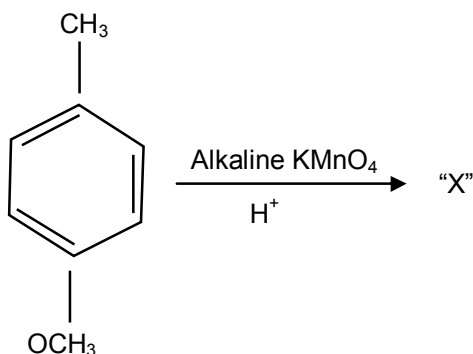
15. The chemical is added to reduce the melting point of the reaction mixture during the extraction of aluminium is :

- (1) Cryolite (2) Calamine (3) Kaolite (4) Bauxite

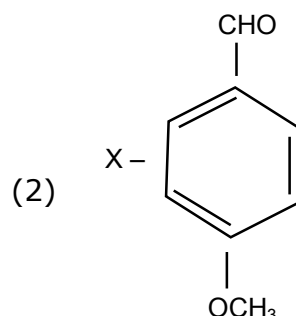
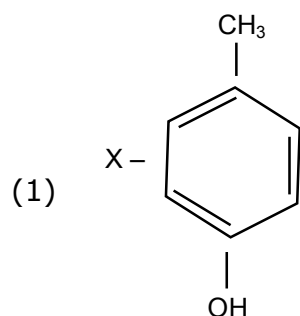
Ans. (1)

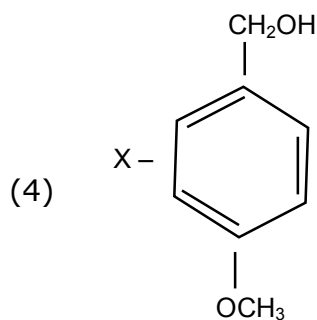
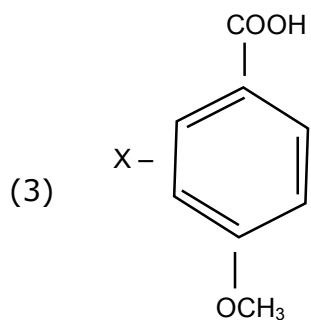
Sol. For reducing the melting point of Alumina, Cryolite i.e. Na_3AlF_6 is added.

16.



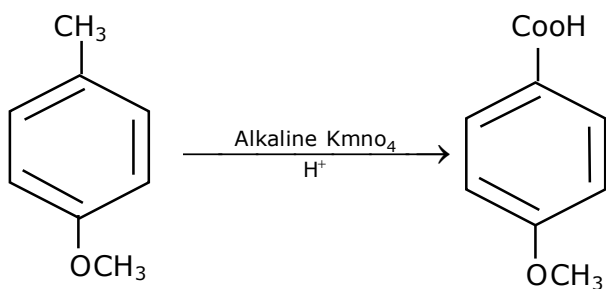
Considering the above chemical reaction, identify the product "X" :



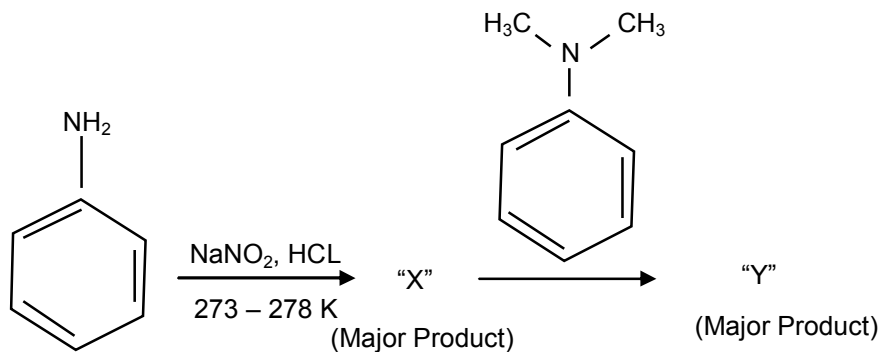


Ans. (3)

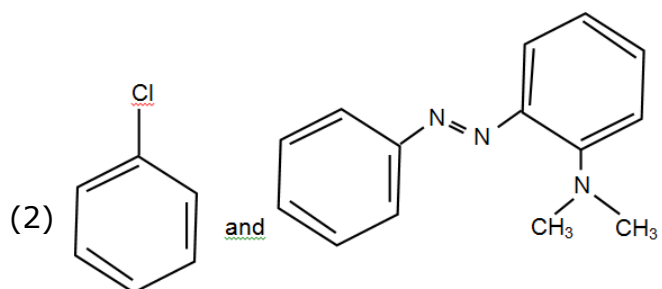
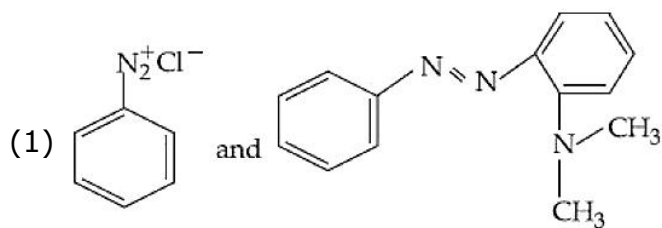
Sol.



17.

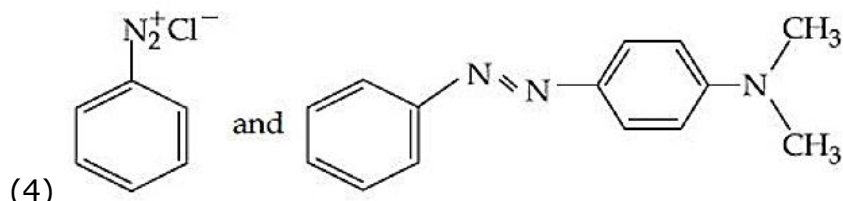
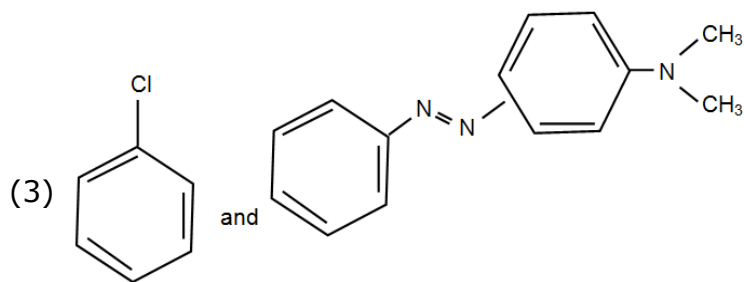


Considering the above reaction, X and Y respectively are :



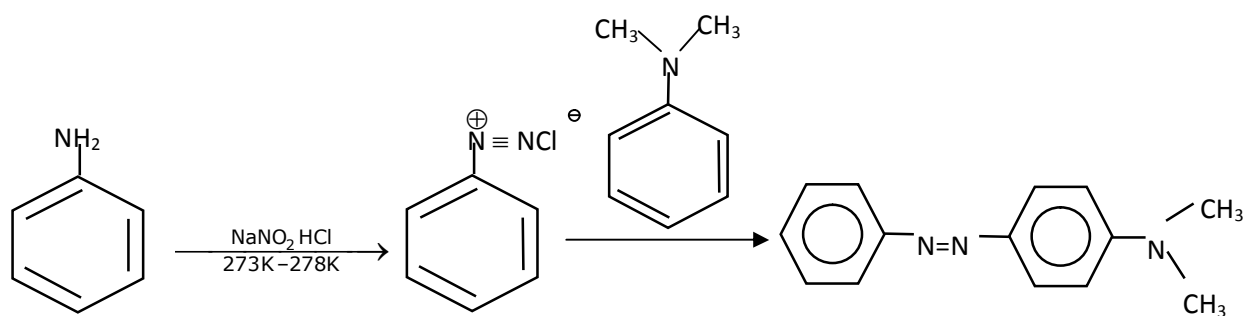
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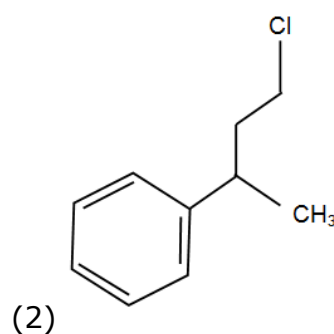
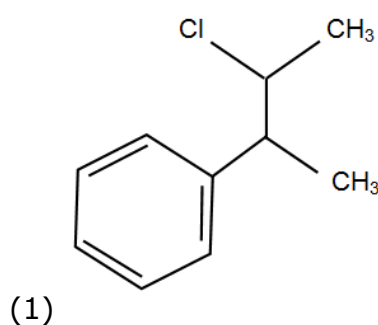


Ans. (4)

Sol.

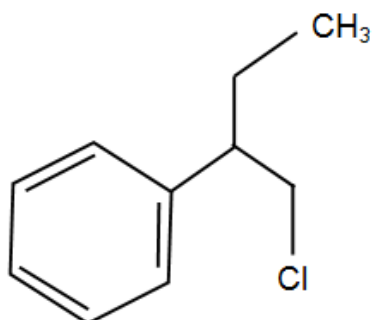


18. Reaction of Grignard reagent, C_2H_5MgBr with C_8H_8O followed by hydrolysis gives compound "A" which reacts instantly with Lucas reagent to give compound B, $C_{10}H_{13}Cl$. The Compound B is :

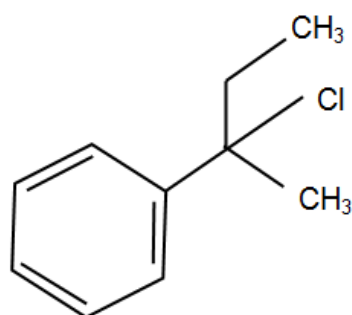


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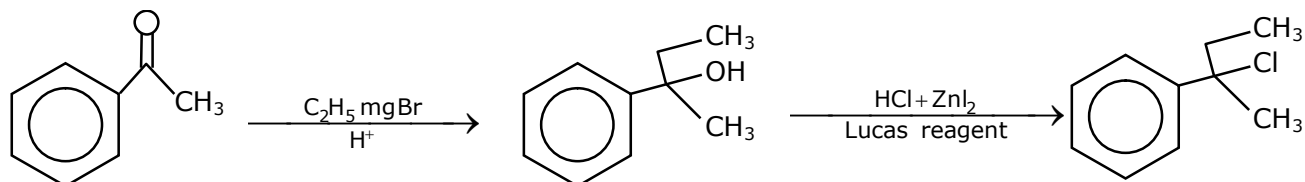
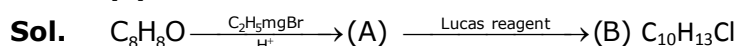


(3)



(4)

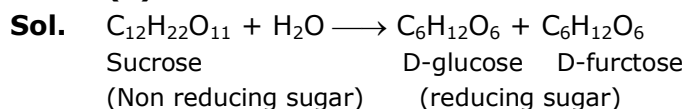
Ans. (4)



19. A non-reducing sugar "A" hydrolyses to give two reducing mono saccharides. Sugar A is:

- (1) Glucose (2) Fructose (3) Sucrose (4) Galactose

Ans. (3)



20. Match List-I with List-II :

List-I

(Process)

- (a) Deacon's process
 (b) Contact process
 (c) Cracking of hydrocarbons
 (d) Hydrogenation of vegetables oils

List-II

(Catalyst)

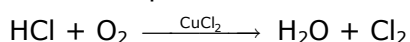
- (i) ZSM-5
 (ii) $CuCl_2$
 (iii) Particles 'Ni'
 (iv) V_2O_5

Choose the most appropriate answer from the option given below:

- (1) (a)-(i), (b)-(iii), (c)-(ii), (d)-(iv) (2) (a)-(iv), (b)-(ii), (c)-(i), (d)-(iii)
 (3) (a)-(ii), (b)-(iv), (c)-(i), (d)-(iii) (4) (a)-(iii), (b)-(i), (c)-(iv), (d)-(ii)

Ans. (3)

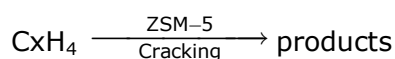
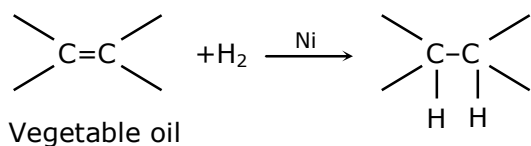
Sol. Deacon's process is used for industrial preparation of Chlorine gas



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Contact process is used for industrial preparation of sulphuric acid & V_2O_5 in catalyst involved in the process.



SECTION - B

1. 2 molal solution of a weak acid HA has a freezing point of 3.885°C . The degree of dissociation of this acid is _____ $\times 10^{-3}$. (Round off to the Nearest Integer).
[Given : Molal depression constant of water = $1.85 \text{ K kg mol}^{-1}$ Freezing point of pure water = 0°C]

Ans. 50

Sol. $T_{f \text{ sol.}} = -3.885^\circ\text{C}$

$$\Delta T_f = +3.885 = i \times k_f \times m$$

$$3.885 = i \times 1.85 \times 2$$

$$i = \frac{3.885}{1.85 \times 2} = [1 + \alpha]$$

$$\alpha = \frac{0.185}{3.7} = 0.05 = 50 \times 10^{-3}$$

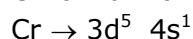
Ans. 50

2. The total number of unpaired electrons present in the complex $\text{K}_3[\text{Cr}(\text{oxalate})_3]$ is _____.

Ans. (3)

Sol. $\text{K}_3[\text{Cr}(\text{OH})_3]$

Chromium & in + 3 oxidation state



$\text{Cr}^{3+} \rightarrow 3d^3$ 3 unpaired electron the hybridisation of chromium in the complex is d^2sp^3

3. AX is a covalent diatomic molecule where A and X are second row elements of periodic table. Based on Molecular orbital theory, the bond order of AX is 2.5. The total number of electrons in AX is _____. (Round off to the Nearest Integer).

Ans. (15)

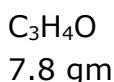
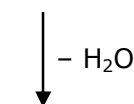
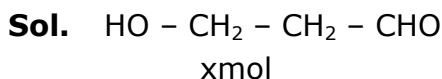
Sol. The comp. AX is NO its bond order is 2.5 & it has total 15 electrons

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4. _____ grams of 3-Hydroxy propanal (MW = 74) must be dehydrated to produce 7.8 g of acrolein (MW = 56) (C₃H₄O) if the percentage yield is 64. (Round off to the Nearest Integer). [Given : Atomic masses : C : 12.0 u, H : 1.0 u, O : 16.0 u]

Ans. 16



$$\frac{7.8}{56} = 0.14 \text{ mol}$$

$$\% \text{ yield} = \frac{7.8 / 56}{x} \times 100 = 64$$

$$x = \frac{7.8 \times 100}{56 \times 64} = \frac{780}{56 \times 64} \text{ mol}$$

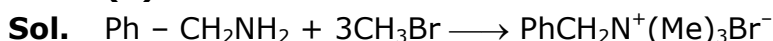
$$W_{\text{Reactant}} = \frac{780}{56 \times 64} \times 74 = 16.11 \text{ gm}$$

5. A reaction of 0.1 mole of Benzylamine with bromomethane gave 23 g of Benzyl trimethyl ammonium bromide. The number of moles of bromomethane consumed in this reaction are $n \times 10^{-1}$, when $n =$ _____. (Round off to the Nearest Integer).

[Given : Atomic masses : C : 12.0 u, H : 1.0 u, N : 14.0 u, Br : 80.0 u]

Given : 4.00

Ans. (3)



$$0.1 \text{ mol} \qquad \qquad \frac{23 \text{ g}}{230} = 0.1 \text{ mol}$$

$$\therefore \text{ moles of CH}_3\text{Br} = 0.3 = 3 \times 10^{-1} \text{ mol}$$

6. 2 NO(g) + Cl₂ (g) ⇌ 2 NOCl(s)

This reaction was studied at –10°C and the following data was obtained.

Run	[NO] ₀	[Cl ₂] ₀	r ₀
1	0.10	0.10	0.18
2	0.10	0.20	0.35
3	0.20	0.20	1.40

[NO]₀ and [Cl₂]₀ are the initial concentrations and r₀ is the initial reaction rate.

The overall order of the reaction is _____. (Round off to the Nearest Integer).

Given : 1.00

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Ans. (3)

Sol. Exp. (I) $0.18 = K(0.1)^x(0.1)^y$ (1) ☐

Exp. (II) $0.35 = K(0.1)^x(0.2)^y$ (2)

Exp. (III) $1.40 = K(0.2)^x(0.2)^y$ (3)

(2) ÷ (3)

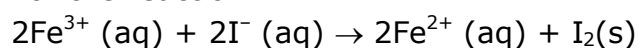
$$\frac{0.35}{1.40} = \frac{K \times (0.1)^x(0.2)^y}{K(0.2)^x(0.2)^y}$$

$$\frac{1}{4} = \left(\frac{1}{2}\right)^x \Rightarrow x = 2$$

(1) ÷ (2)

$$\frac{1}{2} = \left(\frac{1}{2}\right)^y \Rightarrow y = 1$$

7. For the reaction



The magnitude of the standard molar free energy change,

$\Delta_r G_m^{\circ} = -$ _____ kJ (Round off the Nearest Integer).

$$\left[\begin{array}{l} E^{\circ}_{\text{Fe}^{2+}/\text{Fe}(\text{s})} = -0.440 \text{ V}; E^{\circ}_{\text{Fe}^{3+}/\text{Fe}(\text{s})} = -0.036 \text{ V} \\ E^{\circ}_{\text{I}_2/2\text{I}^{-}} = 0.539 \text{ V}; F = 96500 \text{ C} \end{array} \right]$$

Ans. 45 kJ



$$1 \times E^{\circ}_{\text{Fe}^{3+}/\text{Fe}^{2+}} + 2 \times E^{\circ}_{\text{Fe}^{2+}/\text{Fe}} = 3 \times E^{\circ}_{\text{Fe}^{3+}/\text{Fe}}$$

$$E^{\circ}_{\text{Fe}^{3+}/\text{Fe}^{2+}} = 3 \times (-0.036) - 2 \times (-0.44)$$

$$= -0.108 + 0.88$$

$$= 0.772 \text{ V}$$

$$E^{\circ}_{\text{cell}} = E^{\circ}_{\text{Fe}^{3+}/\text{Fe}^{2+}} + E^{\circ}_{\text{I}^{-}/\text{I}_2}$$

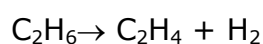
$$= 0.772 - 0.539 = 0.233 \text{ V}$$

$$\Delta G^{\circ} = nFE^{\circ}_{\text{cell}}$$

$$= +2 \times 96500 \times 0.233$$

$$= 44969 \text{ J} = 44.9 \text{ kJ} \approx 45 \text{ kJ}$$

8. For the reaction



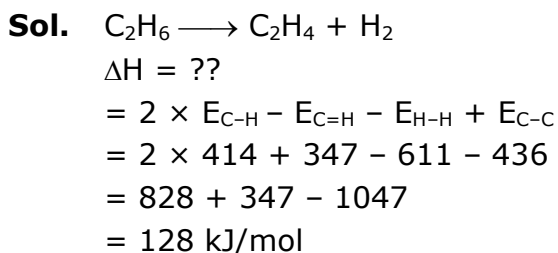
The reaction enthalpy $\Delta_r H =$ _____ kJ mol⁻¹. Round off to the Nearest Integer).

[Given: Bond enthalpies in kJ mol⁻¹; C - C : 347, C = C : 611; C - H : 414; H - H ; 436]

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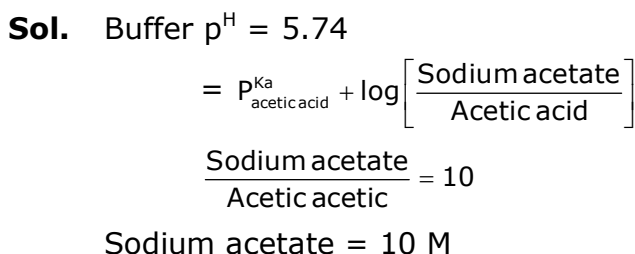
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Ans. 128 kJ/mol



- 9.** In order to prepare a buffer solution of pH 5.74, sodium acetate is added to acetic acid. If the concentration of acetic acid in the buffer is 1.0 M, the concentration of sodium acetate in the buffer is _____ M. (Round off to the Nearest Integer).
[Given: pK_a (acetic acid) = 4.74]

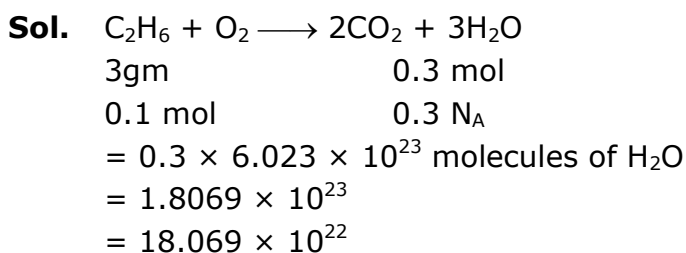
Ans. 10



- 10.** Complete combustion of 3g of ethane gives $x \times 10^{22}$ molecules of water. The value of x is _____. [Round off to the Nearest Integer].
[Use: $N_A = 6.023 \times 10^{23}$; Atomic masses in u : C : 12.0; O : 16.0 : H : 1.0]

Given :18

Ans. 18



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