

CUET UG (Chemistry) - 21 May 2025 Shift 2

Question1

What is the mass percentage of NaCl in the solution if 1.75g of NaCl is dissolved in 5.85g of water.

1. 23.02
2. 29.9
3. 23.98
4. 25.00

Options:

- A. 1
- B. 2
- C. 3
- D. 4

Answer: A

Solution:

Solution – Mass percentage of a component of a solution is defined as:

$$\text{Mass percentage} = \frac{\text{Mass of the component in the solution}}{\text{Total mass of the solution}} \times 100$$

For mass percentage of NaCl in solution, it is given

Mass of NaCl = 1.75g (Mass of component)

Mass of water = 5.85g

Total mass of the solution = 1.75 + 5.85 = 7.60 g

Therefore, Mass percentage of NaCl = $(1.75 \div 7.60) \times 100 = 23.02 \%$

Question2

The aqueous solutions of the following salts were electrolyzed for 30 min with a current of 20 amp. Arrange the following in the increasing order of the amount of metal deposited at the cathode.

- (A) WCl_6
- (B) ZnSO_4
- (C) HfCl_4
- (D) AgNO_3

(Atomic mass of: W = 184 u, Zn = 65 u, Hf = 178 u and Ag = 108u)

Choose the correct answer from the options given below:

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

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

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

Options:

A. 1

B. 2

C. 3

D. 4

Answer: A

Solution:

Solution – According to **Faraday's second law of Electrolysis**: The amounts of different substances liberated by the same quantity of electricity passing through the electrolytic solution are proportional to their chemical equivalent weights (Atomic Mass of Metal ÷ Number of electrons required to reduce the cation). Aqueous solutions of salts were electrolyzed for 30 mins with a current of 20 amp.

Given, atomic mass of W= 184 u, Zn = 65 u, Hf = 178 u, Ag = 108 u

The mass deposited is proportional to the ratio of the molar mass to the number of electrons per ion. Amount of metal deposited in each case is:

$$\text{For } \text{WCl}_6 : \quad \frac{184}{6} = 30.6 \text{ u}$$

$$\text{For } \text{ZnSO}_4 : \quad \frac{65}{2} = 32.5 \text{ u}$$

$$\text{For } \text{HfCl}_4 : \quad \frac{178}{4} = 44.5 \text{ u}$$

$$\text{For } \text{AgNO}_3 : \quad \frac{108}{1} = 108 \text{ u}$$

Increasing order of the amount of metal deposited at the cathode (A) < (B) < (C) < (D)

Question3

How much current is needed to pass for 1 sec for depositing a metal with a mass equal to double of its electrochemical equivalent?

1. 1 amp

2. 2 amp

3. 4 amp

4. 0.5 amp

Options:

A. 1

B. 2

C. 3

D. 4

Answer: B

Solution:

Solution- According to Faraday's first Law of Electrolysis:

The amount of chemical reaction which occurs at any electrode during electrolysis by a current is proportional to the quantity of electricity passed through the electrolyte (solution or melt).

m = Zit

where, **m** = mass of substance deposited

Z = electrochemical equivalent

I = current in ampere

t = time in secs

To deposit a metal with mass equal to double of its electrochemical equivalent,

it is given

$$m = 2 \times Z$$

$$t = 1 \text{ sec}$$

substituting these values in equation

$$m = Zit$$

$$2 \times Z = Z \times I \times 1$$

Solving this we get, **I (current needed) = 2 amp**

Question4

Choose the examples of first order reactions.

(A) Artificial radioactive decay of unstable nuclei

(B) Hydrogenation of ethylene

(C) Thermal decomposition of HI on gold surface

(D) Decomposition of N₂O

Choose the correct answer from the options given below:

1. (A), (B) and (D) only

2. (A), (B) and (C) only

3. (A), (B), (C) and (D)

4. (B), (C) and (D) only

Options:

A. 1

B. 2

C. 3

D. 4

Answer: A

Solution:

Artificial radioactive decay of unstable nuclei, Hydrogenation of ethylene and Decomposition of N₂O are examples of first order reaction

Thermal decomposition of HI on gold surface is an example of zero order reaction.

Question5

Which of the following amine do not respond to Hinsberg test?

1. Aniline

2. N-Methyl aniline

3. N,N-Dimethyl aniline

4. o-Toluidine

Options:

- A. 1
- B. 2
- C. 3
- D. 4

Answer: C

Solution:

Benzenesulphonyl chloride ($\text{C}_6\text{H}_5\text{SO}_2\text{Cl}$) which is also known as Hinsberg's reagent, reacts with primary and secondary amines to form sulphonamides. Tertiary amines do not react with benzenesulphonyl chloride. This property of amines reacting with benzenesulphonyl chloride in a different manner is used for the distinction of primary, secondary and tertiary amines and also for the separation of a mixture of amines.

N, N- dimethylaniline is an example of tertiary amine so it doesn't respond to Hinsberg Test.

Question6

Match List-I with List-II

List-I	List-II
(A) Coupling reaction	(I) Primary amines
(B) Hofmann's degradation	(II) Aromatic amines
(C) Isocyanide test	(III) Phenols and aromatic amines
(D) Diazonium salts	(IV) Amide to amine

Choose the correct answer from the options given below:

- 1. (A) - (I), (B) - (II), (C) - (III), (D) - (IV)
- 2. (A) - (I), (B) - (III), (C) - (II), (D) - (IV)
- 3. (A) - (III), (B) - (IV), (C) - (I), (D) - (II)
- 4. (A) - (III), (B) - (II), (C) - (IV), (D) - (I)

Options:

- A.
- 1
- B.
- 2
- C.
- 3
- D.
- 4

Answer: C

Solution:

Primary aromatic amines form arene **diazonium salts** which are stable for a short time in solution at low temperatures.

In **coupling reaction**, an aromatic diazonium salt and an activated aromatic compound (like **phenol** or aniline) to form an azo compound ($-\text{N}=\text{N}-$). Coupling reaction of aryldiazonium salts with phenols or **arylamines** give rise to the formation of azo dyes

Aliphatic and aromatic primary amines on heating with chloroform and ethanolic potassium hydroxide form **isocyanides** or carbylamine which are foul smelling substances. Secondary and tertiary amines do not show this reaction.

Hoffmann developed a method for preparation of primary amines by treating an amide with bromine in an aqueous or ethanolic solution of sodium hydroxide. It is an conversion of **amide to amine**.

Coupling reaction – phenols and aromatic amines

Hofmann's Degradation - Amide to amine

Isocyanide Test – Primary amines

Diazonium Salts – Aromatic amines

Question7

Toluene on chlorination in presence of UV light gives

1. Benzyl Chloride
2. Benzal Chloride
3. p- Chlorotoluene
4. o-Chlorotoluene

Options:

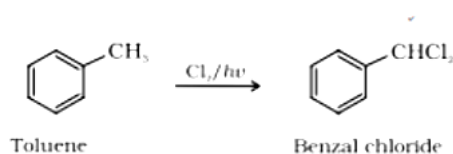
- A. 1
B. 2
C. 3
D. 4

Answer: B

Solution:

Toluene on chlorination in presence of UV light gives **Benzal Chloride**

Side chain chlorination of toluene gives benzal chloride



Question8

Which of the following amine will not undergo acylation reaction?

1. Methylamine
2. Ethylamine
3. N,N-Diethyl aniline
4. N-Methylmethanamine

Options:

- A. 1
B. 2
C. 3
D. 4

Answer: C

Solution:

Aliphatic and aromatic **primary and secondary amines** react with acid chlorides, anhydrides and esters by nucleophilic substitution reaction. This reaction is known as acylation. You can consider this reaction as the replacement of hydrogen atom of -NH_2 or N-H group by the acyl group. The products obtained by acylation reaction are known as amides. Amines also react with benzoyl chloride ($\text{C}_6\text{H}_5\text{COCl}$). This reaction is known as benzoylation.

N,N – diethyl aniline as it is a tertiary amine which will not undergo acylation reaction.

Question9

Which of the following compounds will respond to iodoform test?

(A) Acetone

(B) Ethyl methyl ketone

(C) Acetophenone

(D) Pentan-2-one

Choose the correct answer from the options given below:

1. (A), (B) and (C) only

2. (A), (B) and (D) only

3. (A), (B), (C) and (D)

4. (B), (C) and (D) only

Options:

A. 1

B. 2

C. 3

D. 4

Answer: C

Solution:

Iodoform reaction with sodium hypiodite is also used for detection of **CH_3CO group or $\text{CH}_3\text{CH}(\text{OH})$ group** which produces CH_3CO group on oxidation. A positive result is indicated by the formation of yellow precipitate of iodoform

Pentan-2-one, acetone, acetophenone, and ethyl methyl ketone are all positive for the iodoform test, meaning they will produce a yellow precipitate of iodoform

Question10

The compound resistant to oxidation is

1. Carbonic acid

2. t-Butanol

3. Ethyl alcohol

4. Methyl alcohol

Options:

A. 1

B. 2

C. 3

D. 4

Answer: B

Solution:

Oxidation of alcohols involves the formation of a carbon oxygen double bond with cleavage of an O-H and C-H bonds. Tertiary alcohols do not undergo oxidation reaction

t-butanol being a tertiary alcohol is resistant to oxidation

Question11

The final product of 1-chlorobutane and 2-chlorobutane when treated in KOH (alcohol) gives:

1. 1-butene

2. 3-butene

3. Both 1-butene & 2-butene

4. 2-butene

Options:

A. 1

B. 2

C. 3

D. 4

Answer: C

Solution:

When a haloalkane with beta-hydrogen atom is heated with alcoholic solution of potassium hydroxide, there is elimination of hydrogen atom from beta-carbon and a halogen atom from the alpha-carbon atom. As a result, an alkene is formed as a product. Since beta-hydrogen atom is involved in elimination, it is often called beta-elimination.

In mixture of 1-chlorobutane and 2-chlorobutane when treated with KOH (alcohol) elimination reaction occurs and it gives both **but-1-ene and but-2-ene**.

Question12

Vitamin B12 is a coordination compound of _____

1. Cu

2. Fe

3. Mg

4. Co

Options:

A. 1

B. 2

C. 3

D. 4

Answer: D

Solution:

Question 13

The reduction of cyclohexanone with LiAlH_4 will give:

1. Cyclohexanol
2. Cyclohexanaldehyde
3. Benzoic acid
4. Phenol

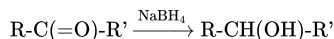
Options:

- A. 1
- B. 2
- C. 3
- D. 4

Answer: A

Solution:

Aldehydes and ketones are reduced to primary and secondary alcohols respectively by sodium borohydride (NaBH_4) or lithium aluminum hydride (LiAlH_4) as well as by catalytic hydrogenation. Aldehydes yield primary alcohols whereas ketones give secondary alcohols.



When cyclohexanone is treated with lithium aluminium hydride it will give cyclohexanol. Carbonyl group is converted to secondary alcohol OH group

Question 14

On the basis of following observations arrange the following compounds in increasing order of mol of AgCl precipitated per mol of the compound with excess of AgNO_3

	Formula	Secondary valences	Solution conductivity
(A)	$\text{PdCl}_2 \cdot 4\text{NH}_3$	4	1:2 electrolyte
(B)	$\text{NiCl}_4 \cdot 2\text{K}$	4	2:1 electrolyte
(C)	$\text{CoCl}_3 \cdot 4\text{NH}_3$	6	1:1 electrolyte
(D)	$\text{CrCl}_3 \cdot 6\text{H}_2\text{O}$	6	1:3 electrolyte

Choose the correct answer from the options given below:

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

Options:

- A.
- 1
- B.
- 2
- C.

3

D.

4

Answer: B

Solution:

According to **Werner's theory**:

Conductivity and secondary valences tell which chlorides are inside the coordination sphere (non-reactive) and which are ionic (free, react with Ag^+ to give AgCl).

$\text{PdCl}_2 \cdot 4\text{NH}_3$ has secondary valency of 4 and has 2 Chloride ions outside the coordination sphere so it will give 2 mol of AgCl

$\text{NiCl}_4 \cdot 2\text{K}$ has no chloride ions outside the coordination sphere so it will give no mol of AgCl

$\text{CoCl}_3 \cdot 4\text{NH}_3$ has 1 chloride ion outside the coordination sphere so it will give 1 mol of AgCl

$\text{CrCl}_3 \cdot 6\text{H}_2\text{O}$ will give 3 mol of AgCl

So, increasing order B, C, A, D

Question15

Acetaldehyde on treatment with Fehling's solution gives a precipitate of

1. Cu_2O
2. Cu
3. CuO
4. Cu_2O_2

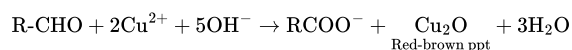
Options:

- A. 1
- B. 2
- C. 3
- D. 4

Answer: A

Solution:

Fehling reagent comprises of two solutions; Fehling solution A and Fehling solution B. Fehling solution A is aqueous copper sulphate and Fehling solution B is alkaline sodium potassium tartarate (Rochelle salt). These two solutions are mixed in equal amounts before test. On heating an aldehyde with Fehling's reagent, a reddish-brown precipitate of **Cu_2O** is obtained



Question16

Which type of amine produces N_2 when treated with HONO ?

1. Primary amine
2. Secondary amine
3. Tertiary amine
4. Quaternary ammonium salt

Options:

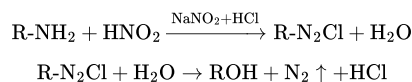
- A. 1

- B. 2
C. 3
D. 4

Answer: A

Solution:

Primary aliphatic amines react with nitrous acid to form aliphatic diazonium salts which being unstable, liberate nitrogen gas quantitatively and alcohols. Quantitative evolution of nitrogen is used in estimation of amino acids and proteins



Question17

Reaction of phenol with chloroform in the presence of sodium hydroxide gives salicylaldehyde. The reaction is known as

1. Reimer-Tiemann reaction
2. Kolbe's reaction
3. Williamson synthesis
4. Claisen Smith Condensation reaction

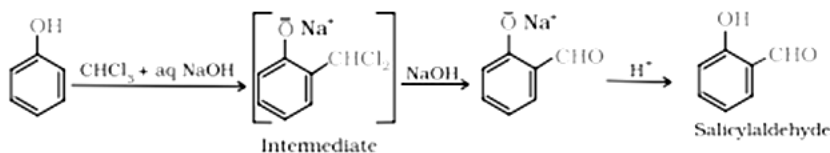
Options:

- A. 1
B. 2
C. 3
D. 4

Answer: A

Solution:

On treating phenol with chloroform in the presence of sodium hydroxide, a -CHO group is introduced at ortho position of benzene ring. This reaction is known as **Reimer - Tiemann reaction**. The intermediate substituted benzal chloride is hydrolysed in the presence of alkali to produce salicylaldehyde



Question18

The Grignard reagent can be prepared by using magnesium in dry ether on

1. C₂H₅OH
2. C₂H₅Br
3. C₂H₆
4. C₂H₅NO₂

Options:

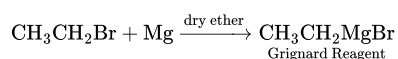
- A. 1
- B. 2
- C. 3
- D. 4

Answer: B

Solution:

Organo-metallic compounds discovered by Victor Grignard in 1900 is alkyl magnesium halide, RMgX , referred as Grignard Reagents. These reagents are obtained by the reaction of haloalkanes with magnesium metal in dry ether.

Ethyl bromide can be used with Magnesium in dry ether to prepare Grignard reagent.



Question19

The correct order of increasing acidic strength is

- (A) Ethanol
- (B) Phenol
- (C) Chloroacetic acid
- (D) Acetic acid

Choose the correct answer from the options given below:

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

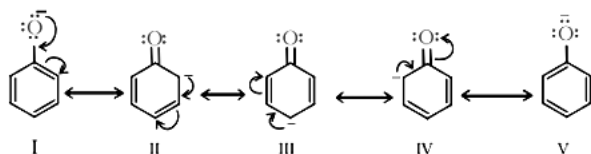
Options:

- A. 1
- B. 2
- C. 3
- D. 4

Answer: A

Solution:

The reaction of phenol with aqueous sodium hydroxide indicates that phenols are stronger acids than alcohols and water. In alkoxide ion, the negative charge is localized on oxygen while in phenoxide ion, the charge is delocalized. The delocalization of negative charge (structures I-V) makes phenoxide ion more stable and favors the ionization of phenol.



Carboxylic acids are weaker than mineral acids, but they are stronger acids than alcohols and many simple phenols. Substituents may affect the stability of the conjugate base and thus, also affect the acidity of the carboxylic acids. Electron withdrawing groups increase the acidity of carboxylic acids by stabilising the

conjugate base through delocalisation of the negative charge by inductive and/or resonance effects. Conversely, electron donating groups decrease the acidity by destabilising the conjugate base.

(Chloroacetic acid) — strongest acid here, since the electron-withdrawing chlorine atom stabilizes the conjugate base via $-I$ effect

Increasing order of acidity Ethanol < Phenol < Acetic acid < Chloroacetic acid

Question 20

Which of the following statements are correct?

- (A) A solution which obeys Raoult's law strictly is called an ideal solution.
- (B) A solution which shows deviations from Raoult's law is called a real solution.
- (C) If T_b is the boiling point of the solvent and T is the boiling point of the solution, then the difference $T_b - T$ is called the boiling point depression.
- (D) The elevation of boiling point is related to the lowering of vapor pressure.

Choose the correct answer from the options given below:

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

Options:

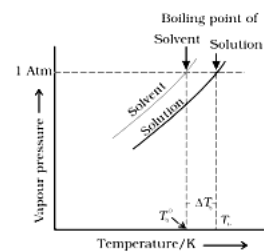
- A. 1
- B. 2
- C. 3
- D. 4

Answer: A

Solution:

A solution that obeys **Raoult's law** at all concentrations and temperatures is called an **ideal solution**. A solution that **deviates** from Raoult's law (either positively or negatively) is called a **real solution**

Let T_b^0 be the boiling point of pure solvent and T_b be the boiling point of solution. The increase in the boiling point $\Delta T_b = T_b - T_b^0$ is known as **elevation of boiling point**.



ig. 2.7: The vapour pressure curve for solutions below the curve for pure water. The diagram shows that ΔT_b denotes the elevation of boiling point of a solvent in solution.

Boiling point elevation occurs because adding a solute **lowers the vapor pressure**, requiring a **higher temperature** to boil.

A, B, D statements are correct

Question21

Match List-I with List-II

List-I	List-II
Materials	Conductivity (S m^{-1})
(A) Gold	(I) 1.0×10^{-16}
(B) Germanium	(II) 1.2×10
(C) Glass	(III) 4.5×10^3
(D) Graphite	(VI) 2.0

Choose the correct answer from the options given below:

- 1. (A) - (I), (B) - (II), (C) - (III), (D) - (IV)
- 2. (A) - (I), (B) - (III), (C) - (II), (D) - (IV)
- 3. (A) - (I), (B) - (II), (C) - (IV), (D) - (III)
- 4. (A) - (III), (B) - (IV), (C) - (I), (D) - (II)

Options:

- A.
1
- B.
2
- C.
3
- D.

Answer: D

Solution:

Material	Conductivity/ S m^{-1}	Material	Conductivity/ S m^{-1}
Conductors		Aqueous Solutions	
Sodium	2.1×10^3	Pure water	3.5×10^{-5}
Copper	5.9×10^3	0.1 M HCl	3.91
Silver	6.2×10^3	0.01M KCl	0.14
Gold	4.5×10^3	0.01M NaCl	0.12
Iron	1.0×10^3	0.1 M HAc	0.047
Graphite	1.2×10	0.01M HAc	0.016
Insulators		Semiconductors	
Glass	1.0×10^{-16}	CuO	1×10^{-7}
Teflon	1.0×10^{-18}	Si	1.5×10^{-2}
		Ge	2.0

Gold – 4.5×10^{-3}

Germanium – 2.0

Glass – 1.0×10^{-16}

Graphite – 1.2×10

Question22

Arrange the following compounds in increasing order of reactivity towards Nucleophilic Substitution Reaction

(A) Chlorobenzene

(B) 4- Nitrochlorobenzene

(C) 2,4 - Dinitrochlorobenzene

(D) 2,4,6-Trinitrochloronitrobenzene

Choose the correct answer from the options given below:

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

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

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

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

Options:

A. 1

B. 2

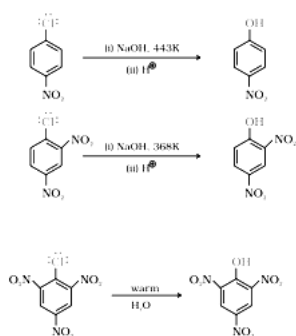
C. 3

D. 4

Answer: A

Solution:

Aryl halides are extremely less reactive towards nucleophilic substitution. The presence of an electron withdrawing group (-NO₂) at ortho- and para-positions increases the reactivity of haloarenes.



The presence of nitro group at ortho- and para-positions withdraws the electron density from the benzene ring and thus facilitates the attack of the nucleophile on haloarene. The carbanion thus formed is stabilized through resonance.

Increasing order of reactivity is Chlorobenzene < 4-Nitrochlorobenzene < 2,4-Dinitrochlorobenzene < 2,4,6-Trinitrochlorobenzene

Question23

Decreasing order of basicity for the following compounds:

- (A) Ethylamine
- (B) Diethylamine
- (C) Ammonia
- (D) Benzenamine

Choose the correct answer from the options given below:

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

Options:

- A. 1
- B. 2
- C. 3
- D. 4

Answer: C

Solution:

Larger the value of Kb or smaller the value of pKb, stronger is the base. Alkylamines are stronger bases than ammonia. Aniline or other arylamines, the -NH₂ group is attached directly to the benzene ring. It results in the unshared electron pair on nitrogen atom to be in conjugation with the benzene ring and thus making it less available for protonation

The decreasing order of basic strength of the above amines and ammonia follows the following order: (C₂H₅)₂NH > C₂H₅NH₂ > NH₃ > C₆H₅NH₂

Diethylamine (N-ethylethanamine pkb 3.00) > (A) Ethylamine (pkb 3.29) > (C) Ammonia > (D) Benzenamine (pkb 9.38)

Question24

Match the wavelength of light absorbed given in List-I with the color of light absorbed in List-II

List-I	List-II
Wavelength of light absorbed(nm)	Colour of light absorbed
(A) 535	(I) Yellow
(B) 475	(II) Red
(C) 600	(III) Blue
(D) 498	(IV) Blue Green

Choose the correct answer from the options given below:

1. (A) - (I), (B) - (II), (C) - (III), (D) - (IV)
2. (A) - (I), (B) - (III), (C) - (II), (D) - (IV)
3. (A) - (IV), (B) - (II), (C) - (I), (D) - (III)
4. (A) - (IV), (B) - (I), (C) - (II), (D) - (III)

Options:

A.

1

B.

2

C.

3

D.

4

Answer: B

Solution:

The increasing order of wavelength for VIBGYOR (i.e., from shortest to longest wavelength) is:

Violet < Indigo < Blue < Green < Yellow < Orange < Red

RED – 600

YELLOW – 535

BLUE GREEN – 498

BLUE – 475

Question25

CuSO_4 is colorless but $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ is blue in color. Which of the following statements is **incorrect** al

$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$?

1. in $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ water act as ligand
2. crystal field splitting takes place in $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$
3. presence of SO_4^{2-} ion in coordination sphere imparts the color of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$
4. *d-d* transition takes place in $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$

Options:

- A. 1
- B. 2
- C. 3
- D. 4

Answer: C

Solution:

In $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ the water molecules act as ligands around the Cu^{2+} ion, producing a crystal-field splitting of the d-orbitals and allowing d-d transitions that give the blue color. The SO_4^{2-} ion is present as a counter-ion and are not present in the coordination sphere and doesn't impart colour to copper sulphate.

Question 26

Which of the following statements, for the reaction of type $A \rightarrow B$, are correct?

- (A) The initial rates for a second order reaction depend on the square of the concentration of the reactant
- (B) The half-life is the time for half of the reactant to be consumed
- (C) The expression for rate of second order reaction is $r = k[2A]^2$
- (D) The half-life of a second-order reaction depends on the initial concentration

Choose the correct answer from the options given below:

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

Options:

- A. 1
- B. 2
- C. 3
- D. 4

Answer: A

Solution:

For the given reaction $A \rightarrow B$ The order of a rate law is the sum of the exponents of its concentration terms.

The initial rate for a second order reaction depends on the square of the concentration of the reactant.

For a second-order reaction:

$$\text{Rate} = k[A]^2 (\text{expression for rate of second order reaction})$$

So, the rate depends on the square of the concentration of A.

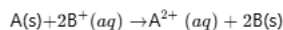
The half-life of a reaction is the time in which the concentration of a reactant is reduced to one half of its initial concentration. It is represented as $t_{1/2}$ which can also mean the half of the reactant is consumed. Half life of a second order reaction depends on initial concentration.

$$t_{1/2} = \frac{1}{k[A]_0}$$

A, B and D statements are correct.

Question27

If the E_{cell}° of the given hypothetical cell reaction is 0.046 V, the value of $\log K_c$ for this reaction at 298 K would be:



1. 1.556
2. 15.56
3. 1.12
4. 3.92

Options:

- A. 1
- B. 2
- C. 3
- D. 4

Answer: A

Solution:

The reversible work done by a galvanic cell is equal to decrease in its Gibbs energy.

If the emf of the cell is E and nF is the total charge passed, then $\Delta G = -nFE_{\text{cell}}$.

If concentration of all species is unity, $E_{\text{cell}} = E_{\text{cell}}^{\circ}$, so $\Delta G^{\circ} = -nFE_{\text{cell}}^{\circ}$.

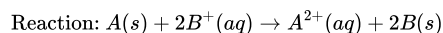
$$\Delta G^{\circ} = -RT \ln K$$

$$-nFE_{\text{cell}}^{\circ} = -RT \ln K$$

$$\ln K = \frac{nFE_{\text{cell}}^{\circ}}{RT}$$

$$\log K = \frac{nFE_{\text{cell}}^{\circ}}{2.303RT}$$

$$\text{Given: } E_{\text{cell}}^{\circ} = 0.046 \text{ V, } T = 298 \text{ K}$$



$$n = 2$$

Substituting values of $n = 2$, $F = 96500 \text{ C/mol}$, $R = 8.314 \text{ J/mol.K}$ and $T = 298 \text{ K}$

$$\log K = \frac{2 \times 96500 \times 0.046}{2.303 \times 8.314 \times 298}$$

$$\log K = 1.556$$

Question28

The following statements predict the temperature dependence on the rate of reaction:

- (A) Increase in temperature increases the rate of reaction.
- (B) Increase in temperature decreases the rate of reaction.
- (C) Increase in temperature by 10 °C doubles the reaction rate.
- (D) An increase in temperature by 10 °C triples the rate of reaction.

Choose the correct answer from the options given below:

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

Options:

- A. 1
- B. 2
- C. 3
- D. 4

Answer: A

Solution:

Most of the chemical reactions are accelerated by increase in temperature. For a chemical reaction with rise in temperature by 10° , the rate constant is nearly doubled. The temperature dependence of the rate of a chemical reaction can be accurately explained by Arrhenius equation

Question29

What is the oxidation number of the metal of $[\text{Co}(\text{H}_2\text{O})(\text{CN})(\text{ox})_2]^{2-}$ coordination entity?

1. +5
2. +1
3. +3
- 4.+2

Options:

- A. 1
- B. 2
- C. 3
- D. 4

Answer: C

Solution:

Let x = oxidation number of Co.

Charge on ligands:

H_2O (neutral) = 0, $\text{CN}^- = -1$, Oxalate ($\text{C}_2\text{O}_4^{2-}$) = -2

Since there are two oxalate ions: $2 \times (-2) = -4$

Total charge on complex = $x + 0 + (-1) + (-4)$

$$x - 5 = -2$$

$$x = +3$$

Question30

The order of kinetics of $\text{S}_{\text{N}}1$ reactions is:

1. First

2. Zero

3. Second

4. Third

Options:

A. 1

B. 2

C. 3

D. 4

Answer: A

Solution:

SN1 reactions **follow first-order kinetics**, meaning the reaction rate is dependent only on the concentration of the substrate, not the nucleophile. The rate law for an SN1 reaction is expressed as $\text{Rate} = k[\text{substrate}]$

Where k is the rate constant and $[\text{Substrate}]$ is the concentration of the substrate. This is because the first step, the formation of a carbocation intermediate, is the rate-determining step and only involves the substrate and not the nucleophile

Question31

The units of rate of reaction and rate constant are identical for a

1. Fractional order reaction

2. Zero order reaction

3. First order reaction

4. Second order reaction

Options:

A. 1

B. 2

C. 3

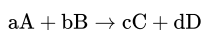
D. 4

Answer: B

Solution:

The rate of a reaction can be defined as the change in concentration of a reactant or product in unit time. Units of rate are concentration/time

For a general reaction



$$\text{Rate} = k[A]^x[B]^y$$

Where $x + y = n = \text{order of the reaction}$

$$k = \frac{\text{Rate}}{[A]^x[B]^y}$$
$$= \frac{\text{concentration}}{\text{time}} \times \frac{1}{(\text{concentration})^n} \quad (\text{where } [A] = [B])$$

For a zero-order reaction $n=0$ so Unit of rate constant k in zero order reaction becomes concentration/time same as unit of rate.

Question32

Which of the following is not true with reference to evaporation of liquid?

- 1. The liquids having low inter-molecular forces evaporate faster.**
- 2. The higher the temperature, the higher is the rate of evaporation.**
- 3. Larger the surface area, larger is the rate of evaporation.**
- 4. The evaporation rate follows the order of Water > Alcohol > Ether.**

Options:

- A. 1
- B. 2
- C. 3
- D. 4

Answer: D

Solution:

First 3 statements are true.

Weaker intermolecular forces make it easier for molecules to escape into vapor and evaporate. Higher temperature gives molecules more kinetic energy to escape and evaporate faster. Larger the surface area, larger is the rate of evaporation as more molecules are exposed to air, so evaporation increases.

The correct order of evaporation rate is **Ether > Alcohol > Water**, because ether has the weakest intermolecular forces and water the strongest (due to hydrogen bonding).

Question 33

The rate of a first order reaction at a constant temperature

- 1. Increases as the reaction proceeds**
- 2. Decreases as the reaction proceeds**
- 3. May increase or decrease as the reaction proceeds**
- 4. Remains constant as the reaction proceeds**

Options:

- A. 1
- B. 2
- C. 3
- D. 4

Answer: B

Solution:

The rate of the reaction for first order reaction is proportional to the first power of the concentration of the reactant R. For example, $R \rightarrow P$

$$\text{Rate} = -\frac{d[R]}{dt} = k[R]$$

As concentration of reactant decreases as reaction proceeds Rate also decreases

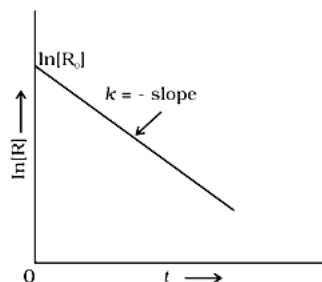
Integrating this equation we get,

When $t = 0$, $R = [R]_0$, where $[R]_0$ is the initial concentration of the reactant.

$$\ln \frac{[R]}{[R]_0} = -kt$$

Taking antilog of both sides

$$[R] = [R]_0 e^{-kt}$$



Question34

"Wood spirit " is

1. Methanol
2. Ethanol
3. Propanol
4. Phenol

Options:

- A. 1
- B. 2
- C. 3
- D. 4

Answer: A

Solution:

Wood spirit is another name for **methanol or methyl alcohol**

Question35

Match solution in List-I with nature of solute and solvent List-II

List-I	List-II
Solution	Solute and Solvent
(A) Amalgam of mercury in sodium	(I) solid in liquid
(B) An alloy	(II) liquid in gas
(C) A saturated solution of KCl	(III) liquid in solid
(D) Chloroform in nitrogen gas	(IV) Copper in gold

Choose the correct answer from the options given below:

1. (A) - (I), (B) - (II), (C) - (III), (D) - (IV)
2. (A) - (I), (B) - (III), (C) - (II), (D) - (IV)
3. (A) - (I), (B) - (II), (C) - (IV), (D) - (III)
4. (A) - (III), (B) - (IV), (C) - (I), (D) - (II)

Options:

A.

1

B.

2

C.

3

D.

4

Answer: D

Solution:

Amalgam of mercury in sodium → Mercury (liquid) dissolved in solid sodium

An alloy → Example: copper in gold
→ **solid in solid**

A saturated solution of KCl → KCl (solid) in water (liquid)

Chloroform in nitrogen gas → Chloroform (liquid) dispersed in gas

Question36

The reagent used to convert propanol to 1-bromopropane is:

1. PBr₃
2. Br₂
3. CH₃Br
4. CBr₃

Options:

A. 1

B. 2

C. 3

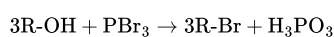
D. 4

Answer: A

Solution:

Alkyl halides are best prepared from alcohols, which are easily accessible. The hydroxyl group of an alcohol is replaced by halogen on reaction with concentrated halogen acids, phosphorus halides or thionyl chloride.

PBr₃ can be used as the reagent to convert propanol to 1-bromopropane.



(General Reaction:) $3\text{R-OH} + \text{PX}_3 \rightarrow 3\text{R-X} + \text{H}_3\text{PO}_3$ ($X = \text{Cl, Br}$)

Question37

Colligative properties are applicable to:

1. dilute solution
2. solid solutions
3. concentrated solutions
4. only aqueous solution

Options:

- A. 1
- B. 2
- C. 3
- D. 4

Answer: A

Solution:

Properties that depend on the number of solute particles irrespective of their nature relative to the total number of particles present in the solution. Such properties are called colligative properties. Colligative properties are applicable for ideal dilute solutions. These relationships are derived based on the **ideal solution assumption** (Raoult's law holds true) and **dilute condition**, where solute-solute and solute-solvent interactions are negligible compared to solvent-solvent interactions.

Question38

Which one represents the correct reduction reaction for the $\text{Cu}^{2+}|\text{Cu}$ half-cell?

1. $\text{Cu}^{2+}(\text{aq}) + 2\text{e}^{-} \rightarrow \text{Cu}(\text{s})$
2. $\text{Cu}^{2+}(\text{aq}) \rightarrow \text{Cu}(\text{s}) + 2\text{e}^{-}$
3. $\text{Cu}(\text{s}) \rightarrow \text{Cu}(\text{aq}) + 2\text{e}^{-}$
4. $\text{Cu}^{2+}(\text{aq}) + 2\text{e}^{-} \rightarrow \text{Cu}^{+}(\text{s}) + \text{e}^{-}$

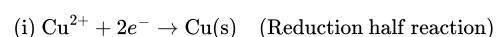
Options:

- A. 1
- B. 2
- C. 3
- D. 4

Answer: A

Solution:

Reduction is a process where a chemical species **gains electrons**. The reduction half reaction occurs on the copper electrode.



Question39

The Lucas reagent will react fastest with:

1. $(\text{CH}_3)_3\text{COH}$
2. $\text{CH}_3\text{CH}_2\text{OH}$
3. $\text{CH}_3(\text{CH}_2)_2\text{OH}$
4. $\text{CH}_3\text{CH}(\text{CH}_3)\text{OH}$

Options:

- A. 1
- B. 2
- C. 3
- D. 4

Answer: A

Solution:

Alcohols are soluble in Lucas reagent (conc. HCl and ZnCl_2) while their halides are immiscible and produce turbidity in solution. In case of tertiary alcohols, turbidity is produced immediately as they form the halides easily. Primary alcohols do not produce turbidity at room temperature.

Tertiary alcohol $(\text{CH}_3)_3\text{COH}$ reacts fastest with lucas reagent

Question40

Match List-I with List-II

List-I	List-II
(A) Fermentation of glucose	(I) Invertase
(B) Methanol	(II) Zymase
(C) Ethanol	(III) Poisonous even in small amounts
(D) Fermentation of sucrose	(IV) Solvent in paint industry

Choose the correct answer from the options given below:

1. (A) - (I), (B) - (II), (C) - (III), (D) - (IV)
2. (A) - (II), (B) - (III), (C) - (IV), (D) - (I)
3. (A) - (I), (B) - (II), (C) - (IV), (D) - (III)
4. (A) - (III), (B) - (IV), (C) - (I), (D) - (II)

Options:

- A.
- 1
- B.
- 2
- C.
- 3
- D.
- 4

Answer: B

Solution:

Zymase is the enzyme that converts glucose to ethanol and CO₂ during fermentation.

Methanol is highly toxic; even small quantities can cause blindness or death.

Ethanol is used as an industrial solvent, including in paints and varnishes.

Invertase enzyme hydrolyses sucrose into glucose and fructose before fermentation.

Question41

Read the passage carefully and answer the questions

Biomolecules are the organic compounds present as an essential constituents of living organisms in different cells. The molecules are generally termed as macromolecules, which are carbohydrates, enzymes, nucleic acids, amino acids and proteins etc. Carbohydrates are classified as sugars and non-sugars include sucrose, glucose, fructose, starch and cellulose. Enzymes are coordinated with various chemical reactions in nucleic acid. Nucleic acids are found in living organisms made up of proteins and natural polymers. Two types that are generally found in biological systems are DNA and RNA nucleic acid. Amino acids are bifunctional groups of carboxyl and amino groups. Proteins are a class of biologically important compounds. They are crucial to virtually all processes in living systems. Some of them are hormones, which serve as chemical messengers that coordinate certain biochemical activities.

Cane sugar on boiling with HCl or H₂SO₄ hydrolysis yields

- 1. Two molecules of glucose**
- 2. 1:1 mixture of Glucose and Fructose**
- 3. Two molecules of fructose**
- 4. No Reaction**

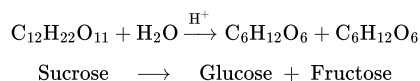
Options:

- A. 1
- B. 2
- C. 3
- D. 4

Answer: B

Solution:

Sucrose (Cane sugar): If sucrose is boiled with dilute HCl or H₂SO₄ in alcoholic solution, **glucose and fructose are obtained in equal amounts.**



Question42

Read the passage carefully and answer the questions

Biomolecules are the organic compounds present as an essential constituents of living organisms in different cells. The molecules are generally termed as macromolecules, which are carbohydrates, enzymes, nucleic acids, amino acids and proteins etc. Carbohydrates are classified as sugars and non-sugars include sucrose, glucose, fructose, starch and cellulose. Enzymes are coordinated with various chemical reactions in nucleic acid. Nucleic acids are found in living organisms made up of proteins and natural polymers. Two types that are generally found in biological systems are DNA and RNA nucleic acid. Amino acids are bifunctional groups of carboxyl and amino groups. Proteins are a class of biologically important compounds. They are crucial to virtually all processes in living systems. Some of them are hormones, which serve as chemical messengers that coordinate certain biochemical activities.

Glucose when treated with Bromine water forms

1. Saccharic acid
2. Gluconic acid
3. Glyceric acid
4. Glycerldehyde

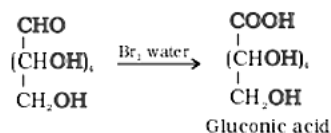
Options:

- A. 1
- B. 2
- C. 3
- D. 4

Answer: B

Solution:

Glucose gets oxidised to six carbon carboxylic acid (gluconic acid) on reaction with a mild oxidising agent like bromine water. This indicates that the carbonyl group is present as an aldehydic group.



Question43

Read the passage carefully and answer the questions

Biomolecules are the organic compounds present as an essential constituents of living organisms in different cells. The molecules are generally termed as macromolecules, which are carbohydrates, enzymes, nucleic acids, amino acids and proteins etc. Carbohydrates are classified as sugars and non-sugars include sucrose, glucose, fructose, starch and cellulose. Enzymes are coordinated with various chemical reactions in nucleic acid. Nucleic acids are found in living organisms made up of proteins and natural polymers. Two types that are generally found in biological systems are DNA and RNA nucleic acid. Amino acids are bifunctional groups of carboxyl and amino groups. Proteins are a class of biologically important compounds. They are crucial to virtually all processes in living systems. Some of them are hormones, which serve as chemical messengers that coordinate certain biochemical activities.

Starch is a polymer of saccharides known as

- 1. Glucose**
- 2. Fructose**
- 3. Sucrose**
- 4. Cellulose**

Options:

- A. 1**
- B. 2**
- C. 3**
- D. 4**

Answer: A

Solution:

Starch is the main storage polysaccharide of plants.

It is the most important dietary source for human beings.

It is a polymer of α -glucose and consists of two components — Amylose and Amylopectin.

Question44

Read the passage carefully and answer the questions

Biomolecules are the organic compounds present as an essential constituents of living organisms in different cells. The molecules are generally termed as macromolecules, which are carbohydrates, enzymes, nucleic acids, amino acids and proteins etc. Carbohydrates are classified as sugars and non-sugars include sucrose, glucose, fructose, starch and cellulose. Enzymes are coordinated with various chemical reactions in nucleic acid. Nucleic acids are found in living organisms made up of proteins and natural polymers. Two types that are generally found in biological systems are DNA and RNA nucleic acid. Amino acids are bifunctional groups of carboxyl and amino groups. Proteins are a class of biologically important compounds. They are crucial to virtually all processes in living systems. Some of them are hormones, which serve as chemical messengers that coordinate certain biochemical activities.

The disaccharide present in milk is known as

1. Sucrose
2. Lactose
3. Maltose
4. Galactose

Options:

- A. 1
- B. 2
- C. 3
- D. 4

Answer: B

Solution:

Lactose: It is more commonly known as milk sugar since this disaccharide is found in milk.

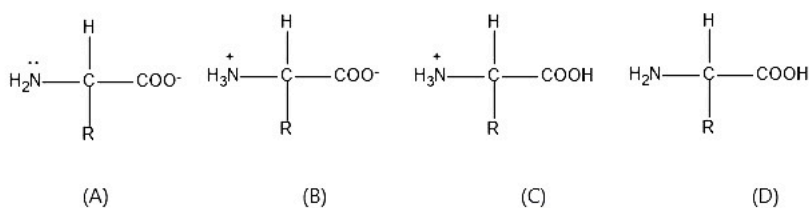
It is composed of β -D-galactose and β -D-glucose.

Question45

Read the passage carefully and answer the questions

Biomolecules are the organic compounds present as an essential constituents of living organisms in different cells. The molecules are generally termed as macromolecules, which are carbohydrates, enzymes, nucleic acids, amino acids and proteins etc. Carbohydrates are classified as sugars and non-sugars include sucrose, glucose, fructose, starch and cellulose. Enzymes are coordinated with various chemical reactions in nucleic acid. Nucleic acids are found in living organisms made up of proteins and natural polymers. Two types that are generally found in biological systems are DNA and RNA nucleic acid. Amino acids are bifunctional groups of carboxyl and amino groups. Proteins are a class of biologically important compounds. They are crucial to virtually all processes in living systems. Some of them are hormones, which serve as chemical messengers that coordinate certain biochemical activities.

The zwitterionic form of amino acid is



1. (A)
2. (B)
3. (C)
4. (D)

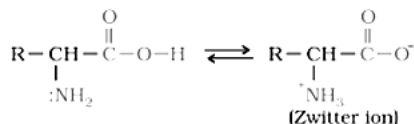
Options:

- A. 1
- B. 2
- C. 3
- D. 4

Answer: B

Solution:

In amino acids there is presence of both acidic (carboxyl group) and basic (amino group) groups in the same molecule. In aqueous solution, the carboxyl group can lose a proton and amino group can accept a proton, giving rise to a dipolar ion known as zwitter ion. This is neutral but contains both positive and negative charges. In zwitter ionic form, amino acids show amphoteric behaviour as they react both with acids and bases.



Question46

Read the passage carefully and answer the questions

The transition metals and their compounds are known for their catalytic activity. This activity is ascribed to their ability to adopt multiple oxidation states and to form complexes. Vanadium(V) oxide (in Contact Process), finely divided iron, and nickel (in Catalytic Hydrogenation) are some of the examples. Catalysts at a solid surface involve the formation of bonds between reactant molecules and atoms of the surface of the catalyst (first row transition metals utilise 3d and 4s electrons for bonding). This has the effect of increasing the concentration of the reactants at the catalyst surface and also weakening of the bonds in the reacting molecules (the activation energy is lowering). Also because the transition metal ions can change their oxidation states, they become more effective as catalysts.

In the Wacker process the oxidation of ethene to ethanal is catalysed by _____

1. TiCl_4
2. PdCl_2
3. MnO_2
4. KMnO_4

Options:

- A. 1
- B. 2
- C. 3
- D. 4

Answer: B

Solution:

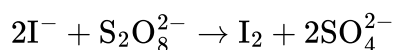
Acetaldehyde is prepared industrially by oxidation of ethene in the presence of palladium(II) chloride and cupric chloride — this is known as the Wacker process.

Question47

Read the passage carefully and answer the questions

The transition metals and their compounds are known for their catalytic activity. This activity is ascribed to their ability to adopt multiple oxidation states and to form complexes. Vanadium(V) oxide (in Contact Process), finely divided iron, and nickel (in Catalytic Hydrogenation) are some of the examples. Catalysts at a solid surface involve the formation of bonds between reactant molecules and atoms of the surface of the catalyst (first row transition metals utilise 3d and 4s electrons for bonding). This has the effect of increasing the concentration of the reactants at the catalyst surface and also weakening of the bonds in the reacting molecules (the activation energy is lowering). Also because the transition metal ions can change their oxidation states, they become more effective as catalysts.

Reaction between iodide and persulphate ions takes place as follows:



Which of the following catalyses the above reaction?

1. Fe^{2+}
2. Fe^{3+}
3. Mn^{2+}
4. Sn^{2+}

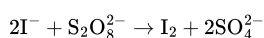
Options:

- A. 1
- B. 2
- C. 3
- D. 4

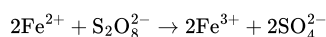
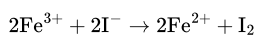
Answer: A

Solution:

Iron(III) catalyzes the reaction between iodide and persulphate ions.



An explanation of this catalytic action is as follows:



Question48

Read the passage carefully and answer the questions

The transition metals and their compounds are known for their catalytic activity. This activity is ascribed to their ability to adopt multiple oxidation states and to form complexes. Vanadium(V) oxide (in Contact Process), finely divided iron, and nickel (in Catalytic Hydrogenation) are some of the examples. Catalysts at a solid surface involve the formation of bonds between reactant molecules and atoms of the surface of the catalyst (first row transition metals utilise 3d and 4s electrons for bonding). This has the effect of increasing the concentration of the reactants at the catalyst surface and also weakening of the bonds in the reacting molecules (the activation energy is lowering). Also because the transition metal ions can change their oxidation states, they become more effective as catalysts.

Which of the following catalyses the oxidation of SO₂ in the manufacture of sulphuric acid?

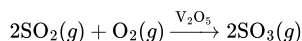
1. Vanadium(V) oxide
2. finely divided iron
3. nickel
4. Vanadium(II) oxide

Options:

- A. 1
- B. 2
- C. 3
- D. 4

Answer: A

Solution:



Sulphuric acid is one of the most important industrial chemicals worldwide.

It is manufactured by the Contact Process.

The key step is the catalytic oxidation of SO₂ with O₂ to produce SO₃.

In presence of Vanadium(V) oxide

Question49

Read the passage carefully and answer the questions

The transition metals and their compounds are known for their catalytic activity. This activity is ascribed to their ability to adopt multiple oxidation states and to form complexes. Vanadium(V) oxide (in Contact Process), finely divided iron, and nickel (in Catalytic Hydrogenation) are some of the examples. Catalysts at a solid surface involve the formation of bonds between reactant molecules and atoms of the surface of the catalyst (first row transition metals utilise 3d and 4s electrons for bonding). This has the effect of increasing the concentration of the reactants at the catalyst surface and also weakening of the bonds in the reacting molecules (the activation energy is lowering). Also because the transition metal ions can change their oxidation states, they become more effective as catalysts.

$\text{TiCl}_4 + \text{Al}(\text{CH}_3)_3$ is used as a catalyst in:

1. Ziegler-Natta catalysis
2. Haber's process
3. Contact process
4. Sandmeyer reaction

Options:

- A. 1
- B. 2
- C. 3
- D. 4

Answer: A

Solution:

High density polythene is formed when addition polymerization of ethene takes place in a hydrocarbon solvent in the presence of a catalyst such as triethylaluminium or trimethylaluminium and titanium tetrachloride (Ziegler-Natta catalyst) at a temperature of 333 K to 343 K and under a pressure of 6-7 atmospheres

Question50

Read the passage carefully and answer the questions

The transition metals and their compounds are known for their catalytic activity. This activity is ascribed to their ability to adopt multiple oxidation states and to form complexes. Vanadium(V) oxide (in Contact Process), finely divided iron, and nickel (in Catalytic Hydrogenation) are some of the examples. Catalysts at a solid surface involve the formation of bonds between reactant molecules and atoms of the surface of the catalyst (first row transition metals utilise 3d

and 4s electrons for bonding). This has the effect of increasing the concentration of the reactants at the catalyst surface and also weakening of the bonds in the reacting molecules (the activation energy is lowering). Also because the transition metal ions can change their oxidation states, they become more effective as catalysts.

Which of the following is incorrect about the ability of catalytic action of transition metals?

1. ability to form complexes
2. ability to adopt multiple oxidation states
3. weakening of the bonds in the reacting molecules-catalyst complex
4. formation of bonds between reactant molecules and catalyst

Options:

- A. 1
- B. 2
- C. 3
- D. 4

Answer: C

Solution:

The transition metals and their compounds are known for their catalytic activity. This activity is ascribed to their **ability to adopt multiple oxidation states and to form complexes**. Catalysts at a solid surface involve the **formation of bonds between reactant molecules and atoms of the surface of the catalyst**. This has the effect of increasing the concentration of the reactants at the catalyst surface and also weakening of the bonds in the reacting molecules. It doesn't weaken bond between reacting molecules and catalyst complex but inter bonds between reacting molecules.
