CUET (UG) Exam Paper 2025

National Testing Agency

CHEMISTRY

(Solved)

[This includes Questions pertaining to Domain Specific Subject only]

Time Allowed: 60 Mins. **Total Questions : 50** **Maximum Marks: 250**

General Instructions :

(i) *This Test contains 50 questions.*

(ii) *Five (5) marks will be given for each correct answer.*

(iii) *One (1) mark will be deducted for each incorrect answer.*

(iv) *If more than one option is chosen, then it will be considered as an incorrect answer.*

(v) *Unanswered questions will be given no mark.*

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

(1) Cu_2O **(2)** Cu

(3) CuO **(4)** Cu_2O_2

Ans. Option (1) is correct.

Explanation: Fehling's test – Reaction with acetaldehyde

Concept:

Fehling's test is a chemical test used to differentiate aldehydes from ketones. It is based on the reduction of copper(II) ions (Cu^{2+}) to copper(I) oxide (Cu_2O).

Observation:

When acetaldehyde (CH_3CHO) is treated with Fehling's solution, a brick-red precipitate is formed.

Reaction:

$CH_3CHO + 2Cu^{2+} + 5OH^- \rightarrow CH_3COO^- + Cu_2O\downarrow + 3H_2O$

- CH_3CHO = Acetaldehyde (Aldehyde)
- Cu^{2+} = From Fehling's solution
- $Cu_2O\downarrow$ = Brick-red precipitate (Cuprous oxide)

Conclusion:

Acetaldehyde gives a positive Fehling's test by forming a red precipitate of Cu_2O (Copper(I) oxide).

2. 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

Ans. Option (3) is correct.

Explanation: The Hinsberg test is used to distinguish between primary, secondary and tertiary amines.

- Primary amines react with a Hinsberg reagent (benzenesulfonyl chloride) to form a sulfonamide that is soluble in alkali.
- Secondary amines form a sulfonamide that is insoluble in alkali.
- Tertiary amines do not react with Hinsberg reagents.

N,N-Dimethyl aniline is a tertiary amine; thus, it does not respond to the Hinsberg test.

Therefore, the correct option is: 3. N,N-Dimethyl aniline.

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

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

(2) $Cu^{2+}(aq) + Cu(s) \rightarrow 2e^-$

(3) $Cu(s) + Cu(aq) \rightarrow 2e^-$

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

Ans. Option (1) is correct.

Explanation: In a reduction reaction, a species gains electrons. In the $Cu^{2+}|Cu$ half-cell:

- Cu^{2+} ions in aqueous solution gain 2 electrons to form solid copper (Cu).
- This is a standard reduction half-reaction.

Thus, the correct representation of the reduction reaction is:

$Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$

4. 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)

Ans. Option (3) is correct.

Explanation: **Basicity order:**

Diethylamine > Ethylamine > Ammonia > Benzenamine

Reason (brief):
- Alkyl groups increase basicity via +I effect.
- Aromatic amines (like benzenamine) are less basic due to resonance. i.e. More alkyl groups = more basicity
  Aromatic ring (in benzenamine) = lowers basicity
- Ammonia has no alkyl group, so it is less basic than aliphatic amines.

5. Which type of amine produces N_2 when treated with HONO?

(1) Primary amine
(2) Secondary amine
(3) Tertiary amine
(4) Quaternary ammonium salt

Ans. Option (1) is correct.

Explanation: Primary amines react with nitrous acid (HONO) to form diazonium salts, which decompose to release nitrogen gas (N_2).
Primary amine + HONO → Diazonium salt → N_2 gas + other products

6. 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 N_2O.

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

Ans. Option (3) is correct.

Explanation: **(A) Artificial radioactive decay of unstable nuclei**
- Always follows first-order kinetics.
- Rate depends only on the number of undecayed nuclei.
- Rate law:

$$\text{Rate} = k[N]$$

(B) Hydrogenation of ethylene
- Although it is a surface reaction, under certain conditions it behaves like a pseudo-first-order reaction.
- When H_2 is in large excess, the rate depends only on ethylene concentration.
- Hence, it is treated as first-order with respect to ethylene.

(C) Thermal decomposition of HI on gold surface
- Occurs through an adsorbed HI intermediate, often showing first-order behaviour.
- Particularly valid when HI is in low concentration, and surface is saturated.

(D) Decomposition of N_2O
- A gas-phase unimolecular reaction, classic example of first-order kinetics.
- **Rate law:**

$$\text{Rate} = k[N_2O]$$

7. Which of the following statements for the reaction of type A → 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

Ans. Option (3) is correct.

Explanation: (A) True — Rate of 2nd order reaction: $r = k[A]^2$, depends on square of concentration.
(B) True — half-life $t_{1/2}$ is the time taken for concentration to reduce to half its initial value. This is true for all reaction orders.
(C) True — Correct rate expression: $r = k[2A]^2$ (here 2A means stoichiometry).
(D) True — For 2nd order: $t_{1/2} = 1/(k[A]_0)$ → depends on initial concentration.

8. Vitamin B_{12} is a coordination compound of _____

(1) Cu **(2)** Fe
(3) Mg **(4)** Co

Ans. Option (4) is correct.

Explanation: Vitamin B_{12} is a coordination compound of Cobalt (Co).
It contains a central cobalt ion bonded to a corrin ring structure.

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

(1) PBr_3 **(2)** Br_2
(3) CH_3Br **(4)** CBr_3

Ans. Option (1) is correct.

Explanation: PBr_3 (phosphorus tribromide) is used to convert 1° alcohols like propanol to alkyl bromides (e.g., 1-bromopropane) via substitution.
Reaction:
$CH_3CH_2CH_2OH + PBr_3 \rightarrow CH_3CH_2CH_2Br + H_3PO_3$

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

(1) C_2H_5OH **(2)** C_2H_5Br
(3) C_2H_6 **(4)** $C_2H_5NO_2$

Ans. Option (2) is correct.

Explanation: Grignard reagent is prepared by reacting alkyl halide (like C_2H_5Br) with magnesium in dry ether.
Reaction:
$C_2H_5Br + Mg \rightarrow C_2H_5MgBr$ (Grignard reagent)

11. 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)

Ans. Option (1) is correct.

Explanation: Acidity trend (increasing order):
1. **Ethanol (A):** Very weak acid (alcohol).
2. **Phenol (B):** More acidic than ethanol due to resonance stabilisation of phenoxide ion.
3. **Acetic acid (D):** A carboxylic acid, stronger acid than phenol.
4. **Chloroacetic acid (C):** Stronger than acetic acid because of the electron-withdrawing effect of chlorine.

12. 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 = 108 u)

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)

Ans. Option (1) is correct.

Explanation: **Faraday's First Law:**
The amount of metal deposited is directly proportional to the equivalent weight of the metal.
Mass of metal deposited $\propto$ Atomic mass/n
Where:
- n = number of electrons involved in reduction at cathode.

Let's calculate equivalent weights:
(A) WCl_6
- Metal = W (Tungsten), Atomic mass = 184 u
- Oxidation state = $+6 \rightarrow n = 6$
- Equivalent weight = $\frac{184}{6} \approx 30.67$

(B) $ZnSO_4$
- Metal = Zn, Atomic mass = 65 u
- Oxidation state = $+2 \rightarrow n = 2$
- Equivalent weight = $\frac{65}{2} = 32.5$

(C) $HfCl_4$
- Metal = Hf, Atomic mass = 178 u
- Oxidation state = $+4 \rightarrow n = 4$
- Equivalent weight = $\frac{178}{4} = 44.5$

(D) $AgNO_3$
- Metal = Ag, Atomic mass = 108 u
- Oxidation state = $+1 \rightarrow n = 1$
- Equivalent weight = $\frac{108}{1} = 108$

As mass $\propto$ equivalent weight:
- Lesser equivalent weight $\rightarrow$ less deposition
- Greater equivalent weight $\rightarrow$ more deposition

Order:
(A) < (B) < (C) < (D)

13. $CuSO_4$ is colourless but $CuSO_4.5H_2O$ is blue in colour. Which of the following statement statements is incorrect about the colour of $CuSO_4.5H_2O$?

(1) In $CuSO_4.5H_2O$ water act as ligand.
(2) Crystal field splitting takes place in $CuSO_4.5H_2O$.
(3) Presence of SO_4^{2-} ion in coordination sphere imparts the colour of $CuSO_4.5H_2O$.
(4) *d-d* transition takes place in $CuSO_4.5H_2O$.

Ans. Option (1) is correct.

Explanation: **(A)** Correct – Increasing temperature increases reaction rate (general rule in kinetics).
(B) Incorrect – Reaction rate does not decrease with temperature increase.
(C) Correct – A 10°C rise generally doubles the rate (approximate rule).
(D) Not always true – Tripling is not a general rule.

14. 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 decrease 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

Ans. Option (1) is correct.

Explanation: **(A)**True – Increasing temperature generally increases reaction rate.
(B) False – Rate does not decrease with temperature increase.
(C) True – Common rule of thumb: rate doubles for every 10°C rise.
(D) Not universally true – Tripling is not a standard rule.

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

(1) 23.02 **(2)** 29.9

(3) 23.98 **(4)** 25.00

Ans. Option (1) is correct.

Explanation: **Given:**

- Mass of NaCl = 1.75 g
- Mass of water = 5.85 g
- Total mass of solution = 1.75 + 5.85 = 7.60 g

Formula:

$$\text{Mass \% of NaCl} = \frac{1.75}{7.60} \times 100 = 23.02\%$$

16. 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 the Real solution

(C) If T_b is the boiling point of the solvent and T is the boiling point of the solution, the difference in the boiling points ($\Delta T_b = T_b - T$) is called the elevation of the boiling point.

(D) The elevation of the 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

Ans. Option (3) is correct.

Explanation: **(A)** Correct – Ideal solutions obey Raoult's law strictly.
(B) Correct – Solutions that deviate from Raoult's law are called real solutions.
(C) Correct – Boiling point elevation is calculated as $\Delta T_b = T_{solution} - T_{solvent}$.
(D) Correct – Boiling point elevation occurs due to lowering of vapour pressure.

17. 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

Ans. Option (2) is correct.

Explanation: For a first-order reaction, the rate depends on the concentration of the reactant, which decreases over time.

18. Match the wavelength of light absorbed given in List-I with the colour of light absorbed in List-II.

List-I Wavelength of light absorbed (nm)		List-II 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)

Ans. Option (2) is correct.

Explanation:

Wavelength (nm)	Colour
~400–450	Violet
~450–495	Blue/Blue-green
~495–570	Green/Yellow
~570–590	Yellow-Orange
~590–620	Orange-Red
~620–750	Red

19. Which of the following amines will not undergo acylation reaction?

(1) Methylamine

(2) Ethylamine

(3) N, N-Diethyl aniline

(4) N-Methylmethanamine

Ans. Option (3) is correct.

Explanation: Acylation reaction:
Acylation requires a lone pair on nitrogen that can attack the acyl group (RCOCl).

1. Methylamine – Primary amine → can undergo acylation
2. Ethylamine – Primary amine → can undergo acylation
3. N,N-Diethyl aniline – Tertiary aromatic amine → no H on nitrogen, lone pair delocalised → does NOT undergo acylation
4. N-Methylmethanamine – Secondary amine → can undergo acylation

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

List-I Solution		List-II 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) - (III), (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)

Ans. Option (4) is correct.

Explanation: **(A)** Amalgam of mercury in sodium → solid in liquid → (I).
(B) An alloy → Commonly copper in gold → (IV).

(C) A saturated solution of KCl → Solid KCl in water (solid in liquid) → (I).
(D) Chloroform in nitrogen gas → liquid in gas → (II)
None of the options exactly match this correct sequence; thus, technically none of the options are fully correct. However, Option 4 matches 3 out of 4 correctly, just that (A) is mismatched.

21. 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

$A(s) + 2(B)^+(aq) \rightarrow A^{2+}(aq) + 2B(s)$

(1) 1.556 **(2)** 15.56
(3) 1.12 **(7)** 3.92

Ans. Option (1) is correct.

Explanation: **Given:**
$E^\circ_{cell} = 0.046\,V$
$T = 298\,K$
Reaction:
$A(s) + 2B^+(aq) \rightarrow A^{2+}(aq) + 2B(s)$
We know:
$\Delta G^0 = -nF\,E^\circ_{cell} = -2.303\,RT\log K_c$
Where:
n = (2 electrons exchanged)
$F = 96500\,C/mol$
$R = 8.314\,J/mol$
$T = 298\,K$

$$\log K_c = \frac{nFE^\circ_{cell}}{2.303\,RT}$$

$$\log K_c = \frac{2 \times 96500 \times 0.046}{2.303 \times 8.314 \times 298} = \frac{8878}{5709.55} \approx 1.556$$

22. 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

Ans. Option (3) is correct.

Explanation: When alkyl halides are treated with alcoholic KOH, an elimination reaction (E_2) occurs, leading to the formation of alkenes.
For 1-chlorobutane:

$$CH_3 - CH_2 - CH_2 - CH_2Cl \xrightarrow{(alc.KOH)} CH_2 = CH - CH_2 - CH_3$$
(1-butene)

For 2-chlorobutane:

$$CH_3 - CHCl - CH_2 - CH_3 \xrightarrow{(alc.KOH)} CH_3 - CH = CH - CH_3$$
(2-butene)

Final Products:
- From 1-chlorobutane → 1-butene
- From 2-chlorobutane → 2-butene

23. The reduction of cyclohexanone with $LiAlH_4$ will give:

(1) Cyclohexanol **(2)** Cyclohexanaldehyde
(3) Benzoic acid **(4)** Phenol

Ans. Option (1) is correct.

Explanation: Lithium aluminium hydride ($LiAlH_4$) is a strong reducing agent that reduces ketones to secondary alcohols.
Reaction:
Cyclohexanone (a cyclic ketone) when reduced with $LiAlH_4$ yields cyclohexanol, a secondary alcohol.

24. The lucas reagent will react fastest with

(1) $(CH_3)_3COH$ **(2)** CH_3CH_2OH
(3) $CH_3(CH_2)_2OH$ **(4)** $CH_3CH(CH_3) - OH$

Ans. Option (1) is correct.

Explanation: Lucas reagent ($HCl + ZnCl_2$) reacts with alcohols to form alkyl chlorides via an S_N1 mechanism, where the rate depends on the stability of the carbocation.
Order of reactivity:
Tertiary alcohol > Secondary alcohol > Primary alcohol
1. $(CH_3)_3COH$ → Tertiary alcohol
2. CH_3CH_2OH → Primary alcohol
3. $CH_3(CH_2)_2OH$ → Primary alcohol
4. $CH_3CH(CH_3)OH$ → Secondary alcohol

Fastest reaction:
Tertiary alcohol reacts the fastest with a Lucas reagent.

25. Which of he 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.

Ans. Option (4) is correct.

Explanation:
- Liquids with low intermolecular forces evaporate faster — True
- Higher temperature increases evaporation — True
- Larger surface area increases evaporation — True
- Evaporation Rate Order: Ether > Alcohol > Water (as water has the strongest hydrogen bonding)

Correct Order:
Ether > Alcohol > Water

26. 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

Ans. Option (3) is correct.

Explanation: The iodoform test is given by:
- Methyl ketones ($R - CO - CH_3$)
- Alcohols with the structure $R - CH(OH) - CH_3$

Given Compounds:
(A) Acetone ($CH_3 - CO - CH_3$) → Methyl ketone → Gives iodoform test
(B) Ethyl methyl ketone ($CH_3 - CO - C_2H_5$) → Methyl ketone → Gives iodoform test
(C) Acetophenone ($C_6H_5 - CO - CH_3$) → Methyl ketone → Gives iodoform test
(D) Pentan-2-one ($CH_3 - CO - CH_2 - CH_2 - CH_3$) → Methyl ketone → Shows positive iodoform test

27. Match List-I with List-II.

List-I Materials		List-II 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	**IV.**	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)

Ans. Option () is correct.

Explanation: Gold → Excellent conductor → 4.5×10^3 S/m → (III).
Germanium → Semiconductor → 1.2×10 S/m → (II).
Glass → Insulator → 1.0×10^{-18} S/m → (I).
Graphite → Moderate conductor → 2.0 S/m → (IV).

28. What is the oxidation number of the metal of $[Co(H_2O)(CN)(ox)_2]^{2-}$ co-ordination entity?
(1) +5 **(2)** +1
(3) +3 **(4)** +2

Ans. Option (3) is correct.

Explanation: **Oxidation number calculation for:** $[Co(H_2O)(CN)(ox)_2]^{2-}$
Let the oxidation number of Co = x
- H_2O = neutral (0)
- CN^- = –1
- ox (oxalate, $C_2O_4^{2-}$) = –2 each → total = –4

Total charge equation:
$x + (0) + (-1) + 2(-2) = -2$
Simplifying:
$x - 1 - 4 = -2$
$x - 5 = -2$
$x = +3$

29. The compound resistant to oxidation is
(1) Carbonic acid **(2)** *t*-Butanol
(3) Ethyl alcohol **(4)** Methyl alcohol

Ans. Option (2) is correct.

Explanation: The compound resistant to oxidation is:
- **Carbonic acid:** Not relevant here, it is not an alcohol.
- ***t*-Butanol (tert-butanol):** A tertiary alcohol, which is highly resistant to oxidation.
- **Ethyl alcohol (ethanol):** Primary alcohol, easily oxidised to aldehyde and then acid.
- **Methyl alcohol (methanol):** Another primary alcohol, easily oxidised to formaldehyde and formic acid.

Thus, tert-butanol is resistant to oxidation.

30. 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)

Ans. Option (3) is correct.

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

31. 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)

Ans. Option (2) is correct.

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

32. "Wood spirit" is

(1) Methanol **(2)** Ethanol

(3) Propanol **(4)** Phenol

Ans. Option (1) is correct.

Explanation: "Wood spirit" is Methanol
Methanol is commonly known as "wood spirit" or "wood alcohol" because it was originally produced by the destructive distillation of wood.

33. 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

Ans. Option (2) is correct.

Explanation: The units of rate of reaction and rate constant are identical for a zero order reaction
For a zero order reaction,
Rate = $k[A]^0 = k$
Thus, units of rate constant (k) = units of rate of reaction, which is typically mol L^{-1} s^{-1}.

34. 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

Ans. Option (1) is correct.

Explanation: The reaction of phenol with chloroform ($CHCl_3$) in the presence of sodium hydroxide (NaOH) to yield salicylaldehyde is known as the Reimer–Tiemann reaction.
This reaction involves the ortho-formylation of phenol to form salicylaldehyde and is a classic example of electrophilic substitution.

35. 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

Ans. Option (2) is correct.

Explanation: **Given:**
- Time, t = 1s
- Mass deposited, m = 2 Z
- Electrochemical equivalent = Z

Formula (Faraday's First Law):
m = ZIt
Substitute the values:
2Z = Z.I.1
Divide both sides by Z:
$\Rightarrow$ I = 2A

36. Colligative properties are applicable to:

(1) dilute solution

(2) solid solutions

(3) concentrated solution

(4) only aqueous solution

Ans. Option (1) is correct.

Explanation: Colligative properties (like relative lowering of vapour pressure, boiling point elevation, freezing point depression and osmotic pressure) depend only on the number of solute particles and not their nature.
These properties are:
- Best observed in dilute solutions, where the ideal solution behaviour is followed.
- Not strictly valid for concentrated, solid or only aqueous solutions due to deviations from ideality.

37. Toluene on chlorination in presence of UV light gives

(1) Benzyl Chloride **(2)** Benzal Chloride

(3) *p*-Chlorotoluene **(4)** *o*-Chlorotoluene

Ans. Option (1) are correct.

Explanation: •Chlorination in the presence of UV light proceeds via a free radical mechanism.
- In toluene ($C_6H_5CH_3$), UV light facilitates substitution at the benzylic position (i.e., on the $-CH_3$ group), not on the aromatic ring.
- The hydrogen atom of the methyl group is replaced by chlorine to yield benzyl chloride ($C_6H_5CH_2Cl$).

Note: *p*-Chlorotoluene and *o*-Chlorotoluene are formed during electrophilic aromatic substitution (not free radical), typically without UV light.

38. The order of kinetics of S_N1 reactions is:

(1) First **(2)** Zero

(3) Second **(4)** Third

Ans. Option (1) is correct.

Explanation: • S_N1 stands for substitution nucleophilic unimolecular.
- The rate-determining step involves only one molecule: the alkyl halide, which forms a carbocation intermediate.
- Hence, the rate law is:

  Rate = k[Alkyl halide]
- It does not depend on the concentration of the nucleophile.

39. 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.	$PdCl_2.4NH_3$	4	1 : 2 electrolyte
B.	$NiCl_4.2K$	4	2 : 1 electrolyte
C.	$CoCl_3.4NH_3$	6	1 : 1 electrolyte
D.	$CrCl_3.6H_2O$	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)

Ans. Option (1) is correct.

Explanation:
(A) $PdCl_2 \cdot 4NH_3$
- Coordination number = 4
- Likely complex: $[Pd(NH_3)_4]Cl_2$
- Free Cl^- = 2 → reacts with $AgNO_3$
- 1:2 electrolyte → confirms 2 Cl^- outside
- AgCl formed = 2 mol

(B) $NiCl_2 \cdot 2K$
- Total ions: 3 ($2K^+ + [NiCl_2]^{2-}$) → 2:1 electrolyte
- Free Cl^- = 2
- AgCl formed = 2 mol

(C) $CoCl_3 \cdot 4NH_3$
- Coordination number = 6
- Likely complex: $[Co(NH_3)_4Cl]Cl_2$
- Free Cl^- = 2
- However, 1:1 electrolyte → Only 1 free ion pair
- Hence, likely: $[Co(NH_3)_4Cl_2]Cl$
- Free Cl^- = 1
- AgCl formed = 1 mol

(D) $CrCl^- \cdot 6H_2O$
- Coordination number = 6
- Likely complex: $[Cr(H_2O)_6]Cl_3$
- Free Cl^- = 3
- 1:3 electrolyte confirms it
- AgCl formed = 3 mol

Increasing order of AgCl precipitated:
(C) < (A) = (B) < (D)

40. 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)

Ans. Option (1) is correct.

Explanation: In aromatic nucleophilic substitution, the presence of electron-withdrawing groups (like $-NO_2$) at the ortho and para positions increases the reactivity by stabiliding the intermediate (Meisenheimer complex).
Order of electron-withdrawing group effect:
- No $-NO_2$ (A) → least reactive
- 1 para $-NO_2$ (B) → more reactive
- 2 $-NO_2$ (ortho and para) (C) → even more reactive
- 3 $-NO_2$ (2,4,6) (D) → most reactive

Final order:
(A) < (B) < (C) < (D)

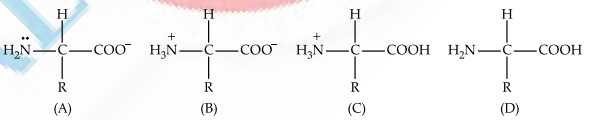
Read the passage carefully and answer the question:
Biomolecules are the organic compounds present as an essential constituents of living organisms in different cells. The molecules are generally termed as macromolecules, which are carbohydrates, enzymes, nucleic acids, amino acids and proteins, etc.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

41. Glucose when treated with bromine water forms
(1) Saccharic acid **(2)** Gluconic acid
(3) Glyceric acid **(4)** Glyceraldehyde

Ans. Option (2) is correct.

Explanation: When glucose is treated with bromine water, a mild oxidising agent, it selectively oxidises the aldehyde group (–CHO) at C–1 of glucose to a carboxylic acid group (–COOH), forming gluconic acid.
Reaction:
Glucose ($C_6H_{12}O_6$) + Br_2 + H_2O → Gluconic acid ($C_6H_{12}O_6$) + 2HBr
Other Options:
- **Saccharic acid:** Formed when glucose is oxidised with strong oxidising agents like HNO_3.
- **Glyceric acid:** Derived from glycerol, not glucose.
- **Glyceraldehyde:** A 3-carbon sugar, unrelated to glucose oxidation with bromine water.

42. The zwitterionic form of amino acid is



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

Ans. Option (2) is correct.

Explanation: The zwitterion (or dipolar ion) form of an amino acid is the structure where:
- the amino group ($-NH_2$) accepts a proton and becomes $-NH_3^+$.
- the carboxylic acid group (–COOH) loses a proton and becomes $-COO^-$.

This results in a molecule that has both a positive and a negative charge, but the net charge is zero.
Zwitterion Structure:
$H_3N+ -CH (R) -COO^-$
→ This matches option (B) in the image.
Why not others?
- **(A):** No charges — not zwitterionic.
- **(C):** Both groups are neutral — not zwitterionic.
- **(D):** No charges — also incorrect.

43. Starch is polymer of saccharides known as
(1) Glucose **(2)** Fructose
(3) Sucrose **(4)** Sucrose

Ans. Option (1) is correct.

Explanation: Starch is a polysaccharide, meaning it is a polymer made up of many monosaccharide units.
- The monomer unit of starch is α-D-glucose.
- Starch is composed of two components:
  (i) Amylose (linear chains of α-1, 4-linked glucose
  (ii) Amylopectin (branched chains with α-1, 6-linkages)

Why other options are incorrect:
- **Fructose:** A monosaccharide but not a component of starch.
- **Sucrose:** A disaccharide (glucose + fructose), not a polymer.
- **Cellulose:** A different glucose polymer with β-1, 4-linkages.

44. Cane sugar on boiling with HCl or H_2SO_4 hydrolysis yields
(1) Two molecules of glucose
(2) 1 : 1 mixture of glucose and fructose
(3) Two molecules of fructose
(4) No Reaction

Ans. Option (2) is correct.

Explanation: Cane sugar is sucrose, which is a disaccharide made up of:
- 1 molecule of glucose.
- 1 molecule of fructose.

On hydrolysis (acidic):
Sucrose + H_2O → (HCl or H_2SO_4 as catalyst) → Glucose + Fructose
This reaction breaks the glycosidic bond between glucose and fructose.
Why the other options are incorrect:
- **Two molecules of glucose** → Incorrect; sucrose contains only one glucose.
- **Two molecules of fructose** → Incorrect; only one fructose is present.
- **No Reaction** → Incorrect; reaction definitely occurs with acid hydrolysis.

45. The disaccharide present in milk is known as
(1) Sucrose **(2)** Lactose
(3) Maltose **(4)** Galactose

Ans. Option (2) is correct.

Explanation: The disaccharide present in milk is lactose.
- Lactose is composed of:
  - Glucose
  - Galactose
  - Linked by a β-1, 4-glycosidic bond

Why other options are incorrect:
1. **Sucrose:** Found in sugarcane, not milk. It is glucose + fructose.
2. **Maltose :** Formed from two glucose molecules; found in malted foods.
3. **Galactose:** It is monosaccharide, not a disaccharide.

Read the passage carefully and answer the question:
The transition metals and their compounds are known for their catalytic activity. This activity is ascribed to their ability to adopt multiple oxidation stats and to form complexes. Vanadium (V) oxide (in Contact Process), finely divided iron and nickel (in Catalytic Hydrogenation) are some of the examples. Catalyst (first row transition metal utilise 3*d* and 4*s* 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.

46. $TiCl_4 + Al(CH_3)_3$ is used as catalyst in _____
(1) Ziegler-Natta catalysis
(2) Haber's process
(3) Contact process
(4) Sandmeyer reaction

Ans. Option (1) is correct.

Explanation: • $TiCl_4 + Al(CH_3)_3$ is used as a catalyst system in Ziegler-Natta catalysis.
- This type of catalysis is widely used in the polymerisation of alkenes like ethylene and propylene to produce polymers such as polyethylene and polypropylene.

Why other options are incorrect:
2. **Haber's process:** Uses finely divided iron as a catalyst (for ammonia synthesis).
3. **Contact process:** Uses vanadium(V) oxide (V_2O_5) for sulphuric acid production.
4. **Sandmeyer reaction:** Uses copper salts (like CuCl or CuBr), not $TiCl_4$ or $Al(CH_3)_3$.

47. Which of the following is **incorrect** about the ability of catalytic action of transition metal?
(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

Ans. Option (3) is correct.

Explanation:
1. **Ability to form complexes:** Correct; transition metals can form coordinate bonds with ligands, leading to complex formation.
2. **Ability to adopt multiple oxidation states:** Correct; transition metals easily switch oxidation states, which helps in redox reactions.
3. **Weakening of the bonds in the reacting molecules–catalyst complex:** Incorrect; transition metals weaken the bonds in the reactant molecules, not in the catalyst-reactant complex itself. The bond weakening in reactant molecules facilitates the reaction — this statement misrepresents the process.
4. **Formation of bonds between reactant molecules and catalyst:** Correct; surface adsorption leads to bond formation with the catalyst surface, aiding the reaction.

48. Which of the following catalyses the oxidation of SO_2 in the manufacture of sulphuric acid?

(1) Vanadium (V) oxide **(2)** Finely divided iron

(3) Nickel **(4)** Vanadium (II) oxide

Ans. Option (1) is correct.

Explanation: The question asks which catalyst is used for the oxidation of SO_2 to SO_3 in the manufacture of sulphuric acid.
This reaction is a key step in the contact process, and the catalyst used is:
- Vanadium(V) oxide (V_2O_5)

Other Options:
- Finely divided iron – Used in the Haber's process for ammonia synthesis.
- Nickel – Catalyst in catalytic hydrogenation, not in sulphuric acid production.
- Vanadium(II) oxide – Incorrect oxidation state; not used in this process.

49. In the Wacker process the oxidation of ethyne to ethanal is catalysed by_____

(1) $TiCl_4$ **(2)** $PdCl_2$

(3) MnO_2 **(4)** $KMnO_4$

Ans. Option (2) is correct.

Explanation: The Wacker Process is a well-known industrial reaction where:
- Ethene (C_2H_4) is oxidised to acetaldehyde (CH_3CHO)

(Note: The question incorrectly says 'ethyne to ethanol' — the Wacker process actually involves ethene to acetaldehyde, not ethyne.)
Catalyst used:
- Palladium(II) chloride ($PdCl_2$) along with copper(II) chloride ($CuCl_2$) in aqueous medium.

Incorrect Options:
1. $TiCl_4$ – Used in Ziegler–Natta polymerisation.
2. MnO_2 – Used in oxidation reactions but not in the Wacker process.
3. $KMnO_4$ – A strong oxidising agent, but not used in Wacker oxidation.

50. Reaction between iodide and persulphate ions take place as follow:

$2I^- + S_2O_8^{2-} \rightarrow I_2 + 2SO_4^{2-}$

Which of the following catalyses the above reaction?

(1) Fe^{2+} **(2)** Fe^{3+}

(3) Mn^{2+} **(4)** Sn^{2+}

Ans. Option (1) is correct.

Explanation: The reaction between iodide ions (I^-) and persulphate ions ($S_2O_8^{2-}$) is:

$$2I^- + S_2O_8^{2-} \rightarrow I_2 + 2SO_4^{2-}$$

This reaction is slow in the absence of a catalyst because both reactants are negatively charged ions, which repel each other. To speed it up, a catalyst is needed.

Catalysis Mechanism:
Fe^{2+} acts as a homogeneous catalyst by undergoing intermediate redox reactions:
1. $S_2O_8^{2-} + Fe^{2+} \rightarrow Fe^{3+} + SO_4^{2-} + SO_4\cdot$
2. $Fe^{3+} + I^- \rightarrow Fe^{2+} + I\cdot$
3. Free radicals then help propagate the reaction to form I_2.

This cycle regenerates Fe^{2+}, thus, it acts as a true catalyst.

Incorrect Options:
- Fe^{3+} (Option 2): Oxidised form; does not initiate the reaction effectively.
- Mn^{2+} (Option 3) and Sn^{2+} (Option 4): Do not participate in this specific redox catalysis mechanism.

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