

$$E^\circ \text{Cl}_2/\text{Cl}^- = 1.36\text{V}$$

- (a) Cl^-
(c) Cr^{3+}

$$E^\circ \text{Cr}^{3+}/\text{Cr} = -0.74\text{V}$$

- (b) Cr
(d) Mn

6. The ratio of the time period for $\frac{3}{4}$ of the reaction of first order to complete to that required for half of the reaction is:

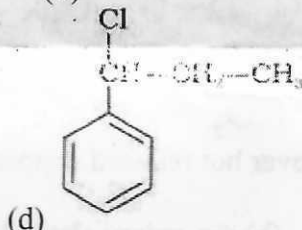
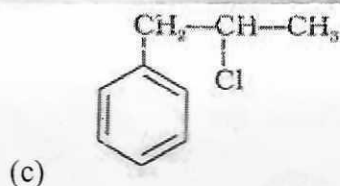
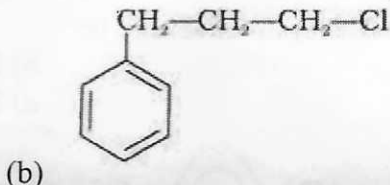
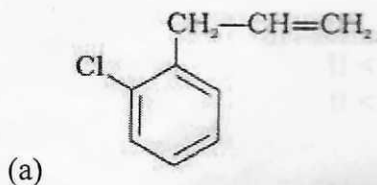
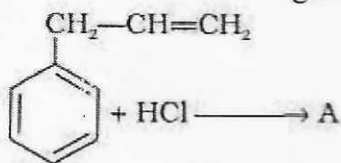
- a) 4:3
b) 3:2
c) 2:1
d) 1:2

7. For a reaction $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$ (Rate $\frac{d[\text{NH}_3]}{dt} = 2 \times 10^{-4} \text{mol l}^{-1} \text{s}^{-1}$)

The rate $\frac{-d[\text{N}_2]}{dt}$ is given as

- a) $10^{-4} \text{mol l}^{-1} \text{s}^{-1}$ b) $10^4 \text{mol l}^{-1} \text{s}^{-1}$ c) $10^{-2} \text{mol l}^{-1} \text{s}^{-1}$ d) $10^2 \text{mol l}^{-1} \text{s}^{-1}$

8. What is 'A' in the following reaction?



9. The reaction $(\text{CH}_3)_2\text{CHCl} + \text{NaI} \rightarrow (\text{CH}_3)_2\text{CHI} + \text{NaCl}$ is known as –

- (a) Finkelstein's reaction/ (b) Stephen's reaction
(c) Kolbe's reaction (d) Wurtz reaction

10. The calculated value of paramagnetic moment of Ti^{3+} in a complex is

- (a) 2.28 BM (b) 1.73BM (c) 4.34BM (d) 1.414BM

11. The main reason for larger number of oxidation states exhibited by the actinoids than the corresponding lanthanoids is:

- (a) Lesser energy difference between 5f and 6d orbitals than between 4f and 5d orbitals
(b) Larger atomic size of actinoids than the lanthanoids
(c) More energy difference between 5f and 6d orbitals than between 4f and 5d orbitals
(d) Greater reactive nature of the actinoids than the lanthanoids

12. Considering the formation, breaking and strength of hydrogen bond, predict which of the following mixtures will show a positive deviation from Raoult's law?

- (a) Methanol and acetone. (b) Chloroform and acetone.
(c) Nitric acid and water. (d) Phenol and aniline.

DIRECTION: In each of the following questions, a statement of Assertion is given and a corresponding statement of Reason is given just below it. Mark the correct answer as:

- (a) Both A and R are true and R is the correct explanation of A.
- (b) Both A and R are true but R is not the correct explanation of A.
- (c) A is true but R is false.
- (d) A is false but R is true.

13. Assertion (A): If red blood cells were removed from the body and placed in pure water pressure inside the cells increases.

Reason (R): The concentration of the salt content in the cells increases.

14. Assertion (A): Molar conductivity of weak electrolyte decreases as solution approaches infinite dilution.

Reason (R): For weak electrolytes, ionization process increases with dilution.

15. Assertion (A): Primary alcohols are converted to Aldehydes on reaction with Pyridinium chloro chromate (PCC).

Reason (R): PCC is a strong oxidising agent.

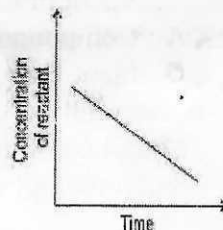
16. Assertion (A): Phenols are more reactive towards electrophilic substitution reaction, compared to benzene.

Reason (R): -OH group in phenol increases the electron density in ortho and para position due to +M effect.

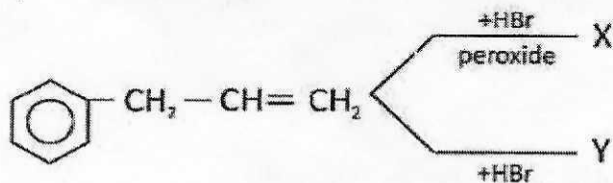
SECTION - B

17. Given alongside is a graph of concentration of reactant vs time for a reaction

- (a) Based on the graph above draw a rate of reaction vs concentration of reactant graph for the same reaction.
- (b) What will be the order of this reaction? Justify



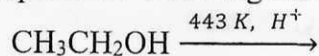
18. What are X and Y?



19. How are the following conversions carried out?

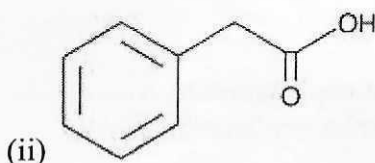
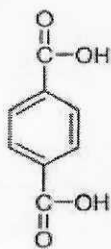
- (i) Aniline to chloro benzene
- (ii) Chloro benzene to p-nitrophenol

20. Complete the following reaction and suggest a suitable mechanism for the reaction.



21.a. Oxidation of ketones involves carbon-carbon bond cleavage. Name the products formed on oxidation of 2, 5-dimethylhexan-3-one.

b. Write IUPAC name of:



SECTION-C

22. The vapour pressure of pure liquids A and B are 450 and 700 mm Hg respectively, at 350 K. Find out the composition of the liquid mixture if total vapour pressure is 600 mm Hg. Also find the composition of the vapour phase.

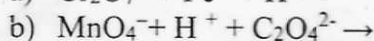
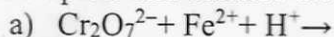
23. I. Answer the following questions with respect to the series of ions given below:

Sc^{+3} , Ti^{+4} , V^{+4} , V^{+2} , Cr^{+2} , Fe^{+3} , Ni^{+2} , Cu^{+2} , Zn^{+2}

(a) Why do Sc^{+3} , Ti^{+4} , and Zn^{+2} form colourless aqueous solution?

(b) Why are alloys mostly prepared from transition metals?

II. Complete and balance the following reactions-



24. Write: (i) Fittig Reaction (ii) Sandmeyer Reaction (iii) Balz-Schiemann reaction

25. a. An alcohol A ($\text{C}_4\text{H}_{10}\text{O}$) on oxidation with acidified potassium dichromate gives acid B ($\text{C}_2\text{H}_4\text{O}_2$). Compound A when dehydrated with conc. H_2SO_4 at 443 K gives compound C. Treatment of C with aqueous H_2SO_4 gives compound D ($\text{C}_4\text{H}_{10}\text{O}$) which is an isomer of A. Compound D is resistant to oxidation but compound A can be easily oxidised.

→ Identify A, B, C and D and write their structures.

b. Account for the following:

t-butyl chloride on heating with sodium methoxide gives 2-methyl propene instead of t-butyl methyl ether.

26. a. What is the result when phenol is oxidized by $\text{Na}_2\text{Cr}_2\text{O}_7/\text{H}_2\text{SO}_4$?

b. Write the names of reagents and equations for the preparation of the following ethers by Williamson's synthesis: (i) 1-Propoxypropane (ii) Ethoxybenzene

27. Calculate the EMF of the following cell at 298K.



$$E^0_{\text{Sn}^{2+}|\text{Sn}} = -0.14\text{V} \quad E^0_{\text{Ag}^+|\text{Ag}} = 0.80\text{V} \quad R = 8.314\text{JK}^{-1}\text{mol}^{-1} \quad F = 96500\text{Cmol}^{-1}$$

28. a. Arrange the following compounds in increasing order of their boiling points:



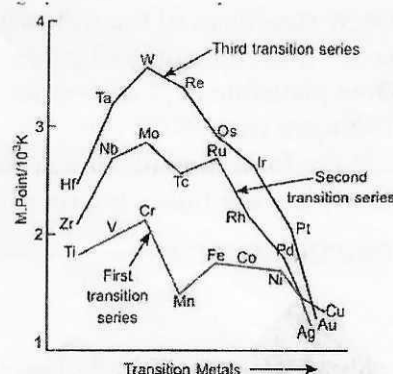
b. Would you expect Benzaldehyde to be more reactive or less reactive in nucleophilic addition reactions than propanol? Explain your answer.

c. 4-Nitro benzoic acid is more acidic than 4-methoxy benzoic acid. Give reason.

SECTION -D

29. Observe the graph of transition metal and their melting points and answer the questions:

- Why KMnO_4 is used in cleaning surgical instruments in hospitals?
- The atomic radius of Fe, Co and Ni are nearly same. Why?
- Calculate the magnetic moment of Ni^{2+} ion.
- Sc^{3+} is colourless in aqueous solution whereas Ti^{3+} is coloured. Explain.



30.

Some Azeotropic Mixtures					
A	B	Minimum Boiling Azeotropes	Boiling Points		
			A	B	Mixture Azeotrope
H_2O	$\text{C}_2\text{H}_5\text{OH}$	95.37%	373 K	351.3 K	351.15 K
H_2O	$\text{C}_3\text{H}_7\text{OH}$	71.69%	373 K	370.19 K	350.72 K
$\text{CH}_3\text{COOCH}_3$	CS_2	67%	329.25 K	319.25 K	312.30 K
A	B	Maximum Boiling Azeotropes	A	B	Mixture Azeotrope
H_2O	HCl	20.3%	373 K	188 K	383 K
H_2O	HNO_3	68.0%	373 K	359 K	393.5 K
H_2O	H_2SO_4	71.6%	373 K	383 K	476 K

Observe the table in which azeotropic mixtures are given along their boiling points of pure components and answer the following questions.

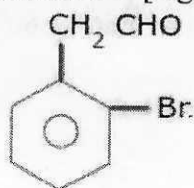
- What type of azeotropes are formed by non ideal solutions showing positive deviations from Raoult's law?
- The elevation in boiling point produced by dilute equimolar solution of three substances are in the order $A > \text{glucose} > B$. Suggest a reason for this observation.
- 100 mg of a protein is dissolved in enough water to make 10.0 mL of a solution. If this solution has an osmotic pressure of 13.3 mm Hg at 25°C , what is the molar mass of protein? ($R = 0.0821 \text{ L atm. mol}^{-1} \text{ K}^{-1}$ and $760 \text{ mm Hg} = 1 \text{ atm}$)

SECTION – E

31.a) Give chemical test to distinguish between following pair of compounds:

Propanal and Acetone

b) Write the products of: $\text{CH}_3\text{CHO} + [\text{Ag}(\text{NH}_3)_2]^+ + \text{OH}^- \text{-----}$



c) Write the IUPAC name of:

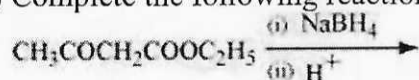
d) Draw structures of the following derivatives.

The 2,4-dinitrophenylhydrazone of benzaldehyde

e) Give plausible explanation for each of the following:

There are two $-NH_2$ groups in semicarbazide. However, only one is involved in the formation of semicarbazones.

f) Complete the following reaction.



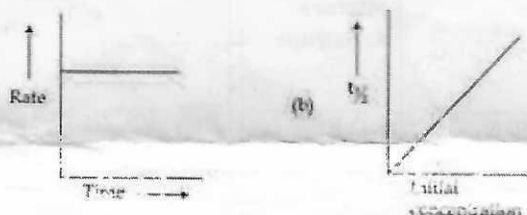
32.a. For the hydrolysis of methyl acetate solution, the following result were obtained:

t/s	0	30	60
$[CH_3COOCH_3]/mol^{-1}$	0.60	0.30	0.15

Show that it follows pseudo first order reaction, as the concentration of water remains constant. (Given $\log 2=0.3010$, $\log 4=0.6021$)

b. Predict the order of the reaction in the given plots:

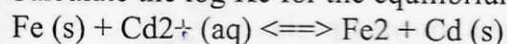
Where $[R]_0$ is the concentration of reactant.



33. Attempt the following:

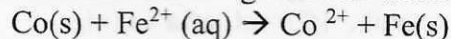
a) Write the electrode reactions of H_2-O_2 fuel cell.

b) Calculate the $\log K_c$ for the equilibrium reaction:



(Given: $E^0_{Cd^{2+}/Cd} = -0.40 V$, $E^0_{Fe^{2+}/Fe} = -0.44 V$)

c) Predict whether the following reaction would occur spontaneously at 298 K.



Given $[Co^{2+}] = 1.0M$ $[Fe^{2+}] = 1.0M$

$E^0_{Fe^{2+}/Fe} = -0.44V$ $E^0_{Co^{2+}/Co} = -0.28V$

d) Calculate the degree of dissociation (α) of CH_3COOH if λ_m and λ^0_m of CH_3COOH are $48 \text{ Scm}^2 \text{ mol}^{-1}$ and $400 \text{ Scm}^2 \text{ mol}^{-1}$ respectively.

e) Out of the following pairs, predict with reason which pair will allow greater conduction of electricity. Silver wire at $30^\circ C$ or silver wire at $60^\circ C$.