



GENERAL INSTRUCTIONS:

Questions 1-5 are very short answer questions of 1 mark each.

Questions 6-10 are short answer questions of 2 marks each.

Questions 11-22 are short answer questions of 3 marks each.

Question 23 is a long answer question of 4 marks.

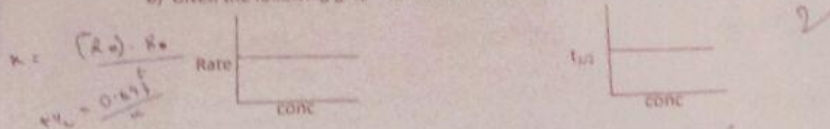
Questions 24-26 are long answer questions of 5 marks each.

- 1/ Classify on the basis of the description given below:
i) A white solid – melts at 613°C and the liquid is conducting though the solid is not. (type of solid)
ii) $a=b\neq c$, $\alpha=\beta=90^{\circ}$, $\gamma=120^{\circ}$ (type of crystal system)
- 2/ Which of the following will have approximately the same effect on the freezing point of water as 0.1 mole of sodium chloride?
i) 0.3 mole of sodium sulphate
ii) 0.1 mole of glucose
iii) 0.1 mole of copper(II) nitrate
iv) 0.05 mole of aluminum chloride
- 3/ What is ZSM-5? What is it used for?
- 4/ Draw resonating structure to show that carboxylic C is less electrophilic than carbonyl C.
- 5/ Name the reaction: $\text{C}_6\text{H}_5\text{CONH}_2 \xrightarrow[\text{Br}_2]{\text{NaOH}} \text{C}_6\text{H}_5\text{NH}_2$ 1 x 5
- 6/ Account for the following:
i) Frenkel defect is not observed in alkali metal halides.
ii) Germanium is an insulator, but germanium doped with arsenic is a good conductor of electricity.
- 7/ Write the anodic reaction when:
i) dilute H_2SO_4 is electrolysed
ii) Concentrated H_2SO_4 is electrolysed

OR

Write the reactions taking place at the anode and cathode in the mercury cell.

- 8 a) For the reaction: $A + 2B \rightarrow AB_2$, the rate constant is $1.26 \times 10^{-3} \text{ L mol}^{-1} \text{ s}^{-1}$. What is the order of the reaction?
 b) Given the following graphs, predict the order of the reaction.



- 9 Write the mechanism for dehydration of ethanol at 413K.
 10 How is ethanol obtained commercially by fermentation process? What is denatured alcohol? 2 x 5

- 11 Thallium chloride, $TlCl$ crystallises in either simple cubic lattice or face centered cubic lattice of Cl^- ions with Tl^+ ions in the holes. If the density of the solid is 9.00 g cm^{-3} and edge of the unit cell is $3.85 \times 10^{-8} \text{ cm}$, what is the unit cell geometry? (Atomic mass: $Tl = 204u$, $Cl = 35.5u$)

- 12 A mixture containing equal number of moles of hexane (b.pt = 69°C) and cyclohexane (b.pt = 81°C) is heated.
 i) What conditions determine the temperature at which the liquid boils?
 ii) What do the relative boiling points show about the relative strengths of the intermolecular forces in the two substances?
 iii) Would you expect the mixture to boil below 69°C , between 69°C and 81°C , or above 81°C ?
 iv) Compare the composition of the vapour with that of the liquid.
 v) What separation technique depends on this principle?
 vi) Give one industrial application of the separation method.

- 13 The electrical resistance of a column of 0.05 M NaOH solution of diameter 1 cm and length 50 cm is $5.55 \times 10^3 \text{ ohm}$. Calculate its resistivity, conductivity and molar conductivity.

- 14 Calculate the emf of the cell in which the following reaction takes place:
 $Ni(s) + 2Ag^+(0.002M) \rightarrow Ni^{2+}(0.160M) + 2Ag(s)$
 Given: $E^\circ_{cell} = +1.05V$

- 15 The reaction between A and B is first order with respect to A and zero order with respect to B. Fill in the blanks X, Y and Z in the following table:

Experiment	[A]/ mol L^{-1}	[B]/ mol L^{-1}	Initial rate / $\text{mol L}^{-1} \text{ min}^{-1}$
I	0.1	0.1	2.0×10^{-3}
II	X	0.2	4.0×10^{-3}
III	0.4	0.4	Y
IV	Z	0.2	2.0×10^{-3}

OR

For a first order reaction, $R \rightarrow P$, prove that the time for 75% completion of the reaction is twice the time for the reaction to be 50% complete.

- 16 A first order reaction is 50% complete in 40 minutes at 27°C and in 20 minutes at 37°C . Calculate the energy of activation.

- 17 Write the structure of:
 i) 2-oxocyclopentanecarboxylic acid
 ii) DDT
 iii) Ethyl sec-butylether

2

- 18 Distinguish between:
 i) Ethylamine and Dimethylamine
 ii) CH_3COOH and HCOOH
 iii) Chlorobenzene and Benzyl chloride


2

19 Explain the following reactions:

- i) Cannizzaro reaction
 ii) Reimer-Tiemann reaction
 iii) Gabriel Phthalimide reaction

20 Give the structure and IUPAC name of the expected product of the following reactions:

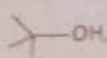
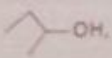
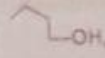
i) Hydroboration of but-1-ene

ii) Ozonolysis of 

iii) Benzoylation of methanamine

21 Arrange the following in the order indicated:

i) $\text{Cl}-\text{CH}_2\text{CH}=\text{CH}-\text{CH}_2\text{CH}_3$, $\text{CH}_3\text{C}(\text{Cl})=\text{CHCH}_2\text{CH}_3$, $\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}_2\text{Cl}$, $\text{CH}_3\text{CH}=\text{CHCH}(\text{Cl})-\text{CH}_3$
 (increasing $\text{S}_{\text{N}}1$ reactivity)

ii)  CH_3OH ,   OH , (decreasing reactivity towards HBr)
 A B C D

iii) $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$, CH_3COCH_3 , $\text{CH}_3\text{CH}_2\text{COOH}$, $\text{CH}_3\text{OCH}_2\text{CH}_3$ (increasing boiling point)

22 Give one example of:

- i) Zwitter ion ii) Decarboxylation iii) Nucleophilic addition

3 x 12

23 A student while working in the laboratory got a cut on the finger. It started bleeding. The lab in charge immediately applied ferric chloride on the wound after washing it clean. The bleeding stopped.

- i) Why did the bleeding stop on applying FeCl_3 on the affected part.
 ii) What is the phenomenon involved?
 iii) Can KCl be used instead of FeCl_3 . Which one is preferred?
 iv) What is the value associated from the point of view of the chemist?

4

24 Define 'freezing point'.

19.5 g of CH_3FCOOH is dissolved in 500 g of water. The depression in freezing point of water observed is 1.0°C . Calculate the van't Hoff factor and dissociation constant of fluoroacetic acid. ($K_f \text{H}_2\text{O} = 1.86 \text{ K kg mol}^{-1}$, $F = 19\text{u}$)

OR

Define 'Raoult's Law'.

A solution containing 30 g of a non-volatile solute exactly in 90 g of water has a vapour pressure of 2.8 kPa at 298 K. Further 18 g of water is then added to the solution, and the new vapour pressure becomes 2.9 kPa at 298 K. Calculate

- Molar mass of the solute
- Vapour pressure of water at 298 K.

25 Organic compound A ($\text{C}_3\text{H}_8\text{O}$) gives brisk effervescence with Na metal and on reaction with Cu at 573 K gives B ($\text{C}_3\text{H}_6\text{O}$). Compound B gives a yellow precipitate with I_2 and alkali. B on reaction with semicarbazide gives C. What are the structures of A, B and C. Write all the reactions involved.

OR

How will you convert:

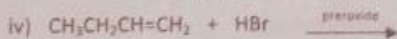
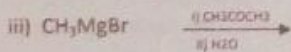
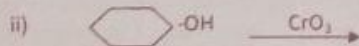
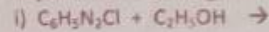
- Toluene to Benzyl chloride
- Ethyl chloride to Propionic acid
- Ethanal to But-2-enal
- Benzene to Aniline
- Ethanol to Methanol

26 Give reason for the following:

- Nitration of aniline unexpectedly gives 47% m-nitroaniline
- Acetone is completely miscible in water while acetophenone is not.
- The alkoxy group in arylalkyl ethers directs the incoming group to ortho and para positions in the benzene ring.
- Para-dichlorobenzene has a higher melting point than ortho-dichlorobenzene.
- Benzoic acid has a lower pK_a than phenol.

OR

Complete the following reactions:



5 x3