

D12

I term exam (2015-16)

Time : 3 hours

Maximum Marks : 70

General Instructions :

1. All questions are compulsory.
2. Question no. 1 to 5 carry 1 mark each. Answer in around one line.
3. Question no. 6 to 10 carry 2 marks each. Answer in around 30 words.
4. Question no. 11 to 22 carry 3 marks each. Answer in around 40 words.
5. Question no. 23 is value based question carrying 4 marks.
6. Question no. 24 to 26 carry 5 marks each. Answer in around 70 words.
7. Use log tables if necessary, use of calculators is not allowed.

- Q1. What makes glass different from quartz? Under what condition quartz is converted to glass?
- Q2. Why is the vapour pressure of an aqueous solution of glucose lower than that of water?
- Q3. In a reaction if the concentration of reactant A is tripled, the rate of reaction becomes twenty seven times. What is the order of reaction?
- Q4. Write the structure and basicity of pyrophosphoric acid.
- Q5. Explain why p-dichlorobenzene has higher m.p. than those of ortho and m-isomers?
- Q6. 15.0 g of an unknown molecular substance was dissolved in 450 g of water. The resulting solution was found to freeze at -0.34°C . What is the molar mass of this substance. (K_f for water = $1.86 \text{ K kg mol}^{-1}$)
- Q7. A chemical reaction, $2\text{A} \rightarrow 4\text{B} + \text{C}$, in gas phase occurs in a closed vessel. The concentration of B is found to be increased by $5 \times 10^{-3} \text{ mol/L}$ in 10 seconds. Calculate
- i) The rate of appearance of B
 - ii) The rate of disappearance of A

OR

A first order gas reaction $\text{A}_2(\text{g}) + \text{B}_2(\text{g}) \rightarrow 2\text{A}(\text{g}) + 2\text{B}(\text{g})$ at the temperature 4000°C has the rate constant $K = 2.0 \times 10^{-4} \text{ sec}^{-1}$. What percentage of A_2 is decomposed on heating for 900 seconds?

Q8. Give reasons for the following

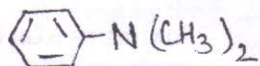
- i) NO_2 is coloured and readily dimerises.
- ii) PCl_5 behaves as an ionic species in solid state.

Q9. i) Starting from methyl iodine, how will you prepare : A) nitromethane B) methyl nitrite

ii) Arrange the following halides in the decreasing order of $\text{S}_{\text{N}}1$ reactivity

$\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl}$, $\text{CH}_2=\text{CHCHClCH}_3$ and $\text{CH}_3\text{CH}_2\text{CHClCH}_3$

Q10. i) Write the IUPAC name of



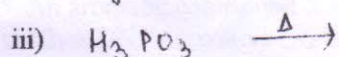
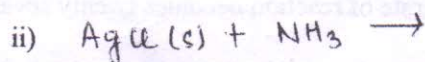
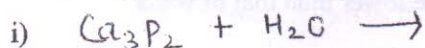
ii) Explain why aniline cannot be prepared by Gabriel phthalimide synthesis?

Q11. i) The density of copper metal is 8.95 g cm^{-3} . If the radius of copper atom is 127 pm , is the copper unit cell a simple cubic, a body-centred cubic or a face centred cubic structure?

ii) Define F-centre. Mention its one consequence.

Q12. Why should a solution of a non-volatile or non-electrolyte solute boil at a higher temperature? Explain with the help of a diagram. Derive the relationship between molar mass and elevation in boiling point.

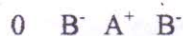
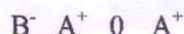
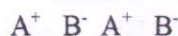
Q13. Complete the following reactions



Q14. Conductivity of 0.00241 M acetic acid is $7.896 \times 10^{-5} \text{ Scm}^{-1}$. Calculate its molar conductivity if for acetic acid is $390.5 \text{ Scm}^2 \text{ mol}^{-1}$, what is its dissociation constant?

λ_m^∞ (limiting molar conductivity)

Q15. I) Examine the given defective crystal



Answer the following questions

- What type of stoichiometric defect is shown by the crystal?
- How is the density of the crystal affected by this defect?
- What type of ionic substances show such defect?

II) Calculate the packing fraction in case of fcc structure.

Q16. The rate constant of a reaction at 700 K and 760 K are $0.011 \text{ M}^{-1} \text{ s}^{-1}$ and $0.105 \text{ M}^{-1} \text{ s}^{-1}$ respectively. Calculate the values of Arrhenius parameters (A and E_a).

Q17. Give reasons for the following

- o-nitrophenol is more acidic than o-methoxyphenol
- butan-1-ol has a higher boiling point than diethylether
- $(\text{CH}_3)_3\text{CO}-\text{CH}_3$ on reaction with HI gives $(\text{CH}_3)_3\text{C}-\text{I}$ and CH_3-OH as the main products and not $(\text{CH}_3)_3\text{C}-\text{OH}$ and CH_3-I .

Q18. I) Although chlorine is an electron withdrawing group, yet it is ortho and para directing in electrophilic substitution reaction. Explain why is it so?

II) Give the IUPAC name of $\text{CH}_3\text{C}(p\text{-ClC}_6\text{H}_4)_2\text{CH}(\text{Br})\text{CH}_3$

Q19. An organic compound A ($\text{C}_2\text{H}_3\text{N}$) is used as a solvent of choice for many organic reactions because it is not reactive in mild acidic and basic conditions. Compound A on treatment with Ni/H_2 forms B. When B is treated with nitrous acid at 273K, ethanol is obtained. When B is warmed with chloroform and NaOH , a foul smelling compound C formed. Identify A, B and C. Write all the chemical reactions involved.

Q20. Explain the following reactions giving one example of each :

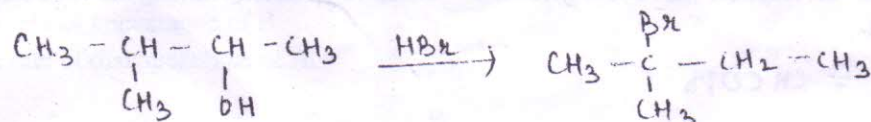
- Cross Aldol condensation
- Hell-Volhard-Zelinsky reaction
- Wolff-Kishner reduction

Q21. How will you carry out the following conversions

- Benzene to biphenyl
- Benzyl alcohol to 2-phenylethanoic acid
- Ethene to but-2-yne

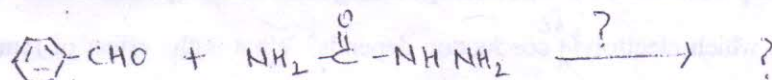
OR

- Explain Rieman Tiemann reaction : with an example
- When 3-methylbutan-2-ol is treated with HBr , the following reaction takes place



Give a mechanism for this reaction

Q22. i) Complete the following reaction



ii) Predict giving reasons, order of basicity of the following compounds in A) gaseous phase and B) in aqueous phase CH_3NH_2 , $(\text{CH}_3)_3\text{N}$ and $(\text{CH}_2)_2\text{NH}$

Q23. Ram takes an open pan to cook vegetables at a hill station while Shyam cook the same vegetables in a pressure cooker at the same place.

(a) Explain with reason who will cook vegetable faster

(b) Mention the reason for the delay in cooking

(c) Which value is learnt by the student in the process of cooking food in the pressure cooker.

Q24. I) How would you obtain the following

- i) Picric acid from phenol
- ii) 2-Methylpropan-2-ol from methyl magnesium bromide
- iii) Propan-2-ol from propene

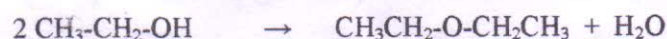
II) Write down a chemical test to distinguish between primary, secondary and tertiary alcohols.

OR

i) Name the reagents in the following reactions

- (a) Oxidation of primary alcohol to an aldehyde
- (b) Butan-2-one to butan-2-ol

ii) Explain the detailed mechanism of the following reaction

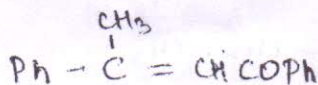


Q25. An aromatic compound X with molecular formula $\text{C}_9\text{H}_{10}\text{O}$ gives the following chemical tests : (i) Forms 2, 4-DNP derivative (ii) Reduces Tollens' reagent (iii) Undergoes Cannizzaro reaction (iv) On vigorous oxidation gives 1, 2-benzenedicarboxylic acid.

Identify X and write its IUPAC name. Also write the reactions involved in the formation of above mentioned products.

OR

A tertiary alcohol 'A' on acid catalyzed dehydration gave product 'B'. Ozonolysis of 'B' gives compounds 'C' and 'D'. Compound 'C' on reaction with KOH gives benzyl alcohol and compound 'E'. Compound 'D' on reaction with KOH gives α,β - unsaturated ketone having the following structure



Identify A, B, C, D and E

Q26. i) Derive the relationship between Gibb's free energy change and the cell potential.

ii) What are the factors on which electrolytic conduction depends? What is the effect of temperature on electrolytic conduction?

OR

- i) When a current of 0.75A is passed through CuSO_4 solution for 25 min, 0.369g of copper is deposited at the cathode. Calculate the atomic mass of copper.
- ii) The molar conductances of NaOH, NaCl and BaCl_2 at infinite dilution are 2.481×10^{-2} , 1.265×10^{-2} and $2.800 \times 10^{-2} \text{Sm}^2\text{mol}^{-1}$ respectively. Calculate molar conductance of Ba(OH)_2 at infinite dilution.