

Roll No.

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Candidates must write code on the title page of the answer –book

- Code number given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.
- Please check that this question paper contains 26 questions.
- Please write down the Serial Number of the question before attempting it.
- 15 minute time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the students will read the question paper only and will not write any answer on the answer-book during this period.

## CHEMISTRY (Theory)

**Time allowed : 3 hours**

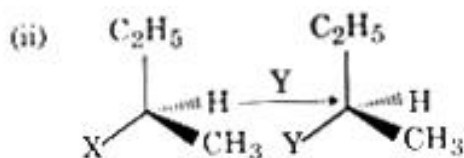
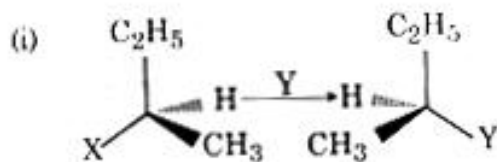
**Maximum Marks : 70**

**General Instructions :**

- All questions are compulsory.*
- Questions number 1 to 5 are very short answer questions and carry 1 mark each.*
- Questions number 6 to 10 are short answer questions and carry 2 marks each.*
- Questions number 11 to 22 are also short answer questions and carry 3 marks each.*
- Questions number 23 is a value based question and carry 4 marks.*
- Questions number 24 to 26 are long answer questions and carry 5 marks each.*
- Use log tables, if necessary. Use to calculators is **not** allowed.*

**P.T.O**

- On heating  $\text{Pd}(\text{NO}_3)_2$  a brown gas is evolved which undergoes dimerization on cooling. Identify the gas.
- Which of the following two reactions is  $\text{S}_{\text{N}}2$  and why ?



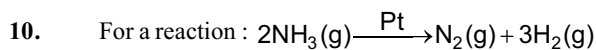
- Write the reason for the stability of colloidal sols.
- $\text{ZnO}$  turns yellow on heating. Why ?
- Write the IUPAC name of the given compound :  

$$\text{CH}_3 - \text{NH} - \text{CH}_2 - \underset{\text{CH}_3}{\text{CH}} - \text{CH}_3$$
- Write the structures of the following :  
 (i)  $(\text{HPO}_3)_3$                       (ii)  $\text{XeF}_4$
- (i) Write the colligative property which is used to find the molecular mass of macromolecules.  
 (ii) In non-ideal solution, what type of deviation shows the formation of minimum boiling azeotropes ?
- Write the chemical equations involved in the following reactions :  
 (i) Kolbe's reaction  
 (ii) Friedal - Crafts acetylation of anisole  

OR

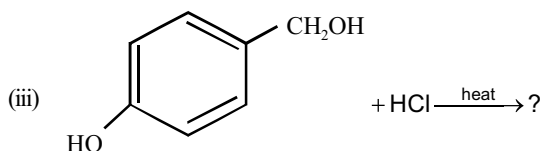
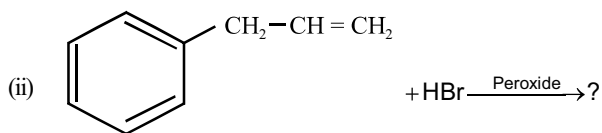
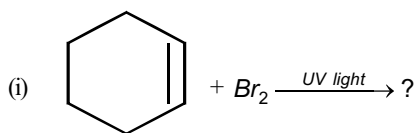
 How do you convert :  
 (i) Phenol to toluene  
 (ii) Formaldehyde to Ethanol

9. When a coordination compound  $\text{NiCl}_2 \cdot 6\text{H}_2\text{O}$  is mixed with  $\text{AgNO}_3$ , 2 moles of  $\text{AgCl}$  are precipitated per mole of the compound. Write
- Structural formula of the complex
  - IUPAC name of the complex



Rate = k

- Write the order and molecularity of this reaction.
  - Write the unit of k.
11. Write the major monohalo product (s) in each of the following reactions :



12. An element crystallizes in a f.c.c. lattice with cell edge of 400 pm. The density of the element is  $7 \text{ g cm}^{-3}$ . How many atoms are present in 280 g of the element ?
13. Give reasons for the following :
- Protonation of Phenols is difficult whereas ethanol easily undergoes protonation.
  - Boiling point of ethanol is higher than that of dimethyl ether.
  - Anisole on reaction with HI gives phenol and  $\text{CH}_3\text{-I}$  as main products and not iodobenzene and  $\text{CH}_3\text{OH}$ .

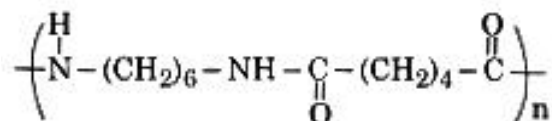
14. (i) Write one reaction of D-Glucose which cannot be explained by its open chain structure.  
 (ii) What type of linkage is present in Nucleic acids ?  
 (iii) Give one example each for water-soluble vitamins and fat-soluble vitamins ?
15. Calculate the boiling point of solution when 2 g of  $\text{Na}_2\text{SO}_4$  ( $M = 142 \text{ g mol}^{-1}$ ) was dissolved in 50 g of water, assuming  $\text{Na}_2\text{SO}_4$  undergoes complete ionization.  
 ( $K_b$  for water =  $0.52 \text{ K kg mol}^{-1}$ )
16. (i) Name the method of refining which is based on the principle of adsorption.  
 (ii) What is the role of depressant in froth floatation process ?  
 (iii) What is the role of limestone in the extraction of iron from its oxides ?
17. Define the following terms :  
 (i) O/W Emulsion  
 (ii) Zeta potential  
 (iii) Multimolecular colloids
18. (i) For the complex  $(\text{Fe}(\text{CN})_6)^{4-}$ , write the hybridization, magnetic character and spin type of the complex. (At. number : Fe = 26)  
 (ii) Draw one of the geometrical isomers of the complex  $[\text{Co}(\text{en})_2]^+$  which is optically active.
19. Assign reason for the following :  
 (i)  $\text{H}_3\text{PO}_2$  is a stronger reducing agent than  $\text{H}_3\text{PO}_4$ .  
 (ii) Sulphur shows more tendency for catenation than Oxygen.  
 (iii) Reducing character increases from HF to HI.
20. Write the structures of A, B and C in the following reactions :
- (i)  $\text{C}_6\text{H}_5\text{COO}^-\text{NH}_4^+ \xrightarrow{\Delta} \text{A} \xrightarrow{\text{Br}_2/\text{KOH}} \text{B} \xrightarrow{\text{CH}_3\text{COCl}/\text{pyridine}} \text{C}$
- (ii)  $\text{C}_6\text{H}_5\text{N}_2\text{BF}_4^+ \xrightarrow[\Delta]{\text{NaNO}_2/\text{Cu}} \text{A} \xrightarrow{\text{Sn}/\text{HCl}} \text{B} \xrightarrow{\text{CHCl}_3/\text{alc. KOH}} \text{C}$

21. The rate constant for the first order decomposition of  $\text{H}_2\text{O}_2$  is given by the following equation :

$$\log k = 14.2 - \frac{1.0 \times 10^4 \text{K}}{T}$$

Calculate  $E_a$  for this reaction and rate constant  $k$  if its half-life period be 200 minutes. (Given :  $R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$ )

22. (i) What is the role of benzoyl peroxide in the polymerization of ethene ?  
 (ii) Identify the monomers in the following polymer :



- (iii) Arrange the following polymers in the increasing order of their intermolecular forces :  
 Nylon-6, 6 Polythene, Buna-S

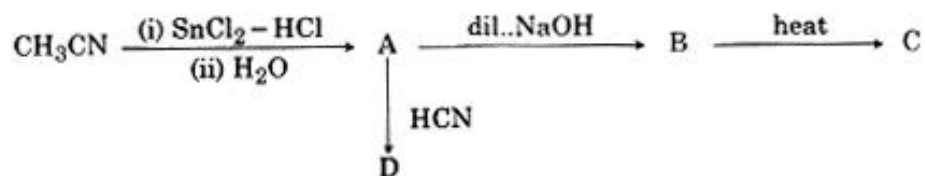
OR

Write the mechanism of free radical polymerization of ethene.

23. Due to hectic and busy schedule, Mr. Awasthi made his life full of tensions and anxiety. He started taking sleeping pills to overcome the depression without consulting the doctor. Mr. Roy, a close friend of Mr. Awasthi advised him to stop taking sleeping pills and suggested to change his lifestyle by doing Yoga, meditation and some physical exercise. Mr. Awasthi followed his friend's advice and after few days he started feeling better. After reading the above passage, answer the following :

- (i) What are the values (at least two) displayed by Mr. Roy ?  
 (ii) Why it is not advisable to take sleeping pills without consulting doctor ?  
 (iii) What are tranquilizers ? Give two examples.

24. (a) Write the structures of A, B, C and D in the following reactions :

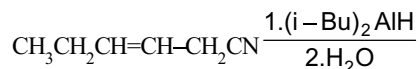


- (b) Distinguish between :  
 (i)  $\text{C}_6\text{H}_5 - \text{CH} = \text{CH} - \text{COCH}_3$  and  $\text{C}_6\text{H}_5 - \text{CH} = \text{CH} - \text{COCH}_2\text{CH}_3$   
 (ii)  $\text{CH}_3\text{CH}_2\text{COOH}$  and  $\text{HCOOH}$

- (c) Arrange the following in the increasing order of their boiling points :  
 $\text{CH}_3\text{CH}_2\text{OH}$ ,  $\text{CH}_3\text{COCH}_3$ ,  $\text{CH}_3\text{COOH}$

OR

- (a) Write the chemical reaction involved in Etard reaction.
- (b) Arrange the following in the increasing order of their reactivity towards nucleophilic addition reaction :  
 $\text{CH}_3\text{-CHO}$ ,  $\text{C}_6\text{H}_5\text{COCH}_3$ ,  $\text{HCHO}$
- (c) Why  $\text{pK}_a$  of  $\text{Cl-CH}_2\text{-COOH}$  is lower than the  $\text{pK}_a$  of  $\text{CH}_3\text{COOH}$  ?
- (d) Write the product in the following reaction.

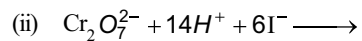


- (e) A and B are two functional isomers of compound  $\text{C}_3\text{H}_6\text{O}$ . On heating with  $\text{NaOH}$  and  $\text{I}_2$ , isomer A forms yellow precipitate of iodoform whereas isomer B does not form any precipitate. Write the formulae of A and B.
25. (a) Calculate  $E^\circ_{\text{cell}}$  for the following reaction at 298 K :  
 $2\text{Cr(s)} + 3\text{Fe}^{2+}(0.01\text{M}) \rightarrow 2\text{Cr}^{3+}(0.01\text{M}) + 3\text{Fe(s)}$   
 Given :  $E^\circ_{\text{cell}} = 0.261\text{ V}$
- (b) Using the  $E^\circ$  values of A and B, predict which one is better for coating the surface of iron [ $E^\circ(\text{Fe}^{2+}/\text{Fe}) = -0.44\text{ V}$ ] to prevent corrosion and why ?  
 Given :  $E^\circ(\text{A}^{2+}/\text{A}) = -2.37\text{ V}$  ;  $E^\circ(\text{B}^{2+}/\text{B}) = -0.14\text{ V}$

OR

- (a) The conductivity of  $0.001\text{ mol L}^{-1}$  solution of  $\text{CH}_3\text{COOH}$  is  $3.905 \times 10^{-5}\text{ S cm}^{-1}$ . Calculate its molar conductivity and degree of dissociation ( $\alpha$ ).  
 Given  $\lambda^\circ(\text{H}^+) = 349.6\text{ S cm}^2\text{ mol}^{-1}$  and  $\lambda^\circ(\text{CH}_3\text{COO}^-) = 40.9\text{ S cm}^2\text{ mol}^{-1}$ .
- (b) Define electrochemical cell. What happens if external potential applied becomes greater than  $E^\circ_{\text{cell}}$  of electrochemical cell ?
26. (a) Account for the following :
- (i) Mn shows the highest oxidation state of +7 with oxygen but with fluorine it shows the highest oxidation state of +4.
  - (ii) Zirconium and Hafnium exhibit similar properties.
  - (iii) Transition metals act as catalysts.

(b) Complete the following equations :



OR

The elements of 3d transition series are given as :

Sc Ti V Cr Mn Fe Co Ni Cu Zn

Answer the following :

- (i) Write the element which is not regarded as a transition element. Give reason.
- (ii) Which element has the highest m.p ?
- (iii) Write the element which can show an oxidation state of +1.
- (iv) Which element is a strong oxidizing agent in +3 oxidation state and why ?