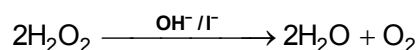


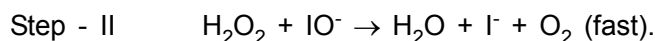
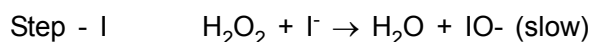
SAMPLE PAPER-III**Chemistry (Theory)****Time** : 3 hours**Total Marks** : 70**General Instruction**

1. All questions are compulsory.
 2. Question No. 1 to 8 are very short questions, carrying one mark each.
 3. Question No. 9 to 18 are short answer questions carrying 2 marks each.
 4. Question No. 19 to 27 are short answer questions carrying 3 marks each.
 5. Question No. 28 to 30 are long answer questions carrying 5 marks each.
 6. Use of calculators is not allowed. Use the log tables wherever necessary.
-
1. A and B liquids on mixing produce a warm solution. Which type of deviation from Raoult's law is there?
 2. Why is ferric chloride preferred over potassium chloride in case of a cut leading to bleeding?
 3. Among octahedral and tetrahedral crystal fields, in which case the magnitude of crystal field splitting is larger?
 4. Why is ortho-nitrophenol more acidic than ortho-methoxyphenol?
 5. Write two important uses of formalin.
 6. Why do amines act as nucleophiles?
 7. Why can't aluminium be reduced by carbon?
 8. What are the ultimate products of digestion of proteins?
 9. Gold (atomic mass=197u, atomic radius = 0.144nm) crystallizes in a face centered unit cell. Determine the density of gold. [$N_A=6.022 \times 10^{23} \text{mol}^{-1}$].
 10. Classify each of the following as being either a p-type or an n-type semiconductor. Give reason.
 - (a) Si doped with In, a group 13 element.
 - (b) Si doped with P, a group 15 element.

11. Determine the molarity of an antifreeze solution containing 250g water mixed with 222g ethylene glycol ($C_2H_6O_2$) (molar mass 62 g mol^{-1}) The density of this solution is 1.07 g/mL .
12. An aqueous solution containing urea was found to have boiling point more than the normal boiling point of water (373.13 K). When the same solution was cooled, it was found that its freezing point is less than the normal freezing point of water (273.13 K). Explain these observations.
13. Consider the decomposition of hydrogen peroxide in alkaline medium which is catalysed by iodine ions.



This reaction takes place in two steps as given below :



- (a) Write the rate law expression and determine the order of reaction w.r.t. H_2O_2 .
- (b) What is the molecularity of each individual step?
14. (a) What is the role of depressant in froth floatation process?
- (b) Out of C and CO which is a better reducing agent for FeO.
- (i) In the lower part of blast furnace (Higher temperature).
- (ii) In the upper part of blast furnace (Lower temperature).
15. Complete the following reactions :—
- (a) $\text{P}_4 + 8\text{SOCl}_2 \longrightarrow$
- (b) $\text{I}^- + \text{O}_2 + \text{H}_2\text{O} \longrightarrow$
16. Using valence bond theory, predict the geometry of diamagnetic $[\text{Co}(\text{CO})_4]^-$. (Atomic number of Co is 27).
17. (a) Write the structure of following compound.
- 1-Bromo-4-sec-butyl-2-methylbenzene

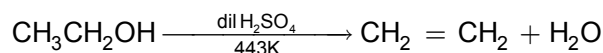
- (b) How will you bring about the conversion :
Methyl bromide to methyl iodide.
18. Sneha's grandmother lives in Manali. In winter, there is lot of snow in front of the house. She asked Sneha to clear the snow. Sneha added NaCl to snow to clear it.
- (i) Why Sneha does so?
(ii) What is the value in Sneha's thinking?
Arrange the following in increasing order of SN2 reactivity.
- (b) $(\text{CH}_2)_3\text{CBr}$, $\text{CH}_3\text{CH}_2\text{CHBrCH}_3$, $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Br}$
19. Draw the structures of the following :
- (a) SF_4
(b) XeO_3
(c) HOClO_2
20. In a hydrolysis reaction, 5g ethyl acetate is hydrolysed in presence of dilute HCl in 300 minutes. If the reaction is of first order and the initial concentration of ethyl acetate is 22g/L, calculate the rate constant of the reaction.
21. (a) Give reasons for the following :
- (i) Glucose does not give 2,4-DNP test and Schiff's test
(ii) Aminoacids have high melting points and are soluble in water.
- (b) What is meant by the secondary structure of proteins?
22. (a) Give an example of a synthetic rubber and mention its main advantage.
(b) Write the structures of the monomers of Dacron.
(c) Arrange the following polymers in the increasing order of tensile strength.
Nylon-6, Buna-S, Polythene.
23. Give one example for each of the following :
- (a) An artificial sweetener whose use is limited to cold drinks.

- (b) A non-ionic detergent.
- (c) A pain reliever used for relief from severe pains like post-operative pain or pain due to terminal cancer.
24. (a) Give chemical tests to distinguish between the following compounds (One test in each case).
- (i) Aniline and ethylamine
- (ii) Methylamine and dimethylamine
- (b) How will you convert aniline to sulphanilic acid?

OR

An aromatic compound (A) on treatment with ammonia followed by heating forms compound (B), which on heating with Br₂ and KOH forms a compound (C) having molecular formula C₆H₇N. Give the structures of A, B and C and write the reactions involved.

25. (a) Give the mechanism of the following reaction :

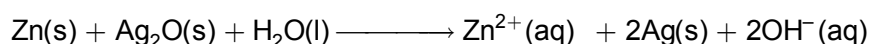


- (b) Describe hydroboration oxidation reaction with the help of an example.
26. Give reasons—
- (a) Interhalogen compounds are more reactive than halogens except F₂.
- (b) PCl₅ is known but NCl₅ is not known.
- (c) Amongst all noble gases, only xenon is known to form compounds with oxygen and fluorine.
27. (a) Give one main difference between lyophilic and lyophobic colloids.
- (b) What is observed when—
- (i) A beam of light is passed through a colloidal solution.
- (ii) Electric current is passed through a colloidal solution.
28. (a) Two electrolytic cells containing silver nitrate solution and dilute sulphuric acid solution were connected in series. A steady current of 2.5 amp was passed through them till 1.078g of silver was deposited.
- [Ag = 107.8 g mol⁻¹, F = 96,500 Cmol⁻¹].

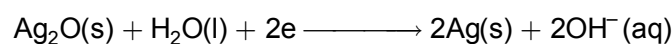
- (I) How much electricity was consumed?
 (ii) What was the weight of oxygen gas liberated?
- (b) Give reason :
- (i) The equilibrium constant K is related to E°_{cell} and not E_{cell}
 (ii) Conductivity of an electrolytic solution decreases with the decrease in concentration.

OR

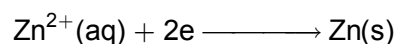
- (a) What is a fuel cell? What is its main advantage?
 (b) What are the reactions occurring at the cathode and anode of a Leclanche cell?
 (c) In the button cell widely used for watches and other devices, the following reaction takes place :



Give the cell representation and determine the value of K_c for the above reaction using the following data.



$$(E^{\circ} = 0.344\text{V})$$



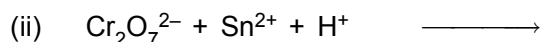
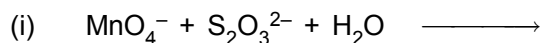
$$(E^{\circ} = -0.76\text{V})$$

29. Explain the following :
- (a) Actinoids show large number of oxidation states.
 (b) Transition metals form a large number of complex compounds.
 (c) Chromium is a typical hard metal while mercury is a liquid.
 (d) MnO is basic while Mn_2O_7 is acidic in nature.
 (e) Silver is a transition metal but zinc is not.

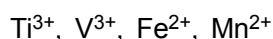
OR

- (a) Give two consequences of lanthanoid contraction.

(b) Complete the following reactions :



(c) Which of the following has maximum number of unpaired electrons?



(d) Based on the following data, arrange Fe^{2+} , Mn^{2+} and Cr^{2+} in the increasing order of stability of +2 oxidation state

$$E^\circ(\text{Cr}^{3+}/\text{Cr}^{2+}) = -0.4\text{V}, E^\circ(\text{Mn}^{3+}/\text{Mn}^{2+}) = 1.5\text{V}, E^\circ(\text{Fe}^{3+}/\text{Fe}^{2+}) = 0.8\text{V}$$

30. (a) Identify A, B and C in the following reaction :



(b) Give reasons

- (i) *p*-Nitro benzoic acid has higher K_a value than benzoic acid.
- (ii) Acetone is less reactive than acetaldehyde towards nucleophilic attack.

OR

(a) An organic compound (A) has molecular formula ($\text{C}_5\text{H}_{10}\text{O}$). It does not reduce Tollens' reagent but forms an orange precipitate with 2,4-DNP reagent. It forms a carboxylic acid (B) with molecular formula ($\text{C}_3\text{H}_6\text{O}_2$) when treated with alkaline KMnO_4 and a yellow precipitate on treatment with NaOH and I_2 . On oxidation under vigorous conditions gives ethanoic acid and propanoic acid. Sodium salt of (B) gave a hydrocarbon (C) in Kolbe's Electrolytic Reduction. Identify (A), (B) and (C) and write the reactions involved.

(b) Predict the products formed in the following cases.

- (i) (A) ($\text{C}_3\text{H}_6\text{O}$) reacts with PhMgBr and is then hydrolysed.
- (ii) (A) reacts with hydrazine and is then heated with KOH and ethylene glycol.
- (iii) (A) does not give Cannizzaro reaction.