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**Part III — CHEMISTRY**

( New Syllabus )

( English Version )

Time Allowed : 3 Hours ]

[ Maximum Marks : 150

- Note :
- Answer *all* the questions from **Part - I**.
  - Answer any *fifteen* questions from **Part- II**.
  - Answer any *seven* questions from **Part - III** covering all Sections and choosing at least *two* questions from each Section.
  - Question No. **70** is compulsory. Answer any *three* from the remaining questions in **Part - IV**.
  - Draw diagrams and write equations wherever necessary.

**PART - I**Note : Answer *all* the questions.

30 × 1 = 30

Choose and write the correct answer :

- The transition element with the lowest atomic number is
  - scandium
  - titanium
  - zinc
  - lanthanum.
- The elements in which extra electron enter (  $n - 2$  )  $f$  orbital are
  - s-block elements
  - p-block elements
  - d-block elements
  - f-block elements.

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3. The isotope used as a power source in long mission space probes is
- |           |           |
|-----------|-----------|
| a) U-235  | b) Pu-235 |
| c) Pu-238 | d) U-238. |
4. The type of isomerism found in the complexes  $[\text{Pt}(\text{NH}_3)_4]$ ,  $[\text{CuCl}_4]$  and  $[\text{Cu}(\text{NH}_3)_4]$ ,  $[\text{PtCl}_4]$  is
- |                         |                            |
|-------------------------|----------------------------|
| a) ionisation isomerism | b) co-ordination isomerism |
| c) linkage isomerism    | d) ligand isomerism.       |
5. After 24 hours 0.125 g of the initial quantity of 1 g of a radioactive isotope is left out. The half-life period is
- |             |              |
|-------------|--------------|
| a) 24 hours | b) 12 hours  |
| c) 8 hours  | d) 16 hours. |
6. For a reaction  $E_a = 0$  and  $k = 4.2 \times 10^5 \text{ sec}^{-1}$  at 300 K, the value of  $k$  at 310 K will be
- |  |  |
|--|--|
| a) $4.2 \times 10^5 \text{ sec}^{-1}$    | b) $8.4 \times 10^5 \text{ sec}^{-1}$      |
| c) $8.4 \times 10^{-5} \text{ sec}^{-1}$ | d) $4.2 \times 10^{-5} \text{ sec}^{-1}$ . |
7. The iron catalyst used in the Haber's process is poisoned by
- |                         |                              |
|-------------------------|------------------------------|
| a) Pt                   | b) $\text{H}_2$              |
| c) $\text{H}_2\text{S}$ | d) $\text{As}_2\text{O}_3$ . |
8. Curd is a colloidal solution of
- |                     |                    |
|---------------------|--------------------|
| a) liquid in liquid | b) liquid in solid |
| c) solid in liquid  | d) solid in solid. |
9. An emulsion is a colloidal solution of
- |                |                      |
|----------------|----------------------|
| a) two solids  | b) two gases         |
| c) two liquids | d) solid and liquid. |
10. When one coulomb of electricity is passed through an electrolytic solution, the mass deposited on the electrode is equal to
- |                               |                     |
|-------------------------------|---------------------|
| a) equivalent weight          | b) molecular weight |
| c) electrochemical equivalent | d) one gram.        |

11. The isomerism exhibited by  $\text{CH}_3 - \text{CH}_2 - \text{N} \begin{matrix} \text{=O} \\ \searrow \\ \text{O} \end{matrix}$  and  $\text{CH}_3 - \text{CH}_2 - \text{O} - \text{N} = \text{O}$  is
- a) position  
b) chain  
c) functional  
d) tautomerism.
12. Which of the following nitro-compounds behave as an acid in the presence of strong alkali ?
- a) Primary  
b) Secondary  
c) Tertiary  
d) both (a) and (b).
13. Conversion of benzene diazonium chloride to chlorobenzene is called
- a) Sandmeyer's reaction  
b) Stephan's reaction  
c) Gomberg reaction  
d) Schotten-Baumann reaction.
14. Proteins are
- a) polypeptides  
b) polyacids  
c) polyphenols  
d) polyesters.
15. Mixture of equal molecules of D (+) glucose and D (-) fructose is called as
- a) Fruit sugar  
b) Invert sugar  
c) Cane sugar  
d) Non-sugar.
16. Dual character of an electron was explained by
- a) Bohr  
b) Heisenberg  
c) de Broglie  
d) Pauli.
17. The momentum of a particle which has de Broglie wavelength of 1 Å ( $h = 6.626 \times 10^{-34} \text{ kg m}^2 \text{ s}^{-1}$ ) is
- a)  $6.6 \times 10^{-23} \text{ kg ms}^{-1}$   
b)  $6.6 \times 10^{-24} \text{ kg ms}^{-1}$   
c)  $6.6 \times 10^{-34} \text{ kg ms}^{-1}$   
d)  $6.6 \times 10^{34} \text{ kg ms}^{-1}$ .
18. The order of ionisation energy is
- a)  $s < p < d < f$   
b)  $s > p > d > f$   
c)  $s > d > p > f$   
d)  $s < d < p < f$ .
19. The general electronic configuration of carbon family is
- a)  $ns^2 np^2$   
b)  $ns^2 np^3$   
c)  $ns^2 np^1$   
d)  $ns^2 np^4$ .

20. Which of the following compounds will not give positive Chromyl Chloride Test ?

- a)  $\text{CuCl}_2$     b)  $\text{C}_6\text{H}_5\text{Cl}$   
 c)  $\text{ZnCl}_2$     d)  $\text{HgCl}_2$ .

21. In a simple cubic cell, each point on a corner is shared by

- a) one unit cell                                      b) two unit cells  
 c) eight unit cells                                      d) four unit cells.

22. The change of entropy for the process  $\text{H}_2\text{O}(\text{liq}) \rightarrow \text{H}_2\text{O}(\text{vap})$  involving

$\Delta H_{\text{vap}} = 40850 \text{ J mol}^{-1}$  at 373 K is

- a)  $120 \text{ J mol}^{-1} \text{ K}^{-1}$                                   b)  $9.1 \times 10^{-3} \text{ J mol}^{-1} \text{ K}^{-1}$   
 c)  $109.52 \text{ J mol}^{-1} \text{ K}^{-1}$                               d)  $9.1 \times 10^{-4} \text{ J mol}^{-1} \text{ K}^{-1}$ .

23. Which of the following does not result in an increase in the entropy ?

- a) Rusting of iron  
 b) Crystallisation of sucrose from solution  
 c) Vaporisation of camphor  
 d) Conversion of ice to water.

24. For the homogenous gas reaction at 600 K



the equilibrium constant  $K_c$  has the unit

- a)  $\text{mol dm}^{-3}$     b)  $(\text{mol dm}^{-3})^{-1}$   
 c)  $(\text{mol dm}^{-3})^{10}$                                       d)  $(\text{mol dm}^{-3})^9$ .

25.  $2 \text{H}_2\text{O}(g) + 2 \text{Cl}_2(g) \rightleftharpoons 4 \text{HCl}(g) + \text{O}_2(g)$ , the value of  $K_p$  and  $K_c$  are related as

- a)  $K_p = K_c$     b)  $K_p > K_c$   
 c)  $K_p < K_c$     d)  $K_p = K_c = 0$ .

26. Oxidation of glycerol with bismuth nitrate gives

- a) meso-oxalic acid                                      b) glyceric acid  
 c) tartronic acid    d) both (b) and (c).

27. According to Lewis concept of acids and bases, ethers are
- neutral
  - acidic
  - basic
  - amphoteric.
28. The compound mixed with ethanol to serve as substitute for petrol is
- methoxy methane
  - ethoxy ethane
  - methanol
  - ethanal.
29. Aldol is
- 2-hydroxy butanol
  - 3-hydroxy butanol
  - 3-hydroxy butanal
  - 2-hydroxy butanal.
30.  $\text{CH}_3\text{CH}(\text{OH})\text{COOH} \xrightarrow{\text{H}_2\text{O}_2 / \text{Fe}^{2+}} \text{X}$ . The X is
- $\text{CH}_3\text{COCOOH}$
  - $\text{CH}_3\text{CH}_2\text{COOH}$
  - $\text{CH}_3\text{CHOHCHO}$
  - $\text{CH}_2(\text{COOH})_2$

### PART - II

Note : Answer any *fifteen* questions.

15 × 3 = 45

- State Heisenberg's Uncertainty principle.
- Why is electron affinity of fluorine less than that of chlorine ?
- What are cyclic silicates ? Give an example.
- $\text{H}_3\text{PO}_4$  is triprotic. Prove.
- Explain why  $\text{Mn}^{2+}$  is more stable than  $\text{Mn}^{3+}$ .
- A substance is found to have a magnetic moment of 3.9 BM. How many unpaired electrons does it contain ?
- Explain the principle behind the 'Hydrogen bomb'.
- What are superconductors ? Give any one of its applications.
- What is entropy ? What is its unit ?
- The equilibrium constant  $K_c$  for  $\text{A}(\text{g}) \rightleftharpoons \text{B}(\text{g})$  is  $2.5 \times 10^{-2}$ . The rate constant of the forward reaction is  $0.05 \text{ sec}^{-1}$ . Calculate the rate constant of the reverse reaction.

41. Give any three examples for opposing reactions.
42. The half-life period of a first order reaction is 20 mins. Calculate the rate constant.
43. What is electrophoresis ?
44. State Faraday's first and second laws of electrolysis.
45. Mesotartaric acid is an optically inactive compound with asymmetric carbon atoms. Justify your answer.
46. How can the consumption of alcohol by a person be detected ?
47. How will you convert phenol to phenolphthalein ?
48. Give the IUPAC names for the following :
  - i) Crotonaldehyde
  - ii) Methyl *n*-propyl ketone
  - iii) Phenyl acetaldehyde.
49. What is trans-esterification ?
50. How will you convert acetamide to methyl amine ? Give equation.
51. How is Dacron prepared ? Give any one of its uses.

### PART - III

Note : Answer any seven questions choosing at least two questions from each Section. 7 × 5 = 35

### SECTION - A

52. Explain the formation of oxygen molecule by molecular orbital theory.
53. How is zinc extracted from its chief ore ?
54. Compare the points of similarities and differences between lanthanides and actinides ( any five points ).
55. Explain the postulates of Werner's theory.

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## SECTION - B

56. Write the various statements of second law of thermodynamics.
57. Derive the relation  $K_p = K_c (RT)^{\Delta n(g)}$  for a general chemical equilibrium reaction.
58. State the characteristics of order of a reaction.
59. Calculate the *e.m.f.* of the cell having the cell reaction



when concentration of  $\text{Zn}^{2+} = 0.1 \text{ M}$  and  $\text{Ag}^+ = 10 \text{ M}$  in the solution.

## SECTION - C

60. How do ethers react with HI ? Give the significance of the reaction.
61. Explain the mechanism of Cannizzaro reaction.
62. How is lactic acid manufactured in large scale ? How can it be converted into cyclic diester ?
63. Explain briefly the characteristics of rocket propellants.

## PART - IV

Note : Question No. 70 is compulsory and answer any *three* from the remaining questions. 4 × 10 = 40

64. a) Explain Pauling's method to determine ionic radii. 5  
 b) How is fluorine isolated from their fluorides by Dennis method ? 5
65. a) Mention the type of hybridisation, magnetic property and geometry of the following complexes using VB theory. 5  
 i)  $[\text{FeF}_6]^{4-}$  ii)  $[\text{Fe}(\text{CN})_6]^{4-}$   
 b) How are radioactive isotopes useful in medicine ? 5

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66. a) Explain Schottky and Frenkel defects. 5  
b) Write briefly about the adsorption theory of catalysis. 5
67. a) Explain Ostwald's dilution law. 5  
b) Write the IUPAC convention of representation of a cell. 5
68. a) Distinguish enantiomers from diastereomers. Give an example each. 5  
b) Give the mechanism of esterification. 5
69. a) Distinguish between primary, secondary and tertiary amines. 5  
b) Discuss the structure of fructose in detail. 5
70. a) An organic compound (A) of molecular formula  $C_7H_6O$  is not reduced by Fehling's solution but will undergo Cannizzaro reaction. Compound (A) reacts with Aniline to give compound (B). Compound (A) also reacts with  $Cl_2$  in the presence of catalyst to give compound (C). Identify (A), (B) and (C) and explain the reactions. 5  
b) An element (A) belongs to group number 11 and period number 4. (A) is a reddish brown metal. (A) reacts with HCl in the presence of air and gives compound (B). (A) also reacts with conc.  $HNO_3$  to give compound (C) with the liberation of  $NO_2$ . Identify (A), (B) and (C). Explain the reactions. 5

OR

- c) An organic compound (A) of molecular formula  $C_3H_8O$  gives turbidity within 5 - 10 min on reaction with anhydrous  $ZnCl_2 / HCl$ . Compound (A) on treatment with sodium hypochlorite gives a carbonyl compound (B) which on further chlorination gives compound (C) of molecular formula  $C_3H_3OCl_3$ . Identify (A), (B) and (C). Explain the reactions. 5
- d) What is the pH of a solution containing 0.5 M propionic acid and 0.5 M sodium propionate? The  $K_a$  of propionic acid is  $1.34 \times 10^{-5}$ . 5
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