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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 :

- Ethylene diamine forms glycol with

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| a) nitrous acid | b) Na_2CO_3 solution |
| c) NaHCO_3 solution | d) Baeyer's reagent. |
- When ethers are exposed to air for a long time, they form

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| a) peroxides | b) halides |
| c) oxides | d) superoxides. |

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3. The isomerism exhibited by 1-propanol and methoxy ethane is
a) chain
b) position
c) functional
d) metamerism.
4. The compound that does not answer iodoform test is
a) acetophenone
b) isopropyl alcohol
c) 2-pentanol
d) benzophenone.
5. The compound found as stony deposits in kidneys is
a) potassium oxalate
b) oxalic acid
c) potassium succinate
d) calcium oxalate.
6. Semiconductors which exhibit conductivity due to the flow of excess negatively charged electron are called
a) superconductors
b) n-type semiconductors
c) p-type semiconductors
d) insulators.
7. The amount of heat exchanged with the surrounding at constant temperature and pressure is called
a) ΔE
b) ΔH
c) ΔS
d) ΔG .
8. If ΔG for a reaction is negative, the change is
a) spontaneous
b) non-spontaneous
c) reversible
d) none of these.
9. For a homogenous gaseous reaction at 600 K
$$4 \text{ NH}_3 (g) + 5 \text{ O}_2 \rightleftharpoons 4 \text{ NO} (g) + 6 \text{ H}_2 \text{ O} (g)$$
the equilibrium constant K_c has the unit
a) $(\text{mol dm}^{-3})^{-1}$
b) mol dm^{-3}
c) $(\text{mol dm}^{-3})^4$
d) $(\text{mol dm}^{-3})^{-2}$.
10. If the equilibrium constant for the formation of a product is 25, the equilibrium constant for the decomposition of the same product is
a) 25
b) $\frac{1}{25}$
c) 5
d) 625.

11. de Broglie equation is

- a) $\lambda = \frac{mv}{h}$ b) $\lambda = hmv$
c) $\lambda = \frac{hv}{m}$ d) $\lambda = \frac{h}{mv}$

12. The bond order of nitrogen molecule is

- a) 1 b) 2
c) 3 d) 4.

13. Effective nuclear charge Z^* can be calculated using the formula

- a) $Z^* = Z - S$ b) $Z^* = Z + S$
c) $Z^* = S - Z$ d) $Z = Z^* - S$

14. The metalloid among the following is

- a) Pb b) P
c) Ge d) Sn.

15. The chemical composition of slag formed during the smelting process in the extraction of copper is

- a) $\text{Cu}_2\text{O} + \text{FeS}$ b) FeSiO_3
c) CuFeS_2 d) $\text{Cu}_2\text{S} + \text{FeO}$.

16. Organic compound that does not undergo diazotisation is

- a) *m*-toluidine b) aniline
c) *p*-aminophenol d) benzylamine.

17. The intermediate formed on electrolytic reduction of nitrobenzene in conc. H_2SO_4 is

- a) $\text{C}_6\text{H}_5\text{NH}-\text{NHC}_6\text{H}_5$ b) $\text{C}_6\text{H}_5-\text{NHOH}$
c) $\text{C}_6\text{H}_5-\text{N}=\text{N}-\text{C}_6\text{H}_5$ d) all of these.

18. The compound that does not show tautomerism is

- a) nitrobenzene b) nitromethane
c) nitroethane d) 2-nitropropane.

19. The reducing sugar is

- a) sucrose b) cellulose
c) starch d) glucose.

20. The amino acid without chiral carbon is
- a) Glycine b) Alanine
c) Proline d) Tyrosine.
21. The half-life period of a first order reaction is 10 minutes. The rate constant is
- a) $6.93 \times 10^2 \text{ min}^{-1}$ b) $0.693 \times 10^{-2} \text{ min}^{-1}$
c) $6.932 \times 10^{-2} \text{ min}^{-1}$ d) $69.3 \times 10^{-1} \text{ min}^{-1}$.
22. Tyndall's effect is not observed in
- a) emulsions b) colloidal solutions
c) true solutions d) none of these.
23. Decomposition of hydrogen peroxide is retarded in the presence of
- a) alcohol b) glycerine
c) MnO_2 d) Mo.
24. An example of gel is
- a) paint b) pumice-stone
c) milk d) curd.
25. The indicator suitable for the titration of oxalic acid against NaOH is
- a) Methyl orange b) Potassium permanganate
c) Phenolphthalein d) Litmus.
26. The transition element showing maximum oxidation state is
- a) Sc b) Ti
c) Os d) Zn.
27. Elements that form oxocations are
- a) lanthanides b) actinides
c) noble gases d) base metals.
28. The radioactive lanthanide is
- a) terbium b) lutetium
c) promethium d) gadolinium.

29. An example of ambidentate ligand is

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| a) Cl^- | b) NO_2^- |
| c) H_2O | d) NH_3 |

30. Which one of the following particles is used to bombard ${}_{13}\text{Al}^{27}$ to give ${}_{15}\text{P}^{30}$ and a neutron?

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| a) α -particle | b) β -particle |
| c) Neutron | d) Proton. |

PART - II

Note : i) Answer any *fifteen* questions.

ii) Answer each question in *one or two* sentences. $15 \times 3 = 45$

31. Distinguish between a particle and a wave.
32. Why is the first ionisation energy of Beryllium greater than that of Lithium?
33. Prove that phosphorous acid is a powerful reducing agent.
34. What is Plumbo solvency?
35. Why do transition elements form complexes?
36. Give any two evidences for the oxidising nature of potassium dichromate.
37. What is the Q value of a nuclear reaction?
38. What are superconductors?
39. What is Gibbs' free energy?
40. In the equilibrium $\text{H}_2 + \text{I}_2 \rightleftharpoons 2\text{HI}$, the number of moles of H_2 , I_2 and HI are 1, 2, 3 moles respectively. Total pressure of the reaction mixture is 60 atm. Calculate the partial pressures of H_2 and HI in the mixture.
41. The initial rate of a first order reaction is $5.2 \times 10^{-6} \text{ mol lit}^{-1} \text{ s}^{-1}$ at 298 K, when the initial concentration of the reactant is $2.6 \times 10^{-3} \text{ mol lit}^{-1}$. Calculate the first order rate constant of the reaction at the same temperature.
42. Write a note on consecutive reactions.
43. What are emulsions?
44. State Kohlrausch's law.

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45. Differentiate diastereomer from enantiomer.
46. Why is glycol more viscous than ethanol ?
47. How is phenolphthalein prepared ?
48. How does formaldehyde react with ammonia ?
49. What is meant by esterification reaction ? Write the equation.
50. An organic compound (A) having molecular formula C_2H_7N is treated with nitrous acid to give (B) of molecular formula C_2H_6O which answers iodoform test. Identify (A) and (B) and explain the reaction.
51. Write a brief note on Buna-S.

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 O_2 molecule using molecular orbital theory.
53. Explain the extraction of silver from its chief ore (Argentite).
54. Discuss the consequences of lanthanide contraction.
55. Using VB theory explain why $[Ni(CN)_4]^{2-}$ is diamagnetic whereas $[Ni(NH_3)_4]^{2+}$ is paramagnetic.

SECTION - B

56. Write the various statements of second law of thermodynamics.
57. Apply Le Chatelier principle to Haber's process of manufacture of ammonia.
58. Explain the experimental determination of rate constant for the decomposition of hydrogen peroxide in aqueous solutions.
59. Calculate the *e.m.f* of zinc-silver cell at $25^\circ C$ when $[Zn^{2+}] = 0.10 M$ and $[Ag^+] = 10 M$. (E_{cell}° at $25^\circ C = 1.56$ volts).

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SECTION - C

60. Discuss the isomerism in ethers.
61. Write the mechanism of crossed aldol condensation of acetone.
62. Account for the reducing property of formic acid.
63. Explain briefly on Rocket propellants.

PART - IV

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

64. a) Explain the various factors that affect electron affinity. 5
- b) How are noble gases isolated from air ? 5
65. a) Give the postulates of Werner's theory of coordination compounds. 5
- b) Write a note on radio carbon dating. 5
66. a) Explain Braggs spectrometer method. 5
- b) Write any three methods for the preparation of colloids by dispersion methods. 5
67. a) Explain Ostwald's theory of indicators. 5
- b) Derive Nernst equation. 5
68. a) Discuss the optical isomerism in tartaric acid. 5
- b) How can salicylic acid be converted to
- i) Aspirin
- ii) 2, 4, 6 tribromophenol
- iii) Methyl salicylate ? 5
69. a) Distinguish between primary, secondary and tertiary amines. 5
- b) Prove the structure of glucose. 5

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70. a) An organic compound (A) C_2H_6O liberates hydrogen on treatment with metallic sodium. (A) on mild oxidation gives (B) C_2H_4O which answers iodoform test. (B) when treated with conc. H_2SO_4 undergoes polymerisation to give (C), a cyclic compound. Identify (A), (B) and (C) and explain the reactions. 5
- b) Silver reacts with dil. HNO_3 to give compound (A) which on heating at 723 K gives (B). (B) on further heating gives (C). Further compound (A) reacts with KBr and gives (D) which is highly useful in photography. Identify (A), (B), (C) and (D) and write the reactions. 5

OR

- c) An organic compound (A) of molecular formula C_2H_6O on treatment with PCl_5 gives compound (B). Compound (B) reacts with KCN to give a compound (C) of molecular formula C_3H_5N which undergoes acid hydrolysis to give compound (D) which on treatment with Sodalime gives a hydrocarbon. Identify (A), (B), (C) and (D) and explain the reactions.
- d) Find the pH of a buffer solution containing 0.20 mole per litre sodium acetate and 0.15 mole per litre acetic acid. K_a for acetic acid is 1.8×10^{-5} .
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