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Part III — CHEMISTRY

(English Version)

Time Allowed : 3 Hours]

[Maximum Marks : 150

Note : Draw diagrams and write equations wherever necessary.

PART - I

Note : i) Answer all the questions.

ii) Choose and write the correct answer. $30 \times 1 = 30$

1. Which compound is formed when excess of KCN is added to an aqueous solution of copper sulphate ?
 - a) $\text{Cu}(\text{CN})_2$
 - b) $\text{K}_2[\text{Cu}(\text{CN})_6]$
 - c) $\text{K}[\text{Cu}(\text{CN})_2]$
 - d) $\text{Cu}_2(\text{CN})_2 + (\text{CN})_2$
2. Alloys of Lanthanides are called as
 - a) Mish metals
 - b) Metalloids
 - c) Plate metal
 - d) actinides.
3. Lanthanide contraction is due to
 - a) perfect shielding of 4f electrons
 - b) imperfect shielding of 4f electrons
 - c) perfect shielding of 3d electrons
 - d) imperfect shielding of 3d electrons.
4. An example of a chelating ligand is
 - a) nitro
 - b) chloro
 - c) bromo
 - d) en.

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19. Inert gas used in beacon lights for safety of air navigation is
- a) Helium b) Argon
c) Neon d) Xenon.
20. Which one of the following will have maximum magnetic moment ?
- a) $3d^2$ b) $3d^6$
c) $3d^7$ d) $3d^9$.
21. The Bragg's equation is
- a) $\lambda = 2d \sin \theta$ b) $nd = 2\lambda \sin \theta$
c) $2\lambda = nd \sin \theta$ d) $n\lambda = 2d \sin \theta$.
22. According to Trouton's rule, the value of change in entropy of vaporisation is
- a) 21 cal. deg⁻¹ mole⁻¹ b) 12 cal. deg⁻¹ mol⁻¹
c) 21 k.cal. deg. mole⁻¹ d) 12 kcal. deg. mol⁻¹.
23. In which of the following processes, the process is always non-feasible ?
- a) $\Delta H > 0, \Delta S > 0$ b) $\Delta H < 0, \Delta S > 0$
c) $\Delta H > 0, \Delta S < 0$ d) $\Delta H < 0, \Delta S < 0$.
24. In the manufacture of ammonia by Haber's process, the maximum yield of ammonia will be obtained with the process having
- a) low pressure and high temperature
b) low pressure and low temperature
c) high pressure and high temperature
d) high pressure and low temperature.
25. The relationship between K_p and K_c for the equilibrium
- $$2H_2O(g) + 2Cl_2(g) \rightleftharpoons 4HCl(g) + O_2(g)$$
- is
- a) $K_p = K_c$ b) $K_p = K_c(RT)^2$
c) $K_p = K_c(RT)^1$ d) $K_p = K_c(RT)^{-2}$.

- ## PART - II

ii) Each answer should be in one or two sentences. $15 \times 3 = 45$

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37. Write the uses of Radio carbon dating.
38. What is molecular crystal ? Give an example.
39. Calculate the maximum % efficiency possible from a thermal engine operating between 110°C and 25°C .
40. Define reaction quotient.
41. What is pseudo first order reaction ? Give example.
42. Write the Arrhenius equation and explain the terms.
43. Write any three general characteristics of catalytic reaction.
44. What is common ion effect ? Give example.
45. Distinguish racemic mixture from mesoform.
46. How can Terylene be prepared ?
47. How is tertiary butyl alcohol converted to isobutylene ?
48. How can acetophenone be prepared by Friedel-Crafts reaction ?
49. What is aspirin ? How is it prepared ?
50. An organic compound A of molecular formula $\text{C}_2\text{H}_5\text{ON}$ treated with bromine and KOH gives B of molecular formula CH_5N . Identify A and B. Write the equation involved.
51. Write any three characteristics of dyes.

PART - III

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

SECTION - A

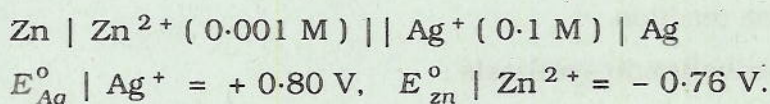
52. Derive de-Broglie's equation.
53. Explain the extraction of zinc from its ore.
54. Write any five differences between lanthanides and actinides.

55. For the complex $K_4 [Fe(CN)_6]$ mention the following :

- IUPAC name
- Central metal ion
- Ligand
- Co-ordination number
- Charge on the complex ion.

SECTION - B

- Write the characteristics of free energy G .
- Derive the expressions for K_c and K_p for decomposition of PCl_5 .
- Write the characteristics of order of reaction.
- Calculate the e.m.f. of the cell :



SECTION - C

- Distinguish aliphatic and aromatic ethers.
- How is acetone converted to —
 - mesityl oxide
 - mesitylene ?
- Write the mechanism of esterification reaction.
- Explain briefly on characteristics of rocket propellants.

PART - IV

Note : i) Question No. 70 is compulsory and answer any three from the remaining questions.

ii) Answer four questions in all.

$$4 \times 10 = 40$$

- How do electronegativity values help to find out the nature of bonding between atoms ?
 - How are noble gases separated by Dewar's method ?

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65. a) Write the application of VB theory on the following complexes :
- $[\text{Fe}^{\text{II}}(\text{F})_6]^{4-}$
 - $[\text{Fe}^{\text{II}}(\text{CN})_6]^{4-}$.
- b) Differentiate between chemical reaction and nuclear reaction.
66. a) Write the properties of ionic crystals.
- b) How can colloidal solutions be purified by dialysis ?
67. a) Derive Henderson equation.
- b) Write IUPAC representation of a cell.
68. a) Explain geometrical isomerism with example.
- b) How to do the following conversions ?
- Lactic acid to lactide
 - Salicylic acid to methyl salicylate.
69. a) Write the following reactions :
- Carbylamine reaction
 - Gabriel's phthalimide synthesis .
- b) How are carbohydrates classified ? Give example for each.
70. a) An organic compound A ($\text{C}_2\text{H}_6\text{O}$) liberates hydrogen with sodium metal. A when heated with alumina at 620 K gives an alkene B which when passed through Bayer's reagent gives C ($\text{C}_2\text{H}_6\text{O}_2$) . C reacts with PI_3 and gives back B. Identify A, B and C. Write the reactions.
- b) The chief ore of chromium A on roasting with molten sodium carbonate gives compound B. Compound B on acidification with conc. H_2SO_4 gives compound C. Compound C on treatment with KCl gives compound D. Identify A, B, C and D. Explain the reactions.
- OR
- c) An organic compound A (C_7H_8) on oxidation by air in the presence of V_2O_5 at 773 K gives B ($\text{C}_7\text{H}_6\text{O}$) , which reduces Tollen's reagent. B when heated with acetic anhydride and sodium acetate gives C ($\text{C}_9\text{H}_8\text{O}_2$) . Identify A, B and C. Write the reactions.
- d) Calculate the pH of 0.1 M acetic acid solution. Dissociation constant of acetic acid is 1.8×10^{-5} M.