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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 : Answer *all* the questions. $30 \times 1 = 30$

Choose and write the correct answer :

1. The reaction of ethylene glycol with PI_3 gives

   a) ICH_2CH_2I b) $CH_2 = CH_2$

   c) $CH_2 = CHI$ d) $ICH = CHI.$

2. The number of ether isomers possible for $C_4H_{10}O$ is

   a)   7   b)   5

   c)   4   d)   3.

3. Oxygen atom of ether is

   a)   more reactive   b)   replaceable

   c)   oxidising   d)   comparatively inert.

4. The compound that does not reduce Fehling solution is

   a)   formaldehyde   b)   acetaldehyde

   c)   benzaldehyde   d)   propionaldehyde.

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5. Ethylene dicyanide on hydrolysis gives

    a)   oxalic acid   b)   succinic acid

    c)   adipic acid   d)   propionic acid.

6. In Bragg's equation n represents

    a)   number of moles   b)   Avogadro number

    c)   quantum number   d)   order of reflection.

7. Change in Gibbs free energy is given by

    a) $\Delta G = \Delta H + T \Delta S$ b) $\Delta G = \Delta H - T \Delta S$

    c) $\Delta G = \Delta H \times T \Delta S$ d) $\Delta G = T \Delta S - \Delta H$.

8. $H_2O(l) \rightarrow H_2O(g)$. In this process the entropy,

    a)   remains constant   b)   decreases

    c)   increases   d)   becomes zero.

9. State of chemical equilibrium is

    a)   dynamic   b)   stationary

    c)   none of these   d)   both (a) and (b).

10. $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$. The equilibrium constant K_c for this reaction is 16. K_p value is

    a) $\dfrac{1}{16}$ b)   4

    c)   64   d)   16.

11. $E_n = -\dfrac{313 \cdot 6}{n^2}$, $E_n = -34 \cdot 84$, n value is

    a)   4   b)   3

    c)   2   d)   1.

12. Water exists in liquid state. This is due to

    a)   high boiling point   b)   low boiling point

    c)   freezing point is zero   d)   hydrogen bond.

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13. Effective nuclear charge is given by the equation

   a) $z^* = z - s$

   b) $z^* = z + s$

   c) $z^* = s - z$

   d) $z = z^* - s$.

14. The compound used to arrest the bleeding is

   a) K_2SO_4

   b) Potash alum

   c) $Al_2(SO_4)_3$

   d) KI.

15. The number of unpaired electrons in Ti^{3+} is 1. Its magnetic moment in BM is

   a) 1·414

   b) 2

   c) 1·732

   d) 3.

16. $C_6H_5NH_2 \xrightarrow[273\ K]{NaNO_2\ /\ HCl} X$. X is

   a) C_6H_5Cl

   b) C_6H_5NHOH

   c) $C_6H_5N_2Cl$

   d) C_6H_5OH.

17. Oil of mirbane is

   a) nitrobenzene

   b) benzaldehyde

   c) methyl salicylate

   d) aspirin.

18. Primary amine acts as

   a) electrophile

   b) Lewis acid

   c) free radical

   d) Lewis base.

19. Ultimate product of hydrolysis of proteins is

   a) aniline

   b) aliphatic acid

   c) amino acid

   d) aromatic acid.

20. Inversion of sucrose refers to

   a) oxidation of sucrose

   b) reduction of sucrose

   c) sucrose to glucose and fructose

   d) polymerisation of sucrose.

21. In a first order reaction the concentration of the reactant is increased by 2 times. The rate of the reaction is increased by

   a) 2 times

   b) 4 times

   c) 10 times

   d) 6 times.

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22. Colloidal medicines are more effective because

    a)   they are clean

    b)   they are easy to prepare

    c)   they are easily assimilated and adsorbed

    d)   the germs move towards them.

23. Which one is correct factor that explains the increase of rate of reaction by a catalyst ?

    a)   Shape selectivity   b)   Particle size

    c)   Increase of free energy   d)   Lowering of activation energy.

24. The function of $FeCl_3$ in the conversion of $Fe(OH)_3$ precipitate into a colloid is

    a)   peptising agent   b)   emulsifying agent

    c)   reducing agent   d)   precipitating agent.

25. Equivalent conductance of acetic acid at 25°C is

80 ohm^{-1} cm^2 (gram equivalent)$^{-1}$ and at infinite dilution is

400 ohm^{-1} cm^2 (gram equivalent)$^{-1}$. The degree of dissociation is

    a)   1   b)   0·2

    c)   0·1   d)   0·3.

26. Which of the following is wrong statement regarding $K_2Cr_2O_7$?

    a)   Oxidising agent

    b)   Used in tanning industry

    c)   Soluble in water

    d)   Reduces ferric sulphate to ferrous sulphate.

27. The common oxidation state of lanthanides is

    a)   + 2   b)   + 1

    c)   + 3   d)   + 4.

28. Alloys of lanthanides are called as

   a) misch metals   b) metalloids

   c) plate metals   d) actinides.

29. The co-ordination number of Cr (III) in $\left[Cr \left(H_2O \right)_4 Cl_2 \right] Cl . 2H_2O$ is

   a) 3   b) 4

   c) 6   d) 2.

30. The reaction $_5B^8 \rightarrow {}_4Be^8$ takes place due to

   a) α-decay   b) β-decay ?

   c) electron capture   d) positron decay.

PART – II

Note :   i)   Answer any *fifteen* questions.

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

31. What is the significance of negative electronic energy ?

32. 'The ionisation energy of boron is less than beryllium.' Why ?

33. How is phosphoric acid prepared in the laboratory ?

34. Give three uses of neon.

35. Why do *d*-block elements form complexes ?

36. What is the reaction of $CuSO_4$ with KCN ?

37. Half-life period of $_{79}Au^{198}$ nucleus is 150 days. Calculate its average life.

38. Write a note on Frenkel defect.

39. ΔH and ΔS values of a reaction at 300 K are – 10 k. cal mole^{-1} and 20 cal. deg^{-1} mole^{-1} respectively. Calculate ΔG value.

40. What is reaction quotient ? How is it related to equilibrium constant ?

41. Derive an equation for the half-life period of a first order reaction.

42. Define order of a reaction.

43. What are promoters ? Give an example.

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44. Define equivalent conductance. Give the equation for it.

45. What are optical isomers ? Give example.

46. Write a note on Kolbe's reaction.

47. How is glycerol synthesized from propylene ?

48. Write two tests to identify aldehydes.

49. How is methyl salicylate prepared ?

50. $C_6H_5CH_2NH_2 \xrightarrow{HNO_2} A \xrightarrow{[O]} B \xrightarrow[HCl]{Zn/Hg} C$. Identify A, B and C.

51. What are anaesthetics ? Give one example.

PART – III

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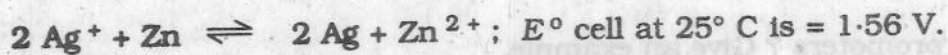
SECTION – A

52. Explain the formation of N_2 molecule by using molecular orbital theory.

53. How is silver extracted from its ore ?

54. Compare the properties of lanthanides and actinides.

55. $\left[Ni(CN)_4 \right]^{2-}$ is diamagnetic whereas $\left[Ni(NH_3)_4 \right]^{2+}$ is paramagnetic.

Explain.

SECTION – B

56. What are the characteristics of entropy ?

57. Apply the Le Chatelier's principle for the formation of SO_3 by contact process.

58. Explain various types of complex reactions and give one example for each.

59. Calculate the e.m.f. of the zinc-silver cell at 25°C . When $\left[Zn^{2+} \right] = 0.10$ M and $\left[Ag^+ \right] = 10$ M, cell reaction is

$$2\,Ag^+ + Zn \rightleftharpoons 2\,Ag + Zn^{2+} ; \quad E° \text{ cell at } 25° C \text{ is } = 1.56 \text{ V}.$$

SECTION – C

60. Give any two methods of preparation of anisole and explain the reaction of HI with anisole.

61. Explain the mechanism of Cannizzaro reaction.

62. What happens when

    i)   Oxalic acid is treated with NH_3

    ii) Benzoic acid is treated with PCl_5 ?

63. Write a note on rocket propellants.

PART – IV

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

64. a) Explain any three factors which affect the ionisation energy.

    b) How is lead extracted from its ore ?

65. a) Explain the Werner's theory of co-ordination compounds.

    b) Explain nuclear fission reaction with an example.

66. a) What are superconductors ? Write their uses.

    b) What is electro-osmosis ? Explain the experiment.

67. a) Explain quinonoid theory of indicators.

    b) Derive the Nernst equation.

68. a) Explain the optical activity of Tartaric acid.

    b) How do you distinguish formic acid from acetic acid ?

69. a) How does nitrous acid react with primary, secondary and tertiary amines ?

    b) Outline the classification of carbohydrates giving examples for each.

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70. a) Compound A of molecular formula C_7H_8 is treated with chlorine and then with NaOH to get compound B of molecular formula C_7H_8O. B on oxidation by acidified $K_2Cr_2O_7$ gives compound C of molecular formula C_7H_6O. Compound C on treatment with 50% caustic soda gives the compound B and also D. Find A, B, C and D. Explain the reactions.

   b) A bluish white metal A present in 4th period and 12th group on heating in air gives a white cloud B. Metal A on treatment with conc. H_2SO_4 gives the compound C and SO_2 gas. Find A, B and C. Explain the reactions.

   OR

   c) Compound A having the molecular formula C_2H_4O reduces Tollen's reagent. A on treatment with HCN followed by hydrolysis gives the compound B with molecular formula $C_3H_6O_3$. Compound B on oxidation by Fenton's reagent gives the compound C with the molecular formula $C_3H_4O_3$. Find A, B and C. Explain the reactions.

   d) The equivalent conductance of HCl, CH_3COONa and NaCl at infinite dilution are $426 \cdot 16$, $91 \cdot 0$ and $126 \cdot 45$ ohm^{-1} cm^2 (gram equivalent)$^{-1}$ respectively. Calculate the equivalent conductance of acetic acid.

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