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Number

Part III — CHEMISTRY

(English Version)

Time Allowed : 3 Hours]   [Maximum Marks : 150

Note :   i)   Answer *all* the questions from **Part – I.**

ii)   Answer any *fifteen* questions from **Part– II.**

iii)   Answer any *seven* questions from **Part – III** covering all Sections and choosing at least *two* questions from each Section.

iv)   Question No. **70** is compulsory. Answer any *three* from the remaining questions in **Part – IV.**

v)   Draw diagrams and write equations wherever necessary.

PART – I

Note : Answer *all* the questions.   30 × 1 = 30

Choose and write the correct answer :

1.   The metal used in galvanising iron sheets is

a)   chromium   b)   zinc

c)   copper   d)   silver.

2.   Among the Lanthanide elements, with the increase in atomic number the tendency to act as reducing agent

a)   increases   b)   decreases

c)   no change   d)   none of these.

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3. The long mission space probes use .... as power source.

   a) Pu

   b) U

   c) Th

   d) Pm.

4. Which of the following is cationic complex ?

   a) $K_4 \left[Fe(CN)_6 \right]$

   b) $\left[Cu(NH_3)_4 \right] Cl_2$

   c) $K_3 \left[Cr(C_2O_4)_3 \right]$

   d) $K_3 \left[Fe(CN)_6 \right]$.

5. Loss of β-particle is equivalent to

   a) increase of one proton only

   b) decrease of one neutron

   c) loss of proton

   d) both (a) and (b).

6. The first order rate constant of a reaction is $0 \cdot 0693$ min^{-1}. Then the time required for 50% completion of a reaction is

   a) 10 min

   b) 1 min

   c) 100 min

   d) 50 min.

7. In case of physical adsorption, there is desorption when

   a) temperature increases

   b) temperature decreases

   c) pressure increases

   d) concentration increases.

8. Smoke is a colloidal solution of

   a) gas in solid

   b) solid in gas

   c) gas in liquid

   d) liquid in gas.

9. Colloidal medicines are more effective because

   a) they are clean

   b) they are easy to prepare

   c) the germs move towards them

   d) they are easily assimilated and adsorbed.

10. When sodium acetate is added to a solution of acetic acid, the degree of ionisation of acetic acid

    a) increases

    b) decreases

    c) does not change

    d) becomes unity.

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11. The nitro group can be reduced to primary amino group by

a) Sn / conc. HCl
b) Zn dust
c) Zn / NH$_4$Cl
d) Zn / NaOH.

12. The organic compound that undergoes carbylamine reaction is

a) $(C_2H_5)_2 NH$
b) $C_2H_5NH_2$
c) $(C_2H_5)_3 N$
d) $(C_2H_5)_4 N^+I^-$.

13. The nitrogen compound used in the preparation of sulpha drugs is

a) methylamine
b) nitromethane
c) aminobenzene
d) nitrobenzene.

14. Nucleic acid is made up of

a) an organic base
b) a sugar unit
c) phosphoric acid
d) all of these.

15. Ultimate product of hydrolysis of protein is

a) aniline
b) aliphatic acid
c) amino acid
d) aromatic acid.

16. The circumference of the circular orbit of an electron is an integral multiple of its

a) frequency
b) momentum
c) mass
d) wavelength.

17. The nature of hybridisation in IF$_7$ molecule is

a) sp^3d^2
b) sp^3d^4
c) sp^3d^3
d) sp^2d^4.

18. On moving down a group, the radius of an ion

a) decreases

b) increases

c) first increases and then decreases

d) remains a constant.

19. The toxic element of Boron family is

    a)   Boron   b)   Indium

    c)   Thallium   d)   Gallium.

20. The general outer electronic configuration of d block elements is

    a) $(n-1)\,d^{1-10}$ b) $(n-1)\,d^{1-10}\,ns^{1-2}$

    c) $(n-1)\,d^{10}\,ns^{1-2}$ d) $(n-1)\,d^{5}\,ns^{1}$.

21. The crystal structure of CsCl is

    a)   simple cube   b)   face-centred cube

    c)   body-centred cube   d)   edge-centred cube.

22. 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) $\Delta G = \Delta H \cdot T\Delta S$ d)   none of these.

23. For the reaction $2\,Cl\,(g) \rightarrow Cl_2\,(g)$, the signs of ΔH and ΔS are respectively

    a)   + , −   b)   + , +

    c)   − , −   d)   − , + .

24. If the equilibrium constant of the reaction $2A \rightleftharpoons B$ is K_1

    and that of $B \rightleftharpoons 2A$ is K_2, then

    a) $K_1 = 2K_2$ b) $K_1 = \dfrac{1}{K_2}$

    c) $K_1 = \left(K_2\right)^2$ d) $K_2 = \left(\dfrac{1}{K_1}\right)^2$.

25. When Δn_g in a homogenous gaseous equilibrium is positive, then

    a) $K_p = K_c$ b) $K_p < K_c$

    c) $K_p > K_c$ d) $K_p = \dfrac{K_c}{2}$.

26. The characteristic odour of lower phenols is

    a)   carbolic acid   b)   fruity

    c)   oil of bitter almonds   d)   rotten fish.

27. Oxygen atom of ether is

    a) very active   b) inert

    c) oxidising   d) replaceable.

28. Diethyl ether behaves as a

    a) Lewis acid   b) Lewis base

    c) neutral compound   d) Brönsted acid.

29. The formation of a cyanohydrin with a ketone is an example of

    a) electrophilic substitution   b) nucleophilic addition

    c) nucleophilic substitution   d) electrophilic addition.

30. The isomerism exhibited by CH_3CH_2COOH and CH_3COOCH_3 is

    a) metamerism   b) functional isomerism

    c) chain isomerism   d) position isomerism.

PART – II

Note :   i)   Answer any *fifteen* questions.

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

31. What are the conditions for effective H_2-bonding ?

32. Explain why the first ionisation energy of Be is greater than that of B.

33. Write a note on plumbo solvency.

34. Illustrate the dehydrating property of phosphorous pentoxide (P_2O_5) with two examples.

35. Why do *d*-block elements have variable oxidation states ?

36. How is chrome-plating done ?

37. Give any three differences between chemical reactions and nuclear reactions.

38. What is a vitreous state ?

39. What types of liquids or substances deviate from Trouton's Rule ?

40. Write the equilibrium constants K_c for the following reactions :

    i) $H_2O_2(g) \rightleftharpoons H_2O(g) + \frac{1}{2}O_2(g)$

    ii) $CO(g) + H_2O(g) \rightleftharpoons CO_2(g) + H_2(g).$

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41. Show that for a first order reaction time required for 99% completion is twice the time required for 90% completion of the reaction.

42. What are consecutive reactions ? Give an example.

43. Write a note on auto-catalyst.

44. What is meant by common ion effect ?

45. Mesotartaric acid is optically inactive. Justify.

46. Give a brief account on coupling reaction of phenol with benzene diazonium chloride.

47. Give any three uses of benzyl alcohol.

48. How is urotropine prepared ? Mention its use.

49. Write a note on HVZ reaction.

50. What is Gabriel phthalimide synthesis ?

51. Write a brief note on 'Antiseptic'.

PART – III

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

SECTION – A

52. Derive de Broglie's equation.

53. How is gold extracted from its ore ?

54. Describe the extraction of lanthanides from monazite sand.

55. For the complex $K_4 \left[Fe \left(CN \right)_6 \right]$

mention

a) IUPAC name

b) Central metal ion

c) Geometry of the complex

d) Ligand

e) Co-ordination number.

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SECTION – B

56. State the various statements of second law of thermodynamics.

57. The dissociation equilibrium constant of HI is $2 \cdot 06 \times 10^{-2}$ at 458 K. At equilibrium the concentrations of HI and I_2 are 0·36 M and 0·15 M respectively. What is the equilibrium concentration of H_2 at 458 K ?

58. Discuss the characteristics of a first order reaction.

59. Derive Nernst equation.

SECTION – C

60. Distinguish between anisole and diethyl ether.

61. Explain the mechanism of aldol condensation of acetaldehyde.

62. How is benzoic acid obtained from

a)

$$CH_2\,CH_3$$
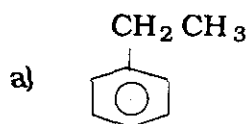
b) Phenyl cyanide

c) Carbon dioxide ?

63. Write a note on anaesthetics.

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 influence electron affinity.   5

   b) Describe in detail how noble gases are isolated from air by Ramsay-Rayleigh's method.   5

65. a) Apply *VB* theory to find out the geometry of $\left[\, Ni \left(\, NH_3 \,\right)_4 \,\right]^{2+}$ and calculate its magnetic moment.   5

   b) Write about radiocarbon dating.   5

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66. a) Explain Bragg's spectrometer method.   5

     b) Write any two chemical methods for the preparation of colloids.   5

67. a) Derive Henderson equation.   5

     b) Establish a relation between free energy and *e.m.f.*   5

68. a) Distinguish racemic form from Meso form with suitable example.   5

     b) Discuss the isomerism exhibited by carboxylic acid.   5

69. a) How are the following conversions carried out ?

     i) Nitrobenzene to phenyl hydroxylamine

     ii) Aniline to phenyl isocyanide

     iii) Benzene diazonium chloride to biphenyl.   5

     b) What is a peptide bond ? Illustrate the formation of a peptide bond in glycyl alanine. Draw the structures of glucose and fructose.   5

70. a) An organic compound $A\left(C_7H_6O\right)$ reduces Tollen's reagent. On treating with an alkali compound A forms B and C. B on treating with sodalime forms benzene and $C\left(C_7H_8O\right)$ is an antiseptic. Identify compounds A, B and C. Explain the reactions.   5

     b) The sulphide ore of an element of group 12 when roasted gave compound A which on reduction with carbon gave the element B. The carbonate C of this element is used for skin diseases. Identify A, B and C and write the required reaction.   5

OR

     c) An organic compound A of molecular formula C_6H_6O gives violet colouration with neutral $FeCl_3$. Compound A on treatment with metallic Na gives compound B. Compound B on treatment with CO_2 at 400 K under pressure gives C. This product on acidification gives compound $D\left(C_7H_6O_3\right)$ which is used in medicine. Identify A, B, C and D and explain the reactions.   5

     d) Find the pH of a buffer solution containing 0·2 mole/l of CH_3COONa and 0·15 mole/l of CH_3COOH. K_a for acetic acid is $1·8 \times 10^{-5}$.   5

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