HS/XI/Sc/Ch/22

2022

CHEMISTRY

(Theory)

Full Marks : 70

Time : 3 hours

General Instructions :

(i) All questions are compulsory.

(ii) Question No. **1** to **5** are multiple choice questions carrying 1 mark each.

(iii) Question No. **6** to **10** are very short answer questions carrying 1 mark each.

(iv) Question No. **11** to **17** are short answer questions carrying 2 marks each.

(v) Question No. **18** to **26** are long answer questions carrying 3 marks each.

(vi) Question No. **27** is a value based answer question carrying 4 marks.

(vii) Question No. **28 to 30** are very long answer questions carrying 5 marks each.

(viii) If necessary simple calculator and log table can be used.

PART — I

Choose the correct answer: $1 \times 5 = 5$

1. Which of the following set of quantum numbers are not possible. 1

(a) $n = 1,\ l = 0,\ M_l = 0,\ M_s = +\frac{1}{2}$

(b) $n = 1,\ l = 1,\ M_l = 0,\ M_s = +\frac{1}{2}$

(c) $n = 2,\ l = 1,\ M_l = 0,\ M_s = +\frac{1}{2}$

(d) $n = 2,\ l = 0,\ M_l = 0,\ M_s = +\frac{1}{2}$

2. In the modern periodic table, the period indicate the value of 1

(a) Atomic number

(b) Atomic mass

(c) Principal quantum number

(d) Spin quantum number

3. A Thermodynamic state function is a quantity 1

(a) Used to determine heat changes

(b) Whose value is independent of path

(c) Used to determine pressure volume work

(d) Whose value depends on temperature only

4. Which one of the alkaline earth metal carbonates is thermally the most stable? 1

(a) $MgCO_3$

(b) $CaCO_3$

(c) $SrCO_3$

(d) $BaCO_3$

5. The reaction: 1

$$CH_3CH_2I + KOH(aq) \rightarrow CH_3CH_2OH + KI$$

is classified as

(a) Electrophilic substitution

(b) Nucleophilic substitution

(c) Elimination

(d) Addition

PART — II

6. Define Modern Periodic Law 1

7. Distinguish between a σ (sigma) and a π (pi) bond. 1

8. What is disproportionation reaction? 1

9. Name the different allotropes of carbon. 1

10. Why is the small drops of mercury form spherical bead instead of spreading on the surface. 1

PART — III

11. A compound contain 4.07% hydrogen, 24.27% carbon and 71.65% chlorine. Its molar mass is 98.96g. What are its empirical and molecular formula? 2

12. The threshold frequency υ_o for a metal is $7.0 \times 10^{14} s^{-1}$. Calculate the kinetic energy of an electron emitted when radiation of frequency $\upsilon = 1.0 \times 10^{15} s^{-1}$ hits the metal. 2

13. Explain why cations are smaller and anions larger in radii than their parent atoms? 2

14. Derive equation,

$pV = nRT$

Where the symbols carry usual meaning. 2

15. *Either*

Which out of NH_3 and NF_3 has higher dipole moments and why? 2

Or

Define hydrogen bond. Is it weaker or stronger than the van der Waals forces? 2

16. What causes the temporary and permanent hardness of water? 2

17. *Either*

What are electrophiles and nucleophiles? Explain with example. 2

Or

Define Hyperconjugation with suitable example. 2

PART — IV

18. *Either*

(a) Write the electronic configuration of Cu(At no. 29) 1

(b) Account for the stability of completely filled and half filled subshells 2

Or

Give the postulates of Bohr's model of hydrogen atom. 3

19. Define hybridisation? Explain the structure of C_2H_4 molecule on basis of hybridisation. 3

20. Derive the relationship between C_p and C_v for an ideal gas. 3

21. *(a)* State Le Chatelier's principle. 1

(b) For the equilibrium 2

$$2NOCl(g) \rightleftharpoons 2NO(g) + Cl_2(g)$$

the value of the equilibrium constant K_c is 3.75×10^{-6} at 1069K. Calculate K_p for the reaction at this temperature?

22. *Either*

(a) On the basis of molecular Hydride classify the following compound as electron deficient, electron precise and electron rich hydrides. 2

B_2H_6, CH_4, H_2O and NH_3.

(b) What are amphoteric oxide? Give example. 1

Or

(c) Starting from Borax, how Boric acid is prepared? Give balance chemical equation. 2

(d) What happen when Al is treated with dilute NaOH solution? 1

23. *(a)* Calculate the oxidation number of sulphur (s) in ½×2 = 1

(i) $H_2S_4O_6$

(ii) $Na_2S_2O_3$

(b) Balance the following redox reaction by any method. 2

$Cr_2O_7^{-2} + SO_2(g) \rightarrow Cr^{+3}(aq) + SO_4^{-2}(aq)$ (acid medium)

24. *(a)* Name the different isotopes of Hydrogen. 1

(b) Calculate the mass of a photon with wavelength $3.6A^0$. 2

25. *(a)* Define functional group isomerism with example. 1

(b) Differentiate between distillation under reduced pressure and steam distillation. 2

26. *Either*

(a) Define ozonolysis with example. 2

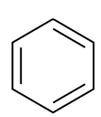
(b) How benzene is prepared from phenol? Give chemical equation. 1

Or

(c) What are ortho-para directing group? Explain with example 1

(d) Write the product of the following reaction

(i) $CH_4 + O_2 \xrightarrow[\Delta]{Mo_2O_3}$ 1

(ii)  $+ 6Cl_2 \xrightarrow[\text{dark, cold}]{\text{Anhyd. } AlCl_3}$ 1

PART – V

27. As an individual who is responsible for protecting the environment, what measure would you take to reduce environmental pollution in your locality. 4

28. *Either*

(a) Derive the relation

$$\Delta G = \Delta H - T\Delta S < 0$$ 2

(b) What are extensive and intensive properties of a system? Cite example. 2

(c) What is bond dissociation enthalpy ($\Delta_{hexa} H^{\theta}$) 1

Or

(d) The combustion of one mole of benzene takes place at 298 K and 1 atm. After combustion, $CO_2(g)$ and $H_2O(l)$ are produced and 3267.0 kJ of heat is liberated. Calculate the standard enthalpy of formation ($\Delta_f H^{\theta}$) of benzene Standard enthalpy of formation of $CO_2(g)$ and $H_2O(1)$ are –393.5 kJ/mol and –285.83 kJ/mol respectively. 3

(e) How temperature affects the spontaneity of a chemical reaction? 2

29. *(a)* Give Chemical equation to show

(i) The amphoteric nature of H_2O $1\frac{1}{2}$

(ii) The oxidising property of H_2O_2 $1\frac{1}{2}$

(b) What is “dead burnt plaster”? 1

(c) List out two uses of quicklime. 1

30. *(a)* What is hydrogenation reaction? Give example. 1

(b) What is heterolytic cleavage? 1

(c) Draw the newman projection formula of Ethane. 1

(d) Give the mechanism of addition of

$$HBr \text{ to } CH_3 - C = \underset{H}{C} - \underset{CH_3}{CH_3}$$ 2

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