Answer any 6 questions from 1 to 12. Each carries 2 scores. $(6 \times 2 = 12)$

1. Write any two important results observed during photoelectric effect.

2. Represent the orbitals with the following quantum numbers :
   (i) $n = 2, l = 1$ (1)
   (ii) $n = 5, l = 0$ (1)

3. Draw the potential energy curve for the formation of a hydrogen molecule on the basis of inter-nuclear distance between the hydrogen atoms.

4. Write the Van der Waals equation and explain the terms.

5. State Hess's law of constant heat summation.

6. What are Buffer Solutions ? Give an example.

7. (i) What is a conjugate acid-base pair ? (1)
   (ii) Write the conjugate acid of the base H_2O. (1)

8. Match the following :

Compound	Use
(i) Calcium sulphate	(A) Water softening
(ii) Sodium bicarbonate	(B) Purification of Sugar
(iii) Calcium oxide	(C) Antiseptic
(iv) Sodium carbonate	(D) Dentistry
	(E) Purification of Bauxite

$(4 \times \frac{1}{2} = 2)$

9. Write the IUPAC names of the following :
   (i) $CH_3 - CH - CH_2 - CH - CH_2 - CH_3$ (1)
   $\qquad\qquad |\qquad\qquad\quad |$
   $\qquad\quad CH_3\qquad\quad CH_2 - CH_3$

   (ii) $CH_3 - CO - CH_2 - CH_2 - CH_2 - COOH$ (1)

2

10. Write the differences between homolytic and heterolytic bond cleavages.

11. Draw the Newman projections for the eclipsed and staggered conformations of ethane.

12 Draw the geometrical isomers of but-2-ene.

Answer any 8 questions from 13 to 28. Each carries 3 scores $(8 \times 3 = 24)$

13 State and illustrate law of multiple proportions.

14. (i) Calculate the mass of $CO_2(g)$ in gram produced by the reaction between 3 mol of $CH_4(g)$ and 2 mol of $O_2(g)$ according to the equation :

$$CH_4(g) + 2O_2(g) \longrightarrow CO_2(g) + 2H_2O(g)$$ **(2)**

(ii) Identify the limiting reagent in this reaction. **(1)**

15. (i) State modern periodic law. **(1)**

(ii) Give any two properties of transition elements. **(2)**

16. (i) Define electron gain enthalpy. **(1)**

(ii) Electron gain enthalpy of chlorine is more negative than that of fluorine. Explain. **(2)**

17. (i) What is meant by dipolemoment ? **(1)**

(ii) Dipolemoment of BF_3 is zero, but that of NH_3 is not zero. Why ? **(2)**

18. (i) State Boyle's law. **(1)**

(ii) A vessel of 120 mL capacity contains a certain amount of gas at 35° C and 1.2 bar pressure. The gas is transferred to another vessel of volume 180 mL at 35 °C. What would be its new pressure ? **(2)**

19. (i) Real gases deviate from ideal behaviour due to two assumptions of Kinetic molecular theory which do not hold good at all conditions. State them. **(2)**

(ii) What is meant by compressibility factor ? **(1)**

20 i) Define extensive and intensive properties.   (2)

(ii) Choose the intensive property from the following :

(A) Enthalpy

(B) Molar volume

(C) Heat capacity

(D) Internal energy   (1)

21. The enthalpy and entropy changes for a reaction are 490 kJmol^{-1} and 198 Jk^{-1}mol^{-1}. Calculate the value of Gibb's energy change (ΔG) for this reaction at 300 K. Predict whether the reaction is spontaneous at this temperature.

22. Balance the following redox equation in acidic medium by half reaction method :

$$Fe^{2+} + Cr_2O_7^{2-} \longrightarrow Fe^{3+} + Cr^{3+}$$

23. (i) What are disproportionation reactions ?   (1)

(ii) Check whether the reaction

$2H_2O_{2(l)} \longrightarrow 2H_2O_{(l)} + O_{2(g)}$ is a disproportionation reaction. Justify your answer.   (2)

24. (i) Which of the following mixture is known as 'syn gas' ?

(A) CO and H_2O (B) CO and N_2

(C) CO and H_2 (D) CO_2 and H_2O (1)

(ii) Explain the production of dihydrogen gas by water gas shift reaction.   (2)

25 (i) Give any one disadvantage of hardness of water.   (1)

(ii) Hydrogen peroxide is stored in wax-lined glass or plastic vessels in dark. Why ? (2)

26. Explain the manufacture of Sodium carbonate by Solvay process, with necessary chemical equations.

27. (i) Give reasons for the anomalous properties shown by Lithium. **(1)**

(ii) Give any two anomalous properties shown by Lithium. **(2)**

28. (i) Differentiate chain isomerism from position isomerism. **(2)**

(ii) Write the structures of all the possible positon isomers of butanol $(C_4H_{10}O)$. **(1)**

Answer any 6 questions from 29 to 40. Each carries 4 scores. **(6 × 4 = 24)**

29. (i) Write the important observations made by Rutherford in his α-particle scattering experiment. **(2)**

(ii) What are the important postulates of Rutherford's nuclear model of atom. **(2)**

30. (i) State Heisenberg's Uncertainty Principle. Give its mathematical expression. **(2)**

(ii) What will be the wavelength of a ball of mass 0.1 kg moving with a velocity of 10 m/s ? $(h = 6.626 \times 10^{-34} \, Js)$ **(2)**

31. (i) A molecule of the type AB_2E_2 has 2 bond pairs of electrons and 2 lone pairs of electrons. The most stable structure of this molecule is _____ .

(A) Tetrahedral (B) Bent

(C) Square planar (D) Square pyramid **(1)**

(ii) Write the important postulates of VSEPR theory. **(3)**

32. (i) Write the molecular orbital configuration of O_2 molecule. Account for its paramagnetic character. **(2)**

(ii) Calculate the bond order of O_2 molecule. **(2)**

33. (i) State Le Chatelier's principle. **(1)**

(ii) What are the effects of the following changes in the equilibrium process :

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g); \Delta H = -92.38 \, kJ/mol.$$

(A) Increasing the pressure

(B) Increasing the temperature

(C) Removal of NH_3 from the reaction vessel. **(3)**

34. (i) Define the term pH. **(1)**

(ii) The concentration of H^+ ion in a soft drink is 3×10^{-12} M. Calculate its pH. Identify whether the solution is acidic or basic. **(3)**

35. (i) The allotropic form of carbon which is obtained by heating graphite in an electric arc in presence of an inert gas is _____ .

(A) Diamond (B) Carbon black

(C) Fullerene (D) Charcoal **(1)**

(ii) Diamond is hard and a non-conductor of electricity, while graphite is soft and a good conductor of electricity, eventhough both are the different forms of carbon. Justify the statement on the basis of their structure. **(3)**

36. (i) Write the industrial production of diborane. **(1)**

(ii) Name the final product obtained when diborane is heated with ammonia. **(1)**

(iii) Explain the structure of diborane. **(2)**

37. Explain the detection of nitrogen present in an organic compound by Lassigne's test.

38. Explain the following :

(i) Wurtz reaction

(ii) Kharash effect **(2 × 2 = 4)**

39. (i) Which gas is formed when water is added to Calcium carbide (CaC_2) ? **(1)**

(ii) What are electrophilic substitution reactions ? Explain any one electrophilic substitution reaction of benzene with necessary chemical equations. **(3)**

40 (i) Which of the following is NOT a green house gas ?

(A) CO_2 (B) CO

(C) Ozone (D) CH_4 **(1)**

(ii) Define the term Biochemical Oxygen Demand. **(2)**

(iii) Give any one application of Green Chemistry in day-to-day life. **(1)**