1. What do you mean by green chemistry?  1
2. What are zeolites?  1
3. Tea or coffee is sipped from a saucer when it is hot. Why?  1
4. What are the conjugate bases of HCN and NH₄⁺?  1
5. What is an electrochemical cell?  1
6. What are trans-uranium elements?  1
7. Complete the following equation:
   \[ \text{CH}_3 \cdot \text{CH} = \text{CH}_2 + \text{HBr} \rightarrow \]
   1
8. What is the significance of Uncertainty Principle in our daily life?  1
9. The density of 3M solution of NaCl is 1.25gm⁻¹. Calculate the molality of the solution.
   (Atomic mass of Na= 23, Cl= 35.5)  2
10. Arrange the following in the increasing order of the property indicated:
(a) \( \text{H}_2\text{O}, \text{NH}_3, \text{CH}_4 \) (Bond angle)
(b) \( \text{HF}, \text{HCl}, \text{HBr} \) (Boiling point)

11. The ionization constant of HF and HCN at 298 K are 6.8 \( \times 10^{-4} \) and 4.8 \( \times 10^{-9} \) respectively. Calculate the ionization constants of the corresponding conjugate bases.

OR

Ionization constant of Acetic Acid is 1.74 \( \times 10^{-5} \). Calculate its degree of dissociation in its 0.05M solution. Calculate the concentration of acetate ions in the solution.

12. Balance the equation by ion electron method:
\[
\text{MnO}_4^- (aq) + I^- (aq) \rightarrow \text{MnO}_2 (s) + I_2 (s) \quad (\text{In basic medium})
\]

OR
\[
\text{MnO}_4^- (aq) + \text{SO}_2 (g) \rightarrow \text{Mn}^{2+} (aq) + \text{HSO}_4^- (aq) \quad (\text{In Acidic medium})
\]

13. (i) Write water gas shift reaction.

(ii) How does hydrogen peroxide react with KMnO4 in acidic medium?

14. Why is LiF almost insoluble in water whereas LiCl is soluble not only in water but in acetone also?

15. How does no bond resonance take place? Explain with the help of an example.

16. Write the IUPAC names of the following:
(i) \( \text{CH}_3-\text{CH}-\text{CH}-\text{CH}-\text{CH}_3 \)
    \[
    \quad \quad \quad \quad \quad
    \quad \text{NO}_2 \quad \text{I} \quad \text{OH}
    \]

(ii) \( \text{C}_8\text{H}_1\text{CHO} \)

17. Out of benzene, m-dinitro benzene and toluene which will undergo nitration most easily and why?

18. (i) Expand B.O.D and P.C.B.

(ii) Explain the term Eutrophication.

19. A compound contains 4.07% Hydrogen, 24.27% Carbon and 71.67% Chlorine. Its molar mass is 98.96g. What are its empirical and molecular formulae. (At.mass of \( \text{C}, \text{H}, \text{Cl} \) is 12, 1 and 35.5 resp.)

20. What is diagonal relationship? What are its causes? Explain with examples.

21. Which hybrid orbitals are used by carbon atoms in the following molecules?
(i) \( \text{CH}_3\text{CHO} \)
(ii) \( \text{CH}_3\text{COOH} \)
(iii) \( \text{C}_2\text{H}_5\text{OH} \)
22. (i) What is compressibility factor?
   (ii) Explain the physical significance of Vanderwaal's parameters.
23. (i) What is adiabatic process? Explain with an example.
   (ii) Give the units of entropy.
   (iii) Derive the relationship between $C_P$ and $C_V$.
24. (i) What are extensive properties? Give any two examples?
   (ii) Predict the feasibility under which $\Delta G$ of the reaction is negative.
   (iii) The dissolution of $\text{NH}_4\text{Cl}$ in water is endothermic but it still dissolves in water readily. Why?
25. At 473K, equilibrium constant $K_c$ for decomposition of $\text{PCl}_5$ is $8.3 \times 10^{-3}$. If decomposition is depicted as
   \[ \text{PCl}_5(s) \rightleftharpoons \text{PCl}_3(s) + \text{Cl}_2(g) \quad \Delta H^\circ = 124 \text{kJ mol}^{-1} \]  
   (i) Write an expression for $K_c$ for the reaction.
   (ii) What is the value of $K_c$ for the reverse reaction at same temperature.
   (iii) What would be the effect on $K_c$ if:
       * the pressure is increased
       * the temperature is increased.
26. Write balanced chemical equations for the following:
   (i) Sodium peroxide dissolves in water.
   (ii) $\text{K}_2\text{O}_2$ reacts with water.
   (iii) Sodium oxide reacts with carbon dioxide.
27. (i) Name the compound which is formed during Carius method for estimation of phosphorus.
   (ii) 0.3780g of an organic substance gave 0.5740g of silver chloride in Carius estimation. Calculate the percentage of chlorine present in the compound.
      (At mass of Cl = 35.5, Ag = 108)
   OR
   (i) Name a suitable technique of separation of the components from a mixture of calcium sulphate and camphor.
   (ii) 0.25g of an organic compound gave $30 \text{cm}^3$ of moist dinitrogen at 288K and 745mm pressure. Calculate the percentage of nitrogen.
      (Aqueous tension at 288K = 12.7mm, At. Mass of N = 14)
28. (i) Compare the relative stability of the following species and indicate their magnetic properties:
      $\text{O}_2, \text{O}_2^+, \text{O}_2^-$ and $\text{O}_2^{2-}$.
(ii) Describe the hybridization in case of PCl₅. Why are axial bonds longer than equatorial bonds?

OR

(i) Compare the dipole moment of NH₃ and NF₃. Justify your answer.

(ii) Explain the structure of carbonate ion in terms of resonance.

29. (A) Explain the following:
   (i) PbCl₂ does not react with Cl₂ to give PbCl₄.
   (ii) A mixture of dilute NaOH and Al pieces are used to open drain.
   (iii) Al utensils should not be kept in water overnight.

(B) Write chemical equations to show the products formed by the hydrolysis of RSiCl₃.

OR

(A) Write balanced equations for:
   (i) Silicon dioxide is treated with hydrogen fluoride.
   (ii) Boric acid is added to water.
   (iii) Diborane reacts with ammonia followed by heating.

(B) Explain:
   (i) BF₃ behaves as a Lewis acid.
   (ii) Ga has a lower atomic radius compared to Al.

30. (i) Propanal and propenal 3-one are the ozonolysis products of an alkene. Write the structure of the alkene and also give the equation.

(ii) Arrange these set of compounds in the order of their decreasing relative reactivity with an electrophile and assign reason:
    Toluene, p-CH₃C₆H₄NO₂, p-NO₂C₆H₄NO₂.

(iii) How will you carry out Friedel Craft’s Alkylation reaction

OR

(i) An alkene A contains 3 C=C, 8 C-H and 1 C-C(π) bonds. Upon Ozonolysis A gives 2 moles of an aldehyde of molar mass 44 μ. Write the IUPAC name of A and also write the reaction.

(ii) Arrange these set of compounds in the order of their decreasing relative reactivity with an electrophile and assign reason; Chlorobenzene, 2,4-dinitrochlorobenzene, p-nitrochlorobenzene

(iii) How will you carry out Wurtz reaction?