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CHEMISTRY GURU

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CLASS 11TH CHEMISTRY QUESTION BANK

- Chapter-wise Questions
- Definitions & Theory Questions
- Numerical Problems
- Reactions & Conceptual Questions
- Previous Year Questions (With Pattern)
- Exam-Oriented Practice

Practice Today... Perform Tomorrow...

1. Basic Concepts of Chemistry and Chemical Calculations
2. Atomic Structure
3. Periodic Classification of Elements
4. Chemical Bonding
5. States of Matter
6. Thermodynamics
7. Equilibrium
8. Redox Reactions
9. Hydrogen
10. s-Block Elements
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12. Organic Chemistry
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14. General Principles and Processes of Isolation of Elements
15. Some Important Compounds

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Dr P ASHOKAN
M.Sc., M.Phil., B.Ed., Ph.D.

CLASS XI CHEMISTRY QUESTION BANK 2025–2026

Dr. P. Ashokan, M.Sc., B.Ed., M.Phil., Ph.D.

1. Basic Concepts of Chemistry and Chemical Calculations

1. Define relative atomic mass (Ar).

2. Define relative molecular mass.

3. Calculate the molar masses of: (i) urea, $CO(NH_2)_2$; (ii) acetone, CH_3COCH_3;

(iii) boric acid, H_3BO_3; (iv) sulphuric acid, H_2SO_4.

4. Calculate the molar masses of: (i) ethanol, C_2H_5OH; (ii) glucose, $C_6H_{12}O_6$.

5. Define a mole. What do you understand by the term 'mole'?

6. Define Avogadro's number.

7. Define molar mass.

8. Define equivalent mass.

9. Define molar volume.

10. Define gram equivalent mass.

11. Calculate the equivalent mass of H_2SO_4.

12. Define basicity. Determine the basicity of orthophosphoric acid (H_3PO_4).

13. If the molecular formula of acetic acid is $C_2H_4O_2$, write its empirical formula.

14. Write the empirical formulae of: (i) fructose in honey, $C_6H_{12}O_6$; (ii) caffeine in tea and coffee, $C_8H_{10}N_4O_2$.

15. An organic compound in vinegar contains 40% carbon, 6.6% hydrogen and 53.4% oxygen. Determine its empirical formula.

16. A compound contains 76.6% carbon, 6.38% hydrogen and the remainder oxygen. Find its empirical and molecular formulae if its vapour density is 47.

17. The empirical formula of a compound is C_6H_6O and its vapour density is 47. Determine its molecular formula.

18. Calculate the amount of water formed when 32 g of methane is burnt.

19. What is a limiting reagent?

20. What are excess reactants?

21. Differentiate between oxidation and reduction.

22. What do you understand by oxidation number?

23. Find the oxidation number of the underlined element in: (i) H_2O_2 (ii) KO_2 (iii) OF_2 (iv) CO_2 (v) H_2SO_4 (vi) CH_2F_2 (vii) $Cr_2O_7^{2-}$ (viii) $KMnO_4$.

24. What are decomposition reactions?

25. What are disproportionation reactions?

26. Elemental analysis gives: Na = 14.31%, S = 9.97%, H = 6.22%, O = 69.5%. All hydrogen is present as water of crystallisation. Find the molecular formula if the molecular mass is 322.

2. Quantum Mechanical Model of the Atom

1. Write the postulates of Bohr's atomic model.

2. What are the limitations of Bohr's atomic model?

3. Write short notes on: (i) Zeeman effect (ii) Stark effect.

4. Write the de Broglie equation.

5. Describe the Davisson–Germer experiment.

6. State Heisenberg's uncertainty principle.

7. The uncertainty in the velocity of an electron is 5.7×10^5 m s^{-1}. Calculate the uncertainty in its position.

8. Write the time-independent Schrödinger equation.

9. What is an orbital? State the values of n and l for electrons in the $3p_x$ and $4d_{x^2-y^2}$ orbitals.

10. What are the main features of the quantum mechanical model?

11. Write notes on the quantum numbers: (i) principal (n), (ii) azimuthal/angular momentum (l), (iii) magnetic (m_l), and (iv) spin (m_s).

12. Calculate the maximum number of electrons in the L shell.

13. How many orbitals are possible in the fourth energy level (n = 4)?

14. What is effective nuclear charge?

15. State the Aufbau principle.

16. State the Pauli exclusion principle.

17. State Hund's rule.

18. Write the electronic configuration and orbital diagram of nitrogen.

19. Write the electronic configuration of chromium (Z = 24).

20. Write the electronic configuration of copper (Z = 29).

21. What is exchange energy?

22. Which quantum numbers describe an orbital's shape, energy, orientation and size?

23. How many radial and angular nodes are present in the 2s, 3d, 4p, 5d and 4f orbitals?

24. Write the electronic configurations of Mn^{2+} and Cr^{3+}.

3. Periodic Classification of Elements

1. State Dobereiner's law of triads.

2. State Newlands' law of octaves.

3. Define the periodic law.

4. State the modern periodic law.

5. Give the IUPAC systematic names and symbols for elements with atomic numbers 111, 120 and 222.

6. Write the general electronic configurations of lanthanoids and actinoids.

7. What are f-block elements?

8. Define atomic radius.

9. Define effective nuclear charge.

10. Calculate the effective nuclear charge experienced by the 3d and 4s electrons in scandium (Sc).

11. Calculate the effective nuclear charge experienced by a 3p electron in Al and Cl.

12. Define ionic radius.

13. Explain Pauling's method for determining ionic radii.

14. What are isoelectronic ions? Give examples.

15. What is ionisation enthalpy (ionisation energy)?

16. Explain why the second ionisation energy is always greater than the first.

17. Describe the periodic trend in ionisation energy.

18. Why is the ionisation energy of nitrogen greater than that of oxygen?

19. Compare the ionisation energies of beryllium (Be) and boron (B).

20. What is the shielding effect?

21. What is electron affinity?

22. Why do beryllium (Be) and nitrogen (N) have nearly zero electron affinity?

23. Define electronegativity.

24. Why do halogens act as oxidising agents?

25. Briefly explain the basis of Pauling's electronegativity scale.

26. Describe periodic trends in electronegativity across periods and down groups.

27. Define valency.

28. Explain the diagonal relationship.

29. State any two anomalous properties of second-period elements.

30. Give one example each of: (i) basic oxide (ii) acidic oxide (iii) amphoteric oxide.

4. Hydrogen

1. What are isotopes? Name the isotopes of hydrogen.

2. Differentiate between ortho-hydrogen and para-hydrogen.

3. How can para-hydrogen be converted into ortho-hydrogen?

4. How is hydrogen prepared in the laboratory?

5. What is water gas (synthesis gas)? Alternatively, describe the industrial preparation of hydrogen.

6. What is the water-gas shift reaction?

7. How is tritium prepared?

8. Write the substitution reactions of deuterium.

9. What are the uses of hydrogen?

10. Differentiate between hard water and soft water.

11. Explain Clark's method for removing temporary hardness of water.

12. What methods are used to convert hard water into soft water?

13. Why does hard water produce less lather with soap?

14. What are the uses of heavy water (deuterium oxide)?

15. Complete the reaction: $Na_2O_2 + ? \rightarrow Na_2SO_4 + H_2O_2$.

16. How is hydrogen peroxide prepared industrially?

17. Why is H_2O_2 stored in plastic containers rather than glass containers?

18. What are the uses of hydrogen peroxide?

19. Compare the structures of H_2O and H_2O_2.

20. What are hydrides? Name their types.

21. Name the three types of covalent (molecular) hydrides.

22. What are interstitial (metallic) hydrides? Give an example.

23. Define hydrogen bonding.

24. Explain the types of hydrogen bonding with suitable examples.

25. Arrange NH_3, H_2O and HF in increasing order of hydrogen-bonding strength.

26. Write the hydrogen bonds present in a DNA molecule.

5. Alkali and Alkaline Earth Metals

1. State the flame colours of salts of: (i) sodium (ii) potassium (iii) calcium (iv) barium.

2. What is the cause of the anomalous properties of lithium?

3. What similarities exist between lithium and magnesium?

4. Which alkali-metal halides show covalent character? Explain with reasons.

5. Why do alkali metals dissolve in liquid ammonia to give blue solutions?

6. Write the uses of alkali metals.

7. Write the equations for the reactions involved in the Solvay process for preparing sodium carbonate.

8. How is sodium hydroxide manufactured commercially by the Castner–Kellner process?

9. Write the uses of: (i) sodium carbonate (washing soda) (ii) sodium chloride (common salt) (iii) sodium hydroxide (caustic soda) (iv) sodium bicarbonate (baking soda).

10. What is the biological importance of sodium and potassium?

11. What causes the anomalous properties of beryllium?

12. State any three properties in which beryllium differs from the other elements of its group.

13. What similarities exist between beryllium and aluminium?

14. Give the uses of (i) beryllium (ii) magnesium (iii) calcium.

15. Why is BeO insoluble in water while the other alkaline-earth metal oxides dissolve in water?

16. Write the balanced equation for the thermal decomposition of calcium carbonate.

17. Why is $Ca(OH)_2$ used for whitewashing?

18. How is bleaching powder prepared?

19. Give the uses of gypsum.

20. How is plaster of Paris prepared?

21. State the uses of plaster of Paris.

22. Briefly explain the biological importance of calcium and magnesium.

6. Gaseous State

1. State Boyle's law (pressure–volume relationship).

2. Air in a motor-engine cylinder has a pressure of 1.05 atm and a volume of 0.375 dm^3. At the same temperature it is compressed to 0.125 dm^3. Calculate the final pressure.

3. State Charles's law (volume–temperature relationship).

4. State Gay-Lussac's pressure–temperature law.

5. State Avogadro's hypothesis.

6. Write the mathematical relationship between the volume of a gas and the number of moles.

7. Explain the ideal gas equation.

8. State Dalton's law of partial pressures.

9. What are the applications of Dalton's law?

10. State Graham's law of gaseous diffusion.

11. Differentiate between diffusion and effusion.

12. What are ideal gases?

13. How do real gases differ from ideal gases?

14. Write the mathematical expression for the compressibility factor (Z).

15. Explain the van der Waals equation.

16. Explain the volume correction in the van der Waals equation.

17. Describe isotherms (Andrews' isotherms).

18. Explain how critical constants are derived from van der Waals constants.

19. State the Joule–Thomson effect.

20. What is inversion temperature (T_i)?

21. What are the different methods of liquefying gases?

22. A gas occupies 2.58 dm^3 at 15°C and 1 atm. If heated to 38°C at the same pressure, will its volume increase? Calculate the final volume.

23. Explain: (i) carbonated-drink bottles are kept in water during summer; (ii) weather balloons expand as they rise; (iii) is it easy for a person at the summit of Mount Everest to drink water through a straw?

24. Can a gas with van der Waals constant a = 0 be liquefied? Explain.

7. Thermodynamics

1. What are intensive and extensive properties?

2. Define an adiabatic process and an isothermal process.

3. Define an isobaric process.

4. Define an isochoric process.

5. What are state functions and path functions? Give examples.

6. What is internal energy (U)? What is its significance?

7. What are the characteristics of internal energy?

8. State the zeroth law of thermodynamics.

9. State the first law of thermodynamics.

10. Write the mathematical statement of the first law of thermodynamics.

11. What is enthalpy (H)?

12. Write the relationship between enthalpy (H) and internal energy (U).

13. Define molar heat capacity and state its unit.

14. Write the relationship between C_p and C_v for an ideal gas.

15. Describe the construction and uses of a bomb calorimeter.

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

17. What is lattice energy?

18. Explain the indirect method of calculating the lattice energy of NaCl using the Born–Haber cycle.

19. Define entropy (S).

20. State the different formulations of the second law of thermodynamics.

21. Petrol burns at 816°C in an automobile engine. If the surroundings are at 21°C, calculate the maximum efficiency of the engine.

22. An engine operates between 127°C and 47°C. Calculate its maximum percentage efficiency, assuming no energy is lost through friction.

23. Calculate the entropy change when 1 mol of ice melts at 0°C. The molar enthalpy of fusion of ice is 6008 J mol^{-1}.

24. Define Gibbs free energy (G).

25. State the characteristics of Gibbs free energy.

26. What are spontaneous processes? State the conditions for spontaneity.

27. State the third law of thermodynamics.

8. Physical and Chemical Equilibrium

1. Define homogeneous and heterogeneous equilibria.
2. State the law of mass action.
3. Define the equilibrium constant.
4. Explain the relationship between Kp and Kc.
5. Write the balanced chemical equation for the equilibrium represented by Kc = $[CaO(s)][CO_2(g)]/[CaCO_3(s)]$.
6. Write expressions for Kp and Kc for: $2CO(g) \rightleftharpoons CO_2(g) + C(s)$.
7. What are the applications of the equilibrium constant?
8. Define the reaction quotient (Q).
9. Explain how the direction of a reaction can be predicted using the reaction quotient.

10. Derive the general expressions for Kp and Kc for: $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$.

11. Derive the general expressions for Kp and Kc for the decomposition of PCl_5.

12. Explain the Haber process for the manufacture of ammonia, or derive the expressions for Kp and Kc for: $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$.

13. The equilibrium concentrations of NH_3, N_2 and H_2 are 1.8×10^{-2} M, 1.2×10^{-2} M and 3×10^{-2} M, respectively. Calculate the equilibrium constant for the formation of NH_3 from N_2 and H_2.

14. State Le Chatelier's principle.

15. Using Le Chatelier's principle, explain the effects of (i) concentration, (ii) pressure, (iii) temperature, (iv) catalyst and (v) inert gas on equilibrium.

16. Why is chemical equilibrium called dynamic equilibrium even though the concentrations remain constant?

17. What happens when an inert gas is added to a system at equilibrium at constant volume?

18. Derive the van 't Hoff equation.

19. Write a balanced chemical equation for an equilibrium reaction whose equilibrium-constant expression is $Kc = [NH_3]^4[O_2]^5/[NO]^4[H_2O]^6$.

9. Solutions

1. Define (i) molality and (ii) normality.

2. Explain the effect of pressure on solubility.

3. State and explain Henry's law.

4. What are the limitations of Henry's law?

5. Why do aquatic animals feel more comfortable in cold water than in warm water during summer?

6. What is the vapour pressure of a liquid?

7. State Raoult's law.

8. Using Raoult's law, derive the expression for the vapour pressure of a binary solution containing two volatile liquids.

9. State Dalton's law of partial pressures.

10. What are ideal solutions? Give an example.

11. What conditions must a solution satisfy to behave ideally?

12. What are non-ideal solutions? Give an example.

13. What are colligative properties? List the four colligative properties.

14. Define relative lowering of vapour pressure.

15. Write the equation used to calculate molar masses from relative lowering of vapour pressure.

16. How can the molar mass of a solute be calculated from elevation of boiling point?

17. What is osmosis?

18. Define osmotic pressure.

19. Write the van 't Hoff equation for calculating osmotic pressure.

20. How can the molar mass of a solute be calculated from osmotic pressure?

21. Define isotonic solutions.

22. What is a hypotonic solution?

23. What is a hypertonic solution?

24. What is reverse osmosis (RO)?

25. Define the van 't Hoff factor.

10. Chemical Bonding

1. Draw the Lewis dot structures of (i) CH_4, (ii) H_2O, (iii) NH_3 and (iv) HNO_3.

2. Calculate the formal charges on carbon and oxygen in the structure O=C=O.

3. Define bond length. What methods can be used to determine bond length?

4. Define bond order.

5. Define bond energy.

6. What is dipole moment?

7. CO_2 is a linear molecule with two polar bonds, yet its dipole moment is zero. Explain why.

8. State Fajans' rule.

9. Explain the covalent character in an ionic bond.

10. Using VSEPR theory, predict the shapes of molecules.

11. Arrange the following molecules in decreasing order of bond angle: (i) CH_4, H_2O, NH_3; (ii) C_2H_2, BF_3, CCl_4.

12. What are the main features of valence bond (VB) theory?

13. Define (i) sigma bond and (ii) pi bond.

14. Explain the formation of the HF molecule using orbital overlap.

15. What is hybridisation? State the type of hybridisation in methane.

16. Explain the bonds present in ethylene and acetylene.

17. State the hybridisation in (i) BF_3, (ii) PCl_5, (iii) SF_4 and (iv) CH_4.

18. What are the main features of molecular orbital theory?

19. Explain the formation of the H_2 molecule using molecular orbital theory.

20. Explain the formation of the N_2 molecule using molecular orbital theory.

21. Explain the formation of the O_2 molecule using molecular orbital theory.

11. Fundamentals of Organic Chemistry

1. State the general characteristics of organic compounds.

2. What is a homologous series?

3. Write the general formulae of (i) alkanes, (ii) alkenes and (iii) alkynes.

4. Explain the classification of organic compounds based on their structure.

5. What is a functional group? Identify the functional groups in (i) acetaldehyde, (ii) oxalic acid, (iii) dimethyl ether and (iv) methylamine.

6. What is isomerism? Name its types.

7. Explain the different types of structural isomerism found in organic compounds.

8. Explain geometrical isomerism using 2-butene as an example.

9. Explain optical isomerism with an example.

10. Explain the chemical reactions involved in detecting nitrogen and sulphur in organic compounds by Lassaigne's test.

11. Explain the principle of the Carius method for estimating halogens in organic compounds.

12. Which method is used to detect nitrogen in food materials and fertilisers?

13. What is sublimation?

14. Explain crystallisation as a method for purifying organic solids.

15. How would you separate and purify liquids with very small differences in boiling points?

16. State the principle of chromatography.

17. List the different types of chromatography.

18. What is the retention factor (Rf)?

19. Name the given compounds according to IUPAC nomenclature. (The structures referred to in the source are not visible in the extracted text.)

12. Basic Concepts of Organic Reaction Mechanisms

1. Differentiate between electrophiles and nucleophiles.

2. What are electrophiles and nucleophiles? Give examples.

3. Explain the inductive effect (I effect).

4. Explain the electromeric effect (E effect).

5. What is the resonance or mesomeric effect?

6. Explain the positive mesomeric effect with an example.

7. Write a short note on resonance without a bond.

8. Explain the no-bond resonance structures found in propene.

9. What are the different types of organic reactions?

10. Explain the different types of substitution reactions with examples.

11. Explain an elimination reaction with an example.

12. The text of question 12 is blank in the source PDF; its question cannot be reliably translated.

13. The text of question 13 is blank in the source PDF; its question cannot be reliably translated.

13. Hydrocarbons

1. Write the Sabatier–Senderens reaction.
2. Write the Kolbe electrolysis reaction.
3. How can propane be prepared from the sodium salts of fatty acids?
4. How can chloroethane be converted into ethane?
5. Write the Wurtz reaction.
6. What is a Grignard reagent? How can methane be prepared using it?
7. Complete the reactions shown in the question.
8. Write the conformations of ethane.
9. Explain the conformations of n-butane.
10. Write the mechanism of the chain reaction between methane and chlorine in the presence of light.
11. Write the geometrical isomers of 2-butene.
12. Write methods for preparing (i) cis-alkenes and (ii) trans-alkenes from alkynes.
13. Give a test for alkenes, or state a simple test to distinguish propane and propene.
14. Explain Markovnikov's rule with a suitable example.
15. Explain the anti-Markovnikov rule (peroxide effect/Kharasch effect).
16. Complete the reaction sequence involving ethanol, concentrated sulphuric acid, benzoyl peroxide and HBr as shown in the source.
17. What happens when ethylene reacts with cold, alkaline potassium permanganate?
18. For the sequence $CH_2=CH_2 + Br_2 \rightarrow A$, then A with alcoholic KOH $\rightarrow$ B, and B with $NaNH_2 \rightarrow$ C, identify A, B and C.
19. Complete: (i) $CaC_2 + H_2O \rightarrow$? (ii) How is BHC prepared?
20. How would you distinguish between 1-butyne and 2-butyne?
21. Write the reaction of acetylene with ozone.
22. Write the reaction for converting acetylene into benzene.

23. What is polymerisation? Write two types of polymerisation reactions of acetylene (ethyne).

24. How can the aromatic character of a compound be determined using Hückel's rule?

25. Explain the structure of benzene.

26. How can benzene be prepared from (i) acetylene and (ii) phenol?

27. Write the Friedel–Crafts reaction.

28. Write the electrophilic substitution (nitration) reaction of an aromatic compound.

29. Write about Birch reduction.

30. How can benzene be converted into (i) chlorobenzene, (ii) cyclohexane and (iii) maleic acid?

14. Haloalkanes and Haloarenes

1. Give methods for preparing haloalkanes from alcohols.

2. Write notes on (i) the Finkelstein reaction and (ii) the Swarts reaction.

3. Complete: (i) $CH_3CH_2Br + KCN \rightarrow ?$ (ii) $CH_3CH_2Br + AgCN \rightarrow ?$

4. Complete: (i) $CH_3CH_2Br + KNO_2 \rightarrow ?$ (ii) $CH_3CH_2Br + AgNO_2 \rightarrow ?$

5. Explain the mechanism of an SN2 reaction.

6. Compare the mechanisms of SN1 and SN2 reactions.

7. Explain the mechanism of the elimination reaction of tert-butyl chloride with alcoholic KOH.

8. Write a beta-elimination reaction.

9. What are the uses of haloalkanes?

10. Starting from CH_3MgI, how would you prepare (i) ethanol, (ii) acetaldehyde, (iii) acetone and (iv) methane?

11. Which has the higher melting point, ortho-dichlorobenzene or para-dichlorobenzene? Explain with a reason.

12. Write notes on (i) the Fittig reaction, (ii) the Wurtz–Fittig reaction, (iii) the Sandmeyer reaction and (iv) the Gattermann method.

13. How does chlorobenzene react with metallic sodium in the presence of ether? Name the reaction.

14. Complete the reactions: (i) $C_6H_5Cl + 2NH_3$ under 250°C/5 atm; (ii) $C_6H_5Cl + 2Na + C_6H_5Cl$ in ether/heat.

15. Write notes on (i) Dow's process, (ii) Raschig's process and (iii) Williamson ether synthesis.

16. What are the uses of chlorobenzene?

17. How does chloroform react with oxygen in sunlight?

18. Write the structure and uses of DDT.

19. How is DDT prepared?

20. What are Freons? Explain their uses and environmental effects.

21. Explain the preparation of (i) biphenyl and (ii) chloropicrin.

22. Complete: (i) $C_6H_5Cl + Mg$ in THF; (ii) $CCl_4 + H_2O$ in the presence of peroxide; (iii) $CH_3–CH=CH_2 + HBr$.

23. A compound A with molecular formula C_2H_5Cl reacts with aqueous KOH to give B and with alcoholic KOH to give C. Identify A, B and C.

24. An alkene A reacts with HCl to form B. B reacts with ammonia to form C, with molecular formula C_2H_7N. C gives the carbylamine reaction. Identify A, B and C.

15. Environmental Chemistry

1. Differentiate between biodegradable and non-biodegradable pollutants.

2. What is the greenhouse effect? Name the gases responsible for it.

3. Explain how the greenhouse effect causes global warming.

4. Define acid rain.

5. How is acid rain formed? Explain its effects.

6. What are particulate pollutants? Explain any three.

7. Differentiate between biotic and abiotic particulate pollutants.

8. Define smog.

9. Differentiate between classical (London) smog and photochemical (Los Angeles) smog.

10. What are ozone-depleting substances (ODS)?

11. Which layer is considered Earth's protective shield? Why?

12. What are the environmental effects of ozone-layer depletion?

13. What is eutrophication?

14. What is an algal bloom?

15. Differentiate between BOD and COD.

16. State the drinking-water standards recommended by the Bureau of Indian Standards.

17. Give examples of (i) insecticides, (ii) fungicides and (iii) herbicides.

18. What measures would you recommend to protect the environment from pollution?

19. What is green chemistry?

20. What are the contributions of green chemistry to everyday life?

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