

F.Sc. CHEMISTRY Part 1
CHAPTER 1
(BASIC CONCEPTS)

Short Questions (2010-2022):

1. What are molecular ions? **2012**
2. Define molecular ion. How is it formed? **2016**
3. Define molecular ion, write its uses. **2014**
4. Define relative atomic mass. Give two examples. **2019**

OR

Why we use the term relative atomic mass? **2022**

5. Calculate the percentage of Nitrogen in urea. **2019**
6. What are isotopes? Why they have same chemical but different physical properties? **2015**
7. Define isotopes. **2012**
8. Define isotopes why they have same chemical properties? **2019**
9. Explain mathematical relationship of m/e of an ion in mass spectrometry. **2011**
10. What is mass spectrum? **2013**
11. How does no individual neon atom in the sample of the element has mass 20.18 amu? **2014,2018**
12. Write functions of Mg (ClO₄)₂ and KOH in combustion analysis. **2014**
13. Why oxygen cannot be determined directly in combustion analysis? **2010**
14. Define gram formula giving one example. **2019**
15. Differentiate between empirical and molecular formula. **2012**
16. A compound may have same molecular and empirical formula, Justify. **2015**
17. Define molecular formula. How is it related with empirical formula? **2015**
18. Define limiting reactant. Give an example. **2011,2017**
19. How various chemical reactions taking place in our surrounding involve limiting reactants? **2018**

OR

Many chemical reactions taking place in our surrounding involve limiting reactants. Give reason

20. Define actual yield. Write formula for the calculation of % age yield. **2010**
21. Why actual yield is always less than theoretical yield? **2013,2015,2017**
22. Why we calculate %age yield? **2014**
23. Law of conservation of mass has to be obeyed during stoichiometric calculations. Explain? **2013, 2022**

OR

How is law of conservation of mass obeyed during stoichiometric calculations? **2018,2021**

24. Define empirical formula and molecular formula with examples. **2013**
25. Give assumptions of stoichiometry. **2014,2015**
26. Magnesium atom is twice heavier than carbon atom. Comment. **2011**
27. Calculate the number of water molecules in 10 g of ice. **2013**
28. How one mg of K₂CrO₄ has thrice the number of ions than the number of formula units when ionized. **2010,2012,2013,2018**
29. How 4.9 g of H₂SO₄ when completely ionized in water have equal number of +ve and -ve charges but the number of positively charged ions are twice the number of negatively charged ions. **2012, 2018**
30. 23 g of sodium and 39 g of potassium have equal number of atoms in them. Justify. **2012**
31. Calculate the mass in Kg of 2.6×10^{20} molecules of SO₂. **2014**
32. Define Avogadro's Number. Give one example. **2021**
33. What is Avogadro's number? Give equation to relate the Avogadro's number and mass of element. **2015,2021**
34. One mole of H₂SO₄ should completely react with two moles of NaOH. How does Avogadro's number help to explain it? **2016**
35. One mole of H₂O has 2 moles of bonds, 3 moles of atoms, 10 moles of electrons and 28 moles of total fundamental particles present in it. **2016**
36. How N₂ and CO have same number of electrons, protons and neutrons. **2016,2016,2021,2022**
37. Calculate the number of moles of oxygen atoms in 9 g of Mg(NO₃)₂. **2016**
38. Calculate the mass in grams of 2.74 moles of KMnO₄ (At.wt. K=39 amu, Mn 55 amu, O=16 amu) **2017**.

39. Why do 2 g of H_2 , 16g of CH_4 , 44g of CO_2 occupy separately the volume of 22.414 dm^3 although the sizes and masses of molecules of three gases are very different from each other? **2018**

Long Questions:

1. Explain the construction and working of mass spectrometer. **2022**
2. Describe combustion analysis method for the determination of percentage composition of an organic compound. **2019**

OR

How the %age of Carbon, Hydrogen and Oxygen in the given organic compound be estimated by combustion analysis? **2022**

3. Write detailed note on a) Avogadro's number and b) molar volume. **2019**
4. What is difference between actual yield and theoretical yield? Why actual yield is lesser than theoretical yield? **2012**
5. Define limiting reactant. How is it helpful to control chemical reaction? **2012**
6. What is stoichiometry? Give its assumptions. Mention two important laws which help to perform the stoichiometric calculations. **2014**
7. Write down the steps to calculate empirical formula of a compound. **2014**
8. Define stoichiometry. Give its assumptions. Discuss the mass-mass relationship during stoichiometry. **2017**
9. Ammonia gas can be prepared by heating together two solids NH_4Cl and (Example#13). **2015,2016,2021**
10. The combustion analysis of an organic compound shows it to contain 65.44% Carbon,.. (Example#5) **2016**
11. Serotonin is a chemical compound..... (Numerical Q. # 17). **2018**
12. Ethylene glycol is used as automobile.....(Numerical Q. # 16). **2018**
13. Mg metal reacts with HCl.....(Example#12) **2010**
14. Calculate the number of grams of K_2SO_4 and H_2O produced.....(Example#11) **2011,2021**
15. Calculate the number of grams of Al_2S_3 produced.....(Numerical Q. #20). **2013**
16. A well known ideal gas is enclosed in a container having volume 500cm^3 (Example#10). **2013**
17. A mixture of two liquids, hydrazine N_2H_4 and N_2O_4 (Numerical Q. #21). **2015**

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F.Sc. CHEMISTRY Part 1

CHAPTER 2

(EXPERIMENTAL TECHNIQUES IN CHEMISTRY)

Short Questions (2010-2022):

1. Define analytical chemistry. **2017**
2. Why concentrated KMnO_4 and HCl solutions can't be filtered by Gooch crucible? **2016**
3. What is the purpose of Gooch crucible? **2022**
4. What is difference between Gooch crucible and Sintered glass crucible? **2012, 2018**
5. Draw the beautiful diagram of sublimation process. **2021**
6. Differentiate between mobile phase and stationary phases in chromatographic technique. **2021**
7. Write down the uses of chromatography. **2021**
8. What is ether extraction? **2019, 2021**
9. Define distribution law about solvent extraction? **2019**
10. Write two disadvantages of drying the crystals between folds of filter paper. **2019**
11. Define qualitative and quantitative analysis. **2015, 2018**
12. Name the various experimental techniques used for the purification of the substances. **2018**
13. In solvent extraction technique, repeated extractions using small portions of solvent are more efficient than using a single extraction but with larger volume of solvent.
Comment. **2011, 2022, 2022**
14. Write the names of major steps of crystallization. **2016**
15. Desiccator is the safest method of drying the crystals. Explain. **2012**
16. Why there is a need to crystallize the crude product? **2014**
17. How undesirable colours in the crystallization process can be removed? **2022**

OR

How the decolorization of crude crystal can take place? **2022**

18. How crystallized substances are dried? **2012**
19. How are crystals dried by safest and reliable method? **2016**
20. Write four properties of a good solvent. **2016**
21. Write the names of eight solvents used for the crystallization. **2013**
22. Define sublimation and partition law. **2015, 2015**
23. Give the importance of sublimation. **2013**
24. What type of substances can be purified by sublimation? **2015**
25. Define Sublimand and sublimate. **2014**
26. Give two applications of paper chromatography. **2017**
27. How does the rate of filtration increase by using fluted filter paper? **2018, 2019**
28. Define chromatography. Give its two uses. **2010**
29. Differentiate between partition and adsorption chromatography. **2015, 2011**
30. Write main uses of chromatography. **2014**

OR

Write two uses of chromatography. **2022**

31. What is solvent extraction? **2013.**
27. Define R_f value. Give its unit. **2017**

F.Sc. CHEMISTRY Part 1

CHAPTER 3

(GASES)

Short Questions (2010-2022):

1. Define pressure. Give its different units. **2017**
2. Write down the value of atmospheric pressure in four different units. **2015**
3. What are isotherms? **2014**
4. Why do we get straight line when pressure is plotted against inverse of volume? **2019**
5. Why the graph plotted between pressure and volume moves away from pressure axis at higher altitude? **2021**
6. The plot of PV Vs P is a straight line at constant temperature and with a fixed number of moles of an ideal gas. Justify. **2016**
7. Justify that volume of gas becomes theoretically zero at -273°C . **2014**
8. Write down the quantitative statement of Charles's Law. **2021**
9. Write formulas to interconvert various scales of temperature. **2022**
10. What do you mean by absolute zero temperature of gases? **2016**
11. Derive expression for the molecular mass of the gas using general gas equation. **2018**
12. How density of an ideal gas can be calculated from ideal gas equation? Derive expression. **2018,2022**
13. Why lighter gases diffuse more rapidly than heavier gases? **2016,2019**
14. Rate of diffusion of ammonia is more than that of HCl. Why? **2017**
15. Calculate the density of methane at STP. **2010**
16. Define Avogadro's Law. **2012, 2014, 2016**
17. Calculate number of molecules and number of atoms in 20 cm^3 of CH_4 at 0°C and 700mm . **2012**
18. State Joule-Thomson Effect. Write its application. **2010,2011**
OR Define Joule-Thomson Effect. **2012**
19. Hydrogen and Helium are ideal at room temperature but SO_2 and Cl_2 are non-ideal. **2012**
20. Some of the postulates of Kinetic Molecular Theory are faulty. Justify. **2012**
OR Write down two faulty assumptions (postulates) of KMT of gases. **2015,2022**
21. Explain Boyle's law with the help of KMT. **2013, 2014**
22. Derive Graham's law from kinetic equation of gases. **2013, 2019**
23. Derive Avogadro's law from kinetic equation of gases. **2021**
24. Derive Charles's law from kinetic equation of gases. **2022**
25. Prove Boyle's Law in the light of K.M.T. **2021**
26. Give four fundamental postulates of KMT of gases. **2013**
27. Calculate the value of R in S.I units. **2013 ,2015,2016,2019, 2021**
28. What is the physical meaning of R. **2021**
29. Calculate the value of R in units' $\text{atm}\cdot\text{dm}^3\cdot\text{k}^{-1}\cdot\text{mol}^{-1}$. **2018**
30. Prove that $P_A = P_t \cdot X_A$ **2014**
31. Why regular air can't be used in diver's tanks? **2010**
32. Why the pilots feel uncomfortable breathing at high altitude? **2021**
33. Calculate fraction of total pressure exerted by Oxygen when equal masses of CH_4 and O_2 are mixed into an empty container at 25°C . **2014**.
34. What do you mean by critical temperature of gases? **2016**
35. H_2 and He behave ideally while Cl_2 and SO_2 do not. Why? **2017**
36. SO_2 is comparatively non-ideal at 273K but behave ideally at 373K . **2011,2013,2018**
37. Water vapors do not behave ideally at 273K . Give reason. **2022**
38. Pressure of ammonia gas at given conditions is less as calculated by Vander Waal equation than that calculated by general gas equation. Why? **2012**
39. What is physical significance of Vander Waal's constants 'a' and 'b'.
40. Where do natural and artificial plasma exist? **2018**
41. Write two characteristics of plasma. **2018,2019,2021,2022**
42. Define Plasma. Give its one application. **2011**

43. What are Neon advertisement signs?
44. How is fluorescent light bulb different from ordinary light bulb?
45. Give two applications of Plasma. **2013,2015**

Long Questions:

1. One mole of methane gas.....(Example# 08)**2014,2019**
2. A sample of nitrogen gas is enclosed in a vessel of volume 380 cm^32019 (Example # 3).
2019,2022
3. Describe Dalton's law of partial pressures. Write its three applications. **2010**
4. State and explain Graham's law of diffusion of gases. **2011**
5. Calculate the density of methane at STP. What happens to...(Example#4). **2012**
6. 250 cm^3 of hydrogen effuses 4 times more(Example#7) **2012**
7. Write a note on Linde's method of liquefaction. **2013,2018**
8. Calculate the mass of 1 dm^3 of ammonia at....(Example# 5)**2014,2022**
9. How pressure and volume were corrected by van der Waal? **2015**
10. Derive Boyle's law and Charles's law from kinetic equation of gases. **2018**
11. Give Postulates of Kinetic Molecular Theory of Gases. **2021**
12. State Charles's law. Explain its experimental verification. **2021**

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CHAPTER 4
(LIQUIDS AND SOLIDS)

Short Questions (2010-2022):

1. What are dipole-dipole forces of attraction? Explain with examples. **2015, 2021**
2. What are Debye forces? **2018**
3. Name the factors which affect the London forces. **2021**
4. What is polarizability? Give its relationship with London dispersion forces. **2022**
5. Ice occupies more space than water. Give reason. **2013**
6. Why H_2O is liquid but NH_3 is a gas at room temperature? **2022**
7. Water and ethanol can mix in all proportions. Give reason. **2013**

OR

Ethyl alcohol is soluble into water. Why? **2021**

8. Lower alcohols are soluble into water but hydrocarbons not. Give reason. **2018**
9. Write a brief note on solubility of hydrogen bonded molecules. **2012**
10. Explain Hydrogen Bonding in deoxyribonucleic acid (DNA). **2021**
11. Why boiling point of water is greater than HF? **2014**
12. Earthen ware vessels keep water cool. Explain. **2012**
13. Why evaporation causes cooling? **2012, 2014, 2016, 2016, 2019, 2019**
14. Explain why evaporation takes place at all temperatures? **2014**
15. Why vapor pressure increases with temperature? **2012**
16. Why boiling point of water is different at Murree Hills and at Mount Everest? **2018**
17. Why different liquids evaporate at different rates even at the same temperature. **2015**
18. Vacuum distillation can be used to avoid decomposition of sensitive liquids. Explain. **2012**
19. Ionic solids do not conduct electricity in solid state. Give reason. **2013.**
20. Write down two applications of liquid crystals. **2013**
21. Define isomorphism and polymorphism with examples. **2013, 2018, 2019**
22. Define polymorphism. Give an example. **2017**
23. What is symmetry of crystal? **2022**
24. Why ionic solids are highly brittle? **2013, 2014, 2015, 2017**
25. Why heat of sublimation of iodine is very high? **2012, 2014, 2019**
26. Define transition temperature with example. **2014, 2016**
27. Cleavage of crystals is an anisotropic behavior. Explain it. **2014, 2021**

OR

What do you know about Anisotropy? Explain with example **2021, 2022**

28. Give two applications of liquid crystals. **2019, 2019**
29. How the liquid crystals help in the detection of blockages in veins and arteries. **2015**

OR

30. How are liquid crystals used to locate veins, arteries, infections, and tumors? **2018**
31. What is relationship between polymorphism and allotropy? **2015**
32. Define Isomorphism? Give example? **2015, 2022**
33. What is habit of crystal? How is it changed? **2022**
34. Transition temperature is the term used for elements as well as compounds. Explain. **2015**
35. Define transition temperature. Give two examples. **2018, 2021**
36. Define unit cell. Give its crystallographic elements. **2022**

36. The vapor pressure of diethyl ethyl is higher than water at same temperature? **2015**
37. Give four properties of molecular solids. **2016**
38. Define molar heat of fusion and molar heat of vaporization. **2016**
39. Describe that heat of sublimation is greater than heat of vaporization. **2016**
40. Why ice floats over the surface of water? **2016, 2018**
41. Define allotropy. Give its one example. **2017, 2021**
42. Write two properties of molecular solids. **2017**
43. Why graphite conducts electricity in one direction only and not in other? **2022**
44. Why the electrical conductivity of metals decreases by increasing temperature? **2018**

Additional important (Other Boards):

45. What is meant by dynamic equilibrium? Give an example.
46. HF is weaker acid than HCl. Why?
47. Diamond is hard and an electrical insulator. Give reason?

Long Questions:

1. Define hydrogen bonding. How does it explain the solubility of hydrogen bonded molecules and structure of ice? **2010**
2. Explain the structure of Ice on the basis of Hydrogen Bonding. **2021**
3. Explain hydrogen bonding in NH_3 , H_2O and HF. How is it helpful in explaining the structure of ice? **2011**
4. Classify solids on the basis of Bonding. **2012**
5. Write brief note on Anisotropy and polymorphism. **2012**
6. What is boiling point? What is the effect of external pressure on the boiling point? Why the temperature remains constant at boiling point although heat is continuously supplied. **2013**
7. What are ionic solids? Give their properties in details. **2013**

OR

Define ionic solids. Give their three properties. **2019**

8. Write four properties of covalent solids. **2022**
9. What are liquid crystals? Give their uses in daily life. **2014, 2106**
10. What are molecular solids? Give their important characteristics? **2014, 2015, 2022**

OR

Write down four properties of molecular solids. **2018**

11. What is hydrogen bonding? Discuss hydrogen bonding in biological properties. **2015**
12. What is vapor pressure of a liquid? Also discuss its measurement by Manometric method and draw diagram. **2016, 2018, 2019**
13. Discuss London dispersion forces. Elaborate two factors on which it depends. **2017**
14. Give Postulates of Kinetic Molecular theory (K.M.T). **2021**

F.Sc. CHEMISTRY Part 1
CHAPTER 5
ATOMIC STRUCTURE

Short Questions (2010-2022):

1. Write any two defects of Bohr's atomic model. **2019**
 2. Cathode rays are material in nature justify it. **2016**
 3. Why it is important (necessary) to decrease the pressure in the discharge tube to get the cathode rays? **2012, 2017**
 4. Why e/m of cathode rays is just equal to that of electron? **2013, 2017, 2018**
- OR**
- Why are Cathode rays also called electrons? **2021**
5. Give four properties of positive rays. **2013, 2021**
 6. Why positive rays are called canal rays? **2022**
 7. Give reason for the production of positive rays. **2013**
 8. Give any two properties of Neutron. **2014, 2016, 2017**
 9. What are slow and fast neutrons? **2022**
 10. Write nuclear reactions for the production of gamma radiations and beta particles. **2021**
 11. Write the nuclear reaction for the decay of neutron. **2014, 2018, 2019**
 12. How neutron was discovered by Chadwick. Give nuclear equation involved. **2015**
 13. How was neutron discovered? **2022**
 14. Calculate mass of an electron when $e/m = 1.7588 \times 10^{11} \text{ C.Kg}^{-1}$ **2012, 2014**
- OR**
- Calculate mass of an electron from its e/m value. **2013**
15. What is Moseley's law? **2012, 2022**
 16. How do you come to know that velocities of electrons in higher orbits are less than those in lower orbits of hydrogen atom? **2012**
 17. Energy of an electron is inversely proportional to n^2 but energies of higher orbits are always greater than those of the lower orbits. Justify it. **2012**
 18. What is Plank's quantum theory? **2013**
- OR**
- Write down any two postulates of Plank's Quantum theory. **2018, 2019**
19. State Heisenberg's uncertainty principle and give its equation. **2013, 2015, 2016, 2021**
 20. Write down electronic configuration of **Fe** (26) and **Br** (35). **2014**
 21. Write down electronic configuration of **P** (31) and **Cu** (29). **2015**
 22. Write down electronic configuration of **Cr** (24). **2016**
 23. What is difference between continuous spectrum and line spectrum? **2014**
 24. Write two points in importance of Moseley's law. **2014**
 25. What are the defects (draw backs) in the Rutherford's atomic model? **2015, 2015, 2016, 2016**
 26. Justify that distance gaps between different orbitals go on increasing from the lower to higher orbit. **2015, 2018**
 27. Define Zeeman's effect and Stark's effect. **2015** **OR** What is Zeeman's effect? **2018**
 28. Differentiate between line spectrum and continuous spectrum. **2017, 2022**
 29. Define Spectrum and name any two types of spectra. **2021**
 30. Write names of different quantum numbers. **2021**
 31. Discuss briefly principal quantum number. **2022**
 32. State spin Quantum number briefly. **2013**
 33. What is orbital? Discuss the shape of p-orbitals. **2016**
 34. For Azimuthal Quantum number $l=2$, $l=3$, calculate the total values of magnetic quantum number m . **2021**
 35. Calculate the number of electrons in s, p, d and f- sub shells from the formula and write separately. **2018**
 36. State Pauli's exclusion principle. **2012, 2014, 2016**
 37. State Pauli's exclusion principle and Hund's rule. **2015, 2018**
 38. Define Hund's rule? **2014, 2019, 2022**

39. What is Aufbau's principle? 2022

Long Questions:

1. Write any four properties of cathode rays. **2019**
2. **Give properties**
3. Define orbital. Discuss shapes of its two types. **2010**
4. Write four defects of Bohr's atomic model. **2011, 2014, 2019**
5. Derive the formula for calculating the energy of an electron in nth orbit using Bohr's model. **2012**
6. Derive an expression to determine the radius of an orbit using Bohr Model. **2021, 2022**
7. Describe Millikan's oil drop method for the measurement of charge on electron. **2013, 2013, 2014, 2016**
8. Discuss magnetic and spin quantum numbers. **2015**
9. Write down the properties of cathode rays. **2015**
10. Define Quantum numbers. Discuss briefly Azimuthal quantum number. **2016**
11. How did Rutherford discover the nucleus of atom? **2017**
12. Give properties of neutron in detail (any four). **2018, 2022**
13. Write down the experiment how neutron was discovered. **2021**
14. Describe J.J Thomson's experiment for determining e/m value of electron. **2018**

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F.Sc. CHEMISTRY Part 1
CHAPTER 6
(CHEMICAL BONDING)

Short Questions (2010-2022):

1. Differentiate between bonding and antibonding molecular orbitals with reference to relative energies and symmetry of electronic clouds (no figures required). **2019**
2. Why is the radius or size of a cation smaller than its parent atom? **2019,2022**
3. Write down the two postulates of VSEPR. **2021**
4. Explain the geometry of H₂S on the basis of VSEPR. **2019**
5. Why the radius of an atom can't be determined precisely? **2019,2022**
6. What is octet rule? Give one example. **2022**
7. What is octet rule? Give two examples of compounds which deviate from it. **2012**
8. 75.4 pm is the compromised distance between the bonded hydrogen atoms. Justify. **2018**
9. Bond distance is the compromised distance between the two atoms. Justify. **2021**
10. Define ionic bond with an example. **2012**
11. Define covalent bond. Draw the Lewis structure of water molecule. **2022**
12. Distinction between covalent and coordinate covalent bond vanishes after bond formation. **2012**
13. Why the radius of Cl⁻ ion increases from 99 pm to 181 pm. **2013**

OR

Why the ionic radius is greater than atomic radius? **2016**

14. State electronegativity and electron affinity. **2016**
15. Why is the radius of a cation smaller than its parent atom? **2014**
16. Differentiate between covalent bond and coordinate covalent bond. **2013, 2021**
17. Define coordinate covalent bond and give an example. **2014, 2021,2022**
18. Why the energy of anti-bonding molecular orbital is higher than corresponding bonding molecular orbital? **2013**
19. How does ionization energy vary in periodic table? **2014**
20. Ionization energy is an index to the metallic nature of an element. Justify. **2018**
21. Define Bond order. Calculate bond order of hydrogen molecule. **2014**

OR

What is Bond order? Give an example. **2014, 2015, 2017, 2018, 2021,2022**

22. Draw M.O.T diagram of Hydrogen molecule showing its bonding and antibonding molecular orbitals. **2021,2021**
23. Differentiate between atomic orbital and molecular orbital. **2015**
24. Define sigma bond and pi bond. **2021**
25. π bonds are more diffused than σ bonds. Why? **2014,2022**
26. Define electronegativity. Give its trend in the periodic table. **2014, 2019**
27. How is the nature of a chemical bond predicted with the help of electronegativity values of two bonded atoms? **2015**
28. Why is no bond in chemistry 100% ionic? **2015, 2018**
29. Define atomic orbital hybridization. **2021**
30. The bond angles of H₂O and NH₃ are not 109.5° like that of CH₄ although Oxygen and Nitrogen atoms are sp³ hybridized. Why? **2015**
31. State the geometry of ammonia molecule on the basis of VSEPR theory. **2015**
32. Define Dipole moment and give its S.I units. **2012**
33. Why the abnormality of bond length and bond strength in HI is less prominent than that of HCl. **2016**
34. Why the dipole moment of CO₂ is Zero but that of SO₂ is 1.61 D? **2016,2022**
35. Why the dipole moment of SO₂ is 1.61D but that of SO₃ is zero? **2013**
36. Why the dipole moment of CO₂ is Zero but that of CO is 0.12 D? **2018**
37. Why BF₃ is non-polar but SO₂ is polar? **2016**
38. How the percentage of ionic character of covalent bond is determined by Dipole moment? **2015**
39. Why the melting points, boiling points, heats of sublimation and heats of vaporization of electrovalent compounds are higher as compared with those of covalent compounds? **2016**
40. Write two points of Valence bond theory. **2016**
41. Why ionization energy decreases down the group although nuclear charge increases. Explain. **2016,2017**
42. Define ionization energy (potential). Give its trends in the periodic table. **2019, 2019**

43. Why it is impossible for CH_4 to make a coordinate covalent bond with H^+ ion while water and ammonia can do so? **2017**
44. Why the lone pairs of electrons occupy more space than bond pairs? **2017**
45. On what factors strength of bond depends? **2018**
46. Why ionic compounds do not show the phenomenon of isomerism, but covalent compounds do? **2018**
47. How the type of bonding affects the solubility of compounds. **2015**

Additional important:

1. Differentiate between hybrid orbital and molecular orbital?
2. Why the energy of anti-bonding molecular orbitals is higher as compared to bonding molecular orbitals?

Long Questions:

1. Define bond energy. Discuss two facts which affect it. **2010**
2. Write the main postulates of VSEPR theory and explain the structure of Ammonia on the basis of this theory. **2012,2016**
3. Explain the structure of ethyne according to hybridization concept. **2012,2019**
4. Explain sp^3 hybridization by taking example of Methane (CH_4). **2014,2022**
5. Explain type of hybridization in H_2O and NH_3 . **2022**
6. What is sp^2 hybridization. Explain the structure of ethene? **2021**
7. Explain the molecular orbital structure of following molecules on the basis of MOT. N_2 and O_2 molecule. **2013**
8. Describe the bonding in O_2 according to Molecular orbital theory and explain its paramagnetic property. **2011,2014, 2016**
9. Explain important points of Molecular orbital theory and draw structure of Nitrogen (N_2) molecule according to this theory. **2015**
10. Explain paramagnetic behavior of O_2 on the basis of MOT and prove that MOT is superior to other theories. **2015**
11. Draw the molecular orbital picture of O_2 molecule. **2019**
12. How does MOT explain the paramagnetic nature of O_2 molecule? Also calculate its bond order. **2018**
13. Define electron affinity. Name the factors affecting it. How does it vary in the periodic table? **2013**
14. Discuss the valence bond theory. How are the sigma and pi bonds formed by the overlapping of different orbitals? **2017**
15. Define dipole moment. Give its units. How is it used to determine the geometry of molecule? Give an example. **2018**
16. Define ionization energy. Write factors affecting. Define factors affecting it and trends in the periodic table. **2021**

F.Sc. CHEMISTRY Part 1
CHAPTER 7
(Thermochemistry)

Short Questions (2010-2022)

1. Define thermochemistry. **2022**
2. What is thermochemical equation? Give two examples. **2014**
3. What is thermochemical equation? What information does it convey? **2012**
4. What are thermochemical reactions? Give their types. **2012**
5. Why it is necessary to mention the physical states of reactants and products in the thermo-chemical equation? **2016**
6. What is spontaneous process? Give two examples. **2017**
7. Burning of candle is spontaneous process. Justify it. **2015,2018,2019**
8. Burning of natural gas is spontaneous reaction. Justify it. **2019**
9. Differentiate between endothermic and exothermic reactions. **2015**
10. What are endothermic and exothermic reactions? Give examples. **2018**
11. What are exothermic reactions? Give examples. **2022**
12. Define system and surrounding. Give examples. **2022**
13. What is internal energy of a system? **2016**
14. Define state function? Write names of two state functions. **2014, 2019**
15. Define state and state function. **2019**
16. What is 1st law of thermodynamics? Give its mathematical equation. **2021**
17. Is it true that ΔH and ΔE have the same values for the reaction taking place in solution state? **2012**
18. Prove that $\Delta E = q_v$ **2021**
19. Explain the term enthalpy of atomization. **2015**
20. Define enthalpy of solution. Give an example. **2017,2018**
21. Define enthalpy of combustion. **2021,2022**
22. Define Enthalpy of solution and enthalpy of neutralization. **2018**
23. Define enthalpy of neutralization with an example. **2014**
24. Define enthalpy of formation with an example. **2012, 2021,2022**
25. Draw a labeled diagram of Bomb Calorimeter. **2012**
26. State the Hess's Law of constant heat summation. **2013**
27. Differentiate between Law of conservation of energy and Hess's Law. **2016**

Additional important:

28. Why is heat energy released in exothermic reactions? **23.** Why the work done by the system is taken as negative?

Long Questions:

1. Define Enthalpy and prove that $\Delta H = q_p$ **2010, 2021**
2. State and explain with an example the Hess's law of constant heat summation. **2011**
3. Define and explain Hess's law and give its applications. **2012,2014**
4. State Hess's Law of constant heat summation. Explain it giving two examples. **2018,2019,2021**
5. State 1st law of thermodynamics. Prove that $\Delta E = q_v$ **2013, 2022**
6. State 1st law of thermodynamics. How does it explain that $\Delta H = q_p$?
7. Define Enthalpy of reaction. How is it measured by Glass Calorimeter? **2013**
8. Define with examples System, Surrounding, Non-spontaneous reactions, endothermic reactions. **2015**
9. What is molar heat of combustion? How is it measured by bomb calorimeter? **2015**
10. Explain Bomb Calorimetric method for the measurement of enthalpy of reaction. Also draw diagram. **2022**
11. Explain the following terms; **2019**
 - a. Standard heat of neutralization
 - b. standard enthalpy of solution

F.Sc. CHEMISTRY Part 1
CHAPTER 8
(CHEMICAL EQUILIBIUM)

Short Questions (2010-2022):

1. Explain the term reversible reaction and state of equilibrium. **2012**
2. How the direction of a reversible reaction at any instant can be determined by K_c value? **2015**
3. State Le-Chatelier's principle. And discuss the effect of change in concentration of a product on reversible reaction. **2015**
4. State Le-Chatelier's principle? **2013**
5. How does change of pressure shifts the equilibrium position in the synthesis of ammonia? **2012**
6. The change of temperature disturbs both the equilibrium position and equilibrium constant of a reaction. Explain it. **2012**
7. How the equilibrium constant K_c predicts the direction of a reversible reaction? **2015, 2021**
8. The solubility of glucose in water is increased by increasing the temperature. Explain. **2012, 2022**
9. Define pH. How it is helpful to know the nature of solution? **2021**
10. Define ionic product of water and what is its value at 30°C . **2022**
11. Define pH and pOH. **2012, 2017**

OR

Define pOH of a solution. Give its mathematical equation. **2014**

12. Calculate the pH of 10^{-4} mol. dm^{-3} solution of HCl. **2018**
13. Calculate the pH of 10^{-4} mol. dm^{-3} solution of $\text{Ba}(\text{OH})_2$ **2016**
14. How do the buffers act? Give example. **2012, 2022**
15. How does the catalyst affect the equilibrium constant? **2012, 2018**
16. How are the buffer solutions prepared? **2012**
17. What do you mean by Buffer capacity? **2013, 2017**
18. Write two applications of equilibrium constant? **2013**
19. Write two uses of buffer solutions. **2013**

OR Why do we need Buffers? **2021**

OR What are the applications of Buffers in daily life? **2022**

20. Give two applications of solubility product. **2013**
21. Write Handerson's equations for acidic and basic buffers? **2014, 2021**
22. What is Handerson's equation, and for which purpose it is used? **2022**
23. What are buffer solutions? How a basic buffer can be prepared? **2015**
24. Define solubility product. Derive solubility product expression for Ag_2CrO_4 ? **2016**
25. Define solubility product. Derive solubility product expression for PbCl_2 ? **2016**
26. How change in volume disturbs the equilibrium position for some of the gas phase reactions but not the equilibrium constant? **2016**
27. How does a catalyst affect a reversible reaction? **2017**
28. What is the formula to calculate the percentage ionization of weak acids? **2018**
29. Define Lowry-Bronsted concept of acids and bases? **2018**
30. Prove by equations that what happens when Na_2CrO_4 is added to saturated solution of PbCrO_4 . **2018**
31. Why solid ice at 0°C can be melted by applying pressure without supply of heat from outside. **2018**
32. Write the relationship of K_p with K_c . **2018**
33. Give applications of common ion effect (any two). **2022**
34. Define Chemical equilibrium. Give its any two properties. **Additional**

Long Questions:

1. Example# No. 7 **2010, 2014, 2015, 2016**
2. Example # No. 6 **2011, 2016**
3. Write a note on synthesis of ammonia by Haber's process keeping in mind the applications of chemical equilibrium in industry. **2012**
4. State le-Chatelier's principle. Describe the effect of change in temperature of a system in equilibrium by this Principle. **2012**

5. State le-Chatelier's principle. How is this principle used to explain the effect of change in concentration on equilibrium constant of a reaction? **2018**
6. Example # No. 4 **2013**
7. Example # No. 2 **2013, 2021**
8. Example # No. 5 **2014**
9. Exercise Numerical Q.23(a) **2015**
10. Exercise Numerical Q.23(b) **2021**
11. Exercise Numerical Q.25 **2017, 2022**
12. Exercise Numerical Q.24 **2022**
13. What is common ion effect? How this principle is used in salt analysis? Give two examples. **2018**

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F.Sc. CHEMISTRY Part 1
CHAPTER 9
(SOLUTIONS)

Short Questions BISE Lahore (2010-2022):

1. Define molarity and molality. **2014**
2. What is molarity? Calculate the molarity of a solution containing 9g of glucose in 250 cm³ of solution. **2015**
3. How molality is independent of temperature, but molarity depends on temperature? **2016**
4. One molal solution of glucose is dilute as compared to one molar solution of glucose. Justify it? **2013**
5. Why 1 molal solution of NaOH is dilute as compared to one molar solution? **2022**
6. One molal solution of urea is dilute as compared to one molar solution of urea. Justify it? **2013,2016**
7. Define Ebullioscopic constant with example. **2012**
8. Define colligative properties. Give two examples. **2022**
9. How will you justify that lowering of vapor pressure is a colligative property? **2021**
10. Relative lowering of vapor pressure is independent of temperature. Justify it. **2012, 2021**
11. Justify that boiling points of solvents increase due to presence of non-volatile solutes. **2012,2016**
12. Depression of freezing point is a colligative property. Justify it. **2013**
13. Give two applications of Colligative properties. **2021**
14. What is meant by molality? Give its formula. **2013**
15. Why NaCl and KNO₃ are used to lower the melting points of ice? **2013, 2015**
16. Why is Beckman's thermometer used to find the depression in freezing point? **2013**
17. Differentiate between ideal and non-ideal solutions. **2013, 2021**
18. Why is the vapor pressure of a solution lesser than vapor pressure of pure solvent? **2014**
19. Calculate the percentage by weight of NaCl if 2g of it is dissolved in 20g of water. **2014**
20. Define heat of solution. **2021**
21. What is meant by water of crystallization? Give an example. **2014**
22. Define Zeotropic mixtures. Give one example. **2014**
23. What are zeotropic and azeotropic mixtures? **2018**
24. Differentiate between molarity and molality. **2016**
25. Define upper consolute temperature. Give two examples. **2015,2018**
26. Define hydrolysis with example. **2015**
27. Differentiate between hydration and hydrolysis. **2015**
28. What are the names of four major parts of apparatus used in Landsberger's method for elevation of boiling point? **2016**
29. Why the solubility of glucose into water increases by increasing temperature? **2017**
30. Give two statements of Raoult's Law. **2018**
31. State Raoult's law. Give its mathematical equation. **2021**
32. What is fractional crystallization? **2018**
33. Aqueous solution of CuSO₄ is acidic in nature. Justify it. **2012**
34. Aqueous solution of CH₃COONa is basic in nature. **2016**
35. What is continuous solubility curve? Which solutions give this type of curve? **2022**
36. What are discontinuous solubility curves? **2022**

Long Questions BISE Lahore:

1. Define Solubility curves. Explain continuous and discontinuous solubility curves. **2021,2022**
2. Give graphical explanation of boiling point elevation of solution. **2010,2015**
3. What are Colligative properties of solutions? Explain elevation of boiling point. **2021**
4. State and explain Raoult's law in three forms. **2011, 2013**
5. State different forms of Raoult's law. How can this law help us to understand the ideality of a solution? **2016**
6. What are ideal solutions? Explain the fractional distillation of ideal mixture of two liquids. **2012**
7. Differentiate between ideal and non-ideal solutions. **2012**

OR

- Write four differences between ideal and non-ideal solutions. **2017**
8. Give three statements of Raoult's law and mention how Raoult's law helps us in determining the ideality of solution? **2013**

9. Define the terms: Molarity, Molality, Mole fraction, Parts per million **2014**
10. Describe freezing point depression method to determine the molecular mass of an organic compound. **2014**
11. Describe one method to determine the boiling elevation of a solution. **2015,2022**
12. What is hydration and hydrolysis? Describe with two examples in each. **2016**
13. The boiling point of water is $99.725\text{ }^{\circ}\text{C}$. To a sample of 600g of water are added 24g of solute having molar mass of $58\text{ g}\cdot\text{mol}^{-1}$ to form a solution. Calculate the boiling point of solution. **2018**
14. The freezing point of pure camphor is 178.4°C . Find the freezing point of solution containing 2 g of a non-volatile compound having molar mass of 140 gmol^{-1} in 40 g of camphor. The molal freezing point constant (K_f) of camphor is $37.7\text{ }^{\circ}\text{C}\cdot\text{Kg}^{-1}\cdot\text{mol}^{-1}$. **2018**

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F.Sc. CHEMISTRY Part 1
CHAPTER 10
(Electrochemistry)

Short Questions BISE Lahore (2010-2021):

1. What is electrochemistry. **2016,2018**
2. Define anode and cathode. **2022**
3. What is difference between metallic conduction and electrolytic conduction? **2014**
4. Differentiate between electrolytic cell and galvanic cell. **2012**
5. Explain how impure copper can be purified by electrolytic process. **2012**
6. The standard oxidation potential of zinc is 0.76V and its reduction potential is -0.76 V. Why? **2012**
7. Give two applications of electrochemical series. **2012**
8. A salt bridge maintains the electrical neutrality in the cell. Explain. **2012, 2021**
9. Write down the function of salt bridge? **2014,2016, 2017,2018,2022**
10. A porous plate or a salt bridge is not required in lead acid storage battery. **2018**
11. Define electrochemical series. **2013, 2021**
12. Write down two functions of salt bridge in a galvanic cell? **2013**
13. Write down reactions taking place at the electrodes during the discharging of Nickel-Cadmium cell. **2013**
14. Describe Nickel-Cadmium cell. **2022**
15. What is standard electrode potential? **2014, 2017**
16. Give chemical reactions taking place at anode and cathode in a fuel cell. **2014**
17. Calculate the oxidation number of Mn in KMnO_4 . **2014, 2016,2022**
18. Calculate the oxidation number of Mn in KMnO_4 and Na_2MnO_4 . **2015,2021**
19. Calculate the oxidation number of S in $\text{Cr}_2(\text{SO}_4)_3$ and SO_4^{2-} . **2016**
20. Calculate the oxidation number of Cr in CrCl_3 ? **2015**
21. Calculate the oxidation number of P in HPO_3 ? **2017**
22. Calculate the oxidation number of element underlined in the following compounds. **2018**
 - i. K_2MnO_4
 - ii. $\text{Ca}(\text{ClO}_3)_2$
23. What is difference between electrolytic cell and voltaic cell? **2014**
24. Voltaic cell is reversible cell. State. **2015**
25. How fuel cells produce electricity? **2015**
26. Write two advantages of fuel cells. **2016**
27. Give the chemistry of electrolysis of aqueous solution of sodium chloride. **2015**
28. What is electrolysis? Give example. **2015**
29. Write recharging of lead accumulator battery. **2016**
30. Lead accumulator is a chargeable battery. Justify. **2013**
31. What is Standard Hydrogen Electrode (SHE). **2021**
32. Draw diagram of Standard Hydrogen Electrode (SHE). **2021**
33. SHE acts as anode when connected with Copper but as cathode with Zinc. Support your answer with equations. **2018**
34. What is alkaline battery? **2012**
35. How anodized aluminum is prepared in an electrolytic cell? **2021**

Long Questions BISE Lahore (2010-2018):

1. Define electrochemical series? Explain its any three applications. **2010,2016,2021**
2. Define electrochemical series? Explain its two applications. **2010,2016,2018**
3. How electrochemical series is helpful in the prediction of feasibility of chemical reaction and relative chemical reactivity of metals? **2022**
4. Balance the equation by ion-electron method. **2011**
 $\text{MnO}_2 + \text{HCl} \rightarrow \text{MnCl}_2 + \text{H}_2\text{O} + \text{Cl}_2$
5. Define Electrode potential, Redox potential, electrochemical series, Oxidation number. **2012**
6. Explain the structure and function of voltaic or galvanic cell. **2022**
7. How can you measure electrode potential of an element using standard hydrogen electrode (SHE)? **2012, 2016**
8. Describe the construction and working of standard hydrogen electrode? **2013,2021**
9. What is standard hydrogen electrode (SHE)? How it is used to measure the electrode potential of Zinc. **2014**
10. Describe the electrolysis of molten sodium chloride and a concentrated aqueous solution of sodium chloride. **2013,2015**

- 11.** Describe Nickel-Cadmium cell (Rechargeable). **2014**
- 12.** Explain the construction and working of fuel cell. **2015**
- 13.** Write a note on fuel cells. **2017**
- 14.** Give explanation of discharging and recharging of lead accumulator along with reactions occurring at electrodes. **2018**

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F.Sc. CHEMISTRY Part 1
CHAPTER 11
(Reaction Kinetics)

Short Questions (2010-2022):

1. Define rate of a chemical reaction and give its units. **2012,2016**
2. Define specific rate constant. Give equation to support your answer. **2013, 2018**
3. Define specific rate constant briefly. **2021**
4. What happens to the rate of chemical reaction with the passage of time? **2013**
5. What is order of reaction? Give two examples. **2014,2014,2021,2022**
6. What is zero order of reaction? Give one example. **2021**
7. The radioactive decay is always a first order reaction. Give reason. **2016,2018,2012**
8. Define with example 2nd order reaction? **2016**
9. What is specific rate constant or velocity constant? **2015**
10. What is half life period? Give example. **2017**
11. What do you mean by rate determining step? Give example. **2022**
12. How surface area affects the rate of reaction? Give one example. **2016,2022**
13. Define activation energy and activated complex. **2014, 2017**
14. What do you mean by activation energy of a reaction? **2016**
15. How does a catalyst affect a reversible reaction? **2016**
16. What is the effect of temperature on the rate of a reaction? **2021**
17. How enthalpy change of a reaction and energy of activation are distinguished? **2012,2012,2018**
18. Define and give an example of the process of activation of a catalyst. **2013**
19. Define homogeneous catalysis. Give two examples. **2015,2022**
20. What is catalytic poisoning? Give two examples. **2015**
21. What are enzymes? How they act as catalysts? **2013**
22. Write down any two characteristics of enzyme catalysis. **2014**
23. Enzymes are specific in action. Justify. **2015**
24. What is auto catalyst? Give an example. **2016**
25. What is auto catalysis? Give example to support answer. **2017, 2018**

Long Questions:

1. Explain the energy of activation. **2021**
2. How does Arrhenius equation help us to calculate the energy of activation of a reaction? **2012,2013,2013**
3. How rate of reaction depends on the following factors? **2014**
 - a. Nature of reactants
 - b. Surface area
4. Explain effect of temperature on rate of reaction. **2016**
5. What is order of reaction? Describe two methods (half life method and large excess method) for finding the order of reaction. **2016**
6. Define half life period. Describe half life method for the determination of order of reaction. **2011,2017, 2021**
7. Define order of reaction and explain 2nd order and zero order reactions. **2018**
8. Define Order of reaction. Describe it with three examples. **2022**
9. Write a brief note on the following: **2010,2014**
 - a. Homogeneous catalysis
 - b. Heterogeneous catalysis
10. What are enzymes? Write any four characteristics of enzyme catalysis. **2012, 2018**
11. Explain any four characteristics of catalysts. **2015,2022**
12. What is catalytic poisoning? Give two examples. **2015**

13. What are enzymes? Give examples in which they act as catalyst. Mention the characteristics of enzymes. **2015**

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