CHAPTER - 1

SOME BASIC CONCEPTS OF CHEMISTRY

SECTION –A (MCQs)

Q.No.		Marks
1.	Which one of the following will have the largest number of atoms? (a) 1 g Au(s) (b) 1 g Na(s) (c) 1 g Li(s) (d) 1 g of Cl_2(g	1
2.	A hydrocarbon was found to contain 75% by mass of carbon and 25% by mass of hydrogen. What is empirical formula of the compound? (a) C_2H_4 (b) C_2H_6 (c) CH_4 (d) C_6H_6	1
3.	Which of the following is used for treatment of cancer? (a) Cis-Platin (b) Taxol (c) A ZT (Azidothymidine) (d)Both (a) and (b)	1
4.	Which of the following is used for treatment of AIDS? (a) A ZT (Azidothymidine) (b) Azithromycin	1

(c) Streptomycin

(d) Chloromycin

5. Which of the following are homogeneous mixtures? 1

(a) Salt solution

(b) Sugar solution

(c) Air

(d) All of these

6. The number of significant figures in 0.001620 are 1

(a) 4

(b) 3

(c) 6

(d) 2

7. Accuracy means 1

(a) agreement of a particular value to true value

(b) The closeness of various measurements for the same quantity.

(c) Both (a) and (b)

(d)None of these

8. Which of the following measurement is more precise? 1

(a) 4.0

(b) 4.00

(c) 4.000

(d) 4.0000

9. A solution is prepared by adding 2 g of a substance A to 18 g of water. The mass percentage of the solute is- 1

(a) 90 %

(b) 10 %

(c) 20 %

(d) 50 %

10. What is mass percent silicon in 100 g of sodium silicate, Na_2SiO_3? 1

[Given : Atomic masses of Na = 23u, Si = 28u, O = 16u]

(a) 16.7%

(b) 23.0%

(c) 28.0%

(d) 82.0 %

11. Which of the following terms are unit less? 1

(a) Molality

(b) Molarity

(c) Mole fraction

(d)Density

12. The scientific notation for 0.00016 is - 1

(a) 1.6 X 10^{-2}

(b) 16 X 10^{-4}

(c) 1.6 X 10^{4}

(d) 1.6 X 10^{-4}

Assertion- Reason type Questions (Q. No.13 to 16)

In the following question, a statement of assertion followed by statement of areason is given. Choose the correct answer out of the following choices.

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is not the correct explanation of A.

(c) A is true but R is false.

(d) *A is false but R is true.*

13 **Assertion (A):** 2.000 has four significant figures. 1

Reason (R): All zeros after decimal are significant.

14. **Assertion (A):** Equal masses of He, O_2 and SO_2 contain equal number of molecules. 1

Reason (R): Equal volume of He, O_2 and SO_2 contain equal number of molecules at same temperature and pressure.

15. **Assertion (A):** Molarity does have unit, i.e. mol L^{-1} 1

Reason (R): Molarity does not change with temperature.

16. **Assertion (A):** The closeness of various measurements for the same quantity is called precision. 1

Reason (R): The agreement of a particular value to the true value of the result is

called accuracy.

SECTION –B Short Answer Type Questions (2 marks each)

17. An organometallic compound on analysis was found to contain, C = 64.4%, H = 5.5% and Fe = 29.9%. Determine its empirical formula. (At. mass of Fe = 56 u). 2

18. 1 M solution of $NaNO_3$ has density 1.25 g cm^{-3}. Calculate its molality. (Molecular weight of $NaNO_3$ = 85 g mol^{-1}) 2

19. The density of 3 molal solution of NaOH is 1.110 g ml^{-1}. Calculate the molarity of the solution. 2

20. If 4 g of NaOH dissolves in 36 g of H_2O, calculate the mole fraction of each component in the solution. Also, determine the molarity of solution. (specificgravity of solution is 1g mL^{-1}). 2

21. What is the symbol for SI unit of mole? How is the mole defined? 2

SECTION -C Short Answer Type Questions (3 Marks each)

22. Calculate the amount of carbon dioxide that could be produced when- 3
(i) 1 mole of carbon is burnt in air.
(ii) 1 mole of carbon is burnt in 16 g of dioxygen.
(iii) 2 moles of carbon are burnt in 16 g of dioxygen.

23. (i) What is limiting reagent? 3
(ii) Oxygen is prepared by catalytic decomposition of potassium chlorate ($KClO_3$). If 2.4 mol of oxygen is needed for an experiment, how many grams of potassium chlorate must be decomposed? (Atomic mass of K = 39, Cl=35.5, O = 16)

24. A compound contains 4.07% hydrogen, 24.27% carbon and 71.65% chlorine. Its molar mass is 98.96 g. What are its empirical and molecular formulae? 3

25. The reactant which is entirely consumed in reaction is known as limitingreagent. In the reaction $2A + 4B \rightarrow 3C + 4D$, when 5 moles of A react with 6 moles of B, then- 3
(i) which is the limiting reagent?
(ii) Calculate the amount of C formed.

26. Calculate the average atomic mass of hydrogen using the following data : 3

Isotope		% Natural abundance
$^{1}H_{1}$	-	99.985 %
$^{1}H_{2}$	-	0.015 %

27. Which of the following solutions have the same concentration? 3

(a) 20 g of NaOH in 200 mL of solution

(b) 0.5 mol of KC1 in 200 mL of solution

(c) 40 g of NaOH in 100 mL of solution

(d) 20 g of KOH in 200 mL of solution

28. Write difference between – 3

(a)-Molarity and Molality

(b)-Mass and Weight.

SECTION –D Long Answer Type Questions (5 Marks each)

29. A vessel contains 1.6 g of dioxygen at STP (273.15 K, 1 atm pressure). The gas isnow transferred to another vessel at constant temperature where pressure becomes half of the original pressure. Calculate 5

(i) volume of the new vessel.

(ii) number of molecules of dioxygen.

30. Calcium carbonate reacts with aqueous HCl to give $CaCl_2$ and CO_2 according tothe reaction given below: 5

$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + CO_2(g) + H_2O(l)$

What mass of $CaCl_2$ will be formed when 250 ml of 0.76 M HCl reacts with 1000 g of $CaCO_3$? Name the limiting reagent. Calculate the number of moles of $CaCl_2$ formed in the reaction.

31. A box contains some identical red coloured balls, labelled as A, each weighing 2grams. Another box contains identical blue coloured balls, labelled as B, each weighing 5 grams. Consider the combinations AB, AB_2, A_2Band A_2B_3 and show that the law of multiple proportion is applicable. 5

SECTION -E **CASE BASED QUESTIONS** ***(4 Marks each)***

32. **Read the passage and answer the Questions-** 4

The uncertainty in the experimental or the calculated values is indicated by mentioning the number of significant figures. Significant figures are meaningfuldigits which are known with certainty plus one which is estimated or uncertain.The uncertainty is indicated by writing the certain digits and the last uncertain digit. There are certain rules for determining the Number of significant figures. These are Stated below:

All non-zero digits are significant. For Example in 285 cm, there are three Significant figures and in 0.25 mL, there are two significant figures.

Zeros preceding to first non-zero digit are not significant, such zero indicates the position of decimal point. Thus, 0.03 has one significant figure and 0.0052 has two significant figures.

Zeros between two non-zero digits are significant. Thus, 2.005 has four Significant figures.

Zeros at the end or right of a number are significant, provided they are on theright side of the decimal point. For example, 0.200 g has three significant figures. But, if otherwise, the terminal zeros are not significant if there is no decimal point.

Write the answer of following questions –

1. What are significant figures? 1
2. How many significant figures in 2.30002 ? 1
3. What is difference between precision and accuracy ? 2

33. **Read the passage and answer the Questions-** 4

Chemistry is the science of molecules and their transformations. It is the science not so much of the one hundred elements but of the infinite variety of molecules that may be built from them. Chemistry plays a central role in science and is often intertwined with other branches ofscience.to understand the basic concepts of chemistry, which begin with the concept of matter. Let us start with the nature of matter. Matter can exist in three physical states viz. solid, liquid and gas. Particles are held very close to each other in solids in an orderly fashion and there is not much freedom of movement. In liquids, the particles are close to each other but they can move around. However, in gases, the particles are far apart as compared to those present in solid or liquid states and their

movement is easy and fast. different states of matter exhibit the following characteristics:

(i) Solids have definite volume and definite shape.

(ii) Liquids have definite volume but do not have definite shape. They take the shape of the container in which they are placed.

(iii) Gases have neither definite volume nor definite shape. They completely occupy the space in the container in which they are placed.

Matter can be classified as mixture or pure substance. A mixture may be homogeneous or heterogeneous. Pure substances can further be classified into elements and compounds. Particles of an element consist of only one type of atoms. These particles may exist as atoms or molecules. When two or more atoms of different elements combine together in a definite ratio, the molecule of a compound is obtained.

Every substance has unique or characteristic properties. These properties can be classified into two categories — physical properties, such as colour, odour, melting point, boiling point, density, etc., and chemical properties, like composition, combustibility, reactivity with acids and bases, etc. Physical properties can be measured or observed without changing the identity or the composition of the substance. The measurement or observation of chemical properties requires a chemical change to occur. Measurement of physical properties does not require occurance of a chemical change.

Write the answer of following questions –

1.What is difference between homogenous and heterogenous mixture ? 1

2.What is density ? Write its unit. 1

3.What are the different physical properties of matter ? Why these properties are called physical properties?

OR

What Are the Characteristics of The different States of Matter? 2

CHAPTER -2
STRUCTURE OF ATOM

Select and write one most appropriate option out of the four options given for each of the questions 1 – 16.

1. The total no. of orbitals associated with third shell will be
   a.2
   b.4
   c.9
   d.3

2. Which of the following options represent ground state electronic configuration of a copper atom?
   a. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^8\ 4s^2$
   b. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^9\ 4s^2$
   c. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^1$
   d. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5\ 4s^1$

3. Calculate the wavelength associated with a proton moving at $1.0x10^3$m/sec.(Mass of proton=$1.67x10^{-27}$kg and h=$6.63x10^{-34}$Js)
   a. 0.032nm
   b. 0.40nm
   c. 2.5nm
   d. 14.0nm

4. Which of the following statements about the electron is incorrect?
   a. It is a negatively charged particle.
   b. The mass of electron is equal to the mass of neutron.
   c. It is a basic constituent of all atoms.
   d. It is a constituent of cathode rays.

5. Which of the following atom is isoelectronic with Cr^{3+} ion?
   a. Mn^{2+}
   b. V^{2+}
   c. Fe^{2+}
   d. Co^{2+}

6. Which of the following statements is not correct regarding orbits and orbitals?
   a. Except s-orbitals, all orbitals have directional characteristics.
   b. Maximum number of electron occupied by an orbital is always 4.
   c. An orbital is well defined circular path around nucleus in which electron revolves.
   d. Orbits do not have directional characteristics.

7. The number of radial nodes for 3*p* orbital is_____.
   a. 3

b. 4
c. 2
d. 1

8. Which of the following orbitals will have lowest energy?
a. 6s
b. 4p
c. 5d
d. 4f

9. The shape of an orbital is determined by
a. Principal quantum number
b. Azimuthal quantum number
c. Magnetic quantum number
d. Spin quantum number

10 .The atomic number of two elements X and Y are 6 and 7 respectively while their mass number are 14 and 15 respectively. The relationship between X and Y is
a. Isotopes
b. Isobars
c. Isotones
d. Isoelectronic

11. The mass number of NH_4^+ion will be
a.20
b.22
c.18
d.9

12. The total possible values for magnetic quantum number for the value of l=3 is
a. 3
b. 1
c. 5
d. 7

ASSERTION-REASONING QUESTIONS

These consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:

(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true and R is not the correct explanation of A
(c) A is true but R is false
(d) A is False but R is true

1. Assertion- All isotopes of a given element show the same type of chemical behavior.
Reason- The chemical properties of an atom are controlled by the number of electrons in the atom.

2. Assertion-Rutherford postulated that electrons revolves around nucleus in fixed circular paths.
Reason- As long as electron moves in its orbit,it does not loose or gain energy.

3. Assertion- It is impossible to determine the exact position and exact momentum of an electron simultaneously.
Reason -The path of an electron in an atom is clearly defined.

4. Assertion- No two electrons in an atom can have same values of all four Quantum numbers.
Reason- An orbital cannot hold more than two electrons which should have opposite spin.

COMPETENCY BASED QUESTIONS (2M)

1. An atom of an element has 19 electrons .Find out its atomic number, total number of neutrons, valency and no. of unpaired electrons.

2. Write the electronic configurations of the following ions- Na^+, O_2^-.

3. Arrange the following orbitals in the increasing order of energy 3d, 2s, 3s, 2p. State the rule which determines energy sequence of orbitals.

4. State main postulate of Planck's quantum Theory. Write expression for it.

5. Write any one property of electromagnetic radiations. Arrange the following electromagnetic waves in the order of increasing wavelength -visible radiations, infrared radiations, X-rays, ultraviolet rays, Micro waves.

6 How are the following terms related?
a. Wave number and Wavelength.
b. Frequency and Time period**.**

COMPETENCY BASED QUESTIONS (3M)

1. Calculate the wavelength, frequency and wave number of a light wave whose period is 2×10^{-10} second.

2. State photoelectric effect. Find energy of each of the photons which corresponds to the light of
a. frequency of 3×10^{15} hertz .
b. have wavelength of 0.50 Angstrom.

3. State Heisenberg Uncertainity principle. Write its mathematical expression. Calculate the uncertainity in momentum of an electron, if uncertainity in position is 10^{-10}m.

4. Consider a 4f subshell, (attempt any three)

a. What is the maximum no. of electrons having spin in the same direction if it contains 10 electrons.

b. What are the value for Principal and Azimuthal quantum No. for 4f subshell.
c. How many orbitals are associated with f subshell?
d. What are the maximum no. of electrons that can be accommodated in f subshell?

5. Draw the shapes of s, p, d-orbitals.

6. What is the significance of Principal, Azimuthal and Magnetic quantum number in electronic configuration of an atom?

7. Electrons are emitted with zero velocity from a metal surface when it is exposed to radiation of wavelength 6800 nm. Calculate the threshold frequency and work function (W_0) of the metal.

CASE BASED QUESTIONS (4M)

1. Nature of matter was proposed by the de Broglie in 1923. It was experimentally verified by Davisson in Germer by diffraction experiment .Wave character of matter has significance only for microscopic particles de Broglie hypothesis suggested that electron waves were being diffracted by target, much as X rays are diffracted by planes of atoms.
(1+1+2)

A. Write the expression to calculate the de Broglie wavelength.
B. According to de Broglie formula, calculate mass of a microscopic particle of wavelength 3.6×10^{-6}m and moving at a velocity of 100 cm per second.
C. According to de Broglie, matters exhibits dual behaviour that is both particle like and wave like properties. How a cricket ball of mass 100 gram does not move like a waywhen it is thrown by a bowler at is speed of 100 km per hour. Calculate the wavelengthof the ball and explain why it do not show wave nature.

OR

C. Calculate the momentum of a particle having de Broglie wavelength of 0.1nm. (Given $h=6.62 \times 10^{-34}$Js)
a. 6.62x10-24kgm/s
b. 6.62x10-14kgm/s
c. 6.62x10-34kgm/s
d. None of the above.

2. According to quantum mechanical model of the atom, the electron distribution of an atom containing a number of electrons is divided into shells .The shells in turn are thought to consist of one almost subshells and subshells are assumed to be composed of one or more orbitals which the electrons occupy. While for hydrogen and hydrogen like systems all the orbitals within a given shell have same energy and that of energy of the orbitals in a multi electron atom are not same. (1+1+2)

1. Among the following pair of orbitals, which orbital will experience the largest effective nuclear charge : 4d or 4f?

2. Which of the following sets of quantum number are not possible (give reason)
   a. n = 0 ,l = 0, m =0,m_s =+ 1/2 .
   b. n=1, l =0,m =0,m_s =-1/ 2 .

3. State Pauli Exclusion Principle.

OR

Using s, p d f notation, describe the orbital with the following quantum number.
   a. n=2,l=1
   b. n=4,l=0

COMPETENCY BASED QUESTIONS (5M)

1. Answer the following questions (attempt any five parts)
   a. Why do we observe large number of spectral lines in hydrogen sample?
   b. Which series of hydrogen spectrum lies in the visible region?
   c. Differentiate Absorption and Emission Spectra?
   d. State first five series of lines in hydrogen spectrum.
   e. Write Rydberg formula for line spectrum of hydrogen atom.

2. Write Major postulates of Rutherford Atomic model. What was its major drawback? (3+2)

3.Write the electronic configuration of – Cr, Zn and Mn. Account for Stability of half filled and completely filled subshells.
(3+2)

4.What is the wavelength of light emitted when the electron in a hydrogen atom undergoes transition from an energy level with n=4 to an energy level with n=2? 3

4a.A monochromatic yellow light has a wavelength of 580nm. Calculate the frequency and wave number associated with it. 2