

Chapter 3 - Atoms and Molecules

Short Answer Type Questions

1. Which of the following represents a correct chemical formula? Name it.
 - (a) CaCl
 - (b) BiPO₄
 - (c) NaSO₄
 - (d) NaS
2. Write the molecular formulae for the following compounds
 - (a) Copper (II) bromide
 - (b) Aluminium (III) nitrate
 - (c) Calcium (II) phosphate
 - (d) Iron (III) sulphide
 - (e) Mercury (II) chloride
 - (f) Magnesium (II) acetate
3. Write the molecular formulae of all the compounds that can be formed by the combination of following ions
Cu²⁺, Na⁺, Fe³⁺, Cl⁻, SO₄²⁻, PO₄³⁻
4. Write the cations and anions present (if any) in the following compounds
 - (a) CH₃COONa
 - (b) NaCl
 - (c) H₂
 - (d) NH₄NO₃
5. Give the formulae of the compounds formed from the following sets of elements
 - (a) Calcium and fluorine
 - (b) Hydrogen and sulphur
 - (c) Nitrogen and hydrogen

- (d) Carbon and chlorine
 - (e) Sodium and oxygen
 - (f) Carbon and oxygen
6. Which of the following symbols of elements are incorrect? Give their correct symbols
- (a) Cobalt CO
 - (b) Carbon c
 - (c) Aluminium AL
 - (d) Helium He
 - (e) Sodium So
7. Give the chemical formulae for the following compounds and compute the ratio by mass of the combining elements in each one of them. (You may use appendix-III).
- (a) Ammonia
 - (b) Carbon monoxide
 - (c) Hydrogen chloride
 - (d) Aluminium fluoride
 - (e) Magnesium sulphide
8. State the number of atoms present in each of the following chemical species
- (a) CO_3^{2-}
 - (b) PO_3^{3-}
 - (c) P_2O_5
 - (d) CO
9. What is the fraction of the mass of water due to neutrons?
10. Does the solubility of a substance change with temperature? Explain with the help of an example.
11. Classify each of the following on the basis of their atomicity.
- (a) F_2
 - (b) NO_2

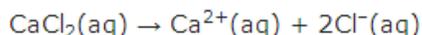
- (c) N_2O
- (d) C_2H_6
- (e) P_4
- (f) H_2O_2
- (g) P_4O_{10}
- (h) O_3
- (i) HCl
- (j) CH_4
- (k) He
- (l) Ag

12. You are provided with a fine white coloured powder which is either sugar or salt. How would you identify it without tasting?
13. Calculate the number of moles of magnesium present in a magnesium ribbon weighing 12 g. Molar atomic mass of magnesium is 24g mol^{-1} .

Long Answer Type Questions

1. Verify by calculating that
- (a) 5 moles of CO_2 and 5 moles of H_2O do not have the same mass.
 - (b) 240 g of calcium and 240 g magnesium elements have a mole ratio of 3:5.
2. Find the ratio by mass of the combining elements in the following compounds. (You may use Appendix-III)
- (a) CaCO_3
 - (b) MgCl_2
 - (c) H_2SO_4
 - (d) $\text{C}_2\text{H}_5\text{OH}$
 - (e) NH_3
 - (f) Ca(OH)_2

3. Calcium chloride when dissolved in water dissociates into its ions according to the following equation.



Calculate the number of ions obtained from CaCl_2 when 222 g of it is dissolved in water.

4. The difference in the mass of 100 moles each of sodium atoms and sodium ions is 5.48002 g. Compute the mass of an electron.
5. Cinnabar (HgS) is a prominent ore of mercury. How many grams of mercury are present in 225 g of pure HgS ? Molar mass of Hg and S are 200.6 g mol^{-1} and 32 g mol^{-1} respectively.
6. The mass of one steel screw is 4.11g. Find the mass of one mole of these steel screws. Compare this value with the mass of the Earth ($5.98 \times 10^{24}\text{kg}$). Which one of the two is heavier and by how many times?
7. A sample of vitamic C is known to contain 2.58×10^{24} oxygen atoms. How many moles of oxygen atoms are present in the sample?
8. Raunak took 5 moles of carbon atoms in a container and Krish also took 5 moles of sodium atoms in another container of same weight. (a) Whose container is heavier? (b) Whose container has more number of atoms?
9. Fill in the missing data in the Table 3.1

Table 3.1

Species	H_2O	CO_2	Na atom	MgCl_2
Property				
No. of moles	2	—	—	0.5
No. of particles	—	3.011×10^{23}	—	—
Mass	36g	—	115 g	—

10. The visible universe is estimated to contain 10^{22} stars. How many moles of stars are present in the visible universe?
11. What is the SI prefix for each of the following multiples and sub multiples of a unit?
- o (a) 10^3

- o (b) 10^{-1}
- o (c) 10^{-2}
- o (d) 10^{-6}
- o (e) 10^{-9}
- o (f) 10^{-12}

12. Express each of the following in kilograms

- o (a) 5.84×10^{-3} mg
- o (b) 58.34 g
- o (c) 0.584g
- o (d) 5.873×10^{-21} g

13. Compute the difference in masses of 10³ moles each of magnesium atoms and magnesium ions.

(Mass of an electron = 9.1×10^{-31} kg)

14. Which has more number of atoms?

100g of N₂ or 100 g of NH₃

15. Compute the number of ions present in 5.85 g of sodium chloride.

16. A gold sample contains 90% of gold and the rest copper. How many atoms of gold are present in one gram of this sample of gold?

17. What are ionic and molecular compounds? Give examples.

18. Compute the difference in masses of one mole each of aluminium atoms and one mole of its ions. (Mass of an electron is 9.1×10^{-28} g). Which one is heavier?

19. A silver ornament of mass 'm' gram is polished with gold equivalent to 1% of the mass of silver. Compute the ratio of the number of atoms of gold and silver in the ornament.

20. A sample of ethane (C₂H₆) gas has the same mass as 1.5×10^{20} molecules of methane (CH₄). How many C₂H₆ molecules does the sample of gas contain?

21. Fill in the blanks

- o (a) In a chemical reaction, the sum of the masses of the reactants and products remains unchanged. This is called ———.

- (b) A group of atoms carrying a fixed charge on them is called -----.
- (c) The formula unit mass of $\text{Ca}_3(\text{PO}_4)_2$ is -----.
- (d) Formula of sodium carbonate is ----- and that of ammonium sulphate is -----.

22. Complete the following crossword puzzle (Fig. 3.1) by using the name of the chemical elements. Use the data given in Table 3.2.

Table 3.2

Table 3.2

Across	Down
2. The element used by Rutherford during his α -scattering experiment	1. A white lustrous metal used for making ornaments and which tends to get tarnished black in the presence of moist air
3. An element which forms rust on exposure to moist air	4. Both brass and bronze are alloys of the element
5. A very reactive non-metal stored under water	6. The metal which exists in the liquid state at room temperature
7. Zinc metal when treated with dilute hydrochloric acid produces a gas of this element which when tested with burning splinter produces a pop sound.	8. An element with symbol Pb

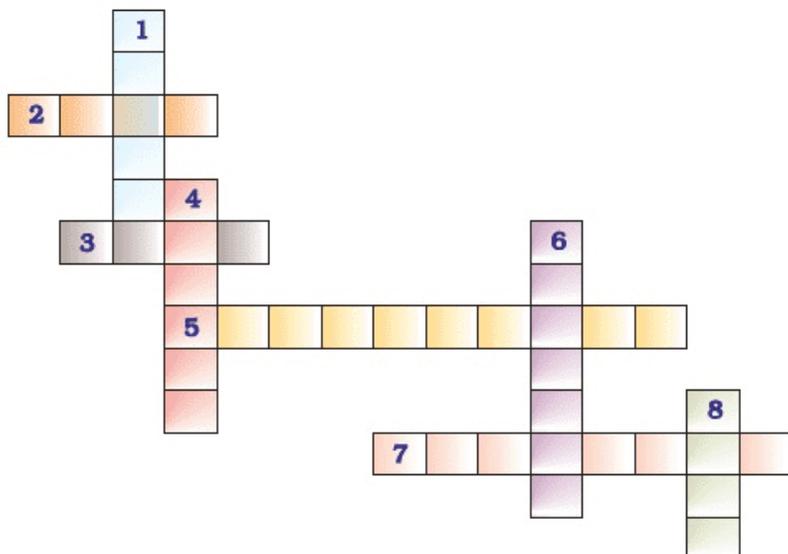


Fig. 3.1

23. (a) In this crossword puzzle (Fig 3.2), names of 11 elements are hidden.

Symbols of these are given below. Complete the puzzle.

- 1. Cl
- 2. H
- 3. Ar
- 4. O
- 5. Xe
- 6. N
- 7. He
- 8. F
- 9. Kr
- 10. Rn
- 11. Ne

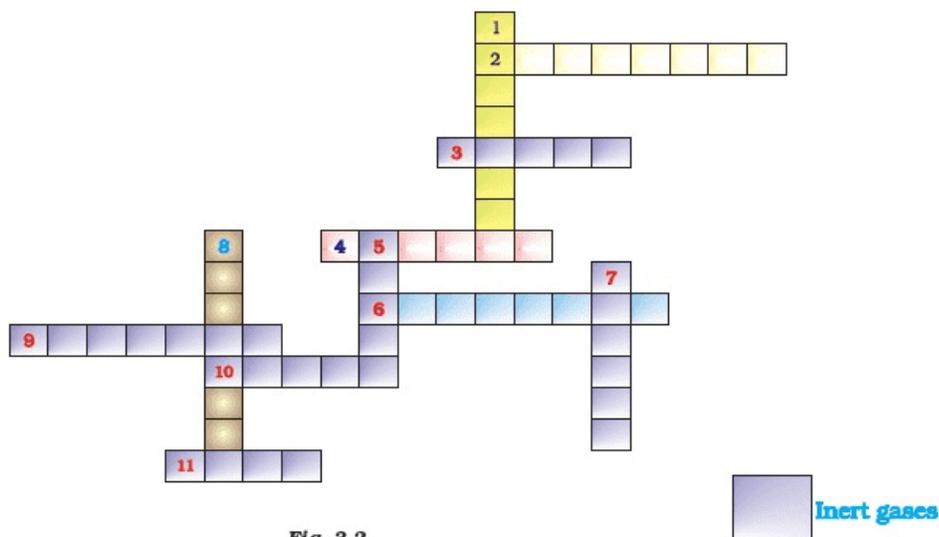


Fig. 3.2

- (b) Identify the total number of inert gases, their names and symbols from this cross word puzzle.

24. Write the formulae for the following and calculate the molecular mass for each one of them.

- (a) Caustic potash
- (b) Baking powder
- (c) Lime stone
- (d) Caustic soda
- (e) Ethanol
- (f) Common salt

25. In photosynthesis, 6 molecules of carbon dioxide combine with an equal number of water molecules through a complex series of reactions to give a molecule of glucose having a molecular formula $C_6H_{12}O_6$. How many grams of water would be required to produce 18 g of glucose? Compute the volume of water so consumed assuming the density of water to be 1g cm^{-3} .