Atoms and Molecules

Multiple Choice Questions

1. Which of the following correctly represents 360 g of water?

(i) 2 moles of H₂0

(ii) 20 moles of water

(iii) 6.022×10^{23} molecules of water

(iv) 1.2044×10²⁵ molecules of water

- (a) (i)
- (b) (i) and (iv)
- (c) (ii) and (iii)
- (d) (ii) and (iv)
- **Ans.** (d) (ii) and (iv)

2. Which of the following statements is not true about an atom?

- (a) Atoms are not able to exist independently
- (b) Atoms are the basic units from which molecules and ions are formed
- (c) Atoms are always neutral in nature
- (d) Atoms aggregate in large numbers to form the matter that we can see, feel or touch
- **Ans.** (a) Atoms are not able to exist independently.

Explanation: Atoms of inert gases exist independently, i.e. as single atom.

3. The chemical symbol for nitrogen gas is

- (a) Ni
- (b) N₂
- (c) N+
- (d) N
- **Ans.** (b) N₂

4. The chemical symbol for sodium is

- (a) So
- (b) Sd
- (c) NA
- (d) Na
- Ans. (d) Na

5. Which of the following would weigh the highest?

- (a) 0.2 mole of sucrose (C₁₂H₂₂O₁₁)
- (b) 2 moles of CO₂
- (c) 2 moles of CaCO₃
- (d) 10 moles of H_2O
- **Ans.** (c) 2 moles of CaCO₃

Explanation: Weight of 1 mole of each compound can be calculated as follows:

(a) Sucrose $= 12 \times 12 + 22 \times 1 + 11 \times 16 = 144 + 22 + 176 = 342 g$ Or 0.2 M Sucrose $= 342 \times 0.2 = 68.4 g$ (b) 1 M carbon dioxide $= 1 \times 12 + 2 \times 16 = 44 g$ Or 2 M CO₂ $= 44 \times 2 = 88 g$ (c) 1 M CaCO₃ $= 1 \times 10 + 1 \times 12 + 3 \times 16 = 100 g$ Or 2 M CaCO₃ $= 100 \times 2 = 200 g$ (d) 1 M H₂O $= 2 \times 1 + 1 \times 16 = 18 g$ Or 10 M water $= 18 \times 10 = 180 g$

6. Which of the following has maximum number of atoms?

- (a) 18 g of H₂O
- (b) 18 g of O₂
- (c) 18 g of CO₂
- (d) 18 g of CH₄
- **Ans.** (d) 18 g of CH₄

Explanation: Number of atoms

 $= \frac{\text{mass of substance} \times \text{no. of atoms in a molecule}}{\times N_A}$

molar mass (a) for 18g of H₂O= $\frac{18g \times 3}{18g} \times N_A = 3N_A$ (b) for 18g of O₂= $\frac{18g \times 2}{32g} \times N_A = 1.125N_A$ (c) for 18g of CO₂= $\frac{18g \times 3}{44g} \times N_A = 1.23N_A$ (d) for 18g of CH₄= $\frac{18g \times 5}{16g} \times N_A = 5.625N_A$

7. Which of the following contains maximum number of molecules?

- (a) 1g CO₂ (b) 1g N₂
- (c) 1g H₂
- (d) 1g CH₄

Ans. (c) 1g H₂

Explanation: Number of molecules $=\frac{\text{mass of substance}}{\text{molar mass}} \times N_A$

For 1 g hydrogen $=\frac{1g}{2g} \times N_A = 0.5 N_A = 0.5 \times 6.022 \times 10^{23}$

 $=3.011\times10^{23}$

Molar mass of other molecules are much higher than given mass, so number of molecules in them will be less than that in hydrogen.

8. Mass of one atom of oxygen is

(a)
$$\frac{16}{6.023 \times 10^{23}} g$$

(b) $\frac{32}{6.023 \times 10^{23}} g$
(c) $\frac{1}{6.023 \times 10^{23}} g$
(d) 8 u
Ans. (a) $\frac{16}{6.023 \times 10^{23}} g$

Explanation: Mass of one atom of oxygen

 $=\frac{\text{Atomic mass}}{N_{\text{A}}}=\frac{16}{6.023\times 10^{23}}\,g$

- 9. 3.42 g of sucrose are dissolved in 18 g of water in a beaker. The number of oxygen atoms in the solution are
 - (a) 6.68×10^{23}
 - (b) 6.09 x 10²²
 - (c) 6.022 x 10²³ (d) 6.022 x 10²¹
- **Ans.** (a) 6.68 x 10²³

Explanation: Number of moles = mass of substance/molar mass Molar mass of sucrose = 342 g

No. of moles for 3.42 g sucrose
$$=\frac{3.42 g}{342 g} = 0.01 M$$

1 M sucrose (C₁₁H₂₂O₁₁) contains = $11 \times N_A$ atoms of oxygen

So, number of oxygen atoms in 0.01 M sucrose = $0.11 N_A$

No. of moles for 18 g water = $\frac{18g}{18g} = 1M$

1 M water contains 1 N_A oxygen atoms

So, total number of oxygen atoms in given solution

 $= 0.11N_{A} + 1.0N_{A} = 1.11N_{A}$

$$= 1.11 \times 6.022 \times 10^{23} = 6.68 \times 10^{23}.$$

10. A change in the physical state can be brought about

- (a) only when energy is given to the system
- (b) only when energy is taken out from the system
- (c) when energy is either given to, or taken out from the system
- (d) without any energy change
- Ans. (c) when energy is either given to, or taken out from the system
 Explanation: When a solid changes into liquid, it takes energy. When a liquid changes into solid, it releases energy.

Atoms and Molecules

Short Answer Questions

11. Which of the following represent correct chemical formula? Name it.

- (a) CaCl
- (b) BiPO₄
- (c) NaSO₄
- (d) NaS
- Ans. (b) In BiPO₄; with ions are trivalent and hence this shows the correct chemical formula. In option (a); Ca is bivalent while chlorine is monovalent. In options (c) and (d); Na is monovalent while sulphate and Sulphur are bivalent.

12. Write the molecular formulae for the following compounds

(a) Copper (II) bromide
Ans. CuBr₂
(b) Aluminium (III) nitrate
Ans. Al(NO₃)₃
(c) Calcium (II) phosphate
Ans. Ca₃(PO₄)₂
(d) Iron (III) sulphide
Ans. Fe₂S₃
(e) Mercury (II) chloride
Ans. HgCl₂
(f) Magesium (II) acetate
Ans. Mg(CH₃COO)₂

13. Write the molecular formulae of all the compounds that can be formed by the combination of following ions

 Cu^{2+} , Na^+ , Fe^{3+} , Cl^- , SO_4^{2-} , PO_4^{3-}

Ans. CuCl₂/ CuSO₄/ Cu₃(PO₄)₂ NaCl/ Na₂SO₄/ Na₃PO₄ FeCl₃/ Fe₂(SO₄)₃ / FePO₄

14. Write the cations and anions present (if any) in the following compounds

- (a) CH₃COONa
- (b) NaCl
- (c) H₂
- (d) NH4NO3

Ans.

Anions	Cations
(a) CH₃ COO [.]	Na+
(b) CI ⁻	Na ⁺
(c) It is a covalent compound	
(d) NO ₃	NH_4^+

15. Give the formulae of the compounds formed from the following sets of elements (a) Calcium and fluorine

Ans. CaF2
(b) Hydrogen and sulphur
Ans. H₂S
(c)Nitrogen and hydrogen
Ans. NH3
(d)Carbon and chlorine
Ans. CCI4
(e)Sodium and oxygen
Ans. Na₂O
(f) Carbon and oxygen
Ans. CO, CO₂

- 16. 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
- **Ans.** (a) Incorrect, the correct symbol of cobalt is Co
 - (b) Incorrect, the correct symbol of carbon is C
 - (c) Incorrect, the correct symbol of aluminium is Al
 - (d) Correct (He)
 - (e) Incorrect, the correct symbol of sodium is Na
- 17. 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
- (a) NH_3 ; ratio N : H = 14 : 3Ans.
 - (b) CO; ratio C : O = 3 : 4
 - (c) HCl; ratio H : Cl = 1 : 35.5 or 2 : 71
 - (d) AlF_3 ; ratio Al : F = 9 : 19
 - (e) MgS; ratio Mg : S = 3 : 4

18. State the number of atoms present in each of the following chemical species

(a) CO_3^{2-} **Ans.** 4 (b) PO_4^{3-} **Ans.** 5 (c) P₂O₅ Ans. 7 (d) CO Ans. 2

19. What is the fraction of the mass of water due to neutrons?

Mass of one mole (Avogadro Number) of neutrons $\sim 1 \text{ g}$ Ans.

Mass of one neutron = $\frac{1}{\text{Avogadro Number (N}_{A})} g$

Mass of one molecule of water $=\frac{\text{molar mass}}{N_{\star}}=\frac{18}{N_{\star}}g$

There are 8 neutrons in one atom of oxygen

Mass of 8 neutrons $=\frac{8}{N_{\star}}$

 $\frac{8}{18}$ Fraction of mass of water due to neutrons

Does the solubility of a substance change with temperature? Explain with the help 20. of an example.

Yes, it is a temperature dependent property. The solubility generally, increases with Ans. increase in temperature. For example, you can dissolve more sugar in hot water than in cold water.

21. Classify each of the following on the basis of their atomicity.

- (a) F₂
- (b) NO₂
- (c) N₂O
- (d) C₂H₆
- (e) P₄
- (f) H₂O₂
- (g) P₄O₁₀
- (H) O₃ (i) HCl
- (j) CH₄
- (k) He
- (l) Ag
- **Ans.** (a) 2 atom
 - (b) 3 atom (c) 3 atom
 - (d) 8 atom
 - (e) 4 atom
 - (f) 4 atom
 - (1) 4 atom
 - (g) 14 atom
 - (h) 3 atom
 - (i) 2 atom
 - (j) 5 atom
 - (k) 1 atom (noble gases are always monoatomic)

(l) Polyatomic (because metals are bound by metallic bond and any measurable quantity of a metal can contain millions of atoms.)

22. You are provided with a fine white coloured powder which is either sugar or salt. How would you identify it without tasting?

Ans. On heating the powder, it will char if it is a sugar. Alternatively, the powder may be dissolved in water and checked for its conduction of electricity. If it conducts, it is a salt.

- 23. Calculate the number of moles of magnesium present in a magnesium ribbon weighing 12 g. Molar atomic mass of magnesium is 24g mol⁻¹.
- **Ans.** Number of moles = mass/molar mass = 12 g/24 g = 0.5 mol

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Long Answer Questions

24. Verify by calculating that (a) 5 moles of CO₂ and 5 moles of H₂O do not have the same mass. Ans. CO₂ has molar mass = 44g mol⁻¹ 5 moles of CO₂ have molar mass = 44 × 5= 220 g H₂O has molar mass = 18 g mol⁻¹ 5 moles of H₂O have mass = 18 × 5 g= 90 g (b) 240 g of calcium and 240 g magnesium elements have a mole ratio of 3:5. Ans. Number of moles in 240g Ca metal = $\frac{240}{40} = 6$ Number of moles in 240g of Mg metal = $\frac{240}{24} = 10$ Ratio 6: 10 = 3: 5

25. Find the ratio by mass of the combining elements in the following compounds. (You may use Appendix-III)

(a) CaCO₃ Ans. Ca: C: O₃ = 40: 12: 16 × 3 = 40: 12: 48 = 10: 3: 12 (b) MgCl₂ Ans. Mg: Cl₂ = 24: 35.55 × 2 = 24: 71 (c) H₂SO₄ Ans. H₂: S: O₄ = 1 × 2: 32: 16 × 4 = 2: 32: 64 = 1: 16: 32 (d) C₂H₅OH Ans. C₂: H₆: O = 12 × 2: 1 × 6: 16 = 24: 6: 16 = 12: 3: 8 (e) NH₃ Ans. N: H₃ = 14: 1 × 3 = 14: 3 (f) Ca(OH)₂ Ans. Ca: O₂: H₂ = 40: 16 × 2: 1 × 2 = 40: 32: 2 = 20: 16: 1

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

 $CaCl_2(aq) \rightarrow Ca^{2+}(aq) + 2Cl^{-}(aq)$

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

Ans. 1 mole of calcium chloride = 111g ∴ 222g of CaCl₂ is equivalent to 2 moles of CaCl₂ Since 1 formula unit CaCl₂ gives 3 ions, therefore, 1 mol of CaCl₂ will give 3 moles of ions 2 moles of CaCl₂ would give $3 \times 2 = 6$ moles of ions.

No. of ions = No. of moles of ions × Avogadro number

 $= 6 \times 6.022 \times 10^{23}$ $= 36.132 \times 10^{23}$

 $= 3.6132 \times 10^{24}$ ions

27. 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.

A sodium atom and ion, differ by one electron. For 100 moles each of sodium atoms and Ans. ions there would be a difference of 100 moles of electrons.

Mass of 100 moles of electrons= 5.48002 g

Mass of 1 mole of electron
$$= \frac{5.48002}{100}g$$

Mass of one electron $= \frac{5.48002}{100 \times 6.022 \times 10^{23}} = 9.1 \times 10^{-28}g = 9.1 \times 10^{-31} kg$

28. 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.

Molar mass of HgS = $200.6 + 32 = 232.6 \text{ g mol}^{-1}$ Ans. Mass of Hg in 232.6 g of HgS = 200.6 g Mass of Hg in 225 g of HgS = $\frac{200.6}{232.6} \times 225 = 194.04g$

- 29. 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 x 10²⁴kg). Which one of the two is heavier and by how many times?
- One mole of screws weigh = 2.475×10^{24} g = 2.475×10^{21} kg Ans.

$$\frac{\text{Mass of the Earth}}{\text{Mole of 1 mole of screws}} = \frac{5.98 \times 10^{24} \text{ Kg}}{2.475 \times 10^{21} \text{ Kg}} = 2.4 \times 10^{3}$$

Mass of earth is 2.4×10^3 times the mass of screws The earth is 2400 times heavier than one mole of screws.

A sample of vitamin C is known to contain 2.58×10^{24} oxygen atoms. How many 30. moles of oxygen atoms are present in the sample?

- 1 mole of oxygen atoms = 6.023×10^{23} atoms Ans.
 - :. Number or moles of oxygen atoms $=\frac{2.58\times10^{24}}{6.022\times10^{23}}=4.28 \, mol$

4.28 moles of oxygen atoms.

- 31. 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 heavier?(b) Whose container has more number of atoms?
- Ans. (a) Mass of sodium atoms carried by Krish = (5×23)g = 115g
 While mass of carbon atom carried by Raunak = (5×12)g = 60g
 Thus, Krish's container is heavy
 (b) Both the bags have same number of atoms as they have same number of moles of

Species property	H ₂ O	CO ₂	Na atom	MgCl ₂
No. of moles	2	-	-	0.5
No. of particles	-	3.011×10 ²³	-	-
Mass	36 g	-	115 g	-

32. Fill in the missing data in the Table 3.1

Ans.

atoms.

Species Property	H_2O	CO ₂	Na atom	MgCI ₂
No. of moles	2	0.5	5	0.5
No. of particles	1.2044×10 ²⁴	3.011×10 ²³	3.011×10 ²⁴	3.011×10 ²³
Mass	36 g	22 g	115 g	47.5 g

33. The visible universe is estimated to contain 10²² stars. How many moles of stars are present in the visible universe?

Ans. Number of moles of stars
$$=\frac{10^{22}}{6.023 \times 10^{23}} = 0.0166$$
 moles

34. What is the SI prefix for each of the following multiples and submultiples of a unit? (a) 10³ (b) 10⁻¹ (c) 10⁻² (d) 10⁻⁶ (e) 10⁻⁹ (f) 10⁻¹²

Ans. (a) kilo

- (b) deci
- (c) centi
- (d) micro
- (e) nano
- (f) pico

- 35. Express each of the following in kilograms

 (a) 5.84 × 10⁻³ mg
 Ans. 5.84×10⁻⁹ Kg
 (b) 58.34 g
 Ans. 5.834×10⁻² Kg
 (c) 0.584 g
 Ans. 5.84×10⁻⁴ Kg
 (d) 5.873 × 10⁻²¹ g
 - **Ans.** 5.873×10⁻²⁴ Kg
- 36. Compute the difference in masses of 10³ moles each of magnesium atoms and magnesium ions. (Mass of an electron = 9.1×10⁻³¹ kg)
- Ans. A Mg²⁺ ion and Mg atom differ by two electrons. 10³ moles of Mg²⁺ and Mg atoms would differ by 10³×2 moles of electrons Mass of 2×10³ moles of electrons = 2×10³×6.023×10²³×9.1×10⁻³¹Kg \Rightarrow 2×6.022×9.1×10⁻⁵Kg
 - \Rightarrow 109.6004 × 10⁻⁵ Kg
 - \Rightarrow 1.096×10⁻³ Kg
- 37. Which has more number of atoms?(i) 100g of N₂

Ans. 100 g of N₂ = $\frac{100}{28}$ moles Number of molecules = $\frac{100}{28} \times 6.022 \times 10^{23}$ Number of atoms = $\frac{2 \times 100}{28} \times 6.022 \times 10^{23} = 43.01 \times 10^{23}$ (ii) 100 g of NH₃ Ans. 100 g of NH₃ = $\frac{100}{17}$ moles = $\frac{100}{17} \times 6.022 \times 10^{23}$ molecules = $\frac{100}{17} \times 6.022 \times 10^{23} \times 4$ atoms = 141.69×10²³ NH₃ would have more atoms. 38. Compute the number of ions present in 5.85 g of sodium chloride.

- Ans. 5.85 g of NaCl = $\frac{5.85}{58.5} = 0.1$ moles Or 0.1 moles of NaCl particle Each NaCl particle is equivalent to one Na⁺ one Cl \Rightarrow 2 ions \Rightarrow Total moles of ions = 0.1 × 2 \Rightarrow 2 moles No. of ions = 0.2×6.022×10²³ \Rightarrow 1.2042×10²³ ions
- **39.** 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?
- **Ans.** One gram of gold sample will contain $\frac{90}{100} = 0.9g$ of gold

Number of moles of gold = $\frac{\text{mass of gold}}{\text{atomic mass of gold}}$

$$=\frac{0.9}{197}=0.0046$$

One moles of gold contains N_A atoms = 6.022×10^{23}

 $\therefore 0.0046$ mole of gold will contain = $0.0046 \times 6.022 \times 10^{23}$

 $=2.77\times10^{21}$

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

- **Ans.** Atoms of different elements join together in definite proportions to form molecules of compounds. Examples— water, ammonia, carbondioxide. Compounds composed of metals and non-metals contain charged species. The charged species are known as ions. An ion is a charged particle and can be negatively or positively charged. A negatively charged ion is called an anion and the positively charged ion is called cation. Examples— sodium chloride, calcium oxide.
- 41. Compute the difference in masses of one mole each of aluminium atoms and one mole of its ions. (Mass of an electron is 9.1x10⁻²⁸ g). Which one is heavier?
- **Ans.** Mass of 1 mole of aluminium atom = the molar mass of aluminium = 27 g mol⁻¹ An aluminium atom needs to lose three electrons to become an ion, AI³⁺ For one mole of AI³⁺ ion, three moles of electrons are to best lost. The mass of three moles of electrons = $3 \times (9.1 \times 10^{-28}) \times 6.022 \times 10^{23} g$

$$= 27.3 \times 6.022 \times 10^{-5} g$$

 $= 164.400 \times 10^{-5} g$ = 0.00164 g Molar mass of Al³⁺ = (27 - 0.00164)g mol⁻¹ = 26.998g mol⁻¹ Difference = 27 - 26.9984 = 0.0016 g

- 42. 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.
- **Ans.** Mass of silver = m g

Mass of gold $=\frac{m}{100}g$

Number of atoms of silver $=\frac{\text{mass}}{\text{atomic mass}} \times N_A$

$$=\frac{m}{108}\times N_A$$

Number of atoms of gold = $\frac{m}{100 \times 197} \times N_A$

Ratio of number of atoms of gold to silver = Au: Ag

$$= \frac{m}{100 \times 197} \times N_{A} : \frac{m}{108} \times N_{A}$$

= 108 : 100 \times 197
= 108 : 19700
= 1 : 182.41

- 43. 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?
- Ans. Mass of 1 molecules of CH₄ = $\frac{16g}{N_A}$ Mass of 1.5×10²⁰ molecules of methane = $\frac{1.5 \times 10^{20} \times 16}{N_A} g$ Mass of 1 molecules of C₂H₆ = $\frac{30}{N_A} g$ Mass of molecules of C₂H₆ is = $\frac{1.5 \times 10^{20} \times 16}{N_A} g$ \therefore number of molecules of ethane = $\frac{1.5 \times 10^{20} \times 16}{N_A} = \frac{N_A}{30} = 0.8 \times 10^{20}$

44. Fill in the blanks

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

Ans. Law of conservation of mass

(b) A group of atoms carrying a fixed charge on them is called ______.

Ans. Polyatomic ion

(c) The formula unit mass of Ca₃(PO₄)₂ is _____.

Ans. $(3 \times \text{atomic mass of Ca}) + (2 \times \text{atomic mass of phosphorus}) + (8 \times \text{atomic mass of oxygen}) = 310$

(d) Formula of sodium carbonate is and that of ammonium sulphate is ______.

Ans. Na₂ CO₃; (NH₄)₂SO₄

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

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



Ans. (1) Silver (2) Gold (3) iron (4) Copper (5) Phosphorus (6) Mercury (7) Hydrogen (8) Lead



46. (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 2 Ar 4 O 5 Yo 6 N 7 Ho 8 F 0 Kr 10 Pr 11 No

1. Cl, 2. H, 3. Ar, 4. O, 5. Xe, 6. N, 7. He, 8. F, 9. Kr, 10. Rn, 11. Ne (b) Identify the total number of inert gases their names and symbol

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



Ans. (a)



(b) Insert Gases: There are total six insert six inert gases present in this crossword, i.e. helium (He), Argon (Ar), Xenon (Xe), Krypton (Kr), Radon (Rn) and Neon (Ne).

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

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(a) Caustic potash
Ans. KOH
(39 + 16 + 1) = 56 \text{ g mol}^{-1}
(b) Baking powder
Ans. NaHCO<sub>3</sub>
23 + 1 + 12 + (3 \times 16) = 84 \text{ g mol}^{-1}
(c) Lime stone
Ans. CaCO<sub>3</sub>
40 + 12 + (3 \times 16) = 100 \text{ g mol}^{-1}
(d) Caustic soda
Ans. NaOH
23 + 16 + 1 = 40 \text{ g mol}^{-1}
(e) Ethanol
Ans. C_2H_5OH = C_2H_6O
2 \times 12 + (6 \times 1) + 16 = 46 \text{ g mol}^{-1}
(f) Common salt
Ans. NaCl
23 + 35.5 = 58.5 \text{ g mol}^{-1}
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48. 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 C₆H₁₂O₆. 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 1 g cm⁻³.

Ans.
$$6CO_2 + 6H_2O \xrightarrow{Chlorophyll}{sunlight} \rightarrow C_6H_{12}O_6 + 6O_2$$

1 mole of glucose needs 6 moles of water
180 g of glucose needs (6 × 18) g of water
1 g of glucose will need $\frac{108}{180}g$ of water.
18 g of glucose would need $\frac{108}{180} \times 18$ g of water = 10.8 g
Volume of water used $= \frac{Mass}{Density} = \frac{10.8}{1g \text{ cm}^{-3}} = 10.8 \text{ cm}^3$.