# CHEMISTRY

# BOOKS - BHARATI BHAWAN

# CHEMISTRY (HINGLISH)

# ATOMS , MOLECULES AND IONS

**Examples**

**1.** Determine the molecular mass of water .

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**2.** Find out the molecular mass of sulphuric acid .

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**3.** Calculate the number of moles in $5.75g$ of sodium. $(\text{Atomic mass of sodium} = 23)$

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**4.** How many grams of each of the following elements must be taken to get 1 mol of the element ?

$(a)$ Sodium

$(b)$ Chlorine

$(C)$ Copper

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**5.** What is the mass in grams of a single atom of chlorine ? (Atomic mass of chlorine = 35.5)

**6.** The density of liquid mercury is $13.6 g/cm^3$.

How many moles of mercury are there in 1 litre

of the metal? (Atomic mass of $Hg = 200$).

**7.** The mass of a single atom of an element M

is $3.15 \times 10^{-23}$ g . What is its atomic mass ?

What could the element be ?

**8.** An atom of neon has a mass of $3.35 \times 10^{-23} g$. how many atoms of neon are there in $20g$ of the gas ?

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**9.** How many atoms are there in 100 amu of helium , if atomic mass of helium is $4$ amu ?

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**10.** How many grams of sodium wil have the same number of atoms as 6 grams of magnesium

$(\text{Given Na} = 23u, Mg = 24u)$?

**11.** If $^{12}C$ is used as standard , the relative mass of an atom of sodium is 23 and the relative mass of an atom of phosphorus is 31 . Find the relative masses of a samples of

sodium and phosphorus with respect to each other when each contains $3.0 \times 10^{25}$ atoms .

**12.** Find the mass in grams out of 2.42 mol of zinc .

**13.** How many atoms of copper are present in 0.35 mol of pure copper metal ?

**14.** How many moles of $Cr$ are there in $85g$ of $Cr_2S_3$ ? $(Cr = 52, S = 32)$

**15.** What is the mass of $5\ mol$ of ammonia ?

**16.** What mass in grams is represented by (a) 0.40 mol of $CO_2$ , (b) 3.00 mol of $NH_3$ , (c) 5.14 mol $H_5IO_6$ ? (C = 12 , O = 16 , N = 14 , H = 1 and I = 127)

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**17.** Calculate the volume in litres of $20g$ of hydrogen gas at STP .

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**18.** The molecular mass of $H_2SO_4$ is 98 amu . Calculate the number of moles of each element in 294 g of $H_2SO_4$ .

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**19.** Find the mass of oxygen contained in 1 kg of potassium nitrate $(KNO_3)$ .

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**20.** You are asked by your teacher to buy 10 mol of distilled water from a shop where small bottles each containing 20 g of such water are available . How many bottles will you buy ?

**21.** Determine the mass of the following :

(i) 0.7 mole of $O_2$ gas (ii) 0.7 mol of $O$ atoms .

**22.** Determine the mass of the following :

(i) $6.022 \times 10^{23}$ number of $O_2$ molecules

(ii) $6.022 \times 10^{23}$ number of $O$ atoms .

**23.** Find the percentage of calcium in calcium carbonate $(CaCO_3)$.

**24.** What is the percentage of sulphur in sulphuric acid $(H_2SO_4)$ ?

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**25.** What are the percentage compositions of hydrogen and oxygen in water $(H_2O)$ ? (H =1 , O = 16)

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Pick The Correct Option

1. All samples of carbon dioxide contain carbon and oxygen in the mass ratio of $3:8$ This is in agreement with the law of .

(a). conservation of mass

(b). constant proportion

(c). multiple proportions

(d). gaseous volumes

A. conservation of mass

B. constant proportions

C. multiple proportions

D. gaseous volumes

**Answer: B**

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**2.** That the atom is indivisible was proposed by
.

A. Rutherford

B. Dalton

C. Bohr

D. Einstein

**Answer: B**

**3.** The value of the Avogadro constant is

A. $6.022 \times 10^{24}$

B. $6.022 \times 10^{22}$

C. $60.22 \times 10^{23}$

D. $6.022 \times 10^{23}$

**Answer: D**

**4.** The volume of 1 mole of a gas at standard temperature and pressure is:

A. 11.2 litres

B. 22.4 litres

C. 100 litres

D. none of these

**Answer: B**

**5.** If the atomic mass of sodium is $23$, the number of moles in $46gm$ of sodium is:
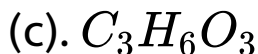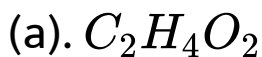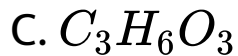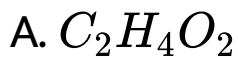
A. 1

B. 2

C. 2.3

D. 4.6

**Answer: B**

**6.** The empirical formula of a compound of molecular mass 120 is $CH_2O$. The molecular formula of the compound is :

(a). $C_2H_4O_2$

(b). $C_4H_8O_4$

(c). $C_3H_6O_3$

(d). all of these

A. $C_2H_4O_2$

B. $C_4H_8O_4$

C. $C_3H_6O_3$

D. none of these

**Answer: B**

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**7.** Which of the following is a tetraatomic

molecule ?

A. $O_2$

B. $O_3$

C. $NO_2$

D. $SO_3$

**Answer: D**

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**8.** The number of atoms present in a molecule of a substance is called its_____

A. molecularity

B. atomicity

C. valency

D. reactivity

**Answer: B**

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**9.** The valency of nitrogen in ammonia $(NH_3)$ is

A. 2

B. 0

C. 3

D. 4
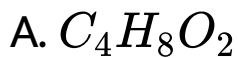
**Answer: C**

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**10.** The molecular formula of ethanoic acid is

$C_2H_4O_2$. Its empirical formula is

A. $C_4H_8O_2$

B. $CH_2O$

C. $CHO$

D. $CHO_2$

**Answer: B**

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Fill In The Blanks

**1.** An element has only one type of ...........

**2.** In a chemical compound , the constituent elements are present in .............. Proportions by weight .

**3.** The symbol of fluorine is ..............

**4.** The atomic mass of sodium is 23 . The gram-atomic mass of sodium is .............

**5.** The mass of 5 moles of ammonia $(NH_3)$ is .............

**6.** The valency of Cu in cuprous chloride $(Cu_2Cl_2)$ is .............

**7.** The valency of an element A is 3 and that of another element B is 2 . The formula of the compound formed from A and B is .............

Mark The Statements True T And False F

**1.** A molecule is made up of atoms .

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**2.** Atoms of different elements have the same mass .

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**3.** The symbol of silver is S .

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**4.** 1 amu = $\dfrac{1}{12}$ the mass of one C-12 atom .

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**5.** The molecules of different substances have the same mass .

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**6.** All elements having valency 2 are called divalent .

**7.** The formula of sodium carbonate is $Na_2CO_3$ .

**8.** Noble gas molecules are diatomic .

**9.** The molecular formula of a compound is determined by the valency of the elements present in the compound .

**Very Short Answer Questions**

**1.** Who was the first to propose the concept of compound atom ?

**2.** What is meant by the gram- atomic mass of an element ?

**3.** The atomic masses of sodium and chlorine are $23$ and $35.5$ respectively . What is the formula mass of sodium chloride $(NaCl)$ ?

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**4.** The atomic mass of $Ca$ is $40$ and the molecular mass of $CaCO_3$ is $100$ . What is the percentage of $Ca$ in $CaCO_3$ ?

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**5.** What is a symbol ?

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**6.** What is an atom ?

▶ **Watch Video Solution**

**7.** Write the formula of calcium nitrate .

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**8.** The molecular formula of sulphur is S . What do you understand by this ?

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**9.** Define valency of an element.

▶ **Watch Video Solution**

**10.** What is an ion ?

▶ **Watch Video Solution**

11. Write the chemical formula of the following

:

(a) Calcium chloride (b) Aluminium nitrate

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12. Give the names of elements present in

ammonium chloride .

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**13.** What is the mass of 1 mole of oxygen atoms ?

**14.** Convert into mole :

(a) 28 g of nitrogen atoms

(b) 20 g of carbon dioxide

Short Answer Questions

**1.** State any two postulates of Dalton's atomic theory .

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**2.** State the law of constant proportion .

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**3.** 5.2 g of substance A reacts with 2.7 g of substance B to produce 7.9 g of the substance

AB . How would you justify that the result is in agreement with the law of conservation of mass ?

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**4.** What are the characteristics of an atom ?

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**5.** What information do you get from the symbol of an element ?

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**6.** Explain 'relative atomic mass' .

**Watch Video Solution**

**7.** Define a molecule .

**Watch Video Solution**

**8.** Mention any two characteristics of a molecule .

▶ Watch Video Solution

**9.** What are ions ?

▶ Watch Video Solution

**10.** What is a mole of a substance ?

▶ Watch Video Solution

**11.** Write the chemical formula of the following substances :

(a) Sodium sulphate (b) Sulphur trioxide

(c) Barium nitrate (d) Calcium oxide

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**12.** What are polyatomic ions? Give examples.

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**13.** Show with an example the difference between empirical and molecular formulae . How are the two related ?

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**14.** Explain the significance of mole .

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**Numericals**

**1.** How many moles are there in $5g$ of calcium ?

**2.** Calculate the number of moles in the following :

(i) $128g$ of oxygen (ii) $68g$ of ammonia

**3.** What is the number of molecules present in

$0.5$ mole of hydrogen ?

**4.** What is the mass in grams of $3$ moles of $N$ ?

**5.** Calculate the mass of $12.0 \times 10^{14}$ atoms of hydrogen .

**6.** Calculate the percentage composition of

(i) iron in ferric oxide , $Fe_2O_3$ (atomic mass of Fe = 56)

(ii) nitrogen in urea $H_2NCONH_2$

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**7.** If one mole of carbon atoms weighs 12 grams, what is the mass (in grams) of 1 atom of carbon?

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**8.** How many grams of sodium wil have the same number of atoms as 6 grams of magnesium

$(\text{Given Na} = 23u, Mg = 24u)$?

**9.** Calculate the mass in grams of $0.2$ mole of water $(H_2O)$. $(H = 1, O = 16)$

**10.** How many moles of calcium carbonate $(CaCO_3)$ are present in $10g$ of the substance ? $(Ca = 40u, C = 12u, O = 16u)$

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**11.** Calculate the number of atoms of each element present in 9.8 g of sulphuric acid , $H_2SO_4$ , (H = 1,S = 32 , O = 16)

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**12.** Calculate the number of calcium ions in $5.6g$ of calcium oxide . $(Ca = 40)$

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**13.** What is the percentage composition of the elements in ammonia , $NH_3$ ? $(N = 14, H = 1)$
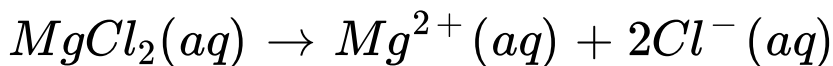
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**14.** 2.0 of a sample of sodium chloride contains 0.785 g of sodium and 1.775 g of chlorine . In another sample , 2.925 g of sodium chloride was found to contain 1.15 g of sodium and 1.775 g of chlorine . Show that these data are in agreement with the law of constant proportion .

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**15.** In aqueous solution magnesium chloride dissociates into ions as follows .

$$MgCl_2(aq) \rightarrow Mg^{2+}(aq) + 2Cl^-(aq)$$

Calculate the number of ions produced when $23.75g$ of magnesium chloride is dissolved in water .

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**16.** Calculate the mass of water required to produce $36g$ of glucose during the process of

photosynthesis in plants .

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