

## CHEMISTRY

### BOOKS - MTG IIT JEE FOUNDATION

### ATOMS AND MOLECULES

#### Illustrations

1. 10.0 g of  $CaCO_3$  on heating gave 4.4 g of  $CO_2$  and 5.6 g of CaO. Show that these observations are in agreement with the law of conservation of mass.



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**2.** Weight of copper oxide obtained, by heating 4.32 g of metallic copper with nitric acid and subsequent ignition, was 5.40 g. In another experiment, 2.30 g of copper oxide on reduction yielded 1.84 g of copper. Show that these findings are in accordance with the law of constant proportions.

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**3.** Copper oxide was prepared by two different methods. In case, 1.75 g of the metal gave 2.19 g of oxide. In the second case, 1.14 g of the metal gave 1.43 g of the oxide, show that the given data illustrate the law of constant proportions.



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4. Calculate the mass of carbon present in 2 g of carbon dioxide.



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5. Calculate the number of gram atoms in

(i) 640 g of sulphur

(ii) 360 g of magnesium.



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6. An atom of copper has a mass of  $1.0625 \times 10^{-22}$ .

How many atoms of copper are there in 16 g?



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7. The ratio of masses of carbon and oxygen is 3 : 8 and their atomic masses are 12 and 16 respectively in a molecule of carbon dioxide. Calculate the ratio of atoms of carbon and oxygen in the molecule of carbon dioxide.



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8. (i) Find the molecular mass of the following:

(a)  $C_2H_6$  (b)  $PCl_3$

[Atomic masses: C = 12, Cl = 35.5, H = 1, P = 31]

(ii) Find the formula mass of the following : (a)  $KNO_3$

(b)  $CuSO_{4.5}H_2O$

[Atomic masses : K = 39, O = 16, N = 14, S = 32, Cu = 63.5, H = 1]



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9. Write the formula of compounds formed by :

(i)  $Ag^+$  and  $S^{2-}$

(b)  $Cr^{3+}$  and  $O^{2-}$

(c)  $Al^{3+}$  and  $SO_4^{2-}$



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10. What is the valency of the metal in the following formulae?

(a)  $CaCl_2$ , (b)  $Na_2O$ , (c)  $Fe_2O_3$



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11. A metal M forms an ionic compound X of formula  $M_2(SO_4)_3$ .

(a) Identify the cation in X.

(b) Given the relative formula mass of X is 392, determine the relative atomic mass of metal M.

(c) (i) What is the formula of the nitrate of metal M?

(ii) Calculate the relative formula mass of nitrate compound in (c)(i).



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12. Calculate the mass percentage composition of copper in copper sulphate.

[ $Cu = 63.5$ ,  $S = 32$ ,  $O = 16$ ]



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13. 4.9 g of sulphuric acid contains 0.1 g of hydrogen, 1.6 g of sulphur and rest oxygen. Calculate the mass

percentage composition of all the elements of sulphuric acid.

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**14.** Calculate the mass of 0.72 gram molecule of carbon dioxide ( $CO_2$ )

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**15.** From 200 mg of  $CO_2$ ,  $10^{21}$  molecules are removed. How many moles of  $CO_2$  are left ?

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**16.** How many electrons are present in 1.6 g of methane?



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**17.** Calculate the number of moles in  $3.0115 \times 10^{23}$  atoms of calcium.



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**18.** Calculate the mass of-

(a) 0.2 mol molecules of oxygen

(b) one atom of aluminium

(c) 3.0 mol of Chloride ion

(d) 2.5 mol of NaCl. (Atomic masses:

$O = 16u$ ,  $Cl = 35.5u$ ,  $Na = 23u$ ,  $Al = 27u$ )

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19. Calculate the mass of  $SO_2$  gas which will contain the same number of molecules as present in 4.4 g of  $CO_2$ .

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20. In which one of the following cases the number of hydrogen atoms is more ?

Two moles of  $HCl$  or One mole of  $NH_3$

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## Solved Examples

1. A piece of copper weighs 0.635 g. How many atoms of copper does it contain?



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2. Calculate the mass of a single atom of sulphur and a single molecule of carbon dioxide? [Given = Atomic mass of S = 32 u, C = 12 u, O = 16 u]



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3. What mass of silver nitrate will react with 5.85 g of sodium chloride to produce 14.35 g of silver chloride and 8.5 g of sodium nitrate if the law of conservation of mass is true?

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4. Calculate the molecular masses of the following:

(i)  $C_{12}H_{22}O_{11}$ , (ii)  $Al_2(SO_4)_3$

Given atomic masses :

$C = 12.0u$ ,  $H = 1.0u$ ,  $O = 16.0u$ ,  $Al = 27.0u$ ,  $S = 32.0u$

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5. An element X shows a variable valency of 3 and 5.

What are the formulae of the oxide formed by it?

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6. Calculate formula unit mass of  $Na_2CO_3 \cdot 10H_2O$

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7.  $10^{22}$  atoms of an element X are found to have a mass of 930 mg. Calculate the molar mass of the element 'X'.

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8. Calculate the number of molecules present in 1 litre of water assuming that density of water is  $1\text{gmL}^{-1}$ .

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9. Calculate the mass percentage of composition of sulphur in calcium sulphate,  $\text{CaSO}_4$  [Ca = 40, S= 32, O= 16]

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10. Which amongst the following has more number of atoms?

(i) 11.5 g of sodium, or

(ii) 15 g of calcium [Na = 23, Ca = 40]

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11. Calculate the number of atoms of each type that are present in 3.42g of sucrose ( $C_{12}H_{22}O_{11}$ ).

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12. Calculate mass of sodium which contains same number of atoms as are present in 4g of calcium (Atomic weight  $Na = 23$ , atomic weight  $Ca = 40$ )

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

(i) 28 g of He (ii) 46 g of Na (iii) 60 g of Ca.

Given, gram atomic mass of He = 4 g, Na = 23 g and Ca = 40 g

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**14.** Calculate the weight of carbon monoxide having the same number of oxygen atoms as are present in 22g of carbon dioxide

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15. A flask P contains 0.5 mole of oxygen gas. Another flask Q contains 0.4 mole of ozone gas. Which of the two flasks contains greater number of oxygen atoms ?



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## Ncert Section

1. In a reaction, 5.3 g of sodium carbonate reacted with 6 g of acetic acid. The products were 2.2 g of carbon dioxide, 0.9 g water and 8.2 g of sodium acetate. Show that these observations are in agreement with the law of conservation of mass.

sodium carbonate + acetic acid  $\rightarrow$  sodium acetate +  
carbon dioxide + water

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2. Hydrogen and oxygen combine in the ratio of 1: 8 by mass to form water. What mass of oxygen gas would be required to react completely with 3 g of hydrogen gas?

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3. Which postulate of Dalton's atomic theory is the result of the law of conservation of mass?

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4. Which postulate of Dalton's atomic theory can explain the law of definite proportions?



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5. Define the atomic mass unit.



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6. Why is it not possible to see an atom with naked eyes?



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7. Write down the formulae of

(i) sodium oxide

(ii) aluminium chloride

(iii) sodium sulphide

(iv) magnesium hydroxide



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8. Write down the names of compounds represented by the following formulae:

(i)  $Al_2(SO_4)_3$

(ii)  $CaCl_2$

(iii)  $K_2SO_4$

(iv)  $KNO_3$

(v)  $CaCO_3$



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9. What is meant by the term chemical formula?



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10. How many atoms are present in a

(i)  $H_2S$  molecule and

(ii)  $PO_4^{3-}$  ion?



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11. Calculate the molecular masses of  $H_2$ ,  $O_2$ ,  $Cl_2$ ,  $CO_2$ ,  $CH_4$ ,  $C_2H_6$ ,  $C_2H_4$ ,  $NH_3$ ,  $CH_3OH$ .

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12. Calculate the formula unit masses of  $ZnO$ ,  $Na_2O$ ,  $K_2CO_3$ . Given atomic masses of Zn = 65 u, Na = 23 u, K = 39 u, C = 12 u and O = 16 u.

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

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14. Which has more number of atoms, 100 grams of sodium or 100 grams of iron (given, atomic mass of Na = 23 u, Fe = 56 u)?



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15. A 0.24 g sample of compound of oxygen and boron was found by analysis to contain 0.096 g of boron and 0.144 g of oxygen. Calculate the percentage composition of the compound by weight.



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**16.** When 3.0 g of carbon is burnt in 8.00 g oxygen, 11.00 g of carbon dioxide is produced. What mass of carbon dioxide will be formed when 3.00 g of carbon is burnt in 50.00 g of oxygen? Which law of chemical combination will govern your answer?

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

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**18.** Write the chemical formulae of the following.

(a) Magnesium chloride



- (b) Calcium oxide
- (c) Copper nitrate
- (d) Aluminium chloride
- (e) Calcium carbonate.



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**19.** Give the names of the elements present in the following compounds.

- (a) Quick lime
- (b) Hydrogen bromide
- (c) Baking powder
- (d) Potassium sulphate.



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20. Calculate the molar mass of the following substances.

(a) Ethyne,  $C_2H_2$

(b) Sulphur molecule,  $S_8$

(c) Phosphorus molecule,  $P_4$  (Atomic mass of phosphorus = 31)

(d) Hydrochloric acid, HCl

(e) Nitric acid,  $HNO_3$



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21. What is the mass of—

(a) 1 mole of nitrogen atoms?

(b) 4 moles of aluminium atoms (Atomic mass of

aluminium = 27)?

(c) 10 moles of sodium sulphite ( $Na_2SO_3$ )?



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**22.** Convert into moles :

(a) 12 g of oxygen gas

(b) 20 g of water

(c) 22 g of carbon dioxide

(Atomic masses :  $O = 16u$ ,  $H = 1u$  and  $C = 12u$ )



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**23.** What is the mass of:

(a) 0.2 mole of oxygen atoms?

(b) 0.5 mole of water molecules?

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**24.** Calculate the number of molecules of sulphur ( $S_8$ ) present in 16 g of solid sulphur.

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**25.** Calculate the number of aluminium ions present in 0.051 g of aluminium oxide.

(Hint: The mass of an ion is the same as that of an atom of the same element. Atomic mass of Al = 27 u)



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## Exercise Multiple Choice Questions Level 1

1. A sample of pure water, irrespective of source, contains 88.89% oxygen and 11.11% hydrogen by mass.

The data supports the

- A. law of constant proportions
- B. law of conservation of mass
- C. law of reciprocal proportions

D. law of multiple proportions.

**Answer: A**



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2. Which of the following has the smallest mass?

A. 4 g of He

B.  $6.022 \times 10^{23}$  atoms of He

C. 1 atom of He

D. 1 mole atoms of He

**Answer: C**



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3. Which of the following is a triatomic molecule?

A. Carbon dioxide

B. Ammonia

C. Helium

D. Sugar

**Answer: A**



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4. The atomic mass of calcium (Ca) is 40 g. The number of moles in 60 g of calcium are

A. 0.5 mol

B. 2.0 mol

C. 1.5 mol

D. 0.75 mol

**Answer: C**



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5. 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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6. What mass of carbon dioxide ( $CO_2$ ) will contain  $3.011 \times 10^{23}$  molecules?

A. 11.0 g

B. 22.0g

C. 4.4 g

D. 44.0 g

**Answer: B**



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7. How many grams of  $H_2SO_4$  are present in 0.25 g mole of  $H_2SO_4$  ?

A. 2.45

B. 24.5

C. 0.245

D. 0.25

**Answer: B**



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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 mass of a molecule of water is

A.  $3 \times 10^{-26} \text{ kg}$

B.  $3 \times 10^{-25} \text{ kg}$

C.  $1.5 \times 10^{-26} \text{ kg}$

D.  $2.5 \times 10^{-26} \text{ kg}$

**Answer: A**



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11. The volume occupied by 4.4 g of  $CO_2$  at STP is

A. 22.4 L

B. 2.24 L

C. 0.224 L

D. 0.1 L

**Answer: B**



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12. Molecular mass is defined as the

- A. mass of one atom compared with the mass of one molecule
- B. mass of one atom compared with the mass of one atom of hydrogen
- C. mass of one molecule of any substance compared with the mass of one atom of C-12
- D. none of the above.

**Answer: C**



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**13.** The molecular formula  $P_2O_5$  means that

- A. a molecule contains 2 atoms of P and 5 atoms of O
- B. the ratio of the mass of P to the mass of O in the molecule is 2 : 5
- C. there are twice as many P atoms in the molecule as there are O atoms
- D. the ratio of the mass of P to the mass of O in the molecule is 5 : 2.

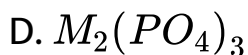
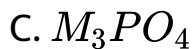
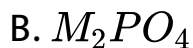
**Answer: A**



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14. The formula of chloride of a metal M is  $MCl_3$ , then the formula of the phosphate of metal M will be:



**Answer: A**



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15. An atom is the:

- A. smallest particle of matter known
- B. smallest particle of a gas
- C. smallest particle of an element that can take part in a chemical change
- D. radioactive emission.

**Answer: C**



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**16.** Which of the following represents a polyatomic ion?

- A. Sulphide
- B. Chloride

C. Sulphate

D. Nitride

**Answer: C**



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17. Valency of silver in  $Ag_2S$  is:

A. 1

B. 2

C. 0

D. 3

**Answer: A**



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**18.** 52 g of He contains

A.  $4 \times 6.022 \times 10^{23}$  atoms

B. 13 atoms

C.  $13 \times 6.022 \times 10^{23}$  atoms

D. 4 atoms

**Answer: C**



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**19.** Atomicity of sulphur is:

A. 8

B. 4

C. 2

D. 1

**Answer: A**



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**20.** A chemical equation is always balanced to fulfil the condition of

- A. Dalton's atomic theory
- B. law of constant composition
- C. law of multiple proportions
- D. law of conservation of mass.

**Answer: D**



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**21. Chemical formula of ferric oxide is:**

- A. FeO
- B.  $Fe_2O_3$
- C.  $Fe_3O_4$

D. none of these

**Answer: B**



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**22. Mass of 1 mole of nitrogen atoms is:**

A. 28 g

B. 14.0 g

C. 28 amu

D. 14 amu

**Answer: B**



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23. 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**



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24. How many molecules are present in one in one gram of hydrogen?

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

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

C.  $3.01 \times 10^{23}$

D.  $3.0125 \times 10^{-12}$

**Answer: C**



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25. In which of the following the valency of each of the constituent elements is equal to the total number of

atoms in one molecule of the compound?

A. HCl

B.  $H_2S$

C. CaO

D.  $MgCl_2$

**Answer: C**



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**26.** Number of moles of water present in 180 g of water will be:

A. 5

B. 10

C. 15

D. 18

**Answer: B**



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**27. Mass of 3 moles of NaOH in grams is:**

A. 240 g

B. 120 g

C. 100 g

D. 69 g

**Answer: B**



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**28.** Which one of the following statements is incorrect?

A. One gram atom of carbon-12 contains Avogadro's number of atoms.

B. One mole of oxygen gas contains Avogadro's number of molecules.

C. One mole hydrogen gas contains Avogadro's number of atoms.

D. One mole of electron stands for ' $6.02 \times 10^{23}$ ' electrons.

**Answer: C**



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**29.** The volume occupied by 1 mole atom of a diatomic gas at STP is

A. 22.4 L

B. 11.2 L

C. 5.6 L

D. 44.8 L

**Answer: B**



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**30.** Molecules of phosphorus and ammonia are respectively:

- A. monoatomic and triatomic
- B. monoatomic and diatomic
- C. tetraatomic and triatomic
- D. tetraatomic and tetraatomic.

**Answer: D**



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31. Which of the following molecules has highest number of particles?

A. 8 g of  $CH_4$

B. 4.4 g of  $CO_2$

C. 34.2g of  $C_{12}H_{22}O_{11}$

D. 2 g of  $H_2$

**Answer: D**



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32. Which one of the following parts of gases contains the same number of molecules?

A. 16 g of  $O_2$  and 14 g of  $N_2$

B. 8 g of  $O_2$  and 22 g of  $CO_2$

C. 28 g of  $N_2$  and 22 g of  $CO_2$

D. 32 g of  $O_2$  and 32 g of  $N_2$

**Answer: A**



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33. Weight of  $6.022 \times 10^{20}$  atoms of silver (at. mass 108 u) is



A.  $108 \times 10^3 \text{ g}$

B. 108 g

C. 0.108 g

D. 10.8 g

**Answer: C**



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**34.** The number of carbon atoms in 1 g of  $\text{CaCO}_3$  is,

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

B.  $6.022 \times 10^{21}$

C.  $3.0125 \times 10^{22}$

D.  $1.204 \times 10^{23}$

**Answer: B**



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**35.** In carbon disulphide ( $CS_2$ ), the mass of sulphur in combination with 3.0 g of carbon is:

A. 4.0 g

B. 6.0 g

C. 64.0 g

D. 16.0 g

**Answer: D**



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**36.** Which one of the following statements is true?

A. Mass of 0.5 mole of  $N_2$  gas  $>$  Mass of 0.5 mole  
of N atoms

B. Mass of 0.5 mole of  $N_2$  gas = Mass of 0.5 mole of  
N atoms

C. Mass of 0.5 mole of  $N_2$  gas  $<$  Mass of 0.5 mole  
of N atoms

D. Mass of 0.5 mole of  $N_2$  gas = Mass of 0.5 mole of  $O_2$  gas

**Answer: A**



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37. Two gaseous sample were analysed. One contained 1.2 g of carbon and 3.2 g of oxygen. The other contained 27.3 % carbon and 72.7 % oxygen. The experimental data are in accordance with

A. law of conservation of mass

B. law of definite proportions

C. law of reciprocal proportions

D. law of multiple proportions.

**Answer: B**



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**38.** 20.8g of  $BaCl_2$  on reaction with 9.8g of  $H_2SO_4$  produces 7.3 g of HCl and some amount of  $BaSO_4$ . The amount of  $BaSO_4$  formed is

A. 23.3 g

B. 20.8 g

C. 9.8 g

D. 10.4 g

**Answer: A**



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**39.** The number of atoms in 4.25g of  $NH_3$  is approximately

A.  $1 \times 10^{23}$

B.  $1.5 \times 10^{23}$

C.  $2 \times 10^{23}$

D.  $6 \times 10^{23}$

**Answer: D**



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**40.** A sample of phosphorus trichloride ( $PCl_3$ ) contains 1.4 moles of the substance. How many atoms are there in the sample ?

A. 4

B.  $8.4 \times 10^{23}$

C.  $3.36 \times 10^{24}$

D. 5.6

**Answer: C**



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41. The mass of one C atom is:

A.  $6.023 \times 10^{23} g$

B.  $1.99 \times 10^{-23} g$

C.  $2.00 g$

D.  $12 g$

Answer: B



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42. What are the total number of moles of atoms in 4.32 g of  $Sc(NO_3)_3$ ?

(Atomic weights: Sc = 45.0, O = 16.0, N = 14.01).

A. 0.0132

B. 0.324

C. 0.0187

D. 0.243

**Answer: C**



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43. The weight of a molecule of the compound  $C_{60}H_{122}$  is

A.  $1.4 \times 10^{-21} g$

B.  $1.09 \times 10^{-21} g$

C.  $5.025 \times 10^{23} g$

D.  $16.023 \times 10^{23} g$

**Answer: A**



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44. In a science project, Aditya has to make a chart, illustrating various elements and their atomicity. Aditya

decided to show elements of different atomicity by different shapes.

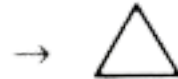
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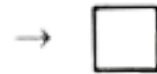
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Triatomic



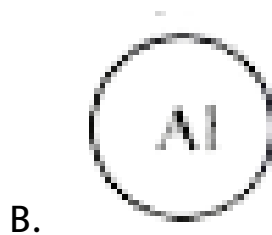
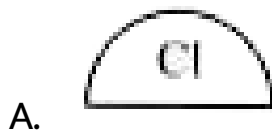
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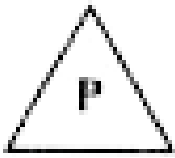


Polyatomic



Pick the element which is shown incorrectly.





C.



D.

**Answer: C**



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**45.** The mass of few entities are mentioned in the column II. Match the two columns and mark the correct

option from the codes given below.

	<b>Column I</b>	<b>Column II</b>
p.	10 moles of $\text{Na}_2\text{SO}_3$	(i) 124.7 g
q.	1.5 moles of Na	(ii) 34.5 g
r.	$1.5 \times 10^{23}$ molecules of $\text{NH}_3$	(iii) 1260 g
s.	0.5 mole of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$	(iv) 4.23 g

A. p-(iii), q-(ii), r-(iv), s-(i)

B. p-(i), q-(ii), r-(iii), s-(iv)

C. p-(ii), q-(iv), r-(i), s-(iii)

D. p-(iv), q-(i), r-(ii), s-(iii)

**Answer: A**



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46. Which of the following is a suitable example for illustrating the law of conservation of mass? (Atomic mass of O = 16, H = 1)

A. 18 g of water is formed by the combination of 16 g of oxygen with 2 g of hydrogen.

B. 18 g of water in liquid state obtained by heating 18 g of ice.

C. 18 g of water is completely converted into vapour state on heating.

D. 18 g of water freezes at  $4^{\circ}\text{C}$  to give same mass of ice.

**Answer: A**



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**47.** Which of the following correctly represents 360 g of water?

(i) 2 moles of  $H_2O$

ii) 20 moles of water.

iii)  $6.022 \times 10^{23}$  molecules of water.

iv)  $1.2044 \times 10^{25}$  molecules of water.

A. I

B. I and IV

C. II and III

D. II and IV

**Answer: D**



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**48.** In an experiment, 1.50 g of pure copper(II) oxide was reduced to pure metal by heating with pure carbon. In another experiment, 1.15 g of pure copper was treated with nitric acid and the product formed was heated strongly till no further change was observed. The mass of copper(II) oxide so formed was found to be 1.40 g. The mass of pure metal formed in the first experiment and the law followed are respectively



- A. 1.15 g and law of conservation of mass
- B. 1.50 g and law of constant proportions
- C. 1.23 g and law of constant proportions
- D. 2.47 g and law of multiple proportions.

**Answer: C**



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**49.** A solution contains 58.5 g of common salt in 360 g of water. Calculate the total number of protons in solution.

A.  $21 \times 6.023 \times 10^{23}$

B.  $22.8 \times 6.023 \times 10^{23}$

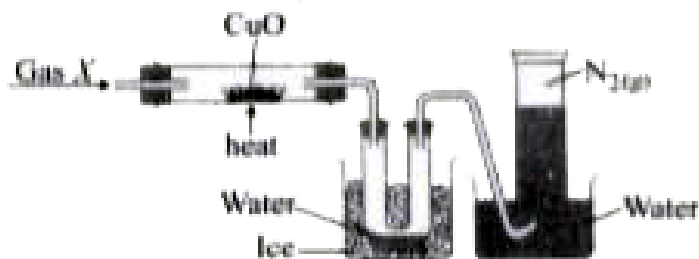
C.  $200 \times 6.023 \times 10^{23}$

D.  $228 \times 6.023 \times 10^{23}$

**Answer: D**

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50. The given figure shows the set-up to study the reaction between gas X and copper (II) oxide :



Which of the following statements are correct? (Given :

Atomic mass of N = 14 u, H = 1 u, O = 16 u, C = 12u)

I. Gas X is a compound of two elements, nitrogen and hydrogen.

II. The number of atoms present in 11.2 L of  $N_2$  is  $6.023 \times 10^{23}$

III. 1 mole of  $H_2O$  contains 1 mole of oxygen molecules and 2 moles of hydrogen atoms.

IV.  $N_2$  gas being soluble in water is collected by upward displacement of water.

A. I and II only

B. I and III only

C. II and IV only

D. III and IV only

**Answer: A**

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## Exercise Match The Following

1. In this section, each question has two matching lists. Choices for the correct combination of elements from List-I and List-II are given as options (a), (b), (c) and (d) out of which one is correct.

<b>List-I</b>	<b>List-II</b>
(P) 52 g of He	1. 2 moles
(Q) 8 g of O <sub>2</sub>	2. 1 mole
(R) 2 g of H <sub>2</sub>	3. 0.25 mole
(S) 56 g of N <sub>2</sub>	4. 13 mole

A. P-4, Q-3, R-2, S-1

B. P-1, Q-4, R-3, S-2

C. P-2, Q-3, R-1, S-4

D. P-4, Q-2, R-3, S-1

**Answer: A**



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**2.** In this section, each question has two matching lists.

Choices for the correct combination of elements from

List-I and List-II are given as options (a), (b), (c) and (d)

out of which one is correct.

**List-I**

(P)  $K_2CO_3$

(Q)  $Na_2O$

(R)  $HNO_3$

(S)  $SO_2$

(a) P-1, Q-4, R-3, S-2

**List-II**

1. 62 u

2. 138 u

3. 64 u

4. 63 u

(b) P-3, Q-2, R-4, S-1

A. P-1, Q-4, R-3, S-2

B. P-3, Q-2, R-4, S-1

C. P-2, Q-1, R-4, S-3

D. P-2, Q-3, R-1, S-4

**Answer: C**



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3. In this section, each question has two matching lists. Choices for the correct combination of elements from List-I and List-II are given as options (a), (b), (c) and (d) out of which one is correct.

**List-I**

(P) 0.25 mole oxygen

(Q) 18 g water

(R) 46 g Na atom

(S) 1 mole C atom

(a) P-1, Q-2, R-3, S-4

(c) P-4, Q-1, R-3, S-2

**List-II**

1.  $6.022 \times 10^{23}$  molecules

2.  $1.505 \times 10^{23}$  molecules

3.  $6.022 \times 10^{23}$  atoms

4.  $12.044 \times 10^{23}$  atoms

(b) P-2, Q-1, R-4, S-3

(d) P-1, Q-4, R-3, S-2

A. P-1, Q-2, R-3, S-4

B. P-2, Q-1, R-4, S-3

C. P-4, Q-1, R-3, S-2

D. P-1, Q-4, R-3, S-2

**Answer: B**

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4. In this section, each question has two matching lists. Choices for the correct combination of elements from List-I and List-II are given as options (a), (b), (c) and (d) out of which one is correct.

**List-I  
(Compound)**

(P) Water  
(Q) Ammonia  
(R) Carbon dioxide  
(S) Sulphur dioxide

(a) P-4, Q-3, R-2, S-1  
(c) P-3, Q-1, R-4, S-2

**List-II  
(Ratio of atoms  
by mass)**

1. 14 : 3  
2. 1 : 8  
3. 1 : 1  
4. 3 : 8

(b) P-1, Q-2, R-3, S-4  
(d) P-2, Q-1, R-4, S-3



A. P-4, Q-3, R-2, S-1

B. P-1, Q-2, R-3, S-4

C. P-3, Q-1, R-4, S-2

D. P-2, Q-1, R-4, S-3

**Answer: D**



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**5.** In this section, each question has two matching lists.

Choices for the correct combination of elements from

List-I and List-II are given as options (a), (b), (c) and (d)

out of which one is correct.

<b>List-I (Atom)</b>	<b>List-II (Atomic mass)</b>
(P) Calcium	1. 14
(Q) Nitrogen	2. 16
(R) Oxygen	3. 23
(S) Sodium	4. 40

A. P-3, Q-4, R-1, S-2

B. P-2, Q-3, R-4, S-1

C. P-4, Q-1, R-2, S-3

D. P-1, Q-2, R-3, S-4

**Answer: C**



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1. Assertion : When 10 g of  $CaCO_3$  is decomposed, 5.6 g of residue is left and 4.4 g of  $CO_2$  escapes.

Reason : Law of conservation of mass is followed.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

**Answer: A**



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2. Assertion: Pure water obtained from different sources such as river, well, spring, sea etc. always contains hydrogen and oxygen combined in the ratio of 1 : 8 by mass.

Reason: A chemical compound always contains same elements combined in same fixed proportion by mass.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

**Answer: A**



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3. Assertion : Molecular weight of  $SO_2$  is double to that of  $O_2$

Reason : One mole of  $SO_2$  contains double the number of molecules present in one mole of  $O_2$

A. If both assertion and reason are true and reason is the correct explanation of assertion.

- B. If both assertion and reason are true but reason is not the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

**Answer: C**

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4. Assertion : 1 mole of  $H_2$  and  $O_2$  each occupy 22.4 L at standard temperature and pressure.

Reason : Molar volume for all gases at the standard temperature and pressure has the same value.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true but reason is not the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

**Answer: A**

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**5. Assertion :** Atomic mass of aluminium is 27.

**Reason :** An atom of aluminium is 27 times heavier than

$\frac{1}{12}$ th of the mass of carbon-12 atom.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true but reason is not the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

**Answer: A**



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6. Assertion : One atomic mass unit (amu) is mass of an atom equal to exactly one-twelfth of the mass of a carbon-12 atom.

Reason : Carbon-12 isotope was selected as standard.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

**Answer: A**



7. Assertion : Number of gram-molecules of  $SO_2Cl_2$  in 13.5 g of sulphuryl chloride is 0.1.

Reason : Gram molecular mass is equal to one gram molecule.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true but reason is not the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

Answer: A

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8. Assertion : Percentage of carbon in  $Na_2CO_3$  is 11.32%.

Reason: \_\_\_\_\_ % of \_\_\_\_\_ carbon

$$= \frac{\text{Mass of carbon element}}{\text{Molecular mass of } Na_2CO_3} \times 100$$

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

**Answer: A**

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**9. Assertion :** Atomicity of  $O_3$  is 3.

**Reason :** 1 mole of an element contains  $6.023 \times 10^{23}$  atoms.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

**Answer: B**



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**10.** Assertion : Both 44 g  $CO_2$  and 16 g  $CH_4$  have same number of carbon atoms.

Reason : Both contain 1 g atom of carbon which contains  $6.023 \times 10^{23}$  carbon atoms.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

- B. If both assertion and reason are true but reason is not the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

**Answer: A**

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## Exercise Comprehension Type

1. PASSAGE-I :A mole of an atom is a collection of atoms whose total mass is the number of grams equal to the atomic mass. Since equal number of moles of different

elements contain an equal number of atoms it becomes convenient to express the amounts of the elements in terms of moles. A mole represents a definite number of particles viz, atoms, molecules, ions or electrons. This definite number is called Avogadro number or Avogadro constant which is equal to  $6.022 \times 10^{23}$ . Hence a mole represents  $6.022 \times 10^{23}$  particles of the substance. One mole of substance represents one gram-formula of the substance. One mole of a gas at standard temperature and pressure occupies 22.4 litres.

How many grams of sodium must be taken to get 1 mole of the element ?

A. 23 g

B. 35.5 g

C. 63.5 g

D. 46 g

**Answer: A**



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2. **PASSAGE-I** :A mole of an atom is a collection of atoms whose total mass is the number of grams equal to the atomic mass. Since equal number of moles of different elements contain an equal number of atoms it becomes convenient to express the amounts of the elements in terms of moles. A mole represents a definite number of particles viz, atoms, molecules, ions or electrons. This



definite number is called Avogadro number or Avogadro constant which is equal to  $6.022 \times 10^{23}$ . Hence a mole represents  $6.022 \times 10^{23}$  particles of the substance. One mole of substance represents one gram-formula of the substance. One mole of a gas at standard temperature and pressure occupies 22.4 litres.

What is the mass in grams of a single atom of chlorine?

(Atomic mass of chlorine = 35.5)

A.  $6.54 \times 10^{23} \text{ g}$

B.  $5.9 \times 10^{-23} \text{ g}$

C. 0.0025 g

D. 35.5 g

**Answer: B**



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**3. PASSAGE-I :** A mole of an atom is a collection of atoms whose total mass is the number of grams equal to the atomic mass. Since equal number of moles of different elements contain an equal number of atoms it becomes convenient to express the amounts of the elements in terms of moles. A mole represents a definite number of particles viz, atoms, molecules, ions or electrons. This definite number is called Avogadro number or Avogadro constant which is equal to  $6.022 \times 10^{23}$ . Hence a mole represents  $6.022 \times 10^{23}$  particles of the substance. One mole of substance represents one gram-formula of the substance. One mole of a gas at standard temperature

and pressure occupies 22.4 litres.

How many number of moles are there in 5.75 g of sodium ? (Atomic mass of sodium = 23)

A. 0.25

B. 0.5

C. 1

D. 2.5

**Answer: A**



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4. PASSAGE-I :A mole of an atom is a collection of atoms whose total mass is the number of grams equal to the atomic mass. Since equal number of moles of different elements contain an equal number of atoms it becomes convenient to express the amounts of the elements in terms of moles. A mole represents a definite number of particles viz, atoms, molecules, ions or electrons. This definite number is called Avogadro number or Avogadro constant which is equal to  $6.022 \times 10^{23}$  Hence a mole represents  $6.022 \times 10^{23}$  particles of the substance. One mole of substance represents one gram-formula of the substance. One mole of a gas at standard temperature and pressure occupies 22.4 litres.

What is the mass in grams of 2.42 mol of zinc? (Atomic mass of Zn = 65.41)

A. 200 g

B. 25 g

C. 85 g

D. 158 g

**Answer: D**



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5. PASSAGE-II : The percentage composition of elements in a compound is calculated from the molecular formula

of the compound. The molecular mass of a compound is calculated from the atomic masses of the various elements present in the compound. The percentage of mass of each element is then calculated by the help of the following relation. Percentage mass of the element

$$\text{in the compound} = \frac{\text{Mass of the element}}{\text{Mass of the compound}} \times 100$$

What is the percentage of calcium in calcium carbonate?

A. 0.3265

B. 0.4

C. 0.889

D. 0.18

**Answer: B**



6. PASSAGE-II : The percentage composition of elements in a compound is calculated from the molecular formula of the compound. The molecular mass of a compound is calculated from the atomic masses of the various elements present in the compound. The percentage of mass of each element is then calculated by the help of the following relation. Percentage mass of the element

$$\text{in the compound} = \frac{\text{Mass of the element}}{\text{Mass of the compound}} \times 100$$

A. 12 g

B. 6 g

C. 0.545 g

D. 5.45 g

**Answer: C**



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7. PASSAGE-II : The percentage composition of elements in a compound is calculated from the molecular formula of the compound. The molecular mass of a compound is calculated from the atomic masses of the various elements present in the compound. The percentage of mass of each element is then calculated by the help of the following relation. Percentage mass of the element

$$\text{in the compound} = \frac{\text{Mass of the element}}{\text{Mass of the compound}} \times 100$$



A. 28

B. 56

C. 65

D. 75

**Answer: A**



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**8. PA SSAGE-III:** According to Dalton's atomic theory, all matter whether an element, a compound or a mixture is composed of small particles called atoms which can neither be created nor destroyed during a chemical reaction. Dalton's theory provides a simple explanation

for the laws of chemical combination. He used his theory to explain law of conservation of masses, law of constant proportions and law of multiple proportions, based on various postulates of the theory. Dalton was the first scientist to use the symbols for the elements in a very specific sense. When he used a symbol for an element he also meant a definite quantity of that element, that is one atom of that element.

Which postulate of Dalton's atomic theory is the result of the law of conservation of mass?

- A. Atoms can neither be created nor destroyed.
- B. Each element is composed of extremely small particles called atoms.
- C. All the atoms of a given element are identical.

D. During chemical combination, atoms of different elements combine in simple ratios.

**Answer: A**



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9. PA SSAGE-III: According to Dalton's atomic theory, all matter whether an element, a compound or a mixture is composed of small particles called atoms which can neither be created nor destroyed during a chemical reaction. Dalton's theory provides a simple explanation for the laws of chemical combination. He used his theory to explain law of conservation of masses, law of

constant proportions and law of multiple proportions, based on various postulates of the theory. Dalton was the first scientist to use the symbols for the elements in a very specific sense. When he used a symbol for an element he also meant a definite quantity of that element, that is one atom of that element.

Which postulate of Dalton's atomic theory explains law of definite proportions?

A. Atoms of an element do not change during a chemical reaction.

B. An element consists of atoms having fixed mass and the number and kind of atoms in a given compound is fixed.

C. Different elements have different kind of atoms.

D. Atoms are of various kinds.

**Answer: B**



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**10. PA SSAGE-III:** According to Dalton's atomic theory, all matter whether an element, a compound or a mixture is composed of small particles called atoms which can neither be created nor destroyed during a chemical reaction. Dalton's theory provides a simple explanation for the laws of chemical combination. He used his theory to explain law of conservation of masses, law of

constant proportions and law of multiple proportions, based on various postulates of the theory. Dalton was the first scientist to use the symbols for the elements in a very specific sense. When he used a symbol for an element he also meant a definite quantity of that element, that is one atom of that element.

"If 100 g of calcium carbonate (whether in the form of marble or chalk) are decomposed, 56 g of calcium oxide and 44 g of carbon dioxide are formed." Which law of chemical combination is illustrated by this statement?

- A. Law of constant proportions
- B. Law of conservation of mass
- C. Law of multiple proportions
- D. Law of conservation of energy

**Answer: B**



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**11. PA SSAGE-III:** According to Dalton's atomic theory, all matter whether an element, a compound or a mixture is composed of small particles called atoms which can neither be created nor destroyed during a chemical reaction. Dalton's theory provides a simple explanation for the laws of chemical combination. He used his theory to explain law of conservation of masses, law of constant proportions and law of multiple proportions, based on various postulates of the theory. Dalton was the first scientist to use the symbols for the elements in

a very specific sense. When he used a symbol for an element he also meant a definite quantity of that element, that is one atom of that element.

When 5 g calcium is burnt in 2 g oxygen, 7 g of calcium oxide is produced. When 5 g of calcium is burnt in 20 g of oxygen, then also 7 g of calcium oxide is produced.

Which law of chemical combination is being followed?

- A. Law of conservation of mass
- B. Law of multiple proportions
- C. Law of constant proportions
- D. No law is being followed.

**Answer: C**



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**12. P A S S A G E - I V :** The molecular mass of a substance is the relative mass of its molecule as compared with the mass of a carbon-12 atom taken as 12 units. The molecular mass of a substance indicates the number of times one molecule of a substance is heavier than  $\frac{1}{12}$  of C-12 atom. It is equal to the sum of atomic masses of all the atoms present in a molecule. Depending on the number of atoms of same or different elements present in the molecule, it can be monoatomic, diatomic, triatomic, tetratomic or a polyatomic molecule.

Which is an example of a polyatomic molecule?

A.  $S_8$

B.  $HNO_3$

C.  $C_2H_5OH$

D. All of these

**Answer: D**



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**13. P A S S A G E - I V :** The molecular mass of a substance is the relative mass of its molecule as compared with the mass of a carbon-12 atom taken as 12 units. The molecular mass of a substance indicates the number of times one molecule of a substance is heavier than  $\frac{1}{12}$  of C-12 atom. It is equal to the sum of atomic masses of

all the atoms present in a molecule. Depending on the number of atoms of same or different elements present in the molecule, it can be monoatomic, diatomic, triatomic, tetratomic or a polyatomic molecule.

Total number of atoms in 44 g of  $CO_2$  is :

A.  $6.02 \times 10^{23}$

B.  $6.02 \times 10^{24}$

C.  $1.806 \times 10^{24}$

D.  $18.06 \times 10^{22}$

**Answer: C**



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**14. PA S S A G E - I V :** The molecular mass of a substance is the relative mass of its molecule as compared with the mass of a carbon-12 atom taken as 12 units. The molecular mass of a substance indicates the number of times one molecule of a substance is heavier than  $\frac{1}{12}$  of C-12 atom. It is equal to the sum of atomic masses of all the atoms present in a molecule. Depending on the number of atoms of same or different elements present in the molecule, it can be monoatomic, diatomic, triatomic, tetratomic or a polyatomic molecule.

Carbon dioxide, hydrogen sulphide, calcium chloride and sodium oxide are examples of

A. triatomic molecules

B. triatomic and tetratomic molecules

C. diatomic and triatomic molecules

D. tetratomic molecules.

**Answer: A**



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## Exercise Subjective Problems Very Short Answer Type

1. Give two examples of trivalent metal ions.



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2. Give one example of (i) a polyatomic cation, (ii) a polyatomic anion.

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3. Calculate formula mass of sodium carbonate.

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4. Write formula for the following compounds :  
aluminium sulphide, tin (II) fluoride, magnesium sulphate and ammonium nitrate.

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5. How many atoms are present in 1 mole of hydrogen gas ?

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6. Write the names of the following compounds :  
 $H_2S$ ,  $CO$ ,  $N_2O_4$  and  $PCl_5$ .

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7. From the given list identify the diatomic molecules :  
 $Ne$ ,  $Ar$ ,  $O_2$ ,  $F_2$ ,  $Cl_2$ ,  $H_2O$ ,  $P_4$ ,  $S_8$ ,  $O_3$

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8. Calculate the molar mass of ethyl alcohol ( $C_2H_5OH$ ).

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9. What will be formed when an atom 'A' gains two electrons?

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10. Formula of the carbonate of a metal M is  $M_2CO_3$ .

Write the formula of its chloride.

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11. Calculate the molar mass of copper sulphate.

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

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13. Calculate the molecular mass of sugar ( $C_{12}H_{22}O_{11}$ )

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14. Calculate the number of moles in 10 g of hydrogen.

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15. Define the atomicity of a molecule of an element?

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## Exercise Subjective Problems Short Answer Type

1. Carbon and oxygen react with each other in the ratio 3 : 8 by mass. What weight of carbon should be used to react completely with 40 g of oxygen?

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2. Give the chemical formula, for each of the following acids :

(a) Nitric acid (b) Hydrogen bromide

(c) Carbonic acid (d) Hypochlorous acid

(e) Iodic acid (f) Sulphurous acid



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3. Calculate the volume occupied by 2.8 g of  $N_2$  at STP.



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4. 8.4 g of sodium bicarbonate on reaction with 20 g of acetic acid liberated 4.4 g of carbon dioxide gas into the atmosphere. What is the mass of the residue left?

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5. What is the mass of 0.5 mole of water ( $H_2O$ ).

(Atomic masses :  $H = 1u$ ,  $O = 16u$ )

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6. Calculate the number of atoms of each element present in 122.5 g of  $KClO_3$ .





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7. Calculate the number of moles in 2800 mL of oxygen gas at STP.



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8. Calculate the number of moles in  $12.044 \times 10^{23}$  helium atoms.



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9. Why does the atomic mass of an element not represent the actual mass of its atom?



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10. What is the difference between the actual mass of a molecule and gram molecular mass?



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11. An element has fractional atomic mass. What does it indicate ?



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12. How many moles are present in 11.5 g of sodium?



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13. How many particles are represented by 0.25 mole of an element?



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14. Differentiate between an atom and an ion.



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15. Write the formula and names of compounds formed by:

(a)  $Na^+$  and  $HCO_3^-$ , (b)  $K^+$  and  $CO_3^{2-}$

(c)  $Cu^{2+}$  and  $SO_4^{2-}$ , (d)  $Cu^{2+}$  and  $O^{2-}$

(e)  $Na^+$  and  $SO_4^{2-}$ , (f)  $NH_4^+$  and  $CO_3^{2-}$



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## Exercise Subjective Problems Long Answer Type

1. 25.4 gm of iodine and 14.2 gm of chlorine are made to react completely to yield mixture of  $ICl$  and  $ICl_3$ . Ratio of moles of  $ICl$  &  $ICl_3$  formed is (Atomic mass I: 127, Cl=35.5)



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2. The molecular formula of ferric sulphate is  $Fe_2(SO_4)_3$ . (Atomic mass : Fe = 56, S = 32, O = 16)

(a) Calculate the molar mass of  $Fe_2(SO_4)_3$ .

(b) How many moles of each element are there in 40 g of ferric sulphate?

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3. A sample of ammonia ( $NH_3$ ) weighs 2.00 g. What mass of sulphur dioxide ( $SO_2$ ) contains the same number of molecules as are in 2.00 g of ammonia?

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4. (i) What is the mass of one atom of hydrogen?

(atomic mass of hydrogen = 1 u) (ii) How many  $NH_4$

ions are present in 1.5 moles of  $(NH_4)_3PO_4$ ?



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5. Calculate the number of moles of phosphorus (P)

atoms in 100 g of phosphorus. If phosphorus is

considered to contain  $P_4$  molecules, then how many

moles of  $P_4$  molecules are there?



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**Exercise Integer Numerical Value Type**

1. The mass of 0.5 moles of methane is



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2. The mass of one molecule of water is  $x \times 10^{-23}$  g.

The value of x is:



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3. The ratio of molecules present in 6.6 g of  $CO_2$  and 3.2 g of  $SO_2$  is:



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4. A person spends ten thousand rupees per second. Number of years that will take to spend approximately one mole of rupees is

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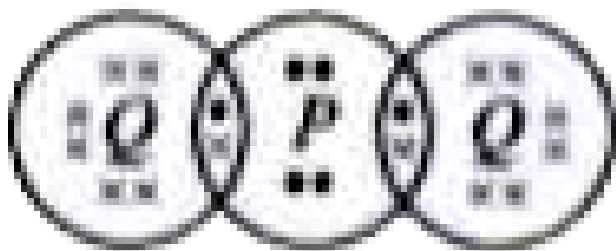
5. The weight of  $1 \times 10^{22}$  molecules of  $CuSO_4 \cdot 5H_2O$  is

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## Olympiad Hots Corner

1. A compound,  $PQ_2$  has the following arrangement of electrons :

The elements P and Q are respectively:



A. N,Cl

B. Cl,S

C. O,F

D. Na,F

**Answer: C**



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2. How many moles of electrons weigh one kilogram?

(Mass of electron =  $9.108 \times 10^{-31}$  kg, Avogadro's number =  $6.023 \times 10^{23}$ )

A.  $\frac{1}{9.108 \times 6.023} \times 10^8$

B.  $6.023 \times 10^{23}$

C.  $\frac{1}{9.108} \times 10^{31}$

D.  $\frac{6.023}{9.108} \times 10^{54}$

**Answer:**



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3. A sample of  $MgCO_3$  contains  $3.01 \times 10^{23} Mg^{2+}$  ions and  $3.01 \times 10^{23} CO_3^{2-}$  ions. The mass of the sample is:

A. 42 mg

B. 84 g

C. 0.042 kg

D. 42 mol

**Answer: C**



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4. What mass of hydrogen and oxygen will be produced on complete electrolysis of 18 g of water?

- A. 2 g hydrogen and 32 g oxygen
- B. 2 g hydrogen and 16 g oxygen
- C. 4 g hydrogen and 32 g oxygen
- D. 4 g hydrogen and 14 g oxygen

**Answer: B**

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5. Ninhydrin having molecular formula  $C_9H_6O_4$ , is commonly used by forensic scientists to detect and analyse fingerprints. The number of molecules in 7.4 g of ninhydrin is

(Atomic mass of C = 12 u, H = 1 u, O = 16 u)



A.  $1.5 \times 10^{22}$

B.  $2.5 \times 10^{23}$

C.  $2.5 \times 10^{22}$

D.  $4.2 \times 10^{23}$

**Answer: C**



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**6.** A sample of ascorbic acid (vitamin C) is synthesised in the laboratory. It contains 1.50 g of carbon and 2.00 g of oxygen. Another sample of ascorbic acid isolated from citrus fruits contains 6.35 g of carbon. How many grams

of oxygen does it contain? Which law do you assume in answering this question?

A. 7.25 : Law of conservation of mass

B. 6.35 : Law of definite proportions

C. 8.47 : Law of definite proportions

D. 6.35 : Law of multiple proportions

**Answer: C**



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7. The total number of electrons present in 16 g of methane gas is:

A.  $96.352 \times 10^{23}$

B.  $48.176 \times 10^{23}$

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

D.  $30.110 \times 10^{23}$

**Answer: C**



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**8. The number of atoms in 0.1 mol of a triatomic gas is:**

A.  $6.026 \times 10^{22}$

B.  $1.806 \times 10^{23}$

C.  $3.6 \times 10^{23}$

D.  $1.8 \times 10^{22}$

**Answer: B**



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9. The number of particles present in one mole of any substance is equal to:

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

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

C.  $6.022 \times 10^{27}$

D.  $60.22 \times 10^{27}$

**Answer: A**



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**10.** Atoms are neither created nor destroyed in a chemical reaction. This postulate was given by:

A. J. J. Thomson

B. Niels Bohr

C. John Dalton

D. Amedeo Avogadro.

**Answer: C**



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11. Which of the following statements are correct?

(Given : At. wt. of Ca = 40 u, Mg = 24 u, N = 14 u, H = 1 u,

Na = 23 u, Cl = 35.5 u)

I. 240 g of calcium and 240 g of magnesium elements have a molar ratio of 3 : 5.

II. 100 g of  $N_2$  contains more atoms than 100 g of  $NH_3$ .

III. Total number of ions in 5.85 g of sodium chloride is

$$1.2 \times 10^{22}$$

IV. 1 gram molecule of hydrogen gas contains

$12.046 \times 10^{23}$  atoms of hydrogen.

V. 5.6 g of nitrogen gas occupies 3.2 L of volume at STP.

A. II and III only

B. I, II and III only

C. I and IV only

D. IV and V only

**Answer: C**



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**12.** Elements belonging to different groups of the periodic table are given below. If the element X forms a chloride whose formula is ' $XCl_2$ ' then element 'X' belongs to the group whose representative element is:

A. Al

B. Na

C. Mg

D. Si

**Answer: C**



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**13.** Which of the following contains maximum number of molecules?

A. 1 g  $N_2$

B. 1 g  $CO_2$

C. 1 g  $H_2$



D. 1g  $O_2$

**Answer: C**



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**14.** What is the mass of  $12.044 \times 10^{23}$  number of  $O_2$  molecules?

A. 8 g

B. 16 g

C. 32 g

D. 64 g

**Answer: D**



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**15.** If three gases X, Y and Z are arranged in increasing order of their relative molecular mass and the mass of each gas is 10 g at S.T.P state, which gas will contain the least number of molecules and which will contain the most?

A. X least and Y maximum

B. X maximum and Z least

C. Y maximum and Z least

D. Y least and Z maximum

**Answer: B**

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**16.** The maximum number of molecules is present in :

A. 1.5 L  $H_2$  gas at STP

B. 5 L  $N_2$  gas at STP

C. 0.5 g  $H_2$  gas

D. 10 g  $O_2$  gas.

**Answer: A**

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17. You are provided with 64 g of solid sulphur in container A and 64 g of oxygen in container B. Which will have more number of molecules? (Atomic mass of S = 32, O = 16)

A. 64 g of  $S_8$

B. 64 g of  $O_2$

C. Both have equal number of molecules.

D. Cannot be calculated with the given information.

**Answer: B**



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18. Arrange the following in the order of increasing mass (atomic mass: O=16, Cu-63, N-14)

I. one atom of oxygen

II. one atom of nitrogen

III  $1 \times 10^{-10}$  mole of oxygen

IV.  $1 \times 10^{-10}$  mole of copper

A.  $II < I < III < IV$

B.  $I < II < III < IV$

C.  $III < II < IV < I$

D.  $IV < II < III < I$

**Answer: A**



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19. Valency of sulphur atom in  $SO_2$  is:

A. 3

B. 2

C. 4

D. 6

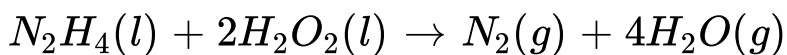
**Answer: C**



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20. Some rocket engines use a mixture of hydrazine,  $N_2H_4$  and hydrogen peroxide,  $H_2O_2$  as the propellant.

The reaction is given by the following equation :



How much of the excess reactant, remains unchanged when 0.750 mol of  $N_2H_4$  is mixed with 17 g of  $H_2O_2$  ?

- A. 16 g  $N_2H_4$
- B. 0.25 mol  $H_2O_2$
- C. 0.25 mol  $N_2H_4$
- D. 8.5 g  $H_2O_2$

**Answer: A**



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