

CBSE Class 9 Science
Important Questions
Chapter 3
Atoms and Molecules

1 Marks Questions

1. Atomic radius is measured in nanometers and

- (a) $1\text{nm} = 10^{-10}\text{m}$
- (b) $1\text{m} = 10^{-10}\text{nm}$
- (c) $1\text{m} = 10^{-9}\text{nm}$
- (d) $1\text{nm} = 10^{-9}\text{m}$

Ans. (c) $1\text{m} = 10^{-9}\text{nm}$

2. Symbol of Iron is :-

- (a) Ir
- (b) I
- (c) Fe
- (d) None of these

Ans. (c) Fe

3. Atomicity of chlorine and Argon is

- (a) Diatomic and Monoatomic
- (b) Monoatomic and Diatomic
- (c) Monoatomic and Monoatomic
- (d) Diatomic and Diatomic

Ans. (a) Diatomic and Monoatomic

4. Molecular mass of water (H_2O) is

- (a) 18g
- (b) 8g
- (c) 33g
- (d) 34g

Ans. (a) 18g

5. 1 Mole of a compound contains –

- (a) 6.023×10^{23} atoms
- (b) 6.023×10^{24} atoms
- (c) 60.23×10^{23} atoms
- (d) 6.023×10^{25} atoms

Ans. (a) 6.023×10^{23} atoms

6. Oxygen is –

- (a) Monovalent
- (b) Bivalent
- (c) Trivalent
- (d) Tetravalent

Ans. (a) Monovalent

7. What is the molecular formula for Calcium Hydroxide?

- (a) $\text{Ca}(\text{OH})_2$
- (b) Ca OH
- (c) $\text{Ca}_2 \text{OH}$
- (d) Ca_2

Ans. (b) Ca OH

8. Neutron is

- (a) Chargeless and Massless
- (b) Chargeless and has Mass
- (c) Has charge and Mass
- (d) Has charge and Massless.

Ans. (b) Chargeless and has Mass

9. Which of the following statements is correct?

- (a) Cathode rays travel in straight line and have momentum.
- (b) Cathode rays travel in straight line and have no momentum
- (c) Cathode rays do not travel in straight line but have Momentum.
- (d) Cathode rays do not travel in straight line and have no momentum.

Ans. (a) Cathode rays travel in straight line and have momentum.

10. α -particles are represented as :-

- (a) ${}_{2}^{4}\text{He}^{2+}$
- (b) ${}_{2}^{4}\text{He}^{2-}$
- (c) ${}_{2}^{4}\text{He}^{+}$
- (d) ${}_{2}^{4}\text{He}^{-}$

Ans. (a) ${}_{2}^{4}\text{He}^{2+}$

11. ${}_{18}^{40}\text{Ar}$ and ${}_{18}^{40}\text{Ar}$ are

- (a) Isotopes
- (b) Isobars
- (c) Isotones

(d) Both b and c

Ans. (b) Isobars

12. The maximum number of electrons in L shell is

(a) 8

(b) 18

(c) 28

(d) 38.

Ans. (a) 8

2 Marks Questions

1. 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?

Ans. As per the given 1:8 ratio mass of oxygen gas required to react completely with 1g of hydrogen gas is 8g.

Therefore mass of oxygen gas required to react completely with 3g of hydrogen gas will be = $3 \times 8 = 24\text{g}$

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

Ans. The postulate of Dalton's atomic theory which is the result of the law of conservation of mass is mentioned as below :

Atoms are indivisible particles, which cannot be created or destroyed in a chemical reaction.

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

Ans. The postulate of Dalton's atomic theory which explains the law of definite proportions is "Atoms combine in the ratio of small whole numbers to form compounds and the relative number and kinds of atoms are constant in a given compound."

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

Ans. An atom is an extremely minute particle and as such actual mass of an atom of hydrogen is considered to be 1.6×10^{-24} g. That is why it is not possible to see an atom with naked eyes.

5. How many atoms are present in a

(i) H_2S molecule and

(ii) PO_4^{3-} ion?

Ans. (i) 2 atoms of hydrogen + 1 atom of sulphur = 3 atoms

(ii) 1 atom of phosphorus + 4 atoms of oxygen = 5 atoms

6. 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.

Ans. Formula unit mass of :

(i) ZnO = Atomic mass of Zn + atomic mass of O = $(65 + 16)\text{u} = 81\text{ u}$

(ii) Na_2O = Atomic mass of Na + atomic mass of O = $(23 \times 2) + 16 = 46 + 16 = 62\text{ u}$

(iii) K_2CO_3 = $(39 \times 2) + 12 + (16 \times 3) = 78 + 12 + 48 = 138\text{ u}$

7. 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)?

Ans. We can find out the element with more number of atoms by calculating number of moles of each of them :

Number of moles of sodium in 100g = $m_1/M_1 = 100/23 = 4.34$

Number of moles of iron in 100g = $m_2/M_2 = 100/56 = 1.79$

Therefore, the number of atoms is more for sodium as compared to iron.

8. 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?

Ans. According to the law of chemical combination of constant proportions "in a chemical compound the elementary constituents always combine in constant proportions by weight/mass". Therefore whether 3 g carbon is burnt in 8 g oxygen or 3g carbon is burnt in 50g oxygen in both cases only 11g carbon dioxide will be formed.

9. What is the mass of:

(a) 0.2 mole of oxygen atoms?

(b) 0.5 mole of water molecules?

Ans. (a) since 1 mole of O = atomic mass of O = 16u=16g

then 0.2mole of O = $0.2 \times 16 = 3.2\text{g}$

(b) 1mol of H_2O = molecular mass of $\text{H}_2\text{O} = 1 \times 2 + 16 = 18 \text{ u} = 18\text{g}$

then 0.5mol of $\text{H}_2\text{O} = 0.5 \times 18 = 9\text{g}$

10. Calculate the number of molecules of sulphur (S₈) present in 16 g of solid sulphur.

Ans. 1mol of S₈ = molecular mass of S₈ = $32 \times 8 = 256\text{u} = 256\text{g}$

since 256g of S₈ = 1mol = 6.022×10^{23} atoms (Avogadro number)

16g of S₈ = $16 \times 6.022 \times 10^{23} / 256 = 3.76 \times 10^{22}$ molecules

11. 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)

Ans. 1mol of Al_2O_3 = molecular mass of $\text{Al}_2\text{O}_3 = 27 \times 2 + 16 \times 3 = 102\text{u} = 102\text{g}$

aluminium ions present in $\text{Al}_2\text{O}_3 = 2\text{Al}^{3+}$

102 g of Al_2O_3 contains aluminium ions = $2 \times 6.022 \times 10^{23}$

then 0.051 g Al_2O_3 contains aluminium ions = $2 \times 6.022 \times 10^{23} \times 0.051 / 102 = 6.022 \times 10^{20}$

12. State law of conservation of Mass?

Ans. According to law of conservation of Mass, mass can neither be created nor be destroyed in a chemical reaction.

13. Define Valency? Find the Valency of oxygen and Aluminum.

Ans. Valency is defined as the number of electrons that an element has to gain or lose from its outermost shell so that it can be stable or the combining capacity of an atom.

Oxygen – Atomic number = 8; Electronic configuration = 2, 6 i.e. it has to gain $2e^-$ so that in : outer most shell has $8e^-$, Valency of O is -2 Similarly, valency of Al (Aluminum) is +3 (\because electronic configuration \rightarrow 2, 8, 3) so it loses $3e^-$ from its outermost shell.

14. Calculate the molar mass of Na_2SO_4 and $CaCO_3$?

Ans. Molar Mass of Na_2SO_4 =

$\Rightarrow 2 \times$ Mass of sodium + $1 \times$ Mass of sulphur + $4 \times$ Mass of oxygen

$$= 2 \times 23 + 1 \times 32 + 4 \times 16$$

$$= 46 + 32 + 64$$

$$= 142 \text{ a.m.u.}$$

Molar Mass of $CaCO_3$ =

$\Rightarrow 1 \times$ Mass of calcium + $1 \times$ Mass of carbon + $3 \times$ Mass of oxygen

$$= 40 + 12 + 3 \times 16$$

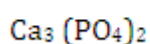
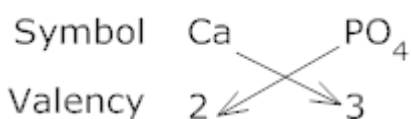
$$= 40 + 12 + 48 = 100 \text{ a.m.u.}$$

15. Write the chemical formula for

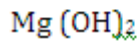
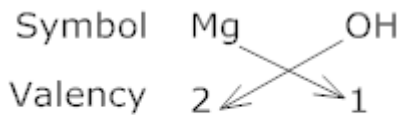
a) Calcium Phosphate b) Magnesium Hydroxide c) Aluminum chloride.

Ans. Chemical formula for

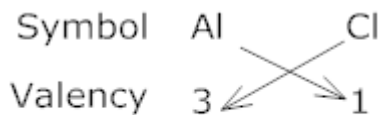
1) Calcium Phosphate



2) Magnesium Hydroxide



3) Aluminium chloride



16. State the law of constant Proportion?

Ans. According to law of constant proportion, whatever the method of its formation, a chemical compound in its pure state will always contain the same elements combined together in the fixed ratio by mass.

17. How many molecules of water are present in a drop of water which has a mass of 50mg?

Ans. We know that:-

1 mole of an compound = 6.023×10^{23} atoms

= Gram molecular mass

Gram Molecular mass of H_2O = 18g

$18 \text{g} = 6.023 \times 10^{23}$ atoms

Now 50mg of H_2O = $6.23 \times 10^{23} \times 50 \times 10^{-3}$

= 1.673×10^{21} molecules.

18. Find the number of protons and neutrons in the nucleus of an atom of an element X which is represented as ${}^{207}_{82}\text{X}$.

Ans. The element is ${}^{207}_{82}\text{X}$

Now, 82 = Atomic Number

207 = Mass Number.

(a) Atomic number = number of protons

82 = Number of protons.

(b) Mass number = Number of protons + Number of neutrons

207 = 82 + Number of neutrons

207 – 82 = Number of neutrons

125 = Number of neutrons.

19. Define the terms:- a) Atomic number b) Mass number

Ans. Atomic Number is defined as the total number of protons present in an atom.

Mass number is defined as the sum total of number of protons and the number of neutrons present in an atom.

20. What is meant by e/m ratio? What was the value of this ratio for a particle in the cathode rays?

Ans. $\frac{e}{m}$ ratio is the ratio of charge of the particle to mass of those particle.

The $\frac{e}{m}$ ratio for cathode rays was found out to be $1.759 \times 10^{11} \text{ C / Kg}$.

21. Complete the following equations which describe nuclear charge –

a) ${}_{11}^{23}\text{Mg} + {}_0^1\text{n} \rightarrow \text{_____} + {}_{-1}^{10}\text{e}$

b) ${}_{49}^{99}\text{In} + {}_{24}^{24}\text{Mg} \rightarrow {}_{01}^{1}\text{H} + \text{_____}$

c) ${}_{81}^{16}\text{Ga} + {}_0^1\text{n} \rightarrow \text{_____} + {}_{24}^{24}\text{Mg}$

Ans. In any nuclear reaction, mass number (no. of p+ + no. of no) and atomic number (no. of p+) must be conserved.

(1) ${}_{11}^{23}\text{Mg} + {}_0^1\text{n} \rightarrow {}_{11}^{24}\text{Mg} + {}_{-1}^{10}\text{e}$

(2) ${}_{49}^{99}\text{In} + {}_{24}^{24}\text{Mg} \rightarrow {}_{73}^{123}\text{In} + {}_0^1\text{n}$

(3) ${}_{81}^{16}\text{Ga} + {}_0^1\text{n} \rightarrow {}_{81}^{17}\text{Ga} + {}_{24}^{24}\text{Mg}$

22. Stat the properties of cathode rays?

Ans. Properties of cathode rays are :-

- (1) They travel in straight line
- (2) They have momentum and energy
- (3) They are deflected by electric and magnetic fields.

3 Marks Questions

1. Define the atomic mass unit.

Ans. According to the latest recommendations of International Union of Pure and Applied Chemistry (IUPAC) the atomic mass unit (amu) is abbreviated as u or unified mass.

For chemical calculations the atomic masses of elements are expressed by taking the atomic mass of one atom of an element as the standard mass. Like the atomic mass of carbon is taken as 12 units and each unit is called as 1 a.m.u i.e.

1 amu = 1/12 of atomic masses of $^{12}_6\text{C}$.

2. Write down the formulae of

- (i) sodium oxide
- (ii) aluminium chloride
- (iii) sodium sulphide
- (iv) magnesium hydroxide

Ans.

| Compound | Formula |
|---------------------|--------------------------|
| Sodium oxide | $2\text{Na}_2\text{O}$ |
| Aluminium Chloride | AlCl_3 |
| Sodium Sulphide | $2\text{Na}_2\text{S}$ |
| Magnesium Hydroxide | $\text{Mg}(\text{OH})_2$ |

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

- (i) $2(\text{Al}_2\text{SO}_4)_3$
- (ii) CaCl_2
- (iii) $2\text{K}_2\text{SO}_4$
- (iv) KNO_3
- (v) CaCl_3 .

Ans.

| Formula | Compound |
|-------------------------------|--------------------|
| $2(\text{Al}_2\text{SO}_4)_3$ | Aluminium sulphate |
| CaCl_2 | Calcium chloride |
| $2\text{K}_2\text{SO}_4$ | Potassium sulphate |
| KNO_3 | Potassium nitrate |

| | |
|-------------------|-------------------|
| CaCO ₃ | Calcium carbonate |
|-------------------|-------------------|

4. What is meant by the term chemical formula?

Ans. A chemical formula is the representation of elements present in a compound with the help of symbols and also the number of atoms of each element with those numbers only. For e.g.: A molecule of water (compound) contains 2 atoms of hydrogen and one atom of oxygen hence its chemical formula is H₂O.

5. What are polyatomic ions? Give examples.

Ans. When two or more atoms in a group is having a charge, such is called a polyatomic ion. For e.g. : NH₄⁺, CO₃⁻ etc.

6. Write the chemical formulae of the following.

- Magnesium chloride
- Calcium oxide
- Copper nitrate
- Aluminium chloride
- Calcium carbonate.

Ans.

| Compound | Chemical formula |
|--------------------|-----------------------------------|
| Magnesium chloride | MgCl ₂ |
| Calcium oxide | CaO |
| Copper nitrate | Cu(NO ₃) ₂ |
| Aluminium chloride | AlCl ₃ |
| Calcium carbonate | CaCO ₃ |

7. Give the names of the elements present in the following compounds.

- Quick lime
- Hydrogen bromide
- Baking powder
- Potassium sulphate.

Ans.

| Compound | Formula | Elements present |
|--------------------|--------------------------------|-------------------------------------|
| Quick lime | CaO | Calcium and oxygen |
| Hydrogen bromide | HBr | Hydrogen and bromine |
| Baking powder | NaHCO ₃ | Sodium, hydrogen, carbon and oxygen |
| Potassium sulphate | K ₂ SO ₄ | Potassium, sulphur and oxygen |

8. 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

Ans. (a) Ethyne = $\text{C}_2\text{H}_2 = 12 \times 2 + 1 \times 2 = 24 + 2 = 26 \text{ u} = 26 \text{ g}$

(b) Sulphur molecular = $\text{S}_8 = 32 \times 8 = 256 \text{ u} = 256 \text{ g}$

(c) Phosphorus molecule = $\text{P}_4 = 31 \times 4 = 124 \text{ u} = 124 \text{ g}$

(d) Hydrochloric acid = HCl = $1 + 35.5 = 36.5 \text{ u} = 36.5 \text{ g}$

(e) Nitric acid = $\text{HNO}_3 = 1 + 14 + (16 \times 3) = 15 + 48 = 63 \text{ u} = 63 \text{ g}$

9. 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)?

Ans. (a) Atomic mass of nitrogen is 14 u.

therefore 1 mol of N = 14g

(b) Atomic mass of aluminium = 27u

therefore 1 mol of Al = 27g and so 4 mol of Al = $27 \times 4 = 108\text{g}$

(c) molecular mass of $\text{Na}_2\text{SO}_3 = 23 \times 2 + 32 + 16 \times 3 = 46 + 32 + 48 = 126 \text{ u}$

therefore 1 mol of Na_2SO_3 has weight/mass 126g.

hence, 10 mol of $\text{Na}_2\text{SO}_3 = 10 \times 126 = 1260\text{g}$

10. Convert into mole.

(a) 12 g of oxygen gas

(b) 20 g of water

(c) 22 g of carbon dioxide.

Ans. (a) molecular mass of $\text{O}_2 = 32 \text{ u} = 32\text{g}$ (1 mole)

since 32 g of $\text{O}_2 = 1 \text{ mole}$ then 12g of $\text{O}_2 = 1 \times 12 / 32 = 0.375 \text{ mole}$.

(b) molecular mass of $\text{H}_2\text{O} = 1 \times 2 + 16 = 18 \text{ u} = 18\text{g}$ (1 mole)

20g $\text{H}_2\text{O} = 1 \times 20 / 18 = 1.11 \text{ mole}$.

(c) molecular mass of $\text{CO}_2 = 12 + 16 \times 2 = 12 + 32 = 44 \text{ u} = 44\text{g}$ (1 mole)

22g of $\text{CO}_2 = 1 \times 22 / 44 = 0.5 \text{ mole}$.

11. State the Postulates of Dalton Theory?

Ans. The postulates of Dalton theory are

- a) All matter is made of vary tiny particles called atom
- b) Atoms are indivisible particle; they cannot be created or destroyed during a chemical reaction
- c) Atoms of a \given element are identical in mass and chemical properties
- d) Atoms of different elements have different mass and chemical properties.
- e) Atom combines in the ratio of their whole number to form compounds
- f) The relative number and kinds of atoms are constant in a compound.

12. Find the percentage of water of crystallization in $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$.

Ans. The RMM of $\text{FeSO}_4 \cdot 7\text{H}_2\text{O} = 55.9 + 32.0 + 4 \times 16 + 7(18)$
 $= 55.9 + 32 + 64 + 126$
 $= 277.9 \text{ g/mol.}$

277.9 g/mol of FeSO_4 contain 126g of water

\therefore 100g of crystal will contain $100 \times \frac{126}{277.9}$ of water of crystallization

This is 45.34 of water of crystallization

The amount of water of crystallization in $\text{FeSO}_4 \cdot 7\text{H}_2\text{O} = 45.34\%$ by mass.

13. 2.42g of copper gave 3.025g of a black oxide of copper, 6.49g of a black oxide, on reduction with hydrogen, gave 5.192g of copper. Show that these figures are in accordance with law of constant proportion?

Ans. The percentage of copper is first oxide
 $= \frac{2.42}{3.025} \times 100 = 80.0$

The percentage of copper is second oxide = $\frac{5.192}{6.49} \times 100 = 80.02$

As the percentage of copper in both the oxides is same, thence law of constant composition is verified.

14. A compound was found to have the following percentage composition by mass Zn = 22.65%, S = 11.15%, H = 4.88%, O = 61.32%. The relative molecular mass is 287g/mol. Find the molecular formula of the compound, assuming that all the hydrogen in the compound is present in water of crystallizations.

Ans. Zn : S : O : H = 22.65 : 11.15 : 61.32 : 4.88
 $= 0.3485 : 0.3484 : 3.833 : 4.88$

To obtain an integral ratio, we divide by smallest number

$= \frac{0.3485}{0.3484} : \frac{0.3484}{0.3484} : \frac{3.833}{0.3484} : \frac{4.88}{0.3484}$

$= 1 : 1 : 11 : 14$

\therefore empirical formula is $\text{ZnSO}_{11}\text{H}_{14}$

Let Molecular formula be $(\text{ZnSO}_{11}\text{H}_{14})_n$

RMM for the molecular = $n(65 + 32 + (11 \times 16) + 14)$

Formula = 287

$287n = 287$

n = 1

∴ Molecular formula is Zn S₁₁O₁₄

15. Which element will be more reactive and why → the element whose atomic number is 10 or the one whose atomic number is 11?

Ans. Element with atomic number 11 is more reactive than the one with atomic number 10 because electronic configuration of atomic number 11 will be 2, 8, 1 so, it has to lose only 1e⁻ from its outermost shell to be stable which is more easy than the element with atomic number 10 because its electronic configuration is 2, 8 and has 8e⁻ in the outermost shell and hence is already stable.

16. What are the failures of Dalton Atomic theory?

Ans. Failures of Dalton Atomic Theory are :-

- 1) Atom is not the smallest particle as it is made up of protons, neutrons and electrons.
 - 2) Atom's mass can be converted to energy ($E = mc^2$) and hence can be created and destroyed.
 - 3) Atoms of one element have been changed into atoms of another element through artificial transmutation of elements.
 - 4) Atoms of same element need not resemble each other in all respects as isotopes (Different of same element) exist.
 - 5) Atoms of different elements need not differ in all respects as isobars (same forms of different elements) exist.
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17. Calculate the molecular Mass of

a) Ammonium sulphate [(NH₄)₂SO₄]

b) Penicillin [C₁₆H₁₈N₂SO₄]

c) Paracetamol [C₈H₉NO₂]

Ans. a) Ammonium Sulphate [(NH₄)₂SO₄]

= [1 × mass of N + 4 × Mass of Hydrogen] × 2 + 1 × mass of sulphur + 4 × Mass of oxygen
= [1 × 14 + 4 × 1] × 2 + 1 × 32 + 4 × 16 = 18 × 2 + 32 + 64 = 36 + 32 + 64 = 132 g/mol.

b) Penicillin [C₁₆H₁₈N₂SO₄]

= 16 × mass of carbon + 18 × Mass of hydrogen + 2 × Mass of Nitrogen + 1 × mass of sulphur + 4 × Mass of oxygen.

= 16 × 12 + 18 × 1 + 2 × 14 + 1 × 32 + 4 × 16

= 192 + 18 + 28 + 32 + 64 = 334 g/mol.

c) Paracetamol [C₈H₉NO₂]

= 8 × Mass of carbon + 9 × Mass of hydrogen + 1 × mass of Nitrogen + 1 × mass of oxygen.

= 8 × 12 + 9 × 1 + 1 × 14 + 1 × 16

$$= 96 + 9 + 14 + 16$$

$$= 135 \text{ g/mol}$$

18. The following questions are about one mole of sulphuric acid [24]?

- Find the number of gram atoms of hydrogen in it?
- How many atoms of hydrogen does it have?
- How many atoms (in grams) of hydrogen are present for every gram atom of oxygen in it?
- Calculate the number of atoms in [24]?

Ans. 1 Mole of H_2SO_4 = gram molecular Mass = 6.023×10^{23} molecules

a) In $\text{H}_2\text{SO}_4 \rightarrow$ 2 gram atoms of hydrogen are present

b) 6.023×10^{23} atoms = H_2SO_4

So, $2\text{H} = 2 \times 6.023 \times 10^{23}$

$= 12.046 \times 10^{23}$

c) In H_2SO_4 ;

for every 2 hydrogen there are 4 oxygen

so for 1 hydrogen = 2 oxygen are present

$= 2$ oxygen are present

For 1 oxygen = 24 hydrogen are present

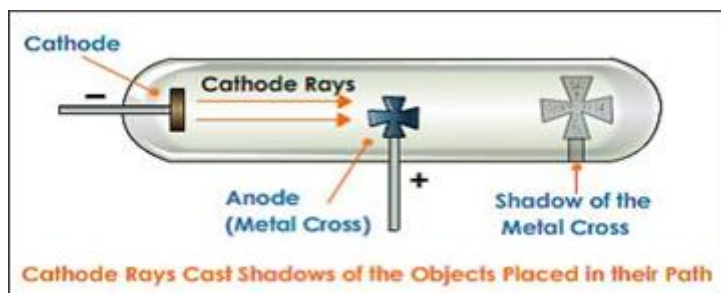
$= 0.5$ Hydrogen are present

d) 1 Mole of $\text{H}_2\text{SO}_4 = 6.023 \times 10^{23}$ atoms.

19. Write an experiment to show that cathode rays travel in straight line?

Ans. Experiment to show that cathode rays travel in straight line:-

- Take a discharge tube coated with a fluorescent substance
- Place an opaque object in the path of the cathode rays.
- When cathode rays were made to pass through the discharge tube then discharge the glowed wherever cathode rays fall except in the region of the shadow of the opaque object.
- The above experiment shows that cathode rays travel in straight line.



20. What is radioactivity? What are the applications of radioisotopes?

Ans. The spontaneous emission of radiation by a substance is called as radioactivity.

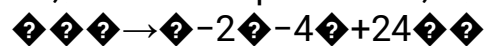
Applications of radioisotopes:-

- Isotope of CO-60 emits γ -radiation which is used in radiotherapy for cancer.
- Iodine-131 is used in diagnosis and treatment of disease of the thyroid gland.
- Isotope P-32 is used in treatment of leukemia.
- Carbon - 14 is used to study biochemical processes.

21. There are 2 elements C and B. C emits an α - particle and B emits a β - particle. How will the resultant elements charge?

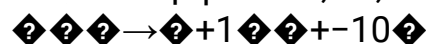
Ans. When a α -particle is released, atomic number decreases by 2-units and mass number decrease by 4- units. When a β particle is releases by 1 unit and mass number remains the same.

So, c-emits a α -particle so,



The resultant element will have its atomic number decreases by 2 units and mass number decreases by 4 units.

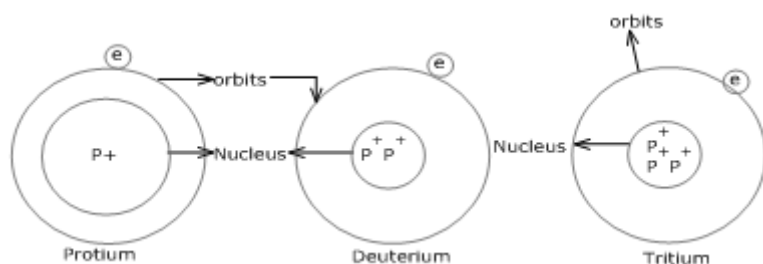
B-emits a β -particle, so,



The atomic number of B increases by 1 unit and mass number remains same.

22. What are isotopes? Name the isotopes of hydrogen and draw the structure of their atoms?

Ans. Isotopes are atoms of the same element having same atomic number and different mass number.



There are 3 isotopes of hydrogen:-

- Protium = 11
- Deuterium = 12
- Tritium = 13

p+ = Proton

e- = electron.

5 Marks Questions

1. In a reaction, 5.3 g of sodium carbonate reacted with 6 g of ethanoic acid. The products were 2.2g of carbon dioxide, 0.9g water and 8.2g of sodium ethanoate.

Show that these observations are in agreement with the law of conservation of mass.

sodium carbonate + ethanoic acid → **sodium ethanoate + carbondioxide + water**

Ans. According to law of conservation of mass :

mass of reactants = mass of products

Lets calculate and find out both results –

mass of reactants = mass of sodium carbonate + mass of ethanoic acid

$$= 5.3\text{g} + 6\text{g}$$

$$= 11.3\text{g}$$

mass of products = mass of sodium ethanoate + mass of carbon dioxide + mass of water

$$= 8.2\text{g} + 2.2\text{g} + 0.9\text{g} = 11.3\text{g}$$

Hence it is proved that these observations are in agreement with the law of conservation of mass.

2. Calculate the molecular masses of

1. H_2
2. O_2
3. Cl_2
4. CO_2
5. C_4
6. C_2O_6
7. C_2O_4
8. C_3
9. $\text{C}_3\text{O}_4\text{H}$

Ans.

1. Molecular mass of H_2
= atomic mass of H x 2 = $1 \times 2 = 2\text{u}$.
2. Molecular mass of O_2
= atomic mass of O x 2 = $16 \times 2 = 32\text{u}$.
3. Molecular mass of Cl_2
= atomic mass of Cl x 2 = $35.5 \times 2 = 71\text{u}$.
4. Molecular mass of CO_2
= atomic mass of C + (atomic mass of O x 2)
= $12 + (16 \times 2)$
= $(12 + 32) = 44\text{u}$

5. Molecular mass of $C_4H_4 = 12 + \text{atomic mass of hydrogen} \times 4$
 $= 12 + (1 \times 4)$
 $= 12 + 4 = 16 \text{ u}$
 6. Molecular mass of C_2H_6
 $= (12 \times 2) + (1 \times 6) = 24 + 6 = 30 \text{ u}$
 7. Molecular mass of C_2H_4
 $= (12 \times 2) + (1 \times 4) = 24 + 4 = 28 \text{ u}$
 8. Molecular mass of C_2H_3
 $= 14 + (1 \times 3) = 14 + 3 = 17 \text{ u}$
 9. Molecular mass of C_3H_3O
 $= 12 + (1 \times 3) + 16 + 1 = 12 + 3 + 16 + 1 = 32 \text{ u}$
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3. If one mole of carbon atoms weighs 12 grams, what is the mass (in grams) of 1 atom of carbon?

Ans. Weight of one mole of carbon = atomic mass of carbon (1 atom of carbon) = 12 u

Therefore one mole of carbon contains = 12 g = 6.022×10^{23} atoms (Avogadro number)

so 1 atom of carbon = $12 / 6.022 \times 10^{23}$ g

or, 12 u = $12 / 6.022 \times 10^{23}$ g

1 u = $12 / 6.022 \times 10^{23} \times 12$ g

1 u = $1 / 6.022 \times 10^{23}$ g

1 u = $0.1660577 \times 10^{-23}$ g

or, 1 u = 1.660577×10^{-24} g

4. 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.

Ans. Mass of the given sample compound = 0.24g

Mass of boron in the given sample compound = 0.096g

Mass of oxygen in the given sample compound = 0.144g

% composition of compound = % of boron and % of oxygen

Therefore % of boron = $\text{mass of boron} \times 100 / \text{mass of the sample compound}$

= $0.096 \times 100 / 0.24$

= 40%

Therefore % of oxygen = $\text{mass of oxygen} \times 100 / \text{mass of the sample compound}$

= $0.144 \times 100 / 0.24$

= 60%

