

Chapter 3: Atoms and Molecules

NCERT Exemplar · Class 9 · Science

Multiple-choice Questions

Question 1

Which of the following correctly represents 360 g of water?

Choose the option :

(a) (i)

(b) (i) and (iv)

(c) (ii) and (iii)

(d) (ii) and (iv)

A.

2 moles of H₂O

B.

20 moles of water

C.

6.022×10^{23} molecules of water

D.

1.2044×10^{25} molecules of water

Solution

Answer is (d) (ii) and (iv)

Explanation:

Number of moles = Mass of water / Molar mass of water

Number of moles = $360\text{g} / 18\text{g/mol}$

Number of moles = 20

Number of molecules = $20 \times 6.022 \times 10^{23} = 1.2044 \times 10^{25}$ molecules of water

Thus, option (d) is correct.

Question 2

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

A.

Atoms are not able to exist independently

B.

Atoms are the basic units from which molecules and ions are formed

C.

Atoms are always neutral in nature

D.

Atoms aggregate in large numbers to form the matter that we can see, feel or touch

Answer

Correct option: A

Solution

Answer is (a) Atoms are not able to exist independently

Question 3

The chemical symbol for nitrogen gas is

A.

Ni

B.

N_2

C.

N^+

D.

N

Answer

Correct option: B

Solution

Answer is (b) N_2

Explanation:

The chemical formula of Nitrogen is N but Nitrogen exist in molecule of two ions hence chemical symbol of Nitrogen gas is written as N_2 .

Question 4

The chemical symbol for sodium is

A.

So

B.

Sd

C.

NA

D.

Na

Answer

Correct option: D

Solution

Answer is (d) Na

Explanation:

Sodium word is derived from Latin word Natrium hence the chemical name of sodium is Na.

Question 5

Which of the following would weigh the highest?

A.

0.2 mole of sucrose ($C_{12}H_{22}O_{11}$)

B.

2 moles of CO_2

C.

2 moles of $CaCO_3$

D.

10 moles of H_2O

Answer

Correct option: C

Solution

Answer is (c) 2 moles of $CaCO_3$

Explanation:

The molecular mass of $C_{12}H_{22}O_{11}$ is $= 12(12) + 22(1) + 11(16)$ gm $= 342$ gm

0.2 moles of it weigh $= 0.2 \times 342$ gm $= 68.4$ gm

The molar mass of CO_2 is $= 12 + 2(16) \text{ gm} = 44\text{gm}$

2 moles of it weigh $= 2 \times 44 = 88\text{gm}$

The molar mass of CaCO_3 weigh $= 40 + 12 + 3(16) = 100\text{gm}$

2 mole of it weigh $= 2 \times 100 \text{ gm} = 200\text{gm}$

Molar mass of H_2O is $= 2(1) + 16 = 18\text{gm}$

10 mole of it weigh $= 10 \times 18 \text{ gm} = 180\text{gm}$

Question 6

Which of the following has maximum number of atoms?

A.

18g of H_2O

B.

18g of O_2

C.

18g of CO_2

D.

18g of CH_4

Answer

Correct option: D

Solution

Answer is (d) 18g of CH_4

Explanation:

Number of atoms $= \text{Mass of substance} \times \text{Number of atoms in the molecule} / \text{Molar mass} \times \text{NA}$

(a) 18 g of water $= 18 \times 3 / 18 \times \text{NA} = 3 \text{ NA}$

(b) 18 g of oxygen = $18 \times 2 / 32 \times N_A = 1.12 N_A$

(c) 18 g of CO_2 = $18 \times 3 / 44 \times N_A = 1.23 N_A$

(d) 18 g of CH_4 = $18 \times 5 / 16 \times N_A = 5.63 N_A$

Note: $N_A = 6.023 \times 10^{23}$

Question 7

Which of the following contains maximum number of molecules?

A.

1g CO_2

B.

1g N_2

C.

1g H_2

D.

1g CH_4

Answer

Correct option: C

Solution

Answer is (c) 1g H_2

Note: $N_A = 6.023 \times 10^{23}$

Explanation:

Question 8

Mass of one atom of oxygen is

- a) $16 / 6.023 \times 10^{23} \text{g}$
- b) $32 / 6.023 \times 10^{23} \text{g}$
- c) $3 / 6.023 \times 10^{23} \text{g}$
- (d) 8u

Solution

Answer is (a) $16 / 6.023 \times 10^{23} \text{g}$

Explanation:

Mass of one atom of oxygen = Atomic mass/ N_A = $16 / 6.023 \times 10^{23} \text{g}$

Note: $N_A = 6.023 \times 10^{23}$

Question 9

3.42 g of sucrose are dissolved in 18g of water in a beaker. The number of oxygen atoms in the solution are

- (a) 6.68×10^{23} (b) 6.09×10^{22} (c) 6.022×10^{23} (d) 6.022×10^{21}

Solution

Answer is (a) 6.68×10^{23}

Explanation: (2)

Question 10

A change in the physical state can be brought about

- (a) only when energy is given to the system
- (b) only when energy is taken out from the system
- (c) when energy is either given to or taken out from the system
- (d) without any energy change

Solution

Answer is (c) when energy is either given to or taken out from the system

Short Answer Questions

Question 11

Which of the following represents a correct chemical formula? Name it.

A.

CaCl

B.

BiPO₄

C.

NaSO₄

D.

NaS

Answer

Correct option: B

Solution

Answer is (b) BiPO₄, Its name is Bismuth Phosphate

Explanation:

Bismuth phosphate is right because Both ions are trivalent Bismuth phosphate(Bi³⁺- Trivalent anion. anion is an ion that is negatively charged).

Question 12

Write the molecular formulae for the following compounds

(a) Copper (II) bromide

(b) Aluminium (III) nitrate

(c) Calcium (II) phosphate

(d) Iron (III) sulphide

(e) Mercury (II) chloride

(f) Magnesium (II) acetate

Solution

Answers are

(a) Copper (II) bromide = CuBr_2

(b) Aluminium (III) nitrate = $\text{Al}(\text{NO}_3)_3$

(c) Calcium (II) phosphate = $\text{Ca}_3(\text{PO}_4)_2$

(d) Iron (III) sulphide = Fe_2S_3

(e) Mercury (II) chloride = HgCl_2

(f) Magnesium (II) acetate = $\text{Mg}(\text{CH}_3\text{COO})_2$

Question 13

Write the molecular formulae of all the compounds that can be formed by the combination of following ions Cu^{2+} , Na^+ , Fe^{3+} , Cl^- , SO_4^{2-} , PO_4^{3-}

Solution

Answers are

CuCl_2 / CuSO_4 / $\text{Cu}_3(\text{PO}_4)_2$

NaCl / Na_2SO_4 / Na_3PO_4

FeCl_3 / $\text{Fe}_2(\text{SO}_4)_3$ / FePO_4

Question 14

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

(a) CH_3COONa

b) NaCl

(c) H₂

(d) NH₄NO₃

Solution

1. In CH₃COONa-CH₃COO is anion and Na is cation.
2. In NaCl-Cl anion Na is cation
3. In H₂ both the ions are cations as they share electrovalent bond between them
4. In NH₄NO₃- NO₃ is anion NH₄ is cation

Question 15

Give the formulae of the compounds formed from the following sets of elements

(a) Calcium and fluorine

(b) Hydrogen and sulphur

(c) Nitrogen and hydrogen

(d) Carbon and chlorine

(e) Sodium and oxygen

(f) Carbon and oxygen

Solution

- (a) Calcium and fluoride – Calcium Fluoride (CaF₂)
- (b) Hydrogen and sulphur- H₂S- Hydrogen Sulphide
- (c) Nitrogen and hydrogen- NH₃- Ammonia
- (d) Carbon and chlorine – CCl₄- Carbon Tetrachloride
- (e) Sodium and oxygen – Na₂O-Sodium Oxide
- (f) Carbon and oxygen- CO₂ ; CO- Carbon-di-oxide; Carbon Monoxide

Question 16

Which of the following symbols of elements are incorrect? Give their correct symbols

(e) Sodium So

A.

Cobalt CO

B.

Carbon c

C.

Aluminium AL

D.

Helium He

Solution

Cobalt CO is wrong, correct symbol is Co

Carbon c is wrong, correct symbol is C

Aluminium AL is wrong, correct symbol is Al

Helium He is the right symbol

Sodium So is wrong, correct symbol is Na

Question 17

Give the chemical formulae for the following compounds and compute the ratio by mass of the combining elements in each one of them. (You may use appendix-III).

(a) Ammonia

(b) Carbon monoxide

(c) Hydrogen chloride

(d) Aluminium fluoride

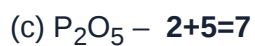
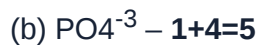
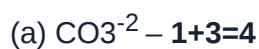
(e) Magnesium sulphide

Solution

S. No.	Compounds	Chemical formula	Ratio by mass of the combining elements
(a)	Ammonia	NH_3	$\text{N:H}=14:3$
(b)	Carbon monoxide	CO	$\text{C:O} = 12:16=3:4$
(c)	Aluminium fluoride	HCl	$\text{H:Cl} = 1:35.5$
(d)	Aluminium fluoride	AlF_3	$\text{Al:F}=27:57=9:19$
(e)	Magnesium sulphide	MgS	$\text{Mg:S} = 24:32=3:4$

Question 18

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

**Solution****Question 19**

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

Solution

Mass of 1 mole of a substance is equal to its relative atomic or molecular mass in grams.

Mass of one mole (Avogadro Number) of neutrons = 1g

Mass of one neutron = $1 / \text{Avogadro number}(N_A)$ g

Mass of one molecule of water = Molar mass / N_A = $18 / N_A$ g

The molar mass of water is 18.015 g/mol. This was calculated by multiplying the atomic weight of hydrogen (1.008) by two and adding the result to the weight for one oxygen (15.999)

Mass of one molecule of water = Molar mass / N_A = $18 / N_A$ g

Avogadro number(N_A) = $6.022 \times 10^{23} \text{mol}^{-1}$

There are 8 neutrons in one atom of oxygen

Number of neutrons in oxygen = number of oxygen – Atomic number of oxygen

Oxygen's atomic weight = 15.9994

increases with an increase in temperature.

Therefore the mass is 16

Therefore number of neutrons = $16 - 8 = 8$

Mass of one neutron = $1 / \text{Avogadro number}(N_A)$ g

Mass of 8 neutrons = $8 / \text{Avogadro number}(N_A)$ g

Fraction of mass of water due to neutrons = $8/18$ g

Question 20

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

Solution

Solubility is the ability of a solute to get dissolved in 100g solvent. Solubility of a given solute to dissolve in specific solvent depends on the temperature. With an increase in temperature solubility of liquids and solids increase. In the same way solubility of gases decreases with increase in temperature.

Ex: Sugar dissolves faster in hot water than in cold water.

Question 21

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

(a) F_2

(b) NO_2

(c) N_2O

(d) C_2H_6

(e) P_4

(f) H_2O_2

(g) P_4O_{10}

(h) O_3

(i) HCl

(j) CH_4

(k) He

(l) Ag

Solution

a. Diatomic (2 atoms)

b. Triatomic (3 atoms)

c. Triatomic (3 atoms)

d. Polyatomic (8 atoms)

e. Polyatomic (4 atoms)

f. Polyatomic (4 atoms)

g. Polyatomic (14 atoms)

h. Triatomic (3 atoms)

i. Diatomic (2 atoms)

j. Polyatomic (5 atoms)

k. Monoatomic (1 atom)

l. Monoatomic (1 atom)

Question 22

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

To examine if the fine white coloured powder is sugar or salt we can conduct two experiments.

Solution

Heating:

Upon heating sugar melts to liquid form because sucrose has a decomposition point and melting point at temperatures between 190 to 192 degrees Celsius. This will turn sugar to light brown colour. On heating further, sugar gets charred to black colour.

Salt has a melting point of 841 degrees Celsius and 1545.8 degrees Fahrenheit. If we don't heat it to that point no change is observed.

Electrical conductivity:

If we dissolve the given substance in water we can check for electrical conductivity to check whether the substance is sugar or salt. If it is salt it conducts electricity. Because salt (NaCl) has positive sodium ions and negative chloride ions hence salt conducts electricity. But sugar doesn't conduct electricity as sugar has only positive ions.

Question 23

Calculate the number of moles of magnesium present in a magnesium ribbon weighing 12 g. Molar atomic mass of magnesium is 24 g mol⁻¹.

Solution

Number of moles = weight / atomic weight

= $12/24 = 0.5$ moles

Long Answer Questions

Question 24

Verify by calculating that (a) 5 moles of CO₂ and 5 moles of H₂O do not have the same mass. (b) 240 g of calcium and 240 g magnesium elements have a mole ratio of 3:5.

Solution

a) Molar mass of CO₂ = $12 + 2 \times 16 = 12 + 32 = 44 \text{ g mol}^{-1}$

5 moles of CO₂ have mass = $44 \times 5 = 220 \text{ g}$

Similarly, molar mass of H₂O = $2 \times 1 + 16 = 18 \text{ g mol}^{-1}$

5 moles of H₂O have mass = $18 \times 5 = 90 \text{ g}$

It is verified that 5 moles of CO₂ and 5 moles of H₂O are not same.

b) Number of moles = $w/\text{atomic weight}$

Atomic weight of Ca = 40 amu

Number of moles in 240g Ca metal $240/40 = 6$

Number of moles in 240g of Mg metal $240/24 = 10$

Atomic weight of Mg = 24amu

Ratio 6:10

Question 25

Find the ratio by mass of the combining elements in the following compounds. (You may use Appendix-III) (a) CaCO₃ (d) C₂H₅OH (b) MgCl₂ (e) NH₃ (c) H₂SO₄ (f) Ca(OH)₂

Solution

a) CaCO₃

Ca: C : O $\times 3$

40 : 12 : 16×3

40: 12 : 48

$$10 : 3 : 12$$

(b) MgCl_2

$$\text{Mg} : \text{Cl} \times 2$$

$$24 : 35.5 \times 2$$

$$24 : 71$$

(c) H_2SO_4

$$\text{H} \times 2 : \text{S} : \text{O} \times 4$$

$$2 : 32 : 16 \times 4$$

$$2 : 32 : 64$$

$$1 : 16 : 32$$

(d) $\text{C}_2\text{H}_5\text{OH}$

$$\text{C} \times 2 : \text{H} \times 6 : \text{O}$$

$$12 \times 2 : 1 \times 6 : 16$$

$$24 : 6 : 16$$

$$12 : 3 : 8$$

(e) NH_3

$$\text{N} : \text{H} \times 3$$

$$14 : 1 \times 3$$

$$14 : 3$$

(f) $\text{Ca}(\text{OH})_2$

$$\text{Ca} : \text{O} \times 2 : \text{H} \times 2$$

$$40 : 16 \times 2 : 1 \times 2$$

$$40 : 32 : 2$$

$$20 : 16 : 1$$

Question 26

Calcium chloride when dissolved in water dissociates into its ions according to the following equation.
 $\text{CaCl}_2(\text{aq}) \rightarrow \text{Ca}^{2+}(\text{aq}) + 2\text{Cl}^{-}(\text{aq})$ Calculate the number of ions obtained from CaCl_2 when 222 g of it is dissolved in water.

Solution

Solution coming soon.

Soln:

Question 27

The difference in the mass of 100 moles each of sodium atoms and sodium ions is 5.48002 g. Compute the mass of an electron.

Solution

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

Mass of 100 moles of electrons = 5.48002 g

Mass of 1 mole of electron = $5.48002 / 100$ g

Mass of one electron = $5.48002 / 100 \times 6.022 \times 10^{23}$

= 9.1×10^{-28} g

= 9.1×10^{-31} kg

Question 28

Cinnabar (HgS) is a prominent ore of mercury. How many grams of mercury are present in 225 g of pure HgS ? Molar mass of Hg and S are 200.6 g mol^{-1} and 32 g mol^{-1} respectively.

Solution

The molar mass of HgS = The molar mass of Hg + the molar mass of S

= $200.6 + 32 = 232.6 \text{ g mol}^{-1}$

1 molecule of HgS contains 1 atom of Hg

232.6 g of HgS contains 200.6 g of Hg

Therefore, Mass of Hg in 225 g of HgS = $200.6 \times 225 / 232.6 = 194.04\text{g}$

Question 29

The mass of one steel screw is 4.11g. Find the mass of one mole of these steel screws. Compare this value with the mass of the Earth ($5.98 \times 10^{24}\text{kg}$). Which one of the two is heavier and by how many times?

Solution

One mole of screws weigh = $2.475 \times 10^{24}\text{g}$

= $2.475 \times 10^{21}\text{ kg}$

Mass of the Earth / Mass of 1 mole of screws = $5.98 \times 10^{24}\text{ kg} / 2.475 \times 10^{21}$

= 2.4×10

Mass of earth is 2.4×10^3 times the mass of screws

The earth is 2400 times heavier than one mole of screws

Question 30

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

Solution

Solution coming soon.

We know,

Question 31

Raunak took 5 moles of carbon atoms in a container and Krish also took 5 moles of sodium atoms in another container of same weight.

(a) Whose container is heavier?

(b) Whose container has more number of atoms?

Solution

a) Mass of sodium atoms carried by Krish = $(5 \times 23) \text{ g} = 115 \text{ g}$

The atomic weight of Na = 23

While the mass of carbon atom carried by Raunak = $(5 \times 12) \text{ g} = 60 \text{ g}$

b) Both container has an equal number of atoms

Question 32

Fill in the missing data in the Table 3.1

Species property	H ₂ O	CO ₂	Na atom	MgCl ₂
No of Moles	2	–	–	0.5
No of particles	–	3.011×10^{23}	–	0
Mass	36g	–	115g	0

Solution

Species property	H ₂ O	CO ₂	Na atom	MgCl ₂
No of Moles	2	0.5	5	0.5
No of particles	12.044×10^{23}	3.011×10^{23}	3.011×10^{23}	3.011×10^{23}
Mass	36g	22g	115g	47.5g

Question 33

The visible universe is estimated to contain 10^{22} stars. How many moles are present in the visible universe?

Solution

$$\text{Number of moles of stars} = 10^{22} / 6.023 \times 10^{23}$$

$$\text{Number of moles of stars} = 0.0166$$

Question 34

What is the SI prefix for each of the following multiples and submultiples of a unit?

(a) 10^3

(b) 10^{-1}

(c) 10^{-2}

(d) 10^{-6}

(e) 10^{-9}

(f) 10^{-12}

Solution

a) $10^3 = 1000 = \text{kilo}$

(b) $10^{-1} = 1/10 = 0.1 = \text{deci}$

(c) $10^{-2} = 1/100 = 0.01 = \text{centi}$

(d) $10^{-6} = 0.000\,001 = \text{micro}$

(e) $10^{-9} = 0.000\,000\,001 = \text{nano}$

(f) $10^{-12} = 0.000\,000\,000\,001 = \text{pico}$

Question 35

Express each of the following in kilograms

(a) $5.84 \times 10^{-3} \text{ mg}$

(b) 58.34 g

(c) 0.584 g

(d) $5.873 \times 10^{-21} \text{ g}$

Solution

(a) $5.84 \times 10^{-3} \text{ mg} = 5.84 \times 10^{-9} \text{ kg}$

(b) $58.34 \text{ g} = 5.834 \times 10^{-2} \text{ kg}$

(c) $0.584\text{g} = 5.84 \times 10^{-4} \text{ kg}$

(d) $5.873 \times 10^{-21} \text{g} = 5.873 \times 10^{-24} \text{ kg}$

Question 36

Compute the difference in masses of 103 moles each of magnesium atoms and magnesium ions. (Mass of an electron = $9.1 \times 10^{-31} \text{ kg}$)

Solution

Mg^{2+} ion and Mg atom differ by two electrons.

103 moles of Mg^{2+} and Mg atoms would differ by

$$10^3 \times 2 \text{ moles of electrons}$$

$$\text{Mass of } 2 \times 10^3 \text{ moles of electrons} = 2 \times 10^3 \times 6.023 \times 10^{23} \times 9.1 \times 10^{-31} \text{ kg}$$

$$2 \times 6.022 \times 9.1 \times 10^{-5} \text{ kg}$$

$$109.6004 \times 10^{-5} \text{ kg}$$

$$1.096 \times 10^{-3} \text{ kg}$$

Question 37

Which has more number of atoms? 100g of N_2 or 100 g of NH_3

Solution

No. of moles of atoms = weight / atomic weight.

For N_2

$$100 \text{ gms of } \text{N}_2 = 100/28 \times 6.022 \times 10^{23} \text{ moles}$$

$$\text{Number of molecules} = 100 / 28 \times 6.022 \times 10^{23}$$

Molar mass of N_2 = 2 x molar mass of monoatomic N

$$\text{Molar mass of } \text{N}_2 = 2 \times 14.0067 = 28 \text{ moles.}$$

$$\text{Number of molecules} = 100/28 \times 6.022 \times 10^{23}$$

$$\text{No. of atoms} = 2 \times 100/28 \times 6.022 \times 10^{23} = 43.01 \times 10^{23}$$

For NH_3

$$100 \text{ gm of } \text{NH}_3 = 100/17 \text{ moles}$$

$$\text{Number of molecules} = 100/17 \times 6.022 \times 10^{23} \text{ molecules}$$

$$\text{No. of atoms in } \text{NH}_3 = (1 + 3) = 4 \times 100/17 \times 6.022 \times 10^{23} =$$

$$141.69 \times 10^{23} \text{ atoms.}$$

Therefore, NH_3 has more atoms than N_2 .

Question 38

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

Solution

$$58.5 \text{ g NaCl contains } 6.023 \times 10^{23} \text{ molecules}$$

$$\text{therefore } 58.5 \text{ g NaCl contains } 12.046 \times 10^{23} \text{ ions.}$$

$$\text{Hence, } 5.85 \text{ g NaCl contains } 5.85 \times 12.046 \times 10^{23} / 58.5$$

$$= 1.2046 \times 10^{23} \text{ ions}$$

Question 39

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

Solution

$$\text{one gram of gold sample will contain } 90/100 = 0.9\text{g of gold}$$

$$\text{number of moles of gold} = \text{mass of gold} / \text{atomic mass of gold}$$

$$= 0.9/19.7 = 0.0046$$

$$\text{one mole of gold contains } N_A \text{ atoms} = 6.022 \times 10^{23}$$

$$\text{Therefore, } 0.0046 \text{ mole of gold will contain} = 0.0046 \times 6.022$$

$$= 2.77 \times 10^{21}$$

Question 40

What are ionic and molecular compounds? Give examples.

Solution

While forming some compounds, atoms gain or lose electrons, and form electrically charged particles called ions. Compounds that are formed by the attraction of cations and anions are called as ionic compounds.

Ex : $2\text{Na} + \text{Cl}_2 \rightarrow 2\text{Na}^+ \text{Cl}^- \rightarrow 2\text{NaCl}$ (sodium chloride- common salt.)

Sodium is a group 1 metal, thus forms a +1 charged cation. Chlorine is a non-metal, and has the ability to form a -1 charged anion.

Compounds formed due to bonding of uncharged ions are called as molecular compounds and the bonding between them is called covalent bonding. Molecular compounds are formed by sharing of electrons between the two atoms and the elements are held together by covalent bonds.

Ex: $2\text{C} + \text{O}_2 \rightarrow 2\text{CO}$ (Carbon monoxide)

Question 41

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

Solution

Mass of one mole of Aluminium atom = $\{13 \times \text{mass of each electron} + 13 \times \text{mass of each proton} + 14 \times \text{mass of each neutron}\} \times \text{Avogadro's constant}$.

We know, if atoms convert into ions, only transfer of electrons takes place, in Al^{+3} ion, Aluminium atom loss three electrons,

So,

Mass of $\text{Al}^{+3} = \{10 \times \text{mass of each electron} + 13 \times \text{mass of each proton} + 14 \times \text{mass of each neutron}\} \times \text{Avogadro's constant}$

Now,

You see mass of aluminium atom is greater than aluminium ion by 3 electrons

Difference in mass = Mass of Aluminium atom - mass of aluminium ion

= $3 \times \text{mass of each electron} \times \text{Avogadro's constant}$.

$$= 3 \times 9.1 \times 10^{-28} \times 6.023 \times 10^{23}$$

$$= 27.3 \times 10^{-28} \times 6.023 \times 10^{23} \text{ g}$$

$$= 164.4 \times 10^{-5} \text{ g}$$

$$= 1.644 \times 10^{-3} \text{ g}$$

$$= 0.0016 \text{ g}$$

Question 42

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

Solution

Mass of silver = m g

Mass of gold = m /100g

Number of atoms of silver = Mass/ Atomic mass $\times N_A$

= m /108 N_A Number of atoms of gold

= m/ 100 $\times 197$

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

= m/ 100 $\times 197 \times N_A$: m/ 108 N_A

= 108 : 100 $\times 197$

= 108 : 19700 = 1 : 182.41

Question 43

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

Solution

Solution coming soon.

Soln: (2)

Question 44

Fill in the blanks

- (a) In a chemical reaction, the sum of the masses of the reactants and products remains unchanged. This is called _____.
- (b) A group of atoms carrying a fixed charge on them is called _____.
- (c) The formula unit mass of $\text{Ca}_3(\text{PO}_4)_2$ is _____.
- (d) Formula of sodium carbonate is _____ and that of ammonium sulphate is _____.

Solution

- a) Law of conservation of mass
- b) Ions
- c) 310

Explanation

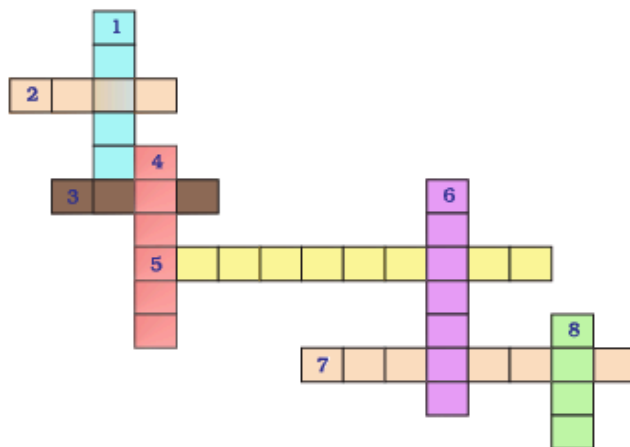
Question 45

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

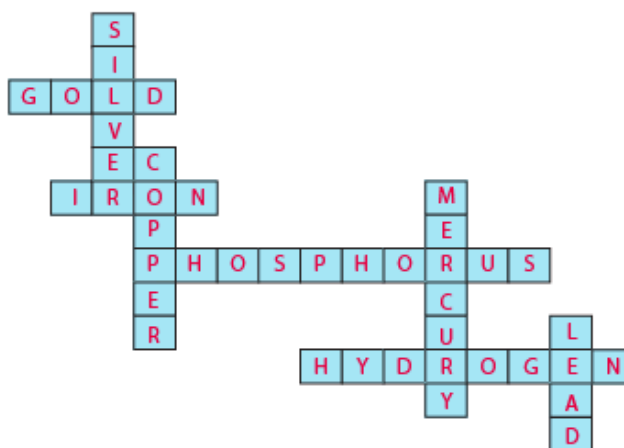
Across	Down
The element used by Rutherford during his α -scattering experiment	A white lustrous metal used for making ornaments and which tends to get tarnished black in the presence of moist air
An element which forms rust on exposure to moist air	Both brass and bronze are alloys of the element
A very reactive non-metal stored under water	The metal which exists in the liquid state at room temperature

Zinc metal when treated with dilute hydrochloric acid produces a gas of this element which when tested with burning splinter produces a pop sound.

An element with symbol Pb



Solution



Question 46

(a) In this crossword puzzle (Fig 3.2), names of 11 elements are hidden. Symbols of these are given below. Complete the puzzle. 1. Cl 7. He 2. H 8. F 3. Ar 9. Kr 4. O 10. Rn 5. Xe 11. Ne 6. N

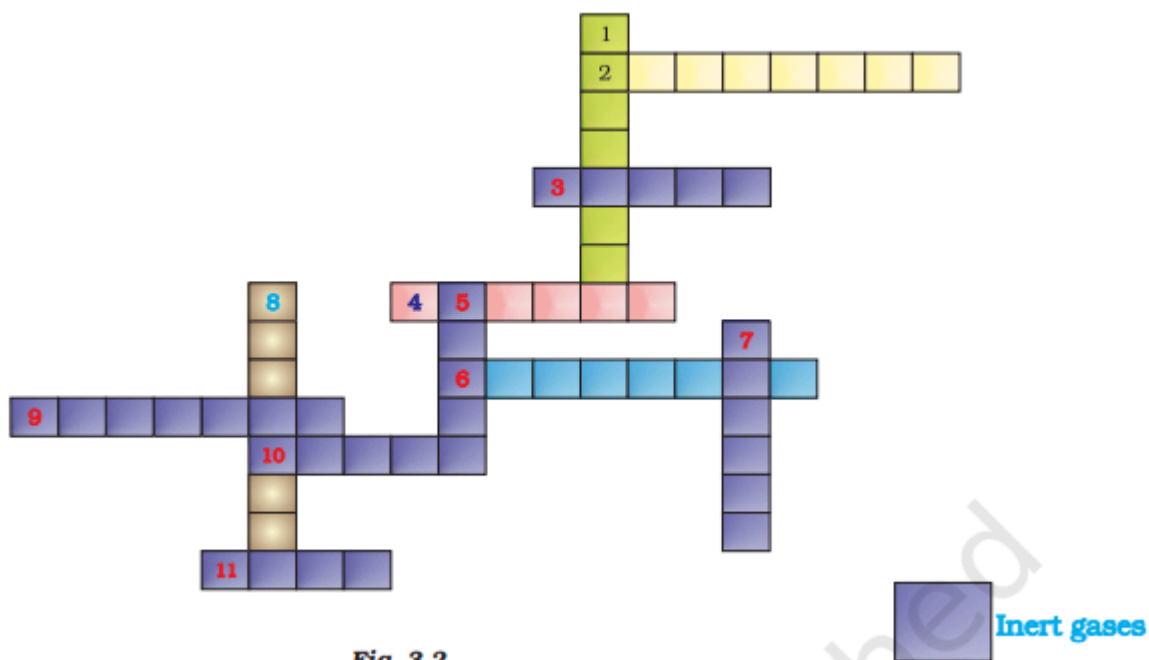
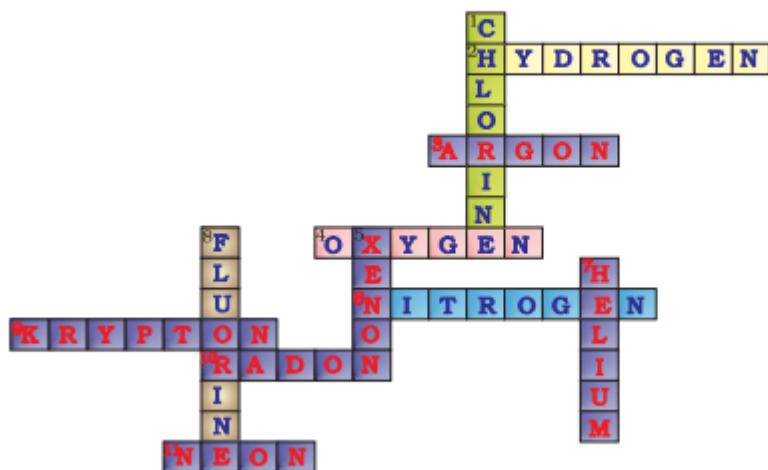


Fig. 3.2

Solution

(a)



b) Six : Helium (He); Neon (Ne); Argon (Ar); Krypton (Kr); Xenon (Xe); Radon (Rn).

Question 47

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

(a) Caustic potash

(b) Baking powder

(c) Limestone

(d) Caustic soda

(e) Ethanol

(f) Common salt

Solution

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

Ser. No.	Compound	Formula	Molecular mass
A	Caustic Potash	KOH	$39+16+1=56\text{u}$
B	Baking powder	NaHCO_3	$23+1+12+3\times 16=84\text{u}$
C	Limestone	CaCO_3	$40+12+3\times 16=100\text{u}$
D	Caustic soda	NaOH	$23+16+1=40\text{u}$
E	Ethanol	$\text{C}_2\text{H}_5\text{OH}$	$2\times 12+5\times 1+16+1=46\text{u}$
F	Common Salt	NaCl	$23+35.5=58.5$

Question 48

In photosynthesis, 6 molecules of carbon dioxide combine with an equal number of water molecules through a complex series of reactions to give a molecule of glucose having a molecular formula $\text{C}_6\text{H}_{12}\text{O}_6$. How many grams of water would be required to produce 18 g of glucose? Compute the volume of water so consumed assuming the density of water to be 1 g cm^{-3} .

Solution

Solution coming soon.