Assignment 1

Chapter 2 Questions

17.

The law of definite proportions state that A chemical compound always contains exactly the same proportion of elements by mass.

Hydrogen only reacts with sufficient number of moles of oxygen to produce water. So that oxygen makes up $\frac{8}{9}$ of the mass of any sample of pure water while hydrogen makes up the remaining $\frac{1}{9}$ of the mass.

19.

Law of conservation of mass: "*Mass is neither created nor destroyed. The mass before a chemical reaction always equals to the mass after a chemical reaction*". This is first noticed by a French chemist Antoine Lavoisier.

Let us illustrate by taking a general example. Let us assume that there are two reactants A and B reacting to form C and D. Let "a" g of A reacting with "b" g of B to give "c" g of C and "d" g of D.

Chemical reaction:

$$A + B \rightarrow C + D$$

$$ag \quad bg \qquad cg \quad dg$$

After the completion of the reaction,

$$(\text{total mass of reactants}) = (\text{total mass of products})$$

$$\Rightarrow (a+b)g = (c+d)g$$

This is the law conservation of mass describes.

21.

J.J. Thomson carried out many experiments, with cathode ray discharge tubes, finally which lead to the invention of electrons.

Where as experiments explained about the positive nucleus present in the atom.

All these experiments tell about the fundamental particles like protons and electrons present in the atom.

An atom with a tiny dense center of positive charge (the nucleus) with electrons moving about the nucleus at relatively large distance s away; the distance is so large that an atom is mostly empty space.

23.

Step 1 of 2

The number and arrangement of electrons in an atom determines how the atom will react with other atoms.

Comment

Step 2 of 2

The electrons determine the chemical properties of an atom. The numbers of neutrons present determine the isotope identity.

27.

Metals have characteristic physical properties such as efficient conduction of heat and electricity, malleability (they can be hammered into thin sheets), ductility (they can be pulled into wires), and (often) a lustrous appearance. Chemically, metals tend to lose electrons to form positive ions.

When you go down a group, the metallic character increases because to the less attraction from the nucles, as an element goes across a period, the metallic character decreases due to more attraction from the nucles.

Metallic character increases from top to bottom

“C” carbon is non-metal

“Si” silicon and “Ge” germanium are metalloids

“Sn” tin and “Pb” lead are metals.

In second period Li is Metal where as C is Nonmetal

29.

Step 1 of 2

a. The bonding shown in the compound is IONIC. Ionic bonding is the electrostatic attraction between oppositely charged ions. The cations and anions are arranged in a specific geometric pattern to constitute the ionic solid.

Comment

Step 2 of 2

b. The bonding shown in the compound is covalent bond. Covalent bonding is a type of bonding in which electrons are shared by atoms. The electron cloud surrounding constituent atoms overlapped with each other to form chemical bonds.

31.

Step 1 of 5

Most of the elements are **metals.** Metals have characteristic physical properties such as efficient conduction of heat and electricity, malleability (they can be hammered into thin sheets), ductility (they can be pulled into wires), and (often) a lustrous appearance.

Statement (a) is true

Comment

Step 2 of 5

b) Counting over in the periodic table, **element 118** will be the next noble gas. Therefore, **the statement (b) is also true.**

Comment

Step 3 of 5

c) Hydrogen has mostly **nonmetallic** properties.

Comment

Step 4 of 5

d) A family of elements is also known as a group of elements.

Comment

Step 5 of 5

e) When a metal reacts with a nonmetal, an ionic compound is produce and the formula of the compound would be AX_2 (since alkaline earth metals for +2 ions and halogens forms -1 ions in ionic compounds).

The correct statement would be when alkaline earth metal, A react with a halogen X, the formula of the ionic compound formed should be AX_2

35.

For our problem, we are given the ratio of the different elements that together make chloroform. In order to figure out our total mass of chloroform in the second sample, we need to calculate what percent of our first sample was carbon by mass. Then we can use this percent to calculate the total mass of chloroform.

Comment

Step 2 of 4

First, let's calculate our total mass of chloroform from the quantities provided.

$$\begin{aligned}\text{Total mass of chloroform} &= \text{Mass of C} + \text{Mass of Cl} + \text{Mass of H}\\ &= 12.0\text{g} + 106.4\text{g} + 1.01\text{g}\\ &= 119.41\text{g}\end{aligned}$$

Comment

Step 3 of 4

Then the mass percent of C present in first sample of chloroform $(CHCl_3)$ is:

$$\begin{aligned}\text{Percent Carbon} &= \frac{\text{Mass of Carbon}}{\text{Mass of } CHCl_3} \times 100\\ &= \frac{12.0\text{g}}{119.41\text{g}} \times 100\\ &= 10\%\end{aligned}$$

Comment

Step 4 of 4

Now, we use this percentage to calculate the total mass of new sample:

It is given that mass of C present in second sample is 30.0 g then mass of $CHCl_3$ is:

$$\begin{aligned}\text{Mass of } CHCl_3 &= \frac{\text{Mass of Carbon}}{\text{Percent Carbon}} \times 100\\ &= \frac{30.0\text{g}}{10} \times 100\\ &= 300\text{ g}\end{aligned}$$

Hence the mass of $CHCl_3$ in new sample is 300 g

51.

Symbol	Original Name	Current Name
Sn	**Stannum**	**Tin**
Pt	**----**	**Platinum**
Hg	**Hydrargyrum**	**Mercury**
K	**Kalium**	**Potassium**
Ag	**Argentum**	**Silver**
Mg	-----	**Magnesium**

55.

a): Ti, Fe, Ag are transition metals

b): Mg, Sr, Ba are alkaline earth metals

c): Li, K, Rb are alkali metals

d): Ne, Kr, Xe are noble gases

e): F, Br, I are halogens

57.

Step 1 of 6

a) Atom with atomic number 8 is oxygen

Mass number = 8 + 9

= 17

So atomic symbol of oxygen is $^{17}_{8}\mathrm{O}$

Comment

Step 2 of 6

b) Atomic number Z of chlorine is 17

So atomic symbol of chlorine = $^{35}_{17}\mathrm{Cl}$

Comment

Step 3 of 6

c) Z = 27 indicates cobalt

So atomic symbol of cobalt is $^{60}_{27}\mathrm{Co}$

Comment

Step 4 of 6

d) Atomic number 26 represents Fe, iron

Mass number = 26 + 31

= 57

So atomic symbol of iron is $^{57}_{26}\mathrm{Fe}$

Comment

Step 5 of 6

e) Atomic number of iodine = 53

So atomic symbol of iodine isotope is $^{131}_{53}\mathrm{I}$

Comment

Step 6 of 6

f) Atomic number '3' indicates lithium atom

Mass number = 3 + 4

= 7

So atomic symbol of lithium = $^{7}_{3}\mathrm{Li}$

59.

Step 1 of 4

In the representation format ${}^{A}_{Z}X$, here

Z = Number of proton

A = Number of proton + Number of neutron

X = Atomic symbol

Charge of a species can be calculated as

$$\text{Charge} = \text{Number of proton} - \text{Number of electron}$$

Comment

Step 2 of 4

(a) In this Species,

Number of proton = 11

Number of electron = 10

Number of neutron = 12

Hence,

$Z = 11$

$A = (11+12)$

$= 23$

$X = \text{Na}$

Charge of the species

$$\begin{aligned}\text{Charge} &= \text{Number of proton} - \text{Number of electron}\\ &= 11-10\\ &= +1\end{aligned}$$

Therefore, the symbol of the given species is $\boxed{{}^{23}_{11}\text{Na}}$

Step 3 of 4

(b) In this Species,

Number of proton = 9

Number of electron = 11

Number of neutron = 10

Hence,

$Z = 9$

$A = (9+10)$

$= 19$

$X = \text{F}$

Charge of the species

$$\begin{aligned}\text{Charge} &= \text{Number of proton} - \text{Number of electron}\\ &= 9-11\\ &= -2\end{aligned}$$

Therefore, the symbol of the species is $\boxed{{}^{19}_{9}\text{F}}$.

Comment

Step 4 of 4

(c)In this Species,

Number of proton = 8

Number of electron = 8

Number of neutron = 8

Hence,

$Z = 8$

$A = (8+8)$

$= 16$

$X = \text{O}$

Charge of the species

$$\begin{aligned}\text{Charge} &= \text{Number of proton} - \text{Number of electron}\\ &= 8-8\\ &= 0\end{aligned}$$

Therefore, the symbol of the species is $\boxed{{}^{16}_{8}\text{O}}$.

61.

e) 3H

Atomic number of H = 1

Number of protons = 1

Number of electrons of neutral H = 1

Number of neutrons = 3 – 1

= 2

Comment

Step 6 of 6

f) ^{56}Fe

Atomic number '26' indicates number of protons of $^{56}Fe = 26$

Number of electrons of neutral Fe = 26

Number of neutrons = 56 – 26

= 30

63.

a) Ba^{2+}: Barium has atomic number 56 and therefore has 56 protons. Since the charge is 2+, we have two electrons less than protons.

So the number of protons = 56 and electrons = 54.

Comment

Step 2 of 7

b) Zn^{2+}: Zinc has atomic number 30 and therefore has 30 protons. Since the charge is 2+, we have two electrons less than protons.

So the number of protons = 30 and electrons = 28.

Comment

Step 3 of 7

c) N^{3-}: Nitrogen has atomic number 7 and therefore has 7 protons. Since the charge is 3-, we have three electrons more than protons.

So the number of protons = 7 and electrons = 10.

Comment

Step 4 of 7

d) Rb^{+}: Rubidium has atomic number 37 and therefore has 37 protons. Since the charge is +1, we have one electron less than proton.

So the number of protons = 37 and electrons = 36.

Comment

Step 5 of 7

e) Co^{3+}: Cobalt has atomic number 27 and therefore has 27 protons. Since the charge is +3, we have 3 electrons less than protons.

So the number of protons = 27 and electrons = 24.

Comment

Step 6 of 7

f) Te^{2-}: Tellurium has atomic number 52 and therefore has 52 protons. Since the charge is 2-, we have two electrons more than protons.

So the number of protons = 52 and electrons = 54.

Comment

Step 7 of 7

g) Br^{-}: Bromine has atomic number 35 and therefore has 35 protons. Since the charge is -1, there is one electron more than proton.

So the number of protons = 35 and electrons = 36.

65.

Step 1 of 2

For neutral atom number of protons is equal to number of electrons. Loss of 3 electrons indicates +3 charge of the atom. No. of protons i.e. atomic number 63 indicates europium "Eu"

Mass number of europium = No. of protons + No. of neutrons

= 63 + 88

= 151

Atomic symbol of europium ion is $^{151}_{63}Eu^{3+}$

Comment

Step 2 of 2

No of protons '50' indicates Sn (tin)

Number of electrons = 48

Loss of 2 electrons indicate Sn^{2+} state

Mass number = No. of protons + No. of neutrons

= 50 + 68

= 118

So atomic symbol of tin is $^{118}_{50}Sn^{2+}$

67.

Step 1

$^{238}_{92}U$ number of protons = 92

Number of electrons = 92

Number of neutrons = 238 − 92

= 146

Net charge = 0

Comment

Step 2

No. of protons 20 represent calcium

+2 charge indicates loss of two electrons so no

No. of neutrons = 20

Mass no = No. of protons + No. of neutrons

= 20 + 20

= 40

So atomic symbol of calcium ion is $^{40}_{20}Ca^{2+}$

Comment

Step 3

23 protons represent vanadium atom

Since no. of electrons = 20

Net charge = + 3

No. of neutrons + No. of protons = Mass no.

So mass number = 23 + 28

= 51

So atomic symbol of vanadium ion is $^{51}_{23}V^{3+}$

Comment

Step 4

$^{89}_{39}Y$

Number of protons = 39

Number of electrons = 39

Number of neutrons = 89 − 39

= 50

Net charge = 0

Step 5

35 protons indicate bromine atom

Since No. of electrons is 36, bromine exists as br

So net charge is "-1"

Mass number = 35 + 44

= 79

Atomic symbol of bromide ion is $^{79}_{35}Br^{-}$

Comment

Step 6

Number of protons 15 indicate phosphorous atom

Since net charge is "3-" , P exists as P^{3-}

No. of electrons = 15 + 3

= 18

Mass number = 15 + 16

= 31

So atomic symbol of phosphorous ion is $^{31}_{15}P^{3-}$

Step 7 of 7

Symbol	Number of protons in nucleus	Number of neutrons in nucleus	Number of electrons	Net charge
$^{238}_{92}U$	92	92	146	0
$^{40}_{20}Ca^{2+}$	20	20	18	2+
$^{51}_{23}V^{3+}$	23	28	20	3+
$^{89}_{39}Y$	39	50	39	0
$^{79}_{35}Br^{-}$	35	44	36	-1
$^{31}_{15}P^{3-}$	15	16	18	3-

69.

a) Radium (Ra) loses two electrons forming Ra^{2+} ion

b) In (indium) loses three electrons forming In^{3+} ion

c) Phosphorous can exhibit +3 and +5 oxidation states loosing 3 electrons and 5 electrons respectively. It can also exhibit -3 oxidation state by gaining three electrons.

d) Tellurium can loss and gain electrons

e) Bromine prefers to gain one electrons forming Br^- ion

f) Rubidium loses one electron forming Rb^{+1} ion

71.

Step 1 of 9

Binary Ionic Compounds contains a positive ion (Cation) always written first in the formula and a negative ion (anion). In naming these compounds, the following rules apply

- The cation is always named first and anion second
- A monatomic (meaning "one-atom") cation takes its name from the name of the element
- A monatomic anion is named by taking the root of the element name and adding –ide.

Compound Ions present Name

a) NaBr Na^+, Br Sodium bromide

Step 2

Compound Ions present Name

b) Rb_2O Rb^{+2} , O^{-2} Rubidium oxide

Comment

Step 3

Compound Ions present Name

c) CaS Ca^{+2},S^{-2} Calcium sulfide

Comment

Step 4

Compound Ions present Name

d) AlI_3 Al^{+3}, I^{-3} Aluminum iodide

Comment

Step 5

e) Strontium fluoride ---------- SrF_2

Step 6

f) Aluminum selenide --------- Al_2Se_3

Comment

Step 7

Comment

Step 8

g) Potassium nitride ------ K_3N

Comment

Step 9

h) Magnesium phosphide ---------- Mg_3P_2

73.

a) CsF: Cesium Fluoride

b) Li_3N : Lithium Nitride

c) Ag_2S : Silver Sulfide

d) MnO_2 : Manganese dioxide

e) TiO_2 : Titanium(IV) oxide

f) Sr_3P_2 : Strontium phosphide

75.

a) $BaSO_3$: Barium Sulfite

b) $NaNO_2$: Sodium Nitrite

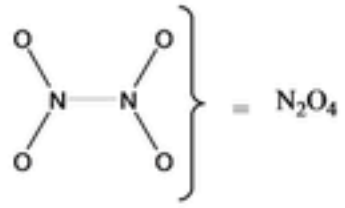
c) $KMnO_4$: Potassium Permanganate

d) $K_2Cr_2O_7$: Potassium Dichromate

77.

Step 1 of 4

a)

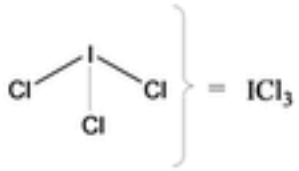


Dinitrogen tetroxide

Comment

Step 2 of 4

b)



Iodine Trichloride

Comment

Step 3 of 4

c) SO_2 : Sulfur Dioxide

Comment

Step 4 of 4

d) P_2S_5 : Diphosphorous Pentasulfide

79.

a) CuI : Copper (I) Iodide

b) CuI_2 : Copper (II) Iodide

c) CoI_2 : Cobalt (II) Iodide

d) Na_2CO_3 : Sodium Carbonate

e) $NaHCO_3$: Sodium bicarbonate

f) S_4N_4 : Tetra Sulfur Tetra Nitride

g) SF_6 : Sulfur Hexafluoride

h) $NaOCl$: Sodium Hypochlorite

i) $BaCrO_4$: Barium Chromate

j) NH_4NO_3 : Ammonium Nitrate

83.

a) Sulfur Difluoride: SF_2

b) Sulfur Hexafluoride: SF_6

c) Sodium Dihydrogen Phosphate: NaH_2PO_4

d) Lithium Nitride: Li_3N

e) Chromium (III) Carbonate: $Cr_2(CO_3)_3$

f) Tin (II) Fluoride: SnF_2

g) Ammonium Acetate: CH_3COONH_4

h) Ammonium Hydrogen Sulfate: NH_4HSO_4

i) Cobalt (III) Nitrate: $Co(NO_3)_3$

j) Mercury (I) Chloride: Hg_2Cl_2

k) Potassium Chlorate: $KClO_3$

l) Sodium Hydride: NaH

85.

Step 1

a) Sodium oxide ---------- Na_2O

Comment

Step 2

b) Sodium peroxide ---------- Na_2O_2

Comment

Step 3

c) Potassium cyanide --------- KCN

Comment

Step 4

d) Copper (II) nitrate ---------- $Cu(NO_3)_2$

Comment

Step 5

e) Selenium tetra bromide ---------- $SeBr_4$

87.

a) HNO_3: Nitric Acid

b) $HClO_4$: Perchloric Acid

c) CH_3COOH : Acetic Acid

d) H_2SO_4: Sulfuric Acid

e) H_3PO_4: Phosphoric Acid

93.

Step 1 of 4

Na_2X gives 2 Na^+ and X^{-2} ions

Number of electrons (X) = number of protons (X) + charge

36 = Number of protons + 2

There fore number of protons in X = 36-2

= 34

The number of neutrons = Atomic mass – number of protons

= 79 – 34

= 45

Atomic number (X) = 34 indicates Selenium (Se)

There fore X is Se

Ionic bonding: The electrostatic attraction between oppositely charged ions.

a) The binary compound formed between X and F is will be a covalent bond because of lower electro negativity difference between atoms so option a is true

Comment

Step 2 of 4

b) X contains 34 protons but not 38protons so statement is false

Comment

Step 3 of 4

c) X has 45 neutrons but not 41 neutrons so statement is false

Comment

Step 4 of 4

d) X is Se but not Sr so option d also false

99.

a) Calcium belongs to II A group. So oxidation state Ca^{2+}

N – being non metal has oxidation state

= Group no – 8

= 5 – 8

= -3

So formula of the ionic compound is Ca_3N_2 and it is calciumnitride.

Comment

Step 2 of 8

b) K belongs to IA group. So oxidation state is +1, K^+

O belongs to IV group. Oxidation state = 6 – 8

= -2

Formula of the ionic compound = K_2O, potassium oxide

Comment

Step 3 of 8

c) Rb belongs to IA group with +1 oxidation state

F belongs to VII A group with oxidation state = 7 – 8

= -1

Formula of the ionic compound = RbF, Rubidium fluoride

101.

Step 1 of 5

In the representation format ${}^{A}_{Z}\mathrm{X}$, here

Z = Number of protons
A = Number of protons + Number of neutrons
X = Atomic symbol

Comment

Step 2 of 5

Identify the each of the following elements:

(a) ${}^{31}_{15}\mathrm{X}$ nucleus has

$$\begin{aligned}\text{number of protons} &= 15\\ \text{number of electrons} &= 15\\ \text{number of neutrons} &= (31-15)\\ &= 16\end{aligned}$$

The atomic number 15 is corresponding to the element is **Phosphorous** (P). Therefore, $\boxed{{}^{31}_{15}\mathrm{P}}$ have **15 protons** and **16 neutrons**.

Comment

Step 3 of 5

(b) ${}^{127}_{53}\mathrm{X}$ nucleus has

$$\begin{aligned}\text{number of protons} &= 53\\ \text{number of electrons} &= 53\\ \text{number of neutrons} &= (127-53)\\ &= 74\end{aligned}$$

The atomic number 53 is corresponding to the element is **Iodine** (I). Therefore, $\boxed{{}^{127}_{53}\mathrm{I}}$ have **53 protons** and **74 neutrons**.

Comment

Step 4 of 5

(c) ${}^{39}_{19}\mathrm{X}$ nucleus has

$$\begin{aligned}\text{number of protons} &= 19\\ \text{number of electrons} &= 19\\ \text{number of neutrons} &= (39-19)\\ &= 20\end{aligned}$$

The atomic number 19 is corresponding to the element is **Potassium** (K). Therefore, $\boxed{{}^{39}_{19}\mathrm{K}}$ have **15 protons** and **16 neutrons**.

Step 5 of 5

(d) ${}^{173}_{70}\mathrm{X}$ nucleus has

$$\begin{aligned}\text{number of protons} &= 70\\ \text{number of electrons} &= 70\\ \text{number of neutrons} &= (173-70)\\ &= 103\end{aligned}$$

The atomic number 70 is corresponding to the element is **Ytterbium** (Yb). Therefore, $\boxed{{}^{173}_{70}\mathrm{Yb}}$ have **70 protons** and **103 neutrons**.

103.

Step 1 of 2

The following table shows each nucleus has number of protons, number of neutrons and number of electrons:

Atom / Ion	Protons	Neutrons	Electrons
$^{120}_{50}\mathrm{Sn}$			
$^{25}_{12}\mathrm{Mg}^{2+}$			
$^{79}_{34}\mathrm{Se}$			
$^{35}_{17}\mathrm{Cl}$			
$^{62}_{29}\mathrm{Cu}$			

Comment

Step 2 of 2

Take $^{120}_{50}\mathrm{Sn}$ which has

$$\begin{aligned}\text{number of protons} &= 50\\ \text{number of electrons} &= 50\\ \text{number of neutrons} &= (120-50)\\ &= 70\end{aligned}$$

Therefore, $^{120}_{50}\mathrm{Sn}$ have 50 protons, 50 electrons, and 70 neutrons.

Similarly, do the calculations for remaining atoms which tabulated as shown below.

Atom / Ion	Protons	Neutrons	Electrons
$^{120}_{50}\mathrm{Sn}$	50	70	50
$^{25}_{12}\mathrm{Mg}^{2+}$	12	13	10
$^{79}_{34}\mathrm{Se}$	34	45	34
$^{35}_{17}\mathrm{Cl}$	17	18	17
$^{62}_{29}\mathrm{Cu}$	29	34	29