**JESUS AND MARY SCHOOL AND COLLEGE**

**SUBJECT – CHEMISTRY**

**CHAPTER – Language of Chemistry**

**CLASS – IX Worksheet– 1**

**Symbols:**

***A specific abbreviation used to denote an element is called its Symbol***. A symbol represents the short form of an element. Symbol denotes a single atom of an element. **John Dalton** was the 1st scientist who represented elements based on the pictorial symbols. In 1814 a Swedish chemist **Jacob Berzelius** devised a system using letters of the alphabets to represent the elements.

**Symbols of elements used often:**

There are over 117 elements known and each element has been assigned a particular symbol. This has been done by

1. *In most of the cases the first letter of the English name of the element has been taken as its symbol. This first letter is written in capital.* For Example:

|  |  |  |
| --- | --- | --- |
| **Element** | **English name** | **Symbol** |
| Hydrogen | Hydrogen | H |
| Carbon | Carbon | C |
| Boron | Boron | B |
| Iodine | Iodine | I |
| Sulphur | Sulphur | S |
| Oxygen | Oxygen | O |
| Vanadium | Veh-Nay-dee-em (Scandinavium) | V |
| Tungsten | Wolfram (German) | W |
| Nitrogen | Nitrogen | N |

1. *When the names of more than one element begin with the same alphabet, then the first letter along with some other prominent letter in their names is taken as their symbols. In such cases the first letter is written in capital while the second letter is written in small.* For Example:

|  |  |  |
| --- | --- | --- |
| **Element** | **English name** | **Symbol** |
| Carbon | Carbon | C |
| Calcium | Calcium | Ca |
| Chromium | Chromium | Cr |
| Chlorine | Chlorine | Cl |
| Cobalt | Cobalt | Co |
| Phosphorus | Phosphorus | P |
| Platinum | Platinum | Pt |
| Palladium | Palladium | Pd |
| Lead | Plumbum (Latin name) | Pb |
| Boron | Boron | B |
| Bromine | Bromine | Br |

1. *The symbols of some elements have been derived from their Latin names.* For Example:

|  |  |  |
| --- | --- | --- |
| **Element** | **English name** | **Symbol** |
| Sodium | Natrium | Na |
| Potassium | Kalium | K |
| Gold | Aurum | Au |
| Silver | Argentum | Ag |
| Copper | Cuprum | Cu |
| Mercury | Hydrargyrum | Hg |
| Lead | Plumbum | Pb |
| Tin | Stannum | Sn |
| Iron | Ferrum | Fe |

**Atom:**

The smallest particle of an element which characterizes all the properties of the element is called an atom. An atom is made up of small particles such as electrons, protons and neutrons which take part in a chemical reaction. It may or may not occur freely in nature.

**Element:**

Each element is made up of atoms. Elements can independently exist in atomic form or molecular form.

**Molecule:**

A molecule is defined as the smallest possible particle of a substance which has all the properties of that substance and can exist freely in nature. In other words it can be said a molecule is a group of atoms which are bonded together in a specific arrangements.

A molecule can have one atom (e.g. He, Ar) or more atoms (e.g. O2, N2, O3 etc.)

**Atomicity:**

The number of atoms present in a single molecule of an element is called its atomicity. Example: Atomicity of H2 is 2, Atomicity of O3 is 3, Atomicity of P4 is 4, and Atomicity of S8 is 8.

**VALENCY**

The combining capacity of an atom or a radical is called its valency.

It is basically the number of electrons gained, lost or shared during the chemical reaction to attain the stable electronic configuration of a nearest noble gas.

**For Metals:**

Metals always lose electrons and therefore their valency is always taken as positive. Depending up on the number of electrons lost metals can be categorized as:

1. Monovalent: $Na-1e$**-** $ \rightarrow Na$+
2. Bivalent: $Mg-2e$**-**$ \rightarrow Mg$ **2+**
3. Trivalent: $Al - 3e$**-**$ \rightarrow Al$**3+**
4. Tetravalent: $Sn - 4e$**-**$\rightarrow Sn$**4+**

Note: The number of electrons present in the outermost shell of a metal can be said its valency because metals can only lose the electrons present in the outermost shell.

**For Non-metals:**

Non-metals always gain or share electrons, therefore their valency is always taken as negative. The number of electrons gained or shared by a non-metal is equal to its valency. Depending up on the number of electrons gained or shared they can be categorized as:

1. Monovalent: $F + 1e$**-**$ \rightarrow F$**1-**
2. Bivalent: $O + 2e $**-**$\rightarrow O$**2-**
3. Trivalent: $ N + 3e$**-**$ \rightarrow N$**3**-

**Variable Valency:**

Some elements exhibit more than one valency in their compounds. Such elements are said to show variable valency.

*Reason for exhibiting variable valency:*  An atom can sometimes lose more electrons present in its valence shell (outermost shell). i.e. they lose electron from the penultimate shell. Penultimate shell is the second last shell of an atom. The lower valency atom is represented by using suffix ‘ous’ while the higher valency is represented by using suffix ‘ic’. Example: Cuprous (Cu1+)and Cupric (Cu2+).

|  |
| --- |
| VARIABLE VELENCY |
| 1+ | 2+ | 3+ | 4+ |
| **Cu** | **Cu** |  |  |
| **Hg** | **Hg** |  |  |
| **Ag** | **Ag** |  |  |
| **Au** |  | **Au** |  |
|  | **Fe** | **Fe** |  |
|  | **Pb** |  | **Pb** |
|  | **Sn** |  | **Sn** |
|  | **Mn** |  | **Mn** |
|  | **Pt** |  | **Pt** |

**Radicals:**

A radical can be defined as an atom or group of atoms of the same or different elements that carries positive or negative charge and behaves like a single unit.

Positively charged radicals are basic radicals or cations, these are electropositive ions

Negatively charged radicals are acidic radicals or anions, these are electronegative ions

Every radical has its own combining capacity or valency. The valency of a radical is usually equal to the number of charges present on it. Depending upon the valency radicals can be monovalent (valency = 1), bivalent (valency = 2), trivalent (valency = 3) and tetravalent (valeny = 4).

Given below is a table showing valencies of various elements:

|  |  |
| --- | --- |
| **POSTIVE RADICALS** | **NEGATIVE RADICALS** |
| **VALENCY 1 – Monovalent elements** | **VALENCY 1 – Monovalent Elements** |
| Potassium | **K1+** | Chloride | **Cl-** |
| Lithium | **Li1+** | Chlorate | **ClO3-** |
| Sodium | **Na1+** | Hypochlorite | **ClO-** |
| Hydrogen | **H1+** | Bromide | **Br-** |
| Ammonium | **NH41+** | Iodide | **I-** |
| Cuprous | **Cu1+** | Hydroxide | **OH-** |
| Argentous | **Ag1+** | Nitrite | **NO2-** |
| Mercurous | **Hg1+** | Nitrate | **NO3-** |
| Aurous | **Au1+** | Bicarbonate | **HCO3-** |
| **VALENCY 2 – Divalent elements** | Bisulphite | **HSO3-** |
| Calcium | **Ca2+** | Bisulphate | **HSO4-** |
| Magnesium | **Mg2+** | Aluminate | **AlO2-** |
| Zinc | **Zn2+** | Permanganate | **MnO4-** |
| Barium | **Ba2+** | **VALENCY 2 – Divalent Elements** |
| Nickel | **Ni2+** | Sulphite | **SO32-** |
| Cobalt | **Co2+** | Sulphate | **SO42-** |
| Argentic | **Ag2+** | Sulphide | **S2-** |
| Mercuric | **Hg2+** | Carbonate | **CO32-** |
| Ferrous | **Fe2+** | Oxide | **O2-** |
| Plumbous | **Pb2+** | Chromate | **CrO42-** |
| Stannous | **Sn2+** | Dichromate | **Cr2O72-** |
| Platinous | **Pt2+** | Peroxide | **O22-** |
| Manganous | **Mn2+** | Silicate | **SiO32-** |
| Cupric | **Cu2+** | Zincate | **ZnO22-** |
| **VALENCY 3 – Trivalent Elements** | Plumbite | **PbO22-** |
| Aluminium | **Al3+** | **VALENCY 3 – Trivalent Elements** |
| Chromium | **Cr3+** | Phosphate | **PO43-** |
| Ferric | **Fe3+** | Nitride | **N3-** |
| Auric | **Au3+** | Phosphite | **PO33-** |
| **VALENCY 4 – Tetravalent Elements** | **VALENCY 4 – Tetravalent Elements** |
| Plumbic | **Pb4+** | Carbide | **C4-** |
| Stannic | **Sn4+** |
| Platinic | **Pt4+** |
| Manganic | **Mn4+** |

**Method of writing a chemical formula (Criss cross method):**

A compound is electrically neutral and is a combination of positive and negative radicals. This combination is in such a manner that both positive and negative charge neutralise each other. The method of writing the formula of a chemical is called ***criss-cross method***. The following steps are involved in it:

1. Write down the cation (basic radical) and anion (acidic radical) side by side. Make sure cation is written first.
2. Write down the of each radical on the top of its symbol. Ignore + and – sign.
3. Divide the valencies by the highest common factor (if any) to obtain a simple ratio.
4. Interchange the valencies and write them on the lower right side of each symbol. There is no need to write the number 1.

Example: Lets find out the formula of Calcium Nirtide

1. Write the symbols of both cation and anion

 **Ca2+ N3-**

1. Writing the valency of radicals:

 **Ca2 N3**

1. Interchange the valency numbers and write them on lower right side of each sumbol:

 **Ca3 N2**

Thus the formula for Calcium Nitride is **Ca3N2**

**EXERCISE:**

**Question 1:**

Write the symbol for the following elements:

1. Gold
2. Copper
3. Kalium
4. Plumbum
5. Natrium
6. Cobalt
7. Silver
8. Vanadium
9. Antimony
10. Boron
11. Bromine

**Question 2:**

Match the following radicals in column A with their correct formula in column B:

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No.** | **COLUMN A** | **S.No.** | **COLUMN B** |
| 1. | Chromate | A. | ZnO22- |
| 2. | Sulphate | B. | PO43- |
| 3. | Carbide | C. | PbO22- |
| 4. | Zincate | D. | CrO42- |
| 5. | Plumbite | E. | C4- |
| 6. | Phosphate | F. | N3- |
| 7. | Permanganate | G. | OH- |
| 8. | Peroxide | H. | SO42- |
| 9. | Hydroxide | I. | O22- |
| 10. | Nitride | J. | MnO4- |

**Question 3:**

Exhibit the variable valencies of the following elements and name them:

1. Lead
2. Iron
3. Mercury
4. Tin
5. Silver

**Question 4:**

Write the formula of the following compounds by using criss - cross method:

1. Ammonium hydroxide
2. Potassium dichromate
3. Aluminium chloride
4. Calcium bicarbonate
5. Magnesium zincate

**Question 5:**

An element X forms a cation X2+, give the formula of the compound of this cation with the following anions:

1. Phosphite
2. Sulphate
3. Carbonate
4. Nitrite
5. Chromate
6. Hydroxide
7. Chloride
8. Carbide

**NOTE: Please do this work in your old copies which will be checked when the school reopens. Please consider this important.**