### CHEMISTRY CLASS 9

### **CLASS WORK**

#### Chemical formulae and equations

Derivation of formulae (key points)

**Chemical Formula Definition:** An expression which states the number and type of atoms present in a molecule of a substance.

Chemical formulas such as HClO4 can be divided into empirical formula, molecular formula, and structural formula. Chemical symbols of elements in the chemical formula represent the elements present, and subscript numbers represent mole proportions of the proceeding elements. Note that no subscript number means a subscript of 1.

From a chemical point of view, an element contained in the substance is a fundamental question, and we represent the elemental composition by a chemical formula, such as H2O for water. This formula implies that the water molecules consist of 2 hydrogen, and 1 oxygen atoms. The formula H2O is also the molecular formula of water. For non-molecular substances such as table salt, we represent the composition with an empirical formula. Sodium chloride is represented by NaCl, meaning that sodium and chlorine ratio in sodium chloride is 1 to 1. Again, the subscript 1 is omitted. Since table salt is an ionic compound, the formula implies that numbers of Na+ ions, and Cl- ions are the same in the solid. The subscript numbers in an empirical formula should have no common divisor.

<b>Common Chemical Formula List</b>		
NaCl	Sodium chloride	
H <sub>2</sub> O	Water	
$C_6H_{12}O_6$	Glucose	
C <sub>2</sub> H <sub>6</sub> O	Alcohol	
CaSO <sub>4</sub>	Sulfate Group	
H <sub>2</sub> S	Hydrogen Sulfide	
NaCl	Salt	
$O_2$	Oxygen	
C <sub>2</sub> H <sub>6</sub> O	Ethanol	

$C_2H_4O_2$	Vinegar	
NH <sub>3</sub>	Ammonia	
MgCl2	Magnesium Chloride	
$C_2H_4O_2$	Acetic Acid	
C <sub>4</sub> H <sub>10</sub>	Butane	
NO <sub>3</sub>	Nitrate	
CuO	Copper Oxide	
$N_2$	Nitrogen	
$CO_2$	Carbon Dioxide	
H <sub>2</sub> SO <sub>4</sub>	Sulfuric Acid	
CH <sub>4</sub>	Methane	
$C_{12}H_{22}O_{11}$	Sucrose	
$C_3H_8$	Propane	
NaHCO <sub>3</sub>	Baking Soda	
LiCl	Lithium chloride	
$\mathbf{F}_2$	Fluoride	
$H_2O_2$	Peroxide	
$C_8H_{10}N_4O_2$	Caffeine	
NaCl	Sodium Chloride	
C <sub>9</sub> H <sub>8</sub> O <sub>4</sub>	Aspirin	
HCl	Hydrochloric Acid	
Zn(NO <sub>3</sub> ) <sub>2</sub>	Zinc	
CO	Carbon Monoxide	
NaOH	Sodium Hydroxide	
NaCN	Sodium Cyanide	
Ca(CN) <sub>2</sub>	Calcium Cyanide	

### **BALANCING CHEMICAL EQUATIONS**

What is a balanced equation?

A chemical equation is balanced when the number of atoms of each type on each side of the equation is the same. Which means if you have 12 hydrogens on the left hand side of the equation, you must have 12 hydrogens on the right hand side, if there are 4 oxygens on the left, there must 4 oxygens on the right, and so on. This is because of the law of conservation of mass - you can't make or destroy atoms during a chemical reaction. But you can't just add atoms at random to each side, you have to work with the molecules of the reactants. Also, you will find it very tricky to try to balance a word equation, it is very much easier to use a chemical equation with chemical symbols, as then you will be able to see how many atoms of each type are in each chemical.

Example 1

Unbalanced Equation:- C3H8 + O2 ---> H2O + CO2

There are three carbons on the left, but only one on the right.

There are eight hydrogens on the left but only two on the right.

There are two oxygens on the left but three on the right.

Balanced Equation:- C3H8 + 5O2 ---> 4H2O + 3CO2

How do we balance the equation?

Balancing chemical equations isn't difficult, once you know the way to do it. Start by finding out how many atoms of each type are on each side of the equation. Some teachers recommend making a little table listing the numbers of each atom for the left hand side and for the right hand side.

Next, look for an element which is in only one chemical on the left and in only one on the right of the equation. (But it is usually a good idea to leave hydrogen and oxygen until you've done the others first.)

To balance that element, multiply the chemical species on the side which doesn't have enough atoms of that type by the number required to bring it up to the same as the other side. The number is called the coefficient.

**BUT** 

If you have to multiply by, say, 2 1/2, do so, THEN multiply EVERYTHING on each side of the equation by two to get rid of the half.

We don't like having halves in equations, as you can't get half a molecule.

Now look for the next element or species that is not balanced and do the same thing.

Repeat until you are forced to balance the hydrogen and oxygens.

If there is a complex ion, sometimes called a polyatomic ion, on each side of the equation that has remained intact, then that can often be balanced first, as it is acts as a single species. The ions NO3- and CO32- are examples of a complex ion.

A VERY useful rule is to leave balancing oxygen and hydrogen to the last steps as these elements are often in more than one chemical on each side, and it is not always easy to know where to start. Some people also say you should leave any atom or species with a valancy of one one until the end, and also generally leave anything present as an element to the end.

In Example 1 above, you would balance the carbons first, by putting a 3 in front of the CO2, then balance the hydrogens by putting a 4 in front of H2O and finally the oxygens (which are in more than one compound on the right, so we leave them until last) by putting a 5 in front of the O2.

Example 2

Unbalanced equation:- H2SO4 + Fe ---> Fe2(SO4)3 + H2

Balance the SO4 first (as it is a complex ion and it is in one chemcial species on each side)

3H2SO4 + Fe ---> Fe2(SO4)3 + H2

Now balance the Fe (which is also in one chemical on each side)

3H2SO4 + 2Fe ---> Fe2(SO4)3 + H2

Finally, balance the hydrogen (although it is in one chemical species on each side, it is usually a good idea to leave it until last)s

Balanced Equation: 3H2SO4 + 2Fe ---> Fe2(SO4)3 + 3H2

We alter the coeficients in the equation.

Do NOT touch the subscripts for the atoms in a chemical species, or you will change it into an different chemical. That would be a bit like saying I want six chicken legs for a meal, so I'll go get a six-legged chicken. As chickens have two legs, you will need three normal, two-legged, chickens, not a six-legged mutant monster, probably from outer space.

If you start by trying to balance something which is in more than one species on one side, you can't easily tell which species you should have more of, and so can end up going round in circles, continually altering things. If this happens, just start again, but balancing atoms or complex ions that are in one species on each side. (This is important or it will not work.)



# The City School North nazimabad boys campus Scheduled test

# MCQ Chemistry Class 9

## Q.1. Choose the best answer:

/10

- I. A strontium atom differs from a strontium ion in that the atom has a greater
  - a. number of electrons
  - b. number of protons
  - c. atomic number
  - d. mass number
- II. What is the general relationship between lattice energy and ionic bond strength?
  - a. The greater the lattice energy, the weaker the ionic bond
  - b. there is no relationship
  - c. the greater the lattice energy, the stronger the ionic bond
  - d. the weaker the lattice energy, the stronger the ionic bond
- III. Magnesium oxide may be used for the lining of an electric furnace for making crockery. Which properties of magnesium oxide help to explain this use?

	strong forces	ionic bonding	electrical
	between		conductor
	particles		
Α	Yes	Yes	No
В	Yes	No	Yes
С	No	Yes	No
D	No	No	Yes

IV. The table shows the electronic structures of four atoms.

atom	electronic structure	
W	2,8,1	
Х	2,8,4	
Υ	2,8,7	
Z	2,8,8	

Which two atoms combine to form a covalent compound?

- a. W and X
- b. W and Y
- c. X and
- d. D X and Z
- V. The following statement is about chemical bonds. Covalent bonds are formed by the ...1... of electrons. Covalent substances have ...2... electrical conductivity. Which words complete the statement?

	1	2
Α	Sharing	High
В	Sharing	Low
С	Transfer	High
D	Transfer	Low

- VI. How does a magnesium atom form a bond with an oxygen atom?
  - a) by giving one pair of electrons to the oxygen atom
  - b) by sharing one pair of electrons, both electrons provided by the magnesium atom
  - c) by sharing two pairs of electrons, both pairs provided by the oxygen atom
  - d) by sharing two pairs of electrons, each atom donating one pair of electrons5
- VII. . The formulae of the ions of four elements are shown below.

Which statement about these ions is correct?

### They all have

- a) The same number of electrons in their outer shells.
- b) The same electronic structure as a noble gas.
- c) The same number of protons in their nuclei.
- d) More electrons than protons.

VIII. What happens when sodium chloride melts?

- a. Covalent bonds in a giant lattice are broken.
- b. Electrons are released from atoms.
- c. Electrostatic forces of attraction between ions are overcome.
- d. Molecules are separated into ions.
- IX. Below are two statements about metals.
  - 1 Metals contain a lattice of negative ions in a 'sea of electrons'.

2 The electrical conductivity of metals is related to the mobility of the electrons in the structure. Which is correct?

- a. Both statements are correct and statement 1 explains statement 2.
- b. Both statements are correct but statement 1 does not explain statement 2.
- c. Statement 1 is correct and statement 2 is incorrect.
- d. Statement 2 is correct and statement 1 is incorrect.
- X. Which statement shows that diamond and graphite are different forms of the element carbon?
  - a. Both have giant molecular structures.
  - b. Complete combustion of equal masses of each produces equal masses of carbon dioxide as the only product.
  - c. Graphite conducts electricity, whereas diamond does not.
  - d. Under suitable conditions, graphite can be converted into diamond.

# **subjective**

Q.2.Gi	ve scientific reasons:	/10	
i.	Ionic compounds have high melting points.		
ii.	Ionizing energy of group I elements is less than group II elements.		
iii.	Non- metals make An ion.		
iv.	Ionic compounds make crystals.		
V.	Graphite conducts electricity but diamond another allotrope of carbon can	't conduct electricity	
Q.3.		/4	

I. Describe with the aid of a diagram the bonding in a sodium chloride crystal.

- II. Suggest the type of bonding that is present in sodium chloride.
- III. What is the oxidation number of hydrogen in sodium chloride?
- IV. What happens when we apply force on a crystal of sodium chloride? Explain with the help of arrangement of atoms in lattice.

# Q.4. Give one similarity and one difference between:

/6

	Ionic bonding	Covalent bonding	Metallic bonding
Similarity			
Difference			