Chemistry IX Notes by Suprin Aziz (JEST BPS 14) GBCHS LAKHAT

Link:

gbchslakhat.sobdar.com/classix/chemistry/chapter1.pdf

CHAPTER 1

Section A

Multiple Choice Questions

Tick Mark the Correct answer

1- The branch of chemistry that deals with hydrocarbons:
(a) Industrial Chemistry (b) Inorganic chemistry **(c) Organic Chemistry** (d) Physical Chemistry

2- The atomic mass of an element expressed in gram is (*mistake in the book: 1 mole can also be right*)
(a) Gram Molecular mass **(b) Gram Atomic Mass** (c) Gram formula mass (d) Mole

3- Which of the following can be separated by physical means?
(a) Mixture (b) Element (c) Compound (d) Substance

4- The mol(ecul)ar mass of H_2SO_4 is (*mistake in the book: Molar and molecula mass are different things*)
(a) 98 a.m.u (b) 9.8 gm (c) 98 gm **(d) 9.8 a.m.u**

5- The Molecule consist of two atoms is
(a) Monoatomic molecule (b) Polyatomic molecule (c) hetero atomic molecule **(d) Di atomic molecule**

6- A formula that indicates actual number and type of atoms in a molecule is called
(a) Chemical Formula (b) Empirical formula **(c) Molecular Formula** (d) Formula mass

7- Ethyl alcohol was prepared by
(a) Ibne-Sina **(b) Al-Razi** (c) Al-Beruni (d) Jaber bin-Hayan

8- Which of the following is a homo atomic (*mistake in the book: "Not" is a typo in the book*)
(a) H_2 (b) NH_3 (c)H_2O (d) CO_2

9- The Empirical Formula of hydrogen peroxide is
(a) H_20_2 **(b) HO** (c) OH (d) O_2H_2

10- A piece of matter in pure form is termed as
(a) Radical (b) Mixture (c) Compound **(d) Substance**

Section B

Short Questions

1- Differentiate between the physical and analytical chemistry?

	Physical Chemistry	Analytical Chemistry
1	It is a branch of chemistry that deals with the relationship between the composition and physical properties of matter and with the change in them.	It is branch of science that deals with separation and analysis.
2	It also deals with laws and principles governing the combination of atoms and molecules in chemical reaction.	It deals with analysis of kind, quality and quantity of various components in given substance It is used in chromatography, electrophoresis and spectroscopy.
3	It is combination of physics and chemistry.	It is combination of analytics and chemistry.

2- Write down the classification of molecule?

Following are the classification of the molecule

a) Mono Atomic molecule
Molecule consists of one atom e.g Helium (He), Neon (Ne) and Argon (Ar)

b) Di Atomic Molecule
Molecule consists of two atoms e.g Hydrogen (H_2), Oxygen (O_2) and Chlorine (Cl_2)

c) Tri Atomic Molecule
Molecule consists of three atoms e.g Water (H_20) and Carbon Dioxide (CO_2)

d) Poly Atomic Molecule
Molecule consists of many atoms e.g CH_4, $C_6H_{12}O_6$ and H_2SO_4.

e) Homo Atomic Molecule
Molecule consists of same of same type of atom e.g H_2, O_2, and P_4.

f) Hetero Atomic Molecule
Molecule consists of different type of atom e.g CO_2, H_2O, NH_3

3- Identify the difference among the following:

(a) Atom & Ion

Atom	Ion
1) It is a building block of an element.	1) It is not a building block of elements. It is instead a building block of an ionic compound.
2) It is not obtained by lose or gain of electrons in atom	2) It is obtained after lose or gain of electron in atom.
3) It is neutral	3) It can never be neutral. It would be always negative or positive.
4) It is less reactive	4) It is highly reactive
5) It can make any bond	5) It is result of ionic bond
6) It can form a molecule or formula unit.	6) It will always form a formula unit
7) Electron remain inside one atom	7) Electrons are transferred from one element to atom to another.
8) It can combine to form acid, base, salt but also other compounds.	8) It mostly only forms acid, base, and salt.
9) Examples: hydrogen, Oxygen, Nitrogen etc	9) Examples: NaCl, HCL, NaOH etc

(b) Molecule and Molecular ion

	Molecule	Molecular Ion
1	It is combination of two or more elements through a covalent bond.	It is a molecule that has lost or gains an electron.
2	It is neutral.	It is not neutral. (It must be positive or negative)
3	It is not much reactive.	It is highly reactive.
4	It has covalent bond	It has covalent bond too but it also forms a ionic bond between one molecule and other molecule or atom.
5	There is just sharing of electrons.	There is sharing as well as transfer of electrons.
6	It is a smallest part of compound itself.	It is a sub part of an compound.
7	It doesn't always form a salt, acid or base.	It mostly forms salt, acid or base.
8	Example: H_20, CO_2	Example: CH_2COO^-, CH^+_4

(c) Compound and Mixture

	Compound	Mixture
1	It is a chemical combination.	It is a physical combination
2	It cannot be easily separated by physical means.	It can be easily separated by physical means.
3	It mostly need or produce heat and energy.	It normally doesn't need or produce that much heat or energy.
4	Resultant compound has new identity and properties.	Resultant mixture has properties and identity of substance mixed.
5	It has reactants and products.	It has solvent and solutes.
6	It has fixed composition by mass	It doesn't have fixed composition by mass
7	Example: H_20, CO_2, NaCL, HCL, NaOH etc	Example: Mixture of sugar and water, metal alloy, coin, rock, etc

4- Define the following terms

(a) Gram Atomic Mass

The Atomic mass expressed in grams is called Gram Atomic Mass. It uses gram unit instead of a.m.u. It is always directly derived from the atomic mass.

Gram Atomic Mass of Hydrogen = 1 Grams

(b) Gram Molecular Mass

The Molecular mass expressed in grams is called Gram Molecular Mass. It uses gram unit instead of a.m.u. It is obtained by addition of gram atomic mass of all elements according to their ration in the molecule.

For Example:

Gram Molecular Mass of Water (H_20) = 18 Grams

(c) Gram Formula Mass

The Formula mass expressed in grams is called Gram Formula Mass. It uses gram unit instead of a.m.u. It is obtained by addition of gram atomic mass of all elements according to their ratio in the formula.

For Example:

Gram Formula Mass of Common Salt (NaCl) = 58 Grams

5- Write down the chemical, Empirical and molecular formula of the following?

Name	Chemical Formula	Empirical Formula	Molecular Formula
Sulphuric Acid	H_2SO_4	H_2SO_4	H_2SO_4
Carbon Dioxide	CO_2	CO_2	CO_2
Glucose	$C_6H_{12}O_6$	CH_2O	$C_6H_{12}O_6$
Benzene	C_6H_6	CH	C_6H_6

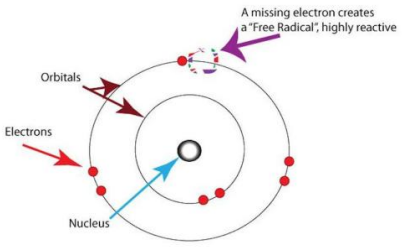
6- What is Free Radical?

Free Radical:

It is an atom that has at least one unpaired electron. The element that has all electrons locked in pairs can never be a free radical. However, even if there is one unpaired electron in the outer most shell of an atom, it would be called Free Radical

For Example:

Sodium, Hydrogen, Chlorine etc



7- Describe relationship between empirical and molecular formula? Explain with examples

a) Empirical Formula:

Empirical formula is simplest expression of the chemical formula.

b) Molecular Formula:

However, the molecular formula is the actual representation of the atoms present in the compound.

c) Relationship between both:

The only relationship between the both is that both are derived from the chemical formula and it can be converted from one to another. Taking out the simplest ratio from molecular formula would convert it into empirical formula and multiplying the empirical formula with the simplest ratio will convert it into the molecular formula.

d) For Example:

i) Chemical Formula of glucose:

$C_6O_{12}H_6$

ii) Empirical Formula of glucose:

CO_2H Simplest Ratio= 6

iii) Molecular Formula of glucose:

Multiplying 2(Simplest Ratio) with CO_2H will result in molecular formula.

$C_6O_{12}H_6$

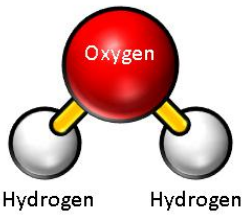
8- Explain why hydrogen and oxygen are considered as elements whereas water is compound

a) Elements

Element is the pure form of substance. They cannot be further divided. Hydrogen and Oxygen are based on individual atoms and are not a combination of more than one substance. Hence, the Hydrogen and Oxygen are elements.

b) Compound

On the other hand, Compound is combination of two or more elements. Hence, it always contain more than one type of atoms. In this context, Water is combination of two elements i.e hydrogen and oxygen joint together to form a molecule. Any things which has more than one element combined together is a compound. Therefore water is a compound while hydrogen and oxygen are elements.



Section C

Detailed Questions

1. What do you mean chemical species; explain ion, molecular ion and free radical?

a) Chemical species:

If one substance, atom, formula or molecule is identical to another one, it can be said that they both belongs to same chemical species. Chemical Species is a chemical entity, such as particular atom, ion, or molecule.

b) Ion

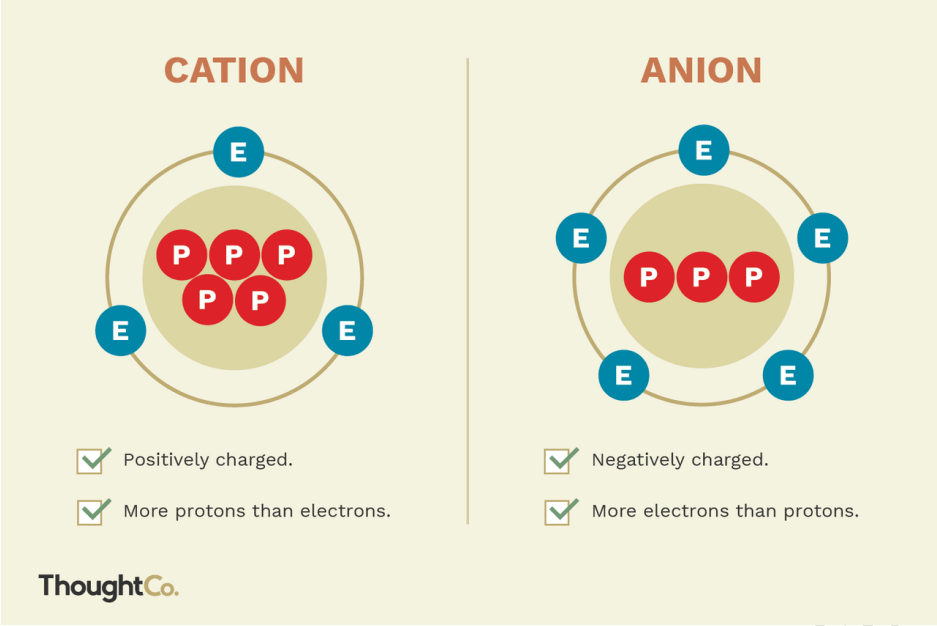
When an atom loses or gains an electron to form an ionic bond. The atom that loses or gains a electron is called ions. There are two types of ions.

a. Cation

When an atom gains an electron, the negative electrons outnumber the positive proton hence it becomes a negative ion and is called a Cat-Ion.

b. Anion

When atom loses an electron, the positive protons outnumber the negative electrons hence it becomes a positive ion and it is called an An-Ion.



c) Molecular Ion

When an whole molecule loses or gains an electron, it becomes a molecular ion. There are two types of molecular Ions

a. Cationic Molecular Ion

When a molecule gains an electron, the negative electrons outnumber the positive proton hence it becomes a negative molecular ion and is called a Cationic molecular ion.

b. Anionic Molecular Ion

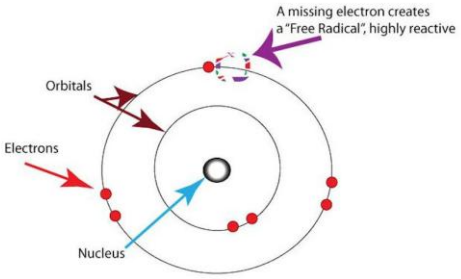
When a molecule loses an electron, the positive protons outnumber the negative electrons hence it becomes a positive molecular ion and it is called an Anionic molecular ion.

d) Free Radical

It is an atom that has at least one unpaired electron. The element that has all electrons locked in pairs can never be a free radical. However, even if there is one unpaired electron in the outer most shell of an atom, it would be called Free Radical

For Example:

Sodium, Hydrogen, Chlorine etc



2. Write down the applications of chemistry in daily life?

Chemistry is part of daily life in following ways.

a) Water as the building block of life.

Water, which is known as H_2O in chemistry is the most common chemical compound on the earth and a universal solvent. It is essential chemical to sustain life hence chemistry allow us to under it and utilize it for the betterment of the life. With chemistry, it was impossible to understand the building block of life. Chemistry allows to forming water out of hydrogen and water and breaking it into them again through electrolysis.

b) Cooking, Eating and digestion of the food as chemical processes.

Distillation, boiling, melting, solidification, de-moisturation, moisturation during the cooking of food are all chemical processes. Without them, cooking was impossible. Eating and Digestion also involves chemicals

such as HCL, Saliva and others to dilute and digest the food. The salt, sugar, baking soda, vinegar, coconut oil and everything used for cooking are also part of chemistry and chemicals.

c) Use of chemistry in constructions, cleaning, washing of our homes.
From cement, Fe (iron), silicon oxide(sand) and many other chemicals for construction. To cleaning using chemical detergents, NaOH, Washing soda, bleach and finally to use of extensive chemical for washing our homes, everything involves chemistry.

d) Use of chemistry in purification of water and other eatables.
Different chemicals such as chlorine are used to purify the water and other eatable products. Similarily preservatives are used to preserve natural fruit juices, frozen food, vegetables, fruits, rice , wheat and many other eatables. Without chemistry it was hardly possible.

e) Use of chemistry in industries.
Bleaching agent is chemical product used for whitening of clothes, homes and other things. Disinfectants are used to beat the virus and bacteria and were widely used to counter the recent COVID-19. Solvents are used for making number of candy, cements, painting, home paint, furniture paint, clothes dying etc. Pesticides are used to save crops. Refrigerates are used to keep our fridges and air-conditions working. PVC is basic of all plastic we use, from pipes to washing machines to room coolers and dispensers. In same manners, drugs are also product of chemistry. Without Chemistry, none of this was possible.

3. Explain in detail empirical and molecular formula?

a) Empirical Formula

This formula shows minimum relative numbers of each type of atoms in a molecule is called empirical formula

- It shows simplest ratio of each atom present in a compound
- It does not show the actual number of atoms in the molecule
- It tells us the type of element present in it

For Example:

Benzene has molecular formula C_6H_6. The Simplest ratio of Hydrogen and carbon is 1:1, so the empirical formula becomes CH.

b) Molecular Formula

This Formula show actual number of atoms of each element present in a molecule.

- It is derived from empirical formula
- It's Mass Calculated by adding atomic weights of its atoms.
- It may be same or multiple of empirical formula

For Example:

Molecular formula of benzene is C_6H_6, which has six carbon and six hydrogen. Molecular formula is an integral multiple of empirical formula.

Molecular Formula = (Empirical Formula)n where n= 1, 2 ,3 ….. etc

4. Explain the steps for balancing the equation?

a) Write down correct formulas of reactants on left hand and correct formulas of products on the right hand Balance the number of atoms on each side

b) If the number of atoms may appear more or less than other side, balance the equation by inspection method. Multiple the coefficients with formula to make the number of atoms same on the both (Reactant and Products) sides of equation.

c) The covalent molecules of hydrogen, nitrogen and chlorine exist as diatomic molecules e.g H_2, O_2, N_2 and CL_2. We must write them as diatomic molecules rather than isolated atoms in chemical equation.

d) Finally check the equation to be sure that number and kind of atom are same as the reactant and product side. If yes than now equation is balanced.

5. Name the branches of chemistry and discuss any five branches?

a) Organic Chemistry

It is branch of chemistry that deals with hydrocarbons and their derivatives.
Organic chemistry is the study of structure, properties, composition, reactions, and preparation of carbon-containing compounds, which includes hydrocarbon expect oxides, carbonates, bicarbonates and cynites. The gasoline, plastics, detergents, dyes, food additives, natural gas, and medicines are studied in the organic chemistry.

b) Inorganic Chemistry

It is branch of chemistry which deals with the study of all elements and their compounds except hydrocarbons. These compounds are generally obtained from non living organisms. It is applicable ion all areas of chemical industry. Such as, glass, cement, ceramics and Metallurgy.

c) Physical chemistry

It is a branch of chemistry that deals with the relationship between the composition and physical properties of matter and with the change in them. It also deals with laws and principles governing the combination of atoms and molecules in chemical reaction.

d) Analytical chemistry

It is branch of chemistry that deals with separation and analysis of kind, quality and quantity of various components in given substance. It is used in chromatography, electrophoresis and spectroscopy.

e) Bio Chemistry

It is a branch of chemistry which deals with the compounds of living organisms (Plants and Animals) their metabolism and synthesis in the living body such as carbohydrates, protein and fats. Biochemistry helps us to understand how living things obtain energy from food. It tells that how disorder or deficiency of these bio-molecular cause diseases. This branch is useful in medicine, agriculture and food science.

Section D

Numerical

(1) Balance the following equations by inspection method.

(a) $NH_3 + 0_2$ ----------→ $NO + H_20$

$\mathbf{4}NH_3 + \mathbf{5}0_2$ ----------→ $\mathbf{4}NO + \mathbf{6}H_20$	
Reactants	Products
N= 1x**4**=4	N= 1x**4**=4
H= 3x**4**=12	H= 2x**6**=12
	O= 1x**6**=6
	O= 1x**4**=4
O= 2x**5**=10	Total O= 6+4 = 10
<- Equation Balanced ->	

(b) KNO_3 ----------→ $KNO_2 + O_2$

$\mathbf{2}KNO_3$ ----------→ $\mathbf{2}KNO_2 + O_2$	
Reactants	Products
K= 1x**2**=2	K= 1x**2**=2
N= 1x**2**=2	N= 1x**2**=2
	O= 2x**2**=4
	O= 2
O= 3x**2**=6	Total O= 4+2 =6
<- Equation Balanced ->	

(c) $Ca + H_20 \text{ ----------} \rightarrow Ca(OH)_2 + H_2$

$Ca + \underline{2}H_20 \text{ ----------} \rightarrow Ca(OH)_2 + H_2$	
Reactants	Products
Ca= 1	Ca= 1
O = 1x**2**= 2	O= 2
	H= 2
	H= 2
H= 2x**2** = 4	Total H= 2+2 = 4
<- Equation Balanced ->	

(d) $NaHCO_3 \text{ ----------} \rightarrow Na_2CO_3 + H_2O + CO_2$

$\underline{2}NaHCO_3 \text{ ----------} \rightarrow Na_2CO_3 + H_2O + CO_2$	
Reactants	Products
Na= 1x**2**= 2	Na = 2
H= 1x**2**= 2	H= 2
	C= 1
	C= 1
C= 1x**2**= 2	Total C= 1+1=2
	O= 3
	O= 1
	O= 2
O= 3x**2**= 6	Total O= 3+1+2= 6
<- Equation Balanced ->	

(e) $CO + O_2 \text{ ----------} \rightarrow CO_2$

$\underline{2}CO + O_2 \text{ ----------} \rightarrow \underline{2}CO_2$	
Reactants	Products
C= 1x**2**=2	C=1x**2**=2
O= 1x**2**=2	
O= 2	
Total O=2+2=4	O= 2x**2**=4
<- Equation Balanced ->	

(2) Calculate the formula mass (a.m.u) of the following?

a) AL_2O_3

Data:

Molecular Mass of Al_2=26 x **2** = 52 a.m.u.

Molecular Mass of O_3= 16 x **3** = 48 a.m.u.

Solution

Formula mass = Molecular Mass of AL_2 + Molecular Mass of AL_3

Formula Mass= 52 + 48

Formula Mass= 100 a.m.u. ANSWER

b) $MgCl_2$

Data:

Atomic Mass of Mg= 24 a.m.u.

Atomic Mass of Cl_2= 35 x **2** = 70 a.m.u.

Solution

Formula mass = Atomic Mass of Mg + Atomic Mass of Cl_2
Formula Mass= 24 + 35
Formula Mass= 59 a.m.u. ANSWER

c) NaCl
Data:
Atomic Mass of Na= 22 a.m.u.
Atomic Mass of Cl= 35 a.m.u.
Solution
Formula mass = Atomic Mass of Na + Atomic Mass of Cl

Formula Mass= 22 + 35
Formula Mass= 57 a.m.u. ANSWER

d) KNO_3
Data:
Atomic Mass of K= 39 a.m.u..
Atomic Mass of N= 14 a.m.u.
Molecular Mass of O_3= 16 x **3** = 48 a.m.u.
Solution
Formula mass = Atomic Mass of K + Atomic Mass of N + Molecular Mass of O_3
Formula Mass= 39+14+48
Formula Mass= 101 a.m.u. ANSWER

(3) Calculate the molecular mass (a.m.u) of the following?

a) C_3H_50H
Data:
Atomic Mass of C= 12 a.m.u.
Atomic Mass of H = 1 a.m.u.
Atomic Mass of O = 16 a.m.u.
Solution
Molecular mass = Atomic Mass of C + Atomic Mass of H + Atomic Mass of O
Molecular Mass= (12x3) + (1x6) + (16)
Molecular Mass= 36 + 6 + 16
Molecular Mass= 58 a.m.u. ANSWER

b) H_20
Data:
Atomic Mass of H = 1 a.m.u.
Atomic Mass of O = 16 a.m.u.
Solution
Molecular mass = Atomic Mass of H + Atomic Mass of O
Molecular Mass= (1x2) +16
Molecular Mass=18 a.m.u. ANSWER

c) NH_3
Data:

Atomic Mass of N= 14 a.m.u.
Atomic Mass of H = 1 a.m.u.
Solution
Molecular mass = Atomic Mass of N + Atomic Mass of H
Molecular Mass= 14+1
Molecular Mass=15 a.m.u. ANSWER

d) CO_2
Data:
Atomic Mass of C= 12 a.m.u.
Atomic Mass of O = 16 a.m.u.
Solution
Molecular mass = Atomic Mass of C + Atomic Mass of O
Molecular Mass= 12 + (16x2)
Molecular Mass=44 a.m.u. ANSWER

(4) How many moles are required to prepare 40gm of H_2SO_4?
Data:
Given Mass = 40 gm
Molecular Mass = 98 gm.
Solution

$$\text{Mole} = \frac{\text{Given Mass}}{\text{Molecular Mass}}$$

$$\text{Mole} = \frac{40}{98}$$

Mole= O.4 Mol ANSWER

0.4 moles are required to prepare 40 gm of H_2SO_4

(5) Calculate the number of moles and number of molecules present in the following?
(a) 16 g of H_2CO_3
Data:
Given Mass = 16 gm
Molecular Mass = 72 gm.
Solution

$$\text{Mole} = \frac{\text{Given Mass}}{\text{Molecular Mass}}$$

$$\text{Mole} = \frac{16}{72}$$

Mole= O.22 Mol ANSWER

$$\text{Mole} = \frac{\text{Number of particles}}{\text{Avogadro's number}}$$

Number of particles= Mole x Avogadro's number
Number of Particles = $0.22 \times 6.02 \times 10^{23}$

Number of Particles = $0.22 \times 6.02 \times 10^{23}$

Number of Particles= 1.32×10^{23} ANSWER

(b) 20g of $C_6H_{12}O_6$

Data:

Given Mass = 20 gm

Molecular Mass = 180 gm.

Solution

$$\text{Mole} = \frac{\text{Given Mass}}{\text{Molecular Mass}}$$

$$\text{Mole} = \frac{20}{180}$$

Mole= O.11 Mol ANSWER

$$\text{Mole} = \frac{\text{Number of particles}}{\text{Avogadro's number}}$$

Number of particles= Mole x Avogadro's number

Number of Particles = $0.11 \times 6.02 \times 10^{23}$

Number of Particles = $0.11 \times 6.02 \times 10^{23}$

Number of Particles= 0.66×10^{23} ANSWER