

**SHORT ANSWER QUESTIONS**

Q1. Define industrial chemistry and analytical chemistry.

Ans. **Industrial Chemistry:** "This branch of chemistry is related to the industrial processes." It is associated with studies of properties uses and application of techniques for the preparation of industrial sales on large scale.

**Analytical Chemistry:** "It deals with the detection and estimation of elements and compounds. In this the composition of elements is primarily analyzed."

Q2. How can you differentiate between organic and inorganic chemistry?

Organic Chemistry	Inorganic Chemistry
It is study of the properties and behaviour of hydrocarbons (compounds of carbon and hydrogen) and their derivatives.	It is the study of properties and behaviour of all elements except the hydrocarbons and their derivatives.

Q3. Give the scope of biochemistry.

Ans. It is the branch of chemistry in which we study the structure, composition, and chemical reactions of substances found in living organisms. It covers all chemical processes taking place in living organisms. Such as synthesis and metabolism of biomolecules like carbohydrates, proteins and fat. Biochemistry emerged as a separate discipline when scientists began to study how living things obtain energy from food or how the fundamental biological changes occur during a disease. Examples of applications of biochemistry are in the fields of medicine, food science and agriculture etc.

Q4. How does homogeneous mixture differ from heterogeneous mixture?

Homogeneous Mixture	Heterogeneous Mixture
Mixtures that have uniform composition throughout are called homogeneous mixtures.	Those mixtures in which composition are not uniform throughout are called heterogeneous mixtures.
For example: Air, gasoline and ice-cream.	For example: Soil, rock and wood.

Q5. What is the relative atomic mass? How it is related to gram?

Ans. The relative atomic mass of an element is the average mass of atoms of that element as compared to 1/12th (one-twelfth) the mass of one atom of carbon-12 isotope (an element having different mass number but same atomic number). The unit for relative atomic masses is called atomic mass unit, with symbol amu. One atomic mass unit is 1/12th the mass of one atom of carbon-12th. When this atomic mass unit is expressed in grams it is

$$1 \text{ amu} = 1.66 \times 10^{-24} \text{ g}$$

Q6. Define empirical formula with example.

Ans. **Empirical Formula:** It is the simplest whole number ratio of atoms present in a compound. The empirical formula of a compound is determined by knowing the percentage composition of a compound.

**Example:** Glucose has simplest ratio 1 : 2 : 1 of carbon, hydrogen and oxygen respectively. Hence its empirical formula is CH<sub>2</sub>O.

Q7. State three reasons why do you think air is a mixture and water a compound?

Air (Mixture)	Water (Compound)
1. Mixture is formed by the simple mixing up of the substances.	It is formed by the chemical combination of atoms of elements.
2. Air does not have a sharp and fixed melting point.	Water has a sharp and fixed melting point.
3. Air has heterogeneous mixture composition.	Water has homogeneous composition.

Q8. Explain why are hydrogen and oxygen considered elements whereas water as a compound.

Ans. Hydrogen and oxygen are elements because they have same type of atoms, having same atomic number and it cannot be decomposed into simple substances by chemical means. Water is considered as compound because it is a substance made up of two or more elements chemically combined together in a fixed ratio by mass. As a result of this combination oxygen and hydrogen lose their own properties and produce new substance (H<sub>2</sub>O).

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Q9. What is the significance of the symbol of an element?

Ans. **Significance of the symbol of an element:** Symbols are used for elements instead of writing of their complete names. So, it takes less time/save time and element can be recognized by that symbol in all over the world.

For example: Oxygen (O), Sulphur (S), Nitrogen (N)

Q10. State the reasons: soft drink is a mixture and water is a compound.

Mixture (Soft Drink)	Compound (Water)
1. Soft drink is made up of simple mixing up of substances.	Water is formed by chemical combination of atoms of elements.
2. Soft drink has heterogeneous composition.	Water has homogenous composition.
3. Its components can be separated by physical means.	Its components cannot be separated by simple chemical means.

Q11. Classify the following into element, compound and mixture:

- (i) He and H<sub>2</sub>      (ii) CO and Co      (iii) Water and milk  
(iv) Gold and brass      (v) Iron and steel

Element	Compound	Mixture
Gold	CO <sub>2</sub> and Co	Milk
He	Water	Brass
Iron		Steel
H <sub>2</sub> is a molecule		

Q12. Define atomic mass unit. Why is it needed?

Ans. **Atomic Mass Unit:** The unit for relative, atomic masses is called atomic mass unit.

Symbol: Its symbol is amu.

One atomic mass unit is 1/12th the mass of one atom of carbon-12th. When this atomic mass unit is expressed in grams, it is:

$$1 \text{ amu} = 1.66 \times 10^{-24} \text{ g}$$

Q13. State the nature and name of the substance formed by combining the following:

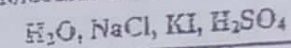
- (i) Zinc + Copper      (ii) Water + Sugar

(iii) Aluminium + Sulphur

(iv) Iron + Chromium + Nickel

Reactants	Nature & Name
Zn + Copper	(Mixture) Brass
Water + Sugar	(Mixture) Sugar solution
Aluminium + Sulphur	(Compound) Aluminium sulphide
Iron + Chromium + Nickel	(Mixture) Nichrome

Q14. Differentiate between molecular mass and formula mass, which of the following will be molecular formula?



Molecular Mass	Formula Mass
The sum of atomic masses of all the atoms present in one molecule of a molecular compound is its molecular mass.	Formula mass is the sum of atomic masses of all the atoms present in one formula unit of a substance.
For example: Molecular mass of water is 18 amu and that of carbon is 44 amu.	For example: Formula mass of sodium chloride is 58.5 amu and that of CaCO <sub>3</sub> is 100 amu.

H<sub>2</sub>O and H<sub>2</sub>SO<sub>4</sub> are the molecular formula.

Q15. Which one has more atoms: 10 g of Al or 10 g of Fe?

Ans. 10 g of Al has more atoms than 10 g of Fe.

Q16. Which one has more molecules: 9 g of water or 9 g of sugar (C<sub>12</sub>H<sub>22</sub>O<sub>11</sub>)?

Ans. 9 g of water has more molecules, than 9 g of sugar because moles of water are more than sugar.

Q17. Which one has more formula units: 1 g of NaCl or 1 g of KCl?

Ans. NaCl has more formula units than KCl.

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Q18. Differentiate between homoatomic and heteroatomic molecules with examples.

Ans.

Homoatomic molecules	Heteroatomic molecules
A molecule containing same type of atoms is called homoatomic molecule.	A molecule consists of different kinds of atoms, it is called as heteroatomic molecule.
<b>For example:</b> H <sub>2</sub> , O <sub>3</sub> , S <sub>8</sub> etc.	<b>For example:</b> CO <sub>2</sub> , H <sub>2</sub> O, NH <sub>3</sub> etc.

Q19. In which one of the following cases the number of hydrogen atoms is more?

2 moles of HCl or 1 mole of NH<sub>3</sub>

(Hint: 1 mole of a substance contains as much number of moles of atoms as are in 1 molecule of a substance.)

Ans. 1 mole of NH<sub>3</sub> has more hydrogen atoms than 2 moles of HCl.

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## SHORT ANSWER QUESTIONS

Q1. What is the nature of charge on cathode rays?

Ans. The properties of cathode rays shows that the nature of cathode rays was independent of the nature of the gas present in the discharge tube or material of the cathode. The fact that they cast the shadow of an opaque object suggested that these are not rays but they are fast moving material particles.

Q2. Give five characteristics of cathode rays?

- Ans. (1) These rays travel in a straight line perpendicular to the cathode surface.  
 (2) They raise the temperature of the body on which they fall.  
 (3) Light is produced when these rays hit the sides of discharge tube.  
 (4) They can cast a sharp shadow.  
 (5) The nature of rays does not depend upon the nature of gas used in discharge tube.

Q3. The atomic symbol of a phosphorus ion is given as  ${}_{15}^{31}\text{P}^{3-}$

(a) How many protons, electrons and neutrons are there in the ion?

Ans. In  ${}_{15}^{31}\text{P}^{3-}$  ion:

The number of protons = 15

The number of electrons = 18

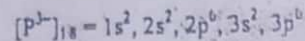
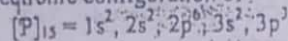
The number of neutrons = 16

(b) What is the name of the ion?

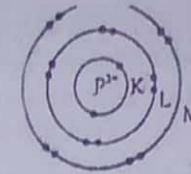
Ans.  $\text{P}^{3-}$  is called phosphorus ion.

(c) Draw the electronic configuration of the ion.

Ans. The electronic configuration of:



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(d) Name the noble gas which has the same electronic configuration as the phosphorus ion has?

Ans. Phosphorus ion  $[\text{P}^{3-}]_{18}$  is formed by gaining three electrons in the outermost shell. Now, they have same electronic configuration as that of noble-gas element "Argon"  $[\text{Ar}]_{18}$ .

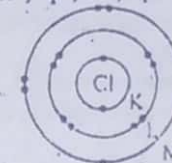
Q4. Differentiate between shell and subshell with examples of each.

Shell	Sub-shell
<ul style="list-style-type: none"> <li>The fixed circular orbits which is associated with a definite amount of energy is called a shell or energy level.</li> </ul>	<ul style="list-style-type: none"> <li>Each shell composed of one or more subshells.</li> </ul> <p style="text-align: center;">OR</p> <ul style="list-style-type: none"> <li>The sub division of a shell in an atom is called subshell.</li> </ul>
<ul style="list-style-type: none"> <li>The shells are subdivided into subshells.</li> </ul>	<ul style="list-style-type: none"> <li>The subshells are also themselves composed of atomic orbital.</li> </ul>
<ul style="list-style-type: none"> <li>Example: K, L, M, N etc. are considered as the shells or energy levels of any atom.</li> </ul>	<ul style="list-style-type: none"> <li>Example: s, p, d and f are considered as the subshells of shell.</li> </ul>

Q5. An element has an atomic number 17. How many electrons are present in K, L and M shells of the atom?

Ans. Atomic number of an atom is considered as the "Total number of protons present in the nucleus of the atom."

If an atom has "17" atomic number its electronic configuration will be as;  
 $[\text{Cl}]_{17} = 1s^2, 2s^2, 2p^6, 3s^2, 3p^3$



K = 2-electrons

L = 8-electrons

M = 7-electrons

Q6. Write down the electronic configuration of  $\text{Al}^{3+}$ . How many electrons are present in its outermost shell?

Ans. In case of simple  $[\text{Al}]$  atom. Its electronic configuration is:

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$[Al]_{13} = 1s^2, 2s^2, 2p^6, 3s^2, 3p^1$   
 In this case, the outermost shell is "M" and it has three electrons in it.

While  
 In case of  $[Al^{3+}]$  ion:

Its electronic configuration is:

$[Al^{3+}]_{10} = 1s^2, 2s^2, 2p^6$   
 Now, the outermost shell is "L" and it has 8 electrons in it.

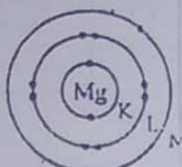
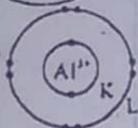
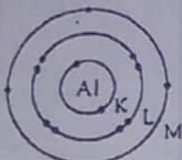
Magnesium has electronic configuration 2, 8, 2.

How many electrons are in the outermost shell?

The atomic number of "Mg" is 12

$[Mg]_{12} = 1s^2, 2s^2, 2p^6, 3s^2$

The outermost shell is "M" and it has only two electrons in it.



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In which subshell of the outermost shell electrons are present?

The outermost electrons of "Mg" are present in "s" subshell of the 3rd shell "M".

Why magnesium tend to lose electrons?

Magnesium is a electropositive metal. It can easily lose its two outermost shell and get charge (2+).

What will be the nature of charge on an atom when it loses an electron or when it gains an electron?

When an atom loses its electron, it becomes positively charged ion called cation.

e.g., Metals of 1st, 2nd group, in periodic table while.

When an atom gains electrons from its surrounding, it becomes negatively charged ion called anion.

e.g., Halogens

For what purpose in U-235 used?

U-235 is used to get large amount of energy which can be used to drives the turbines to generate electricity. This is the peaceful use of atomic energy for the development of a nation.

A patient has goiter. How will it be detected?

Isotopes of Iodine-131 are used for diagnosis of goiter in thyroid gland. These radioactive isotopes are used as tracers in medicine to diagnose the presence of tumor in the human body.

Give three properties of positive rays.

Positive rays are also called "canal rays".

- (i) These rays travel in a straight line in a direction opposite to the cathode rays.
- (ii) These are positively charged rays.
- (iii) Mass of these particles was found equal to that of a proton or simple multiple of it.

Q12. What are the defects of Rutherford's atomic model?

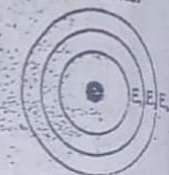
- Ans.
- (i) According to this atomic model, a revolving electron being a charged particle must radiate energy continuously. By decreasing energy, it will closer to nucleus but it is known fact that the revolving electron never fall into the nucleus. Thus Rutherford's picture of an atom is faulty.
  - (ii) Rutherford's model of atom also suggests that there would be a continuous atomic spectrum but actually a line atomic spectrum is obtained.

Q13. As long as an electron remains in an orbit, it does not emit energy. When does it emit or absorb energy?

Ans. Electrons do not emit or absorb energy till they remains in their orbits. When an electron jumps from high energy level to the lower energy level, it emit energy.

$E_2 - E_1 =$  Energy emits and when an electron jumps from lower energy level to high energy level it gains energy.

$E_1 - E_2 =$  Energy gain



## SHORT ANSWER QUESTIONS

Why noble gases are not reactive?

- ns. Noble gases are not reactive because noble gases have eight electrons in their valence shells. So, they do not react with other elements. If elements do not have eight electrons in their valence shells they become reactive and by gaining or losing of electrons make them stable. But noble gases are not reactive.

Why Cesium (at. no. 55) requires little energy to release its one electron present in the outermost shell?

- ns. Cesium requires less energy to release its outermost electron because this electron is far away from nucleus. Hence, its ionization energy is very low. Because of large distance between nucleus and outermost shell it loses its electron easily.

How is periodicity of properties dependent upon number of protons in an atom?

- ns. In periodic table, from left to right proton number increases in nucleus. Hence, nuclear charge will also increase. When nuclear charge changes, properties of elements will also change.

Why shielding effect of electrons makes cation formation easy?

- ns. The decrease in the attractive force exerted by the nucleus on the valence shell electrons due to the presence of the electrons lying between the nucleus and valence-shell, is called shielding effect. When an element loses its one electron then its shielding effect will also increase. That's why, it loses its valence shell easily and became a cation.

What is the difference between Mendeleev's periodic law and modern periodic law?

Mendeleev's Periodic Law		Modern Periodic Law	
1.	Properties of the elements are periodic functions of their atomic masses.	1.	Properties of the elements are periodic function of their atomic numbers.
2.	Atomic masses is the basic property of his law.	2.	Atomic number is the basic property of modern periodic law.

What do you mean by groups and periods in a Periodic Table?

- ns. The horizontal rows of elements in a periodic table are called periods. The vertical columns in a periodic table are called groups.

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7. Why and how are elements arranged in 4<sup>th</sup> period?  
 Ans. Eight elements are present in 4<sup>th</sup> period. Their names are Sodium (Na), Magnesium (Mg), Aluminium (Al), Silicon (Si), Phosphorus (P), Sulphur (S), Chlorine (Cl) and Argon (Ar).
8. Why the size of atom does not decrease regularly in a period?  
 Ans. From left to right atomic radius decreases in a periodic table. This change is not regular because shielding effect changes. If shielding effect increases the size will also increase. If shielding effect decreases the size will also decrease.
9. Give the trend of ionization energy in a period?  
 Ans. The ionization energy of elements increases as we go from left to right in a period.

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Short Answer Questions

Q1. Why do atoms react?  
 Ans. It is an universal rule that everything in this world tends to become more stable. Atoms achieve stability by attaining electronic configuration of inert gases (He, Ne or Ar etc.). Having 2 or 8 electrons in the valence shell is sign of stability. Attaining two electrons in the valence shell is called duplet rule while attaining 8 electrons in the valence shell is called octet rule.

Q2. Why is the bond between an electropositive and an electronegative atom ionic in nature?

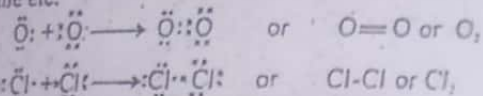
Ans. Because ionic bond is formed due to transfer of electron from one atom to another atom is called ionic bond. The elements of Group 1 and Group 2 being metals have the tendency to lose their electrons forming positively charged ions. Whereas non-metals of Group 15 to Group 17 have the tendency to gain or accept electrons. They are electronegative elements with high electron affinities.

Q3. Ionic compounds are solids. Justify.

Ans. Ionic compounds are made up of positively and negatively charged ions. Thus, they consist of ions and not the molecules. These positively and negatively charged ions are held together in a solid or crystal form with electrostatic attractive forces. So, ionic compounds are solid in nature.

Q4. More electronegative elements can form bonds between themselves. Justify.

Ans. Yes, more electronegative elements can form bonds between themselves because they can share their electrons among themselves. For example: Formation of covalent bonds between two atoms of oxygen and chlorine etc.



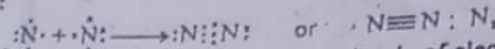
Q5. Metals are good conductor of electricity. Why?

Ans. Metals are good conductors of electricity because metals have free electrons which are mobile in nature. Spaces are present among the atoms. Mobile electrons can move freely in these spaces. Hence, movement/flow of electrons is known as electricity that's why metals are good conductor of electricity.

Q6. Ionic compounds conduct electricity in solution or molten form. Why?

Ans. Ionic compounds conduct electricity in solution or molten form because in these two states ionic compounds have free ions in them. When these free

ions move in solution or molten state they become conductor of electricity.  
 Q7. What type of covalent bond is formed in nitrogen molecule.  
 Ans. In nitrogen molecule, three bond pairs are involved in bond formation. This type is called triple covalent bond. Three small lines are used to indicate these three pairs of electrons between those atoms in the molecules of such compounds.  
 Equation:



Q8. Differentiate between lone pair and bond pair of electron.

Lone Pair	Bond Pair
The non-bonded electron pair available on an atom, like the one lone pair is available on nitrogen in ammonia is called a lone pair. e.g., $\text{NH}_3$	The bonded electron pair available/present within the atoms is called a bond pair. e.g., $\ddot{\text{O}} : + : \ddot{\text{O}} : \longrightarrow \ddot{\text{O}} : : \ddot{\text{O}} \quad \text{or} \quad \text{O}=\text{O}$

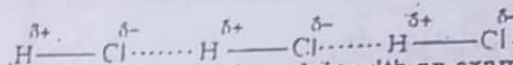
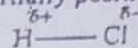
Q9. Describe at least two necessary conditions for the formation of a covalent bond.

Ans. Two necessary conditions for the formation of covalent bond are:

- The electronegativity difference between atoms must be less. So, that the shared pair of electrons is attracted by both the atoms equally.
- Maximum 3 to 6 electrons are present in their valence shells.

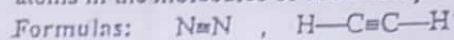
Q10. Why HCl has dipole-dipole forces of attraction?

Ans. HCl has dipole-dipole forces of attraction. The unequal sharing of electrons between two different types of atoms make one end of molecule slightly positive and other end slightly negatively charged. As shared pair of electron is drawn towards more electronegative atom, it is partially negatively charged, as chlorine in hydrogen chloride. The other end automatically becomes partially positively charged.



Q11. What is a triple covalent bond, explain with an example?

Ans. When each bonded atom contributes three electrons, three bond pairs are involved in bond formation. This type is called triple covalent bond. Three small lines are used to indicate these three pairs of electrons between those atoms in the molecules of such compounds. For example:  $\text{N}_2$  &  $\text{C}_2\text{H}_2$



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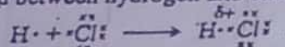
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2. What is difference between polar and non-polar covalent bonds, explain with one example of each?

Polar Covalent Bonds	Non-Polar Covalent Bonds
<p>If the covalent bond is formed between two different types of atoms then bond pair of electrons will not be attracted equally by the bonded atoms. One of the atoms will attract the bond pair of electrons more strongly than the other one. They form polar covalent bond.</p> <p>For example: <math>H^{\delta+}-F^{\delta-}</math>, <math>H^{\delta+}-Cl^{\delta-}</math></p>	<p>If a covalent bond is formed between two similar atoms, the shared pair of electrons is attracted by both the atoms equally. Such type of covalent bond is called non-polar covalent bond.</p> <p>For example: <math>H_2</math> and <math>Cl_2</math></p> <p style="text-align: center;"><math>H-H</math>, <math>Cl-Cl</math></p>

1. Why a covalent bond becomes polar?  
 When there is a difference of electronegativity between two covalently bonded atoms, there will be unequal attraction for the bond pair of electrons between such atoms. It will result in the formation of polar covalent bond.

For example: Bond between hydrogen and chlorine is polar in nature.



What is relationship between electronegativity and polarity?  
 Electronegativity values of the atoms play a very important role in polarity of compounds. These two terms have direct relationship with one another, because of electronegativity difference is high then more polar bond will be and vice versa.

Why does ice float on water?

Floating of ice on water is because of hydrogen bonding. The density of ice at  $0^\circ C$  ( $0.917 \text{ g/cm}^3$ ) is less than that of liquid water at  $0^\circ C$  ( $1.00 \text{ g/cm}^3$ ). In the liquid state water molecules move randomly. However, water freezes, the molecules arrange themselves in an ordered form, that gives them open structure. This process expands the molecules that results in ice being less dense as compared to water.

Give the characteristic properties of ionic compounds.

Characteristic Properties of Ionic Compounds:

Ionic compounds are mostly crystalline solids.

Ionic compounds in solid state have negligible electrical conductance but they are good conductors in solution and in the molten form. It is due to presence of free ions in them.

Ionic compounds have high melting and boiling points. For example, NaCl

has M.P.  $800^\circ C$  and B.P.  $1413^\circ C$ .  
 Ionic compounds dissolve in polar solvents. Like NaCl dissolves in water.

What characteristic properties do the covalent compound have?

(i) They have usually low melting and boiling points.  
 They are usually bad conductors of electricity.  
 They are usually insoluble in water.  
 Bigger molecules with three dimensional bonding form covalent crystals which are very stable and hard. They have high melting and boiling points.

(iv)

Q17.

Ans.

(i)

(ii)

(iii)