

## Homoatomic and Heteroatomic Molecules Questions with Solutions

**Q1.** The homoatomic molecule in the following is:

- a.  $C_{60}$
- b.  $C_6H_{12}O_6$
- c.  $H_2O$
- d.  $Fe_2O_3$

**Answer:** (a)

**Explanation:** The buckyball or  $C_{60}$  is made from only 1 kind of atom, namely carbon.

**Q2.** Give two examples of each of the homoatomic molecules and the heteroatomic molecules.

**Answer:** The examples of heteroatomic molecules are HCl and  $H_2O$ . These compounds consist of two different kinds of atoms, i.e. hydrogen and chlorine, present in the HCl and hydrogen and oxygen in  $H_2O$ .

Examples of homoatomic molecules are  $H_2$  and  $Cl_2$ . The molecules in both the examples are formed from a single type of atom, i.e. hydrogen and chlorine, respectively.

**Q3.** What are homoatomic molecules?

**Answer:** The homoatomic molecules are formed by only one kind of atom. This means that homoatomic molecules contain only a single type of nucleus. For example,  $O_2$ ,  $N_2$ ,  $S_8$ , etc.

**Q4.** Is  $FeSO_4$  a heteroatomic molecule or a homoatomic molecule?

**Answer:**  $FeSO_4$  consists of 3 different types of atoms, namely iron, sulphur and oxygen. Since the molecule is not made up of only one kind of atom,  $FeSO_4$  is a heteroatomic molecule.

**Q5.** For the determination of atomic masses, the mass of an atom of all elements is compared to:

- a. The mass of a hydrogen atom
- b. The mass of an oxygen atom
- c. The mass of an atom of  $^{12}C$
- d. None of the above

**Answer:** (c)

**Explanation:** This is because the  $^{12}C$  isotope has an exact mass of 12 amu.

**Q6.** What is the difference between a heteroatom and a functional group?

**Answer:** Hydrocarbons are organic compounds made from carbon and hydrogen as their constituent elements. When any of the carbon or the hydrogen atom is replaced by an atom of a different element, that atom is called a heteroatom.

A functional group may be an atom or group of atoms which determine the properties of the hydrocarbons when a carbon or hydrogen atom(s) is replaced by it.

**Q7.** Do the heteroatoms make a polar bond with the carbon atoms in the organic compounds?

**Answer:** Yes, this is because the carbon atoms have intermediate electronegativity. As a result, all the heteroatoms have either more or less electronegativity than the carbon atoms. Thus, when any heteroatom comes into contact with a carbon atom in an organic compound, the bond formed between them is polar. The polarity in the bonds arrives due to the difference in the electronegativities of the two different atoms.

**Q8.** The most stable form of phosphorus is:

- a. White phosphorus
- b. Red phosphorus
- c. Black phosphorus
- d. None of the above

**Answer:** (c)

**Explanation:** Black phosphorus is the most stable form of phosphorus at a given room temperature and pressure. Black phosphorus remains stable on heating up to a temperature of ~400-500 °C.

**Q9.** The smallest chemical entity that is capable of its own independent existence is:

- a. Atoms
- b. Ions
- c. Molecules
- d. None of the above

**Answer:** (a)

**Explanation:** Molecules are not the smallest chemical entity. On the other hand, ions are small but incapable of independent existence. Ions always exist in pairs, i.e. the positive and the negative ions making a neutral molecule. Atoms are the smallest chemical entities capable of their own independent existence.

**Q10.** Water is a \_\_\_\_\_ molecule.

**Answer:** Triatomic

**Explanation:** Water ( $\text{H}_2\text{O}$ ) is a triatomic molecule as it contains two atoms of hydrogen (2H) and one atom of oxygen (O).

**Q11.** What are functional groups?

**Answer:** Functional groups are certain sets of molecules that change the properties of the organic compounds to which they are attached. They are of different types. Functional groups are formed by a combination of specific atoms bonded together in a specific pattern by certain specific bonds.

**Q12.** State whether the given statement is true or false.

A molecule is a part of an atom.

- a. True
- b. False

**Answer:** (b)

**Explanation:** A molecule is a group of atoms made from either the same or different kinds of atoms. Hence, a molecule cannot be a part of an atom. In fact, atoms combine together to form molecules. Therefore, the given statement is false.

**Q13.** Do all heteroatoms form functional groups?

**Answer:** All functional groups are formed by the combination of heteroatoms. But not all heteroatoms form the functional groups.

**Q14.** How can a heteroatom be identified in an organic compound?

**Answer:** All organic compounds are formed from hydrocarbon chains and ringed structures. Any atom other than the hydrogen atom and the carbon atom is a heteroatom.

For example, nitrogen (N), sulphur (S), oxygen (O) and halogens (X) are heteroatoms.

**Q15.**  $\text{NH}_3$  is a:

- a. Element
- b. Mixture
- c. Heteroatomic molecule
- d. Homoatomic molecule

**Answer:** (c)

**Explanation:**  $\text{NH}_3$  is made from three types of atoms; thus, it is a heteroatomic molecule.

## Practise Questions on Homoatomic and Heteroatomic Molecules

**Q1.** Define the heteroatomic and homoatomic polymers.

**Answer:** On the basis of the type of atoms forming the polymer backbone, the polymers are classified into two categories: heteroatomic polymers and homoatomic polymers.

The homoatomic polymers are the ones that are formed from the same type of atoms. This means that the polymer backbone is made from a single type of atom. For example,  $P_4$ ,  $S_8$ , etc.

The heteroatomic polymers contain different types of atoms in their polymer backbone. For example, silicones, polymers of phosphonitriles, etc.

**Q2.** Choose the heteroatomic molecules from the given options.

- a.  $H_2SO_4$
- b. KCl
- c.  $NaHCO_3$
- d. All of the above

**Answer:** (d)

**Explanation:** All the molecules given in options (a), (b), and (c) contain more than one kind of atom. Hence, all the compounds in the options above are heteroatomic molecules.

**Q3.** What is a polymer backbone?

**Answer:** The polymer backbone is a framework of atoms. The framework of polymers is created by repeating small chemical units bonded together by a specific bond. These small discrete units are known as monomers.

**Q4.** How can we determine whether the given functional group is acidic or basic in nature?

**Answer:** The acidic functional groups can be determined by the presence of hydrogen atoms that ionise on dissolving in water. The hydrogen ions formed upon ionisation are responsible for the acidic nature of the compound. On the other hand, the functional groups that are capable of giving off hydroxide ions in water are characterised by a weak or polar -OH bond called the basic functional groups.

**Q5.** What is the major difference between organic and inorganic polymers?

**Answer:** The major difference between organic and inorganic polymers is that the polymer backbone is made solely from carbon atoms in organic polymers. However, in the inorganic polymer chains, the polymer backbone is not formed from carbon atoms.