

Mass Chemistry Questions with Solutions

Q1: What is the mass of hydrogen in terms of amu?

- a) 1.0020 amu
- b) 1.0180 amu
- c) 1.0070 amu
- d) 1.0080 amu

Answer: d) 1.0080 amu

Explanation: The mass of a hydrogen atom is 1.6736×10^{-24} g. When converted in terms of amu, 1.6736×10^{-24} g should be divided by 1.66056×10^{-24} g. $1.6736 \times 10^{-24} \text{ g} / 1.66056 \times 10^{-24} \text{ g} = 1.0078 \text{ amu} = 1.008 \text{ amu}$. This is the process to measure any atomic mass in amu.

Q2: Nowadays, "amu" is replaced by ____

- a) u
- b) g
- c) kg
- d) am

Answer: a) u

Explanation: Nowadays, "amu" has been replaced by "u". The Atomic Mass Unit used to be "amu," however it was changed to "u" and is now known as Unified Mass. The mass of one nucleon is one unified atomic mass unit, which is also equivalent to 1 g/mol.

Q3: _____ is the sum of atomic masses of the elements present in a molecule.

- a) Average atomic mass
- b) Atomic mass
- c) Gram formula mass
- d) Molecular mass

Answer: d) Molecular mass

Explanation: The total of the atomic masses of the atoms in a molecule is called molecular mass. The amount of a substance with the same exact mass in grammes as the formula mass in amu is called gram formula mass. The "amu" is the standard unit of mass for measuring mass on a molecular or atomic scale.

Q4: What's the molecular mass of carbon dioxide?

- a) 43
- b) 28

- c) 40
- d) 44

Answer: d) 44

Explanation: Carbon has an individual mass of 12 amu, while oxygen has a mass of 16 amu. CO_2 is the chemical formula for carbon dioxide. As a result, there is one carbon and two oxygens. $12 \text{ (M.wt. of carbon)} + 2 \times 16 \text{ (M.wts. of oxygen)} = 12 + 32 = 44$. As a result, carbon dioxide has a molecular mass of 44.

Q5: Calculate the molecular mass of the sucrose ($\text{C}_{12}\text{H}_{22}\text{O}_{11}$) molecule?

- a) 343 amu
- b) 342 amu
- c) 341 amu
- d) 340 amu

Answer: b) 342 amu

Explanation: Carbon has an individual mass of 12 amu, hydrogen has an individual mass of 1 amu, and oxygen has an individual mass of 16 amu. However, sucrose has 12 carbons, 22 hydrogens and 11 oxygens, that is $12 \times 12 + 22 \times 1 + 11 \times 16 = 342$ amu.

Q6: What's the formula mass of NaCl?

- a) 23 u
- b) 35.5 u
- c) 58 u
- d) 58.5 u

Answer: d) 58.5 u

Explanation: We can only calculate the formula mass of Cl because it can't exist in the solid state in NaCl. Sodium has a mass of 23 units, while chlorine has a mass of 35.5 units. Individual masses, $23 + 35.5 = 58.5$ u, are added together in the formula mass of Sodium chloride.

Q7: What is wrong in saying 'one mole of nitrogen'?

Answer:

The sentence is unclear as to whether we're talking about nitrogen atoms or molecules. 'One mole of nitrogen atoms' or 'one mole of nitrogen molecule' should be used instead.

Q8: How many times heavier is one atom of carbon than one atom of oxygen?

Answer:

Atomic mass of carbon = 12 u

Atomic mass of oxygen = 16 u

Thus, one atom of carbon is $12\text{u}/16\text{u} = 3/4$ times heavier than one atom of oxygen.

Q9: What is meant by the term chemical formula? Give examples.

Answer:

A compound's chemical formula is a symbolic representation of its composition and the number of atoms in a single molecule of a pure substance, which can be an atom or a compound.

For example, the Chemical formula of ammonia is NH_3 , water is H_2O , and carbon dioxide is CO_2 .

Q10: Define one mole, and illustrate its relationship with the Avogadro constant.

Answer:

A mole is a quantity in number equal to the atomic or molecular mass in grammes of any species (atoms, molecules, ions, or particles).

With a value of 6.022×10^{23} , the number of particles (atoms, molecules, or ions) present in 1 mole of any substance is constant. This number is termed the Avogadro constant or Avogadro number.

Q11: What is the mass of the following:

(a) 1 mole of nitrogen atoms?

(b) 4 moles of aluminium atoms (Atomic mass of aluminium = 27)?

(c) 10 moles of sodium sulphite (Na_2SO_3)?

Answer:

(a) 1 mole of nitrogen atoms

= 1 x gram atomic mass of nitrogen atom

= 1 x 14 g = **14 g**

(b) 4 moles of aluminium atoms

= 4 x gram atomic mass of aluminium atoms

= 4 x 27 g = **108 g**

(c) 10 moles of sodium sulphite (Na_2SO_3)

= 10 (2 x gram atomic mass of Na + 1 x gram atomic mass of sulphur + 3 x- gram atomic mass of oxygen)

= 10(2x23g + 1 x32g + 3x16g)

$$\begin{aligned} &= 10 (46 \text{ g} + 32 \text{ g} + 48 \text{ g}) \\ &= 10 \times 126 \text{ g} = \mathbf{1260 \text{ g}} \end{aligned}$$

Q12: Calculate the molecular masses of H_2 , O_2 , CO_2 , CH_4 , NH_3 , CH_3OH .

Answer:

The molecular mass is the total sum of the masses of the atoms or components in the molecule.

(i) Molecular mass of H_2 = 2 x Atomic mass of H
 $= 2 \times 1 = \mathbf{2 \text{ u}}$

(ii) Molecular mass of O_2 = 2 x Atomic mass of O
 $= 2 \times 16 = \mathbf{32 \text{ u}}$

(iii) Molecular mass of CO_2 = Atomic mass of C + 2 x Atomic mass of O
 $= 12 + 2 \times 16 = \mathbf{44 \text{ u}}$

(iv) Molecular mass of CH_4 = Atomic mass of C + 4 x Atomic mass of H
 $= 12 + 4 \times 1 = \mathbf{16 \text{ u}}$

(v) Molecular mass of NH_3 = Atomic mass of N + 3 x Atomic mass of H
 $= 14 + 3 \times 1 = \mathbf{17 \text{ u}}$

(vi) Molecular mass of CH_3OH = Atomic mass of C + 4 x Atomic mass of H + 1 x Atomic mass of O
 $= 12 + 4 \times 1 + 16 = \mathbf{32 \text{ u}}$

Q13: Give the postulates of Dalton's atomic theory.

Answer:

- Every element is made of atoms, which are extremely tiny particles.
- The mass and characteristics of all atoms of a specific element will be identical. Distinct chemical elements have varied types of atoms, as well as different masses for those atoms.
- Atoms can't be created, destroyed, or converted into other elements' atoms.
- When atoms of several elements combine in small whole number ratios, compounds are created.
- The relative number and types of atoms in a compound are constant.

Q14: When 3 g of magnesium is burned with 2 g of oxygen, the result is 5 g of magnesium oxide. When 3 g magnesium is burned in 5 g oxygen, how much magnesium oxide is produced? Which chemical combination law will determine your reaction? State the law.

Answer:

When 3 g of magnesium is burned with 2 g of oxygen, the result is 5 g of magnesium oxide.

Magnesium and oxygen are mixed in a 3:2 ratio to produce magnesium oxide.

When 3 g of magnesium is burned in 5 g of oxygen, 5 g of magnesium oxide is produced, while the remaining oxygen is wasted.

It is controlled by the law of definite proportion.

It states that the elements of a chemical substance are always present in specific mass proportions.

Q15: (a) Why does not atomic mass of an element demonstrate the actual mass of its atom?

(b) "An element's atomic mass is a fraction." What does it indicate?

Answer:

(a) Atoms of distinct elements are quite small and their actual masses are incredibly tiny. The relative atomic mass of the element is used to solve this problem. Hydrogen has a relative atomic mass of 1 u, which corresponds to a gram atomic mass of 1 g.

(b) If the atomic mass of an element is in fraction it implies that it exists in the form of isotopes. The atomic mass of a given element is the sum of the atomic masses of its isotopes, and it is usually expressed as a fraction.

Practise Questions on Mass

Q1: What is the abbreviation of amu?

- a) Atomic matter unit
- b) Atomic mass unified
- c) Atomic mass unit
- d) At mass unity

Answer: c) Atomic mass unit

Explanation: The Atomic Mass Unit is a unit of mass used to quantify mass at the atomic or molecular level. It weighs around 1.66056×10^{-24} g per unit. 1 amu is described as a mass that is nearly one-twelfth of the mass of a single carbon atom - 12 atom.

Q2: A sample of carbon that contains 70% carbon-12 and 30% carbon-14. What do you think is the average atomic mass of this sample?

- a) 14.5
- b) 14.14
- c) 14
- d) 12

Answer: c) 14

Explanation: Given that,

carbon-12 is of 70% and carbon-14 is of 30%.

In order to find avg atomic mass, add the products of multiplications 12 with 70/100 and 14 with 30/100.

$\Rightarrow 12 \times 0.7 = 9.8$; $14 \times 0.3 = 4.2$.

\Rightarrow Adding them, $9.8 + 4.2 = 14$.

Q3: Give an example to show the law of conservation of mass applies to physical changes also.

Answer:

In a chemical reaction, the law of conservation of mass states that mass cannot be created or destroyed. This law, however, also applies to physical changes. When ice melts into water, for example, the mass of the ice equals the mass of the water, i.e. the mass is conserved. This proves the law of mass conservation.

Q4: Differentiate between the actual mass of a molecule and gram molecular mass.

Answer:

The actual mass of a molecule is determined by dividing the molar mass by Avogadro's number, whereas gram molecular mass denotes the molecular mass expressed in grams, i.e., the mass of 1 mole of molecules, i.e. Avogadro's number of molecules.

Q5: Which of the following are tri-atomic and tetra-atomic molecules?

CH_3Cl , CaCl_2 , NH_3 , PCl_3 , P_2O_5 , H_2O , $\text{C}_2\text{H}_5\text{OH}$

Answer:

(i) Tri-atomic molecules are CaCl_2 , H_2O .

(ii) Tetra-atomic molecules are NH_3 and PCl_3 .