Video worksheet – The mole

Solutions

First 4 questions are discussed in the accompanying video

1. How many moles of CO_2 molecules are present in 4.4 grams of pure CO_2?
2. Consider a 19.5 gram sample of copper hydroxide.
   a. How many moles of $Cu(OH)_2$ particles are present in 19.5 grams of pure $Cu(OH)_2$?
   b. How many mole of atoms are present in this mass of $Cu(OH)_2$?
3. What is the formula mass of a substance given that 0.33 mol of this substance has a mass of 64.0 grams?
4. What is the formula mass of a substance given that 93.0 grams of the pure substance contains 3.01 X 10^{23} molecules of the substance?
5. Calculate the number of molecules in 3 moles of a substance CO_2.

$$3 \times 6.02 \times 10^{23} = 1.81 \times 10^{24}$$

6. Find the mass of 0.50 moles of sodium chloride (NaCl). (58.44 g/mol)

$$Mass = 0.50 \times 58.44 = 29\text{g}$$

7. How many moles are there in 88 grams of carbon dioxide (CO_2)

$$\frac{88}{44} = 2\ mol$$

8. Calculate the number of molecules in 16 grams of oxygen gas (O_2, 32 g/mol)

$$Moles = \frac{16}{32} = 0.50$$

$$Particles = 0.50 \times 6.022 \times 10^{23} = 3.0 \times 10^{23}$$

9. Identify an unknown carbonate if 21.2 grams of the pure carbonate contains 0.200 mol of the substance.
   *Hint – find the formula mass of the carbonate first.

$$Formula\ mass = \frac{21.2}{0.200} = 106\ g/mol$$

Common carbonates:

- *$CaCO_3$ ≈ 100 g/mol*
- *$MgCO_3$ ≈ 84 g/mol*
- *Na_2CO_3 ≈ 106 g/mol → Likely sodium carbonate*

10. How many atoms are in 0.25 moles of water (H_2O, 18 g/mol)?

$$Moles\ of atoms = 0.25 \times 3 = 0.75\ mol$$

11. A sample contains 3.61 grams of a compound which represents 0.1 mols. Calculate the molar mass of the compound.

$$Moles\ atoms = 0.25 \times 3 = 0.75\ mol\ atoms$$

12. A sample containing 0.1385 mols of an unknown gas weighing 4.4 grams. Calculate its molar mass and identify the gas if the possible options are hydrogen (H_2), nitrogen (N_2), or oxygen (O_2).

$$Molar\ mass = \frac{4.4}{0.138} = 31.7\ g/mol$$

Compare:

- *H_2 = 2 g/mol*
- *N_2 = 28 g/mol*
- *O_2 = 32 g/mol most likely*

13. A 5.00 gram sample of a compound contains 0.0833 mols. What is the molar mass, and could the compound be sulfur (S_8) with molar mass of 256 g/mol?

$$Molar\ mass = \frac{5.00}{0.0833} = 60\ g/mol$$

Sulfur (S_8) molar mass = 256 g/mol, so this is not sulfur (S_8).

14. Consider a 0.75 mol sample of glucose ($C_6H_{12}O_6$).
    a. Calculate the number of molecules of glucose ($C_6H_{12}O_6$) present.

$$0.75 \times 6.02 \times 10^{23} = 4.52 \times 10^{23} \textit{ molecules}$$

    b. Calculate the total mole of atoms present in the glucose ($C_6H_{12}O_6$) sample.

$$0.75 \times 24 = 18 \textit{ mol atoms}$$