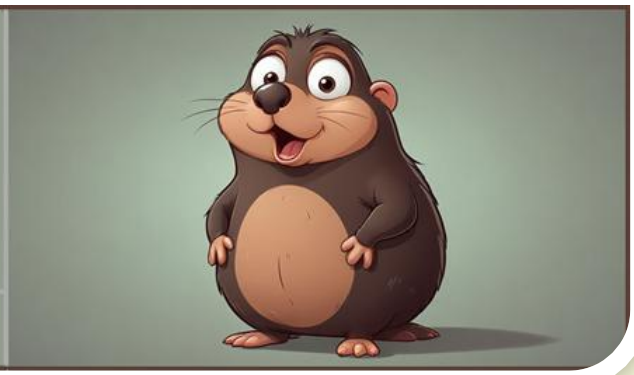
Mole Calculations



Answer all the questions below.

1. What is the relative atomic mass of Carbon (C)?
2. What is the relative formula mass (M_r) of H_2O?
3. How many moles are in 22 grams of CO_2? (Relative atomic masses: C = 12, O = 16)
4. Calculate the relative formula mass (M_r) of NaOH. (Relative atomic masses: Na = 23, O = 16, H = 1)
5. How many moles are in 20 grams of $CaCO_3$? (Relative atomic masses: Ca = 40, C = 12, O = 16)
6. Calculate the mass of 0.25 moles of NaCl. (Relative atomic masses: Na = 23, Cl = 35.5)
7. How many grams of hydrogen gas (H_2) are produced when 3 moles of water (H_2O) decompose into hydrogen and oxygen?

   (Relative atomic masses: H = 1, O = 16)

8. Calculate the mass of 0.5 moles of $MgSO_4 \cdot 7H_2O$.

   (Relative atomic masses: Mg = 24, S = 32, O = 16, H = 1)

9. How many grams of $CaCl_2$ are formed when 50 grams of $CaCO_3$ react with excess hydrochloric acid (HCl)?

   (Relative atomic masses: Ca = 40, C = 12, O = 16, Cl = 35.5)

10. When 10 grams of ethane (C_2H_6) combust completely in oxygen, calculate the mass of CO_2 produced.

    (Relative atomic masses: C = 12, H = 1)

Answers

1. What is the relative atomic mass of Carbon (C)?

Answer: 12

2. What is the relative formula mass (M_r) of H_2O?

Answer: 18

3. How many moles are in 22 grams of CO_2? (Relative atomic masses: C = 12, O = 16)

Answer: 0.5 moles

4. Calculate the relative formula mass (M_r) of NaOH. (Relative atomic masses: Na = 23, O = 16, H = 1)

Answer: M_r=23+16+1=40

5. How many moles are in 20 grams of $CaCO_3$? (Relative atomic masses: Ca = 40, C = 12, O = 16)

Answer: Mr = 40+12+(16×3)= 100

Moles = M_r ÷ mass (mol = M_r ÷ m)

=100 ÷ 20= 0.2 moles

6. Calculate the mass of 0.25 moles of NaCl. (Relative atomic masses: Na = 23, Cl = 35.5)

Answer: M_r = 23 + 35.5 =58.5

Mass = moles × M_r

= 0.25×58.5

=14.62 grams

7. How many grams of hydrogen gas (H_2) are produced when 3 moles of water (H_2O) decompose into hydrogen and oxygen?

(Relative atomic masses: H = 1, O = 16)

Answer: The balanced equation for the decomposition of water is:

$$2H_2O \rightarrow 2H_2 + O_2$$

From the equation, 2 moles of H_2O produce 2 moles of H_2.

So, 3 moles of H_2O produce 3 moles of H_2.

Mass of H_2 = moles × Mr

=3×(2×1)=6 grams

8. Calculate the mass of 0.5 moles of $MgSO_4 \cdot 7H_2O$.

(Relative atomic masses: Mg = 24, S = 32, O = 16, H = 1)

Answer: Mr of $MgSO_4$= 24 + 32+(16×4) =120

Mr of $7H_2O$ = 7 × (2×1+16) = 126

Mr of MgSO4·7H2O = 120 + 126 =246

Mass = moles × Mr

= 0.5 × 246 =123 grams

9. How many grams of $CaCl_2$ are formed when 50 grams of $CaCO_3$ react with excess hydrochloric acid (HCl)?

(Relative atomic masses: Ca = 40, C = 12, O = 16, Cl = 35.5)

Answer: The balanced equation for the reaction is:

$$CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2 + H_2O$$

Calculate moles of $CaCO_3$:

Mr of $CaCO_3$ = 40 + 12 +(16×3) = 100

Moles of $CaCO_3$ reacting = 50 ÷ 100 = 0.5 moles

From the equation, 1 mole of $CaCO_3$ produces 1 mole of $CaCl_2$.

Mr of $CaCl_2$= 40 + (35.5×2) = 111

Mass = moles × Mr

=0.5 × 111

= 55.5 grams

10. When 10 grams of ethane (C_2H_6) combust completely in oxygen, calculate the mass of CO_2 produced.

(Relative atomic masses: C = 12, H = 1)

Answer: The balanced equation for the combustion of ethane is:

$$2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$$

Calculate the moles of C_2H_6:

Mr of C_2H_6=(2×12)+(6×1)=30

Moles of C_2H_6

=10 ÷ 30 = 0.333 moles

From the equation, 2 moles of C_2H_6 produce 4 moles of CO_2, so 0.333 moles of C_2H_6 will produce: 0.333×2=0.666 moles of CO2

Calculate the mass of CO_2:

Mr of CO_2=12+(16×2)=44

Mass of CO_2 = moles × Mr

=0.666×44=29.3 grams