

Worksheet 7-2 Gram-Mole Conversions

The most fundamental idea in chemistry is that all matter is made of tiny particles. To understand what is happening you need to know how many particles there are in a substance. We cannot measure this directly, instead we can measure the mass of a substance and calculate the number of particles. We report the number of particles in a unit called the mole (mol) where one mole = 6.0221415×10^{23} particles (that is 1 mol = 602 214 150 000 000 000 000 000 particles).

Example 1: Find the number of mole in 15 g of sodium (Na).

Molar mass of Na = 22.990 g/mol

$$\frac{15 \text{ g}}{1} \times \frac{1 \text{ mol}}{22.990 \text{ g}} = \boxed{0.65 \text{ mol}}$$

Example 2: Find the number of mole in 320 g of ammonium acetate ($\text{NH}_4\text{C}_2\text{O}_3\text{H}_2$).

Molar mass of $\text{NH}_4\text{C}_2\text{O}_3\text{H}_2$ = 93.082 g/mol

$$\frac{320 \text{ g}}{1} \times \frac{1 \text{ mol}}{93.082 \text{ g}} = \boxed{3.4 \text{ mol}}$$

Example 3: Find the mass of 5.7 mol of iron (II) hydroxide [$\text{Fe}(\text{OH})_2$].

Molar mass of $\text{Fe}(\text{OH})_2$ = 89.859 g/mol

$$\frac{5.7 \text{ mol}}{1} \times \frac{89.859 \text{ g}}{1 \text{ mol}} = \boxed{510 \text{ g}}$$

Find the number of mole in each of the following.

1. 21.3 g of Na_3PO_4
2. 15 g of $\text{NaC}_2\text{H}_3\text{O}_2$
3. 122 g of FeCl_3
4. 2.3 g of Hg_2Br_2
5. 5.21 g of $(\text{NH}_4)_2\text{S}$
6. 83 g of SiF_4
7. 250 g of $(\text{NH}_4)_3\text{PO}_4$
8. 0.62 g of $\text{Ba}(\text{OH})_2$
9. 45 g of NaHSO_4
10. 0.022 g of Ta_2O_5

Find the mass in grams of each of the following.

11. 2.2 mol of CoCl_2
12. 1.66 mol of NH_4OH
13. 0.89 mol of K_2SO_4
14. 0.0033 mol of NaHCO_3
15. 5.1 mol of Ag_2O
16. 0.97 mol of HgF_2
17. 0.044 mol of KMnO_4
18. 21 mol of N_2O_5
19. 0.82 mol of Hg_2SO_4
20. 44 mol of $\text{In}(\text{OH})_3$

1. Molar mass of $\text{Na}_3\text{PO}_4 = 163.940 \text{ g/mol}$
$$\frac{21.3 \text{ g}}{1} \times \frac{1 \text{ mol}}{163.940 \text{ g}} = \boxed{0.130 \text{ mol}}$$
2. Molar mass of $\text{NaC}_2\text{H}_3\text{O}_2 = 82.034 \text{ g/mol}$
$$\frac{15 \text{ g}}{1} \times \frac{1 \text{ mol}}{82.034 \text{ g}} = \boxed{0.18 \text{ mol}}$$
3. Molar mass of $\text{FeCl}_3 = 162.204 \text{ g/mol}$
$$\frac{122 \text{ g}}{1} \times \frac{1 \text{ mol}}{162.204 \text{ g}} = \boxed{0.752 \text{ mol}}$$
4. Molar mass of $\text{Hg}_2\text{Br}_2 = 560.992 \text{ g/mol}$
$$\frac{2.3 \text{ g}}{1} \times \frac{1 \text{ mol}}{560.992 \text{ g}} = \boxed{0.0041 \text{ mol}}$$
5. Molar mass of $(\text{NH}_4)_2\text{S} = 68.144 \text{ g/mol}$
$$\frac{5.21 \text{ g}}{1} \times \frac{1 \text{ mol}}{68.144 \text{ g}} = \boxed{0.0765 \text{ mol}}$$
6. Molar mass of $\text{SiF}_4 = 104.078 \text{ g/mol}$
$$\frac{83 \text{ g}}{1} \times \frac{1 \text{ mol}}{104.078 \text{ g}} = \boxed{0.80 \text{ mol}}$$
7. Molar mass of $(\text{NH}_4)_3\text{PO}_4 = 149.087 \text{ g/mol}$
$$\frac{250 \text{ g}}{1} \times \frac{1 \text{ mol}}{149.087 \text{ g}} = \boxed{1.7 \text{ mol}}$$
8. Molar mass of $\text{Ba}(\text{OH})_2 = 171.342 \text{ g/mol}$
$$\frac{0.62 \text{ g}}{1} \times \frac{1 \text{ mol}}{171.342 \text{ g}} = \boxed{0.0036 \text{ mol}}$$
9. Molar mass of $\text{NaHSO}_4 = 120.660 \text{ g/mol}$
$$\frac{45 \text{ g}}{1} \times \frac{1 \text{ mol}}{120.660 \text{ g}} = \boxed{0.37 \text{ mol}}$$
10. Molar mass of $\text{Ta}_2\text{O}_5 = 441.891 \text{ g/mol}$
$$\frac{0.022 \text{ g}}{1} \times \frac{1 \text{ mol}}{441.891 \text{ g}} = \boxed{5.0 \times 10^{-5} \text{ mol}}$$
11. Molar mass of $\text{CoCl}_2 = 129.839 \text{ g/mol}$
$$\frac{2.2 \text{ g}}{1} \times \frac{1 \text{ mol}}{129.839 \text{ g}} = \boxed{0.017 \text{ mol}}$$

12. Molar mass of $\text{NH}_4\text{OH} = 35.046 \text{ g/mol}$

$$\frac{1.66 \text{ g}}{1} \times \frac{1 \text{ mol}}{35.046 \text{ g}} = \boxed{0.0474 \text{ mol}}$$

13. Molar mass of $\text{K}_2\text{SO}_4 = 174.258 \text{ g/mol}$

$$\frac{0.89 \text{ g}}{1} \times \frac{1 \text{ mol}}{174.258 \text{ g}} = \boxed{0.0051 \text{ mol}}$$

14. Molar mass of $\text{NaHCO}_3 = 84.006 \text{ g/mol}$

$$\frac{0.0033 \text{ g}}{1} \times \frac{1 \text{ mol}}{84.006 \text{ g}} = \boxed{3.9 \times 10^{-5} \text{ mol}}$$

15. Molar mass of $\text{Ag}_2\text{O} = 231.735 \text{ g/mol}$

$$\frac{5.1 \text{ g}}{1} \times \frac{1 \text{ mol}}{231.735 \text{ g}} = \boxed{0.022 \text{ mol}}$$

16. Molar mass of $\text{HgF}_2 = 238.588 \text{ g/mol}$

$$\frac{0.97 \text{ g}}{1} \times \frac{1 \text{ mol}}{238.588 \text{ g}} = \boxed{0.041 \text{ mol}}$$

17. Molar mass of $\text{KMnO}_4 = 158.032 \text{ g/mol}$

$$\frac{0.044 \text{ g}}{1} \times \frac{1 \text{ mol}}{158.032 \text{ g}} = \boxed{2.8 \times 10^{-4} \text{ mol}}$$

18. Molar mass of $\text{N}_2\text{O}_5 = 108.009 \text{ g/mol}$

$$\frac{21 \text{ g}}{1} \times \frac{1 \text{ mol}}{108.009 \text{ g}} = \boxed{0.19 \text{ mol}}$$

19. Molar mass of $\text{Hg}_2\text{SO}_4 = 497.246 \text{ g/mol}$

$$\frac{0.82 \text{ g}}{1} \times \frac{1 \text{ mol}}{497.246 \text{ g}} = \boxed{0.0016 \text{ mol}}$$

20. Molar mass of $\text{In}(\text{OH})_3 = 165.839 \text{ g/mol}$

$$\frac{44 \text{ g}}{1} \times \frac{1 \text{ mol}}{165.839 \text{ g}} = \boxed{0.27 \text{ mol}}$$