

Review moles, stoichiometry, exothermic and endothermic reactions

1. How many moles are in 12 g of H₂O?

$$n = \frac{m}{mm} = \frac{12}{18.02} = 0.67 \text{ mol}$$

2. How many molecules are in 99 g of CaCO₃?

$$n = \frac{m}{mm} = \frac{99}{100.09} = 0.989109801 \text{ mol} \times \frac{1 \text{ mol}}{6.023 \times 10^{23} \text{ molecules}} = 0.989... \times 10^{23} = 6.0 \text{ molecules}$$

3. How many hydrogen atoms are in 24.5 g of Ca(OH)₂?

$$n = \frac{m}{mm} = \frac{24.5}{74.10} = 0.330634278 \text{ mol} \times \frac{1 \text{ mol}}{6.02 \times 10^{23}} = 0.330... \times 10^{23} = 1.990418354 \times 10^{23} \times 2 = 3.98 \text{ atoms}$$

4. Calculate the molarity of a solution by dissolving 250 g of NaCl in water to make a 400.0 mL solution.

$$n = \frac{m}{mm} = \frac{250}{58.44} = 4.277891855 \text{ mol} \times \frac{1 \text{ mol}}{0.4000 \text{ L}} = \frac{4.277...}{0.4} = \frac{x}{1 \text{ L}} = 11 \frac{\text{mol}}{\text{L}}$$

5. There are 10.0 g / 6.0 L of salt NaCl in a Gatorade drink. What is the molar concentration of the drink?

$$\frac{10.0 \text{ g}}{6.0 \text{ L}} = \frac{x}{1 \text{ L}} = 1.66666667 \text{ g/L} \quad n = \frac{m}{mm} = \frac{1.66...}{58.44} = 0.029 \text{ mol/L}$$

6. How many moles of P₂O₅ are in 600.0 mL of a 2.2 M solution?

$$\frac{2.2 \text{ mol}}{\text{L}} = \frac{x}{0.6 \text{ L}} = 1.3 \text{ mol}$$

7. How many grams of NaCl are in 3.00 L of a 6.2 M solution?

$$m = n \times mm = 18.6 \times 58.44 = 1100 \text{ g} \quad \frac{6.2 \text{ mol}}{\text{L}} = \frac{x}{3.00} = 18.6 \text{ mol}$$

8. How would you prepare 5.5 L of 4.5 M solution of KBr?

$$m = n \times mm = 24.75 \times 119.00$$

$$2900 \text{ g}$$

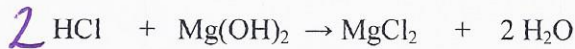
$$\frac{4.5 \text{ mol}}{\text{L}} = \frac{x}{5.5 \text{ L}} = 24.75$$

5 steps
1) weigh
2) put
3) stir
4) add
5) cm.

9. What volume of a 7.0 mol/L solution of H₂O contains 25 g of solute?

$$n = \frac{m}{mm} = \frac{25}{18.02} = 1.387547392 \text{ mol} \quad \frac{7.0 \text{ mol}}{\text{L}} = \frac{1.38...}{x} = 0.20 \text{ L}$$

10. To neutralize hydrochloric acid (HCl), magnesium hydroxide (Mg(OH)₂), a base is added. The neutralization reaction is represented by the following equation:



a- What mass of the Mg(OH)₂ is required to neutralize 9.0 g of HCl?

Given

$$9.0 \text{ g HCl} \times \frac{1 \text{ mol HCl}}{36.46 \text{ g HCl}} \times \frac{1 \text{ mol Mg(OH)}_2}{2 \text{ mol HCl}} \times \frac{58.33 \text{ g Mg(OH)}_2}{1 \text{ mol Mg(OH)}_2} = 7.2 \text{ g}$$

b- How many moles of the Mg(OH)₂ is required to neutralize 7.5 g of H₂O?

Given

$$7.5 \text{ g H}_2\text{O} \times \frac{1 \text{ mol H}_2\text{O}}{18.02 \text{ g H}_2\text{O}} \times \frac{1 \text{ mol Mg(OH)}_2}{2 \text{ mol H}_2\text{O}} = 0.21 \text{ mol}$$

c- You have 6.0 moles of HCl, what mass of MgCl₂ is required to neutralize the 6.0 moles of HCl?

Given

$$6.0 \text{ mol HCl} \times \frac{1 \text{ mol MgCl}_2}{2 \text{ mol HCl}} \times \frac{95.21 \text{ g MgCl}_2}{1 \text{ mol MgCl}_2} = 290 \text{ g}$$

d- You have 7.0 moles of HCl, how many moles of Mg(OH)₂ is required to neutralize the 7 moles of HCl?

Given

$$7.0 \text{ mol HCl} \times \frac{1 \text{ mol Mg(OH)}_2}{2 \text{ mol HCl}} = 3.5 \text{ mol}$$

e- If 700.0 g of water was produced, how many molecules of magnesium chloride (MgCl₂) must have reacted with the oxygen?

Given

$$700.0 \text{ g H}_2\text{O} \times \frac{1 \text{ mol H}_2\text{O}}{18.02 \text{ g H}_2\text{O}} \times \frac{1 \text{ mol MgCl}_2}{2 \text{ mol H}_2\text{O}} \times \frac{6.02 \times 10^{23} \text{ molecules MgCl}_2}{1 \text{ mol MgCl}_2} = 1.169 \times 10^{25} \text{ molecules}$$

f- If 3.00×10^9 molecules of HCl are available, how many moles of water would react with it?

Given

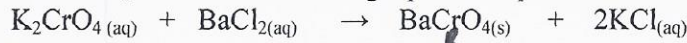
$$3.00 \times 10^9 \text{ molec HCl} \times \frac{1 \text{ mol HCl}}{6.02 \times 10^{23} \text{ molec HCl}} \times \frac{2 \text{ mol H}_2\text{O}}{2 \text{ mol HCl}} = 4.98 \times 10^{-15} \text{ mol}$$

g- If 10.5×10^7 molecules of HCl are available, how many grams of MgCl₂ would react with it?

Given

$$10.5 \times 10^7 \text{ molec HCl} \times \frac{1 \text{ mol HCl}}{6.02 \times 10^{23} \text{ molec HCl}} \times \frac{1 \text{ mol MgCl}_2}{2 \text{ mol HCl}} \times \frac{95.21 \text{ g MgCl}_2}{1 \text{ mol MgCl}_2} = 8.30 \times 10^{-15} \text{ g}$$

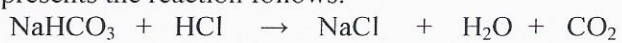
11. 100mL of BaCl₂ is used to produce BaCrO₄. If 5.0 g of BaCrO₄ is made, what is the concentration of the BaCl₂ used? The following equation represents the reaction:



given

$$5.0\text{g BaCrO}_4 \times \frac{1\text{mol BaCrO}_4}{253.33\text{g BaCrO}_4} \times \frac{1\text{mol BaCl}_2}{1\text{mol BaCrO}_4} = \frac{0.019737102}{0.1\text{L}} = \frac{0.2\text{mol}}{\text{L}}$$

12. How many mL of a 9.0M solution of HCl are needed to react with 3.5 g of NaHCO₃? The equation that represents the reaction follows.



given

$$3.5\text{g NaHCO}_3 \times \frac{1\text{mol NaHCO}_3}{84.01\text{g NaHCO}_3} \times \frac{1\text{mol HCl}}{1\text{mol NaHCO}_3} = \frac{0.041661707}{1} = \frac{9.0\text{mol}}{\text{L}}$$

13. Sandy neutralizes 700.0 mL of HCL at a concentration of 5.5mol/L using Ca(OH)₂ according to the following equation:



After the neutralization, she allows the water from the beaker to evaporate. What is the mass of the CaCl₂ that will be left in the beaker?

$$\frac{5.5\text{mol}}{\text{L}} = \frac{x}{0.7\text{L}} \quad \text{given}$$

$$3.85\text{mol HCl} \times \frac{1\text{mol CaCl}_2}{2\text{mol HCl}} \times \frac{110.97\text{g CaCl}_2}{1\text{mol CaCl}_2} = 210\text{g}$$

14. When 900mL of HCl is mixed with NaHCO₃, 16 gg of CO₂ is produced. What was the concentration of the HCl solution used to produce this much gas?

given



$$16\text{g CO}_2 \times \frac{1\text{mol CO}_2}{44.01\text{g CO}_2} \times \frac{1\text{mol HCl}}{1\text{mol CO}_2} = \frac{0.363553738}{0.9} = \frac{x}{1\text{L}} = \frac{4\text{mol}}{\text{L}}$$

15. Label each example as endothermic or exothermic.

- a- Energy is released **Exo**
- b- Environment becomes colder **endo**
- c- Energy is on the reactant side **Endo**
- d- Melting ice-cream **-Endo**
- e- A bon-fire **-Exo**
- f- Making ice **-Endo**
- g- Molecules having more energy **-Exo**
- h- Combustion **-Exo**