

Mole and Stoichiometry Worksheet

1. What is the volume of a 1.5 mol/L KOH solution that contains 2.24 g of solute?

$$n = \frac{m}{m_m} \quad \frac{2.24}{56.11} = 0.039921583 \quad \frac{1.5 \text{ mol}}{\text{L}} = \frac{0.039921583}{x} = 0.027 \text{ L}$$

2. What mass of solute is required to prepare 350 mL of NaOH at a concentration of 0.75 mol/L?

$$\frac{0.75 \text{ mol}}{\text{L}} = \frac{x}{0.35 \text{ L}} = 0.2625 \text{ mol} \quad m = n \times m_m = 0.2625 \times 40.00 = 11 \text{ g}$$

3. What is the volume of a 0.25 M solution of Na₂SO₄ that contains 35.5 g of sodium sulfate?

$$n = \frac{m}{m_m} \quad \frac{35.5}{142.05} = 0.249912003 \quad \frac{0.249912003 \text{ mol}}{0.25 \text{ mol/L}} = 1.0 \text{ L}$$

4. What is the molar concentration of the water in an aquarium that contains 100.0 L of salt water prepared with 2.8 kg of sodium chloride (NaCl)?

$$n = \frac{m}{m_m} \quad \frac{2800}{58.44} = 47.91238877 \quad \frac{47.91238877}{100.0} = 0.48 \text{ mol/L}$$

5. Explain the procedure involved in preparing 250 mL of a 3.0 mol/L solution of CaCO₃.

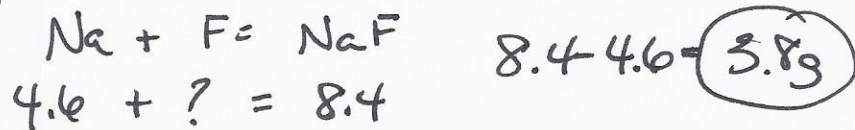
$$\frac{3.0 \text{ mol}}{\text{L}} = \frac{x}{0.25 \text{ L}} = 0.75 \text{ mol} \quad m = n \times m_m = 0.75 \times 100.09 = 75 \text{ g}$$

① Weigh 75g of solute ② Put solute in VF ③ add water & swirl ④ add water to line ⑤ CH

6. What is the molarity of a 10.0 L solution of HCl that contains 0.36 g of solute?

$$n = \frac{m}{m_m} \quad \frac{0.36}{36.46} = 0.009873834 \quad \frac{0.009873834}{10.0} = 0.00099 \text{ mol/L}$$

7. If 4.6 g of sodium (Na) combines with fluorine (F) to produce 8.4 g of sodium fluoride (NaF). How much fluorine reacts?

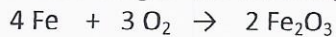


8. 75 mL of BaCl₂ is used to produce BaCrO₄. If 4.81 g of BaCrO₄ is made, what is the concentration of the BaCl₂ used? The following equation represents the reaction:



Given $4.81 \text{ g} \times \frac{1 \text{ mol}}{253.33} \times \frac{1 \text{ mol}}{1 \text{ mol}} = \frac{0.018987092}{0.075 \text{ L}} = 0.25 \text{ mol/L}$

9. Iron rusts according to the following equation:

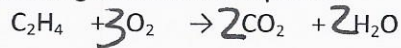


If 10.0 g of iron rust in the presence of oxygen, what mass of Fe_2O_3 will be produced?

Given

$$10.0 \text{g Fe} \times \frac{1 \text{ mol Fe}}{55.85 \text{g Fe}} \times \frac{2 \text{ mol Fe}_2\text{O}_3}{4 \text{ mol Fe}} \times \frac{159.7 \text{g Fe}_2\text{O}_3}{1 \text{ mol Fe}_2\text{O}_3} = 143 \text{g Fe}_2\text{O}_3$$

10. Consider the following unbalanced equation:



How many moles of carbon dioxide will be produced when 5.0 moles of oxygen react?

Given

$$5.0 \text{ mol O}_2 \times \frac{2 \text{ mol CO}_2}{3 \text{ mol O}_2} = 3.3 \text{ mol CO}_2$$

11. Aspirin ($\text{C}_9\text{H}_8\text{O}_4$) is produced from salicylic acid ($\text{C}_7\text{H}_6\text{O}_3$) according to the equation below:

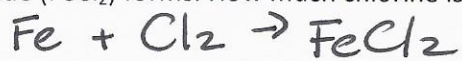


What mass of water is produced when 540 g of aspirin are produced?

Given

$$540 \text{g C}_9\text{H}_8\text{O}_4 \times \frac{1 \text{ mol C}_9\text{H}_8\text{O}_4}{180.17 \text{g C}_9\text{H}_8\text{O}_4} \times \frac{1 \text{ mol H}_2\text{O}}{2 \text{ mol C}_9\text{H}_8\text{O}_4} \times \frac{18.02 \text{g H}_2\text{O}}{1 \text{ mol H}_2\text{O}} = 27 \text{g H}_2\text{O}$$

12. When iron (Fe) reacts with chlorine (Cl_2), iron chloride (FeCl_2) forms. How much chlorine is required to produce 6.0 moles of iron chloride?



Given

$$6.0 \text{ mol FeCl}_2 \times \frac{1 \text{ mol Cl}_2}{1 \text{ mol FeCl}_2} \times \frac{70.90 \text{g Cl}_2}{1 \text{ mol Cl}_2} = 430 \text{g Cl}_2$$

13. When 200 mL of HCl is mixed with NaHCO_3 , 22.01 g of CO_2 is produced. What was the concentration of the HCl solution used to produce this much gas?



Given

$$22.01 \text{g CO}_2 \times \frac{1 \text{ mol CO}_2}{44.01 \text{g CO}_2} \times \frac{1 \text{ mol HCl}}{1 \text{ mol CO}_2} = \frac{0.500 \text{ mol HCl}}{0.2 \text{ L}} = \frac{2.5 \text{ mol}}{\text{L}}$$

14. A student prepared 1 250 mL of solution by using 17.1 g of aluminum sulfate, $\text{Al}_2(\text{SO}_4)_3$. What is the molar concentration of the solution?

$$n = \frac{m}{M} = \frac{17.1}{342.17} = 0.049975159$$

$$\frac{0.049975159}{1.250 \text{ L}} = 0.0400 \text{ mol/L}$$

15. The label of a juice drink indicates the concentration of fructose, $C_6H_{12}O_6$ to be 18.0 g/200 mL. What is the molar concentration of the sugar in the juice?

$$\frac{18.0 \text{ g}}{.2 \text{ L}} = \frac{x}{\text{L}} = \frac{90 \text{ g}}{\text{L}} \quad n = \frac{m}{mm} \quad \frac{90}{180.18} = \frac{.5 \text{ mol}}{\text{L}}$$

16. Which of the following solutions has the highest concentration?

Solution 1- 3.5 moles of NaOH in 3.0 litres of solution

Solution 2- 2.5 moles of HCl in 2.0 litres of solution

$$m = n \times mm$$

$$3.5 \times 40.00 = 140 \text{ g}$$

$$\frac{140}{3.0} = \frac{x}{\text{L}} = 47 \text{ g/L}$$

$$m = n \times mm$$

$$2.5 \times 36.46 = 91.15$$

$$\frac{91.15}{2.0} = \frac{x}{\text{L}} = 46 \text{ g/L}$$

17. What mass of CaCl_2 is needed to prepare 200.0 mL of a solution with a concentration of 2.0 mol/L?

$$\frac{2.0 \text{ mol}}{\text{L}} = \frac{x}{.200 \text{ L}} = .40 \text{ mol}$$

$$m = n \times mm$$

$$.40 \times 110.98$$

$$= 44 \text{ g}$$

18. What is the molar concentration of solution containing 17.6 g of ZnSO_4 dissolved in 750.0 mL?

$$n = \frac{m}{mm} \quad \frac{17.6}{161.46} = .109005326$$

$$\frac{.109 \dots}{.7500} = .145 \text{ mol/L}$$

19. Sandy neutralizes 200 mL of HCL at a concentration of 1.5 mol/L using $\text{Ca}(\text{OH})_2$ according to the following equation:



$$\frac{1.5 \text{ mol}}{\text{L}} = \frac{x}{.2} = .3 \text{ mol}$$

After the neutralization, she allows the water from the beaker to evaporate. What is the mass of the CaCl_2 that will be left in the beaker?

Given

$$.3 \text{ mol} \times \frac{1 \text{ mol}}{2 \text{ mol}} \times \frac{110.97}{1 \text{ mol}} = 20 \text{ g}$$

20. How many grams of solute are there in 350.0 mL of a solution of NH_4OH with a concentration of 0.65 mol/L

$$\frac{.65 \text{ mol}}{\text{L}} = \frac{x}{.350} = .2275$$

$$m = n \times mm$$

$$.2275 \times 35.06$$

$$8.0 \text{ g}$$

21. You are to prepare 30.00 mL of an aqueous solution of sodium hydroxide, NaOH that will have a concentration of 0.80 M. What mass of NaOH do you need?

$$\frac{.80 \text{ mol}}{\text{L}} = \frac{x}{.030 \text{ L}} = .024 \text{ mol}$$

$$m = n \times mm$$

$$.024 \times 40.00 = 0.96 \text{ g}$$

$$0.96 \text{ g}$$

22. Sodium nitrate, NaNO_3 , is a salt that can be used to fertilize plants. You are to prepare 500.0 mL of a 0.20 mol/L sodium nitrate solution. What mass of sodium nitrate must be used?

$$\frac{0.20 \text{ mol}}{\text{L}} = \frac{x}{.50 \text{ L}} = 0.10 \text{ mol} \quad m = n \times \text{mm} \quad .10 \times 85.00 = 8.5 \text{ g}$$

23. A student dissolves 25.0 g of calcium carbonate, CaCO_3 , in water to obtain a 550 mL solution. What is the molar concentration of this solution?

$$\frac{n}{m} = \frac{25.0}{100.09} = 0.249775202 \quad \frac{0.249 \dots}{.55 \text{ L}} = 0.45 \frac{\text{mol}}{\text{L}}$$

24. You must prepare 50.0 mL of an aqueous solution of sodium nitrate (NaNO_3) that will have a concentration of 0.40 mol/L. What mass of NaNO_3 is required?

$$\frac{0.40 \text{ mol}}{\text{L}} = \frac{x}{.050 \text{ L}} = 0.020 \quad m = n \times \text{mm} \quad .020 \times 85.03 = 1.7 \text{ g}$$

25. A 3.0 L aqueous solution contains 120 g of sodium hydroxide, NaOH . What is the molar concentration of this solution?

$$\frac{n}{m} = \frac{120}{40.00} = 3 \text{ mol} \quad \frac{3}{3.0 \text{ L}} = 1.0 \frac{\text{mol}}{\text{L}}$$

26. Iron oxide, Fe_2O_3 , reacts with carbon, C , to produce iron, Fe , according to the following balanced equation:

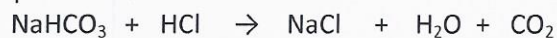


What mass of carbon is required for every 6.0 moles of Fe_2O_3 reacted?

Given

$$6.0 \text{ mol Fe}_2\text{O}_3 \times \frac{3 \text{ mol C}}{1 \text{ mol Fe}_2\text{O}_3} \times \frac{12.01 \text{ g C}}{1 \text{ mol C}} = 220 \text{ g C}$$

27. How many mL of a 6.0M solution of HCl are needed to react with 4.85g of NaHCO_3 ? The equation that represents the reaction follows.



Given

$$4.85 \text{ g NaHCO}_3 \times \frac{1 \text{ mol NaHCO}_3}{84.01 \text{ g/mol NaHCO}_3} \times \frac{1 \text{ mol HCl}}{1 \text{ mol NaHCO}_3} = \frac{0.05781222 \text{ mol}}{\text{L}} = 9.6 \text{ ml}$$