

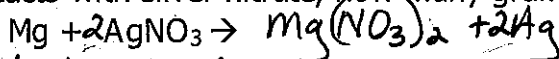
Chemistry – Stoichiometry Worksheet

1. How many grams of calcium carbonate are required to prepare 50.0 g of calcium oxide?



$$\frac{50.0 \text{ g CaO}}{56.08 \text{ g CaO}} \times \frac{1 \text{ mol CaO}}{1 \text{ mol CaO}} \times \frac{1 \text{ mol CaCO}_3}{1 \text{ mol CaO}} \times 100.09 \text{ g} = 89.2 \text{ g CaCO}_3$$

2. When 0.50 g of magnesium reacts with silver nitrate, how many grams of silver are prepared?



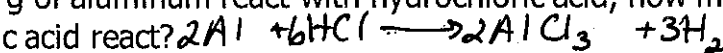
$$\frac{0.50 \text{ g Mg}}{24.31 \text{ g Mg}} \times \frac{1 \text{ mol Mg}}{1 \text{ mol Mg}} \times \frac{2 \text{ mol Ag}}{1 \text{ mol Mg}} \times 107.87 \text{ g} = 4.44 \text{ g Ag}$$

3. If 75.0 g of copper react with mercuric nitrate, how many grams of mercury form?



$$\frac{75.0 \text{ g Cu}}{63.55 \text{ g Cu}} \times \frac{1 \text{ mol Cu}}{1 \text{ mol Cu}} \times \frac{1 \text{ mol Hg}}{1 \text{ mol Cu}} \times 200.59 \text{ g} = 236.7 \text{ g Hg}$$

4. When 60.0 g of aluminum react with hydrochloric acid, how many grams of hydrochloric acid react?



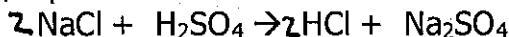
$$\frac{60.0 \text{ g Al}}{26.98 \text{ g Al}} \times \frac{1 \text{ mol Al}}{2 \text{ mol Al}} \times \frac{6 \text{ mol HCl}}{2 \text{ mol Al}} \times 36.46 \text{ g} = 243.3 \text{ g HCl}$$

5. How many grams of magnesium chloride are produced by treating 4.00 g of titanium (III) chloride with magnesium?



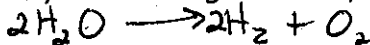
$$\frac{4.00 \text{ g TiCl}_3}{154.23 \text{ g TiCl}_3} \times \frac{1 \text{ mol TiCl}_3}{2 \text{ mol TiCl}_3} \times \frac{3 \text{ mol MgCl}_2}{2 \text{ mol TiCl}_3} \times 95.21 \text{ g} = 3.70 \text{ g MgCl}_2$$

6. What mass of Na_2SO_4 is produced when sulfuric acid reacts with 200.0 g of sodium chloride?



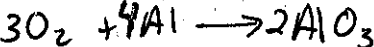
$$\frac{200.0 \text{ g NaCl}}{58.44 \text{ g NaCl}} \times \frac{1 \text{ mol NaCl}}{2 \text{ mol NaCl}} \times \frac{1 \text{ mol Na}_2\text{SO}_4}{2 \text{ mol NaCl}} \times 142.04 \text{ g} = 243.0 \text{ g Na}_2\text{SO}_4$$

7. In the electrolysis of 144 g of water, how many cubic decimeters of oxygen are prepared?



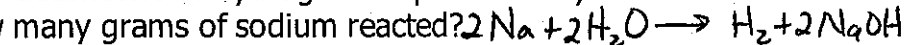
$$\frac{144 \text{ g H}_2\text{O}}{18.02 \text{ g H}_2\text{O}} \times \frac{1 \text{ mol H}_2\text{O}}{2 \text{ mol H}_2\text{O}} \times \frac{1 \text{ mol O}_2}{2 \text{ mol H}_2\text{O}} \times 22.7 \text{ dm}^3 = 90.7 \text{ dm}^3 \text{ O}_2$$

8. Calculate the number of cubic decimeters of oxygen required to react with 75 g of aluminum.



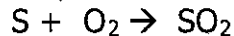
$$\frac{75 \text{ g Al}}{26.98 \text{ g Al}} \times \frac{1 \text{ mol Al}}{4 \text{ mol Al}} \times \frac{3 \text{ mol O}_2}{2 \text{ mol Al}} \times 22.7 \text{ dm}^3 = 47.3 \text{ dm}^3 \text{ O}_2$$

9. If 5.0 cubic decimeters of hydrogen are produced by the reaction of sodium and water, how many grams of sodium reacted?



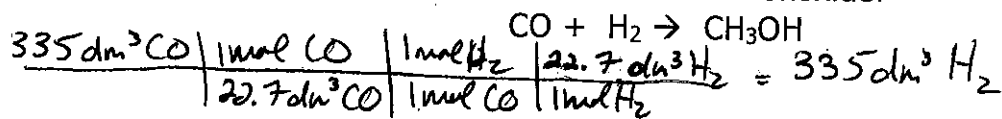
$$\frac{5.0 \text{ dm}^3 \text{ H}_2}{22.7 \text{ dm}^3 \text{ H}_2} \times \frac{1 \text{ mol H}_2}{1 \text{ mol H}_2} \times \frac{2 \text{ mol Na}}{1 \text{ mol H}_2} \times 23.00 \text{ g} = 10.1 \text{ g Na}$$

10. How many grams of sulfur are required in the preparation of 800.0 cubic decimeters of sulfur dioxide?

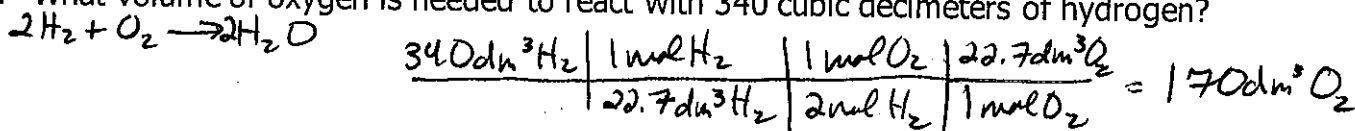


$$\frac{800.0 \text{ dm}^3 \text{ SO}_2}{22.7 \text{ dm}^3 \text{ SO}_2} \times \frac{1 \text{ mol SO}_2}{1 \text{ mol SO}_2} \times \frac{1 \text{ mol S}}{1 \text{ mol SO}_2} \times 32.07 \text{ g} = 1130 \text{ g S}$$

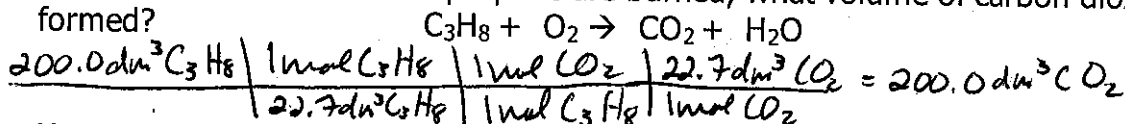
11. In the production of methanol, how many cubic decimeters of hydrogen are required to react with 335 cubic decimeters of carbon monoxide?



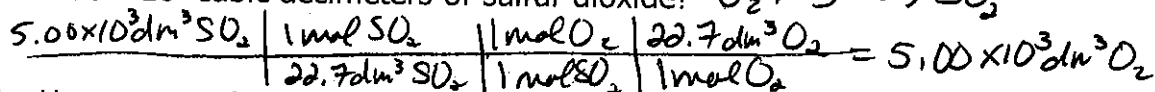
12. What volume of oxygen is needed to react with 340 cubic decimeters of hydrogen?



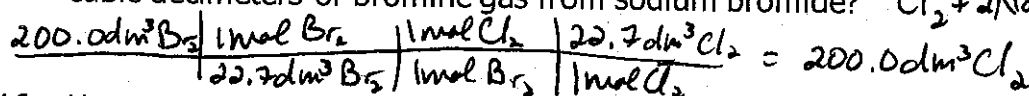
13. If 200.0 cubic decimeters of propane are burned, what volume of carbon dioxide is formed?



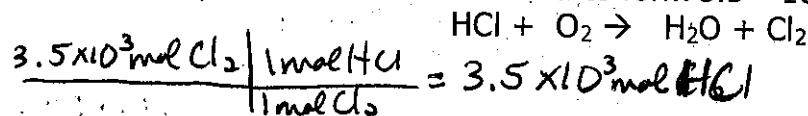
14. How many cubic decimeters of oxygen are needed to react with sulfur to produce 5.00×10^3 cubic decimeters of sulfur dioxide?



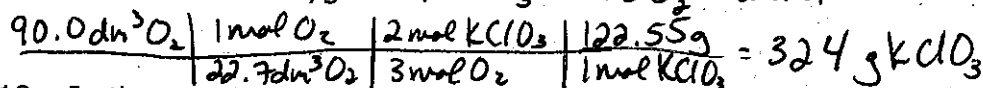
15. How many cubic decimeters of chlorine gas are needed in the production of 200.0 cubic decimeters of bromine gas from sodium bromide?



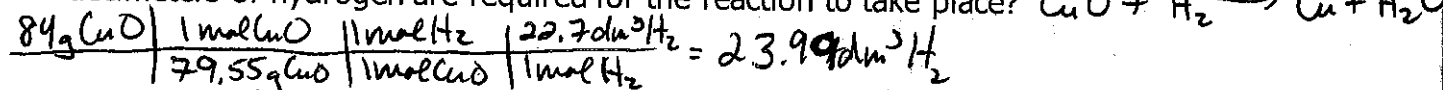
16. How many moles of HCl are needed to form 3.5×10^3 moles of Cl₂?



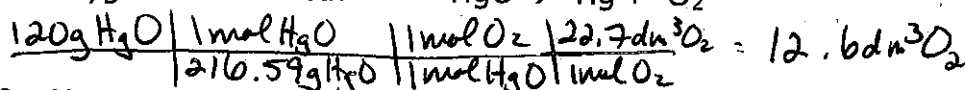
17. How many grams of potassium chlorate are required in the preparation of 90.0 cubic decimeters of oxygen?



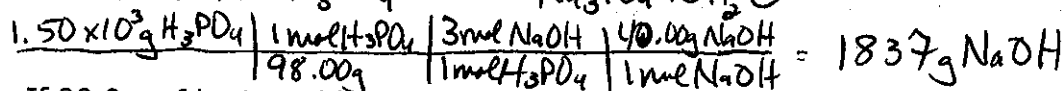
18. In the reaction of 84 g of copper (II) oxide with hydrogen gas, how many cubic decimeters of hydrogen are required for the reaction to take place?



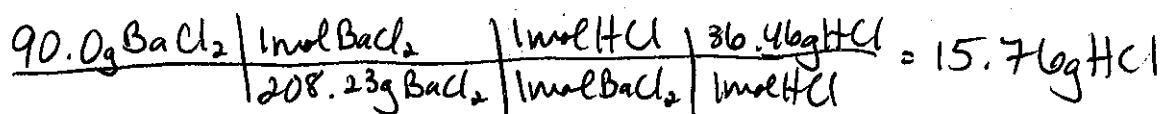
19. If 120 grams of mercuric oxide are decomposed, how many cubic decimeters of oxygen are released?



20. How many grams of sodium hydroxide will react with 1.50×10^3 g of phosphoric acid?



21. If 90.0 g of barium chloride react with sulfuric acid, how many grams of HCl are produced?



22. If 320 grams of sodium carbonate react with calcium hydroxide, how many grams of sodium hydroxide are formed? $\text{Na}_2\text{CO}_3 + \text{Ca}(\text{OH})_2 \rightarrow \text{CaCO}_3 + 2\text{NaOH}$

$$\frac{320\text{g Na}_2\text{CO}_3}{105.99\text{g}} \left| \frac{1\text{mol Na}_2\text{CO}_3}{1\text{mol Na}_2\text{CO}_3} \right| \frac{2\text{mol NaOH}}{1\text{mol Na}_2\text{CO}_3} \left| \frac{40.00\text{g NaOH}}{1\text{mol NaOH}} \right| = 241.5\text{g NaOH}$$

23. What volume of oxygen is necessary to completely react with 125 cubic decimeters of methane gas, CH_4 ? $\text{CH}_4 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$

$$\frac{125\text{ dm}^3\text{ CH}_4}{22.7\text{ dm}^3\text{ CH}_4} \left| \frac{1\text{mol CH}_4}{1\text{mol CH}_4} \right| \frac{1\text{mol O}_2}{1\text{mol CH}_4} \left| \frac{22.7\text{ dm}^3\text{ O}_2}{1\text{mol O}_2} \right| = 125\text{ dm}^3\text{ O}_2$$

24. How many grams of sodium peroxide must react with water to produce 35.0 cubic decimeters of oxygen? $\text{Na}_2\text{O}_2 + \text{H}_2\text{O} \rightarrow \text{NaOH} + \text{O}_2$

$$\frac{35.0\text{ dm}^3\text{ O}_2}{22.7\text{ dm}^3\text{ O}_2} \left| \frac{1\text{mol O}_2}{1\text{mol O}_2} \right| \frac{1\text{mol Na}_2\text{O}_2}{1\text{mol O}_2} \left| \frac{77.98\text{g Na}_2\text{O}_2}{1\text{mol Na}_2\text{O}_2} \right| = 120.2\text{g Na}_2\text{O}_2$$

25. In the Haber process for synthesizing ammonia, NH_3 , how many cubic decimeters of ammonia gas are produced when 400.0 cubic decimeters of nitrogen react with hydrogen? $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$

$$\frac{400.0\text{ dm}^3\text{ N}_2}{22.7\text{ dm}^3\text{ N}_2} \left| \frac{1\text{mol N}_2}{1\text{mol N}_2} \right| \frac{2\text{mol NH}_3}{1\text{mol N}_2} \left| \frac{22.7\text{ dm}^3\text{ NH}_3}{1\text{mol NH}_3} \right| = 800.0\text{ dm}^3\text{ NH}_3$$

26. How many cubic decimeters of hydrochloric acid gas are formed when 170 cubic decimeters of hydrogen combine with chlorine? $\text{H}_2 + \text{Cl}_2 \rightarrow 2\text{HCl}$

$$\frac{170\text{ dm}^3\text{ H}_2}{22.7\text{ dm}^3\text{ H}_2} \left| \frac{1\text{mol H}_2}{1\text{mol H}_2} \right| \frac{2\text{mol HCl}}{1\text{mol H}_2} \left| \frac{22.7\text{ dm}^3\text{ HCl}}{1\text{mol HCl}} \right| = 340\text{ dm}^3\text{ HCl}$$

27. How many grams of sodium iodide are produced by the decomposition of 60.0 g of sodium iodate? $2\text{NaIO}_3 \rightarrow 2\text{NaI} + 3\text{O}_2$

$$\frac{60.0\text{g NaIO}_3}{197.89\text{g}} \left| \frac{1\text{mol NaIO}_3}{2\text{mol NaIO}_3} \right| \frac{2\text{mol NaI}}{1\text{mol NaIO}_3} \left| \frac{149.89\text{g NaI}}{1\text{mol NaI}} \right| = 45.45\text{g NaI}$$

28. If 10.0 g of aluminum sulfide are produced by the reaction of aluminum and sulfur, how many grams of sulfur were needed? $2\text{Al} + 3\text{S} \rightarrow \text{Al}_2\text{S}_3$

$$\frac{10.0\text{g Al}_2\text{S}_3}{150.16\text{g Al}_2\text{S}_3} \left| \frac{1\text{mol Al}_2\text{S}_3}{1\text{mol Al}_2\text{S}_3} \right| \frac{3\text{mol S}}{1\text{mol Al}_2\text{S}_3} \left| \frac{32.07\text{g S}}{1\text{mol S}} \right| = 6.41\text{g S}$$

29. If 2.5 g of cupric sulfate decomposed upon heating, how many grams of cupric oxide formed? $\text{CuSO}_4 \rightarrow \text{CuO} + \text{SO}_3$

$$\frac{2.5\text{g CuSO}_4}{159.61\text{g}} \left| \frac{1\text{mol CuSO}_4}{1\text{mol CuSO}_4} \right| \frac{1\text{mol CuO}}{1\text{mol CuSO}_4} \left| \frac{79.55\text{g CuO}}{1\text{mol CuO}} \right| = 1.25\text{g CuO}$$

30. If 22.4 dm³ of steam react with MgO, calculate the mass of the product that will form. $\text{H}_2\text{O} + \text{MgO} \rightarrow \text{Mg}(\text{OH})_2$

$$\frac{22.4\text{ dm}^3\text{ H}_2\text{O}}{22.7\text{ dm}^3\text{ H}_2\text{O}} \left| \frac{1\text{mol H}_2\text{O}}{1\text{mol H}_2\text{O}} \right| \frac{1\text{mol Mg}(\text{OH})_2}{1\text{mol H}_2\text{O}} \left| \frac{58.32\text{g Mg}(\text{OH})_2}{1\text{mol Mg}(\text{OH})_2} \right| = 57.55\text{g Mg}(\text{OH})_2$$

Titration Practice Worksheet

Find the requested quantities in the following problems:

- 1) If it takes 54 mL of 0.1 M NaOH to neutralize 125 mL of an HCl solution, what is the concentration of the HCl? $\text{NaOH} + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O}$

$$\text{mol NaOH: } \frac{0.1 \text{ mol}}{\text{dm}^3} \left| \frac{54 \text{ cm}^3}{1000 \text{ cm}^3/\text{dm}^3} \right. = 0.0054 \text{ mol NaOH}$$

$$\frac{0.0054 \text{ mol HCl}}{0.125 \text{ dm}^3} = 0.0432 \text{ mol dm}^{-3} \text{ HCl}$$

$$\frac{0.0054 \text{ mol NaOH} \left| \frac{1 \text{ mol HCl}}{1 \text{ mol NaOH}} \right.}{1 \text{ mol NaOH}} = 0.0054 \text{ mol HCl}$$

- 2) If it takes 25 mL of 0.05 M HCl to neutralize 345 mL of NaOH solution, what is the concentration of the NaOH solution?

$$\text{mol HCl: } \frac{0.05 \text{ mol}}{\text{dm}^3} \left| \frac{25 \text{ cm}^3}{1000 \text{ cm}^3/\text{dm}^3} \right. = 0.00125 \text{ mol HCl}$$

$$\frac{0.00125 \text{ mol NaOH}}{0.345 \text{ dm}^3} =$$

$$0.0036 \text{ mol dm}^{-3} \text{ NaOH}$$

$$\frac{0.00125 \text{ mol HCl} \left| \frac{1 \text{ mol NaOH}}{1 \text{ mol HCl}} \right.}{1 \text{ mol HCl}} = 0.00125 \text{ mol NaOH}$$

- 3) If it takes 50 mL of 0.5 M KOH solution to completely neutralize 125 mL of sulfuric acid solution (H_2SO_4), what is the concentration of the H_2SO_4 solution?

$$2 \text{ KOH} + \text{H}_2\text{SO}_4 \rightarrow 2 \text{H}_2\text{O} + \text{K}_2\text{SO}_4$$

$$\text{mol KOH: } \frac{0.5 \text{ mol}}{\text{dm}^3} \left| \frac{50 \text{ cm}^3}{1000 \text{ cm}^3/\text{dm}^3} \right. = 0.025 \text{ mol KOH}$$

$$\frac{0.0125 \text{ mol H}_2\text{SO}_4}{0.125 \text{ dm}^3} = 0.1 \text{ mol dm}^{-3} \text{ H}_2\text{SO}_4$$

$$\frac{0.025 \text{ mol KOH} \left| \frac{1 \text{ mol H}_2\text{SO}_4}{2 \text{ mol KOH}} \right.}{2 \text{ mol KOH}} = 0.0125 \text{ mol H}_2\text{SO}_4$$

- 4) Can I titrate a solution of unknown concentration with another solution of unknown concentration and still get a meaningful answer? Explain your answer in a few sentences.

- 5) Explain the difference between an endpoint and equivalence point in a titration.

see pg. 392 in book