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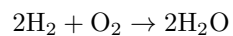
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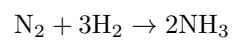
Stoichiometry Practice Worksheet

Show all work clearly. Include units and correct significant figures in all final answers.

1. How many grams of oxygen gas are required to completely react with 25.0 grams of hydrogen gas to produce water? The balanced equation is:

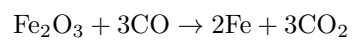


2. Consider the reaction:



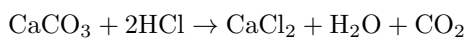
If 15.0 grams of nitrogen gas react with excess hydrogen, what mass of ammonia (in grams) is produced?

3. Iron(III) oxide reacts with carbon monoxide to produce iron and carbon dioxide:



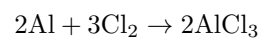
How many moles of carbon monoxide are needed to produce 112 grams of iron?

4. A student reacts 50.0 grams of calcium carbonate (CaCO_3) with excess hydrochloric acid:



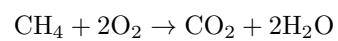
What volume of carbon dioxide gas (at STP) is produced? (At STP, 1 mole of gas occupies 22.4 L.)

5. In the reaction:

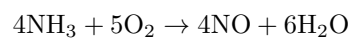


If 10.0 grams of aluminum react with 35.0 grams of chlorine gas, which reactant is limiting? What mass of aluminum chloride is produced?

6. How many molecules of water are produced when 5.00 grams of methane (CH_4) are burned completely in oxygen?

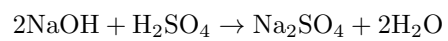


7. For the reaction:



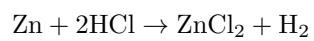
Calculate the mass of nitrogen monoxide produced when 34.0 grams of ammonia react with 80.0 grams of oxygen. Identify the limiting reactant.

8. A sample of 25.0 grams of sodium hydroxide (NaOH) is neutralized by sulfuric acid (H₂SO₄):



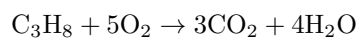
What mass of sodium sulfate is produced?

9. In the reaction:



If 13.0 grams of zinc react with excess hydrochloric acid, what volume of hydrogen gas (at STP) is produced?

10. Consider the combustion of propane:



If 44.0 grams of propane are burned, how many grams of carbon dioxide are produced? How many grams of oxygen are consumed?

Answer Key

- Answer:** 199 g O₂
Work: Molar mass H₂ = 2.02 g/mol; moles H₂ = 25.0 / 2.02 = 12.38 mol; mole ratio O₂:H₂ = 1:2, so moles O₂ = 6.19 mol; mass O₂ = 6.19 × 32.00 = 198.1 g ≈ 199 g.
- Answer:** 18.2 g NH₃
Work: Molar mass N₂ = 28.02 g/mol; moles N₂ = 15.0 / 28.02 = 0.5353 mol; mole ratio NH₃:N₂ = 2:1, so moles NH₃ = 1.0706 mol; mass NH₃ = 1.0706 × 17.04 = 18.24 g ≈ 18.2 g.
- Answer:** 3.01 mol CO
Work: Molar mass Fe = 55.85 g/mol; moles Fe = 112 / 55.85 = 2.005 mol; mole ratio CO:Fe = 3:2, so moles CO = (3/2) × 2.005 = 3.008 mol ≈ 3.01 mol.
- Answer:** 11.2 L CO₂
Work: Molar mass CaCO₃ = 100.09 g/mol; moles CaCO₃ = 50.0 / 100.09 = 0.4996 mol; mole ratio CO₂:CaCO₃ = 1:1, so moles CO₂ = 0.4996 mol; volume at STP = 0.4996 × 22.4 = 11.19 L ≈ 11.2 L.
- Answer:** Cl₂ is limiting; 43.8 g AlCl₃
Work: Molar mass Al = 26.98 g/mol; moles Al = 10.0 / 26.98 = 0.3706 mol; molar mass Cl₂ = 70.90 g/mol; moles Cl₂ = 35.0 / 70.90 = 0.4937 mol; mole ratio Al:Cl₂ = 2:3; required Cl₂ for Al = (3/2) × 0.3706 = 0.5559 mol (more than available, so Cl₂ limiting); moles AlCl₃ from Cl₂ = (2/3) × 0.4937 = 0.3291 mol; mass AlCl₃ = 0.3291 × 133.34 = 43.88 g ≈ 43.8 g.
- Answer:** 3.76 × 10²³ molecules H₂O
Work: Molar mass CH₄ = 16.04 g/mol; moles CH₄ = 5.00 / 16.04 = 0.3117 mol; mole ratio H₂O:CH₄ = 2:1, so moles H₂O = 0.6234 mol; molecules = 0.6234 × 6.022 × 10²³ = 3.754 × 10²³ ≈ 3.76 × 10²³.
- Answer:** O₂ is limiting; 60.0 g NO
Work: Molar mass NH₃ = 17.03 g/mol; moles NH₃ = 34.0 / 17.03 = 1.997 mol; molar mass O₂ = 32.00 g/mol; moles O₂ = 80.0 / 32.00 = 2.50 mol; mole ratio NH₃:O₂ = 4:5; required O₂ for NH₃ = (5/4) × 1.997 = 2.496 mol (available 2.50 mol, so NH₃ slightly in excess? Check: required NH₃ for O₂ = (4/5) × 2.50 = 2.00 mol, available 1.997 mol, so NH₃ is limiting? Let's recalc: 1.997 mol NH₃ needs (5/4) × 1.997 = 2.496 mol O₂, we have 2.50 mol O₂, so O₂ is in excess, NH₃ is limiting. Moles NO = moles NH₃ = 1.997 mol; mass NO = 1.997 × 30.01 = 59.93 g ≈ 60.0 g. (Alternatively, using O₂: 2.50 mol O₂ would produce (4/5) × 2.50 = 2.00 mol NO, but NH₃ only gives 1.997 mol, so NH₃ is limiting.)
- Answer:** 44.4 g Na₂SO₄
Work: Molar mass NaOH = 40.00 g/mol; moles NaOH = 25.0 / 40.00 = 0.625 mol; mole ratio Na₂SO₄:NaOH = 1:2, so moles Na₂SO₄ = 0.3125 mol; molar mass Na₂SO₄ = 142.04 g/mol; mass = 0.3125 × 142.04 = 44.39 g ≈ 44.4 g.
- Answer:** 4.46 L H₂
Work: Molar mass Zn = 65.38 g/mol; moles Zn = 13.0 / 65.38 = 0.1988 mol; mole ratio H₂:Zn = 1:1, so moles H₂ = 0.1988 mol; volume at STP = 0.1988 × 22.4 = 4.453 L ≈ 4.46 L.
- Answer:** 132 g CO₂; 160 g O₂
Work: Molar mass C₃H₈ = 44.10 g/mol; moles C₃H₈ = 44.0 / 44.10 = 0.9977 mol; mole ratio CO₂:C₃H₈ = 3:1, so moles CO₂ = 2.993 mol; mass CO₂ = 2.993 × 44.01 = 131.7 g ≈ 132 g. Mole ratio O₂:C₃H₈ = 5:1, so moles O₂ = 4.989 mol; mass O₂ = 4.989 × 32.00 = 159.6 g ≈ 160 g.