

1. Solid aluminum reacts with a solution copper (II) chloride to produce aluminum chloride and solid copper. (4)

a. Write the balanced reaction.  $2Al + 3CuCl_2 \rightarrow 2AlCl_3 + 3Cu$

b. What mass of copper is produced from 52.85 g of aluminum?

$$\frac{53.96 \text{ g Al}}{52.85 \text{ g Al}} = \frac{190.65 \text{ g Cu}}{x}$$

$$x = 186.738 \text{ g Cu}$$

$$26.98 \times 2 = 53.96$$

$$63.55 \times 3 = 190.6$$

$$186.7 \text{ g Cu}$$

c. How many grams of aluminum are required to react with 1.65 moles of copper (II) chloride?

$$\frac{2 \text{ mol Al}}{x} = \frac{3 \text{ mol CuCl}_2}{1.65 \text{ mol CuCl}_2}$$

$$x = 1.10 \text{ mol Al}$$

$$\frac{1 \text{ mol Al}}{1.10 \text{ mol Al}} = \frac{26.98 \text{ g}}{x}$$

$$x = 29.678 \text{ g Al}$$

$$29.7 \text{ mol Al}$$

$$253.8 \quad 39.95$$

2. Iodine and argon are placed into a container with a small opening. How long would it take the argon gas particles to effuse if it takes the iodine 275 s to effuse completely? (2)

$$\frac{t_{Ar}}{t_{I_2}} = \frac{\sqrt{M_{Ar}}}{\sqrt{M_{I_2}}}$$

$$\frac{t_{Ar}}{275} = \frac{\sqrt{39.95}}{\sqrt{253.8}}$$

$$t_{Ar} = 109.105$$

$$109 \text{ s}$$

3. Oxygen and an unknown noble gas are released at the opposite ends of a glass tube. It is determined that the unknown gas traveled at a speed of 4.10 m/s while the oxygen traveled at 10.8 m/s. Identify the gas. (2)

$$\frac{v_{O_2}}{v_x} = \frac{\sqrt{M_x}}{\sqrt{M_{O_2}}}$$

$$\frac{10.8}{4.10} = \frac{\sqrt{M_x}}{\sqrt{32.00}}$$

$$(\sqrt{M_x})^2 = (14.9)^2$$

$$M_x = 222.01$$

$$M_x = 222 \text{ g/mol}$$

$$\text{Radon}$$

4. A typical diffusion experiment is to release HCl gas on one end of a glass tube and NH<sub>3</sub> gas on the opposite end. The gasses will form a white ring (NH<sub>4</sub>Cl) where they meet. How far will the HCl gas travel if the NH<sub>3</sub> traveled 15.5 cm? (2)

$$\frac{d_{NH_3}}{d_{HCl}} = \frac{\sqrt{M_{HCl}}}{\sqrt{M_{NH_3}}}$$

$$\frac{15.5}{d_{HCl}} = \frac{\sqrt{36.46}}{\sqrt{17.04}}$$

$$d_{HCl} = 10.5964$$

$$d_{HCl} = 10.6 \text{ cm}$$