Skill building

(concentration %(m/v), ppm, limiting reactants, SLC volume calculations, n = CXV)

1. A gas occupies 4.0 L at 300 K and 150 kPa. If its mass is 6.00 g, calculate the molar mass of the gas to the right number of significant figures. (R = 8.31)

2. Convert 150 kPa to atm. (1 atm = 101.3 kPa)

3. A sample of gas weighs 12.00 g and occupies a volume of 8.00 L at 298 K and 120 kPa. Find the molar mass of the gas.

4. 10.0 g of carbon dioxide gas occupies a volume of 5.00 L at 350 K. Calculate the pressure, in kPa, exerted on the walls of the container.

5. Aluminium reacts with iron(III) oxide according to the unbalanced equation below.

$$Al + \quad Fe_2O_3 \rightarrow \quad Al_2O_3 + \quad Fe$$

   a. Balance the equation

   b. If 25.0 g of aluminum reacts with 40.0 g of iron(III) oxide what mass of iron is formed?

6. In the reaction $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$, 50 g of calcium carbonate decomposes. Calculate the volume of carbon dioxide released, at SLC.

7. Using the reaction $H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$, 4.00 g of hydrogen reacts with 12.0g of chlorine gas.

   a. Which is the excess reactant

   b. What mass of the excess reactant remains?

   c. How many grams of hydrochloric acid are produced?

8. Given the combustion reaction of ethane ($C_2H_6 + \frac{7}{2}O_2 \rightarrow 2CO_2 + 3H_2O$),

   a. calculate the volume of CO_2 produced when 30 g of ethane is burned with excess oxygen at SLC.

   b. Calculate the mass of oxygen that was consumed in this reaction.

9. 15.0 L of nitrogen gas react with 45 L of hydrogen gas at 273 K and 100 kPa to form ammonia according to the reaction: $N_2 + 3H_2 \rightarrow 2NH_3$

   a. Identify the limiting reactant.

   b. The ammonia gas produced is placed in a sealed container at 273 K and 100 kPa pressure. Calculate the volume, in litres, of the sealed container.

10. When 12.00 g of magnesium reacts with 40.00 g of oxygen, calculate the mass of magnesium oxide produced.

$$2Mg(s) + O_2 \rightarrow 2MgO(s)$$

11. Calcium reacts with hydrochloric acid according to the equation:

$$Ca(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2(g)$$

If 10.0 g of calcium is added to 150 mL of 1.5 mol/L hydrochloric acid:

- calculate which is the limiting reactant

- the concentration, in mol/litre, of calcium chloride produced assuming the 10.0 grams of Ca takes up zero volume.