

1. a. How many moles of NO_2 gas occupy a volume of 35 L at STP?

$$35 \text{ L} \left(\frac{1 \text{ mol}}{22.4 \text{ L}} \right) = 1.6 \text{ mol}$$

- b. What is the mass of 35 L of NO_2 gas at STP?

$$\text{FW} = (14.0) + 2(16.0) = 46 \text{ g/mol}$$

$$1.6 \text{ mol} \times 46 \text{ g/mol} = 74 \text{ g}$$

- c. How many NO_2 molecules are in 35 L of NO_2 gas at STP?

$$1.6 \text{ mol} \times \frac{6.02 \times 10^{23} \text{ molecules}}{1 \text{ mol}} = 9.6 \times 10^{23} \text{ molecules}$$

2. 8.0 g of an unknown gas occupy a volume of 5.6 L at STP. What is the molar mass of the unknown gas?

$$\text{moles} = 5.6 \text{ L} \left(\frac{1 \text{ mol}}{22.4 \text{ L}} \right) = 0.25 \text{ mol}$$

$$\text{molar mass} = \frac{8.0 \text{ g}}{0.25 \text{ mol}} = 32. \text{ g/mol}$$

3. Weather balloons filled with hydrogen gas are occasionally reported as UFOs. They can reach altitudes of about 40 km. What volume does 7.50 mol of hydrogen gas in a weather balloon occupy at STP?

$$7.50 \text{ mol} \times 22.4 \text{ L/mol} = 168 \text{ L}$$

4. Sulphur dioxide gas is emitted from marshes, volcanoes, and refineries that process crude oil and natural gas. How many moles of sulphur dioxide molecules are contained in 50 mL of the gas at STP?

$$50 \text{ mL} \times \frac{1 \text{ L}}{1000 \text{ mL}} = 0.050 \text{ L} \quad 0.050 \text{ L} \times \frac{1 \text{ mol}}{22.4 \text{ L}} = 2.2 \times 10^{-3} \text{ mol}$$

5. Neon gas under low pressure emits the red light that glows in advertising signs. What volume does 2.25 mol of neon gas occupy at STP before being added to neon tubes in a sign?

$$2.25 \text{ mol} \times 22.4 \text{ L/mol} = 50.4 \text{ L}$$

6. Oxygen is released by plants during photosynthesis and is used by plants and animals during respiration. What amount in moles of oxygen is present in 20.0 L of air at STP? Assume that air is 20% oxygen by volume.

$$20.0 \text{ L} \times 0.20 = 4.0 \text{ L } \text{O}_2 \quad 4.0 \text{ L} \times \frac{1 \text{ mol}}{22.4 \text{ L}} = 0.18 \text{ mol}$$

7. Helium gas is used in balloons to make them float or rise in the air. What is the density of helium gas?

$$1 \text{ mol He} = 4.00 \text{ g} \\ = 22.4 \text{ L} \quad \text{density} = \frac{4.00 \text{ g}}{22.4 \text{ L}} = 0.178 \text{ g/L}$$

8. Uranium hexafluoride is a very dense gas used to separate isotopes of uranium for nuclear applications. What is the density of this gas at STP?



$$\text{density} = \frac{352 \text{ g}}{22.4 \text{ L}} = 15.7 \text{ g/L}$$

$$\text{FW} = 238.0 + 6(19.0) = 352 \text{ g/mol}$$