

Chemistry 20

Lesson 32 – Ideal Gas Law

I. Assignment

Read pages 172 to 175 in the *Nelson* text.

1. What are the assumptions for an ideal gas? How does the behaviour of real gases deviate from the ideal gas assumptions?
2. What amount of methane gas is present in a sample that has a volume of 500 mL at 35°C and 210 kPa?
3. Determine the pressure in a 50 L compressed air cylinder if 30 mol of air is present in the container, which is heated to 40°C.
4. What volume does 50 kg of oxygen gas occupy at a pressure of 150 kPa and a temperature of 125°C?
5. At what temperature does 10.5 g of ammonia gas exert a pressure of 85.0 kPa in a 30.0 L container?
6. Starting with the ideal gas law, derive a formula to calculate the molar mass M of a gas, given the mass and volume of the gas at a specific pressure and temperature.
7. Using the formula derived in question 6, calculate the molar mass of 1.00 L of gas that has a mass of 1.25 g and that exerts a pressure of 100 kPa at 0°C.
8. Steam production during baking is a secondary reason why bread and cakes rise. What volume of water vapor is produced inside a cake when 1.0 g of water is vaporized at 98°C and 103 kPa?
9. Large quantities of chlorine gas are produced from salt to make bleach and for water treatment. What is the volume of 26.5 kmol of chlorine gas at 400 kPa and 35°C?
10. Bromine is produced by reacting chlorine with bromide ions in sea water. What amount of bromine is present in an 18.8 L sample of gas at 60 kPa and 140°C?

11. A student is trying to identify a pure gas sample. She decides to determine the molar mass of the gas, and obtains the following evidence.
- mass of evacuated container = 7.02 g
 - mass of container plus gas = 9.31 g
 - volume of container = 1.25 L
 - temperature of gas = 23.4°C
 - pressure of gas = 102.2 kPa
- a. From the evidence gathered, what is the molar mass of this common gas?
 - b. What is a possible identity of the gas? Can you be certain of this? Briefly explain your reasoning.
12. "Standard ambient temperature and pressure" is a convention established by scientists to suit conditions on Earth. Suppose scientists were to establish standard conditions on the planet Venus as 800°C and 7500 kPa. What is the molar volume of Venus's mainly carbon dioxide atmosphere under these standard conditions?
13. Chinook winds in Alberta cause rapid changes in weather. Calculate the final volume of a cubic metre (1.00 m³) of air at -23°C and 102 kPa when the temperature and pressure change to 12°C and 96 kPa during a Chinook.