

Gas Laws Review

(Boyle's, Charles', Avogadro's, Ideal)

Instructions: for each of the problems below provide the following: the name of the gas law used, show numbers in the formula, and write the answer (sig. figs, and units) in the box provided $V = ?$ n $O_2 = 32g/mol$ P

1. What volume would be occupied by 100. g of oxygen gas at a pressure of 1.50 atm and a temperature of 25.0 °C?

Law: 51.0 L

Work:

Ans: Ideal

$$V = \frac{nRT}{P}$$

$$\frac{100. g / mol}{32.0 g / mol \cdot K} \cdot 0.0821 L \cdot atm / 298 K \cdot 1.50 atm$$

2. An air-filled balloon has a volume of 225 L at 0.940 atm and 25.0 °C. Soon after the pressure changes to 0.990 atm and the temperature changes to 0.0 °C. What is the new volume of the balloon?

Law: 196 L

Work:

Ans: Iden

$$V_2 = \frac{P_1 V_1 T_2}{T_1 P_2} = \frac{0.940 atm \cdot 225 L \cdot 273 K}{298 K \cdot 0.990 atm}$$

3. If 3.25 L of a gas is at 16.5 psi, what pressure is required to reduce the volume to 175 mL?

Law: 306 psi

Work:

Ans: Boyle

$$P_2 = \frac{P_1 V_1}{V_2}$$

$$P_2 = \frac{16.5 psi \cdot 3.25 L}{0.175 L}$$

4. If 12.5 g of carbon dioxide has a volume of 3.50 L, what volume will 34.0 g occupy at the same T & P?

Law: 9.52 L

Work:

Ans: Avogadro

$$V_2 = \frac{V_1 n_2}{n_1}$$

$$\frac{3.50 L \cdot 34.0 g}{12.5 g}$$

$$CO_2 = 44 g/mol$$

$$K = C + 273$$

$$\frac{P_1 V_1}{n_1 T_1} = \frac{P_2 V_2}{n_2 T_2}$$

$$T_2 = \frac{T_1 P_2 V_2}{P_1 V_1}$$

5. A gas confined in a 515 cm³ container exerts a pressure of 107 kPa at 138°C. At what Celsius temperature will it exert a pressure of 235 kPa if it is placed into a 644 cm³ container?

Law: 856°C

Work:

Ans: Ideal

$$\frac{411 K \cdot 235 kPa \cdot 644 cm^3}{107 kPa \cdot 515 cm^3} = 1129 K$$

6. A sample of gas is at constant pressure. At 30°C the volume is 3.8 L. What volume will this sample occupy at 60°C?

Law: 4.1 L

Work:

Ans: Charles

$$V_2 = \frac{V_1 T_2}{T_1}$$

$$\frac{3.8 L \cdot 330 K}{303 K}$$

7. A balloon is inflated with 0.2494 g of helium to a pressure of 1.26 atm. If the desired volume of the balloon is 1.250 L, what must the temperature be in °C?

Law: 35.7°C

Work:

Ans: Ideal

$$T = \frac{PV}{nR}$$

$$\frac{1.26 atm \cdot 1.250 L \cdot mol \cdot K}{0.2494 g \cdot 0.0821 L \cdot atm / mol \cdot K} = 308 K$$

8. A welder's acetylene tank has a volume of 75.0 L. It is stored at a temperature of 23°C and has a pressure of 7660 kPa. How many moles of acetylene are in the tank?

Law: 236 mol C₂H₂

Work:

Ans: Ideal

$$n = \frac{PV}{RT}$$

$$\frac{7660 kPa \cdot 75.0 L \cdot mol \cdot K}{296 K \cdot 101.3 kPa \cdot 0.0821 L \cdot atm / mol \cdot K}$$

9. How many grams of argon would it take to fill a light bulb with a volume of 0.475 L at STP?

Law: 0.848 g

Work:

Ans: Ideal

$$n = \frac{PV}{RT}$$

$$n = 0.0213 mol \cdot 40 g Ar$$

$$\frac{1 atm \cdot 0.475 L \cdot mol \cdot K}{0.0821 L \cdot atm / mol \cdot K \cdot 273 K}$$

10. What pressure is exerted by 0.625 mole of a gas in a 45.4 L container at -240°C?

Law: 2.81 atm

Work:

Ans: Ideal

$$P = \frac{nRT}{V}$$

$$\frac{0.625 mol \cdot 0.0821 L \cdot atm / mol \cdot K \cdot 249 K}{45.4 L}$$