Chemistry: *The Combined Gas Law*

Solve the following problems. As always, include enough work and show the units to ensure full credit.

1. The pressure of a gas changes from 120 kPa to 50 kPa. The volume changes from 45 L to 40 L. If the initial temperature is 81°C, what is the final temperature in °C?

2. A sample of nitrogen goes from 21 m^3 to 14 m^3 and its pressure increases from 100 kPa to 150 kPa. The final temperature is 300 K. What was the initial temperature in Kelvins?

3. A sample of argon goes from 500 K to 350 K and its pressure changes from 280 kPa to 380 kPa. If the initial volume is 18 dm^3, what is the final volume?

4. A sample of neon experiences a pressure drop from 75 kPa to 53 kPa. The temperature increases from 27°C to 93°C. If the initial volume is 12 L, what is the final volume?

5. The volume of a sample of helium increases from 5 L to 25 L and its temperature drops from 2000 K to 1750 K. If the initial pressure is 1500 mm Hg, what is the final pressure?

6. The temperature of a gas increases from 212°C to 380°C. The volume goes from 30 dm^3 to 18 dm^3. If the final pressure is 1.85 atm, what was the initial pressure?

Answers: 1. −142°C   2. 300 K   3. 9.3 dm^3 4. 20.7 L   5. 262.5 mm Hg   6. 0.82 atm

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Solve the following problems. As always, include enough work and show the units to ensure full credit.

1. The pressure of a gas changes from 120 kPa to 50 kPa. The volume changes from 45 L to 40 L. If the initial temperature is 81°C, what is the final temperature in °C?

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$
$$\frac{(120 kPa)(45L)}{354 K} = \frac{(50 kPa)(40L)}{T_2}$$

$$\boxed{T_2 = 131 K}$$
$$131 - 273 = \boxed{-142°C}$$

2. A sample of nitrogen goes from 21 m³ to 14 m³ and its pressure increases from 100 kPa to 150 kPa. The final temperature is 300 K. What was the initial temperature in Kelvins?

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$
$$\frac{(100 kPa)(21 m^3)}{T_1} = \frac{(150 kPa)(14 m^3)}{300. K}$$

$$\boxed{T_1 = 300 K}$$

3. A sample of argon goes from 500 K to 350 K and its pressure changes from 280 kPa to 380 kPa. If the initial volume is 18 dm³, what is the final volume?

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$
$$\frac{(280 kPa)(18 dm^3)}{500 K} = \frac{(380 kPa) V_2}{350 K}$$

$$\boxed{V_2 = 9.3 dm^3}$$

4. A sample of neon experiences a pressure drop from 75 kPa to 53 kPa. The temperature increases from 27°C to 93°C. If the initial volume is 12 L, what is the final volume?

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$
$$\frac{(75 kPa)(12 L)}{300. K} = \frac{(53 kPa) V_2}{366 K}$$

$$\boxed{V_2 = 21 L}$$

5. The volume of a sample of helium increases from 5 L to 25 L and its temperature drops from 2000 K to 1750 K. If the initial pressure is 1500 mm Hg, what is the final pressure?

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$
$$\frac{(1500 mm Hg)(5L)}{2000. K} = \frac{P_2 (25L)}{1750 K}$$

$$P_2 = 263 mm$$
$$\sqrt{300 mm Hg}$$

6. The temperature of a gas increases from 212°C to 380°C. The volume goes from 30 dm³ to 18 dm³. If the final pressure is 1.85 atm, what was the initial pressure?

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$
$$\frac{P_1 (30 dm^3)}{485 K} = \frac{(1.85 atm)(18 dm^3)}{653 K}$$

$$\boxed{P_1 = .82 atm}$$

Answers: 1. −142°C   2. 300 K   3. 9.3 dm³   4. 20.7 L   5. 262.5 mm Hg   6. 0.82 atm
   21   300 mm H₃