WKS – Honors
Boyle's & Charles's Laws

NAME _____
Period _____ **Date** _____

Solve the following problems using Boyle's and Charles's Laws. If a property is not mentioned in a problem, assume that it is held constant. Show all calculations including temperature conversions.

1) A sample of neon gas occupies a volume of 2.8 L at 1.8 atm. What will its volume be at 1.2 atm?

$$P_1V_1 = P_2V_2 \Rightarrow V_2 = \left(\frac{P_1}{P_2}\right)V_1 = \left(\frac{1.8\ \cancel{atm}}{1.2\ \cancel{atm}}\right)(2.8\ L) = \boxed{4.2\ L}$$

2) To what pressure would you have to compress 48.0 L of oxygen gas at 99.3 kPa in order to reduce its volume to 16.0 L?

$$P_1V_1 = P_2V_2 \Rightarrow P_2 = \left(\frac{V_1}{V_2}\right)P_1 = \left(\frac{48.0\ \cancel{L}}{16.0\ \cancel{L}}\right)(99.3\ kPa) = \boxed{298\ kPa}$$

3) A chemist collected 29.0 mL of sulfur dioxide gas at an atmospheric pressure of 0.989 atm. What was the volume when the pressure was reduced to 0.967 atm?

$$P_1V_1 = P_2V_2 \Rightarrow V_2 = \left(\frac{P_1}{P_2}\right)V_1 = \left(\frac{0.989\ \cancel{atm}}{0.967\ \cancel{atm}}\right)(29.0\ mL) = \boxed{29.7\ mL}$$

4) A balloon full of air has a volume of 2.75 L at a temperature of 18°C. What is the balloon's volume at 45°C?

$T_1 = 18°C + 273 = 291\ K;\ T_2 = 45°C + 273 = 318\ K$

$$\frac{V_1}{T_1} = \frac{V_2}{T_2} \Rightarrow V_2 = \left(\frac{T_2}{T_1}\right)V_1 = \left(\frac{318\ \cancel{K}}{291\ \cancel{K}}\right)(2.75\ L) = \boxed{3.01\ L}$$

5) A sample of argon has a volume of 0.43 mL at 24°C. At what temperature *in °C* will it have a volume of 0.57 mL?

$T_1 = 24°C + 273 = 297\ K$

$$\frac{V_1}{T_1} = \frac{V_2}{T_2} \Rightarrow T_2 = \left(\frac{V_2}{V_1}\right)T_1 = \left(\frac{0.57\ \cancel{mL}}{0.43\ \cancel{mL}}\right)(297\ K) = 390\ K;\ T_2 = 390 - 273 = \boxed{120°C}$$

6) 4.40 L of a gas is collected at 50.0°C. What will be its volume upon cooling to 25.0°C?

$T_1 = 50.0°C + 273 = 323\ K;\ T_2 = 25.0°C + 273 = 298\ K$

$$\frac{V_1}{T_1} = \frac{V_2}{T_2} \Rightarrow V_2 = \left(\frac{T_2}{T_1}\right)V_1 = \left(\frac{298\ \cancel{K}}{323\ \cancel{K}}\right)(4.40\ L) = \boxed{4.06\ L}$$

7) 5.00 L of a gas is collected at 100. K and then allowed to expand to 20.0 L. What must the new temperature be?

Temperature is already in K; no need to convert!

$$\frac{V_1}{T_1} = \frac{V_2}{T_2} \Rightarrow T_2 = \left(\frac{V_2}{V_1}\right)T_1;\ T_2 = \left(\frac{20.0\ \cancel{L}}{5.00\ \cancel{L}}\right)(100.\ K) = \boxed{400.\ K}$$