Name _____ Date _____

Charles' Law Worksheet #2. Show all work and include units!

1. When the temperature of a gas decreases, does the volume increase or decrease?

~~Increase~~ Decreases

2. 600.0 mL of air is at 20.0 °C. What is the volume at 60.0 °C?

$\frac{T_1}{V_1} = \frac{T_2}{V_2}$ $T_1 = 20.0°C + 273.0 = 293.0\,K$ $T_2 = 60.0°C + 273.0 = 333.0\,K$

$\frac{293.0\,K}{600.0\,mL} = \frac{333.0\,K}{V_2}$ $\frac{V_2(293\,K)}{293\,K} = \frac{(600.0\,mL)(333.0\,K)}{293\,K}$

$V_2 = 681.9\,mL$ ~~682~~

3. What change in volume results if 60.0 mL of gas is cooled from 33.0 °C to 5.00 °C?

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

$T_1 = 33.0°C + 273.0 = 306.0\,K$

$T_2 = 5.00°C + 273.00 = 278.00\,K$

$\frac{306.0\,K}{60.0\,mL} = \frac{278.0\,K}{V_2}$ $\frac{V_2(306.0\,K)}{306.0\,K} = \frac{(278.0\,K)(60.0\,mL)}{306.0\,K}$

$V_2 = 54.5\,mL$

4. At 210.0 °C a gas has a volume of 8.00 L. What is the volume of this gas at -23.0 °C?

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

$T_1 = 210.0°C + 273.0 = 483.0\,K$

$T_2 = -23.0°C + 273.0 = 250.0\,K$

$\frac{483.0\,K}{8.00\,L} = \frac{250.0\,K}{V_2}$ $\frac{(483.0\,K)\cdot V_2}{483.0\,K} = \frac{(250.0\,K)(8.00\,L)}{483.0\,K}$

$V_2 = 4.14\,L$

5. Carbon dioxide is usually formed when gasoline is burned. If 30.0 L of CO_2 is produced at a temperature of 1.00×10^3 °C and allowed to reach room temperature (25.0 °C) without any pressure changes, what is the new volume of the carbon dioxide?

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

$T_1 = 1.00 \times 10^3°C + 273.00 = 1273.00\,K$

$T_2 = 25.0°C + 273.0 = 298.0\,K$

$\frac{1273.00\,K}{30.0\,L} = \frac{298.0\,K}{V_2}$ $\frac{V_2(1273.00\,K)}{1273.00\,K} = \frac{(30.0\,L)(298.0\,K)}{1273.00\,K}$

$V_2 = 7.02\,L$

6. A gas syringe contains 56.05 milliliters of a gas at 315.1 K. Determine the volume that the gas will occupy if the temperature is increased to 380.5 K.

$\frac{T_1}{V_1} = \frac{T_2}{V_2}$ $\quad \frac{315.1\ K}{56.05\ mL} = \frac{380.5\ K}{V_2}$

$(V_2)(315.1\ K) = (380.5\ K)(56.05\ mL)$

$\frac{(V_2)(315.1\ K)}{315.1\ K} = \frac{(380.5\ K)(56.05\ mL)}{315.1\ K}$

$V_2 = 67.68\ mL$

7. At 27.00 °C a gas has a volume of 6.00 L. What will the volume be at 150.0 °C?

$\frac{T_1}{V_1} = \frac{T_2}{V_2}$ $\quad \frac{300.0\ K}{6.00\ L} = \frac{423.0\ K}{V_2}$

$T_1 = 27.00\ °C + 273.00 = 300.00\ K$

$T_2 = 150.0\ °C + 273.0 = 423.0\ K$

$\frac{V_2(300.0\ K)}{300.0\ K} = \frac{(6.00\ L)(423.0\ K)}{300.0\ K}$

$V_2 = 8.46\ L$

8. Calculate the decrease in temperature when 2.00 L at 20.0 °C is compressed to 1.00 L.

$\frac{T_1}{V_1} = \frac{T_2}{V_2}$ $\quad \frac{293.0\ K}{2.00\ L} = \frac{T_2}{1.00\ L}$

$T_1 = 20.0\ °C + 273.0 = 293.0\ K$

$\frac{(1.00\ L)(293.0\ K)}{2.00\ L} = \frac{T_2 \cdot (2.00\ L)}{2.00\ L}$

$147\ K = T_2$

- $293.0\ K - 147\ K =$ 146 K is the decrease

9. At 225.0 °C a gas has a volume of 400.0 mL. What is the volume of this gas at 127.0 °C?

$\frac{T_1}{V_1} = \frac{T_2}{V_2}$ $\quad \frac{498.0\ K}{400.0\ mL} = \frac{400.0\ K}{V_2}$

$T_1 = 225.0\ °C + 273.0 = 498.0\ K$

$T_2 = 127.0\ °C + 273.0 = 400.0\ K$

$\frac{V_2(498.0\ K)}{498.0\ K} = \frac{(400.0\ K)(400.0\ mL)}{498.0\ K}$

$V_2 = 321.3\ mL$

10. A sample of oxygen gas has a volume of 2.73 dm^3 at 21.0 °C. At what temperature would the gas have a volume of 4.00 dm^3?

$\frac{T_1}{V_1} = \frac{T_2}{V_2}$ $\quad \frac{294.0\ K}{2.73\ dm^3} = \frac{T_2}{4.00\ dm^3}$

$T_1 = 21.0\ °C + 273 = 294.0\ K$

$\frac{T_2(2.73\ dm^3)}{2.73\ dm^3} = \frac{(294.0\ K)(4.00\ dm^3)}{2.73\ dm^3}$

$T_2 = 431\ K$