Name BETH "KEY" Period

Honors Chem 1: Gases Review WS

1. Gas pressure is due to: COLLISIONS OF GAS PARTICLES
2. Temperature is a measure of: AVERAGE KINETIC ENERGY OF THE PARTICLES THAT MAKE UP A SUBSTANCE
3. A vacuum can be described as: EMPTY SPACE

4. If I initially have a gas at a pressure of 14atm (P_1), a volume of 28 liters (V_1), and a temperature of 205 K (T_1), and then I raise the pressure to 20.0atm (P_2) and increase the temperature to 300.0K (T_2), what is the new volume of the gas?

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

$$\frac{(300.0\,K)(14\,atm)(28\,L)}{(20.0\,atm)(205\,K)} = \boxed{29\,L}$$

5. It is not safe to put aerosol spray cans in a campfire because the pressure inside the can gets very high and it can explode. If I have a 1.00 L (V) can that holds 2.25 moles (n) of gas, and the campfire temperature is 1400.°C (T), what is the pressure inside the can?

$PV = nRT \qquad P = \frac{nRT}{V} \qquad T = 1400. + 273.15 = 1673\,K$

$$P = \frac{2.25\,mol \cdot 0.08206\,\frac{atm \cdot L}{K \cdot mol} \cdot 1673\,K}{1.00\,L} = \boxed{309\ atm}$$

6. A volume of air occupying 12.0L (V_1) at 98.9kPa (P_1) is compressed to a pressure of 119.0kPa? (P_2) If the temperature remains constant, what is the new volume of air?

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

$$\frac{98.9\,kPa \cdot 12.0\,L}{119.0\,kPa} = \boxed{9.97\,L}$$

7. What volume would be occupied by 100.0 g of oxygen gas at a pressure of 1.50 atm (P) and a temperature of 25°C (T)?

$T = 25 + 273.15 = 298\,K \leftarrow$ 3 s.f.

change to moles ↑

$$\frac{100.0\,g}{32.00\,\frac{g}{mol}} = 3.125\ mol\ O_2$$

$\frac{PV = nRT}{P \quad P} \qquad V = \frac{nRT}{P}$

$$V = \frac{3.125\,mol \cdot 0.08206\,\frac{atm \cdot L}{K \cdot mol} \cdot 298\,K}{1.50\,atm}$$

$$\boxed{V = 50.9\,L}$$

8. A gas takes up a volume of 15.0 liters, has a pressure of 2.80atm, and a temperature of 299K. If I raise the temperature to 350K and lower the pressure to 1140mmHg, what is the new volume of the gas?

(V_1, P_1, T_1; T_2, P_2, V_2)

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

$$1140\,\text{mmHg} \times \frac{1\,\text{atm}}{760.0\,\text{mmHg}} = 1.50\,\text{atm} \quad (P_2)$$

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

(2 s.f.)

$$\frac{350\,\text{K} \cdot 2.80\,\text{atm} \cdot 15.0\,\text{L}}{1.50\,\text{atm} \cdot 299\,\text{K}} = \boxed{33\,\text{L}}$$

9. On a warm day, an amusement park balloon is filled with 47.8 g of helium. The temperature is 33°C and the pressure in the balloon is 2.25 atm. Calculate the volume of the balloon. (T)

↑ change to moles (n)

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

$$\frac{47.8\,\text{g He}}{4.00\,\text{g/mol}} = 11.95\,\text{mol He}$$

$$T = 273.15 + 33 = 306\,\text{K}$$

$$V = \frac{11.95\,\text{mol} \cdot 0.08206\,\frac{\text{atm}\cdot\text{L}}{\text{K}\cdot\text{mol}} \cdot 306\,\text{K}}{2.25\,\text{atm}}$$

$\boxed{V = 133\,\text{L}}$ That's a big balloon!

10. The pressure of a 17.5L container of gas is 3.00atm and the container is held at a constant temperature of 20.0C. If the volume of the gas is held constant, what would the temperature of the gas be if the pressure is decreased to 2.25atm?

(P_1, T_1; T_2; P_2)

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$ (cross multiply & divide) ← can't solve for T_2 in denominator.

$$\frac{T_1 \cdot T_2 \cdot P_1}{P_1 \cdot T_1} = \frac{P_2 \cdot T_2 \cdot T_1}{T_2 \, P_1} \qquad T_2 = \frac{P_2 T_1}{P_1} \qquad T_2 = \frac{2.25\,\text{atm} \cdot 293.2\,\text{K}}{3.00\,\text{atm}}$$

$T_1 = 273.15 + 20.0 = 293.2\,\text{K}$

$\boxed{T_2 = 220.\,\text{K}}$

11. If a gas in a closed container is pressurized from 15.0 atmospheres to 16.0 atmospheres and its original temperature was 25.0C, what would the final temperature of the gas be?

(P_1, P_2; T_1)

Constant V

$$T_2 = \frac{P_2 T_1}{P_1}$$ ← (same as #10)

$$T_2 = \frac{16.0\,\text{atm} \cdot 298.2\,\text{K}}{15.0\,\text{atm}} = \boxed{318\,\text{K}}$$

12. How many moles of air are there in a 125 mL erlenmeyer flask if the pressure is 755 mm Hg and the temperature is 20°C?

(V; P; T)

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

$$755\,\text{mmHg} \times \frac{1.000\,\text{atm}}{760.0\,\text{mmHg}} = 0.993\,\text{atm}$$

$$125\,\text{mL} \times \frac{1\,\text{L}}{1000\,\text{mL}} = 0.125\,\text{L}$$

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

$$\frac{0.993\,\text{atm} \cdot 0.125\,\text{L}}{293\,\text{K} \cdot 0.08206\,\frac{\text{atm}\cdot\text{L}}{\text{K}\cdot\text{mol}}} = \boxed{5.16 \times 10^{-3}\,\text{mol air}}$$