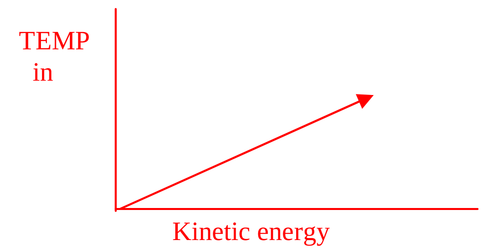
Gases HW - 1 ANSWERS

1 State the 4 variables that we can use to describe a gas

pressure, volume, temperature (K), and the number of moles

2 The Kinetic Molecular Theory can be summed up briefly using these statements: Gases are made up of hard spherical particles. Particle volume is insignificant to gas volume. The particles have no attraction or repulsion for each other. Gas particles move fast and only in straight lines. Particle collisions are elastic – collisions cause no loss of energy. The average kinetic energy of a gas is directly proportional to the temperature of the gas in Kelvin. The collisions of the particles result in gas pressure. Choose 3 and explain them on the BACK Are they true?, almost true?, sometimes true?, or tell how they are untrue but help explain gases. **EXPLAIN THREE**

3 Draw a line graph showing the relationship between temperature in Kelvin as a function of kinetic energy



4 Imagine that you have a balloon of 16.2 L of helium at STP. How many moles of helium do you have?

5. How many grams of helium is that (to the tenth's place)?

6. How many atoms of helium is that?

7. How is it possible to compress 16.2 liters of helium gas into a 1.0 liter canister?

This much gas can be compressed to 1.0 L because the particles are very far apart from each other relative to the size of the space they take up. There’s plenty of room to squish it. By decreasing the volume, Pressure + Temperature increases.

5 On the back page of your reference table is the combined gas law. Copy it into the box.

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

6. Tell what do P, V, and T stand for?

P = pressure, use any units just stay consistent in the whole problem
V = volume, again, use any units just stay consistent in the whole problem
T = temperature, but you can ONLY use Kelvin

7. We only use Kelvin for the T, why?

So we never get a zero or a negative number in our math. That would be bad, bad, bad.

Gases HW - 2 name: ___________________________________

The graphs MUST have axis labels in the correct place.

1 Draw a simple graph showing pressure as a function of volume

2 Draw a simple line graph showing volume as a function of pressure

3 Draw a simple line graph showing pressure as a function of temperature

In the boxes below…

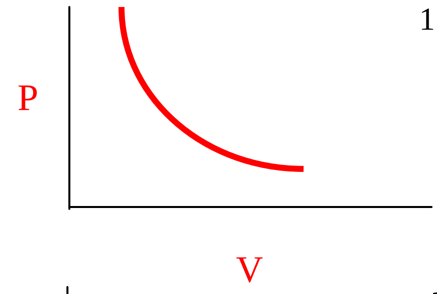
4. Write out the combined gas law

5. Re-write the combined gas law with constant temperature

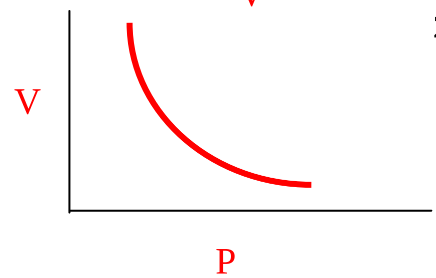
6. Re-write the combined gas law with constant pressure

7. Re-write the combined gas law with constant volume

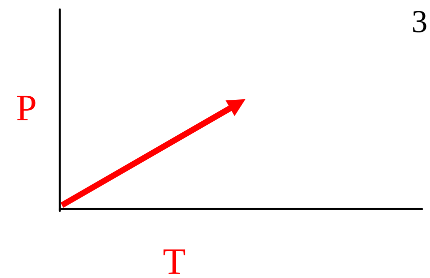
1



2



3



4 $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$	5 $P_1V_1 = P_2V_2$
6 $\frac{V_1}{T_1} = \frac{V_2}{T_2}$	7 $\frac{P_1}{T_1} = \frac{P_2}{T_2}$

8. How many nitrogen molecules are in 5.12 Liters of the gas at STP?

$$\frac{5.12 \text{ L } N_2}{1} \times \frac{1 \text{ mole } N_2}{22.4 \text{ L}} \times \frac{6.02 \times 10^{23} \text{ molecules } N_2}{1 \text{ mole } N_2} = 1.38 \times 10^{23} \text{ molecules } N_2$$

9. The gas in a closed container (constant volume) has a pressure of 3.00×10^2 kPa at 30.0ºC. What will the pressure be if the temperature is lowered to -172ºC? (remember - use Kelvin, and SF!!!) (I'd convert out of scientific notation too)

$$\frac{P_1}{T_1} = \frac{P_2}{T_2} \qquad \frac{300.\text{ kPa}}{303 \text{ K}} = \frac{P_2}{101 \text{ K}} \qquad P_2 = 100.\text{ kPa}$$

10. At constant temperature, calculate the volume of a gas in liters at a pressure of 1.00×10^2 kPa if its volume at 1.20×10^2 kPa is 1.50×10^3 mL. (I'd convert out of scientific notation here as well)

$P_1V_1 = P_2V_2$ (120. kPa)(1500 mL) = (100. kPa)(V_2) all with 3 SF!!!

1800 mL = V_2 = 1.80×10^3 mL with 3 SF

Gases HW - 3 name: ___________________________________

1 State Avogadro's Hypothesis.

Avogadro's Hypothesis states that equal volumes of any gases, at the same temperature and pressure, have equal numbers of particles, and the same number of moles.

2 Write chemical formulas for any two real gases, and for one ideal gas. Ideal gases are fake, there are none. CO_2, O_2, CH_4

3 Under what conditions of temperature and pressure do real gases most closely mimic ideal gases?

High temperature and low pressures, that way they are less likely to turn into a liquid.

4 If you have three different gases (CO_2, He, and C_3H_6) all at 125.4 kPa and 299 K, which is most ideal, and why?

The hydrogen here, because when comparing different gases at the same conditions, it's the smallest particle gas that acts most ideally - that is it's least likely to turn into a liquid.

5 If 32.5 L of He at STP is changed to 75.0 kPa at constant temperature, what is new volume?

$P_1V_1 = P_2V_2$ becomes (101.3 kPa)(32.5 L) = (75.0 kPa)(V_2) V_2 = 43.9 Liters helium

6 The pressure on 125 L of carbon dioxide is 101.3 kPa at 275 Kelvin. If it's chilled to 155 K with volume becomes 65.0 liters, what is the new pressure?

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2} \qquad \frac{(101.3\text{ kPa})(125\text{ L})}{275\text{ K}} = \frac{(P_2)(65.0\text{ L})}{155\text{ K}} = 109.8 = 110.\text{ kPa}$$

7 A sealed cylinder (constant volume) contains N_2 gas at 1.00×10^3 kPa pressure and a temperature of 20.0ºC. If the cylinder is left in the sun and heats to 50.0ºC. What is the new pressure inside the cylinder?

$$\frac{P_1}{T_1} = \frac{P_2}{T_2} \qquad \frac{1.00 \times 10^3\text{ kPa}}{293\text{ K}} = \frac{P_2}{323\text{ K}} \qquad P_2 = 1.10 \times 10^3\text{ kPa}$$

8 A gas with a volume of 4.0 L at 90.0 kPa expands until the pressure drops to 20.0 kPa. What is the new volume if the temperature remains constant?

$P_1V_1 = P_2V_2$ becomes (90.0 kPa)(4.0 L) = (20.0 kPa)(V_2) V_2 = 18 L (2 SF)