Holiday Homework Chemistry 11: Term 2-3 break 2017

Questions:

1. Explain why the pressure of a gas does not change if the number of moles and the temperature and volume do not change, **using the kinetic molecular theory**. (**Hint**: You must be talking about particles and relating particle collisions to constant volume. This should be a very detailed answer that relates particle motion to force per area which is pressure.)

2. Explain why diffusion of a gas is more rapid at a high temperature instead of a low temperature, **using kinetic molecular theory**. Do not talk about the gas laws. Talk about particle motion.

3. **Using kinetic molecular theory**, explain why the piston in a cylinder will rise if the pressure increases. Remember do not use the gas laws to explain kinetic molecular theory. Describe particle collisions.

4. **Using kinetic molecular theory**, explain why the piston in a cylinder will fall if the temperature of the gas in the cylinder decreases.

5. If you take a half full petrol can and tightly close the lid so no fumes come out explain what could happen to the can if there is no safety valve that can open when the outside temperature increases by 20ºC. Explain this event **using kinetic molecular theory**.

6. If you could see individual gas particles describe their motion inside a closed cylinder of fixed volume under the following conditions. Remember to not only talk about how fast particles are moving but also talk about the type of movement and likelihood of collisions under these circumstances. Also state under which circumstance you are likely to see more random motion and why there would be more random motion.

a) Low number of moles at low temperature.

b) High number of moles at a high temperature.

7. If you had 2 L of helium in one container and 2 L of xenon in another container both containers are at STP then…

a) What can you say about the number of moles in each container? Explain your answer.

b) What can you say about the density of the gas in each container? Explain your answer.

c) What could you say about the velocity of the gas particles in each container? Explain your answer.

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8. Read the problem the determine the gas law involved (Boyles, Charles or Combined gas law) and solve for the unknown variable.

a) 2.3 moles of gas is in a 0.5 L cylinder with a moveable piston. The pressure of the gas is 95 kPa under these conditions. If the temperature is held constant and the gas is compressed to 0.35 L what is the new pressure?

   i. Gas Law involved:_____
   ii. Solve for new pressure using this gas law.

   iii. Using PV=nRT solve for the temperature of the gas.

b) 0.825 moles of gas is in a cylinder with a moveable piston. The piston always maintains a constant atmospheric pressure of 101.5 kPa (nothing is allowed to push down on the piston). The volume of the gas is 20.15L at a temperature of 25^{o}C. What will the volume of the gas be if the temperature is increased to 50^{o}C?
   i. Gas Law involved:_____
   ii. Solve for new volume using this gas law.

c) A gas is in a cylinder with a moveable piston. The pistons pressure, volume and temperature can all vary. The gas is initially at 30^{o}C, 130kPa and 1.87L. If the piston is pushed down and its new pressure of the gas is 240kPa and the new volume is 1.45L. Did the gas heat up or cool down? Explain using calculations.

i. Gas Law involved:_____

ii. Solve for new temperature using this gas law.

iii. Using PV=nRT how many moles of gas is in the cylinder (in both situations).

d) A gas is in a cylinder with a moveable piston. The pistons pressure, volume and temperature can all vary. The gas is initially at 25^{o}C, 108kPa and 1.02L. If the temperature **rises by** 20^{o}C and the volume increases by 1.05L what is the new pressure in the cylinder?

e) Gas Law involved:_____

f) Solve for new temperature using this gas law.

g) Using PV=nRT how many moles of gas is in the cylinder (in both situations).

9. More challenging stoichiometry questions.
   A. Calcium carbonate is reacted with an excess of hydrochloric acid to produce 3.412 mL of carbon dioxide gas at STP.
      i. What is the mass of pure calcium carbonate originally used?

      ii. If you started with impure limestone that contained only 78.4% by weight calcium carbonate then what is the original mass of limestone used for this reaction.

   B. 2.35 g of magnesium is reacted with excess sulfuric acid.

      i. What is the volume of hydrogen gas produced at STP due to this reaction? Assume the magnesium strip was pure magnesium.

      ii. If the reaction was conducted at 25^{o}C, 103.5 kPa what volume of hydrogen gas would be produced by this reaction assuming all the magnesium reacted.