Chemistry
Pretest 1.1

1. True? Or False?

   a) The kinetic molecular theory only applies to gases_____ (F)
   b) The three types of motion for a gas are vibrations, rotations and translations_____(T)
   c) Helium gas atoms do not vibrate at room temperature because there are no bonds between them_____(T)
   d) The collisions between air molecules use up energy and eventually make a room cooler._____(F)
   e) At 35 °C, on average nitrogen molecules will move faster than nitrogen molecules at 12 °C._____(T)
   f) At the same temperature helium(He) atoms move faster than those of xenon(Xe)_____ (T)

2. Give an example of an object at a high temperature but which carries very little heat.
   One drop of 90 ° C water can cause a very small burn, but it will not kill anyone. Although its temperature is high, its mass is low, so it contains very little heat. Remember that the heat absorbed by a drop of water as it changes temperature is given by $Q = mc\Delta T$. For that hot drop of water, ΔT is large, but m is small, rendering Q small.

3. Is the substance being described showing real gas behaviour? Or ideal gas behaviour?

   a) There are no attractions between carbon monoxide molecules at 25 °C._____(ideal)
   b) Oxygen gas just before it liquefies at -196 °C._____(real)
   c) Ammonia (NH_3 gas) at a high temperature and low pressure._____(ideal)
   d) Ammonia (NH_3 gas) at room temperature_____(real)

4. Give a detailed account of what occurs at the molecular level when liquid mercury solidifies.

• The liquid atoms of mercury are originally rotating and vibrating.
• The molecules lose heat to their surroundings (cooling)
• As a result, the atoms slow down. and rotations and vibrations become less intense.
• The forces of attraction(bonds) between atoms become stronger at a shorter distance and the atoms lock into an orderly pattern.
• The atoms no longer rotate. We now have a solid, which only vibrates

5. a) Consider the following: Kr: versus O_2 gases, both at 25 °C.

Which gas, if any, moves faster? And if so, how much faster?

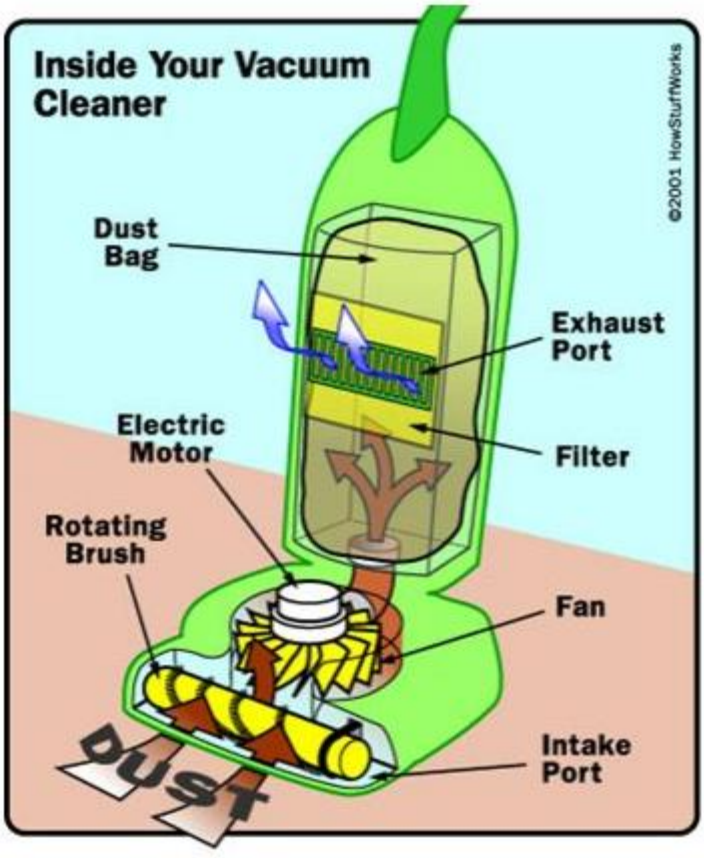
O_2 (lower molar mass) It diffuses $\sqrt{(83.8/32)} = 1.6$ times faster than Kr.

b) At 25 °C, which gas, if any, has more kinetic energy? Why?

Neither one. On the average, kinetic energy will be equal at the same temperature. According to $E_k = (3/2)\,RT$, where $R = 8.31$ J/(K mole), only temperature (in kelvin)can change the kinetic energy of molecules.

6. What role does the fan play in making the vacuum cleaner work? Hint: it's related to a pressure gradient.

The fan blows some air towards the outside, lowering the pressure inside the vacuum



cleaner. This allows atm. pressure to push air and dust from the outside into the bag. The air molecules go through the bag's microscopic pores, but most of the dirt gets trapped inside the bag. .

7. You are lying down, belly up. Does your body experience atmospheric pressure only from above or does the arch of your back experience exactly the same pressure? Explain.

Although pressure is the weight of the atmosphere per unit area, that makes the air collide with the same frequency at about the same distance from sea level. **The collisions of air molecules with your body come from all directions.**

8. Explain why the volume of a gas decreases when its temperature decreases under constant pressure. Make sure that you use relevant parts of the kinetic theory in your explanation.

As the gas loses kinetic energy at a lower temperature, the molecules move less slowly and cover less distance.

9. A student would like to compress a sample of hydrogen gas from 9.0×10^2 ml to 6.0×10^2 ml. By what factor should he change the temperature of the gas while making sure that the pressure remains constant? Respect your grandmother and significant figures.

Use Charles Law: $T_2 = 0.67\ T_1$. It got cooler. (notice 2 sig figs in the answer)