Chemistry
Extra Problems With Kinetic Theory and Pressure

1. a) Why will gases with a lower molar mass move faster at the same temperature?

   If they have the same kinetic energy, which equals 0.5mv^2, but a lower density(and lower molar mass), the only way the multiplication roduct can be the same as that of more dense molecules is if their velocity is higher.

   b) If it takes 12 minutes for a hydrogen balloon to deflate, how many minutes will it take for a nitrogen balloon of the same size, pressure and temperature to deflate?

   $$v_{H2} = \sqrt{\frac{M_{N2}}{M_{H2}}} \ V_{N2} = \sqrt{\frac{28}{2}} \ V_{N2} = 3.74V_{N2}$$

   So if hydrogen is 3.74 times faster than nitrogen, it will take nitrogen 3.74 times longer to diffuse.
   Answer 3.74 * 12 = 45 minutes. (we need 2 sig figs in the answer)

2. Explain reverse sublimation (gas to solid) at the molecular level.

   Initially the gas molecules are vibrating, rotating and translating.
   Then they lose heat.
   They begin to move more slowly and move closer together.
   The bonds strengthen.
   Translations and rotations stop. We have molecules vibrating in the solid state.

3. a) If in a cylinder a gas exerts 202 N per 2.02 square meters, what is its pressure in Pascals?

   $$\text{Pressure} = \frac{Force}{Area} = \frac{202 \text{ N}}{2.02 \ m^2} = 1.00 \ X \ 10^2 \ Pa$$

   b) If in a cylinder a gas exerts 202 N per 2.02 cm^2, what is its pressure in Pascals? In kPa?

   2.02 cm^2(m^2/100^{2}cm^2)= 2.02 X 10^{-4} m^2

   $$\text{Pressure} = \frac{Force}{Area} = \frac{202 \text{ N}}{2.02 \ X \ 10^{-4} \ m^2} = 1.00 \ X \ 10^6 \ Pa \ or \ 1.00 \ X \ 10^3 \ kPa$$

4. At night, land cools faster than the sea does. So there is warm air rising over the water. How does atmospheric pressure play a role in having cool air push towards the sea? (This is what's known as the *land breeze*.)

Land Breeze Circulation
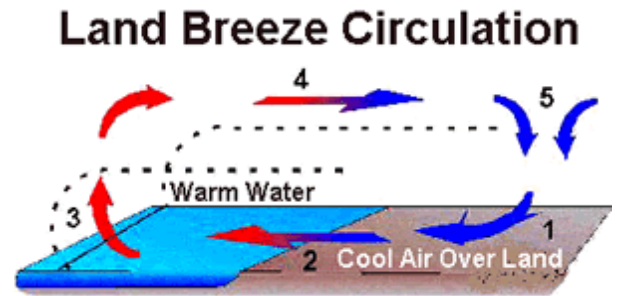
The rising warm air lower pressure above the water. Then the cool air with the higher pressure is able to push towards the lower pressure. (there 's a net force per unit area to the left)

5. a) Draw a graph of the relationship of an ideal gas' volume versus temperature in Celsius.

b) On the same graph, draw the curve for hydrogen gas.
c) Repeat for water vapor.

d) What exists between molecules, which is causing deviations?

Attractions.

e) Why are the deviations greater for certain compounds?

The attractions between water molecules are a lot stronger than those between hydrogen molecules. There is a "polarity" (partial + and -) in the water molecule due to the angle between atoms and due to the electronegativity difference between oxygen and hydrogen.