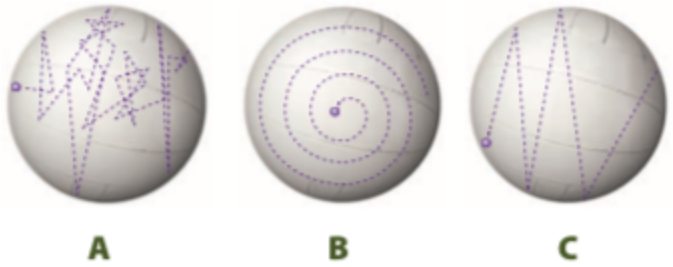
1 - Properties of Gases

Extra Practice Questions from McGraw-Hill Ryerson *Inquiry into Chemistry* Textbook

1. Using the physical properties discussed in class, identify which physical property explains the following real life situations:
    a. A full propane tank can provide enough fuel for an entire season of barbecues.
    b. The label on a can of hairspray contains the warning, “caution may explode when heated.”
    c. A carbon monoxide leak in the basement spreads quickly throughout the house.
    d. Forced air heating is often a better choice for home heating than hot water.
    e. A bicycle tire develops a small hole and very rapidly becomes flat. Use one of the characteristics of gases to explain why the tire deflates so quickly.

2. Explain the meaning of point mass.
3. How does an elastic collision differ from an inelastic collision? To picture an inelastic collision, imagine throwing a ball of putty against a wall.
4. Why is it important that the molecules of an ideal gas have only elastic collisions?

5. The following figure shows three possible paths for a gas molecule moving inside a filled volleyball. Which of these diagrams represents the most likely path of the gas molecule? Justify your choice in terms of the kinetic molecular model of gases.



6. Use kinetic molecular theory to explain:
    a. the miscibility of gases
    b. why gases expand to fill the size of their container c) why gases can be easily compressed

Answer Key

1.

    a. Gases are compressible. Since gases are compressible, they cannot be sold by volume, but are instead sold by mass. Most tanks used on domestic barbeques will hold 9 kg of propane.

    b. Gases expand as the temperature is increased if the pressure remains constant. When a can of hairspray is heated, the volume of the gas will be become too large to be contained by the can and the can will explode.

    c. Gases have a very low resistance to flow and mix evenly and completely. Many toxic gases are also colourless and odorless, which makes them even more dangerous to transport.

    d. Gases mix evenly and completely and have a low resistance to flow, which makes it much easier to move the hot gas through a building. Large buildings cannot be heated with forced air, however, because air's low specific heat capacity compared to water does not permit the storage of sufficient energy to heat a large area.

    e. Gases have low viscosity. When a hole in a bicycle tire appears, it takes very little time for the air to squeeze out through the hole. (One way to measure viscosity is to see how quickly a fluid (i.e., a liquid or gas) can get through a small opening.)

2. The space between gas particles is huge compared to the size of the particles themselves. We can simplify the kinetic molecular theory by assuming that the particles have negligible size but do still have a mass.

3. No kinetic energy is lost by the particles in an elastic collision. In an inelastic collision, some or all of the kinetic energy is lost by the particles in the form of heat.

4. The definition of an ideal gas assumes that the total kinetic energy of a gas sample is conserved when the particles collide with one another and with the container. In other words, the collisions are elastic. Collisions in real gases are inelastic, therefore some kinetic energy is converted to thermal energy and may be transferred from the system to the surroundings.

5. Figure (a), since it shows a random pattern to its motion, with straight lines of travel between collision with the container wall and other particles.

6.

    a. The molecules of a second gas are able to fit into the spaces between the molecules of the first gas.

    b. The molecules are in constant random motion, so if the container is expanded the molecules will travel further before contacting the walls of the container.

    c. Because there are relatively large spaces between molecules in gases and no repulsive forces, the molecules in gases can be easily pushed closer together.