



Macroscopic Properties of Matter

Problem solving and quantities in chemistry

Set 3: Kinetic Energy Exercises

1. In Experiment 6 you examined the relationship between the pressure and volume of a gas as described by Robert Boyle. State Boyle's Law, give a mathematical relationship between pressure and volume and sketch a graph to show this relationship.

Boyle's Law: At constant temperature, the volume of a given quantity of gas is inversely proportional to its pressure; $P_1V_1 = P_2V_2$

2. Aerosol cans, including deodorant sprays, have labels warning against exposing used cans to excessive heat. Record the warning label of an aerosol can that you have at home. Explain the reasons behind these warnings.

Increasing the temperature increases the pressure of gas in the can. It could explode.

3. A car or bicycle tyre becomes hotter during use. Assuming the volume of the tyre remains constant what happens to the pressure of air inside the tyre? Explain in terms of the kinetic theory of matter.

As the temperature of the fixed volume tyre increases the particles of gas move with greater kinetic energy striking the walls of the tyre more frequently resulting in higher pressure.

4. A helium balloon when released rises up into the air and disappears out of sight.

(a) Why does the helium balloon rise?

(b) Describe the pressure changes both in and around a helium balloon as it rises. Use diagrams to help your explanation.

(c) What will eventually happen to the balloon? Explain.

(a) Helium gas is less dense than air so the balloon will float/rise in air.

(b) Pressure in the balloon remains constant as the pressure outside balloon decreases.

(c) The balloon will expand until it bursts.

5. Explain the boiling point of a liquid. Why does water boil at a temperature lower than 100 °C at 2000m above sea level?

Boiling point occurs when the vapour pressure of the liquid being heated reaches atmospheric pressure (pressure above liquid). Atmospheric pressure decreases with altitude.

6. Explain vapour pressure of a liquid. Why is the boiling point of a solution higher than the boiling point of its solvent?

The pressure above a liquid due to its own vapour (gas) particles. A solution has a higher vapour pressure.