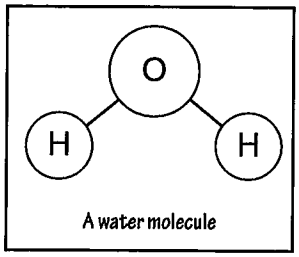
What changes do heating and cooling cause? – I

Atoms are the building blocks of everything. Most things are made up of two or more types of atom. They are joined together as molecules by forces of attraction called bonds. A well-known example of a molecule is water, which is made of two atoms of hydrogen bonded with one atom of oxygen.



A water molecule

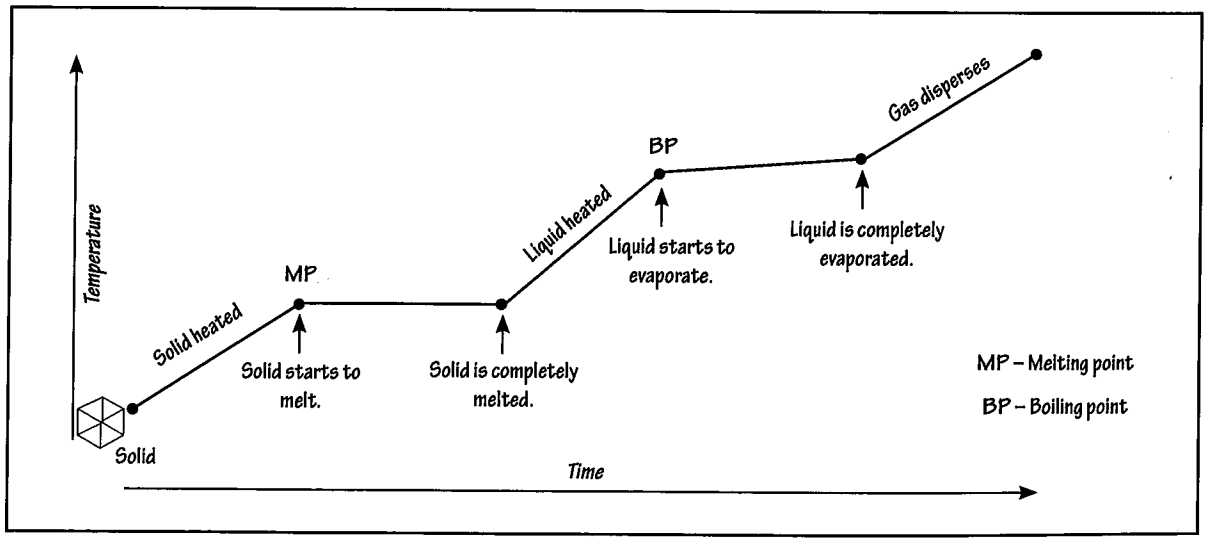
When a substance is heated and cooled, it changes between the states of solid, liquid and gas. In a solid, the molecules, held together as a rigid structure. As the substance is warmed, the molecules begin to move and separate from each other as the bonds among them weaken. This is what happens as a solid melts. The more heat that is applied, the faster the molecules move. When a substance is cooled, the reverse happens. The molecules slow down and move closer together, until they form their rigid structure again.

When a solid substance is heated, the temperature at which it starts to melt is called its melting point. This is the same temperature at which the substance in its liquid form starts to freeze when it is cooled. The melting and freezing points of a substance are the same.

As a solid substance continues to melt, its temperature does not rise even though it is still being heated. The heat energy is being used to speed up the molecules of the solid until the substance is all liquid (at which point its temperature will start to increase). That is why snow, even as it is melting, is always cold.

When a liquid substance is heated, the temperature at which it starts to boil is called its boiling point. The bonds between the molecules are broken and the liquid evaporates as the molecules disperse as a gas.

The gas can be collected in a condenser and cooled to a liquid again. If it is not collected, the gas spreads into the atmosphere.



The water cycle is an example of the constant change of state of a substance. Water is constantly moving among its three states of matter. In oceans, lakes, swimming pools and puddles, water evaporates into water vapour (gas), which later condenses and falls as rain, hail or snow. When the temperature falls to 0 °C and below, ice forms.