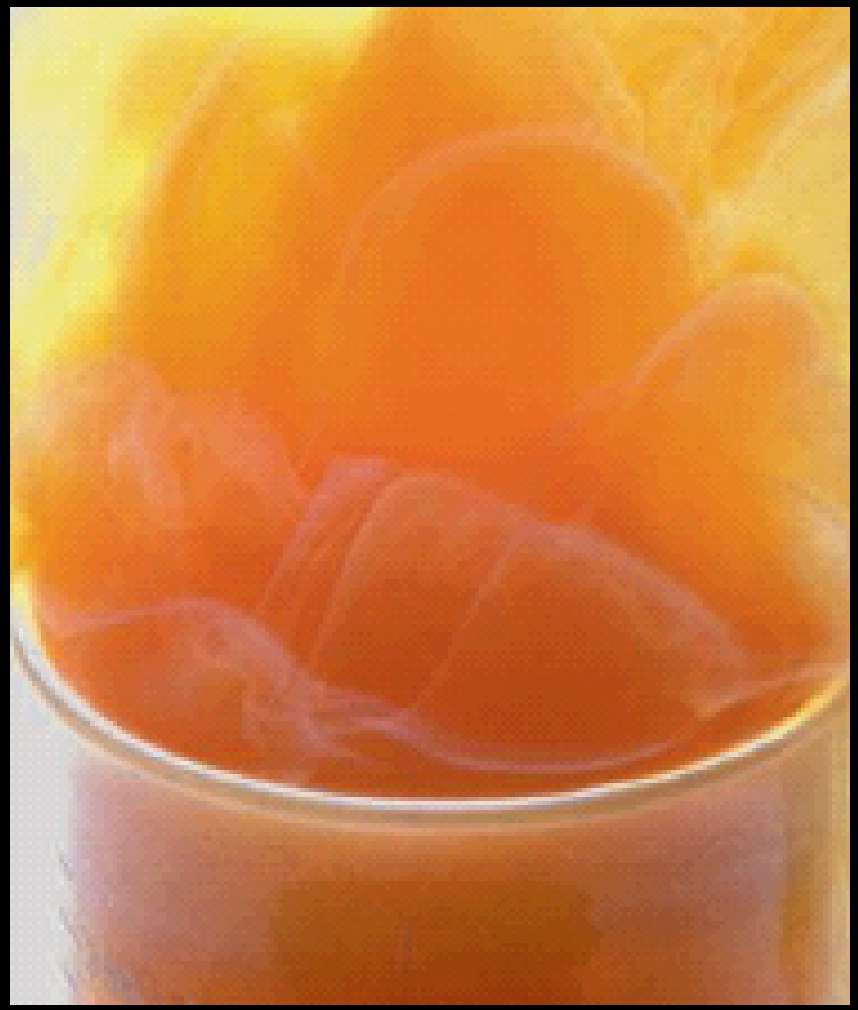


Matter

MATTER

Life is a mystery. Where did we come from? What are we made of? Every material thing that you can see, smell and touch, that occupies space and has mass, is a form of **matter**. This includes your own body. Studying the structure and behaviour of matter — of which life, the earth and the universe are composed — has been an ongoing human preoccupation.

Early Greek philosophers and alchemists, working from their basic observations of matter, believed that all materials were made up of different proportions of four basic elements: earth, air, fire and water. We have come a long way since then. Basing our approach to the study of matter on experimental measurement, we have been able to modify such old theories and develop new ones that more clearly explain the structure of matter. This improved understanding of matter has enabled us to further investigate the different properties of materials that make them useful to our society.

We now know that matter is made up of very small particles and may exist in **solid**, **liquid** or **gaseous states**. The behaviour of these particles is explained by the **particle model**, or **kinetic theory of matter**.

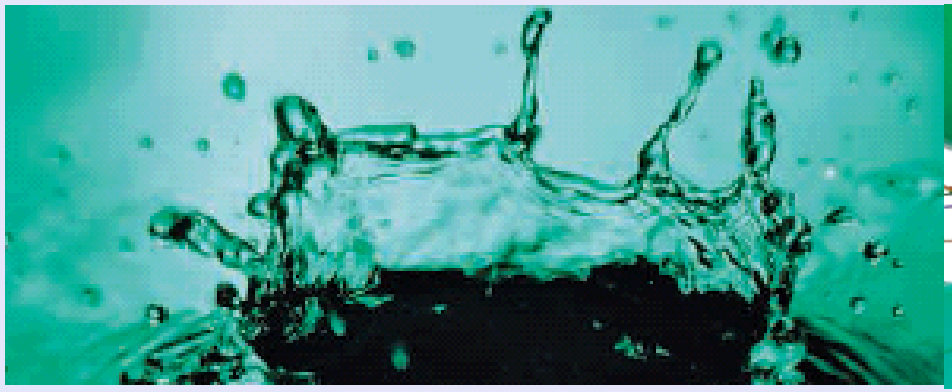
The kinetic theory of matter

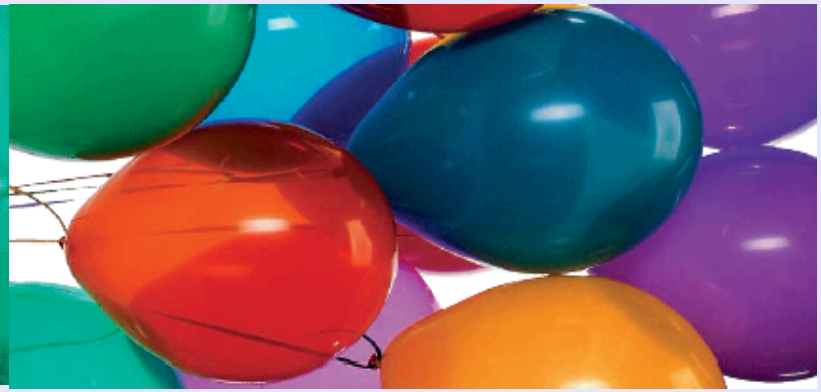
The kinetic theory of matter has the following key points:
• Matter is made up of tiny, invisible moving particles.
• Particles of different substances have different sizes.
• Lighter particles move faster than heavier ones at a particular temperature.
• As the temperature rises, the particles move faster.
• In a solid, the particles are very close and vibrate in fixed positions.
• In a liquid, the particles are a little further apart. They have more energy and they can move around each other.
• In a gas, the particles are far apart. They move rapidly and randomly in all the space that surrounds them.

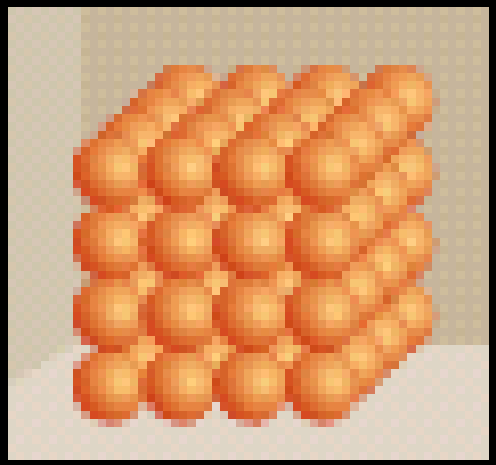
What are the properties of solids, liquids and gases?

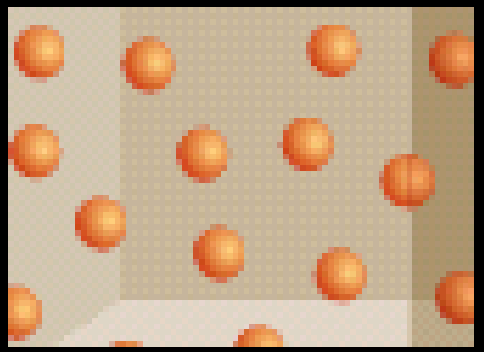
Solids have definite shapes and volumes.
Crystalline solids such as salt and diamonds have particles that are arranged in a regular, repetitive pattern. The particles are able to vibrate but are not free to move. Solids that do not have this regular structure, such as rubber and putty, are described as **amorphous**.

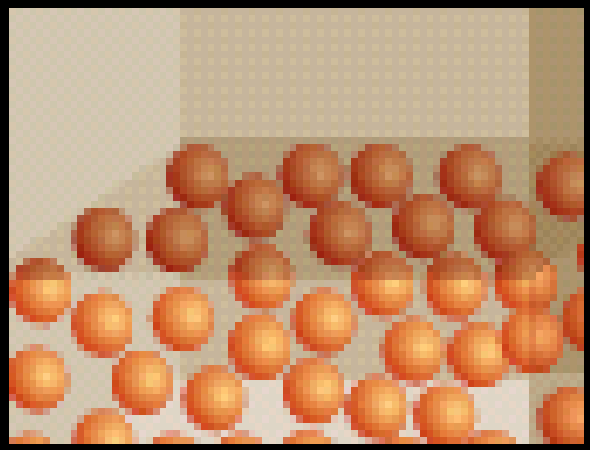
Liquids have a definite volume. They take the shape of a container but their surfaces are always horizontal. Liquid particles are further apart than those in a solid and are in constant motion, free to move. So liquids can flow.
Gases take the same shape and volume as their container. Gas particles are free to move in any direction.











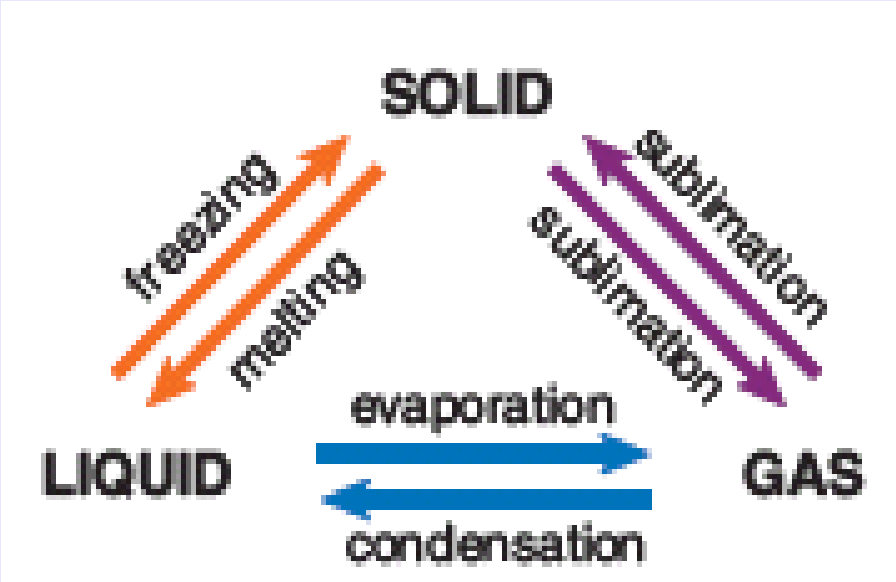
gas

liquid

solid

Changes in states of matter

The state of a sample of matter can be changed by varying the temperature or
sometimes by changing the pressure. The points at which changes in state
occur are known as melting and boiling points, and are physical properties
that can be used to identify a substance and, under given conditions,
determine its state.



Revision questions

1. Use the kinetic theory of matter to explain why a hot air balloon will expand when hot air is put into it.
2. Which state of matter is described as having a definite volume but not a definite shape?
3. Which states of matter are compressible? Explain why.
4. Dicing onions will usually make you cry. However, if the onions are refrigerated for an hour before use, they will not make you cry. Explain this phenomenon in terms of particles.