# ATOMS, ELEMENTS AND COMPOUNDS

## MATTER AND MATERIALS

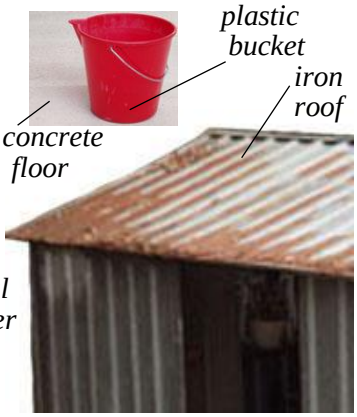
Everything except empty space is made of *matter*. Matter exists in three familiar *states* – solid, liquid and gas – but there are thousands of different kinds of matter. Matter includes materials such as rocks and soil, plastic and metal, cotton and silk - substances such as salt and sugar, water, cooking oil and petrol, air and smoke.

**Material or substance?** The words "material" and "substance" are not scientific words. They are not very well defined and they mean almost the same thing. We tend to call something a *material* when it is a solid that we handle in large quantities - especially when it does not seem to be a very "pure" substance. Concrete and wood are *materials* used in building. We tend to call something a *substance* when it is a liquid or a gas, or when it is a solid that we handle in small quantities - especially when it appears to be "pure". Salt and water are *substances* we use in cooking. Iron is a *material* used to make railings. Iron is also a *substance* that rusts. Both statements are correct.

**Natural and man-made materials.** Think about a kitchen knife with a wooden handle. Is a kitchen knife a natural object or a man-made object? Someone made it so it is a man-made *object*. What about the *materials* in the knife – wood and steel? Are they natural or man-made? Someone shaped the wooden handle, but no one made the material – the *wood*. The wood is a *natural* material, which grew as part of a tree. What about the blade? The blade is made of steel and steel is a *man-made* material. You do not find steel in the natural world. Steel is about 98% iron. Ancient man made iron by heating together *charcoal,* and a red mineral called *haematite,* in a very hot fire. Iron and steel are still made by the *chemical industry* in a very similar way. The first picture below shows molten iron being poured. The kitchen knife contains both a natural material (wood) and a man-made material (steel). The chemical industry produces many useful, man-made materials including cement, metals, plastics, man-made fibres (such as polyester and nylon), glass, artificial fertilisers, medicines and a lot of others.








**Materials and their uses** must be well matched. It would be foolish to make a saucepan out of plastic or wood because plastic melts, and wood burns. Metals such as iron or aluminium are best for making saucepans because metals have the right *properties*. Metals are strong and conduct heat well without melting or burning. Plastic or wood make good handles for saucepans. Plastic and wood are good insulators so you can pick up a hot pan without burning your hands.

**Chemistry** is the study of materials or substances. Chemists want to find out what they are made of. They also try to discover and make new substances, and study their properties. In this chapter you will meet some of the basic ideas of chemistry. You will learn about the *kinetic theory,* which explains how matter behaves by thinking about the tiny *particles* called atoms that everything is made of. You will also learn about the chemical *elements* – simple substances that contain only one kind of atom – about *compounds* in which two or more elements are combined together, and about the *symbols* and *formulae* that chemists use to represent elements and compounds.

- 1. Which of these materials are man-made? *Plastic, water, glass, aluminium, cotton, salt, haematite, charcoal.*
- 2. List 7 substances you can find in the kitchen at home.
- 3. What property of (i) copper makes it suitable for electric wires; (ii) plastic makes it suitable for covering electric wires.
- 4. Guess what are (i) bio-chemistry, (ii) organic chemistry.