

13 Changes



What you will learn

What causes change?

Useful changes

Electric changes

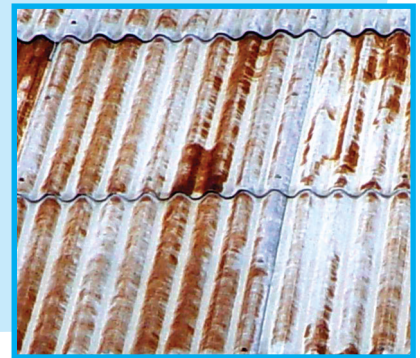
Physical or chemical

What causes change?

We talked about matter and materials before. Now we want to look at changes in matter. Changes in matter are happening around us all the time. Some of these changes such as our physical growth take place quietly while others such as explosions occur with a big bang.

Heat, light, electricity and mixing can change matter.

Look at the photographs and write down what causes the change in matter for each of them.



• Changes caused by heat

Heat can produce many changes to a substance. Heat can change the physical state of matter. Hold an ice block in your palm. What do you feel? What happens to the ice after sometime?

Your palm feel cold. The ice melts (Changes from solid to liquid) using the heat from your hand.

Scientific explanation would be, the ice melts by **absorbing** heat from the hand.



Do you Know?

The Earth was formed 4500 million years ago.

Expansion and contraction

Look at the cartoon below. Can you explain what is going on?



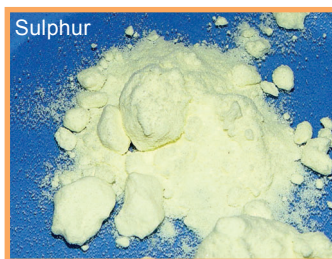
When an object is heated, it **expands** (i.e. its volume increases) and when it cools, it **contracts** (i.e. its volume decreases).

Join together

Heat can also cause the **combination** of two or more substances to form a new substance.



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Iron sulphide

Key Ideas

- Changes can be very fast or slow.
- Heat changes the state of matter.
- Heat can combine two substances to form a new substance.

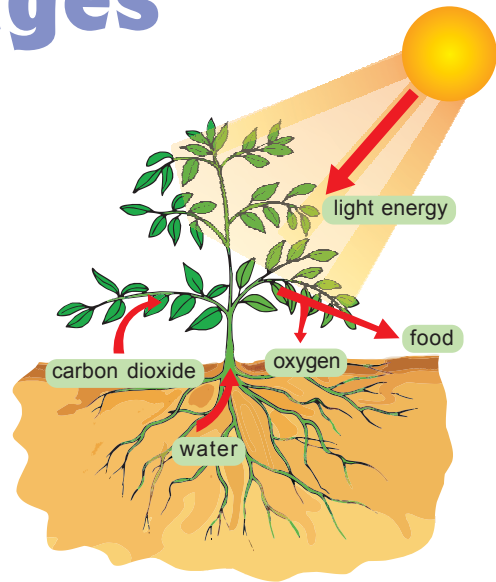


- 1 Write down the effects of heating matter, giving an example of each.
- 2 Write down the effects of heating matter, giving an example of each.

Useful changes

Light is needed by green plants to make food. Green plants use water and carbon dioxide and the energy from sunlight to produce sugar (glucose) and oxygen.

The food that is made by green plants provides food for other living things like us who cannot make food on our own.



Light can change

Light can be changed into other forms of energy such as electricity. You may have seen on the roof top of some houses, solar panel. A solar panel changes light into electricity.

There are calculators too which is powered by solar. It also changes light into electricity.



Do you Know?

The Apollo 17 mission in 1972 was the last manned expedition to the Moon.

Photography

When a substance is split into two or more simpler substances, it is called **decomposing**.

When you take photographs, light decomposes the silver bromide coating on photographic film into silver.

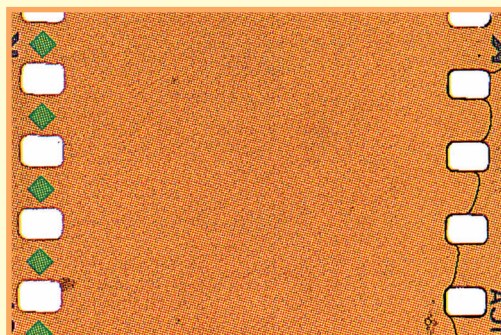
When film is developed into a negative, the silver creates a dark area on the film. This dark area is the image.



Negative of film that is overexposed to light.



Negative of film that is not exposed to light.



Negative of film that is exposed to some light.

What happens when you burn sugar?
How does it look like?



Ideas

☞ Matter can be changed when it is exposed to light.

☞ Light can be used to combine substances as in making food by plants.

☞ Light can be changed into other forms of energy such as electricity.

☞ Light can split substances.

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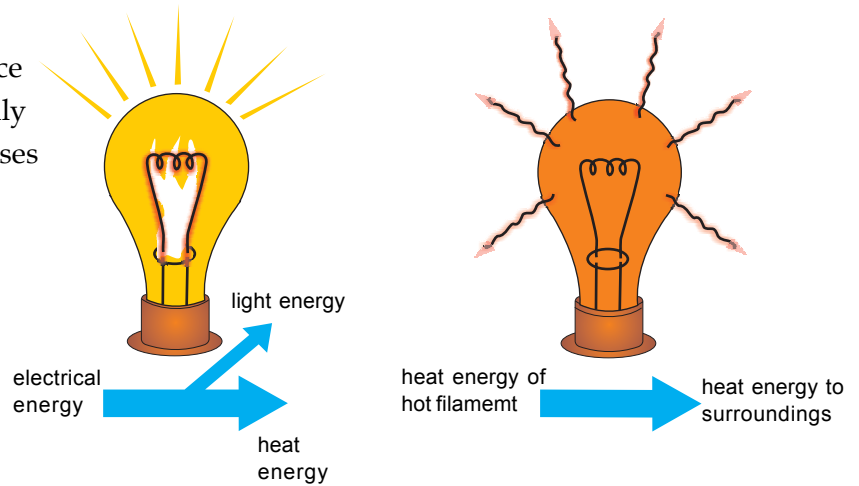
- 1 What causes the changes in photographic film when taking a photograph, and during photo synthesis? Describe these changes.

Electric changes

Passing electric current through a substance may change its properties either temporarily or permanently. When electric current passes through the filament in an electric bulb, the filament heats up and glows.

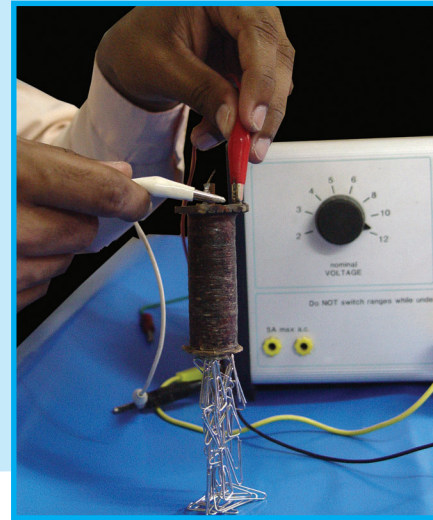
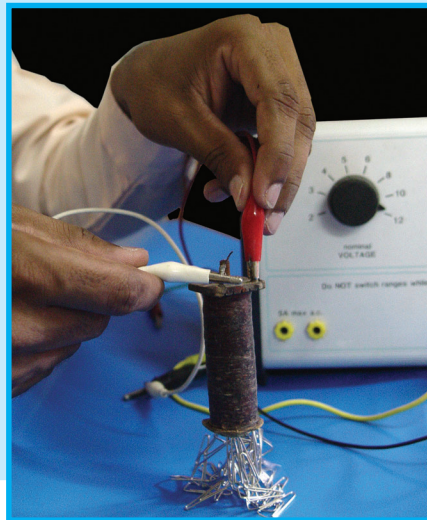
What happens when electric current stops flowing?

The filament will cool down and no light will be given out.



Act like a magnet

Electricity can also cause a piece of iron rod to have a magnetic effect. When electricity is passed through a wire wound round an iron rod, the rod is able to attract the paper clips as shown.



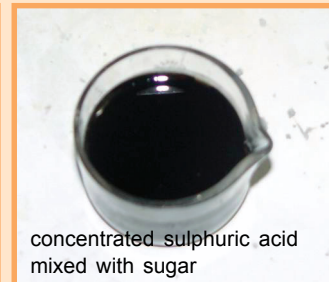
Do you Know?

In 1646 the word 'electricity' was made by Dir Thomas Brown (1605-82).

Mixing changes

Changes occur when we mix two or more substances together. This may not happen all the time. Mixing water and sand will not produce a new substance, but mixing water, sand and cement produces a new substance called mortar.

If you mix sugar with water, you would notice that the sugar crystals disappear after a while and the water becomes sweet. When concentrated sulphuric acid is mixed with sugar in a beaker, a black substance is formed.



concentrated sulphuric acid mixed with sugar

Could you identify the change that is going to occur to the people in the picture opposite?

Clue ... A very useful and not very useful change occurs.



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- 1 Which of the following statements about two different substances is true?
 - a. A mixture is always formed.
 - b. A new substance is always formed.
 - c. A mixture and a new substance are formed.
 - d. A mixture or new substance may be formed.
- 2 Which of the following statements about two different substances is true?
 - a. a coil of wire wound round an iron nail.
 - b. the tungsten filament of a bulb?



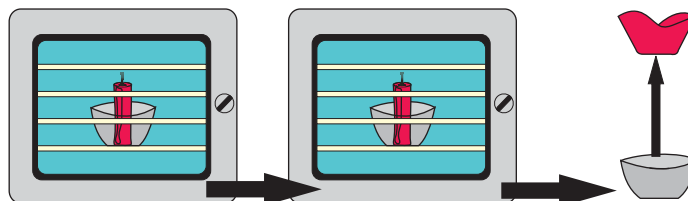
Ideas

⇒ Passing an electric current through a substance may produce a temporary change or a permanent change.

⇒ Mixing a substances may produce a mixture or a new substance.

Physical or chemical

If you heat a candle either by putting it in an oven or using the stove, it melts. The wax has changed state, but it is still the same substance. When it cools down, you get the solid wax back. **Physical changes** like this are reversible.

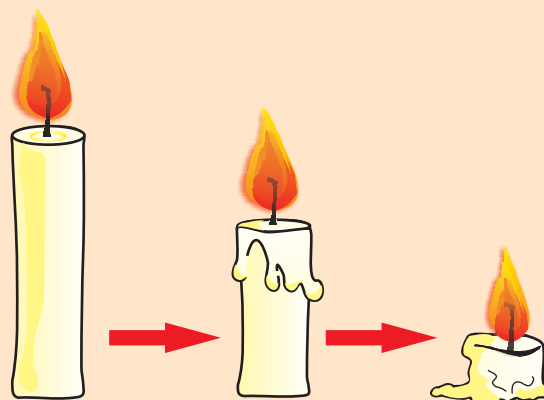


If you heat a candle, the wax just melts, so you can get it back.

If you light a candle, the wax melts at first, but then it seems to vanish. Where has the wax gone? It cannot be a physical change, as you cannot get the wax back. So what is happening?

★ The wax burns

When you light a candle, the wax burns. The heat from the flame makes the wax change into something different. This type of change is called a chemical change. Chemical changes are not easily reversible.

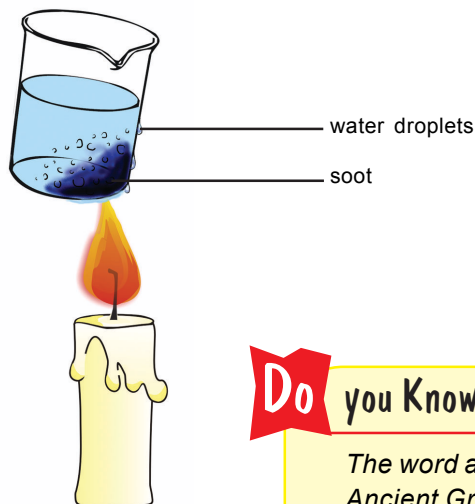


If you light a candle, the wax is lost, and you cannot get it back.

★ New substances

If you hold a beaker of water over a candle flame, candle burns, and you will see two new substances forming. The beaker gets covered in black soot. This is a form of carbon, like coal. You also see drops of water condensing on the cold glass. You might be surprised to find that water is formed when a candle burns!

A third substance is formed which you cannot see. It is the gas carbon dioxide.

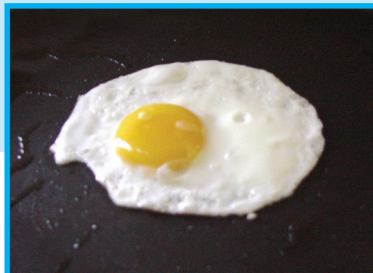
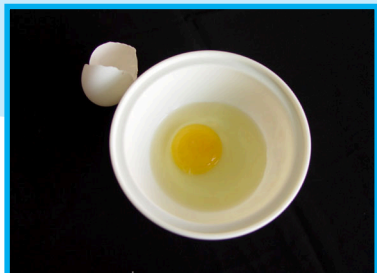


Do you Know?

The word atom is derived from the Ancient Greek word *atomos*, meaning 'indivisible'.

• A chemical change

How do you spot a chemical change? It is not always easy! A change is probably a chemical change if: a completely new substance has formed, or the change cannot be reversed.



• Give off energy

Chemical changes often give out energy such as light, heat or even electricity.

A car moves only if it has energy. This energy comes from burning petrol.

There are several forms (or kinds) of energy. Electrical, chemical, heat, sound and light are some forms of energy we come across.



Fire works give off plenty of heat and light.



- 1 Are these physical or chemical changes? Give reasons for your answers.
 - a. Burning a match
 - b. wood decaying
 - c. Ice cube turn into water
 - d. If you spill water on your page, the ink runs.
 - e. Frying an egg.



Ideas

- ↔ Changes of state are physical changes.
- ↔ Physical changes are reversible.
- ↔ chemical changes are not reversible.
- ↔ Burning is an example of a chemical change.

ALESSANDRO VOLTA

Born in 1745



Alessandro Volta was an Italian. He was born in 1745. At this time, electricity was a mystery. Most people thought it was a form of magic and they gave themselves static shocks to cure illness. Alessandro Volta invented a machine which could give quite a big shock.

Alessandro Volta got a job as a university professor. He became interested in the discovery that two metals could make a dead frog's leg twitch. Another scientist called Galvani thought this twitching was caused by electricity produced by the leg. Alessandro Volta disagreed. He used experiments to show that the twitching only occurred when the frog's leg was placed between the two metals, and the two metals were connected together.

In 1799 he built a big pile of copper and zinc discs which gave out electricity. This was the first chemical battery. Volta continued to improve his invention. He made batteries that gave out a high current. He made batteries that other scientists could learn from.

Napoleon was so impressed that he made Alessandro Volta a Count. Count Volta's name lives on in the electrical unit called the volt.

(J. Boyd & W.WhiteLaw 1989 John Murray)