

簡易英語科技叢書

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## 出版說明

《簡易英語科技叢書》是爲初學英語的中國青年學生提供一套閱讀英語科技書籍資料的參考讀物。

本叢書包括十六個科學課題，分爲十六冊出版。每一課題構成一個完整的知識讀物。這十六個課題把目前國外學校教學中的基礎科學內容都包括進去了。

爲提高讀者科學知識和閱讀興趣，每一分冊均附有生動的彩色插圖，英語文字力求淺顯，使一般初學英語的中國青年學生都能接受。

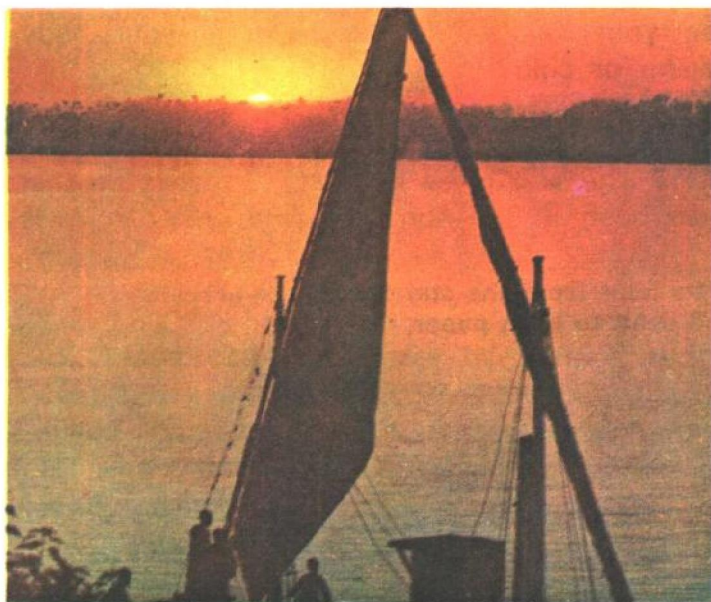
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## INTRODUCTION

Can you imagine how cold the Earth would be if there were no Sun? The Sun is the Earth's main source of heat. Only a little of the Sun's heat reaches the Earth. However, this is enough for life to exist on Earth. All living things need warmth in order to live. The heat from the Sun provides us with this warmth.

**The sun gives us heat.**



Man gets warmth from the sun and the food he eats. Man also makes his own heat. When he is cold he makes a fire to warm himself. He makes clothes to cover himself. He uses heat to cook his food and to light his house.

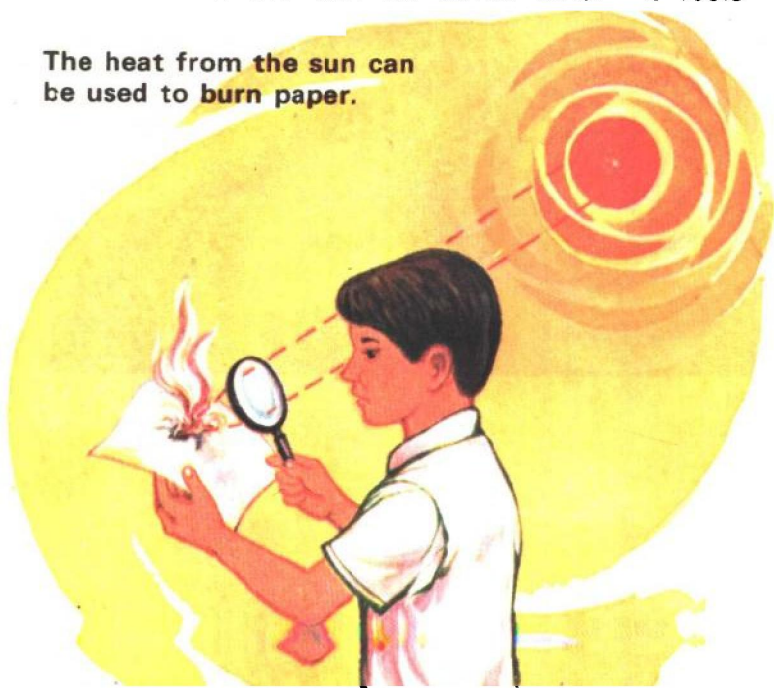
## OUR BODIES CONTAIN HEAT

How can we show that our bodies contain heat? Open your mouth wide and breathe on your hands. Is the air from your body warm or cold?

## WHAT GIVES HEAT?

1. The **sun** gives us heat. Touch a tin that has been in the sun for some time. It feels

**The heat from the sun can be used to burn paper.**



hot. Place the tin inside the house. Touch the tin after some time. It feels cold.

Use a magnifying glass to focus sunlight on a piece of white paper. What happens to the piece of paper at the position where the sunlight is focused? It becomes hot, starts to turn brown and soon bursts into flame. Thus the heat from the sun makes the paper burn.



Heat is produced by burning wood.

2. Man can make heat by burning wood, coal and gas. Wood, coal and gas are called **fuels**. Man burns fuels to keep himself warm. He also burns fuels in machines to make them work. A motor-car runs by burning fuel. An aeroplane flies by burning fuel.

3. **Electricity** also gives heat. Man uses electricity to cook his food and to work his machines. How many things in your house and school are worked by electricity? Name them. How many of these things give out heat?



It is easy to find out whether electricity gives heat or not. Put your hand near a lighted bulb. What do you feel? Touch a radio which has been switched on for some time. What do you feel?

4. Heat can be made by **rubbing** two things together. Rub the palms of your hands together. What do you feel? Take your ruler and rub it up and down the edge of a table. Rub the ruler many times. Then put the ruler against your hand. You will feel that it is hot.

## HOW DO WE MEASURE HEAT?

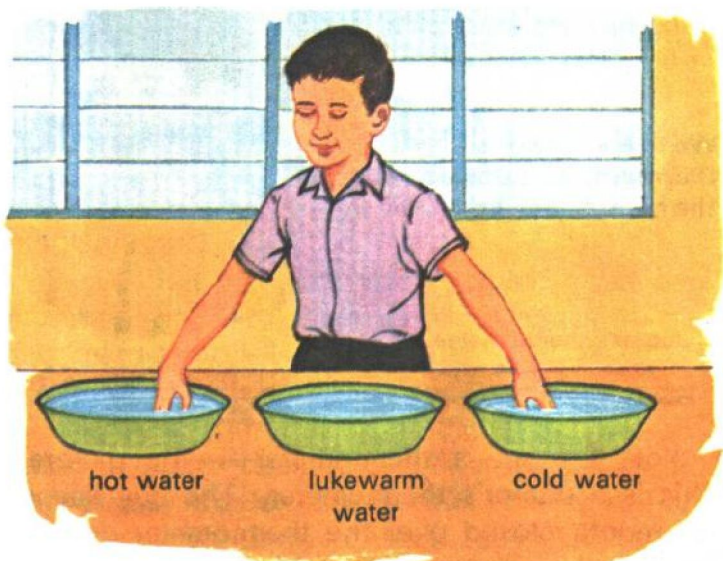
We can measure the length and the width of this book. We can also measure our height and our weight.

Do you know that hotness can be measured too? We can measure the hotness of our bodies. We can tell if we are sick by measuring the hotness of our bodies.

### Things to Do

Take three basins. Fill the first basin with water which is as hot as you are able to bear with your hands. In the second basin mix hot water with cold water. This is **lukewarm** water. Fill the third basin with cold water from the tap.

Place the basins on the table as shown in the picture. Put your right hand in



**Can you tell whether the water is hot or cold by feeling it?**

the hot water. Put your left hand in the cold water. You will find that your right hand feels hot and your left hand feels cold. After twenty seconds move both your hands into the lukewarm water. What do you feel? Your left hand feels warm and your right hand feels cold. But both hands are in the same basin of water! You cannot really tell if a thing is hot or cold by feeling it.

We use a ruler to measure length and breadth. To measure hotness we use a **thermometer**.

**We use a doctor's thermometer to measure the heat of our body.**



doctor's thermometer



You can see a thermometer in the picture. This is a doctor's thermometer. The boy keeps his mouth closed over the thermometer until it reaches the temperature of his body.

Hotness or coldness is called **temperature**. If the boy is sick and his body is very hot, we say that his temperature is 'high'. If the day is cold we say that the temperature is 'low'. Why do we say 'high' temperature and 'low' temperature?

Look carefully at the picture of the room thermometer. It is made of a hollow glass tube or stem, with a hollow glass bulb at the base. In the bulb there is a liquid called **mercury**. The thermometer is fixed to a wooden scale which like your ruler is marked with lines.

Heat makes the mercury rise in the hollow glass stem. The hotter it is, the higher this mercury will rise. Therefore we say the tem-

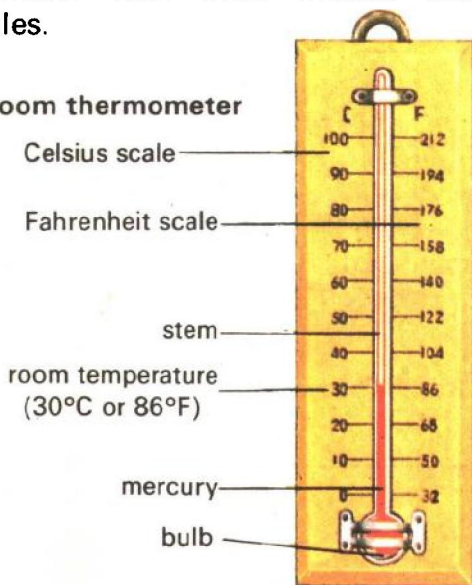
perature is 'high'. When it is cold the mercury in the stem will sink. So we say the temperature is 'low'.

Look at the picture of the room thermometer again. How high has the mercury risen in the stem? By reading the scale we know how hot the room is.

We measure length with a ruler. We can measure length in two different ways — in centimetres and in inches.

We measure temperature with a thermometer, in **degrees Celsius**. 'C' stands for Celsius. Some thermometers use a different scale — the **Fahrenheit scale**. The picture shows a thermometer with both Celsius and Fahrenheit scales.

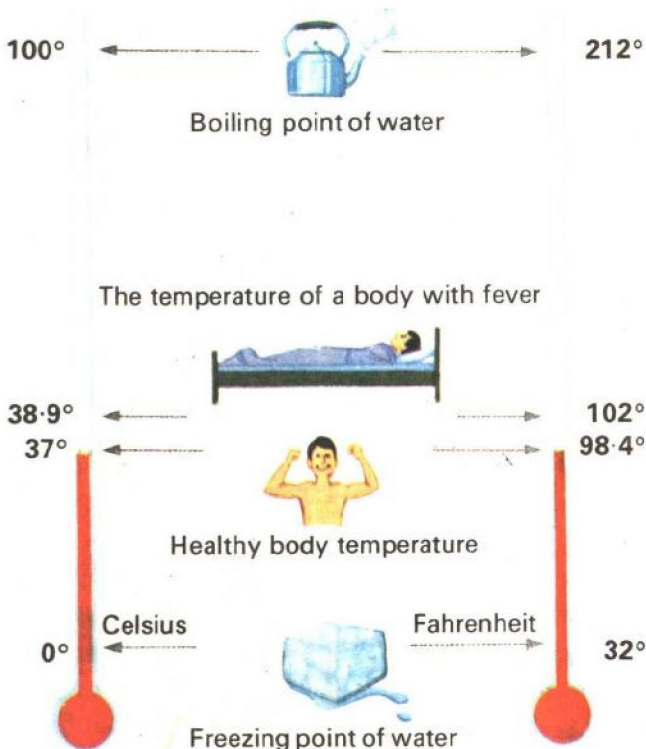
A room thermometer



You will find that the Celsius scale rises from  $0^{\circ}$  to  $100^{\circ}$ . On the Celsius scale,  $0^{\circ}$  shows the temperature at which water freezes, that is, turns into ice.  $100^{\circ}$  shows the temperature at which water boils.

The Fahrenheit scale rises from  $32^{\circ}$  to  $212^{\circ}$ . On the Fahrenheit scale,  $32^{\circ}$  shows the temperature at which water freezes and  $212^{\circ}$  shows the temperature at which water boils.

**Thermometers are used for measuring temperatures.**



## EXPANSION AND CONTRACTION

Expansion means to become bigger and therefore to take up more space. Contraction means to become smaller and therefore to take up less space.

**What happens to the water level in the tube when water expands?**



### Things to Do

Fill a small bottle with water. Colour the water by adding a drop or two of ink and shake the bottle. Get a cork which will fit the mouth of the bottle tightly. Make a hole through the cork. Push a tube through the hole in the cork. You can use the plastic tube of a ball-point pen. Cap the bottle with the cork.

Put your bottle in a pot of hot water. What happens? Mark on the tube the point to which the water has risen. Now place the bottle in ice-cold water. What happens?

The water in the bottle expands when the bottle is placed in a pot of hot water. Therefore the water rises in the tube, thus occupying more space. When the bottle of water is placed in a pot of ice-cold water, the water in the bottle contracts. This causes the water level in the tube to drop, since the water now occupies less space.

## **HEAT MAKES THINGS EXPAND**

You have seen how a thermometer measures hotness. When it is hot the mercury rises in the stem of the thermometer. The hotter it is, the higher the mercury rises. This is because heat makes things expand.

When it is cold the mercury in the stem of the thermometer goes down. This is because coldness or loss of heat makes things contract.

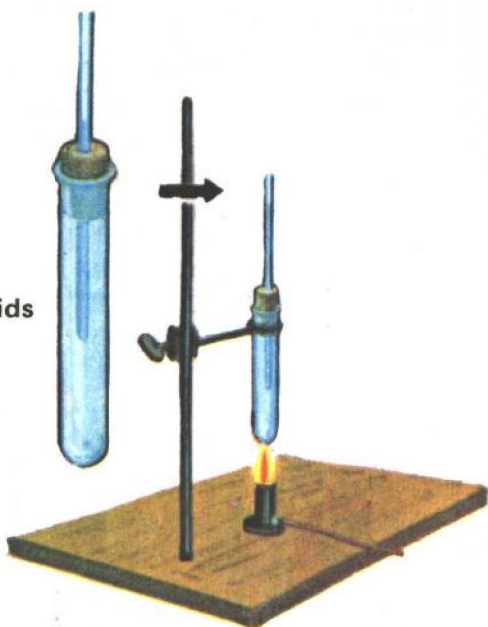
## ***HEAT MAKES LIQUIDS EXPAND***

If you fill a kettle with water right up to the brim and then put it over a fire, the water will overflow as it becomes hot. This is because liquids expand when heated.

## **Things to Do**

Fill a test tube with water mixed with ink. Next, push a 15 cm glass tube into a cork or a rubber stopper which will fit the test tube tightly. When you fit the cork or stopper into the test tube,

**Heat makes liquids expand.**



the water will rise a little way in the glass tube. Mark on the glass tube the level to which the water has risen.

Next, hold the test tube over a flame. Do not wait for the water to boil. Does the water rise in the glass tube? What happens when the water cools?

### ***HEAT MAKES GASES EXPAND***

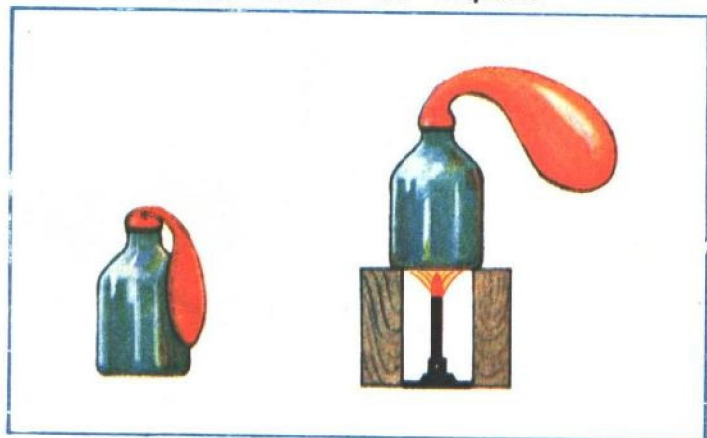
You have seen how water expands when it is heated and contracts when it is cooled. All liquids do this. Will air which is a mixture of gases do the same thing? Will it expand when it is heated and contract when it is cooled?



## Things to Do

Stretch a balloon over the neck of an empty bottle. Remember that air is all around us and that it is also present in the bottle. The outside air cannot get into the bottle now.

**Heat makes air expand.**



Place the bottle over a flame or inside some hot water. The air inside the bottle will expand when it gets hot. It will rise into the balloon and fill it. Now let the bottle cool. What do you think will happen to the balloon?

## *HEAT MAKES SOLIDS EXPAND*

You have seen how liquids and gases expand when they are heated and contract when they are cooled. Will solids do the same thing?