2.4 Weather

Key objectives

You should be able to:

- describe how weather data are collected
- make calculations using information from weather instruments
- use and interpret graphs and other diagrams showing weather and climate data.

Key definition

REVISED

Term	Definition
Isohyet	A line on a map which joins areas of equal rainfall.

Measuring the weather

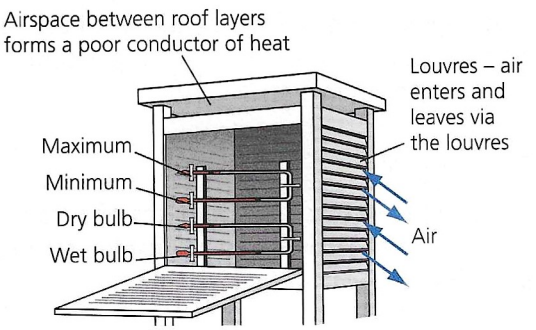
PAGES 149–153

REVISED

Stevenson screen

A Stevenson screen is a wooden box standing on four legs at a height of about 120 cm (Figure 2.11). The screen is raised so that air temperature can be measured. The sides of the box are slatted to allow air to enter freely. The roof is usually made of double boarding to prevent the Sun's heat from reaching the inside of the screen. Insulation is further improved by painting the outside of the screen white to reflect much of the Sun's energy. The screen is usually placed on a grass-covered surface, thereby reducing the radiation of heat from the ground.

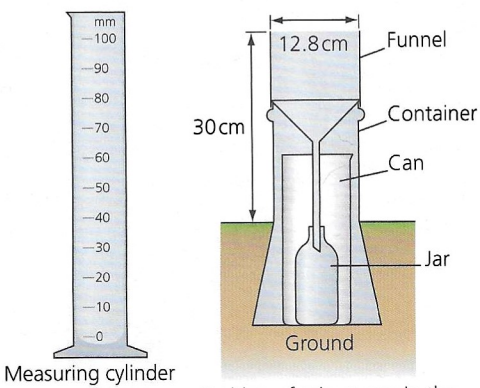
Instruments kept inside the Stevenson screen include a maximum-minimum thermometer and a wet- and dry-bulb thermometer (also called a hygrometer).



▲ **Figure 2.11** Stevenson screen

Rain gauge

A rain gauge is used to measure rainfall. It consists of a cylindrical container, in which there is a collecting can containing a glass or plastic jar, and a funnel that fits on to the top of the container (Figure 2.12). It is important to check the rain gauge every day, preferably at the same time.



▲ **Figure 2.12** Rain gauge

Maximum-minimum thermometer

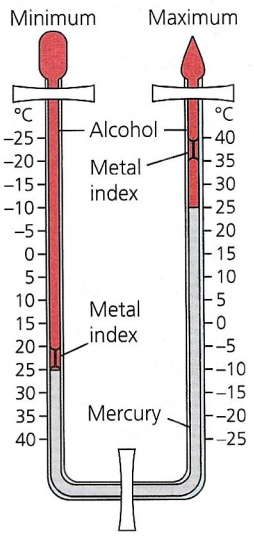
Maximum thermometer

When the temperature rises, the mercury expands and pushes the index along the tube (Figure 2.13). When the temperature falls, the mercury contracts and the index remains behind. The maximum temperature is obtained by reading the scale at the base of the index, which was in contact with the mercury. The index is then drawn back to the mercury by a magnet.

Minimum thermometer

When the temperature falls, the alcohol contracts and its meniscus pulls the index along the tube. When the temperature rises, the alcohol expands. The daily readings of maximum-minimum thermometers are used to work out the average or mean temperature for one day (called the mean daily temperature) and the temperature range for one day (called the daily or diurnal temperature range).

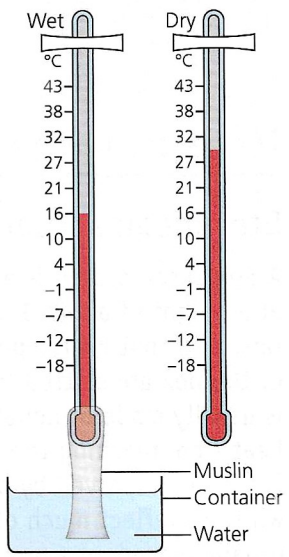
To find the mean daily temperature, the maximum and minimum temperatures for one day are added together and then halved. For example: (maximum temperature 35 °C + minimum temperature 25 °C) ÷ 2 = mean daily temperature 30 °C.



▲ **Figure 2.13** Maximum-minimum thermometer

Wet- and dry-bulb thermometer (hygrometer)

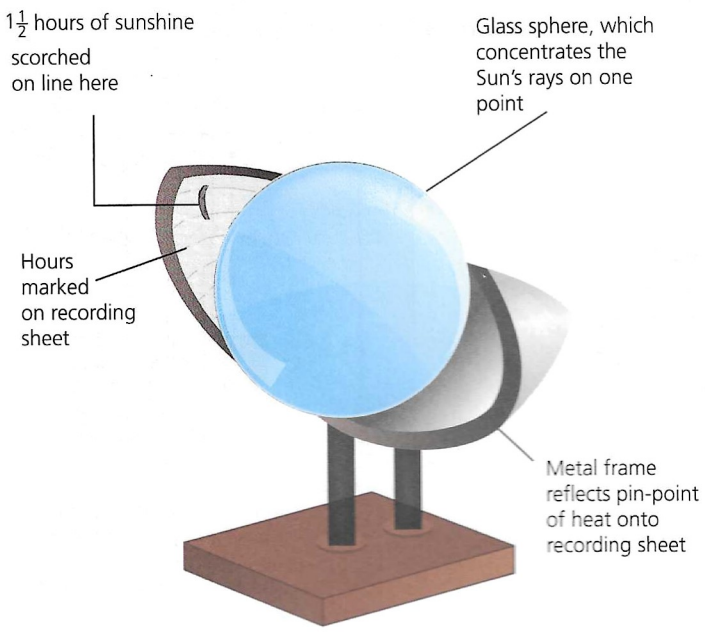
Wet- and dry-bulb thermometers are used to measure relative humidity. The dry-bulb is a glass thermometer which records the actual air temperature. The wet-bulb is a similar thermometer, but with the bulb enclosed in a muslin bag which dips into a bottle of water (Figure 2.14). This thermometer measures the wet-bulb temperature which, unless the relative humidity is close to 100 per cent, is generally lower than the dry-bulb temperature.



▲ **Figure 2.14** Wet- and dry-bulb thermometer

Sunshine recorder

The number of hours and minutes of sunshine received at a place can be measured and recorded by a sunshine recorder (such as a Campbell-Stokes sunshine recorder – Figure 2.15).



▲ **Figure 2.15** A sunshine recorder

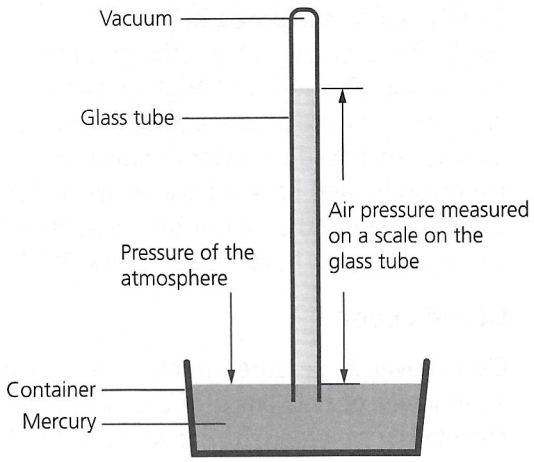
Test yourself

1 Outline the main features of a *Stevenson screen*.

Answer on page 126

Barometer

A mercury barometer consists of a hollow tube from which the air is extracted before the open end is placed in a bath of mercury. Mercury is forced up the tube by the pressure of the atmosphere on the mercury in the bath (Figure 2.16). When the pressure of the mercury in the tube balances the pressure of the air on the exposed mercury, the mercury in the tube stops rising. The height of the column of mercury changes as air pressure changes (i.e. it rises when air pressure increases and falls when air pressure decreases).



▲ **Figure 2.16** A mercury barometer

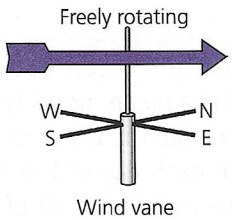
Anemometer

An anemometer is used to measure wind speed. It consists of three or four metal cups fixed to metal arms that rotate freely on a vertical shaft (Figure 2.17). When there is a wind, the cups rotate. The stronger the wind, the faster is the rotation. The number of rotations is recorded on a meter to give the speed of the wind in km/hr.

▲ **Figure 2.17** An anemometer

Wind vane

A wind vane is used to indicate wind direction. It consists of a horizontal rotating arm pivoted on a vertical shaft (Figure 2.18). The rotating arm has a tail at one end and a pointer at the other. When the wind blows, the arm swings until the pointer faces the wind. The directions north, east, south and west are marked on arms that are rigidly fixed to the shaft.



▲ **Figure 2.18** A wind vane

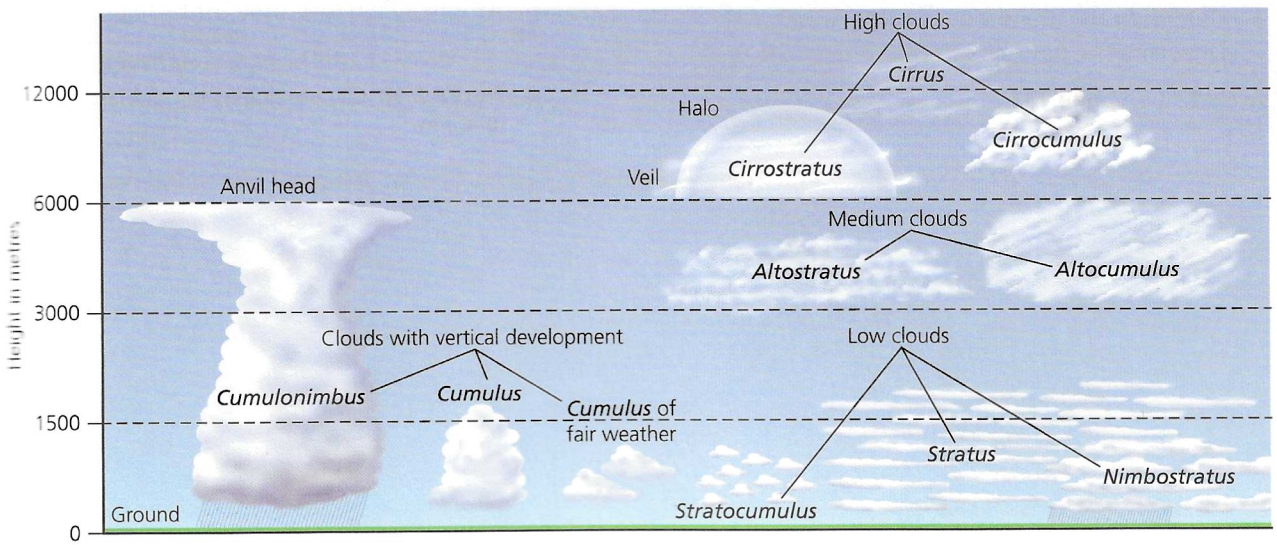
Digital instruments

Digital instruments can be used for weather observations. The main advantage is that they give a reliable reading whereas other methods are more subjective.

Recording the weather PAGE 154

REVISED ☐

Observations of types and amounts of cloud



▲ **Figure 2.19** Cloud types

Clouds can be separated into three broad categories according to the height of their base above the ground: high clouds, medium clouds and low clouds (Figure 2.19). High clouds are usually composed solely of ice crystals and have a base between 5500 and 14 000 m. Medium clouds are usually composed of water droplets or a mixture of water droplets and ice crystals, and have a base between 2000 and 7000 m. Low clouds are usually composed of water droplets, though cumulonimbus clouds include ice crystals, and have a base below 2000 m.

Cloud cover

Cloud cover is measured in oktas (eighths). This is made by a visual assessment of how much of the sky is covered by cloud. If the sky is completely covered with clouds it has 8/8 cloud cover.

Test yourself

2 Identify the instruments used to record:
   a relative humidity
   b wind speed
3 Outline the difference between a *cirrus* cloud and a *cumulonimbus* cloud.

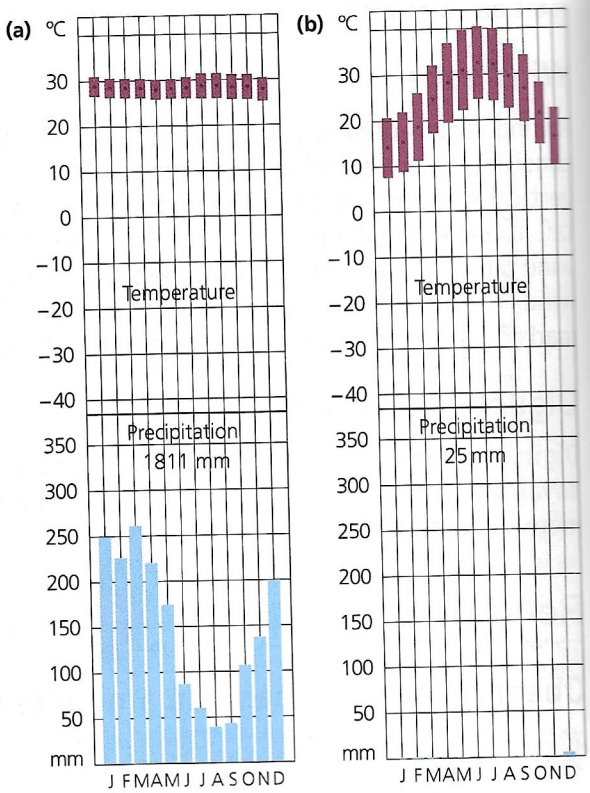
Answers on page 126

Climate graphs

Figure 2.20 shows two simple climate graphs (or climographs). Climate graphs tell us a great deal about the pattern of temperature and rainfall. They are often used to show annual variations or sometimes variations over a few weeks.

The mean monthly average temperature occurs between the mean monthly maximum and the mean monthly minimum. (The mean monthly maximum is the average of all the maximum temperatures for each day of the month. The mean monthly minimum is the average of all of the minimum temperatures recorded for each day in a month.)

Rainfall is normally shown as a bar chart. Different scales are used – in this case temperature is shown on the left-hand side and rainfall on the right-hand side.



▲ **Figure 2.20** Climate graphs for (a) Manaus and (b) Cairo

Exam-style questions

Study the climate graphs in Figure 2.20. For both climate graphs:

1 State the mean monthly temperature for July. [1]
2 State the mean monthly temperature for February. [2]
3 Calculate the annual temperature range. [1]
4 Describe the pattern of rainfall over the year. [3]

Answers on page 131