

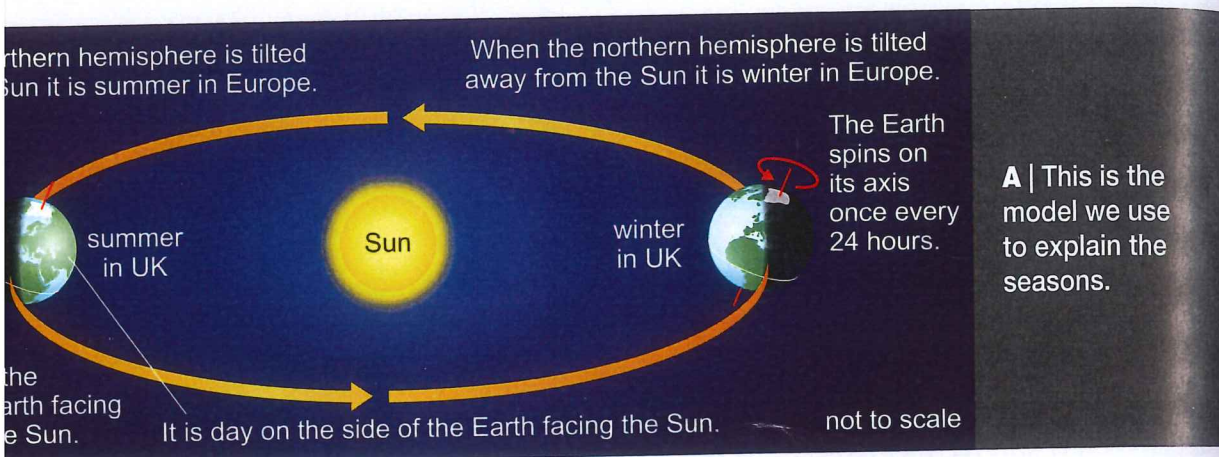
# MODELS IN SCIENCE

## MODELS USED IN SCIENCE?

Models help us to explain observations of many kinds.

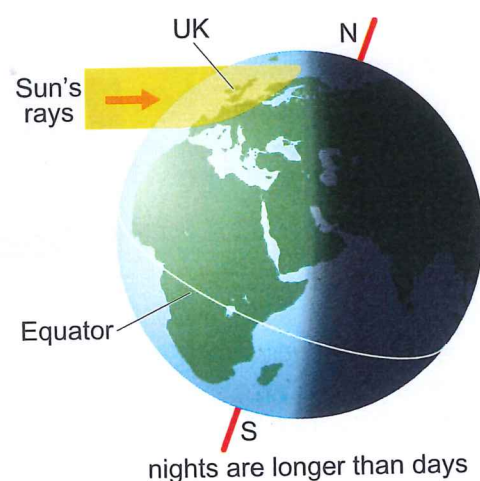
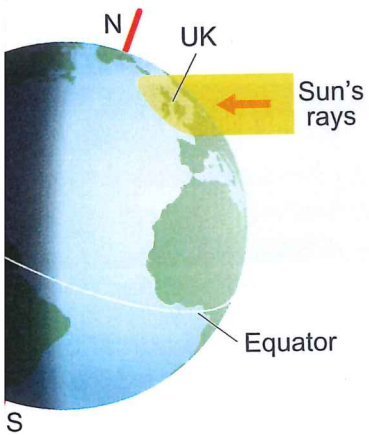
## The Earth, Moon and Sun

Models help us to explain observations about the Earth, Moon and Sun.



Sun's rays are concentrated in the summer.

The Sun's rays are spread out in the winter.



**B** | summer and winter in the Northern Hemisphere

## Solar System and beyond

Earth is just one of eight **planets** that **orbit** the Sun in our **Solar System**. Many of them have **natural satellites**, called moons, orbiting them. Planets and moons are held in their orbits by **gravity**.

Earth is just one of billions of stars in our **galaxy**. There are billions of galaxies in the universe. The distances between stars are so large that we use a unit called a **light year** to measure them.

## The particle model

The particle model helps us to explain why **solids**, **liquids** and **gases** have different properties. It also allows us to explain what happens when matter changes from one **state** to another.

In solids, particles are held close together by strong bonds and vibrate in fixed positions.

This explains why solids keep their shape and volume (they are difficult to **compress**).

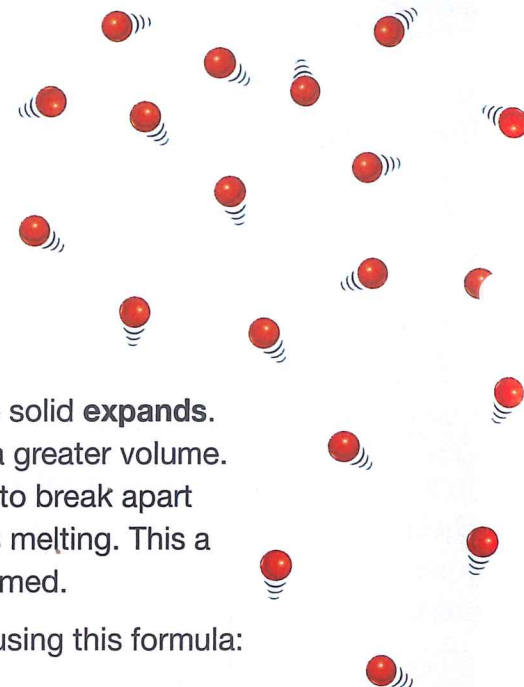
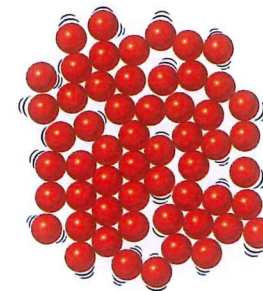
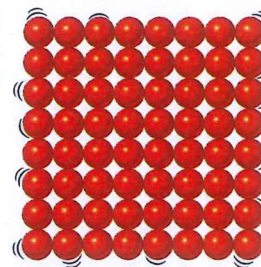
In liquids, particles are held close together by fairly strong bonds. The particles can move around.

This explains why liquids can flow but are difficult to compress.

In gases, particles are far apart with only weak bonds between them. They move about in all directions.

This explains why gases can flow and expand to fill their containers, and why they are easy to compress.

**C**



When a solid is heated the particles move around faster and the solid **expands**. It becomes less **dense** because the same mass now occupies a greater volume. If heating continues, the particles eventually get enough energy to break apart and form a liquid. The temperature stops rising while the solid is melting. This is a **physical change**, because no new chemical substances are formed.

The units for density are  $\text{g/cm}^3$  or  $\text{kg/m}^3$ . Density is worked out using this formula:

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

## Moving particles

The particles in **fluids** (liquids and gases) move faster when energy is transferred to them. A fluid expands when heated (because the particles need more space to move about) and the fluid becomes less dense.

The movement of particles causes:

- **pressure** in liquids and gases
- **diffusion**, an overall movement of particles from a place where there are more of them to a place where there are fewer of them
- **Brownian motion**, when tiny specks of dust in air or water can be seen jiggling around as they are hit by moving particles

The air pressure here is less than at sea level, because there is less air above pressing down.

Particles in fluids are moving around in all directions. The force of the particles hitting things causes pressure. The pressure is equal in all directions.

The pressure in fluids increases with depth.

**D** | pressure in fluids