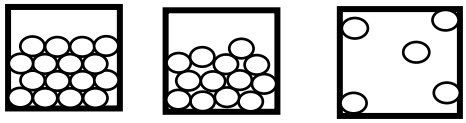
The Three States of Matter

1. The three states of matter are **solids, liquids and gases**
2. Solids, liquids and gases have different physical properties:

Property	Solid	Liquid	Gas
Does the object flow?	No	Yes	Yes
Can the object be compressed?	No	No	Yes
Does the object fill to fit the container?	No	No	Yes
Does the object have a fixed shape?	Yes	No	No
Does the object have a fixed volume?	Yes	Yes	No

The Particle Model

3. All matter is made from tiny particles
4. The arrangement of particles affects the properties of the substance
5. The three states of matter can be represented by a simple model, in which the particles are represented by small circles



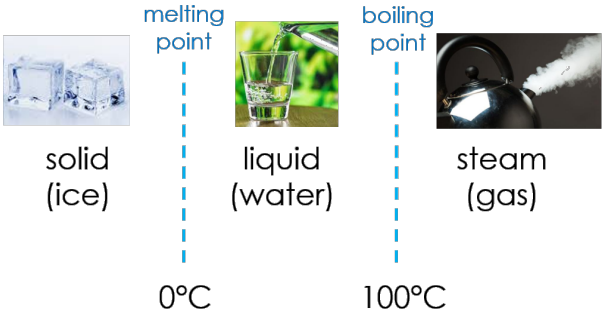
Solid liquid gas

6. Particles in a **solid** are arranged in a regular pattern, touch each other and vibrate on the spot
7. Particles in a **liquid** are arranged randomly, are touching and move freely
8. Particles in a **gas** are arranged randomly, do not touch and move freely
9. Some substances expand when heated. This is because when heated, particles have <u>more</u> energy. They vibrate <u>more.</u> The space between particles is <u>bigger.</u>

Changing State

10. Changes of state involve the rearrangement of particles. The particles themselves do not change.
11. A substance **melts** when it changes from a solid to a liquid
12. When a solid melts, the particles gain **energy** from the surroundings, so they begin to **vibrate faster**. The particles move away from their places in the arrangement and start to move around more.
13. A substance **freezes** when it changes from a liquid to a solid
14. When a liquid starts to freeze, its particles move more slowly as they lose **energy** to the surroundings. The particles form a **regular arrangement** and vibrate on the spot.
15. Melting and freezing of a substance happens at a certain temperature called the **melting point**
16. A substance **boils** when it changes from a liquid to a gas
17. During boiling, a **liquid is heated.** The particles **gain energy. T**hey **move further apart.** This **forms a gas**.
18. A substance **condenses** when it changes from a gas to a liquid
19. During condensation, a **gas cools.** The particles **lose energy.** They **move closer together until they are touching**. This **forms a liquid**.
20. Boiling and condensing take place at the **boiling point.**
21. The **boiling point** is the temperature at which a liquid changes into a gas.

22. When boiling occurs, Bubbles **of the substance** rise up to the surface and escape into the air.
23.

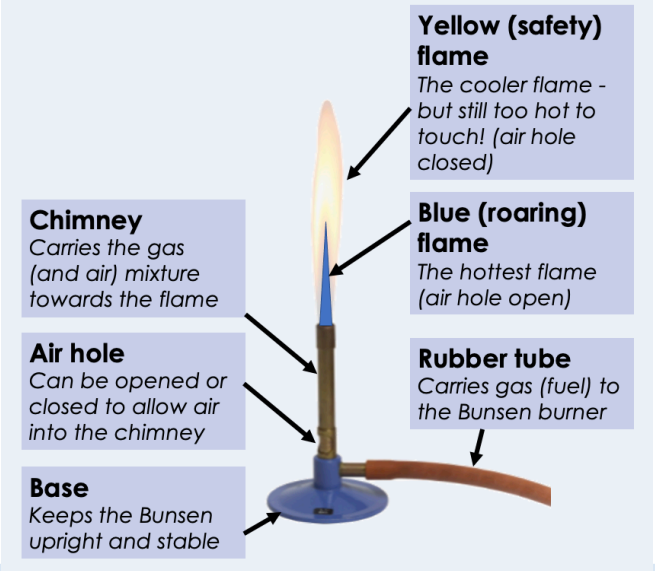


24. The **particles in a solid** can **vibrate in a fixed position** and cannot move from place to place because they do not have enough energy to overcome the forces that attract the particles towards each other

25. The **particles in a liquid** are able to **move around each other** because they have more energy than particles in a solid but not enough to completely overcome the forces of attraction

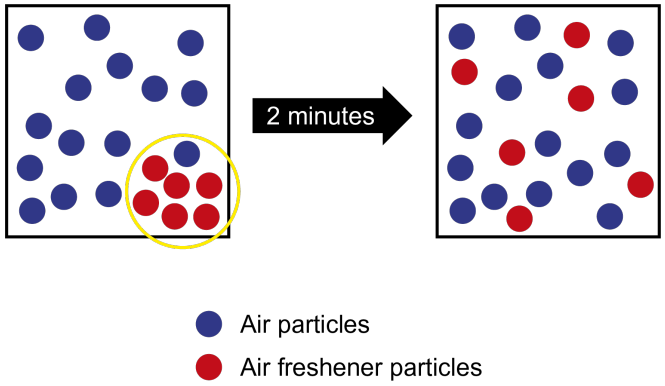
Heating substances

26. A Bunsen burner, electric heater and water bath can all be used to heat substances.



Diffusion

27. Diffusion is the movement of particles from a **high concentration** to a **low concentration**.



The particles of red gas diffuse over 2 minutes. The particles of the red gas move from a higher concentration to where the concentration is lower.

28. **Diffusion happens in liquids and gases** because particles are free to move

29. **Diffusion cannot happen in solids** because particles in a solid are not free to move

30. **Diffusion happens faster** when the particles in a liquid or gas are moving **faster after heating**

Variables

31. A **variable** is anything that can change or be changed.

32. The **independent variable** (IV) is the variable you **change** (the variable you want to investigate)

33. The **dependent variable** (DV) is the variable you **measure** because it depends on the IV

34. The **control variables** (CV) are the variables you **keep the same** because they could affect the dependent variable

Gas Pressure

35. **Gas pressure** happens because of particles colliding with the walls of a container

36. Increasing the size of the container decreases the gas pressure as there will be less collisions.

37. Decreasing the size of the container increases the gas pressure as there will be more collisions.

38. The deeper underwater you travel, the greater the pressure.

39. The higher up you go into the atmosphere, the less the pressure.

40. Greater pressure compresses gas particles so they are closer together and have a smaller volume

Density and volume

41. Density is defined as the mass per unit volume of a substance.

42. Density = mass ÷ volume

$$\rho = \frac{m}{V}$$

Density measured in (g/cm³)

Mass measured in (g)

Volume measured in (cm³)

volume = length x width x height

(cm^3) (cm) (cm) (cm)

43. If an object has an **irregular shape**, the volume can be measured using a **displacement can**, or **Eureka can**.

44. The **displaced** water in the cylinder occupies the same amount of space as the irregular object. **The volume of water in the graduated cylinder is equal to the volume of the object.**

