

## Knowledge Organiser Key Stage 3

Subject : Science

Year: 8 (year 9 unit)

Topic

Title: Matter

### Key Facts

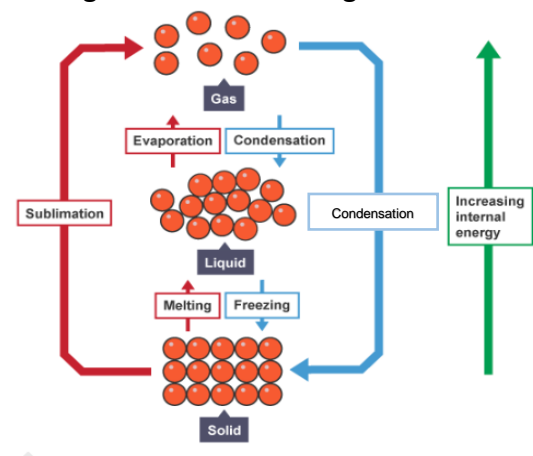
1. Everything around us is made up of **particles**
2. All of these particles are in one of three states of matter – **solids, liquids or gases**
3. Solid particles have the least energy. Solid particles **vibrate** on the spot, in a **fixed position**, and form **strong bonds** with other solid particles in a **regular arrangement**. Solids have a fixed shape and **can't be compressed**.
4. Liquid particles have more energy than solids. Liquid particles move **quickly** and **randomly**, and form **weak bonds** with other liquid particles. Liquid particles are arranged **randomly**, sometimes touching, sometimes not, but the particles are close enough together that liquids **cannot be compressed**.
5. Gas particles have more energy than liquid particles. Gas particles move **very quickly** and **randomly**. Gas particles do not form bonds with each other, so spread out **far apart** in a random way. Because gas particles are far apart, gases have **no fixed shape** and **can be compressed**.
6. The particles in a substance **stay the same** when it changes state. Only **closeness, arrangement** and **motion** change. This means that the **chemical** nature of the substance stays the same and the **mass** of the substance stays the same.
7. **Diffusion** of particles is due to their **movement**. Particles in solids **cannot** diffuse. Warmer particles with more energy move more quickly and so **diffuse more quickly**. Gas particles of a substance diffuse more quickly than liquid particles of the same substance.
8. Pressure (N/m<sup>2</sup>) = Force (N) ÷ Area (m<sup>2</sup>)      **P=F/A**
9. Solids exert pressure towards the centre of the Earth due to their weight. **Fluids** exert pressure in **every direction** as fluid particles are travelling randomly in every direction. If fluid particles hit a surface they exert pressure **at 90° to that surface**.
10. Pressure in a column of fluid (e.g. the liquid in a water pipe, or the gases in the atmosphere) **increases with depth** due to the weight of the fluid above
11. Because the particles in a fluid exert pressure from every direction **including from below**, this causes **buoyancy / upthrust**
12. If an object **floats** in a fluid (e.g. a boat on water, or a balloon in the air) then the force of the upthrust is **equal and opposite** to the objects weight
13. The **maximum upthrust** on a submerged object is equal and opposite to the **weight of fluid displaced** by that object
14. If the maximum upthrust is **lower** than the weight of fluid displaced by an object, it will **sink**. If the maximum upthrust is **higher** than the weight of fluid displaced by an object, it will **float**.
15. You can change the upthrust on an object by changing the way it is in **contact** with the fluid and so how much fluid it **displaces**. A boat placed flat in the water should float. A boat placed end-on might sink!

## Key words

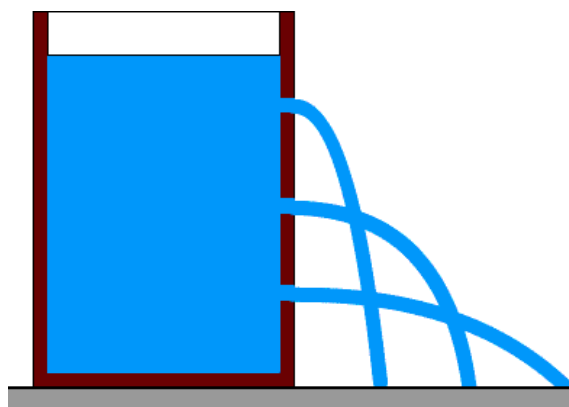
1. **Particle** – a small piece of matter
2. **Matter** – the substances that all physical objects are made from
3. **Regular** – in a repeating pattern
4. **Random** – with no pattern
5. **Compressed** – squashed
6. **Fluid** – a substance that can flow (a liquid or a gas)
7. **Exert** - apply
8. **Diffusion** – the movement of particles from an area of high concentration to an area of low concentration
9. **Brownian motion** – random motion of particles due to their random collisions with each other
10. **Pressure** – a measure of how spread out a force is
11. **Atmospheric pressure** – the pressure due to the weight of the atmosphere
12. **Normal to a surface** – at  $90^\circ$  to the surface, perpendicular to the surface
13. **Upthrust** – the upward force that the particles in a fluid exert on a body floating in the fluid
14. **Maximum** – highest possible
15. **Submerged** – completely surrounded by fluid
16. **Displaced** – moved away, taken the place of

## Diagrams

Arrangement of and changes in States of Matter



Pressure in liquids increases with depth



## Potential misconceptions to avoid / errors students often make

### 1. All particles move, even in very cold solids such as ice

Students sometimes aren't clear enough about whether they are talking about the object or the particles that make up the object.

Solids stay in one place. The tiny particles that make up the solid vibrate in a fixed position

Liquids can flow. The tiny particles that make up a liquid move around randomly and quite quickly.

Gases can flow and fill a container. The tiny particles that make up a gas move around randomly and very quickly

### 2. All particles have energy, even in very cold solids such as ice

Because solids don't vibrate, students sometimes forget that all solid particles have energy and that all solid particles move/vibrate on the spot.

As particles get hotter and gain energy, a solid will melt to a liquid and then a liquid will boil to a gas.

As particles get colder and lose energy, a gas will condense to a liquid and then a liquid freeze to a solid.

The particles move more slowly but they do not stop moving altogether.

### 3. Upthrust in fluids is just like the reaction force in solids

A small force from an object causes a small upthrust. Larger forces cause larger upthrust. Once the upthrust can no longer balance the downwards force, the object will sink!

