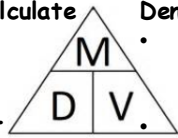


# Particle Model - Foundation

START

How do we calculate density?



$$D = m / v.$$

Density (g/cm<sup>3</sup> or kg/m<sup>3</sup>)  
 Mass (g or kg)  
 Volume (cm<sup>3</sup> or m<sup>3</sup>)

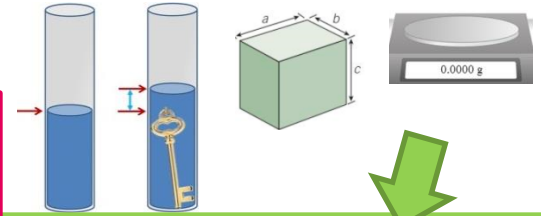
Density of water?

• 1 g/cm<sup>3</sup> (same as 1000 kg/m<sup>3</sup>)

An object floats if it has a lower density than water.  
 An object sinks if it has a higher density than water.

How do we find the density of an object?

- Find the mass, using some weighing scales. Measure the volume by length x width x height of a regular object (like a cuboid or cube)
- Put an irregular object into water (like a key). The water level will rise the same amount as the volume of the object.
- Calculate density using the formula



## What is pressure?

- The particles in gases and liquids move about randomly.
- They **collide** with each other and the walls of their container.
- These collisions cause a force on the inside of the container.
- **Pressure** is the force on an area (**force per unit area**) caused by these collisions. (**Measured in Pa (Pascals)**).

## Specific heat capacity

- The energy needed to increase the temperature of **1kg** of a substance by **1° C**.

$$E = m \times c \times \theta$$

- E = Energy in Joules (J)
- m = Mass in kilograms (kg)
- c = specific heat capacity in Joules per kilogram per degrees Celsius (J/kg°C)
- $\theta$  = Change in temperature (°C)

## Internal energy

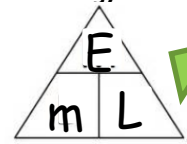
- Made up of the total kinetic energy and potential energy of the particles in a substance.

## Specific Latent Heat

- When a change of state occurs, the **internal energy** increases but the temperature does not.

$$E = m \times L$$

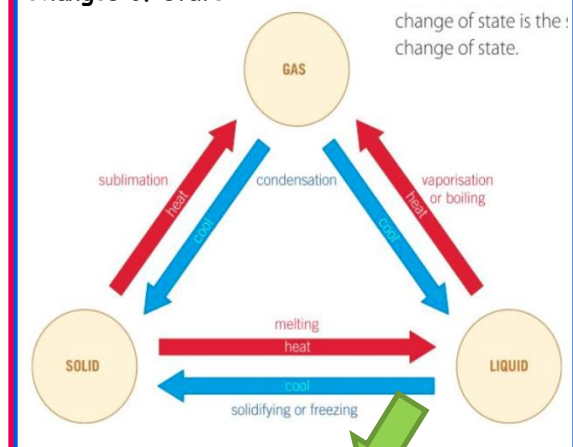
- E = Energy in Joules (J)
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- Specific latent heat of **fusion** is change of state between solid and liquid.
- Specific latent heat of **vaporisation** is change of state between liquid and gas.



## Key words:

- Density:** How tightly packed particles are in a certain volume.
- Particle:** A small piece of matter, e.g. protons, electrons, atoms or molecules.
- Matter:** What everything is made up of.
- State of matter:** Solids, liquids or gases.
- Melting:** When solids turn into liquids.
- Freezing:** When liquids turn into solids.
- Evaporating:** When a liquid turns into a gas.
- Condensing:** When a gas turns into a liquid.
- Internal Energy:** The energy stored inside a system by the particles that make up the system.
- Specific Heat Capacity:** The energy needed to increase the temperature of **1kg** of a substance by **1° C**.
- Specific Latent Heat:** The energy needed to change the state of **1kg** a substance (without changing the temperature).
- Pressure:** The force per m<sup>2</sup> acting on a surface.
- Pascal:** The unit of pressure. 1Pa = 1N/m<sup>2</sup>.

## Changes of state



State of matter	Distance between molecules	Movement	Shape
Solid	Close together (uncompressible)	Vibrate in one place	Fixed
Liquid	Close together (can be squashed)	Particles move around each other.	Take shape of bottom of container
Gas	Far apart (can be squashed)	Particles move randomly.	Take shape of whole container

## Particle Model Questions

1. Define Density.
2. Give the equation for density, explain each of the terms and name the units for each.
3. Explain how you would calculate the density of an irregular object, including the equipment needed.
4. Write and explain the changes of state.
5. Explain the movement, arrangement and shape of the three states of matter.
6. What is specific latent heat of fusion?
7. What is specific latent heat of vaporisation?
8. 0.008kg of water evaporated after 18,400J of energy was added. What is the specific latent heat of water?
9. What is internal energy?
10. Define specific heat capacity?
11. What does it mean if I have an object with a high specific heat capacity?
12. What is pressure?
13. What are the units of pressure?
14. Why does 1kg of ice have less energy than 1kg of water if they are both at 0° C?

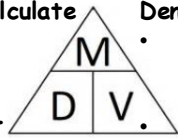
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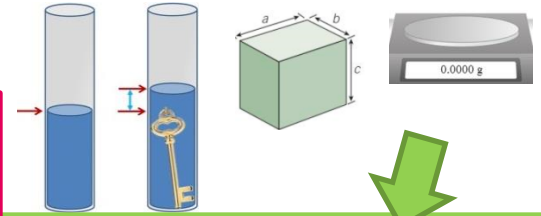
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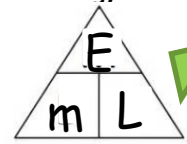
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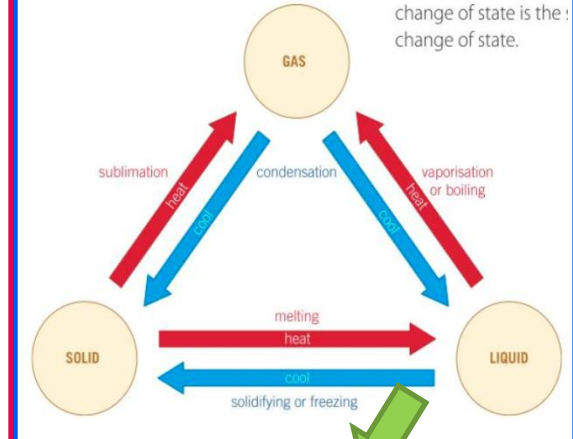
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