GCSE Physics Key Facts – Particle Models

<table>
<tr><th colspan="2">Particle models</th></tr>
<tr><td>Density equation:

ρ = mV

ρ = density (kg/m^3)
m = mass (kg)
V = volume (m^3)</td><td><u>Solids</u> have particles close together that vibrate in a fixed position, with little energy.

Particles in <u>liquids</u> are in contact with each other. They move slow and randomly.

Particles in <u>gases</u> are spread out with lots of <u>energy</u>. They move fast and random.</td></tr>
<tr><td>Particle arrangements can be used to explain differences in density and states of matter</td><td>To measure the density of regularly shaped objects.
1) Measure l, h, w and calculate volume.
2) Measure mass using a top pan balance
3) Use the density equation.</td></tr>
<tr><td>To measure the density of irregularly shaped objects.
1) Fill a displacement can with water.
2) Put object into the water.
3) Measure the volume of water displaced.
4) Measure mass using a top pan balance
5) Use the density equation.</td><td>To measure the density of liquids.
1) Measure the mass of an empty beaker.
2) Fill the beaker with a known volume of your liquid.
3) Measure the mass of the full beaker.
4) Calculate the mass of the liquid.
5) Use the density equation.</td></tr>
<tr><th colspan="2">Internal energy and energy transfers</th></tr>
<tr><td>Internal energy is the energy stored inside a system by the particles that make up the system. It is made up of kinetic energy and potential energy.</td><td>Heating changes the energy stored in a system by increasing the energy of the particles. This can either increase the temperature or cause a change of state.</td></tr>
<tr><td>When temperature of a system increases, the increase in energy of a system depends on the mass of the substance, the type of material and the energy input to the system</td><td>Specific Heat Capacity equation:

change in thermal energy = mass× specic heat capacity × temperature change
$\Delta E = m\,c\,\Delta\vartheta$

change in thermal energy, ΔE, in joules, J
mass, m, in kilograms, kg
specific heat capacity, c, in joules per kilogram per degree Celsius, J/kg °C
temperature change, $\Delta\vartheta$, in degrees Celsius, °C.</td></tr>
<tr><td>Specific heat capacity is the energy needed to increase the temperature of 1kg of a material by 1 ^{0}C</td><td>Latent heat is the energy needed to change the state of 1kg of a substance at a constant temperature.</td></tr>
<tr><td>When there is a change of state, the energy stored (internal energy) increases, but the temperature stays the same. Energy is used to break or make bonds not the kinetic energy of the particles.</td><td>The specific latent heat of a substance is the amount of energy required to change the state of one kilogram of the substance with no change in temperature.</td></tr>
<tr><td>Specific Latent Heat Equation:

Energy for a change of state = mass × specific latent heat
$E = m\,L$

energy, E, in joules, J
mass, m, in kilograms, kg
specific latent heat, L, in joules per kilogram, J/kg</td><td>Specific latent heat of fusion = change of state from solid to liquid

Specific latent heat of vaporisation = change of state from liquid to gas</td></tr>
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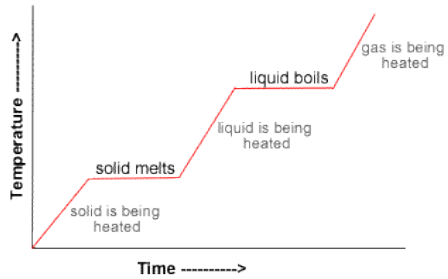
<table>
<tr><td>Interpret heating and cooling graphs:
 
</td><td>Changes of state conserve mass and are physical changes.</td></tr>
<tr><th colspan="2">Particle Models and Pressure</th></tr>
<tr><td>Gas molecules are in constant random motion. The temperature of a gas is related to the average kinetic energy of the molecules.</td><td>Increases the temperature of a gas, when it is at constant volume, increases the pressure exerted by the gas. This is due to the kinetic energy of the gas particles increasing, and them hitting the container surfaces more often and with more force.</td></tr>
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