Specific Heat Capacity and Specific Latent Heat

To be able to explain and calculate specific heat capacity
To be able to explain and calculate specific latent heat

Specific Heat Capacity

We know that when we heat a substance the temperature will increase. The equation that links heat (energy) and temperature is:

$$\Delta Q = mc\Delta T$$

c is the specific heat capacity which is the energy required to raise the temperature of 1 kg of a substance by 1 degree. It can be thought of as the heat energy 1 kg of the substance can hold before the temperature will increase by 1 degree.

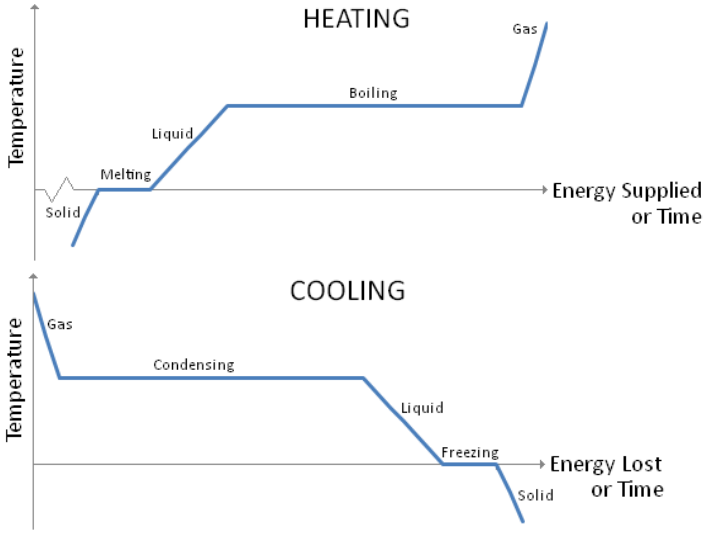
Specific Heat Capacity is measured in Joules per kilogram per Kelvin, J/kg K or J kg^{-1} K^{-1}

Water Analogy

We can think of the energy being transferred as volume of water. Consider two substances: one with a high heat capacity represented by 250 ml beakers and one with a low heat capacity represented by 100 ml beakers. When a beaker is full the temperature of the substance will increase by 1 degree.
We can see that 2 litres of water will fill 8 of the 250 ml beakers or 20 of the 100ml beakers meaning the same amount of energy can raise the temperature of the first substance by 8 degrees or the second by 20 degrees.

Changes of State

When a substance changes state there is no change in temperature.



When a solid is heated energy is transferred to the particles making them vibrate more which means the temperature increases. The potential energy of the solid remains constant but the kinetic energy increases.
At melting point the particles do not vibrate any faster, meaning the kinetic energy and temperature are constant. The bonds that keep the particles in a rigid shape are broken and the potential energy increases.
In liquid form the particles are still in contact with each other but can slide past each other. As more energy is transferred the particles vibrate more. The kinetic energy increases but the potential energy is constant.
At boiling point the particles do not vibrate any faster, meaning the kinetic energy and temperature are constant. The bonds holding the particles together are all broken, this takes much more energy than when melting since all the bonds need to be broken.
When a gas is heated the particles move faster, meaning the kinetic energy and temperature increases. The potential energy stays constant.

Specific Latent Heat

Different substances require different amounts of energy to change them from solid to liquid and from liquid to gas. The energy required is given by the equation:

$$Q = ml$$

l represents the specific latent heat which is the energy required to change 1 kg of a substance from solid to liquid or liquid to gas without a change in temperature.

Specific Latent Heat is measured in Joules per kilogram, J/kg or J kg^{-1}

The specific latent heat of fusion is the energy required to change 1 kg of solid into liquid

The specific latent heat of vaporisation is the energy required to change 1 kg of liquid into gas.
As we have just discussed, changing from a liquid to a gas takes more energy than changing a solid into a gas, so the specific latent heat of vaporisation is higher than the specific latent heat of fusion.