HEAT SUMMARY

Heat and Temperature

Heat is an electromagnetic wave called infra-red radiation that travels at the speed of light.
The frequencies of vibration of heat waves are higher than microwaves and slower than light.
Waves of heat are given off by the outer shell electrons of atoms when they are disturbed in their orbits.
When heat is absorbed by an atom, its speed of vibration increases.
When heat is given off by an atom its speed of vibration decreases.
Heat energy is either the energy carried by the infra-red radiation or the energy of vibration of moving atoms.
Temperature is related to the average kinetic energy of the particles. The higher the temperature the more kinetic energy carried by the particles.
Absolute zero temperature is when all vibration of particles stops.
Arbitrary zeros of temperature are convenient places to start measuring - ice/water is set at 0^{o} Celcius with boiling water 100^{o}C .
Absolute zero temperature is close to -273^{o} Celcius.

Heat energy transfer

Temperature is a measure of hotness – this number can be used to determine the direction of energy transfer between objects.
Heat energy is transferred from an object at higher temperature to one of lower temperature.
When temperatures are equal no energy transfer occurs.
Hot is a sensation felt by the skin when part of the body is near or touching an object at a temperature greater than 37^{o} C.
When a faster moving particle collides with a slower moving one, energy is transferred from the faster moving to the slower one. The faster particle slows and the slower particle speeds up.
Heat energy transfer due to collision is called conduction. It occurs until the temperatures are the same.
The closer the particles in a substance the better the conductor. The order of best to worst conductors is solid, liquid and gas.
Liquids and gases at a higher temperature have particles moving faster. Collisions with other slower particles force the faster ones to the top of the pile. This is called convection.
Convection currents occur when warmer liquids and gases rise and cooler ones fall.
Energy is transferred by radiation when waves of heat leave one object, travel a distance and are absorbed by another object.
The most effective to least effective heat energy transfer is conduction, convection and radiation.

Heat Capacity

Heat Capacity is the energy needed to change the temperature of an object one degree Celsius.
It is a property of an object, not of the material since a standard mass is not involved, it is variable.
The unit of heat capacity is Joule per degree Celsius.
The change in internal energy of an object equals the heat capacity of the object times the change in temperature.
The value of an object's heat capacity depends on the type of material making up the object and the mass of the object. The more matter present, the more energy needed to raise the temperature 1 degree C.
Specific Heat Capacity is the energy needed to make one gram of a substance change temperature by one degree Celcius.
It is a property of the material and not of an object since a standard mass is involved.
The unit of specific heat capacity is Joule per kilogram per degree Celsius.

The change in heat energy of the object equals the specific heat capacity of the substance times the mass of the object times the change in temperature of the object.

Changes of state

As temperature increases a solid expands. When a temperature is reached, the solid loses its shape and becomes a liquid. While melting the temperature of the solid/liquid mixture stays the same.
The heat energy absorbed during melting is called the Latent Heat of Fusion. It is measured in J per kilogram.
The Latent heat does not speed up particles it causes them to move apart.
Energy needed to melt a solid equals Latent Heat of Fusion times mass of solid.
When a liquid is heated it eventually boils. At boiling it changes to a gas at its fastest rate but its temperature remains the same.
The heat energy absorbed during boiling is called the Latent Heat of Vapourisation. It is measured in J per kilogram.
Energy needed to convert a liquid at boiling point to a gas equals Latent Heat of Vaporisation times mass of liquid evaporated.