Topic 3: Heat

Subtopic 3.1: Heat and Temperature

Knowledge	Application
Thermal energy is made up of the combined potential energy and the kinetic energy that is due to the vibration of the particles within the object. The particles within objects with higher temperatures have a higher average kinetic energy. An increase in the temperature of an object is due to an increase in its thermal energy. Temperature can be measured with different scales (common ones being Celsius, Fahrenheit, and Kelvin). As the temperature decreases, the average kinetic energy of the particles drops until the lower limit (known as 'absolute zero') is reached. When a hotter object is put into contact with a cooler object, some of the thermal energy transfers from the hotter object to the cooler one. This *flow* of energy is referred to as 'heat'. If the objects remain in contact, then eventually the objects will reach the same temperature, putting the objects into 'thermal equilibrium'.	Describe the links between temperature, vibrating particles, and thermal energy Describe heat as the flow of energy from hotter to cooler objects. Describe thermal equilibrium.
Heat transfer can occur through conduction, convection, and radiation. Most solids, liquids, and gases expand when heated.	Explain how heat transfer can occur through conduction, convection, and radiation. Describe examples of each heat-transfer process. Describe applications of the expansion of matter due to heat transfer.

Subtopic 3.2: Specific Heat Capacity

Knowledge	Application
Energy can be added to or removed from a system without causing a change of state. The energy that is added or removed causes a change in temperature, ΔT. The change in temperature depends on the mass of the object, m, the amount of heat transferred to or from the object, Q, and the nature of the material (its 'specific heat capacity', c). These variables are linked through the formula: $Q = mc\Delta T$.	Describe and explain specific heat capacity. Solve problems using the formula $Q = mc\Delta T$.

Subtopic 3.3: Change of State

Knowledge	Application
Matter commonly exists in three states: solid, liquid, and gas. To change a solid to a liquid (melting or fusion) and to change a liquid to a gas (boiling or vaporisation) requires the input of energy. This energy breaks bonds between atoms or molecules but does not change the temperature and is thus known as 'latent heat'. The amount of latent heat required (Q) depends upon the nature of the substance (specifically, its latent heat capacity (L)) and the mass of the substance m, and is calculated using $Q = mL$. During the change of state from a gas to a liquid (condensation) or from a liquid to a solid (freezing or solidification), heat is released due to the formation of bonds between atoms or molecules. Some substances change from solid to gas (sublimation) or from gas to solid (deposition) without going through a liquid phase.	Describe and explain latent heat. Explain the difference between evaporation and boiling, using the particle model. Solve problems using the formula $Q = mL$. Undertake experiments to determine the specific heat capacity or latent heat of different materials.