Latent Heat

1. Calculate the amount of heat energy required to melt 0.3 kg of ice at 0 °C.

(Specific latent heat of fusion of ice = 3.34 x 105 J/kg)

1. Calculate the specific latent heat of fusion of naphthalene given that 6 x 105 J of heat are given out when 4.0 kg of naphthalene at its melting point changes to a solid.
2. Calculate what mass of water can be changed to steam if 10.6 kJ of heat energy is supplied to the water at 100 °C.

(Specific latent heat of vaporisation of water = 2.26 x 106 J/kg)

1. Ammonia is vaporised in order to freeze an ice rink.
   1. Find out how much heat it would take to vaporise 1 g of ammonia.
   2. Assuming this heat is taken from water at 0 °C, find the mass of water frozen for every gram of ammonia vaporised.

(Specific latent heat of vaporisation of ammonia = 1.34 x 106 J/kg

Specific latent heat of fusion of ice = 3.34 x 105 J/kg).

1. The graph below shows how the temperature of a 2 kg lump of solid wax varies with time when heated.
   1. Explain what is happening to the wax in the regions AB, BC and CD.
   2. If a 200 W heater was used to heat the wax, calculate the specific latent heat of fusion of the solid wax.

**Principle of Conservation of Energy**

1. If 200 g of water at 40 °C are mixed with 100 g of water at 10 °C and no energy is lost, what is the final temperature of the mixture? (Specific heat capacity of water = 4180 J/kg°C)
2. If an immersion heater heats 300 g of water for 2 minutes and the temperature rises by 30 °C, find the power rating of the heater in watts.
3. A 350 W element is used to boil 300 g of water in a cup. The initial temperature of the water is 20 °C.
   1. How long will it take to reach 100 °C?
   2. State any assumptions made.
4. Meteors are small pieces of matter made mostly of iron. Few meteors hit the surface of the Earth because of the Earth’s atmosphere. Assuming all the kinetic energy of the meteor changes to heat energy in the meteor, if a 0.001 kg meteor, travelling at 30000 ms-1 crashes into the Earth’s atmosphere resulting in a change in temperature of 20000°C, calculate the specific heat capacity of the iron.
5. If a copper ball is dropped on a hard surface the ball is deformed, and we can assume all the kinetic energy is transferred to internal energy in the ball. From what height must the ball be dropped to raise its temperature by 2 °C? (Specific heat capacity of copper = 380 J/kg°C)
6. An electric shower has a 1.5 kW heating element.
   1. How much heat energy can it give out in five minutes?
   2. If the element is used to heat 5 kg of water for 5 minutes, what would be the rise in temperature? (Specific heat capacity of water = 4180 J/kg).
7. A pupil put 2 litres of water at 20 °C into her 1000 W kettle. She switched it on and then forgot it for 15 minutes. Unfortunately, it did not have an automatic cut-out and when she came back the kitchen was full of steam. 1 litre of water has a mass of 1 kg.
   1. How much energy was required to bring the water to boiling point?
   2. How much electrical energy had been used altogether?
   3. How much water had been turned into steam?
   4. Which of your answers are approximate and why?
8. A heating coil carries an electrical current of 2 A for 100 s at a voltage of 20 V. If this is sufficient to boil away 20 g of liquid nitrogen at its boiling point, what is the specific latent heat of vaporisation of nitrogen?
9. A 200 g bun is put in a 600 W microwave oven for one minute. If its temperature rises from 15°C to 45°C, what is the specific heat capacity of the bun?