Specific Heat Capacity Calculation Questions

These questions are based on real-life situations involving kettles, hot drinks, baths, cooking, heating systems and electric vehicles. Some questions require unit conversions and rearranging the equation.

1. A kettle transfers 168 000 J of energy to 2.0 kg of water, causing its temperature to rise by 20°C.
   Calculate the specific heat capacity of the water.
2. A 0.25 kg mug of tea cools from 80°C to 60°C. The tea has a specific heat capacity of 4200 J/kg°C.
   Calculate the energy transferred as the tea cools.
3. A hot water bottle contains 1.5 kg of water. The water is heated by 30°C.
   Calculate the energy needed to heat the water if the specific heat capacity of water is 4200 J/kg°C.
4. A bath contains 80 kg of water. An immersion heater transfers 6 720 000 J of energy to the water.
   Calculate the temperature rise of the water.
5. A 2.0 kg aluminium saucepan is heated from 20°C to 120°C.
   The specific heat capacity of aluminium is 900 J/kg°C.
   Calculate the energy transferred to the saucepan.
6. A storage heater contains 150 kg of ceramic bricks.
   The bricks have a specific heat capacity of 800 J/kg°C.
   The temperature of the bricks rises by 120°C.
   Calculate the energy stored in the bricks.
7. An electric vehicle battery pack has a mass of 450 kg.
   The battery material has a specific heat capacity of 950 J/kg°C.
   During rapid charging, the temperature of the battery rises by 8°C.
   Calculate the thermal energy gained by the battery pack.
8. A metal block gains 180 000 J of thermal energy and its temperature rises by 50°C.
   The mass of the block is 4.0 kg.
   Calculate the specific heat capacity of the metal.

9. A swimming pool contains 120 000 kg of water.
   The water temperature is increased by 5°C.
   Calculate the energy required to heat the pool.
   Give your answer in standard form.
10. Engineers are designing a thermal energy storage system for a school.

A 500 kg block of material has a specific heat capacity of 1 200 J/kg°C.

During the day, its temperature rises from 18°C to 75°C.

Calculate:

a) the temperature change

b) the thermal energy stored

c) the thermal energy stored in kWh (1 kWh = 3 600 000 J).