Worksheet 2.3: Specific Heat Capacity Calculations

PhysicsSheets

Specification: GCSE Physics (AQA / Edexcel / OCR Gateway)

Core Equation: $\Delta E = mc\Delta\theta$

Rearranged Forms:

$m = \frac{\Delta E}{c\Delta\theta}$ | $c = \frac{\Delta E}{m\Delta\theta}$ | $\Delta\theta = \frac{\Delta E}{mc}$

Units:

ΔE (Thermal energy, Joules, J)

m (Mass, kilograms, kg)

c (Specific Heat Capacity, Joules per kilogram per degree Celsius, J/kg°C)

$\Delta\theta$ (Temperature change, degrees Celsius, °C)

Section A: Formula Recall & Unit Conversions

1. Identify the correct SI unit and symbol for each variable in the specific heat capacity formula:

a) Thermal energy (ΔE): _____

b) Mass (m): _____

c) Specific Heat Capacity (c): _____

d) Temperature change ($\Delta\theta$): _____

2. Rearrange the formula $\Delta E = mc\Delta\theta$ to make each variable the subject:

a) $m =$

_____

b) $c =$

_____

c) $\Delta\theta =$

_____

3. Perform the following unit conversions:

a) 350 kJ = _____

b) 750 g = _____

c) 12 minutes = _____

d) 0.005 MJ = _____

e) 2500 mg = _____

f) 0.5 hours = _____

Section B: Core Calculations

1. A 0.8 kg block of aluminium is heated, causing its temperature to rise by 15°C. The specific heat capacity of aluminium is 900 J/kg°C.

a) Calculate the thermal energy transferred to the aluminium block. Show your working.

_____

_____

b) A 2.0 kg mass of water is heated from 20°C to 80°C. The specific heat capacity of water is 4200 J/kg°C. Calculate the thermal energy transferred to the water. Show your working.

c) A 500 g copper block absorbs 15 kJ of thermal energy, causing its temperature to increase by 10°C. Calculate the specific heat capacity of copper. Show your working.

d) An electric kettle contains 1.5 kg of water. It is supplied with 315 kJ of thermal energy. If the specific heat capacity of water is 4200 J/kg°C, calculate the temperature rise of the water. Show your working and give your answer to 2 significant figures.

Section C: Applied Physics Challenges

2. A 2.0 kW immersion heater is used to heat 5.0 kg of water in a tank. The heater is switched on for 10 minutes. Assume all the energy from the heater is transferred to the water. The specific heat capacity of water is 4200 J/kg°C.

a) Calculate the total thermal energy supplied by the immersion heater. Show your working.

b) Calculate the temperature rise of the water. Give your answer to an appropriate number of significant figures.