Calculating Heat Transfer

The transfer of heat from one body to another causes either a temperature change or a change in state or both. We will consider temperature changes first.

Different substances require different amounts of energy to increase their temperature. This is a physical characteristic of the material. We say, 'different substances have a different capacity to hold heat'. Water, for example, holds heat better than steel. Water has a higher heat capacity.

Specific heat capacity (C) is the amount of energy needed to raise the temperature of 1.0 kg of a substance by 1° C .

Specific heat capacity of water = c_w = 4200 J/kg•°C

Cw = Q / m•ΔT

Q = heat energy (J)
m = mass (kg)
ΔT = change in temperature (°C)

Often we solve for heat required (heating) or heat lost (cooling)

Q = Cw • m • ΔT

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Practise questions

1. Calculate the amount of heat needed to raise the temperature of 8.4 kg of water by 6.0 C
2. Determine the heat lost when 3.7 kg of water cools from 31 C to 24 C.
3. An electric immersion heater delivers 0.50 mJ of energy to 5.0 kg of a liquid, changing its temperature from 32 C to 42 C. Find the specific heat capacity of the liquid. Is it water?
4. Water from a tap at 11 C sits in a watering can where it eventually reaches 21 C.
   a) Where did the energy that warms up the water come from?
   B) Determine the mass of the water sample if it has absorbed 21 kJ of energy during the temperature change.

1. 2.1 x 105 J 2. 1.1 x 105 J 3. Cw = 1.0 x 103 J/kg•C 4. B) (0.50 kg)