

G3 Heat Capacity

Data: Specific heat capacity of water = $4180 \text{ J kg}^{-1} \text{ K}^{-1}$

Specific heat capacity of aluminium = $880 \text{ J kg}^{-1} \text{ K}^{-1}$

Specific heat capacity of iron = $435 \text{ J kg}^{-1} \text{ K}^{-1}$

Specific heat capacity of paraffin = $2130 \text{ J kg}^{-1} \text{ K}^{-1}$

G3.1 Complete the values in the table :

Energy /J	Material	Mass /kg	Initial Temperature	Final Temperature
(a)	Aluminium	0.290	15 °C	82 °C
45 200	Paraffin	2.30	3.0 °C	(b)
81 000	Water	1.50	11 °C	(c)

- G3.2 How much time will it take a 2300 W kettle to heat 2.31 kg of water from 12 °C to 100 °C? Assume no heat is lost to the surroundings.
- G3.3 How much water can a shower head heat each second from 12 °C to 41 °C if the heater has a power of 4200 W? Assume that no heat is lost to the surroundings, and give your answer in kilograms.
- G3.4 If 0.024 kg of water gets trapped in the shower heater of question G3.3, the thermal sensor must stop the current before the water reaches 80 °C. Assuming that the water is at 35 °C when the fault occurs, how quickly must the thermal sensor act?
- G3.5 A radiator is made using 5.4 kg of iron. It is then filled with 7.3 kg of water. Calculate its heat capacity, that is the heat required to raise the temperature of the whole thing by 1.0 °C.
- G3.6 In the following questions, two substances are mixed. In each case work out the missing mass m or temperature t , assuming no heat is lost to the surroundings.

First substance			Second substance			Mixture
Material	m_1 /kg	t_1 /°C	Material	m_2 /kg	t_2 /°C	t_{mix} /°C
Water	3.2	83	Paraffin	4.3	18	(a)
Water	0.34	14	Iron	0.15	230	(b)
Water	1.25	56	Paraffin	(c)	170	84
Aluminium	3.2	12	Paraffin	2.1	(d)	51

- G3.7 How much water at 52 °C must I add to 19 kg of water at 21 °C to make it the right temperature, 37 °C for me to bath a baby?
- G3.8 If I add 210 g of rivets, made of some unknown metal, at 303 °C to 500 g of water at 15 °C, and the final temperature is 34 °C, what is the specific heat capacity of the mystery metal?