

PQ 6 Further Heat Calculations

Q

Q1

A 1.00×10^2 -g mass of tungsten at 100.0°C is placed in 2.00×10^2 g of water at 20.0°C . The mixture reaches equilibrium at 21.6°C . Calculate the specific heat of tungsten.

Q2

A 6.0×10^2 -g sample of water at 90.0°C is mixed with 4.00×10^2 g of water at 22.0°C . Assume that there is no heat loss to the surroundings. What is the final temperature of the mixture?

Q3

- A 10.0-kg piece of zinc at 71.0°C is placed in a container of water, The water has a mass of 20.0 kg and a temperature of 10.0°C before the zinc is added. What is the final temperature of the water and the zinc?

Q4

Car Engine A 2.50×10^2 -kg cast-iron car engine contains water as a coolant. Suppose that the engine's temperature is 35.0°C when it is shut off, and the air temperature is 10.0°C . The heat given off by the engine and water in it as they cool to air temperature is 4.40×10^6 J. What mass of water is used to cool the engine?

$$Q = m_W C_W \Delta T + m_i C_i \Delta T$$

$$m_W = \frac{Q - m_i C_i \Delta T}{C_W \Delta T} = \frac{(4.4 \times 10^6 \text{ J}) - ((2.50 \times 10^2 \text{ kg})(450 \text{ J/kg}\cdot^\circ\text{C})(35.0^\circ\text{C} - 10.0^\circ\text{C}))}{(4180 \text{ J/kg}\cdot^\circ\text{C})(35.0^\circ\text{C} - 10.0^\circ\text{C})}$$
$$= 15 \text{ kg}$$

Q5

- Years ago, a block of ice with a mass of about 20.0 kg was used daily in a home icebox. The temperature of the ice was 0.0°C when it was delivered. As it melted, how much heat did the block of ice absorb?

Q6

- How much heat is added to 10.0 g of ice at 20.0°C to convert it to steam at 120.0°C?

Q7

- A cold pack bottle containing 400g of water is put in a icebox and the water frozen to a temperature of -6°C . At 9.00am the cold pack is removed and placed in a box. Both the cold pack and box warm up at a rate of 10Js.
- When will the temperature of the water in the cold pack reach $+5^{\circ}\text{C}$?

Q7 continued

- What will the temperature of the water be at 10.00am?

Q8

- To make iced tea, you start by brewing the tea with hot water. Then you add ice. If you start with 1.0 L of 90°C tea, what is the minimum amount of ice needed to cool it to 0°C?

Q9

- Calculate the heat required to convert 5 kg of ice at -20°C into steam at 100°C .

Q10

- The hot water tap of a bath delivers water at 80°C . Ten litres of hot water is added to a bath containing 30 litres of water at 20°C . Ignoring energy losses to the surrounding environment, what will be the final temperature of the bath water?