

Example 1

Calculate the specific heat capacity of concrete if 3570 J of heat causes the temperature of a 275 gram sample to change from 11.35 °C to 27.45 °C?

Solution

$$Q = 3570 \text{ J}; m = 275 \text{ gram};$$

$$\text{Temperature change} = 27.45 - 11.35 = 16.1 \text{ }^{\circ}\text{C}$$

$$Q = mc\Delta\theta$$

$$3570 = (275) \times c \times (16.1)$$

$$3570 = 4427.5 \times c$$

$$c = \frac{3570}{4427.5} = 0.806 \text{ J/g}^{\circ}\text{C}$$

Example 2

How much heat is required to raise the temperature of 250.0 g of mercury by 52°C? (specific heat capacity mercury = 140 J / kg °C)

Solution

$$\begin{aligned} m &= 250.0 \text{ g} \\ &= 0.2500 \text{ kg} \\ \Delta\theta &= 52 \text{ }^{\circ}\text{C} \\ c_{\text{mer}} &= 140 \text{ J kg}^{-1} \text{ }^{\circ}\text{C}^{-1} \end{aligned}$$

$$\begin{aligned} Q &= mc\Delta\theta \\ &= (0.2500)(140)(52) \\ &= 1820 \text{ J} \end{aligned}$$

Example 3

216 J of energy is required to raise the temperature of aluminum from 15° to 35°C . Calculate the mass of aluminum. Specific Heat Capacity of aluminum is $0.90 \text{ J}^{\circ}\text{C}^{-1}\text{g}^{-1}$.

Solution

$$Q = \quad \text{J}$$

$$\Delta\theta = \quad ^{\circ}\text{C} - \quad ^{\circ}\text{C}$$

$$= \quad ^{\circ}\text{C}$$

$$m = ?$$

$$c = \quad \text{J}^{\circ}\text{C}^{-1}\text{g}^{-1}$$

← Note that this unit is in $\text{J}^{\circ}\text{C}^{-1}\text{g}^{-1}$. So the calculation will obtain the mass value in grams.

$$\text{So } Q = mc\theta$$

$$= m (\quad) (\quad)$$

$$\therefore m =$$

$$(\quad)$$

$$= \quad \text{grams}$$

Example 4

3.5 kg of liquid X at 95°C is allowed to cool. If the specific heat capacity of liquid is $600\text{J/kg}^{\circ}\text{C}$ and 9550 J of heat energy is released, calculate the final temperature of the liquid.

$$m = \quad \text{kg}$$

$$\theta_{\text{initial}} = \quad ^{\circ}\text{C}$$

$$c = \quad \text{J kg}^{-1} \text{ } ^{\circ}\text{C}^{-1}$$

$$\theta = \quad \text{J}$$

$$\theta_{\text{final}} = ?$$

Note that $\Delta\theta$ is the change of temperature. Just take any higher (hotter) value minus the smaller (colder) value.

$$\text{So, } Q = m c \Delta\theta$$

$$= m c (\theta_i - \theta_f)$$

$$= (\quad)(\quad) (\quad - \theta_f)$$

$$= \quad - \theta_f$$

$$\frac{(\quad)(\quad)}{(\quad)}$$

$$\theta_f = \quad -$$

$$= \quad ^{\circ}\text{C} \quad \times$$

Example 5

The initial temperature of 150g of ethanol was 22°C . What will be the final temperature of the ethanol if 3240 J was needed to raise the temperature of the ethanol? Specific heat capacity of ethanol is $2400 \text{ J}^{\circ}\text{C}^{-1}\text{kg}^{-1}$.

Solution

$$m = \quad \text{g}$$
$$= \quad \text{kg}$$

$$\theta_i = \quad ^{\circ}\text{C}$$

$$\theta_f = ?$$

$$Q = \quad \text{J}$$
$$c = \quad \text{J}^{\circ}\text{C}^{-1}\text{kg}^{-1}$$

$$\text{So } Q = mc \Delta \theta$$
$$= (\quad)(\quad)(\theta_f - \quad)$$

$$\frac{ \quad }{ (\quad)(\quad) } = \theta_f - \quad$$

$$\therefore \theta_f = \quad + \quad$$
$$= \quad ^{\circ}\text{C} \quad \star$$

Example 6

A bicycle and have a combine mass of 133 kg. How many energy of heat are generated in the brakes when the temperature change from 77°F to 42°C. The specific heat capacity of iron is 450 J/kg°C.

$$m = \quad \text{kg}$$

$$\theta_i = 77^\circ\text{F} \rightarrow ^\circ\text{C}$$
$$= - \times (\quad - \quad)$$

$$\text{So } \Delta\theta = \quad ^\circ\text{C}$$
$$= \quad - \quad$$
$$= \quad ^\circ\text{C}$$

$$c = \quad \text{J kg}^{-1} ^\circ\text{C}^{-1}$$

$$Q = m c \Delta\theta$$
$$= (\quad)(\quad)(\quad)$$
$$= \quad \text{J}$$
$$\text{@}$$
$$\text{kJ}$$