	Marks
• A calorimeter, consisting of an insulated coffee cup containing 50.0 g of water at 21.0 °C, has a total heat capacity of 9.4 J K^{-1}. When a 30.4 g sample of an alloy at 92.0 °C is placed into the calorimeter, the final temperature of the system is 31.2 °C. What is the specific heat capacity of the alloy?	**3**

The calorimeter is heated from 21.0 °C to 31.2 °C corresponding to a temperature increase of:

$$\Delta T_{\text{calorimeter}} = (31.2 - 21.0)\ \text{K} = +10.2\ \text{K}$$

As the heat capacity of the calorimeter is 9.4 J K^{-1}, the heat change of the caloriometer is:

$$q_{\text{calorimeter}} = C_{\text{calorimeter}}\Delta T_{\text{calorimeter}} = (9.4\ \text{J K}^{-1})(10.2\ \text{K}) = +95.9\ \text{J}$$

As this heat comes from the alloy:

$$q_{\text{alloy}} = -q_{\text{calorimeter}} = -95.9\ \text{J}$$

The alloy cools from 92.0 °C to 31.2 °C corresponds to a temperature change of:

$$\Delta T_{\text{alloy}} = (31.2 - 92.0)\ \text{K} = -60.8\ \text{K}$$

Using $q = mC\Delta T$,

$$C = q / m\Delta T = -95.9\ \text{J} / (30.4\ \text{g} \times -60.8) = 0.052\ \text{J g}^{-1}\ \text{K}^{-1}$$

Answer: **0.052 J g^{-1} K^{-1}**