

$$c(\text{calorimeter}) = 15.6 \text{ J/}^\circ\text{C}$$

$$m(\text{Al}) = 24.1 \text{ g}$$

$$t_1(\text{Al}) = 100 \text{ }^\circ\text{C}$$

$$t_2(\text{Al}) = 23.5 \text{ }^\circ\text{C}$$

$$m(\text{H}_2\text{O}) = 99.6 \text{ g}$$

$$c(\text{H}_2\text{O}) = 4.2 \text{ J/g} \cdot ^\circ\text{C}$$

$$t_1(\text{H}_2\text{O}) = 19.7 \text{ }^\circ\text{C}$$

$$t_2(\text{H}_2\text{O}) = 23.5 \text{ }^\circ\text{C}$$

$$c(\text{Al}) - ?$$

Solution:

$$Q(\text{Al}) = c(\text{Al}) \cdot n(\text{Al}) \cdot (t_1 - t_2)$$

$$n(\text{Al}) = m(\text{Al}) / M(\text{Al}) = 24.1 / 27 = 0.893 \text{ mole}$$

$$Q(\text{calorimeter with water}) = Q(\text{calorimeter}) + Q(\text{water})$$

$$Q(\text{calorimeter}) = c(\text{calorimeter}) \cdot (t_2 - t_1) = 15.6 \cdot (23.5 - 19.7) = 59.3 \text{ J}$$

$$Q(\text{water}) = c(\text{H}_2\text{O}) \cdot m(\text{H}_2\text{O}) \cdot (t_2 - t_1) = 4.2 \cdot 99.6 \cdot (23.5 - 19.7) = 1589.6 \text{ J}$$

$$Q(\text{calorimeter with water}) = Q(\text{Al}) = c(\text{Al}) \cdot n(\text{Al}) \cdot (t_1 - t_2)$$

$$c(\text{Al}) \cdot 0.893 \cdot (100 - 23.5) = 1589.6 + 59.3$$

$$c(\text{Al}) = 24.1 \text{ J / mol} \cdot ^\circ\text{C}$$

Answer:

$$c(\text{Al}) = 24.1 \text{ J / mol} \cdot ^\circ\text{C}$$