

Marks
2

- The specific heat capacity of water is $4.18 \text{ J g}^{-1} \text{ K}^{-1}$ and the specific heat capacity of copper is $0.39 \text{ J g}^{-1} \text{ K}^{-1}$. If the same amount of energy were applied to a 1.0 mol sample of each substance, both initially at $25 \text{ }^\circ\text{C}$, which substance would get hotter? Show all working.

Using $q = C \times m \times \Delta T$, the temperature change for a substance of mass m and specific heat capacity C when an amount of heat equal to q is supplied is given by:

$$\Delta T = \frac{q}{C \times m}$$

The atomic mass of copper is 63.55. Hence, the temperature change for 1.0 mol of copper is

$$\Delta T (\text{copper}) = \frac{q}{(0.39 \times 63.55)} = \frac{q}{24.8} \text{ }^\circ\text{C}$$

The molar mass of H_2O is $(2 \times 1.008 (\text{H})) + 16.00 (\text{O}) = 18.016$. Hence, the temperature change for 1.0 mol of water is

$$\Delta T (\text{water}) = \frac{q}{(4.18 \times 18.016)} = \frac{q}{75.3} \text{ }^\circ\text{C}$$

Hence,

$$\Delta T (\text{copper}) > \Delta T (\text{water})$$

Answer: **Copper**