Marks 2

- The specific heat capacity of water is 4.18 J g^{-1} K^{-1} and the specific heat capacity of copper is 0.39 J g^{-1} K^{-1}. If the same amount of energy were applied to a 1.0 mol sample of each substance, both initially at 25 °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

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

The molar mass of H_2O is (2 × 1.008 (H)) + 16.00 (O) = 18.016. Hence, the temperature change for 1.0 mol of water is

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

Hence,

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

Answer: **Copper**