

1. **How much energy, in J and kJ, is required to raise the temperature of 123.4g of aluminum metal from 3.0 °C to 31.6 °C? $c_{Al} = 0.900 \text{ J/g}^\circ\text{C}$**

Note: We are asked to find the energy required to heat up a piece of aluminum and are given its specific heat. From this we know that q is going to be positive (since energy is required) and that we should use the formula $q = mc\Delta T$.

First we need to calculate ΔT :

$$\Delta T = T_f - T_i = (31.6^\circ\text{C} - 3.0^\circ\text{C}) = 28.6^\circ\text{C}$$

Now we substitute:

$$q = mc\Delta T = (123.4\text{g})(0.900\text{J/g}^\circ\text{C})(28.6^\circ\text{C})$$

$$q = 3.17 \times 10^3 \text{ J} = 3.17 \text{ kJ}$$

2. **How much energy is released when 44.6g of lithium metal is cooled from 82.2 °C to 23.0 °C? Answer in both J and kJ. $c_{Li} = 3.556 \text{ J/g}^\circ\text{C}$.**

Note: Since the lithium is cooling down and energy is being released, we know that our energy, q, is going to be negative. Since there is a temperature change, the formula we need to use here is $q = mc\Delta T$.

First we need to calculate ΔT :

$$\Delta T = T_f - T_i = 23.0^\circ\text{C} - 82.2^\circ\text{C} = -59.2^\circ\text{C}$$

Now we can find q:

$$q = mc\Delta T = (44.6\text{g})(3.556\text{J/g}^\circ\text{C})(-59.2^\circ\text{C})$$

$$q = -9.39 \times 10^3 \text{ J} = -9.39 \text{ kJ}$$

3. **How much energy, in J and kJ, is required to raise the temperature of 2.03g of mercury metal from 8.1 °C to 77.4 °C? $c_{Hg} = 0.138 \text{ J/g}^\circ\text{C}$**

First we note that energy is required, so our q term is going to be positive. Also, since this problem deals with an element heating up, we need to use $q = mc\Delta T$. Our first step is to calculate ΔT :

$$\Delta T = T_f - T_i = 77.4^\circ\text{C} - 8.1^\circ\text{C} = 69.3^\circ\text{C}$$

Next we substitute:

$$q = mc\Delta T = (2.03\text{g})(0.138 \text{ J/g}^\circ\text{C})(69.3^\circ\text{C})$$

$$q = 19.4 \text{ J} = 0.0194 \text{ kJ}$$

4. **How much energy, in J and kJ, is released when 890.6 g of iron metal is cooled from 456 °C to 22 °C? $c_{Fe} = 0.444 \text{ J/g}^\circ\text{C}$**