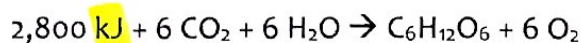


Thermochemistry Whiteboard Challenge

No notes or booklets allowed!

Glucose ($C_6H_{12}O_6$) can be formed in the cells of green plants through an endothermic reaction of carbon dioxide and water. This process, known as photosynthesis, occurs using energy provided by the sun.



- a) In the process of photosynthesis, which requires a greater magnitude of energy: breaking bonds or forming bonds? How can you tell? Explain.

Bond breaking, because ^{endothermic} $+\Delta H_{\text{rxn}}$, so energy input to break bonds must be greater than energy released making bonds.

- b) What is the enthalpy value for photosynthesis, ΔH_{rxn} , in kJ/mol?

$$\Delta H_{\text{rxn}} = +2,800 \text{ kJ/mol}_{\text{rxn}}$$

- c) How much heat would be absorbed or released if 1.72 g of carbon dioxide reacted with excess water? Assume 100% of the carbon dioxide reacts.

← 2 s.f.

$$1.72 \text{ g CO}_2 \times \frac{1 \text{ mol CO}_2}{44.01 \text{ g CO}_2} \times \frac{2,800 \text{ kJ}}{6 \text{ mol CO}_2} = 18 \text{ kJ absorbed}$$

- d) If this reaction occurs in a calorimeter, determine the temperature change of the solution. (Assume the total mass of the calorimeter, including the reacting chemicals, is 245 g and the specific heat of solution is 4.18 J/g°C).

$$q_{\text{rxn}} = -q_{\text{calor.}} = -mC\Delta T$$
$$18,000 \text{ J} = -(245 \text{ g})(4.18 \frac{\text{J}}{\text{g}^\circ\text{C}})\Delta T$$

$$\Delta T = \frac{-18,000}{(245)(4.18)} = -18^\circ\text{C}$$

- e) The initial temperature of the solution in the calorimeter is 28.3°C. What would the final temperature be after the reaction?

$$\Delta T = T_f - T_i$$

$$-18 = T_f - 28.3$$

$$T_f = 28.3 - 18 = 10.^\circ\text{C}$$