Thermochemistry Whiteboard Challenge

No notes or booklets allowed!

1. 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.

$$2{,}800\ kJ + 6\ CO_2 + 6\ H_2O \rightarrow C_6H_{12}O_6 + 6\ O_2$$

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

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

c) A student completes this reaction in a calorimeter, using a sun lamp for their energy source. In their first trial, 1.72 g of carbon dioxide reacted with excess water, and the student monitored the temperature of the reaction mixture throughout. The initial temperature of the solution in the calorimeter is 28.3°C.

i) How much heat will be absorbed or released during this reaction?

ii) Determine the temperature change of the calorimeter 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).

iii) What would the final temperature in the calorimeter be after the reaction?