MEGA LECTURE

Topic 4 Exercise 1 – Enthalpy Changes

The chemical potential energy of a substance is known as its **ENTHALPY** and has the symbol H.

During chemical reactions, the enthalpy can increase or decrease. The change in enthalpy during chemical reactions is called the **ENTHALPY CHANGE** (ΔH). It usually has units of $kJmol^{-1}$.

Almost all reactions require an initial input of energy in order to break the bonds in the reactants. This energy is called the **ACTIVATION ENERGY** (E_a).

1. What is meant by the term 'exothermic reaction'? Describe the energy changes which take place in an exothermic chemical reaction.

2. The combustion of methane is an exothermic reaction:
$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O \quad \Delta H = -890\ kJmol^{-1}$
Draw an enthalpy profile diagram for the combustion of methane. Label the reactants and products, enthalpy change and activation energy.

Explain why the enthalpy increases before it decreases.

3. What will be the enthalpy change for the following reaction?
$CO_2 + 2H_2O \rightarrow CH_4 + 2O_2$

4. a) Calculate the heat energy released when 100 g of methane is burned

b) Calculate the heat energy released when 500 cm^3 of methane is burned at 298 K and 300 kPa

c) Calculate the mass of methane required to produce 50,000 kJ of heat energy.

5. What is meant by the term 'endothermic reaction'? Describe the energy changes which take place in an endothermic chemical reaction.

6. Photosynthesis is an endothermic reaction:
$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2 \qquad \Delta H = +2802\ kJmol^{-1}$
Draw an enthalpy profile diagram for photosynthesis. Label the reactants and products, enthalpy change and activation energy.

7. What will be the enthalpy change for the following reaction?
$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$

8. a) Calculate the amount of light energy required to make 1000 g of glucose.

b) Calculate the amount of light energy required to absorb 500 cm^3 of carbon dioxide is at 298 K and 100 kPa

c) Calculate the mass of glucose which can be made when a tree absorbs 10,000 kJ of light energy.