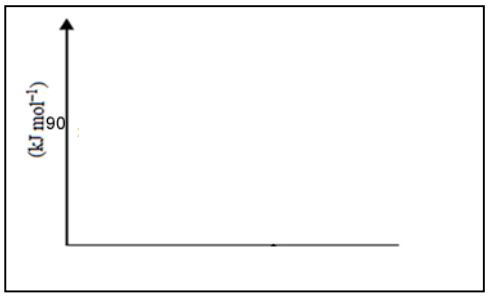
Thermochemical equations and combustion reactions
Lesson 6a

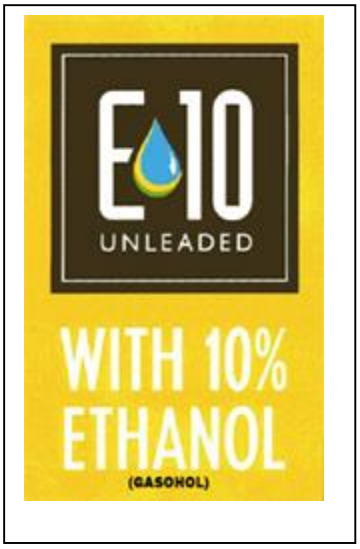
1) One mol of an unknown hydrocarbon is completely burnt in excess oxygen. During this process it was found that 214 kJ of energy was used to break the reactants' bonds and start the reaction process. As atoms then reacted and formed new bonds to create products, a total of 250 kJ of energy was then released. The total enthalpy of the reactants was 90 kJ/mol



i. Using the experimental data shown above, draw the energy profile for the reaction on the set of axis shown on the right. Clearly indicate the:
a) ΔH and its sign.
b) activation energy
c) total enthalpy of the products.

ii. With reference to the Data Sheet, calculate the ΔH for the reaction represented by the equation below.
$6CO_2(g) + 8H_2O(g) \rightarrow 2C_3H_8(g) + 10O_2(g)$.

2) A fuel is composed of 90% octane and 10% ethanol by mass. With reference to the data sheet calculate:
a) the amount of energy delivered by 50.0 grams of this fuel when it combusts completely in excess oxygen.

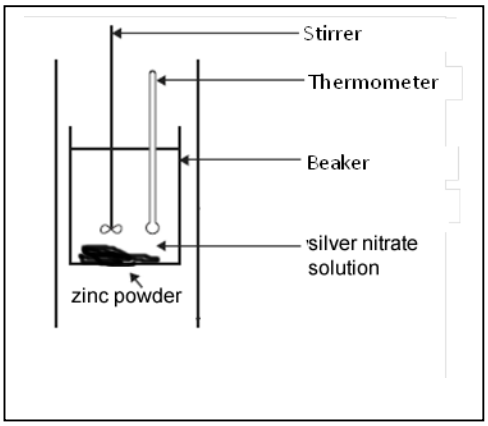


3) What is the mass, in kg, of ethanol that burns in excess oxygen in order to deliver 40.4 MJ of heat energy.

4) What is the mass, in kg, of CO_2 that is produced when 23.2 MJ of energy is obtained from the complete combustion of liquid hexane.
(Molar heat of combustion of hexane is -4158 kJ/mol)

5) What is the amount of energy, kJ, released when one molecule of liquid octane burns completely to produce carbon dioxide and water.

6) A 6.54 g sample of pure Zinc is placed in excess silver nitrate solution, at 21.0 °C. Zinc nitrate, $Zn(NO_3)_2$, and solid silver were formed. The final temperature of the water reached 24.2 °C.
a) Find the experimental ΔH for the reaction below if 100.0 mL of solution was used.
$2AgNO_3(aq) + Zn(s) \rightarrow Zn(NO_3)_2(aq) + 2Ag(s)$



b) What assumptions were made in calculating the ΔH of the reaction above?

C) What mass of silver is formed when 12.2 kJ of energy is released during the reaction?