Friday worksheet 12 – Enthalpy, energy diagrams and experimental technique.

1) A hiker suggested that the higher the altitude the less energy required to heat a given mass of water by 10°C.
A student performed the experiment at three different altitudes using a butane gas bottle. A small spring balance was used to measure masses. A hand held alcohol thermometer was used to record temperature.
The results are provided in the table below.

	Trial 1	Trial 2	Trial 3
Altitude above sea level(metres)	10	880	2500
Air pressure (Kpa)	101	85	79
Air temperature (°C)	13.0	12.0	5.0
Mass of butane bottle before burning	1.200 kg	1.700 kg	1.200 g
Mass of butane bottle after burning	1.999 kg	1.650 kg	1.001 g
Initial temperature of 100 grams of water (°C)	9.01	5.02	1.00
Final temperature of 100 grams of water (°C)	19.54	15.10	11.02
Shape of aluminium container to house the water			

i. Calculate the theoretical amount of energy obtained from the combustion of butane in trial 3.

ii. What percentage of the energy given out by the butane actually went into heating the water?

iii. What is the experimental heat of combustion of butane in kJ/g from the data collected in trial 3.

iv. State a possible hypothesis

v. Are the results provided valid? Explain

vi. What can you say about the reliability of this experiment?

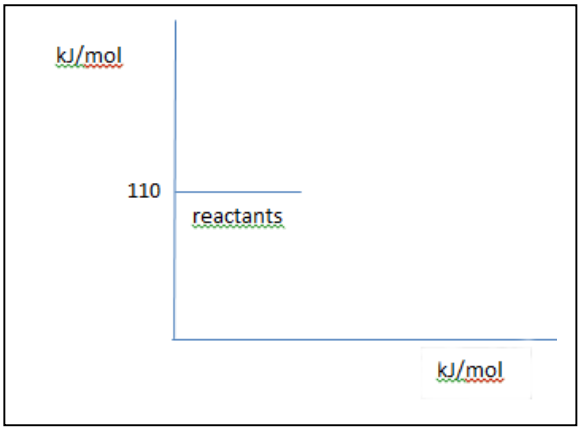
2) Consider the reaction below.

$c_2(g) + 2X(g) \rightarrow 2CX(l)$ $\Delta H = ?\ kJ/mol$

i. Draw the energy profile diagram in the set of axes provided on the right if the energy required to break bonds of the reactant particles is 22.1kJ/mol while 45.2 kJ/mol of energy is given out during bond formation.

Indicate the following on the diagram.

Activation energy and ΔH



ii. On the same set of axes draw the energy profile diagram of the reaction below.

$c_2(g) + 2X(g) \rightarrow 2CX(g)$ $\Delta H = ?\ kJ/mol$

No specific value for ΔH need be given.