1.

When the solids $Ba(OH)_2$ and NH_4SCN are mixed, a solution is produced and the temperature drops.

$$Ba(OH)_2(s) + 2NH_4SCN(s) \rightarrow Ba(SCN)_2(aq) + 2NH_3(g) + 2H_2O(l)$$

Which statement about the energetics of this reaction is correct?

A. The reaction is endothermic and ΔH is negative.

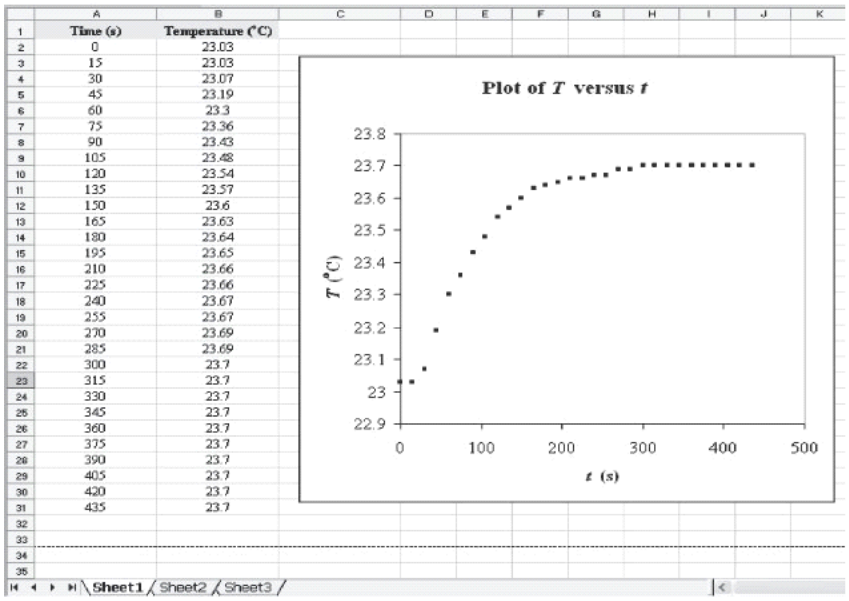
B. The reaction is endothermic and ΔH is positive.

C. The reaction is exothermic and ΔH is negative.

D. The reaction is exothermic and ΔH is positive.

2.

The data below is from an experiment used to measure the enthalpy change for the combustion of 1 mole of sucrose (common table sugar), $C_{12}H_{22}O_{11}(s)$. The time-temperature data was taken from a data-logging software programme.



Time (s)	Temperature (°C)
0	23.03
15	23.03
30	23.07
45	23.19
60	23.3
75	23.36
90	23.43
105	23.48
120	23.54
135	23.57
150	23.6
165	23.63
180	23.64
195	23.65
210	23.66
225	23.66
240	23.67
255	23.67
270	23.69
285	23.69
300	23.7
315	23.7
330	23.7
345	23.7
360	23.7
375	23.7
390	23.7
405	23.7
420	23.7
435	23.7

Sheet1 Sheet2 Sheet3

Mass of sample of sucrose, $m = 0.4385$ g

Heat capacity of the system, $C_{system} = 10.114$ kJ K^{-1}

(a) Calculate ΔT, for the water, surrounding the chamber in the calorimeter.

(b) Determine the amount, in moles, of sucrose.

(c) (i) Calculate the enthalpy change for the combustion of 1 mole of sucrose.

(ii) Using Table 12 of the Data Booklet (theoretical value is 5.3×10^3 kJ mol^{-1}), calculate the percentage experimental error based on the data used in this experiment.

3. To completely neutralize 200mL of 0.500M sodium hydroxide, a student adds 100mL of 0.500M sulfuric acid in a beaker. The temperature of the solution increases from 25.0 ℃ to 29.5℃.

a. Determine the limiting reagent of the reaction.

b. Calculate the heat released in this reaction.

c. Use your answer in part a and b, determine the **molar** enthalpy change of the neutralization reaction.

d. Write the complete thermochemcal equation.

e. Draw the energy diagram of the reaction to show the energy change of reaction over time.

f. Predict the final temperature if the experiment is repeated with 200mL of 100Msodium hydroxide and 100mL of 1.00M sulfuric acid

4.

Calculate ΔH for the reaction $C_2H_4\ (g) + H_2\ (g) \rightarrow C_2H_6\ (g)$, from the following data.

$C_2H_4\ (g) + 3\ O_2\ (g) \rightarrow 2\ CO_2\ (g) + 2\ H_2O\ (l)$ $\Delta H = -1411.\ kJ/mole$

$C_2H_6\ (g) + 7/2\ O_2\ (g) \rightarrow 2\ CO_2\ (g) + 3\ H_2O\ (l)$ $\Delta H = -1560.\ kJ/mole$

$H_2\ (g) + 1/2\ O_2\ (g) \rightarrow H_2O\ (l)$ $\Delta H = -285.8\ kJ/mole$

5.

2. Calculate ΔH for the reaction $4\ NH_3\ (g) + 5\ O_2\ (g) \rightarrow 4\ NO\ (g) + 6\ H_2O\ (g)$, from the following data.

$N_2\ (g) + O_2\ (g) \rightarrow 2\ NO\ (g)$ $\Delta H = -180.5$ kJ

$N_2\ (g) + 3\ H_2\ (g) \rightarrow 2\ NH_3\ (g)$ $\Delta H = -91.8$ kJ

$2\ H_2\ (g) + O_2\ (g) \rightarrow 2\ H_2O\ (g)$ $\Delta H = -483.6$ kJ

6.

Find ΔH_f^0 for acetic acid, $HC_2H_3O_2$, using the following thermochemical data.

$HC_2H_3O_2\ (l) + 2\ O_2\ (g) \rightarrow 2\ CO_2\ (g) + 2\ H_2O\ (l)$ $\Delta H = -875.$ kJ/mole

$C\ (s, \text{graphite}) + O_2\ (g) \rightarrow CO_2\ (g)$ $\Delta H = -394.51$ kJ/mole

$H_2\ (g) + 1/2\ O_2\ (g) \rightarrow H_2O\ (l)$ $\Delta H = -285.8$ kJ/mole

7.

Calculate ΔH for the reaction CH_4 (g) + NH_3 (g) → HCN (g) + 3 H_2 (g), from the reactions.

N_2 (g) + 3 H_2 (g) → 2 NH_3 (g)	ΔH = -91.8 kJ
C (s, graphite) + 2 H_2 (g) → CH_4 (g)	ΔH = -74.9 kJ/mole
H_2 (g) + 2 C (s, graphite) + N_2 (g) → 2 HCN (g)	ΔH = +270.3 kJ

8.

Calculate ΔH for the reaction 2 Al (s) + 3 Cl_2 (g) → 2 $AlCl_3$ (s) from the following data.

2 Al (s) + 6 HCl (aq) → 2 $AlCl_3$ (aq) + 3 H_2 (g)	ΔH = -1049. kJ
HCl (g) → HCl (aq)	ΔH = -74.8 kJ/mole
H_2 (g) + Cl_2 (g) → 2 HCl (g)	ΔH = -1845. kJ
$AlCl_3$ (s) → $AlCl_3$ (aq)	ΔH = -323. kJ/mole