EXPERIMENT NO. 11

2 In this experiment you will determine the enthalpy change of solution, ΔH_{sol}, for hydrated sodium thiosulfate, $Na_2S_2O_3 \cdot 5H_2O$. To do this you will measure the temperature change when a known mass of hydrated sodium thiosulfate is dissolved in a known volume of water.

FB 5 is hydrated sodium thiosulfate, $Na_2S_2O_3 \cdot 5H_2O$.

(a) Method

- Support the cup in the 250 cm^3 beaker.
- Use the 25 cm^3 measuring cylinder to transfer 20.0 cm^3 of distilled water into the cup.
- Weigh the stoppered container of **FB 5** and record the mass.
- Measure and record the initial temperature of the water in the cup.
- Add all the **FB 5** to the water in the cup.
- Stir the mixture and record the minimum temperature that is reached.
- Reweigh the stoppered container. Record the mass.
- Calculate and record the mass of **FB 5** added to the water and the change in temperature.

Initial temperature / °C	26.0
Final temperature / °C	19.0
Change in temperature / °C	7.0
Mass of container + FB5 / g	18.80
Mass of container + residue / g	14.72
Mass of FB5 used / g	4.08

I	
II	
III	
IV	

[4]

(b) Calculations

(i) Calculate the energy change of the reaction.
(Assume that 4.2 J of heat energy changes the temperature of 1.0 cm^3 of solution by 1.0 °C.)
Show your working.

$= mc\Delta T$

$= 20 \times 4.2 \times 7.0$

energy change = 588 ..... J [1]

(ii) Calculate the enthalpy change of solution, ΔH_{sol}, for hydrated sodium thiosulfate.

M_r of $Na_2S_2O_3 \cdot 5H_2O = 248.2$

$n = \frac{m}{M_r} = \frac{4.08}{248.2}$

0.0146 mol

0.0164 mol — 588 J

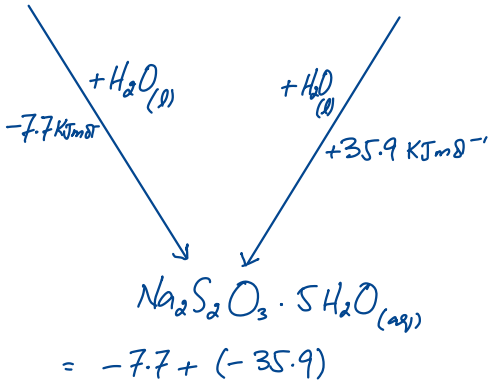
1 mol — x

$\frac{35853 J}{1000} = 35.9$

ΔH_{sol} for $Na_2S_2O_3 \cdot 5H_2O$ = + (sign) ..... 35.9 (value) ..... $kJ\,mol^{-1}$ [2]

(iii) Assume that under the same conditions, the enthalpy change of solution, ΔH_{sol}, for anhydrous sodium thiosulfate, $Na_2S_2O_3$, is –7.7 kJ mol^{-1}.
Construct a Hess's cycle and determine the enthalpy change for the following reaction.
(If you were unable to calculate an answer to **(b)(ii)**, assume a value of +32.2 kJ mol^{-1}. Note this is not the correct value.)

$Na_2S_2O_3(s) + 5H_2O(l) \rightarrow Na_2S_2O_3 \cdot 5H_2O(s)$



ΔH = ..−.. ..43.6.. kJ mol^{-1} [2]
sign *value*

(c) How would your temperature change in **(a)** be affected if your sample of **FB 5** contained a small amount of anhydrous sodium thiosulfate?
Explain your answer.

Change in temperature will be less because ΔHsol of anhydrous $Na_2S_2O_3$ is exothermic.

..... [1]

[Total: 10]