2 When hydrated sodium thiosulfate is dissolved in water the temperature of the liquid changes. You will carry out an experiment to determine the enthalpy change, ΔH, when one mole of hydrated sodium thiosulfate dissolves in water.

FA 3 is hydrated sodium thiosulfate, $Na_2S_2O_3 \cdot 5H_2O$.

(a) Method

- Support the cup in the 250 cm^3 beaker.
- Use the 50 cm^3 measuring cylinder to transfer 30.0 cm^3 of distilled water into the cup.
- Measure the temperature of the water in the cup. Record this in the space for results.
- Weigh the container with **FA 3**. Record the mass.
- Tip all the **FA 3** into the cup.
- Stir the mixture until the minimum temperature is obtained. Record this temperature.
- Weigh the container with any residual **FA 3**. Record the mass.
- Calculate and record the mass of **FA 3** added.
- Calculate and record the temperature change.

Results

I	
II	
III	
IV	

[4]

(b) Calculations

(i) Calculate the amount, in mol, of hydrated sodium thiosulfate added.

amount of $Na_2S_2O_3 \cdot 5H_2O$ = ... mol [1]

(ii) Calculate the energy change, in J, in your experiment.

energy change = ... J [1]

(iii) Calculate the enthalpy change, ΔH, in kJ mol^{-1}, when 1.00 mol of hydrated sodium thiosulfate dissolves in water. Show your working.

ΔH = ... kJ mol^{-1}
sign *value* [1]

(c) The value calculated in **(b)(iii)** can be used to determine the enthalpy change, ΔH_r, for the following reaction.

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

Outline the method of one further experiment you would need to carry out to obtain the data necessary to calculate the value of ΔH_r.
Show how you would use your results from this experiment and **(b)(iii)** to calculate ΔH_r.

Do **not** carry out your experiment.

method .....

.....

.....

calculation .....

.....
[4]

[Total: 11]

Qualitative analysis

For each test you should record all your observations in the spaces provided.

Examples of observations include:
- colour changes seen
- the formation of any precipitate and its solubility (where appropriate) in an excess of the reagent added
- the formation of any gas and its identification (where appropriate) by a suitable test.

You should record clearly at what stage in a test an observation is made.

Where no change is observed, you should write 'no change'.

Where reagents are selected for use in a test, the name or correct formula of the element or compound must be given.

If any solution is warmed, a boiling tube must be used. If a solid is heated, a hard-glass test-tube must be used.

Rinse and reuse test-tubes and boiling tubes where possible.

No additional tests should be attempted.