



Oxford Cambridge and RSA

A Level Chemistry A

H432/03 Unified chemistry

Question Set 2

1

A student plans to determine the enthalpy change of **reaction 3.1** shown below.



This enthalpy change can be determined indirectly using Hess' Law from the enthalpy changes of **reaction 3.2** and **reaction 3.3** shown below.



The student will determine the enthalpy change of **reaction 3.2** as outlined below.

- Weigh a bottle containing $\text{Na}_2\text{O}(\text{s})$ and weigh a polystyrene cup.
- Add about 25 cm^3 of water to the polystyrene cup and measure its temperature.
- Add the $\text{Na}_2\text{O}(\text{s})$, stir the mixture, and measure the maximum temperature reached.
- Weigh the empty bottle and weigh the polystyrene cup with the final solution.

Mass readings

Mass of bottle + $\text{Na}_2\text{O}(\text{s})$	= 16.58 g
Mass of empty bottle	= 15.34 g
Mass of empty polystyrene cup	= 21.58 g
Mass of polystyrene cup + final solution	= 47.33 g

Temperature readings

Initial temperature of water	= $20.5 \text{ }^\circ\text{C}$
Maximum temperature of final solution	= $55.5 \text{ }^\circ\text{C}$

The density and specific heat capacity, c , of the solution are the same as for water.

- (a)* Calculate the enthalpy change of **reaction 3.2** and the enthalpy change of **reaction 3.1**.

Show all your working.

[6]

- (b) The uncertainty in each temperature reading is $\pm 0.1 \text{ }^\circ\text{C}$.

The uncertainty in each mass reading is $\pm 0.005 \text{ g}$.

Determine whether the mass of Na_2O or the temperature change has the greater percentage uncertainty.

Show all your working.

[2]

- (c) Suggest a modification to this experiment, using the **same** apparatus, which would reduce the percentage errors in the measurements. [2]
Explain your reasoning.
- (d) Sodium oxide, Na_2O , can be prepared by the redox reaction of NaNO_2 and sodium metal. Nitrogen gas is also formed. [1]
- (i) What is the systematic name for NaNO_2 ? [1]
- (ii) Using oxidation numbers, with signs, show the element that is oxidised and the element that is reduced in this reaction. [2]
Element oxidised
Oxidation number change from to
Element reduced
Oxidation number change from to
- (iii) Construct the equation for this reaction. [1]

Total Marks for Question Set 2: 14

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