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**1 Planning (P)**

When an acidified solution of hydrogen peroxide is mixed with a solution containing potassium iodide, starch and sodium thiosulfate, the colourless mixture suddenly turns dark blue after a few seconds.
This is one version of what are known as iodine clock experiments.

A teacher demonstrates this iodine clock experiment as follows.

She prepares two separate solutions, **A** and **B**.

Solution **A** contains starch (0.20 g), potassium iodide (50.00 g), sodium ethanoate (4.10 g) and sodium thiosulfate (9.40 g) in 1.0 $dm^3$ of water.

Solution **B** is a mixture of 500 $cm^3$ of 1.5 mol $dm^{-3}$ hydrogen peroxide and 500 $cm^3$ of 1.0 mol $dm^{-3}$ ethanoic acid.

She mixes 50 $cm^3$ of solution **A** with 50 $cm^3$ of solution **B** and, after about 20 seconds, the mixture suddenly turns dark blue.

**(a)** In acidic conditions, hydrogen peroxide and potassium iodide react to produce iodine. Write an ionic equation for this reaction.

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**(b)** Suggest why the reaction mixture contains both ethanoic acid and sodium ethanoate.

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**(c)** Consider the description of the iodine clock experiment given above.

The order of the reaction with respect to the concentration of hydrogen peroxide may be determined by performing a number of experiments and then graphically analysing the results.

Write a plan for such a series of experiments. In your plan, you should use the same proportions of solution **A** and aqueous ethanoic acid as are described above.

Your plan should ensure that at least one of your experiments would be expected to take significantly less than 20 seconds.

You may assume that you are provided with the following.

- solution **A**, having the concentrations of reagents given above
- 1.0 mol $dm^{-3}$ ethanoic acid
- 7.5 mol $dm^{-3}$ hydrogen peroxide solution
- deionised water
- the apparatus normally found in a school or college laboratory

Your plan should contain the following.

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- the intended concentration of the stock solution of hydrogen peroxide to be used
- details for the preparation of this stock solution from the hydrogen peroxide solution provided
- appropriate quantities and concentrations of solutions
- all essential experimental details
- an outline of how the results would be used to determine the order with respect to the concentration of hydrogen peroxide

You may find it useful to use $\frac{1}{\text{time}}$ to represent the reaction rate.

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**(d)** Identify one potential safety hazard in this experiment and state how you would minimise this risk.

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[Total: 12]