Write up your own investigation method in your lab book so another Y12 could carry it out without any assistance. The example below will help. Do not forget references where appropriate.

Investigating the Effect of Surface Area

**on an Enzyme Controlled Reaction**

Catalase is an enzyme found in many tissues. It catalyses the breakdown of hydrogen peroxide, a harmful by-product of metabolism, into water and oxygen. Its activity can be estimated by measuring how rapidly oxygen is evolved.

This investigation considers the effect of changing the surface area of a tissue on the mean rate of oxygen evolution.

**Apparatus:** potatoes cork borers cutting tile Vernier callipers  
chopping board knife stop clock 20vol (6%) hydrogen peroxide

gas syringe measuring cylinders thermostatically controlled water-bath  
boiling tubes test tubes delivery tubes & bung side arm conical flasks  
balance

You may ask for any additional equipment (including safety apparatus) you require.

**Procedure:**

**Read** Student Safety Sheet:- Hydrogen Peroxide

1. Set up the apparatus as shown.

The conical flask’s contents must be submerged in the water bath which must be adjusted to a suitable temperature.

|  |
| --- |
| http://www.chemistryrules.me.uk/junior/reactionrate_apparatus.gif |

2. Measure out 40cm3 of 20vol. hydrogen peroxide and place it in the conical flask.

3. Carefully bore a cylinder of potato using the same diameter cork-borer. At least five will be needed from each potato so think about the best way to start cutting.

4. Square off the ends of the potato cylinder and cut it to 50mm in length.

5. Place the cylinder into the flask of hydrogen peroxide and immediately (but carefully) twist in a dampened bung and mix.

6. As the catalase breaks down the hydrogen peroxide it will produce oxygen. Measure this using the attached gas syringe and record in a suitable table. You should select how often you take measurements.

7. Every 10s the contents of the flask must be mixed.

8. Stages 2 to 7 are repeated with the cylinder cut into 2 then 4 then 8 then 16 sections before placing all the sections into the flask (using fresh hydrogen peroxide and a new cylinder of potato each time).

9. Repeats should be carried out as required.

10. Stages 2 to 7 are carried out using a boiled potato as a control.

**Further questions and tasks:**

1.Record your results in your lab book as you generate them using a full table.   
Refer to ‘*A guide to drawing tables in Biology’*.

Include space to add ‘*initial rate of reaction’* from below.

2.Draw a suitable graph(s) to show the results and use it/them to calculate the *initial rate of reaction* for each surface area. Refer to ‘*A guide to drawing graphs in Biology’*.

3. Plot a graph of your independent variable against initial rate of reaction.

4. Describe and explain the results of the investigation.

5. Explain the control investigation.

6. Although probably adequate to generate meaningful results, this investigation is far from perfect. List at least two areas where errors may have crept in.

For each source of error say ***why*** and ***how*** it might have affected your results.

e.g. The reaction is exothermic, it releases heat1. This might not be dissipated quickly enough by the water-bath. The additional heat energy would increase the kinetic energy of the particles and make successful collisions between enzymes and substrate more likely2, thus increasing the rate of reaction and causing the results to be higher than they should have been.3 The faster the reaction the greater the heat released so this could affect the quicker reactions even more. This would further, but artificially, increase the difference between the slower and faster reactions.4

1 source of error stated.

2 reason why it has an effect.

3 how this would change the results (i.e. would they seem larger or smaller).

4 statement about whether all results would be equally affected.