Concentration versus rate of reaction using the iodine clock.

Safety

- Potassium iodate is mildly toxic by ingestion and is irritating to body tissues. Avoid contact.
- Sodium bisulfite is slightly toxic by ingestion and is a severe body tissue irritant. Avoid contact.
- Sodium thiosulfate is slightly toxic by ingestion and is a body tissue irritant. Avoid contact.
- Iodine is generated in this demonstration. Those who know they are allergic to iodine or do not know whether they are should avoid contact. Wear protective gloves.
- Safety goggles and protective gloves should be worn while doing this demonstration.

Equipment and Materials (for one presentation)

- 0.38 grams of sodium metabisulfite ($Na_2S_2O_5$)
- 1.40 grams of potassium iodate (KIO_3)
- 0.60 grams of soluble starch
- 50mL measuring cylinder
- Distilled (or de-ionized) water
- Glass stirring rod
- Permanent marker
- 2 X 250-mL beakers
- 10 X 200-mL beaker
- Hotplate
- Stopwatch
- Waste container (at least 2-L)
- 10-20 grams of sodium thiosulfate pentahydrate (for waste treatment)

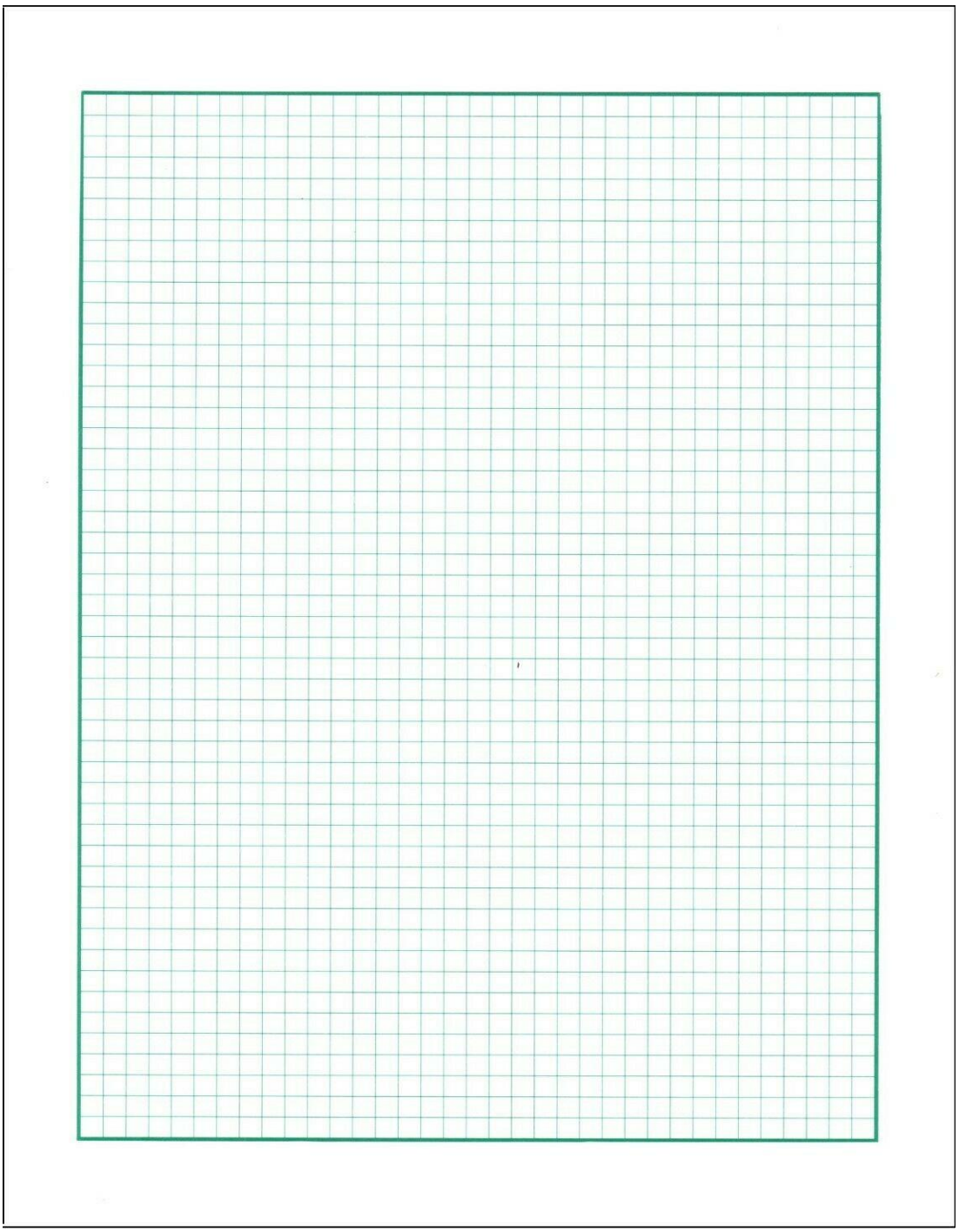
Preparation of solutions

1. Label one 250 mL beaker “A”, place 200 mL of deionised water into the beaker and heat the water on a hotplate.
2. Dissolve 1.40 g of potassium iodate (KIO_3) in the hot water in beaker “A”.
3. Label one 250mL beaker “B” and place 80 mL of deionised water and bring to boil on a hotplate. Slowly add the 0.60 grams of starch until it is all dissolved. Take the beaker off the hotplate and add 0.38 g of sodium metabisulfite ($Na_2S_2O_5$). Stir until dissolved.
4. Using a permanent marker label five 200 mL beakers as 1A, 2A, 3A and 4A.
5. Using a 50mL measuring cylinder, place 50mL of the solution in beaker “A’ in each of four 200 mL beakers labelled in step 4 so that each 200mL beaker has 50mL of solution “A”.
6. Using a permanent marker take the other four 200mL beakers and label them 1B, 2B, 3B, and 4B
7. Using a 50mL measuring cylinder, place 20mL of the solution in beaker “B’ in each of four 200 mL beakers labelled in step 6 so that each 200mL beaker has 20mL of solution “B”.
8. Using a 50mL measuring cylinder pour 10mL of distilled water into beaker 2A and 2B , 20mL of distilled water into beaker 3A and 3B , 30mL of distilled water into beaker 4A and 4B.
9. Mix beakers 1A and 1B by pouring beaker A into beaker B and record the time it takes to turn black using a stopwatch.
10. Repeat step 9 for the remainder of beakers 2, 3 and 4.

Results

Complete the table below and plot the results on the graph paper below.

Amount of water added to dilute original sample (mL)	Time (s)
0	
10	
20	
30	



Below are the results of a student who conducted this same investigation. If you were unable to obtain results from your own investigation you can use the second hand data below.

Amount of water added to dilute original sample (mL)	Time (s)
0	9.02
10	18.01
20	38.53
30	75.22

Student Designed Investigation

Black water magic and the rate of a chemical reaction versus temperature.

Student name: .....

Science Teacher :.....

Due date for this task

Introduction and Outline of Task

Background information

Development of Scientific Question

Questions I have about this topic: (use these sentence starters below to help)

Write some ideas below the table.

Why does….?	What affects the…..?
If I changed……, what would happen to …..?	Does changing…. make a difference to….?
Would it be better if….?	How might…..?
How many ways can you…?	How would you test….?
What happens when….?	Will the same thing happen each time if….?

My question is:

_____

_____

_____

Practical Report

Title of the investigation:

Put your title on the line below:

_____

_____

_____

Scientific aim: To .....

Hints	Features of this part of experiment report
Scientific aim	• Scientific statement linking independent and dependent variables. • Usually begins with To determine, To investigate, To find out… etc

_____

_____

_____

_____

Hypothesis: If ……then……

Hints	Features of this part of experiment report
Hypothesis	• Educated guess about a possible outcome of the experiment • Usually written as "**If** ……(how the independent variable will change), **then** ……(effect on dependent variable), **because**…….. (give your reason why you say this)

_____

_____

_____

_____

Variables:

Hints	Features of this part of experiment report
Variables	• To test this idea I am going to need to change **one** factor on purpose, this is called the independent variable. • The effect that is measured is called the dependent variable. • Controlled variables are the variables that I need to keep the same so that it is a fair test (I can compare my results).

The independent variable will be:

_____

The units and equipment for measuring this variable are:

_____

The dependent variable will be:

_____

The units and equipment for measuring this variable are:

_____

Controlled variables in the experiment are (list as many as you can):

_____

_____

_____

_____

_____

_____

_____

_____

_____

Materials:

Provide your materials list. Give as much detail (eg beakers = 3 X 50mL beaker)

Method:

Hints	Features of this part of experiment report
Method	This is a detailed description of the scientific **procedure** that will be used to investigate the problem. Some things to remember to include in the method: • Write instructional steps in logical order • Number each step • If appropriate include safety instructions • No reference to person • Be specific give the name of the piece of equipment used and quantities measured • Outline what results will be gathered and how they will be measured with what equipment • State how the independent variable will be measured and how many times (6 trials) • State how the independent variable will be changed. • State how the controlled variables will be kept the constant.

Write the method below:

Insert a scientific drawing of the setup if necessary

Risk Assessment:

Put your risk assessment into the table below:

Safety Risk Potential risk identified	Precaution This is what can be done beforehand to reduce the risk of an accident happening	Hazard Management This is what can be done if an accident happens while the investigation is being carried out

Results:

Table goes here

Discussion:

Hints	Features of this part of experiment report
Scientific Discussion	Explains (links cause and effect) the results of your experiment by commenting on the following: • What do the **results** show? • **Explain** (link cause and effect) trends or patterns in the data you have collected. • **Use specific data** from the results you collected from your experiments to explain the trends (or lack of trends). This includes any unusual or unexpected findings. • Outline one possible future improvement to **the procedure** for your experimental design.

Conclusion:

Hints	Features of this part of experiment report
Conclusion	• In the conclusion you need to write down what your hypothesis was and if your results support it. • Write down any trends and patterns in the data. This usually can be written: "As the (independent variable) increased/decreased the (dependent variable) …….".

Criterion B year 3 inquiring and designing

Level	Level Descriptor The student:	Task-Specific Clarification
0	does not reach a standard described by any of the descriptors below.	
1-2	i. states a problem or question to be tested by a scientific investigation, with limited success, ii. states a testable hypothesis, iii. states the variables, iv. design a method, with limited success.	
3-4	i. states a problem or question to be tested by a scientific investigation, ii. outlines a testable hypothesis using scientific reasoning, iii. outlines how to manipulate the variables, outline how relevant data will be collected, iv. design a safe method in which he or she selects materials and equipment.	
5-6	i. outlines a problem or question to be tested by a scientific investigation, ii. outlines and explain a testable hypothesis using scientific reasoning, iii. outlines how to manipulate the variables, outlines how sufficient, relevant data will be collected, iv. designs a complete and safe method in which he or she selects appropriate materials and equipment.	
7-8	i. describes a problem or question to be tested by a scientific investigation, ii. outlines and explains a testable hypothesis using correct scientific reasoning, iii. describes how to manipulate the variables, explain how sufficient, relevant data will be collected, iv. designs a logical, complete and safe method in which he or she selects appropriate materials and equipment.	

States: Give a specific name, value or other brief answer without explanation or calculation
Recall: Remember or recognize from prior learning experiences
Outline*: Give a brief account*
Describe*:* Give a detailed account or picture of a situation, event, pattern or process
Design: Produce a plan, simulation or model
Explain*:* Give a detailed account
Analyse *:* Break down in order to bring out the essential elements or structure. To identify parts and relationships, and to interpret information to reach conclusions.
Interpret: Use knowledge and understanding to recognise trends and draw conclusions from given information

Criterion C year 3 Processing & Evaluating

Level	Level Descriptor The student:	Task-Specific Clarification
0	The student does not reach a standard described by any of the descriptors below.	
1-2	i. collects and presents data in numerical and/or visual forms, ii. accurately interprets data, iii. states the validity of a hypothesis with limited reference to a scientific investigation, iv. states the validity of the method with limited reference to a scientific investigation, v. states limited improvements or extensions to the method.	
3-4	i. correctly collect and present data in numerical and/or visual forms, ii. accurately interprets data and describes results, iii. states the validity of a hypothesis based on the outcome of a scientific investigation, iv. states the validity of the method based on the outcome of a scientific investigation, v. states improvements or extensions to the method that would benefit the scientific investigation.	
5-6	i. correctly collects, organizes and presents data in numerical and/or visual forms, ii. accurately interprets data and describes results using scientific reasoning, iii. outlines the validity of a hypothesis based on the outcome of a scientific investigation, iv. outlines the validity of the method based on the outcome of a scientific investigation, v. outlines improvements or extensions to the method that would benefit the scientific investigation.	
7-8	i. correctly collects, organizes, transforms and presents data in numerical and/or visual forms, ii. accurately interprets data and describes results using correct scientific reasoning, iii. discusses the validity of a hypothesis based on the outcome of a scientific investigation, iv. discusses the validity of the method based on the outcome of a scientific investigation, v. describes improvements or extensions to the method that would benefit the scientific investigation.	

States: Give a specific name, value or other brief answer without explanation or calculation
Recall: Remember or recognize from prior learning experiences
Outline*: Give a brief account*
Describe*:* Give a detailed account or picture of a situation, event, pattern or process
Design: Produce a plan, simulation or model
Explain*:* Give a detailed account
Analyse *:* Break down in order to bring out the essential elements or structure. To identify parts and relationships, and to interpret information to reach conclusions.
Interpret: Use knowledge and understanding to recognise trends and draw conclusions from given information