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| **Instrument Number 2** | | | **Term 2 2022** | |
| **Student Name** |  | **Handout Date** (Week Beginning) | | 26/04/2022 |
| **Teacher Name** |  | **Interim Check Date** | | Ongoing |
| **Unit Number/Name** |  | **Rough Draft Date** | | Ongoing |
| **Due Date** | | **13/05/2022** |

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| **Assessment** | Student Experiment |
| **Time/Length** | Three weeks |
| **Assessment Conditions** | Group work conducting experiment, Individual work during report writing. |

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| **Criterion** | **Marks** | **Grade** |
| **Scientific Inquiry** | /24 |  |

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| **Differentiation: If assessment conditions have been adjusted details are provided below**  All student will receive a physical copy of this task sheet.  Max Grade achievable C+ = Completion of this scaffolded task sheet. Must be Handwritten.  Max Grade achievable A+ = Completion of an electronic report with appropriate section headings, tables, and excel graph. This option does not include completing an electronic version of this scaffolded document. |
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| **Acknowledgement of assessment responsibility** |  |
| I understand the consequences of plagiarism/cheating and confirm this is my own work. | |
| **Student Signature:** | **Date:** ……………………………… |
| **TEACHER COMMENT:** | |
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| B:\Common\_NEW MSHS LOGO\NEW LOGO - B&W\BW-Shield Only white outline.png | | | **Maroochydore State High School**  **Standards Matrix for Year** 10 **Science Chemistry** | |
| **CRITERION** | **6 to 5 marks** | **4 to 3 marks** | **2 to 1 marks** | **0 marks** |
| RESEARCH  and  PLANNING | * informed application of understanding to modify experimental methodologies demonstrated by   + a considered rationale for the experiment   + justified description (introduction) of the methodology * effective and efficient investigation of phenomena demonstrated by   + a specific and relevant research question   + a justified methodology that ensures the collection of sufficient, relevant data   + considered management of risks and ethical or environmental issues. | * adequate application of understanding to modify experimental methodologies demonstrated by   + a reasonable rationale for the experiment   + feasible description (introduction) of the methodology * effective investigation of phenomena demonstrated by   + a relevant research question   + a methodology that enables the collection of sufficient and relevant data   + management of risks and ethical or environmental issues. | * rudimentary application of understanding to modify experimental methodologies demonstrated by   + a vague or irrelevant rationale for the experiment   + inappropriate description (introduction) of the methodology * ineffective investigation of phenomena demonstrated by   + an inappropriate research question   + a methodology that ebales the collection of data   + casual management of risks and ethical or environmental issues. | * does not satisfy any of the descriptors above. |
| ANALYSIS  Of  EVIDENCE | * appropriate application of algorithms, visual and graphical representations of data demonstrated by correct and relevant processing of data * systematic and effective analysis of experimental evidence demonstrated by   + thorough identification of relevant trends, patterns or relationships   + thorough and appropriate identification of the uncertainty and limitations of evidence   + effective and efficient investigation of phenomena demonstrated by the collection of sufficient and relevant raw data. | * adequate application of algorithms, visual and graphical representations of data demonstrated by basic processing of data * effective analysis of experimental evidence demonstrated by   + identification of obvious trends, patterns or relationships   + basic identification of uncertainty and limitations of evidence * effective investigation of phenomena demonstrated by the collection of relevant raw data. | * rudimentary application of algorithms, visual and graphical representations of data about TOPIC demonstrated by incorrect or irrelevant processing of data * ineffective analysis of experimental evidence demonstrated by   + identification of incorrect or irrelevant trends, patterns or relationships   + incorrect or insufficient identification of uncertainty and limitations of evidence * ineffective investigation of phenomena demonstrated by the collection of insufficient and irrelevant raw data | * does not satisfy any of the descriptors above. |
| INTERPRETATION  And  EVALUATION | * insightful interpretation of experimental evidence demonstrated by justified conclusion/s linked to the research question * critical evaluation of experimental processes shown by   + justified discussion of the reliability of the experimental process   + justified discussion of the validity of the experimental process | * adequate interpretation of experimental evidence demonstrated by reasonable conclusion/s relevant to the research question * basic evaluation of experimental processes demonstrated by   + reasonable description of the reliability of the experimental process   + reasonable description of the validity of the experimental process | * invalid interpretation of experimental evidence demonstrated by inappropriate or irrelevant conclusion/s * superficial evaluation of experimental demonstrated by   + cursory or simplistic statements about the reliability of the experimental process   + cursory or simplistic statements about the validity of the experimental process | * does not satisfy any of the descriptors above. |
| COMMUNICATION | * effective communication of understandings and experimental findings, arguments and conclusions demonstrated by   + fluent and concise use of scientific language and representations   + appropriate use of genre conventions * acknowledgment of sources of information through appropriate use of referencing conventions. | * adequate communication of understandings and experimental findings, arguments & conclusions demonstrated by   + competent use of scientific language and representations   + use of basic genre conventions * use of basic referencing conventions. | * ineffective communication of understandings and experimental findings, arguments & conclusions demonstrated by   + inconsistent or inadequate use of scientific language and representations   + obvious lack of several basic genre conventions * use of basic referencing conventions. | * does not satisfy any of the descriptors above. |

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| **A+ ≥22½ A ≥21 A- ≥19** | **B+ ≥18 B≥ 17 B- ≥16** | **C+ ≥14 C ≥12 C- ≥11** | **D+ ≥10 D ≥8 D- ≥6** | **E+ ≥4 E ≥2 E- <2** |

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| **Assessment type:** **Student Experiment**  **Purpose:**   * To use the scientific method to design and safely perform an experiment to investigate reaction rates * To represent data using correct genre (tables, graphs) * To analyse data and reach conclusions   **Task conditions:**   * Groups of three/four for the experiment. * Individual reports must be written. * All student will receive a physical copy of this task sheet. * Max Grade achievable A+ = Completion of an electronic report with appropriate section headings, tables, and excel graph. This option **does not include** completing an electronic version of this scaffolded document. * Class time allotted: Term 2, Weeks 1 to 3.   **Topic (choose one):**  The effect of temperature on the rate of a reaction between sodium thiosulphate and hydrochloric acid.  OR  The effect of concentration on the rate of a reaction between sodium thiosulphate and hydrochloric acid. |

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| **SCAFFOLDING**  Put a **Title** (no marks for this)  **Rationale –** there is only one criteria mark for the rationale and it is based on whether the rationale is “considered”. This term basically boils down to you being able to make three key points   * Provide a context for the research question (the investigation) * Explain the theory behind the research question (the investigation) * Justifies the research question   1st Part  This part of the introduction provides the context for the investigation. It introduces the topic covered by the experiment and positions the topic is in a “big picture” sense. It should describe at least one real life implications of the topic. This section gives the reader some sense of why this topic is “important”.  For example, measuring lichen populations in local creeks and rivers may not initially seem like vital or important scientific work. However, if it is explained that lichen fill a very large important role in the food webs of the waterways, it is obviously more important in terms of overall health of the local waterways.  2nd Part  Provides an explanation of all of the theory you need to interpret your data or understand its meaning. It describes the science within the topic which is relevant to this experiment. This part also details any scientific laws or mathematical formulas which apply to the experiment. This section varies tremendously depending on your topic – some have lots of theory, others have not much as most of the logic is simply common sense.  3rd Part  This should provide a justification of the investigation. This usually involves a couple of sentences explaining how the investigation is something which has not yet been investigated (very common in real life science, unlikely in your case); or, how the investigation will provide a better or more detailed understanding of “the concept” being investigated. This can be very hard at a school level of science, but you must try.  **Research Q**  Short and sharp, be as specific as possible, relate independent to dependent variable. Should be one sentence long with the values of all variables included in the research question. (one criteria for this)  **Methodology**  Intro  This describes the whole experiment in about three to five sentences. Thus, this part is very general and is not a list of steps. By the time I have finished reading this I should have a basic understanding of how you investigated the research question. Note the language – I will not know exactly what you did (that is in the method below), but I will be convinced you will be able to answer the research question. This part is a big part of “justifying”.  Procedure  It is easy to get these marks if you logical sequence of steps which would lead to the collection of sufficient and relevant data, so not realty so somple! It is certainly very easy to not get these marks if you make simple errors.  This section is a list of steps explaining how you did your experiment.   * Use numbered steps. * Use “repeat steps…, except…” where possible. * Write at peer level, so don’t say “collect the equipment”, or “record data”. Some things are assumed, so assume them. If in doubt ask! * Be very obvious you are collecting sufficient data. Sufficient data is 5 variations of the independent variable AND 3 trials at each variation.   Risk assessment and management  Fill in a table like this one for the things in your experiment which may be a source of harm. Check with your teacher for some if you are not sure  You are also supposed to **do the same for any ethical or environmental issues**… this can be a simple statement if there aren’t any.  **Results**  Present your raw data first.  A table will have a heading such as:  *Table 1: Description of the data in the table*  The **first column** will be your independent variable, so use this for a heading in this column (along with units)  The second Column will be your dependent variable, so use this for a heading in this column (along with units).  Show your trials and averages.  Your table should have at least 5 variations of your independent variable and 3 trials of each – this should be “sufficient”. Easy mark  Processing Data (and uncertainty calculations)  This section will provide one example of each of the calculations you have done. It will start with showing an example of how you calculated the average from the raw data. One example of each calculation to your final values should also show shown. In senior you will also show how you all the uncertainty and error (if you have a “known” value to compare to) calculations. Do not confuse uncertainty and error.  Secondary Data  This should be a simple table relating your independent and dependent variables.  The independent (x axis) and dependant (y axis) variable should be graphed. This is very, very likely to be a scatter plot with a trend line. Rarely is it a bar or column graph, so see your teacher before you use a bar graph. Insert a trend line and the equation to the trend line, and the R2 value.  Analysis of trends and relationships  Before you start this identify all the trends in your data. There is at least one – shown by the trend line in your graph; but there may be others (you do not need more than one!)  Start with very brief description of the main trend. Then elaborate or explain if there is any complexity in this relationship, or explain what type of relationship it is – use a mathematical model (equation to the trend line) if you have one. Use some data (from the table/graph) to support this. Sounds hard, but once you have seen it done (check out the examples on my website), it is easy.  If you have another trend or relationship do the same for it.  THEN – try to interpret what these trends imply. This is NOT a conclusion, but should point the way to a conclusion. Sometimes it is easier to come back and do this “interpretation” part once your conclusion is written.  Analysis of data validity  This section provides a description of the uncertainty within the data, and the limitations of the data. This is quite simple (hah! fooled ya!)  Uncertainty in the data.   * Check out the range in your raw data. A large range in your trials means your data has high uncertainty. * If you had anomalies in your data, the data may be uncertain. * There is also the uncertainty of your trend line. Ask yourself the question…do the points on your graph make a consistent trend (are the points close to the trend line or a little “scattered”?). The closer the points are to the trend line the more certain you are (= low uncert) that the trend line accurately represents the trend in the data.   Second - limitations  You have to think of these – almost every investigation has limitations. One may be the number of trials if your uncertainty is high for your data points. Another may be that you need more data points to get an accurate trend. Check out the detailed senior guide for some more advice in this area.  **Conclusion**  The first sentence should be a broad description of the relationship between your independent variable and your dependent variable. Follow this with a detailed description and math eqn.  A good mark hinges on the word “justified”. Make a broader, more general conclusion which explains the implications of this relationship. Show that you understand what this relationship means in terms of the context you described in the rationale.  **Evaluation of reliability and validity**  Note that this section should address the broader experimental process, not just the data itself. Reliability is easy… look back at the uncertainty you described in the earlier. Discuss the uncertainty of the data and the trend line – they are separate issues.  Validity is about “did the experiment measure what it was supposed to measure?”. This can be hard and you have to make a judgement call. | **PLANNING**  **Research Question**  **Methodology**  Intro:  Procedure:  **Risk assessment and Management:**   |  |  |  |  | | --- | --- | --- | --- | | Source of risk | What amount of harm could it cause? | Safety precautions taken | If an incident occurred what should I do? | |  |  |  |  | |  |  |  |  | |  |  |  |  |   **Results – Raw Data**  Table ??: *descriptor for table*   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | *Independent variable (units*) | *Measured variable (units)* | | | | | | Trial 1 | Trial 2 | Trial 3 | Average | Range  (+/-) | |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |  |  |  |  |   \**Anomaly. Explain why you think it’s an anomaly*  **Results – Processing Data**  Table ??: Processing data calculations   |  | | --- | | Steps in the processing of Data using **??** data | | *Statement describing what the calculation is* | | *Example of calculation* | | *Statement describing what the next calculation is* | | *Example of calculation* |   **Results – Secondary Data**  Table ??: *descriptor for table*   |  |  | | --- | --- | | *Independent variable (units)* | *Dependent variable (units)* | |  |  | |  |  | |  |  | |  |  | |  |  |   Graph 1: Concentration of Acid versus rate of decomposition of Calcium carbonate.  *Excel graph goes here (paste in)*  **Analysis of trends and relationships**  **Uncertainty and limitation of the data**  .  **Conclusion**  **Evaluation of Reliability and Validity**  **References** | **MARKING**  **START OF RESEARCH AND PLANNING CRITERION**  **Rationale**  a **considered** rationale for the experiment  a **reasonable** rationale for the experiment  **Research Question**  a **specific** and **relevant** research question  a **relevant** research question  **Methodology**  **justified** procedure for the methodology  **feasible** procedure for the methodology  methodology that enables the collection of **sufficient**, **relevant** data  methodology that enables the **collection** of **relevant** data  **Risk Management**  **considered** management of risks and ethical or environmental issues  **management** of risks and ethical or environmental issue  **Collection of raw data**  collection of sufficient and relevant raw data  collection of relevant raw data  **Processing Data**  correct and relevant processing of data  basic processing of data  **Analysis of trends and relationships**  **thorough** **identification** of **relevant** trends, patterns or relationships  **identification** of **obvious** trends, patterns or relationships  **Data validity**  **thorough** and **appropriate** **identification** of the uncertainty and limitations of evidence  **basic** **identification** of uncertainty and limitations of evidence  **Conclusion**  **justified** conclusion/s **linked** to the research question  **reasonable** conclusion/s **relevant** to the research question  **Evaluation of reliability and validity**  **justified** discussion of the reliability and validity of the experimental process  **reasonable** description of the reliability and validity of the experimental process |