Year 12 Investigating Science Assessment Task 1

PRACTICAL FIRST-HAND INVESTIGATION

Weighting: 25%

Topic 5: Scientific Investigations

Due Date: Wednesday 5th December 2018 - Week 8A Term 4

Task Overview:

This task contains two parts.

PART 1 – Planning and conducting a scientific investigation to gather data

To complete this task, you are required to plan and perform a scientific investigation. This can be one of the investigations listed on the next page or one of your own choosing. If you elect to choose your own investigation, you must submit a detailed plan to Mr Routh for approval.

The practical investigation will be performed outside of class time individually.

PART 2 – Formal investigation report

Students will then be required to analyse and interpret the data collected from the scientific investigation and present it in the format of a formal written scientific report (see provided scaffold). Students will be required to answer a series of questions as part of their analysis (see attached discussion guide sheet).

Syllabus Outcomes:

INS12 – 1 Develops and evaluates questions and hypotheses for scientific investigation
INS12 – 2 Designs and evaluates investigations in order to obtain primary and secondary data and information
INS12 – 3 Conducts investigations to collect valid and reliable primary and secondary data and information
INS12 – 5 Analyses and evaluates primary and secondary data and information
INS12 – 7 Communicates scientific understanding using suitable language and terminology for a specific audience or purpose
INS12 – 12 Develops and evaluates the process of undertaking scientific investigations

Content:
Students:

- Develop a method most appropriate to test a hypothesis following observation
- Justify the type of methodology used to test the hypothesis
- Conduct the planned investigation and collect, record and analyse primary data

1. Draw a conclusion or conclusions, and suggest further investigation or research by:
   – analysing the results and interpreting the data
   – explaining the relevance of the findings of the investigation in relation to the inquiry question and hypothesis
2. Evaluate the validity of the investigation by determining whether the tests measured what they were intended to measure
3. Review a published and peer-reviewed scientific report to determine the conventions of writing a report on a practical investigation
4. Prepare a report on the student investigation that was carried out
5. Evaluate the design of the student investigation by:
   – explaining the choice of independent, dependent and controlled variables with reference to the research question
   - predicting an achievable time frame to conduct the investigation
   – justifying working individually or collaboratively

Choose from the following ideas:

1. Biodegradable Plastics
   https://www.sciencebuddies.org/science-fair-projects/project-ideas/MatlSci_p034/materials-science/biodegradable-plastics#summary

2. A Silver-Cleaning Battery
   https://www.sciencebuddies.org/science-fair-projects/project-ideas/Chem_p029/chemistry/a-silver-cleaning-battery

3. Fish + Food = Science of Aquaponics
   https://www.sciencebuddies.org/science-fair-projects/project-ideas/EnvEng_p032/environmental-engineering/aquaponics

4. Harmful Algal Blooms in the Chesapeake Bay
   https://www.sciencebuddies.org/science-fair-projects/project-ideas/OceanSci_p001/ocean-sciences/algal-blooms

5. Measuring Enzyme Activity: Yeast Catalase
   https://www.sciencebuddies.org/science-fair-projects/project-ideas/Chem_p040/chemistry/measuring-enzyme-activity-yeast-catalase

Scientific Report Writing Scaffold:

To write your formal scientific report you must include the following:

Abstract - An abstract summarises, usually in one paragraph of 300 words or less, the major aspects of the entire report in a prescribed sequence that includes (complete this last, once the report is complete):

1) The overall purpose of the study and the research problem(s) you investigated;
2) The basic design of the study;
3) Major findings or trends found as a result of your analysis; and,
4) A brief summary of your interpretations and conclusions.

Aim – what was the purpose of the investigation?

Background information – A paragraph that informs the reader of the science behind the investigation you are undertaking. For example, if you were to conduct an investigation to prove that increasing the amount of water given to a plant would allow the plant to have maximum growth (total height and mass). You would include any information relevant to your investigation in this section, such as the effect of water on plant growth, what nutrients do plants need to grow and how light affects the growth of plants during the process of photosynthesis would have on your investigation, and include any information that would influence your experimental design (method).

Hypothesis - A tentative explanation for an observed phenomenon, expressed as a precise and unambiguous statement that can be supported or refuted by investigation. A hypothesis is based on prior knowledge and clearly identifies how the independent variable will affect the dependent variable.

Equipment list – a detailed list of all equipment used to perform the investigation.

Variables Identified – Correctly identify the variables in the experiment including; independent, dependent and controlled variables. Indicate your control as well (the thing you're comparing to)

Risk Assessment – Students are to conduct a risk assessment of the investigation. At least 3 risks should be included, and three control measures. The risk assessment should be presented as a table. (see below)

Risk:	**Control Measure:**
Risk 1	
Risk 2	
Risk 3	

Method – As a class we will create a method to conduct the investigation. You must include the method in your report. Your method will need to include any changes that were made to the way the investigation was conducted. It should be in step form, provide clear logical instructions, include how/what equipment is used to collect the data, and include repetition.

Results (table) - first-hand data should be presented in an appropriate table. All tables should be labelled.

Results (graphs) – Make sure that your graphs have appropriate heading, labels on the axis, even scales, and appropriate units. You may draw your graphs using a computer program (excel) or by hand. All graphs should be labelled.

Discussion - This is the section in which you analyse your results. Your discussion should have at least 4 sections.

Section 1: This is the section in which you interpret your results. You should refer directly to the data that was gathered and analyse it using your graph. You should look for trends and discuss why they have occurred. You can link this to your background research to further indicate your understanding of why this trend has occurred.

Section 2: This is the section in which you analyse the accuracy and precision of the data you collected. It is a good idea to give a definition of each term before you start discussing how your investigation

performed. You also need to make sure that you provide evidence (specific examples) of how your investigation was/wasn't accurate or precise. You should also include how you could improve the investigation to increase accuracy and precision.

Section 3: This is the section in which you analyse the reliability of the data you collected. It is a good idea to give a definition of the term before you start discussing how your investigation performed. You also need to make sure that you provide evidence (specific examples) of how your investigation was/wasn't reliable. You should also include how you could improve the investigation to increase reliability.

Section 4: This is the section in which you analyse the validity of the data you collected. It is a good idea to give a definition of the term before you start discussing how your investigation performed. You also need to make sure that you provide evidence (specific examples) of how your investigation was/wasn't valid. You should also include how you could improve the investigation to increase validity.

Conclusion – A paragraph summarising the main findings of the investigation. A concluding paragraph should refer to the aim of the investigation and state whether the hypothesis was proven or disproved, and the consequences/implications of this. You conclusion may identify an area of potential future research based on your investigation. You conclusion should always be based on evidence and refer directly to evidence from your investigation.

Reference list – This is where you include any references that you used/referred to in your investigation. You should try to use references in your background information section and in your discussion. Please see addition information on how to reference using the APA style.

Appendix/appendices – An appendix is always included in a scientific investigation. An appendix is where you include any calculations (if any) that you made during your investigation, any additional data that you collected, your raw data collected in the investigation (this is where you put your messy table from when you actually conducted the investigation), any additional data manipulation that isn't required in the main results section. You can also include picture of your investigation set up and overall seed to plant growth.

Discussion question guide sheet

(use these to support the development of your discussion)

Section 1: This is the section in which you interpret your results.

1. What trends can you see in your graphs?

2. Which colour had the highest growth (both length and mass increase)?

3. Which colour had the lowest growth (both length and mass increase)?

4. Describe any links between your results and your background research (This should be at least **TWO** paragraphs, where you connect scientific information to your results).

Section 2: This is the section in which you analyse the accuracy and precision of the data you collected.

1. Define the terms accuracy and precision.

2. Describe if your results have a high level of accuracy.

3. Analyse the equipment that you used in this investigation and describe any equipment that you could have used to improve the accuracy of this investigation.

4. Analyse the method/techniques that you used in this investigation and describe how you would improve the method/techniques used.

Section 3: This is the section in which you analyse the reliability of the data you collected.

1. Define the term reliability.

2. How many times did you repeat this investigation?

3. Describe if your results have a high level of reliability.

4. Describe how you could improve the reliability of this investigation.

Section 4: This is the section in which you analyse the validity of the data you collected.

1. Define the term validity.

2. Does your experimental method actually achieve testing your hypothesis? Discuss.

3. Is your investigation valid? Discuss.

4. How could you improve the overall validity of this investigation?

Marking Rubric: **Practical first-hand investigation** **NAME:** _____

Outcomes Assessed:	Developing	Achieving	High	Exemplary	Total:
INS12 – 1 Develops and evaluates questions and hypotheses for scientific investigation	• Simple aim of investigation included • Hypothesis is unclear **1 mark**	• Clear aim of investigation included • Clear hypothesis that reflects the purpose of the investigation **2 marks**	• Clear hypothesis that directly links to the aim of the investigation • Hypothesis is reflective of the background information **3 marks**	• Clear hypothesis that directly links to the aim of the investigation • Sophisticated hypothesis that is developed from the background information **4 marks**	
INS12 – 2 Designs and evaluates investigations in order to obtain primary and secondary data and information	• Identifies variables correctly • Chooses appropriate equipment **1 mark**	• Clear risk assessment • Chooses appropriate equipment to complete the practical investigation • Identifies variables correctly, including a number of controlled variables • Method is clear and easy to follow **2 marks**	• Clear risk assessment • Chooses appropriate equipment to complete the practical investigation • Identifies variables correctly, including a number of controlled variables • Modifies the method as a result of testing • Method allows for the reliably collection of data **3 - 4 marks**	• Clear risk assessment that assesses a range of risks in the investigation • Chooses appropriate equipment to complete the practical investigation • Identifies variables correctly, including a number of controlled variables • Method allows for the reliably collection of data • Evaluates and modifies the method as a result of testing and new evidence **5 marks**	
INS12 – 3 Conducts investigations to collect valid and reliable primary and secondary data and information	• Requires teacher assistance to conduct the investigation and to select appropriate equipment **1 mark**	• Conducts investigation effectively to collect valid and reliable data • Employs safe work practices and manage risks • Works effectively as a member of team to collect valid and reliable data **2 marks**	• Secondary sources are referenced appropriately • Employs safe work practices and manage risks • Uses appropriate technologies to ensure accuracy • Primary data collection is included in appendix • Works effectively as a member of team to collect valid and reliable data **3 – 4 marks**	• Secondary sources are referenced appropriately including in text citations. • Employs safe work practices and manage risks • Uses appropriate technologies to ensure accuracy • Primary data collection is included in appendix • Works effectively as a member of team to collect valid and reliable data **5 marks**	

Outcomes Assessed:	Developing	Achieving	High	Exemplary	Total:
INS12 – 5 Analyses and evaluates primary and secondary data and information	• Presents data with limited analysis • Data is disorganised and incomplete **1 – 2 marks**	• Identifies trends, patterns and relationships in data and information with limited analysis • Identifies errors and limitations in data • Attempts to evaluate the accuracy, reliability and validity of the investigation • Gathered data is presented in appropriate tables and graphs in the results section of the report **3 – 5 marks**	• Describes trends, patterns and relationships in data and information • Describes errors and limitations in data • Evaluates the accuracy, reliability and validity of the investigation • Suggests improvements to the investigation • Gathered data is presented clearly in appropriate tables and graphs in the results section of the report **6 – 8 marks**	• Explains trends, patterns and relationships in data and information • Assesses errors and limitations in data • Sophisticated and thorough evaluation of the accuracy, reliability and validity of the investigation • Suggests improvements to the investigation • Gathered data is presented clearly in appropriate tables and graphs in the results section of the report **9 – 10 marks**	
INS12 – 7 Communicates scientific understanding using suitable language and terminology for a specific audience or purpose	• Presents limited information • Shows limited understanding of the scientific method • Shows limited understanding of the scientific concepts **1 mark**	• Communicates basic information in the form of a scientific report • Uses some scientific terminology **2 marks**	• Presents a well-organized report • Selects and uses suitable forms of digital, visual and written forms of communication • Selects and applies appropriate scientific notations, nomenclature and scientific language to communicate **3 – 4 marks**	• Presents a sustained, logical and cohesive report supporting conclusions/ideas with evidence • Selects and uses effective forms of digital, visual and written forms of communication • Selects and applies appropriate scientific notations, nomenclature and scientific language to communicate in a variety of contexts **5 – 6 marks**	

Outcomes Assessed:	Developing	Achieving	High	Exemplary	Total:
INS12 – 12 Develops and evaluates the process of undertaking scientific investigations	• Limited understanding of a scientific investigation and the process of how to undertake one. • Minimal reference list supplied. **1 mark**	• Satisfactory development of a scientific investigation. • Good analysis of the process of undertaking a scientific investigation. • Reference list supplied, some mistakes **2 marks**	• Detailed development of a scientific investigation. • Detailed analysis of the process of undertaking a scientific investigation. • Detailed reference list supplied **3 - 4 marks**	• Detailed and highly developed scientific investigation. • Outstanding analysis of the process of undertaking a scientific investigation. • Detailed and extensive reference list supplied **5 marks**	
				Total Marks:	**__/35**

Teacher Feedback: