2021 Danebank
Student Research Project (SRP) – Notification and Information

Date Due: Wednesday 17th March, 2021 (Hand in in class) Turn It In 8:00am

Total Marks: 40

Weighting: 20%

Nature of Task: to demonstrate your ability to plan and perform a first-hand investigation and to analyse and communicate your results.

Syllabus Outcomes
A student:
SC5-4WS
- develops questions or hypotheses to be investigated scientifically

SC5-5WS
- produces a plan to investigate identified questions, hypotheses or problems, individually and collaboratively:

SC5-6WS
- undertakes first-hand investigations to collect valid and reliable data and information, individually and collaboratively

SC5-7WS
- processes, analyses and evaluates data from first-hand investigations and secondary sources to develop evidence-based arguments and conclusions:

SC5-8WS
- applies scientific understanding and critical thinking skills to suggest possible solutions to identified problems

SC5-9WS
- presents science ideas and evidence for a particular purpose and to a specific audience, using appropriate scientific language, conventions and representations

SC4-1VA, SC5-1VA
- appreciates the importance of science in their lives and the role of scientific inquiry in increasing understanding of the world around them.

1. Important Due Dates

- Aim and Planning Sheet: Week 3
- Draft Results: Weeks 5-6
- Final Report: Wednesday 17th March (Week 8)

2. Sample Report

For this assessment you are to produce a Scientific Report based on an investigation you carry out. A scientific report follows a particular format. Below is a sample report for a Student Research Project (SRP).
In this sample it was investigated whether the price of a fertiliser affected the growth rate of bean seedlings.
The left column shows the different sections in a scientific report as well as a brief description. The right column gives you examples of what could be written for each section.
Note: The following example would not gain full marks. Greater depth and difficulty is required for full marks. This example is intended as a guide only.

Report Section	Example
Title • Descriptive and informative • This can be written as an aim or conclusion.	The effect of the price of fertiliser on the growth rate of bean seedlings Or, The price of fertiliser does not affect the growth rate of bean seedlings.
Abstract • The abstract allows the reader to decide whether the report will be useful to them. • Gives a succinct overview of the project (100 word limit) • Includes aim, an outline of the method and results or conclusion. • Written in past tense and passive voice. • Write this last, once you have completed your investigation and analysis.	The aim of this experiment was to determine whether the price of a fertiliser affects the growth rate of bean seedlings. Five bean seedlings were planted into 4 separate pots. Three fertilisers were used on 3 different pots. The fourth pot was left without fertiliser as the control. The middle-priced fertiliser gave the fastest growth while the most expensive fertiliser was second best.

Introduction • Find out what you can about the topic you are investigating. • The information you gather needs to be relevant to the topic. • The introduction should start general and become more specific, with your **hypothesis** and **aim** included at the end of this section. • A list of the resources you use to write this section should go into your reference list (at the end of the report).	Like all living things, plants need nutrients to survive. The most essential nutrients for plants are carbon, oxygen and hydrogen. They are taken from the air and water. Other nutrients are retrieved from the soil. A Fertiliser is any material added to the soil or applied to a plant to improve the supply of nutrients and promote plant growth. Most fertilisers supply nitrogen, phosphorus and potassium in varying quantities. Fertilisers may have other trace nutrients. Trace nutrients are the nutrients that are need by plants in much lower quantities. The aim of this experiment was to determine which fertiliser produced the greatest growth rate in bean seedlings. It was hypothesised that the more expensive the fertiliser the greater the growth rate of the bean seedlings.
Materials • A list of the equipment you used Note: this does not need to be included.	- 20 bean seedlings - x4 pots (10 L) - Potting mix. - Measuring cylinder. - fertiliser (powdered) — 3 brands (X, Y and Z) based on price (X = dearest; Z = cheapest) (See Appendix 1). - millimetre ruler - measuring spoon.
Method • Guideline for method writing: "someone else should be able to pick up your method and re-create your experiment". • Your method should: - indicate how the equipment was used. - Specify amounts - specify data to be collected.	**example 1** 1. Four 10L pots were filled with of 5L of potting mix. 2. Five bean seedlings were planted into each pot. 3. A measuring spoon was used to add 20mL of each fertiliser into 3 different pots: brand X into the first pot; brand Y into the second pot; and brand Z into the third pot. 4. The fourth pot was left without any fertiliser. This was the control. 5. The plants were placed outside in a sunny location and watered each day with 100mL of water. 6. The increase in height was measured with a ruler and recorded over seven days. **example 2** 1. Fill four 10L pots with 500mL of potting mix 2. Plant 5 bean seedlings into each pot. 3. Add 20mL of each fertiliser into different pots: brand X into the first pot; brand Y into the second pot; and brand Z into the third pot.

- be valid and reliable. • In scientific journals, methods are written in the *past tense and passive voice* (example 1) but can also be written in the *present tense* (example 2). Neither is to include personal pronouns (e.g. “I”, “he”, “she” “we” or “they”). • The method should be succinct and include only essential information.	4. Leave the fourth pot without any fertiliser. This is the experimental control 5. Place pots outside in a sunny location and watered each day with 100mL of water. 6. Measure and record the increase in height with a ruler every day over 7 days.

Results

- Include your observations and measurements.
- DO NOT interpret your results here, only PRESENT them.
- Where possible, present the results in a way that allows the reader to identify trends and patterns easily (e.g. as a table or graph).
- Label each graph, table and/or diagram. The label should be descriptive.
- Include any raw data in appendix

(For raw data, see Appendix 2)

Table 1. The average increase in height (cm) of bean seedlings over 7 days

Fertiliser	Height of seedling (cm)							
	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
X	0	0.3	1.0	1.6	2.3	3.8	5.4	7.3
Y	0	0.4	1.2	1.9	3.1	5.1	7.1	9.9
Z	0	0.2	0.5	1.1	1.6	2.4	3.4	5.0
Control	0	0.1	0.3	0.5	0.8	1.3	1.8	2.5

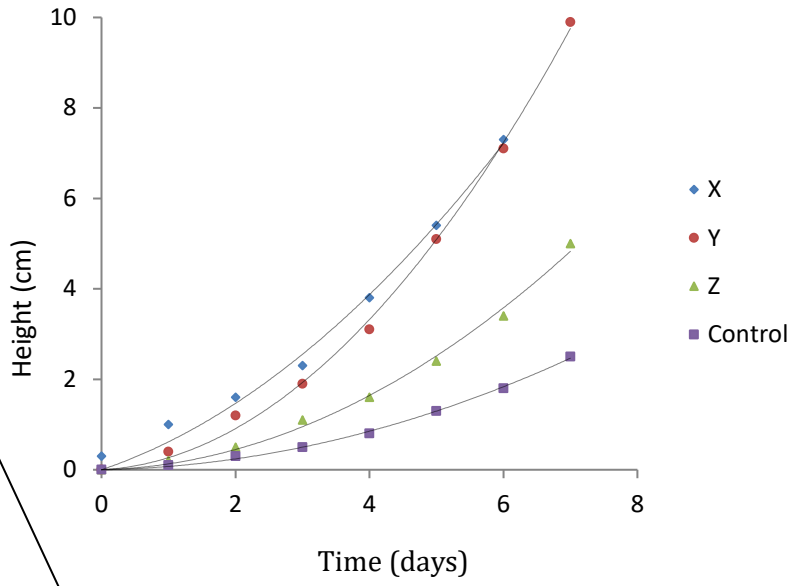

Figure 1. The effect of different priced fertilisers on the growth rate of bean seedlings.

Discussion and Conclusion • Your discussion is an argument for your conclusion. It should include the following: - Main findings supported by data. - Link between research and your findings. - Explain inconsistent or unexpected results. - Explains the significance of the collected data - States with reason if reliable. - States with reason if valid. - Critically evaluates experimental design by suggesting improvements to the investigation - Further areas of investigation. - An overall conclusion which relates back to the aim, supported your results. - A statement which supports or refutes the hypothesis based on the main findings	Fertilisers X and Y produced the most plant growth of 7.3 cm and 9.9cm respectively. Fertiliser Z grew 5.0 cm. All brands of fertilisers showed improved growth in the bean seedling when compared to the control (no fertiliser), which grew 2.5cm. The fertiliser that resulted in the greatest growth was the brand Y which was the second most expensive. Fertilisers have a different combination of nutrients. Some have more nitrogen than others. Others contain more phosphorus. Whether a fertiliser will be effective depends on the nutritional needs of the plant. Some plants cannot tolerate too much of certain nutrients. If given too much they may be fatal. The likely explanation why fertiliser Y was most effective was that it provided the correct ratio of nutrients for bean seedlings. Fertiliser Y may not be as effective for a different type of plant. The significance of these findings may indicate the importance of finding the right fertiliser for each plant type, rather than the assumption that the most expensive fertiliser is the best for all plant types. The results were not reliable as there was too great variation in the final heights of the plants. To improve reliability of the results and confirm the trend more trails need to be completed. (Statement of validity – not shown) (Evaluation of experimental design - not shown) This experiment can be extended by seeing the effect of the same fertilisers on other types of plants and to see whether brand Y achieves the fastest growth. Additionally, the chemical make up of the fertiliser could be investigated in order to determine which components of the fertiliser have the most impact on plant growth. The findings from this investigation indicated that the growth of bean seedlings were increased by fertilisers, but did not show a link between cost of fertiliser and the rate of plant growth. The hypothesis that the most expensive fertiliser brand would show the best growth was not supported by these results.

References

- Use a number of valid and relevant sources (at least 4).
- References to be set out as per school diary.

Fertilisers (n.d.). Retrieved on November 15, 2016, from https://en.wikipedia.org/wiki/Fertilizer

Introducing fertlisers, 2015. Retrieved November 15, 2016, from http://agriculture.vic.gov.au/agriculture/dairy/pastures-management/fertilising-dairy-pastures/introducing-fertilisers

Cambell, C. 2009, *Taking the mystery out of fertilisers*. Retrieved on November 15, 2016, from http://www.abc.net.au/gardening/stories/s2545790.htm

Carnevale, T. 2012. *A fertile experiment*. Retrieved on November 15, 2016, from http://www.abc.net.au/gardening/stories/s3642060.htm

A crash course in fertilisers (n.d.). Retrieved on November 15, 2016 from http://www.sunset.com/garden/garden-basics/crash-course-fertilizers

Appendices

- Gives more detailed information about results, method or calculations. (This information, if placed in the main body of the report, would be too ”clunky”).
- This is where you would include raw data.
- If an appendix is included, it should be referred to in your report.

Appendix 1

Prices taken from Bunning Warehouse
Brand X – Seasol 2x2 Hose on Complete Garden Health: $23.00/L
Brand Y – Yates Thrive soluble All Purpose Plant Food: $16.22/L
Brand Z – Amgrow Nitrosol Concentrate Liquid: $11.94/L

Appendix 2

Raw data for fertilisers X, Y, Z and control. Outliers were removed when calculating averages.

Table 2. Fertiliser X

Plant	Height of seedling (cm)							
	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
1	0	0.3	1.0	1.6	2.3	3.8	5.4	7.3
2	0	0.2	1.2	1.8	3.1	5.1	7.1	9.9
3	0	0.5	0.8	1.4	1.6	2.4	3.4	5.0
4	0	~~0.7~~	1.0	1.6	0.8	1.3	1.8	2.5
5	0	0 3	1.0	~~2.0~~	2.3	3.8	5.4	7.3
Average	0	0.3	1.0	1.6	2.3	3.8	5.4	7.3

Table 3. Fertiliser Y

Plant	Height of seedling (cm)							
	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
1	0	0.3	1.0	1.6	2.3	3.8	5.4	7.3
2	0	0.4	1.2	1.9	3.1	5.1	7.1	9.9
3	0	0.2	0.5	1.1	1.6	2.4	3.4	5.0
4	0	0.1	~~0.3~~	~~0.5~~	~~0.8~~	1.3	1.8	2.5
5	0	0.7	2.0	2.1	3.0	5.0	~~8.0~~	9.9

	Average | 0 | 0.4 | 1.2 | 1.9 | 3.1 | 5.1 | 7.1 | 9.9

Table 4. Fertiliser Z

Plant	Height of seedling (cm)							
	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
1	0	0.3	1.0	1.6	2.3	3.8	5.4	7.3
2	0	0.4	~~1.2~~	~~1.9~~	~~3.1~~	~~5.1~~	~~7.1~~	~~9.9~~
3	0	0.2	0.5	1.1	1.6	2.4	3.4	5.0
4	0	0.1	0.3	0.5	0.8	1.3	1.8	2.5
5	0	0.2	0.5	1.1	1.6	2.4	3.4	5.0
Average	0	0.2	0.5	1.1	1.6	2.4	3.4	5.0

Table 5. Control

Plant	Height of seedling (cm)							
	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
1	0	0.1	0.4	0.5	0.8	1.4	1.8	2.5
2	0	0.1	0.2	0.6	0.8	1.2	1.9	2.7
3	0	0.1	0.3	0.4	0.8	1.3	1.7	2.4
4	0	0.1	0.3	0.5	0.8	1.3	1.8	2.4
5	0	0.1	0.3	0.5	0.8	~~1.8~~	1.8	~~2.0~~
Average	0	0.1	0.3	0.5	0.8	1.3	1.8	2.5

Planning Sheet	**Attach Planning Sheet**

3. Formatting

- Times New Roman, size 12 font, double-spaced.
- Stapled A4 paper. No plastic sleeves or binders.
- Planning sheet attached at the back.

4. **Suggested approach to this task**

- Find an area of interest and investigate ideas around this topic. Complete some basic background information on your task (to be used later in your introduction)
- Determine if you have the time and resources to complete your experiment. Modify if required
- Decide on an aim and hypothesis
- Write risk assessment and method
- **Submit planning sheet - Teacher Checkpoint (Week 3)**
- Perform experiment and record draft results - Teacher Checkpoint if you require (Week 5-6).
- Write up and record results in an appropriate format.
- Complete background information. Add in the references as you go.
- Complete Discussion and Conclusion.
- Include appendices if applicable
- Write abstract and decide on a title.
- Submit Hard Copy to teacher in class and electronic copy via Turn It In.

Year 10 SRP - Planning Sheet 2021 **Name: _____**

Aim		
Hypothesis		
Independent variable		
Dependent variable		
How you're going to make the method valid. (Which variables will you control?)		
Materials		
Outline of method		
Risk assessment	**Risk**	**How it will be minimised**

Teacher: ..... **Signed:** **Dated:**

Note: This page MUST be stapled to your final report and handed in to your class teacher.