**GENERAL INTEGRATED SCIENCE– UNIT 1**

**TASK 5 – Impact of Abiotic Factors on Organism Growth Practical**

**NAME: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ WEIGHTING: 8%**

**DATE: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ MARK: \_\_\_\_\_\_ / 29 =**

Background Information.

An **ecosystem** is defined as any community of living and non-living things that work together. **Biotic factors** are all of the living organisms within an ecosystem; these may be plants, animals, fungi, and any other living things. **Abiotic factors** are all of the non-living things in an ecosystem.

Both biotic and abiotic factors are related to each other in an ecosystem, and if one factor is changed or removed, it can affect the entire ecosystem. Abiotic factors are especially important because they directly affect how organisms survive. Abiotic factors include light, water, temperature, pH and humidity, plus many more.

Mung bean seeds are sprouted for use either fresh or canned. These high protein beans are also rich sources of calcium, phosphorous and other vitamins. For people in regions where animal protein is scarce, mung beans are an important source of protein.

Your Task

A local Kalgoorlie chef is seeking a more sustainable source of protein for some of her restaurant’s dishes, and mungbeans are her favourite choice. Ideally, she would like to grow the mungbeans on a trendy feature wall inside the restaurant, so that the diners can watch their food grow. The trouble is, as much as the chef likes to keep things local, she is concerned that the mungbeans will not grow in Kalgoorlie’s soil!

You have been asked to investigate which soil would allow the chef to grow the best mungbean.

Aim of Investigation

To identify which soil type is optimal for mungbean growth in Kalgoorlie.

1. Identify the:
   1. Independent Variable: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   2. Dependent Variable: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(2 marks)

1. Write a hypothesis for this experiment: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(2 marks)

1. List three controlled variables needed for this experiment.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(3 marks)

**Method**

Equipment List

* One egg carton
* Nutrient-rich soil
* Kalgoorlie Soil
* Coffee Grinds
* Spray bottle
* Distilled water
* Cling wrap
* Mungbean seeds
* Permanent marker

Procedure

1. Before setting up experiment, soak all mungbeans in water overnight to activate them.
2. Gather all materials for your group
3. Place your egg carton on the bench in front of you and use cling wrap to line the egg carton, thus making it water-proof.
4. Fill four of the egg-spots with damp Kalgoorlie soil, four with damp coffee grounds and four with damp, regular compost.
5. Gently press your thumb into the centre of the soil in each egg-spot to create a small dent and place a single, sprouted mungbean seed into each dent.
6. Use a permanent marker to label your group’s mungbean carton and place the carton by a classroom window.
7. Each lesson, when directed by your teacher, one group member must use the spray bottle filled with distilled water to dampen each soil (the soil should be kept very damp for mungbeans to grow).
8. After 4 weeks, measure the height of your mungbean plants and record the data in the table below.

**Results**

1. Observe your mungbeans and their soil. Write two observations, one about the mungbean growth and one about the appearance of the soil, in the table below:

|  |  |  |
| --- | --- | --- |
| **Soil Type** | **Observations** | |
|  | **Soil Appearance** | **Plant Growth** |
| **Kalgoorlie Soil** |  |  |
| **Compost Soil** |  |  |
| **Coffee Grounds** |  |  |

(3 marks)

1. Record your results in the table below.

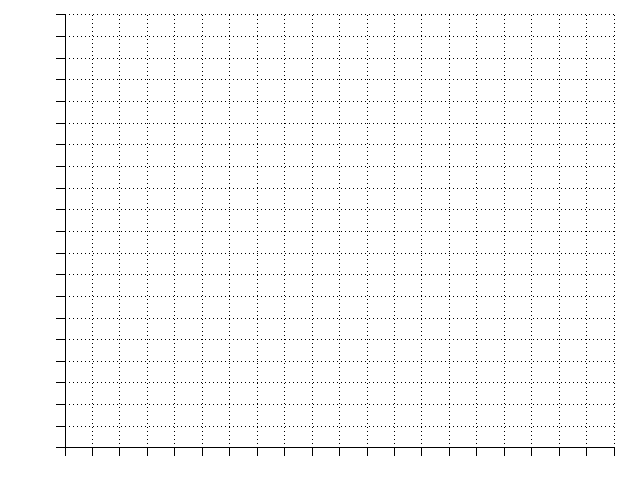
Title: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Soil Type** | **Mungbean height (mm)** | | | | |
|  | **Plant 1** | **Plant 2** | **Plant 3** | **Plant 4** | **Average** |
| **Kalgoorlie Soil** | 25 | 22 | 24 | 1 |  |
| **Compost Soil** | 4 | 6 | 3 | 6 |  |
| **Coffee Grounds** | 1 | 1 | 2 | 1 |  |

(3 marks)

1. Graph your results for the average height of the mungbean plants, in different soils, on the grid below.

(6 marks)

Title: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Data Analysis and Discussion.**

1. Describe the trend in your results by referring to the data. (2 marks)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. State one way to improve this experiment and explain why it would improve the reliability of the results.

(2 marks)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Question 3 refers to the information below.

“Mung beans like fertile, sandy, loam soil\* with excellent drainage and a pH of 6.2 to 7.2. When planting mungbeans, rake the soil to remove weeds, large rocks and clods and amend the soil with a couple of inches of compost worked in. Plant the seed when the soil has warmed to 65 degrees F. (18 C.). Sow seed one inch deep. Keep the area free of weeds but take care not to disturb the roots”.

*\* Loam is soil composed mostly of sand, silt, and a smaller amount of clay. By weight, its mineral composition is about 40–40–20% concentration of sand–silt–clay, respectively.*

1. Read the information above. Using this information, and your understanding of abiotic factors, explain the trend in your results. *(I.e., why did the mungbeans grow best in certain soil?)* (3 marks) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Conclusion**.

1. Write a scientific conclusion for this experiment. (2 marks)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. The most exciting part about a scientific inquiry is that, once the investigation has been completed, you end up developing more questions than you answer. In the space below, identify one question that this data raises that we cannot answer with the information we currently have.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(1 mark)

**Extension**.

Design the feature wall of the restaurant that will grow the mungbeans.

**\*\* ADDITIONAL OPTIONS FOR NEXT TEACHER \*\***

**Prelab Research**

Research the optimum conditions required for mungbeans to grow. You should create notes on the optimum: Temperature, pH, Oxygen, Salinity, Nitrogen, Phosphate and water.

**Testing the soil features.**

You will be testing the salinity, pH and oxygen content in your three types of soil using the data loggers and recording your results in tables below.

**Salinity**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Soil Type** | **Salinity** | | | | |
|  | **Plant 1** | **Plant 2** | **Plant 3** | **Plant 4** | **Average** |
| **Kalgoorlie Soil** |  |  |  |  |  |
| **Compost Soil** |  |  |  |  |  |
| **Coffee Grounds** |  |  |  |  |  |

**pH**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Soil Type** | **pH** | | | | |
|  | **Plant 1** | **Plant 2** | **Plant 3** | **Plant 4** | **Average** |
| **Kalgoorlie Soil** |  |  |  |  |  |
| **Compost Soil** |  |  |  |  |  |
| **Coffee Grounds** |  |  |  |  |  |

**Oxygen**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Soil Type** | **Oxygen in soil** | | | | |
|  | **Plant 1** | **Plant 2** | **Plant 3** | **Plant 4** | **Average** |
| **Kalgoorlie Soil** |  |  |  |  |  |
| **Compost Soil** |  |  |  |  |  |
| **Coffee Grounds** |  |  |  |  |  |

**Nitrogen**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Soil Type** | **Nitrogen in soil** | | | | |
|  | **Plant 1** | **Plant 2** | **Plant 3** | **Plant 4** | **Average** |
| **Kalgoorlie Soil** |  |  |  |  |  |
| **Compost Soil** |  |  |  |  |  |
| **Coffee Grounds** |  |  |  |  |  |

**Phosphate**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Soil Type** | **Phosphate in soil** | | | | |
|  | **Plant 1** | **Plant 2** | **Plant 3** | **Plant 4** | **Average** |
| **Kalgoorlie Soil** |  |  |  |  |  |
| **Compost Soil** |  |  |  |  |  |
| **Coffee Grounds** |  |  |  |  |  |

1. Based on your research and these findings, predict which type of soil will be best suited to growing mungbeans.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(2 marks)

* Would work well to do introduce this assessment by researching best conditions for mungbeans in a single period, then spending a double testing the conditions of the soil and predicting which soil would be best, then setting up the lab and leaving it for at least 4 weeks before measuring the beans.
* Make sure the students water the plants every lesson, because the beans like to be very damp
* Also make sure you soak the beans for at least a day so that they will sprout before you give them to the students to plant.
* Would be good for the students to take photos of their beans ever week, and then have them create the lab report part at home including their picture instead of under test conditions. Could give them a couple of lessons in-class.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Week** | **Lesson 1** | **Lesson 2** | **Lesson 3** | **Lesson 4** |
| **1** | Introduce what abiotic factors are  Station activity on different abiotic factors and how they impact growth of different organisms (do one station for the abiotic factors in different types of ecosystems) | Students research what mungbeans are and how abiotic factors impact their growth  Teacher to ensure mungbeans are soaking by about here so they are ready for planting in Lesson 4 | Students gather the different types of soil and start to test the abiotic factors | Students finish testing the abiotic factors of the different soils and predict which type of soil would be optimum for mungbean growth based on their research and their lab findings  Students plant their mungbeans. Place chart on the wall next to the plants to record when they watered the plants |
| **2** | Water mungbeans. | Water mungbeans. | Water mungbeans. | Water mungbeans and take photo. |
| **3** | Water mungbeans. | Water mungbeans. | Water mungbeans. | Water mungbeans and take photo.  Excursion great western woodland with a Traditional Owner? |
| **4** | Water mungbeans.  How humans impact ecosystems. | Water mungbeans.  How humans impact ecosystems. | Water mungbeans.  How humans impact ecosystems. | Water mungbeans and take photo.  How humans impact ecosystems. |
| **5** | Water mungbeans.  How humans impact ecosystems. | Water mungbeans.  How humans impact ecosystems. | Water mungbeans.  How humans impact ecosystems. | Water mungbeans and take photo.  How humans impact ecosystems due. |
| **6** | Measure mungbeans. Pack-up lab. Lab write-up | Lab write-up | Look-up mungbean recipes or finish write-up. | Cook-up with mungbeans. |

* White boxes = lessons to go through other content like biogeochemical cycles.
* **Green boxes** = mungbean practical lessons
* **Orange boxes** = human impacts on Great Western Woodland extended response.