JOHN CURTIN College of the Arts
COLLEGE OF THE ARTS

General Integrated Science
Year 12
Task 2 – Unit 3
Science Inquiry: Abiotic Factors

Name: _____ **Date:** _____

Conditions
Period allowed for completion of the task
Research: one week (including one 55-minute lesson)
Incursions: two 55-minute lessons
Analysis: two 55-minute lessons

Invigilated Task: one 55-minute lesson

Task weighting
5% of the school mark for this pair of units

Research, field and laboratory analysis = 20 marks
In-class Response = 20 marks

Total = 40 marks

Investigation – Measuring and comparing the abiotic factors of two terrestrial ecosystems

Background information
The abiotic or non-living factors in an ecosystem may include: temperature, water repellence, pH, organic material, and chloride levels. These non-living factors can have considerable impact on soil ecosystems, particularly if they impact on autotrophic organisms (also known as producers).

A summary of some abiotic factors is found below.

1. **Temperature**

Organisms have an upper and a lower temperature limit beyond which growth and reproduction will stop. There is an optimum temperature range within which maximum growth occurs. Soil temperature decreases as the depth of the profile increases. Temperature can also affect other abiotic factors, such as the conentration of dissolved gases that can be held within the soil body.

Temperature is measured with a thermometer.

2. **Water repellent sands and soils**

Non-wetting soils or soil water repellence is caused by a waxy coating on soil particles. It primarily occurs in the topsoil with low clay content. The coatings are made up of water repelling substances, primarily plant leaf waxes and their biodegradation products. - See more at:

http://www.grdc.com.au/Research-and-Development/Major-Initiatives/Non-wetting-soils#sthash.r8cvsZmI.dpuf

Devise a test for measuring the relative soil water repellence by using the following equipment in the science laboratory; filter paper, filter funnel, measuring cylinder, distilled water, beakers.

3. **pH**

pH is the measure of how acidic or basic a solution is. The normal range of pH in a freshwater system is between 6.0 and 9.0. A change in pH can have serious effects on the life in an aquatic ecosystem. It can cause the death of fish, larvae and eggs and it may also reduce the productivity of organisms. Higher levels of carbon dioxide in the water will lower the pH of the water, making it more acidic. The ideal range for freshwater aquatic organisms is between 6.5 and 8.

pH may be measured with universal indicator and a pH chart, or electronic pH probes.

4. **Organic material**

Organic matter in soils is made of the remains of dead organisms, or organic wastes from organisms. Minerals contained within the organic matter are released by the decomposition of the material. Bacteria and fungi are majors decomposers of organic matter in ecosystems.

Devise a test for measuring the mass of organic matter in the soil by using the following equipment in the science laboratory; Bunsen burner, crucible, tongs, electronic balance.

5. Chlorides

Chloride in plants comes mostly from sea spray, dust and air pollution. Fertilization and irrigation also contribute to chloride on garden soil.

Chloride is easily dissolved in water and enters the plant through soil and air. It is essential to the chemical reaction that allows the opening and closing of the plant's stomata, tiny pores that allow gas and water to be exchanged between the plant and the air around it. Without this exchange, photosynthesis can't occur. Sufficient chloride on garden plants may inhibit fungal infections.

To test for the presence of chlorides first leach the soil sample with hot water. Filter off the solids and collect the filtrate in a test tube. Test the filtrate using a few drops of dilute silver nitrate solution. If enough chlorides are present a white precipitate will form in the sample.

6. **Presence of carbonate minerals**

Describe how you will test for carbonate minerals in the soils of both ecosystems.

Task

This task requires you to research the use of **two** different terrestrial ecosystems (as directed by your teacher), attend an incursion, and present your findings in a scientific report. The **two** terrestrial ecosystems have different uses. One of these is an area that has not been disturbed greatly by human activity and the other has significant development as the College Edible Garden.

There are **three** phases to this assessment: pre-excursion, excursion and post-excursion.

Pre-excursion – Research and planning

In your research, you will determine to what extent the abiotic factors may be affecting the use of the land and the ecosystem that is supported there.

Research the history of the two ecosystems.
Research should include:

- the use of the land surrounding the ecosystem
- the possible effects of the land use on ecosystem stability
- rainfall data for the ecosystem.
    - Draw a landscape sketch of the two terrestrial ecosystems, noting natural landforms and evidence of human activity. You may use Google Earth or any other suitable program or software.

You will be allocated into a group of two or three students. In your group:
Practise using the following pieces of equipment:

- thermometer (in air, soil surface and at depth)
- universal indicator and a pH chart, or pH probes
- silver nitrate solution and
- devise a method to compare the soil water repellence between the two sites.
- devise a method to compare the organic matter in the soil between the two sites.
- devise a method to compare the presence of carbonate in the soil between the two sites.

- These pieces of equipment and tests will be used to measure **six** abiotic factors at your ecosystem.
- You must take readings at **three** different locations at each site. Discuss how your group will record the readings for each abiotic factor at the three different locations around each ecosystem. Remember you must average the data collected at each of the three locations at each ecosystem. Draw a table of results for the incursion.
- Each group must determine task responsibilities for each group member, at each ecosystem, to maximise the time available for the measurement of abiotic factors.

Incursion – Collection of data

Look at the first terrestrial ecosystem and, in your group, decide on your **three** locations. You will take readings of the following **five** physical (abiotic) factors: temperature (in air, soil surface and at depth), pH, water repellence, organic material, and chlorides. On your landscape sketch, mark the three locations from which you will collect physical data.

- Before you commence, take notice of any disturbances caused by land use or evidence of human activity that you observe at the site. Record this information.
- Move to the first location and take and record the five abiotic factor measurements. Collect samples for testing in the lab. Record this data.
- Continue until you have recorded the data for all three locations
- Repeat at the second ecosystem.

Post-incursion

Process, evaluate and communicate findings in a draft scientific report

1. Introduction:
   - provide a brief history of the land use and development of the area surrounding each ecosystem
   - discuss the possible effects of the land use on water quality, include rainfall data for the **two** locations
   - include a landscape sketch or photograph/s of each ecosystem (4 marks)

2. Materials: outline the equipment used (include quantities) (1 marks)

3. Method: describe the method used for gathering the data on the **five**abiotic factors (5 marks)

4. Results:
   - collate all the results for the physical measurements and land use observations
   - represent all the data in a table
   - include appropriate titles and headings
   - include a column for the average of the abiotic factors taken at the **three** sites at each ecosystem.

   (3 marks)

5. Discussion:
   - identify any differences between the two ecosystems
   - support your findings with data from the table
   - relate these differences to the history and land use surrounding the two ecosystems
   - account for any anomalous results
   - suggest ways in which the collection of data could have been improved (4 marks)

6. Conclusion:
   - summarise your findings
   - suggest why there were differences between the **two** ecosystems
   - discuss how the differences in **three** physical factors can affect the organisms living in each ecosystem

   (3 marks)

Invigilated Task **20 marks**

In class, using only your draft report, you will be asked to answer questions about this study and how abiotic factors can influence the types of organisms in these ecosystems.