

## Edexcel (B) Biology A-level

### **Required Practical 16 (a and b)**

Investigate the effect of one abiotic factor on the distribution or morphology of one species



## Practical 16a: Investigate the effect of one abiotic factor on the distribution of one species

In order to investigate the distribution of a species we need to use **quadrats**. As we are investigating how one abiotic factor affects the distribution of the species, we need to choose an area that has an obvious **environmental gradient** and then use a **transect**.

### Equipment

Quadrat

20 metre tape measure

### Method

In this example we will be using **light intensity** as the abiotic factor,

1. Choose an area with a clear gradient of light intensity, i.e. from open sunlight to a shaded area.
2. Lay a 20m tape measure from the open area to the shaded area.
3. Look along the transect and pick a plant species that clearly changes in number along the line.
4. Begin at one end of the transect and lay the quadrat next to the 0m mark of the tape
5. Measure the light intensity at ground level.
6. Record the abundance of your chosen species at this point by counting the number present.
7. Move the quadrat 2m along the tape and repeat steps 5 and 6
8. Continue until you have 10 measurements along the transect.
9. Create two more transects running from the openly lit to the shaded area and repeat steps 4 to 8 to have **repeats**. Alternatively, **class data** can be shared.

### Considerations

- Take the readings close together in time to ensure that light intensity does not vary much, e.g. with cloud movement.
- Using an **interrupted transect** is quicker and can be used to measure a greater distance.
- Instead of recording abundance through counting the number of the species, we can also estimate **percentage coverage**, but this is less accurate as it is an estimation.

### Risk assessment

- Be careful when handling quadrats and ensure that they are not thrown.
- Cover cuts and wash hands after fieldwork to stop any risk of infection from plants or soil that could have possibly been contaminated with animal faeces.
- Use sunscreen if you will be working in an area with high UV levels for long periods of time.



- Do not enter water and ensure that you can be seen by others at all times.
- Wear gloves if working with nettles.
- There is a possibility of allergic reaction from pollen so inform your teacher if you feel unwell.

## Conclusions

We can conclude that there is a **relationship** between light intensity (our chosen abiotic factor) and the chosen plant species. However, it does not necessarily mean that the light intensity is the cause of the change in distribution, as there are other biotic (such as competition) and abiotic factors (such as soil moisture content) that can also lead to change in distribution.





## Practical 16b: Investigate the effect of one abiotic factor on the morphology of one species

### Method

1. You will have to plan and then carry out an investigation.
2. Plan a suitable title and do background research on the chosen topic, looking particularly at up-to-date **peer-reviewed articles** in scientific journals as these are of a high quality
3. Use your research to form a hypothesis and write your **hypothesis** and **null hypothesis** down
4. Write a short paragraph explaining how you reached this hypothesis, referencing your research
5. Create a step-by-step plan for your investigation, including a description of how you will determine the different levels of your **independent variable** (such as different levels of light intensity) and a detailed description of how you will be measuring your **dependent variable** (such as number of individuals, equipment used). Explain your decisions, using your research as much as possible.
6. Consider the variables that need to be **controlled** and why and how you will control them.
7. Decide which statistical tests you will use to interpret your data and why.
8. Write an equipment list and check with your teacher to make sure that the equipment is available.
9. Carry out a **risk assessment**.
10. Carry out your investigation and record the results in a table.

### Analysis of results

1. Draw a graph of results
2. Carry out an appropriate statistical test
  - Use a **t-test** if you are looking for a significant difference between two levels of an independent variable.
  - Use a test for **correlation** if you are testing for a relationship, using multiple levels of the independent variable.
3. Write a **conclusion** explaining your results, using biological ideas and your research references.
4. Evaluate your investigation - comment on **reliability** and **validity** of data, explain any **anomalies**, give values for the uncertainty of key measurements.
5. Write a **reference list** for your research sources.

### Considerations

- To ensure that the research sources you use are reliable, check whether the authors have any commercial interests that you create bias, whether the authors have published



elsewhere and whether the publication is widely cited by other authors or whether the results are backed up by other papers.

- In your plan you should include how you will **avoid bias** when choosing your samples.
- In your risk assessment make sure you are aware of the difference between a risk and a hazard
  - **Risk** = the likelihood that a person will be harmed, e.g. high risk or low risk.
  - **Hazard** = a potential source of harm.

## Risk assessment

- Be careful when handling quadrats and ensure that they are not thrown.
- Cover cuts and wash hands after fieldwork to stop any risk of infection from plants or soil that could have possibly been contaminated with animal faeces.
- Use sunscreen if you will be working in area with high UV levels for long periods of time.
- Do not enter water and ensure that you can be seen by others at all times.
- Wear gloves if working with nettles.
- There is a possibility of allergic reaction from pollen so inform your teacher if you feel unwell.

## Example topics

*The effect of **light intensity** of the morphology of plants*

- Light intensity and availability affects the rate of photosynthesis and therefore growth.
- Look at a variety of ways to measure leaf size, such as leaf area or dry mass.

*The effect of **height on the shore** or **wave exposure** on the morphology of rocky shore organisms*

- Many rocky shore species vary in shape or size in relation to abiotic factors, such as period of immersion which is linked to water movements and degree of exposure to waves.
- You could compare a wave-exposed section of shore to a wave-sheltered section.
- You could investigate whether the size or growth rate of a plant varies with height on the shore.

***Mineral ion** availability and morphology of seedling growth*

- Choose a method of measuring growth, e.g. mass, root length, leaf area.
- Research the function of the mineral chosen.
- **Sach's culture medium** is made up of all the key nutrients needed for a plant and so could be compared to a solution where one mineral is deficient in order to see the effects.



- Alternatively, making a comparison of solutions with and without the mineral may be more effective.
- Consider which variables need to be controlled, e.g. size of seed, temperature etc.
- The seeds will need to be grown for around 3 weeks and regularly topped up with growth solution.
- **Germinated barley or mung beans** can easily be grown in a test tube so could be used.

