

INVESTIGATING ENVIRONMENTAL EFFECTS ON PLANT GROWTH

Humans have impacted nutrient cycles in a number of ways, including:

- **EUTROPHICATION** – In water bodies (rivers, lakes ponds) as a result of over-fertilization, leading plants and animals dying from lack of oxygen, because plants cannot photosynthesize at night. Only anaerobic microorganisms survive, and many of these produce methane and smelly organic gases.
- **PHOSPHATES** from phosphate-containing detergent can be a source of this over-nutrition.
- **NITRATES** in the run-off water from fertilized fields can be another source of over-nutrition.
- **SALINITY** – When plants are removed, water tables can rise, dissolving natural salts in subsoil layers. This dry land salinity causes by losses to agriculture in Pakistan, India, and Australia. Beans are particularly sensitive to solutions less than 25 mMol NaCl
- **ACID RAIN** caused by water droplets passing through chemical smogs (Sulfur oxides, S_xO_{xx}) can change the structures of soils and cause them to lose nutrients, like magnesium ions.

Your task is to work in groups of three and plan an investigation where you test the effects of a certain parameter on plant growth. These could include fertilizer, salinity or pH.

Phase One: Planning

Which problem to you want to investigate? (It can be different from those listed above).

What hypothesis are you testing? State your hypothesis as a relationship between the independent and dependent variables.

Predict what you think will happen. Explain why.

Complete as much as possible:

Variables	
What variables may affect the phenomenon you are investigating?	

Which of the variables are you going to investigate as your independent variable ? (This is the variable you will change to see what affect it has on the dependent variable)	
How will the independent variable be changed in the experiment?	
What is the dependent variable ? (ie the variable that responds to changes in the independent variable)	
How will you measure the dependent variable?	

Suggested method to grow the plants



Grow plants in CD cases. This means they can be handled easily, and root and shoot growth measured easily.

Proposal – instead of soil, you could also use wet paper towel.

We will change the selected 'environmental effects' by standing the bottom of the CD case in the required treatment solution

Instead of broad beans, we ...



Phase Two: Experimenting

Collect and record the data you need to test your hypothesis. Draw your data table here.

Title of table: _____

How did you make sure your data were accurate?

Phase three: Data analysis

What is the best way to present your data? Is it appropriate to draw a graph? What type of graph is most suitable?

- Remember to plot the independent variable on the horizontal axis.
- Remember that the title of the graph should mention both the independent and dependent variables.
- Use the graph paper on the next page.

Title: _____

Analyze your data. Are there any patterns or trends in your data? What is the relationship between the variables you have investigated? Is the hypothesis supported by the data?

Using science concepts explain the patterns, trends or relationships you have identified in your data. What is your conclusion?

Phase four: Evaluation

What were the main sources of experimental error? (sample size and selection, measurement error, poor control of variables)

How confident are you with your conclusions? How much uncertainty/error is associated with your data?

How could the design of the experiment have been improved to reduce error?

What have you learned about the topic of your investigation? Was the outcome different from your prediction? Explain.

Explain how eutrophication is caused and how it is impacting aquatic ecosystems ?
