Year 7's and the Beanstalk - A Scientific Investigation

The Planning

1. What is your research question? What do you want to find out? What 'one thing' do you want to change to see what effect it has on some 'other thing' ?

. Answering these questions will help you to answer the next questions concerning which variable you will deliberately change (**independent variable**), which you will measure (**dependent variable**)
and which you will keep the same or constant (**controlled variables**).

2. What is the one thing you are going to change?

. In designing your investigation you should change only ONE variable at a time. The variable that you deliberately change is called the independent variable.

3. What thing are you going to measure?

. The variable that you measure is called the dependent variable.

4.What other variables are there to keep the same? How can you keep them the same?

. It is important to keep the variables that you are NOT investigating the same. These are called controlled variables. This increases the chance that it is the variable you are changing that is causing the effect you are measuring, rather than some other variable.

5.How can you make sure that the investigation is fair and not a 'fluke' or mistake?

. A control enables you to see whether the independent variable has an effect on the dependent variable and provides a baseline for comparison. A large sample size and repeating the investigation decreases the chance that your findings were a fluke or due to a mistake. It also helps to reduce the effects of individual variations that may occur in your data.

6. What is your prediction as to what the answer to your research question might be?

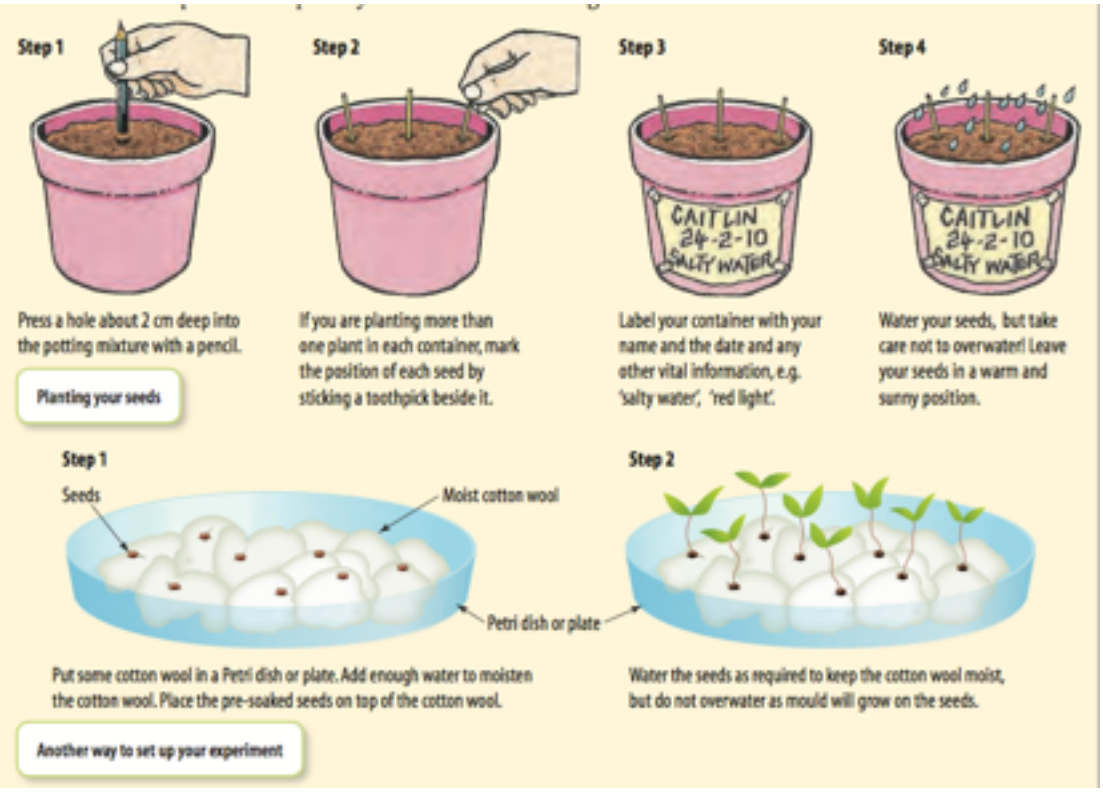
A **hypothesis** is an educated guess or prediction of what the results of an investigation may be. An example is 'that bean growth is faster when watered with tap water rather than salt water' or 'that bean germination decreases with increasing salt concentration'.

7. What materials and equipment do you need for your investigation?

Once you have decided on the variables in your investigation, you can write a list of what you will need to perform it. Include quantities and specific descriptions so that you remember to keep your controlled variables constant.

8. What are you going to do in your investigation? What steps are you going to follow?

By having your steps clearly outlined you could repeat the investigation in exactly the same way if you were to do it again. This is your **procedure** or **method**. Others could repeat it as well. If you make any changes to your plan when you are conducting your investigation, make sure you make a record of them. If you are using bean seeds, remember to soak your bean seeds (10 seeds or more) in a dish of water overnight. There are some examples of set ups for you to consider in the figures below.



9. What are you going to record and how are you going to record it?

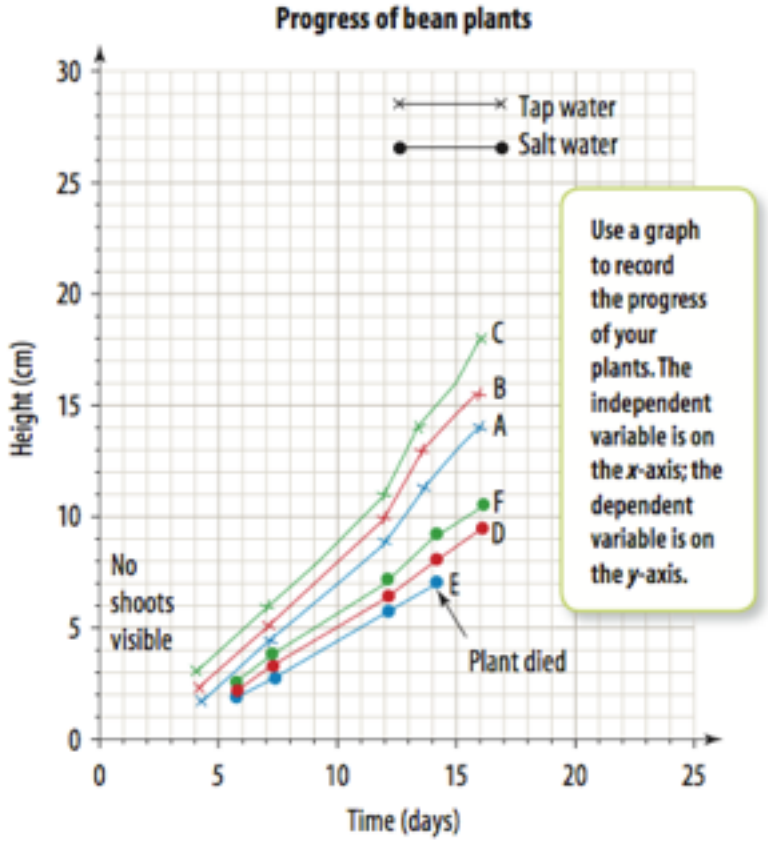
In your procedure you should have outlined *what you intended to measure* and *how you intended to measure and record it*. The details that you record are your **results** or **data**. You may decide to record your results in a table similar to the one shown below or you may use a journal or diary to record observations as diagrams with descriptive labels and measurements.

Date	Day	What I did	Height of seedling (mm)												Observations and diagrams
			Tap water						Salt water						
			A	B	C	D	E	Ave.	A	B	C	D	E	Ave.	
5/3	10	Watered all plants at 3 pm; gave each plant 50 mL water	7.1	8.0	8.9	7.5	8.2		5.0	4.4	5.8	4.8	5.2		

Sample table. This table could be used to record the results for an experiment to find out whether watering plants with salt water affects their growth.

Reformatting your data

While your bean plants are growing, you can record their progress on a line graph such as the one below. This graph shows how the height of two groups of plants changes. If any of your plants die, your investigation is not a failure. You should, however, make a reasonable attempt to suggest why they died.



Example of investigation planning

RESEARCH QUESTION: WHAT IS THE EFFECT OF DIFFERENT CONCENTRATIONS OF SALT ON BEAN GERMINATION?

Independent variable: different concentrations of salt

Dependent variable: bean germination

Controlled variables: for example, types, ages and size of beans, type of salt, temperature, intensity and colour of light, volume of solution added

Control: set-up that had everything the same, but used water with no salt. This could be used as a baseline for control to see whether the addition of salt had an effect on bean germination.

Sample size: using 10 bean seeds instead of one seed in each set-up and using class results to increase the number of times that the investigation was performed.

What you are measuring

What you are changing

Dependent variable	Independent variables (vary only one at a time)
Number of seeds germinated in a week	• Salt concentration • Volume of water added each day • Amount of light (e.g. using different types of cloth to cover)
Time taken for seeds to germinate	• Colour of light (e.g. red, green, blue or yellow cellophane covers) • Different substances added to water (e.g. caffeine, sugar, salt or garlic)
Height of shoots each day	• Type of growth medium (e.g. water, soil, sand, soil, gravel or cotton wool)