Common Tips :

- For food tests always mention the original colour. For example, colour of the reagent changes from blue to green if reducing sugar is present.
- The intensity of colour can be measured using a colorimeter to compare the nutrient content in the given samples.
- You can also measure the time taken for colour change to be observed, if you are comparing the nutrient content in 2 given samples.
- **Some common sources of error include:**
    - Not repeating the experiment
    - Difficulty in judging the colour end point
    - Using the same glass rod for stirring
    - Timing all the experiments at the same time
    - Not measuring the volume of a liquid using an appropriate apparatus.
- **Improvements to the above errors can be:**
    - Repeat the experiment
    - Use a colorimeter or use a white tile
    - Wash the rod or use separate rods
    - 2 people perform the experiment or perform the experiment one after the other
    - Use a measuring cylinder

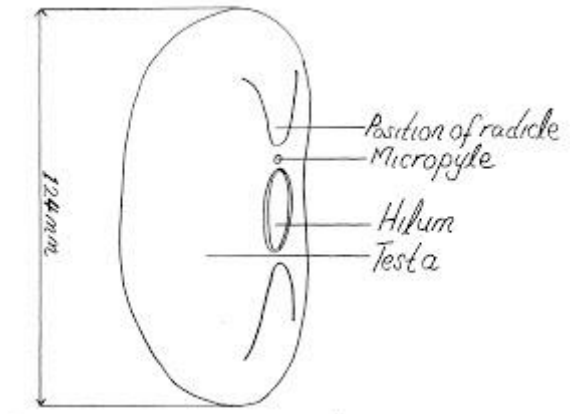
Tabulate the Result

1. The number of rows and columns should be as per the data provided.
2. Each row and column should have a heading with units.
3. Units should be mentioned only in the heading and not with individual values
4. All the readings should be entered to the same number of decimal places.
5. Tables should be drawn with a pencil and details should be written with a pen.
6. Numerical data should be presented as true numbers for example 0.7 and not.7
7. Do not leave any cell blank. Use – for a missing value and 0 for zero.

Drawings:

Drawing Specimens

- Make sure you use a sharp pencil.
- Your outline is clear.
- The drawing should be as large as space provided.
- Ensure your drawing does not go over any printed matter, i.e. the question or the marks.
- It has definite outlines (no 'sketchy' lines)
- No shading.
- No arrow heads when labelling
- Lines point exactly at the labelled part.



Drawing to show the external features of a bean seed (X12·4)

Magnification : $\frac{\text{Length of Drawing}}{\text{Length of Specimen}}$

$= \frac{124\ mm}{10\ mm}$

$= X12 \cdot 4$

Labellings

- The label should point directly to the requested component/part.
- Ensure a ruler is used to draw a label line
- Details
    - Ensure you focus on details such as the number of body segments or the number of sections seen in the given image.
    - Make sure you draw the same number as in the given image.
- Proportions
    - Ensure that the image is enlarged proportionately means all the parts are increased in size proportionately and not only one of the parts.
    - For example: If an insect image is to be redrawn, make sure you increase all the 3 body parts along with the legs in size and not only the body parts.

Magnification

Calculating Magnification

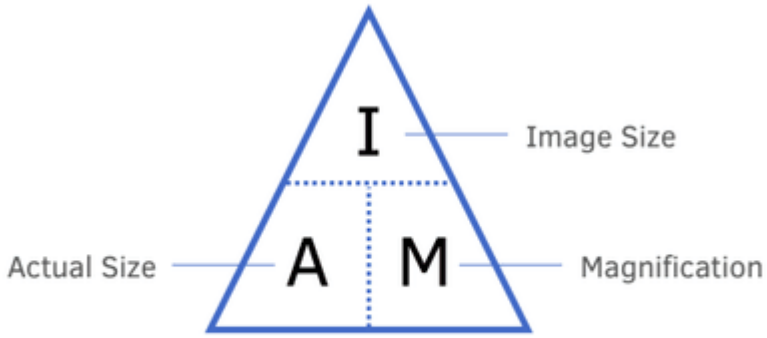


Fig 2. Formula Triangle for Magnification.

Conversions

1. 1m = 100cm
2. 1cm = 10mm
3. 1mm = 1000µm

The unit of magnification must have an X.... before the value.

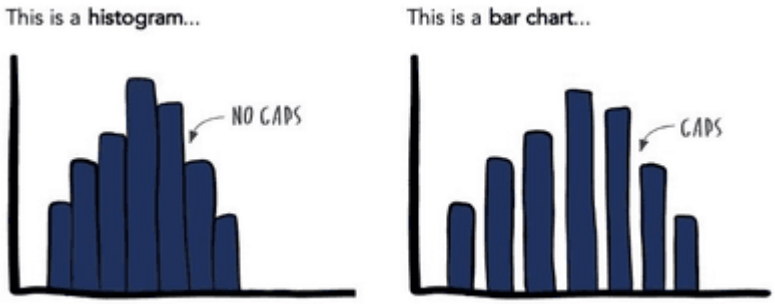
Comparisons

- Make sure the points you use to compare diagrams are visible in the diagrams
- Use labels on the diagrams as your guide
- You can compare numbers shape and proportional sizes.
- Don't compare sizes unless you're given a scale.

Drawing Graphs

- Use a sharp pencil
- Label both axes (with the variable) including the units. For example, Temperature/°C and **a key** may be needed to indicate different plots
- Choose an even scale for each axis that uses up as much of the grid as possible.
    - Use the entire given grid.
    - The scale should be linear which means the difference between 2 numbers on an axis should remain constant.
    - Your graph should occupy more than 50 % of the given grid on both planes.
- The independent variable is plotted on the x-axis
- The dependent variable (i.e. the one that changes due to a change of the other) is plotted on the y-axis.
- Join your plotted points with ruled lines
    - Even if a line of best fit is asked, join all points with ruled lines except the anomalous reading point.
- When drawing bar charts, all bars must be of the same width
- The bars, when drawn cannot touch each other
- Use crosses "(×)" or "⊙" to mark the data points (for scatter graphs)

Bar Charts and Histogram Charts



Planning Investigations

Independent Variable: The variable you will change

Dependent Variable: The variable you will measure.

Control Variable: Variables that you will keep the same.

Use this mnemonic: **I Don't Care So Run Away (IDCSRA)**

· IV – State the independent variable, describe how are you going to maintain it (include names of apparatus), State the values with units. State at least 3 values.

· DV – State the dependent variable, State the units, State how you are going to measure it

· CV – State three different control variables, describe how you are going to control them

· Safety – State a safety measure and how would you eliminate the risk

· Repeat – State Repeat the experiment three times

· Average – State that you would calculate an average (Numerical Data)

· Do **not** give a conclusion as you have not performed the experiment.

Common Different Independent Variables

Independent Variable	How to change it?
Temperature	Use a thermostatically-controlled water bath and a thermometer to measure the temperature. **Possible Range: 10'C, 20'C, 30'C, 40'C, 50'C, 60'C**
Humidity	With or without plastic bag
Light Intensity	Put a lamp at different distances away, measured using a rule **Possible Range: 10cm, 20cm, 30cm, 40cm, 50cm, 60cm, 70cm**
Air Flow	Use fan or don't use a fan (with fan = more air flow)
Carbon Dioxide Concentration	Use different concentrations of Sodium Hydrogen carbonate solution that is a source of CO2

Optional: Include a control experiment if possible.

Enzyme Activity

- 2H2O2 (l)→ 2H2O (l)+ O22*H*2*O*2 (*l*)→ 2*H*2O (*l*)+ *O*2
- This reaction can be catalyzed by an enzyme (catalase) or by a non-biological catalyst (Manganese IV oxide)

Method:

- Put 3 cm^3 of hydrogen peroxide in a test tube.
- Add fresh potato strips and shake gently.
- Keep your thumb on top of the test tube, or use a stopper, to retain the gas.
- Do the "glowing splint" test → the splint relights
- **Positive control:** repeat original experiment using manganese IV oxide → bubbles of O_2 form
    - Conclusion: Reaction happens because of a catalyst
- **1st negative control:** repeat original experiment using boiled potato strips → nothing happens
    - Conclusion: Enzymes denature when they are at high temperatures
- **2nd negative control:** repeat original experiment using water instead of hydrogen peroxide → nothing happens
    - Conclusion: hydrogen peroxide is the substrate
- **3rd negative control:** repeat in a cold environment, the effervescence should be slower
    - Conclusion: enzymes don't work as well in the cold

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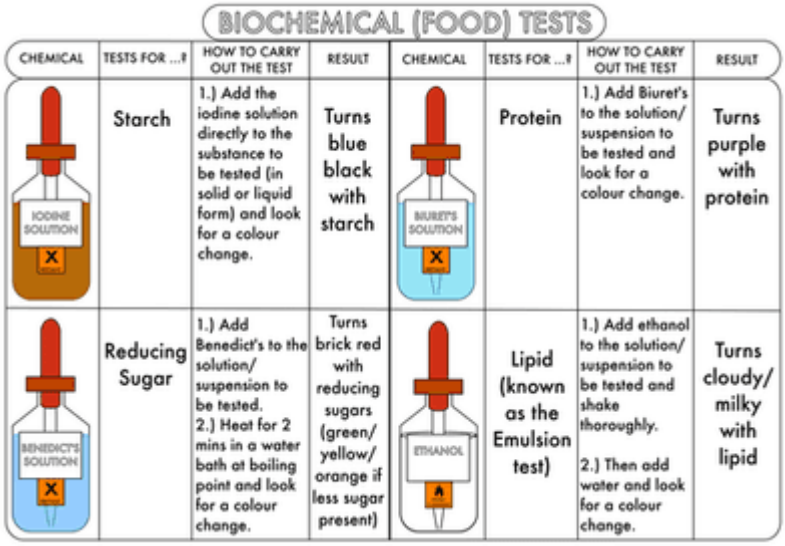
Food Tests

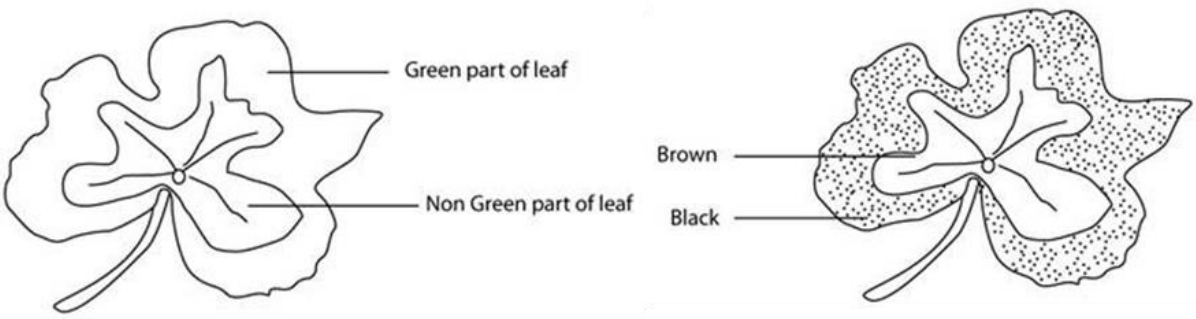
- **Starch:** Add a few drops of iodine solution, +ve result = blue-black colour
- **Reducing Sugars:** Add Benedict's reagent, and then the mixture is heated in a water bath for 2 to 3 minutes.
    - +ve result (increasing concentration of sugar) = blue → brick red
    - -ve result = remains blue
- **Proteins:** Add few drops of Biuret reagent, +ve result = purple/lilac color, -ve result = remains blue
- **Fats:** For the emulsion test, ethanol is added to the mixture and poured into a test tube with an equal amount of distilled water, +ve result = milky-white emulsion.
- **Vitamin C**: Add 1 cm3 of DCPIP solution and a small amount of food sample (as a solution) to a test tube. A positive test will show the blue colour of the dye disappearing.



Factors of Photosynthesis

Chlorophyll Is Necessary for Photosynthesis

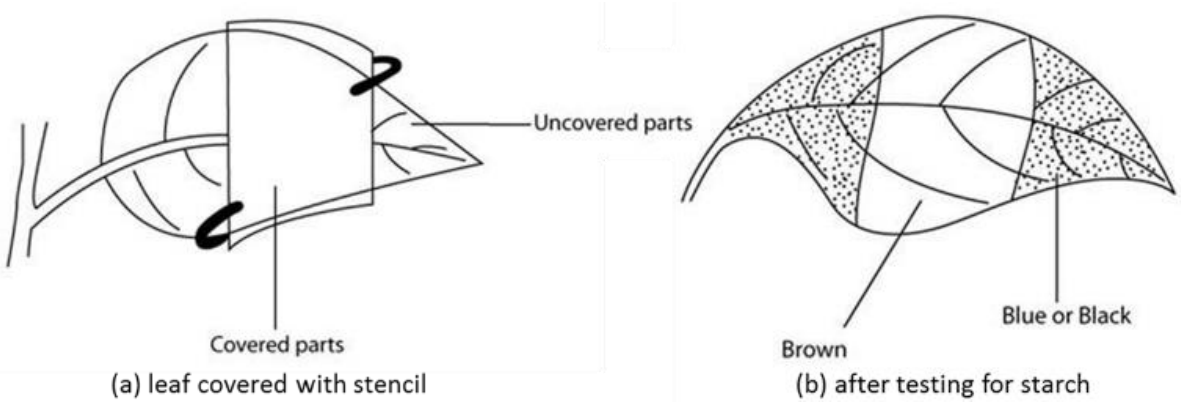
- Take a potted plant with variegated (green and white) leaves.
- Destarch the plant by keeping it in complete darkness for 48hrs
- Expose the plant to the sunlight for a few days.
- Leaf boiled in water for 2 minutes to break down cell walls,
- denature enzymes and allow for easier penetration by ethanol.
- Warmed in ethanol until leaf is colourless to extract chlorophyll,
- which would mask observation
- Dipped in water briefly: to soften leaf and then Leaf is placed on a white tile and iodine is added. If starch is present, colour will be blue-black and if absent, it will remain orange



(a) variegated leaf before (b) after testing for starch

Light Is Necessary for Photosynthesis

- Destarch the plant by keeping it in darkness for 48hrs
- Place a stencil over part of a leaf
- Place the leaf in sunlight for 4-6 hours
- Remove the stencil and test for starch
- -ve result = parts which received light turn black
- +ve result = parts which didn't receive light remain yellow/brown

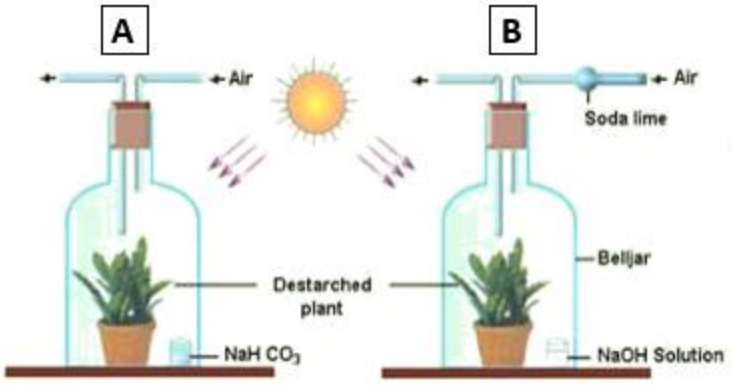


(a) leaf covered with stencil

(b) after testing for starch

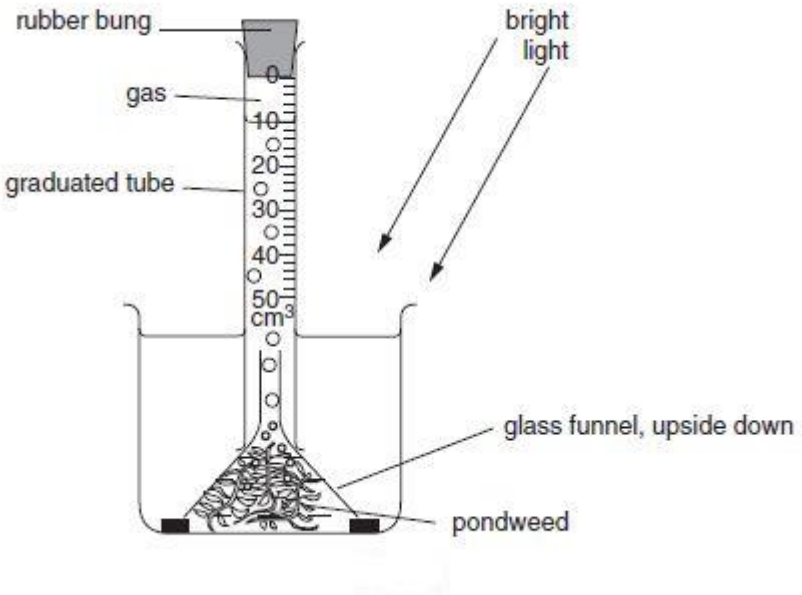
Carbon Dioxide Is Necessary for Photosynthesis

- Take two destarched potted plants.
- Cover both the plants with bell jars and label them as A and B.
- Inside A, keep $NaHCO_3$ (sodium bicarbonate). It produces CO_2.
- Inside B, keep NaOH (Sodium hydroxide). It absorbs CO_2.
- Keep both the set-ups in the sunlight for at least 6 hours.
- Perform the starch test on both of the plants.
- The leaves of Plant A will turn black after the starch test
- The leaves of Plant B will remain orange/brown after starch test



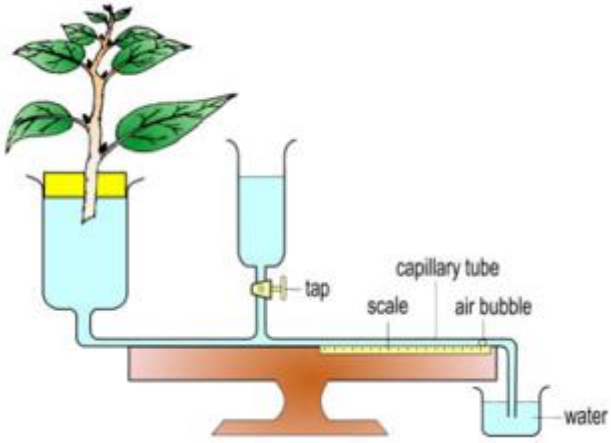
Investigating what happens when varying the factors affecting photosynthesis

- **Light intensity:** First a lamp is placed as close as possible to the apparatus, then the experiment is repeated several times, each times with the lamp further away from the apparatus. Heat from the bulb is prevented by placing a clear glass sheet between the lamp and the apparatus, and the pond weed used is left for several minutes in each new light intensity to allow it to adjust to new conditions before rate is measured.
- **Carbon dioxide:** vary the amount of hydrogen carbonate in the solution, this supplies the plant with carbon dioxide for photosynthesis
- **Temperature:** set up the apparatus in several different-temperature environments



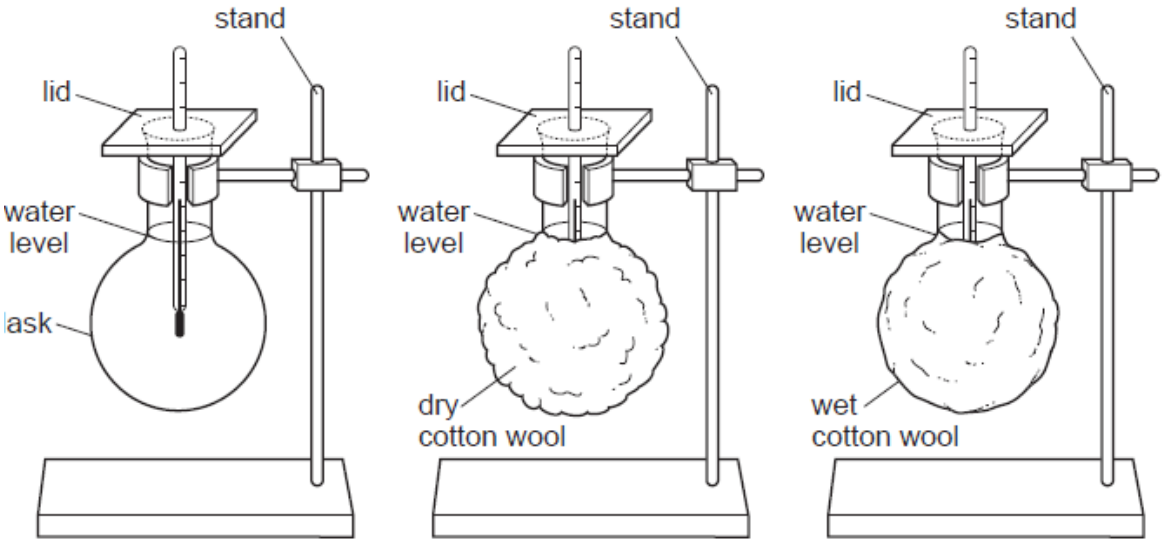
Investigating Transpiration

- Use a sharp razor blade to cut a leafy shoot under water.
- Insert the leafy shoot through the hole of the stopper provided with the potometer.
- Fill the potometer with water and fit the stopper holding the leafy shoot to the apparatus.
- Trap an air bubble in the capillary tube by the following procedures:
    - dip the end of the capillary tube into a beaker of water,
    - close the tap of the reservoir,
    - take away beaker of water and allow the plant to transpire
    - re-immerse the capillary tube into the beaker of water again.
- Estimate rate of transpiration by measuring distance moved by the air bubble per unit time.



Investigating Insulation

- Flask A represents a hairless mammal, B represents a mammal with dry fur and C represents a mammal with wet fur
- Equal amounts of hot water are added to the flask and temperature change after a set period of time is measured using a submerged thermometer.
- Lowest temperature change means best insulated.



flask **A** flask **B** flask **C**

Respiration

Respiration: the breakdown of nutrient molecules to release the energy between their bonds.

Aerobic Respiration

- Chemical reactions in cells that use oxygen to break down nutrient molecules to release energy.
- Glucose + oxygen → carbon dioxide + water
- $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$

Anaerobic Respiration

- Chemical reactions in cells that do not use oxygen to break down nutrient molecules to release energy. It releases much less energy per glucose molecule than aerobic respiration.
- In yeast: Glucose → carbon dioxide + ethanol
- $C_6H_{12}O_6 + \rightarrow 2CO_2 + 2C_2H_5OH$.
- In muscles during vigorous exercise: Glucose → Lactic acid

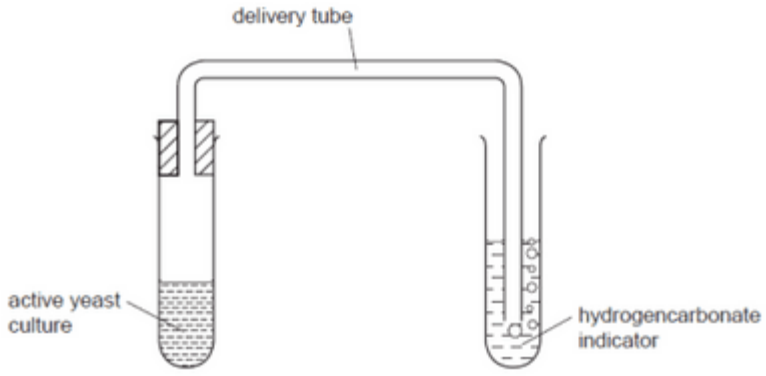
Effect of Temperature on the Rate of Respiration

As temperature increases, molecules gain more **kinetic energy**, moving faster and colliding successfully at a higher rate.

Therefore, up to a certain point, as temperature increases, the rate of respiration increases.

However, because respiration is an enzyme-catalysed reaction, the enzymes begin to denature at specific temperatures.

Therefore, if the temperature increases drastically from optimum, the reaction rate will slow down, as the reaction can no longer be catalysed by enzymes properly.

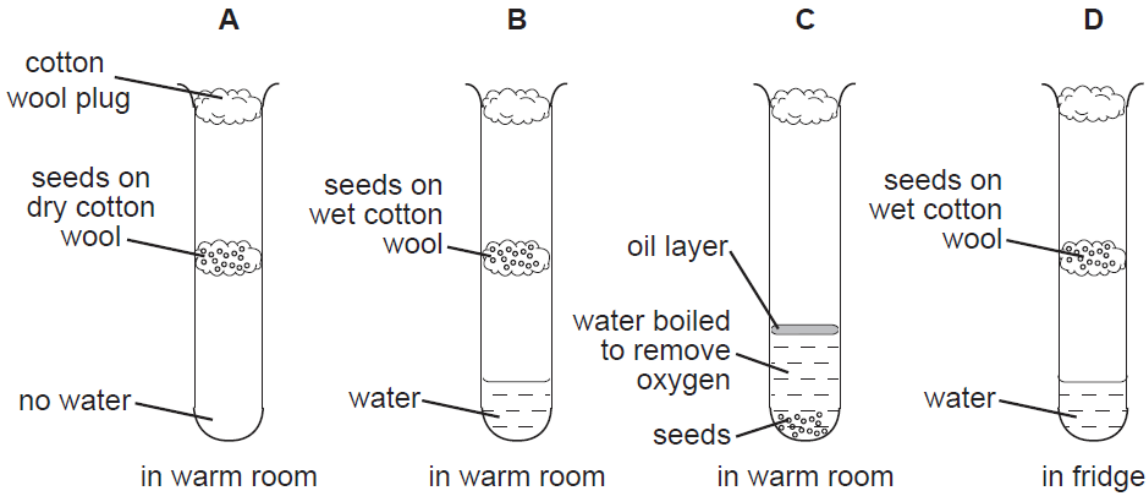


Good Procedures

- Repeat readings to spot anomalous errors or to calculate an average
- Avoid making parallax errors, {the line of sight should be perpendicular to the reading on the scale}
- Look carefully at any scale that is used
- Notice the unit in which the scale is calibrated - always give the unit of any measurement
- Notice the maximum reading that can be obtained
- Notice the smallest change in value that can be obtained
- Aim to use quantities that have magnitudes that are towards the upper values of the scale

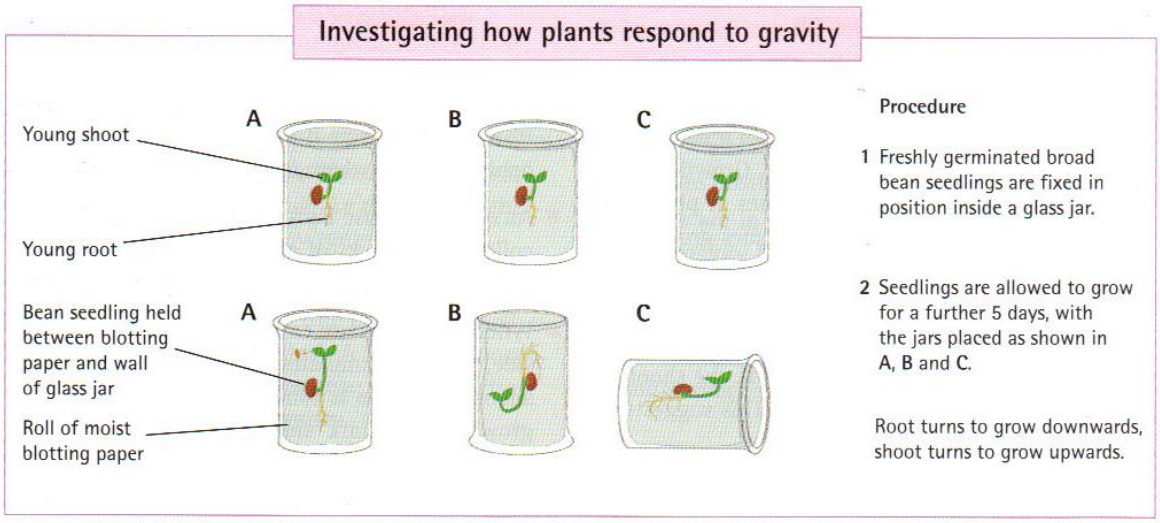
Germination

- B will germinate fastest because it has access to water, and oxygen, and is at a warm temperature.
- A does not have access to water
- C does not have access to oxygen
- D has a very cold temperature even though all other factors are present



Geotropism

- Freshly germinate seedlings inside a glass jar, the seed is held by a roll of moist clotting paper.
- Seedlings are allowed to grow for a further five days, with the jars placed a) the right way up b) upside down and c) on its side.
- In each case the roots will turn to go downwards, and the shoot turns to grow upwards,



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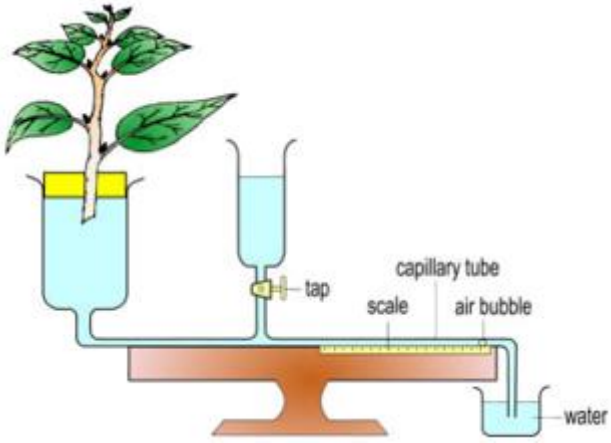

Phototropism

- There are three groups of oat shoots:
    - A) Has its tips removed, B) tips are covered and C) are untreated.
- The coleoptiles are measured, and lengths recorded.
- They are put in light proof boxes with one gap which only allow light to enter laterally
- They are measured 2-3 days later, and new lengths are recorded.
- Untreated coleoptiles will grow the most as they would bend towards the light