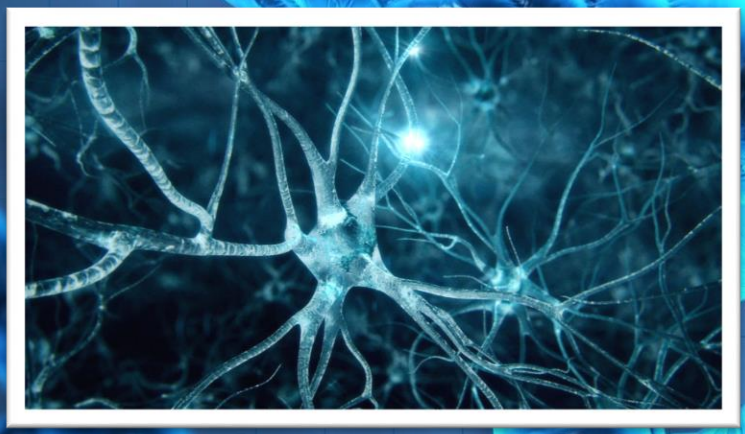
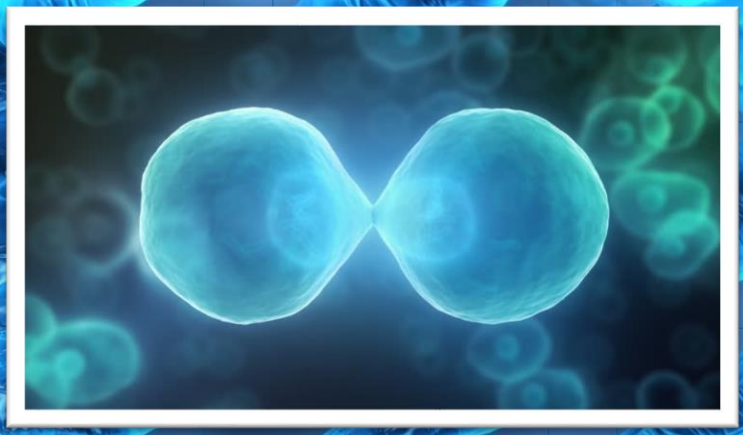




GCSE Biology Practical Book

Name -

Teacher -
Teacher -

GCSE Biology Required Practical Activities

At least 15% of the marks in the written exams will draw on the knowledge and understanding students have gained by carrying out the required practical activities.

Required Practical	Date Completed
Microscopy Use a light microscope to observe, draw and label a selection of plant and animal cells. A magnification scale must be included.	
Microbiology (Biology only) Investigate the effect of antiseptics or antibiotics on bacterial growth using agar plates and measuring zones of inhibition.	
Osmosis Investigate the effect of a range of concentrations of salt or sugar solutions on the mass of plant tissue.	
Enzymes Investigate the effect of pH on the rate of reaction of amylase enzyme. Students should use a continuous sampling technique to determine the time taken to completely digest a starch solution at a range of pH values. Iodine reagent is to be used to test for starch every 30 seconds. Temperature must be controlled by use of a water bath or electric heater.	
Food Tests Use qualitative reagents to test for a range of carbohydrates, lipids and proteins. To include: Benedict's test for sugars; iodine test for starch; and Biuret reagent for protein.	
Photosynthesis Investigate the effect of light intensity on the rate of photosynthesis using an aquatic organism such as pondweed.	
Reaction Time Plan and carry out an investigation into the effect of a factor on human reaction time.	
Plant Responses (Biology only) Investigate the effect of light or gravity on the growth of germinated seedlings. Record results as both length measurements and as careful, labelled biological drawings to show the effects.	
Field Investigations Measure the population size of a common species in a habitat. Use sampling techniques to investigate the effect of a factor on the distribution of this species.	
Decay (Biology only) Investigate the effect of temperature on the rate of decay of fresh milk by measuring pH change.	

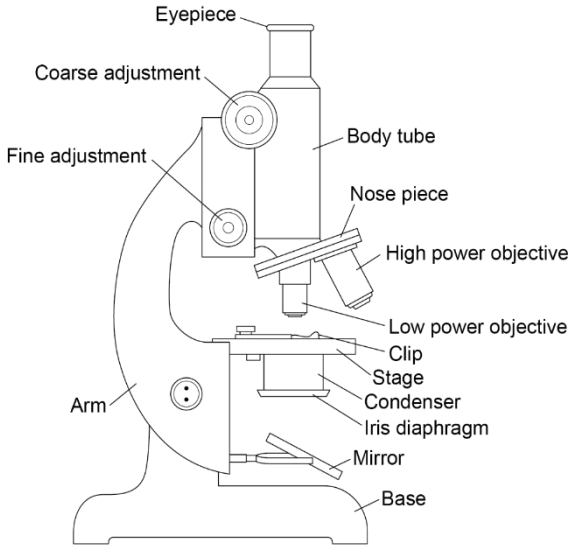
GCSE Biology required practical activity: Microscopy

Prepare A Microscope Slide To Show The Contents Of Cells From Onion Skin

Use an optical microscope to observe and draw the onion cells. You will also need to identify structures within the cells.
Your teacher will provide a selection of other plant and animal cells to view.

Method
You are provided with the following:

- a small piece of onion
- a knife
- a white tile
- forceps
- a microscope slide
- a coverslip
- a microscope
- iodine solution in a dropping bottle
- prepared animal and plant cells



Read these instructions carefully before you start work.

1. Use a dropping pipette to put one drop of water onto a microscope slide.
2. Separate one of the thin layers of the onion.
3. Peel off a thin layer of epidermal tissue from the inner surface.
4. Use forceps to put this thin layer on to the drop of water that you have placed on the microscope slide.
5. Make sure that the layer of onion cells is flat on the slide.
6. Put two drops of iodine solution onto the onion tissue.
7. Carefully lower a coverslip onto the slide. Do this by:
    - placing one edge of the coverslip on the slide
    - use the forceps to lower the other edge onto the slide.
8. There may be some liquid around the edge of the coverslip. Use a piece of paper to soak this liquid up.
9. Put the slide on the microscope stage.
10. Use the lowest power objective lens. Turn the nosepiece to do this.
11. The end of the objective lens needs to almost touch the slide. Do this by turning the coarse adjustment knob. Look from the side (not through the eyepiece) when doing this.
12. Now looking through the eyepiece, turn the coarse adjustment knob in the direction to increase the distance between the objective lens and the slide. Do this until the cells come into focus.
13. Now rotate the nosepiece to use a higher power objective lens.
14. Slightly rotate the fine adjustment knob to bring the cells into a clear focus and use the high-power objective to look at the cells.
15. Make a clear, labelled drawing of some of these cells. Make sure that you draw and label any component parts of the cell.
16. Write the magnification underneath your drawing.
17. Use this technique to draw a range of animal and plant cells on prepared slides.

Results

GCSE Biology required practical activity: Microbiology

Investigating The Effect Of Antiseptics On The Growth Of Bacteria

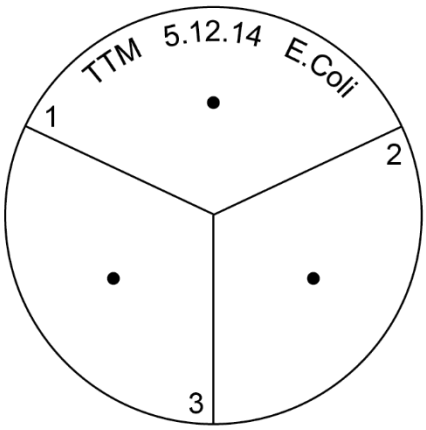
Risk Assessment

- Ensure that your work spaces and hands are thoroughly cleaned before and after the experiment.
- Care must be taken when handling microorganisms such as bacteria. You will use techniques called aseptic techniques during this experiment to avoid contamination.
- Contamination can occur when microorganisms from:
    - the surroundings get into your experiment and spoil your results
    - your experiment get into the surroundings and cause a potential health hazard.

Method

You are provided with the following:

- a nutrient agar plate
- a heatproof mat
- filter paper discs
- three antiseptics
- disinfectant bench spray
- 1% VirKon disinfectant
- forceps
- clear tape
- hand wash
- a wax pencil
- access to an incubator (set to 25oC).

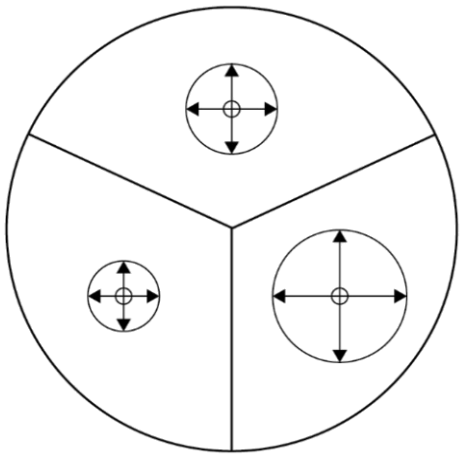


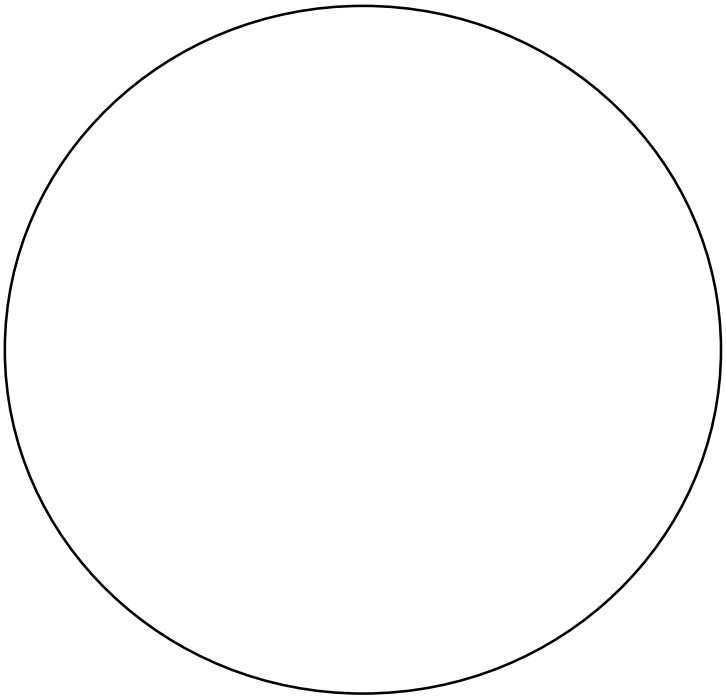
Read these instructions carefully before you start work.

1. Spraying the bench where you are working with disinfectant spray. Then wipe with paper towels.
2. Mark the underneath of a nutrient agar plate (not the lid) with the wax pencil
3. as follows (make sure that the lid stays in place to avoid contamination):
    - divide the plate into three equal sections and number them 1, 2 and 3 around the edge
    - place a dot into the middle of each section
    - around the edge write your initials, the date and the name of the bacteria (E. coli)
4. Wash your hands with the antibacterial hand wash.
5. Put different antiseptics onto the three filter paper discs. This can be done by either soaking them in the liquid or spreading the cream or paste onto them.
6. Carefully lift the lid of the agar plate at an angle. Do not open it fully.
7. Use forceps to carefully put each disc onto one of the dots drawn on with the wax pencil.
8. Make a note of which antiseptic is in each of the three numbered sections of the plate.
9. Secure the lid of the agar plate in place using two small pieces of clear tape.
10. Do not seal the lid all the way around as this creates anaerobic conditions. Anaerobic conditions will prevent the E. coli bacteria from growing and can encourage some other very nasty bacteria to grow.
11. Incubate the plate at 25°C for 48 hours.
12. Measure the diameter of the clear zone around each disc by placing the ruler across the centre of the disc. Measure again at 90° to the first measurement so that the mean diameter can be calculated.
13. Record your results in a table.

Results

2 measurements
of each clear zone





GCSE Biology required practical activity: Osmosis

Investigating Osmosis In Potato Tissue

Osmosis is the movement of water through a selectively permeable membrane. The water moves from an area of high concentration of water to an area of lower concentration of water.

Plant tissues can be used to investigate osmosis. This experiment uses potato, but other tissue such as sweet potato, carrot or beetroot can be used.

Potato tissue is cut into equal sized cylinders. The potato tissue is left overnight in sugar solution and distilled water. The changes in length and mass can then be accurately compared.

Risk Assessment

Care should be taken:

- cutting potato cylinders
- with the use of an electrical balance in the presence of water.

Method

You are provided with the following:

- a potato
- a cork borer or potato chipper/vegetable stick cutter
- a ruler
- a 10 cm^3 measuring cylinder
- labels
- three boiling tubes
- a test tube rack
- paper towels
- a sharp knife
- a white tile
- a range of sugar solutions
- distilled water
- a top-pan balance.

Read these instructions carefully before you start work.

1. Use a cork borer to cut five potato cylinders of the same diameter.
2. Trim the cylinders so that they are all the same length (about 3 cm).
3. Accurately measure and record the length and mass of each potato cylinder.
4. Measure 10 cm3 of the 1.0 M sugar solution and put into the first boiling tube. Label boiling tube as: 1.0. M sugar.
5. Repeat step 4 to produce the additional labelled boiling tubes containing solutions of 0.75 M, 0.5 M. and 0.25 M.
6. Measure 10 cm^3 of the distilled water and put into the fifth boiling tube. Label boiling tube as water.
7. Add one potato cylinder to each boiling tube. Make sure you know the length and mass of each potato cylinder in each boiling tube.
8. Record the lengths and masses of each potato cylinder in a table.
9. Leave the potato cylinders in the boiling tubes overnight in the test tube rack.
10. Remove the cylinders from the boiling tubes and carefully blot them dry with the paper towels.
11. Re-measure the length and mass of each cylinder (make sure you know which is which).
12. Record your measurements in the table. Then calculate the changes in length and mass of each potato cylinder.
13. Plot a graph with: 'Change in mass in g' on the y-axis 'Concentration of sugar solution' on the x-axis.
14. Plot another graph with: 'Change in length in mm' on the y-axis 'Concentration of sugar solution' on the x-axis.
15. Compare the two graphs that you have drawn.

Results

	Concentration of Sugar (M) or (%)				
Initial length (mm)					
Final length (mm)					
Change in length (mm)					
Initial mass (g)					
Final mass in (g)					
Change in mass in (g)					

GCSE Biology required practical activity: Enzymes

Investigating The Effect Of Ph On The Enzyme Amylase

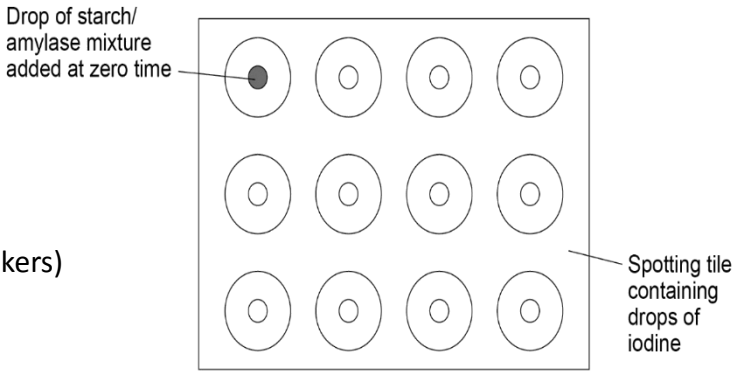
The enzyme amylase controls the breakdown of starch in our digestive system. We are able to simulate digestion using solutions of starch and amylase in test tubes. We can also determine the optimum conditions required.

The presence or absence of starch can be determined using iodine solution. In this experiment, we can measure how long the amylase takes to break down the starch at different pHs.

Risk Assessment

Safety goggles should be worn throughout.

Take care with boiling water.



Method

You are provided with the following:

- test tubes
- a test tube rack
- water bath (electrical or Bunsen burner and beakers)
- spotting tiles
- 5 cm^3 measuring cylinder
- syringes
- a stop clock
- starch solution
- amylase solution
- buffered solutions covering a range of pH, each with a labelled syringe/ plastic pipette
- iodine solution
- syringes.

Read these instructions carefully before you start work.

1. Place one drop of iodine solution into each depression on the spotting tile.
2. Place labelled test tubes containing the buffered pH solutions, amylase solution and starch solutions in to the water bath
3. Allow the solutions to reach 25°C
4. Add 2cm^3 of one of the buffered solutions to a test tube.
5. Use the syringe to place 2 cm^3 of amylase into the buffered pH solution.
6. Use another syringe to add 2 cm^3 of starch to the amylase/buffer solution.
7. Immediately start the stop clock and leave it on throughout the test.
8. Mix using a glass rod.
9. After 30 seconds, remove one drop of the mixture with a glass rod.
10. Place this drop on the first depression of the spotting tile with the iodine solution. The iodine solution should turn blue-black.
11. **Rinse the rod.**
12. Use the glass rod to remove one drop of the mixture every 30 seconds. Put each drop onto the iodine solution in the next depression on the spotting tile. Rinse the glass rod with water after each drop. Continue until the iodine solution and the amylase/buffer/starch mixture remain orange.
13. Repeat the procedure with solutions of other pHs
14. Record your results in a table.
15. Plot a graph with: 'Time taken to break down starch (s)' on the y-axis, 'pH of solution' on the x-axis

Or Calculate the rate of reaction and plot a graph with: 'Rate of reaction' on the y-axis 'pH of the solution' on the x-axis.

Results

GCSE Biology required practical activity: Food tests

Testing For Sugars

In this experiment you will test one or more foodstuffs for the presence of carbohydrates.

Risk Assessment

- Safety goggles should be worn when carrying out the tests.
- Wash off spills on skin immediately.
- Take care with boiling water.

Method

You are provided with the following:

- food to be tested
- a pestle and mortar
- a stirring rod
- filter funnel and filter paper
- 2 x beaker, 250 ml
- a conical flask
- 2 x test tube
- Benedict's solution
- iodine solution
- kettle for boiling water
- a thermometer
- safety goggles.

Read these instructions carefully before you start work.

1. Use a pestle and mortar to grind up a small sample of food.
2. Transfer the ground up food into a small beaker. Then add distilled water.
3. Stir the mixture so that some of the food dissolves in the water.
4. Filter using a funnel with filter paper to obtain as clear a solution as possible.
5. The solution should be collected in a conical flask.
6. Half fill a test tube with some of this solution.
7. Add 10 drops of Benedict's solution to the solution in the test tube.
8. Put hot water from a kettle in a beaker. The water should not be boiling.
9. Put the test tube in the beaker for about five minutes.
10. Note any colour change.
11. If a reducing sugar (such as glucose) is present, the solution will turn green, yellow, or brick-red. The colour depends on the sugar concentration.
12. Take 5 ml of the solution from the conical flask and put it into a clean test tube.
13. Add a few drops of iodine solution and note any colour change.
14. If starch is present, you should see a black or blue-black colour appear.
15. Record your results in a table.

GCSE Biology required practical activity: Food tests

Testing For Lipids

In this experiment you will test one or more foodstuffs for the presence of lipids (fats).

Risk Assessment:

Safety goggles should be worn when carrying out the tests.
Sudan III contains ethanol, which is highly flammable. Keep the solution away from naked flames.
Wash off spills on skin immediately.

Method

- You are provided with the following:
- food to be tested
- a pestle and mortar
- a stirring rod
- 2 x beaker, 250 ml
- a test tube
- Sudan III stain solution.
- safety goggles.

Read these instructions carefully before you start work.

1. Use a pestle and mortar to grind up a small sample of food.
2. Transfer the ground up food into a small beaker. Then add distilled water.
3. Stir the mixture so that some of the food dissolves in the water. Do not filter.
4. Half fill a test tube with some of this solution.
5. Add 3 drops of Sudan III stain to the solution in the test tube. Shake gently to mix.
6. If fat is present: a red-stained oil layer will separate out and float on the water surface.

Testing For Protein

In this experiment you will test one or more foodstuffs for the presence of protein.
Risk assessment:
Safety goggles should be worn when carrying out the tests.
Biuret solution contains copper sulphate, which is poisonous, and sodium hydroxide, which is caustic.
Wash off spills on skin immediately.

Method

- You are provided with the following:
- food to be tested
- a pestle and mortar
- a stirring rod
- a filter funnel and filter paper
- 2 x beaker, 250 ml
- a test tube
- Biuret solution
- safety goggles.

Read these instructions carefully before you start work.

1. Use a pestle and mortar to grind up a small sample of food.
2. Transfer the ground up food into a small beaker. Then add distilled water.
3. Stir the mixture so that some of the food dissolves in the water.
4. Filter using a funnel with filter paper to obtain as clear a solution as possible.
5. The solution should be collected in a conical flask.
6. Put 2 cm^3 of this solution into a test tube.
7. Add 2 cm^3 of Biuret solution to the solution in the test tube. Shake gently to mix.
8. Note any colour change. Proteins will turn the solution pink or purple .

Results

Name Of Food Tested	Colour Produced With Benedict's Solution	Colour Produced With Iodine Solution	Colour Produced With Biuret Solution	Colour Produced With Sudan III

GCSE Biology required practical activity: Photosynthesis

Investigating The Effect Of Light Intensity On Photosynthesis In Pondweed

Plants use carbon dioxide and water to produce glucose and oxygen. This process is called photosynthesis. The rate of photosynthesis is affected by many factors, such as:

- light intensity
- light wavelength.

Aquatic plants produce visible bubbles of oxygen gas into the surrounding water when they photosynthesise. These bubbles can be counted as a measure of the rate of photosynthesis. Pondweed is an example of an aquatic plant.

The effect of light intensity can be investigated by varying the distance between pondweed and a light source. The closer the light source, the greater the light intensity.

Risk Assessment

Care should be taken:

- when handling glassware
- with the use of lamps that may get hot
- with the presence of water and the electrical power supply for the lamp.

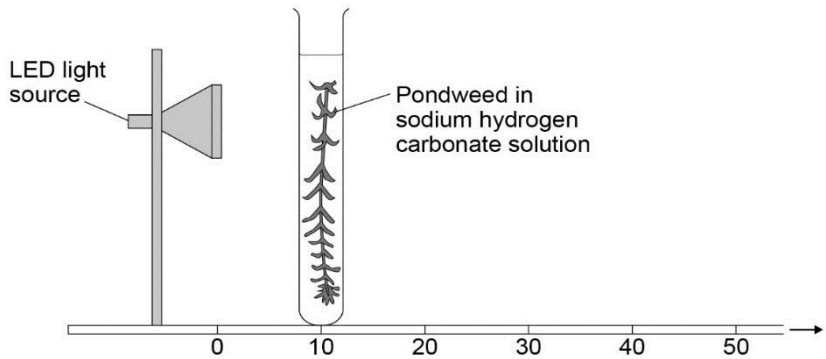
Method

You are provided with the following:

- a boiling tube
- freshly cut 10 cm piece of pondweed
- a light source
- a ruler
- a test tube rack
- a stop watch
- 0.2% solution of sodium hydrogen carbonate
- a glass rod.

Read these instructions carefully before you start work.

1. Set up a test tube rack containing a boiling tube at a distance of 10 cm away from the light source
2. Fill the boiling tube with the sodium hydrogen carbonate solution.
3. Put the piece of pondweed into the boiling tube with the cut end at the top. Gently push the pondweed down with the glass rod.
4. Leave the boiling tube for 5 minutes.
5. Start the stop watch and count the number of bubbles produced in one minute.
6. Record your results in a table.
7. Repeat the count twice more. Then use the data to calculate the mean number of bubbles per minute.
8. Repeat steps 1–7 with the test tube rack and boiling tube at distances of 20 cm, 30 cm and
9. 40 cm from the light source.



Results

Distance between pondweed and light source (cm)	Number of bubbles (minute)			
	1	2	3	Mean
10				
20				
30				
40				

GCSE Biology required practical activity: Reaction Time

Investigating Whether Practice Reduces Human Reaction Times

Messages travel very quickly around your body through the nervous system. This is so that you are able to respond to changes in the environment. The time it takes for you to respond to such a change is called your reaction time.
Athletes spend hours practising to try to reduce their reaction time. This is to help them improve their performance in their particular sport. Responding quicker to the starter's pistol in a race can gain you the advantage over other runners.
You will conduct a simple, measurable experiment called the ruler drop test. From this you can determine whether your reaction time can be reduced with practice.

Risk Assessment
Care should be taken to avoid injury from the falling ruler.

Method
You are provided with the following:
- a metre ruler
- a chair
- a table
- a partner.

Read these instructions carefully before you start work:
1. Use your weaker hand for this experiment. If you are right handed then your left hand is your weaker hand.
2. Sit down on the chair with good upright posture and eyes looking across the room.
3. Place the forearm of your weaker arm across the table with your hand overhanging the edge of the table.
4. Your partner will hold a ruler vertically with the bottom end (the end with the 0 cm) in between your thumb and first finger.
5. Practice holding the ruler with those two fingers.
6. Your partner will take hold of the ruler and ask you to remove your fingers.
7. Your partner will hold the ruler so the zero mark is level with the top of your thumb. They will tell you to prepare to catch the ruler.
8. Your partner will then drop the ruler without telling you.
9. You must catch the ruler as quickly as you can when you sense that the ruler is dropping.
10. After catching the ruler, look at the number level with the top of your thumb.
11. Record this in a table such as the one here.
12. Have a short rest and then repeat the test. Record the number on the ruler as attempt 2.
13. Continue to repeat the test several times.
14. Swap places with your partner. Repeat the experiment to get their results.
15. Use a conversion table to convert your ruler measurements into reaction times.

Results

Drop test attempts	Ruler measurements in cm		Reaction times in seconds	
	Person 1	Person 2	Person 1	Person 2
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

GCSE Biology required practical activity: Plant responses

Investigating The Effect Of Light Intensity On The Growth Of Mustard Seedlings

Light affects the distribution of auxins within the stems of newly germinated seeds. The effect of light on this growth can be determined by measuring the height of shoots with a ruler.

Risk Assessment

Wash hands after handling seeds.

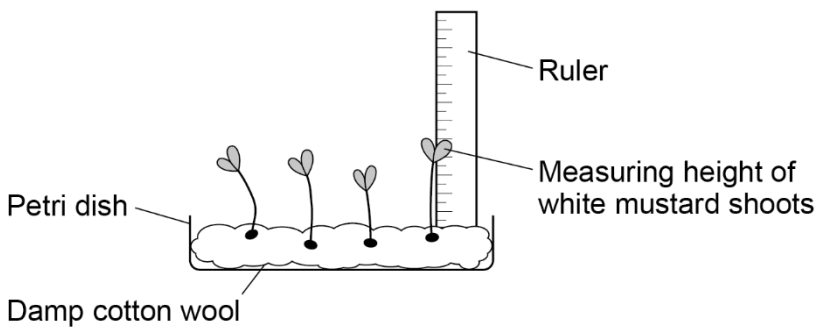
Method

You are provided with the following:

- white mustard seeds
- petri-dishes
- cotton wool
- a ruler
- water
- access to a light windowsill and a dark cupboard.

Read these instructions carefully before you start work.

1. Set up three petri dishes containing cotton wool soaked in equal amounts of water.
2. Put ten mustard seeds in each petri dish.
3. Put the petri dishes in a warm place. They must not be disturbed or moved.
4. Allow the mustard seeds to germinate.
5. Add more water if the cotton wool gets dry (equal amounts of water to each petri dish).
6. Each petri dish should have the same number of seedlings after the seeds have geminated. Remove excess seedlings from any dish that has too many.
7. For example, one dish has eight seedlings which are the fewest compared to the other petri dishes. Therefore, remove seedlings from the other petri dishes so that each dish has eight.
8. Move the petri dishes into position.
    - One should be placed on a windowsill in full sunlight.
    - One should be placed in partial light.
9. The third should be placed in darkness.
10. Measure the height of each seedling. Do this every day, for at least a week.
11. Record the heights in a table such as the one here.
12. You will need a table each for:
    - full sunlight
    - partial light
    - darkness.
13. Calculate the mean height of the seedlings each day.
14. Plot a graph with: 'Mean height in mm' on the y-axis 'Day' on the x-axis.
15. The graph should include data for full sunlight, partial light and darkness.
16. Compare the data.



Day	Height of seedling in full sunlight in mm								
	1	2	3	4	5	6	7	8	Mean
1									
2									
3									
4									
5									
6									
7									

Day	Height of seedling in partial sunlight in mm								
	1	2	3	4	5	6	7	8	Mean
1									
2									
3									
4									
5									
6									
7									

Day	Height of seedling in darkness in mm								
	1	2	3	4	5	6	7	8	Mean
1									
2									
3									
4									
5									
6									
7									

GCSE Biology required practical activity: Field investigations

This investigation has two parts:

1. Investigating the population size of a plant species using random sampling

2. Investigating the effect of a factor on plant distribution using a transect line.

Risk Assessment

Wash hands after handling seeds.

Method

You are provided with the following:

- a 25cm x 25cm quadrat
- a x 30 m tape measure
- a clipboard
- a pen
- paper.

Read these instructions carefully before you start work:

Investigating the population size of a plant species using random sampling.

1. Your teacher will have prepared a survey area for you and will show you how to identify plantain plants. You will need to work in threes.
2. Collect two numbers, one from each bag.
3. Use the numbers and the tape measures to locate the first position for your quadrat.
4. Lay the 25cm x 25 cm quadrat on the ground.
5. Replace the numbers in the bags.
6. Count and record the number of plantain inside the quadrat.
7. Collect two more numbers from the bags and use them to locate the next site.
8. Replace the numbers in the bags for other students to use.
9. Count and record the number of plantain inside the quadrat. Repeat steps 1 – 5 until you have recorded the numbers of plantain in 10 quadrats.
10. Your teacher will show you how to estimate the population of plantain using the equation:

"estimated population size = " "area sampled " /"total area" x number of plantain counted

Investigating the effect of a factor on plant distribution using a transect line

1. Your teacher will help you identify a species of plant to identify.
2. Lay the 30m tape measure in a line from the base of a tree to an open area of ground.
3. Put the 25cm x 25cm quadrat against the transect line. One corner of the quadrat should touch the 0 m mark on the tape measure.
4. Count the number of plants within the quadrat and record them in a table.
5. Move the quadrat 5 m up the transect line and count the number of plants again. Record in the table.
6. Continue to place the quadrat at 5 m intervals and count the number of plants in each quadrat.
7. Gather data from your class to produce a graph of plant numbers against light intensity.

Results

Distance along the transect line in m	Number of plants	Light intensity
0		
5		
10		
15		
20		
25		
30		

GCSE Biology required practical activity: Decay

Investigating The Effect Of Temperature On The Rate Of Decay Of Fresh Milk By Measuring pH Change

Phenolphthalein changes colour at around pH 8. For most purposes, this means that it is pink in alkaline solutions and colourless in acidic solutions.

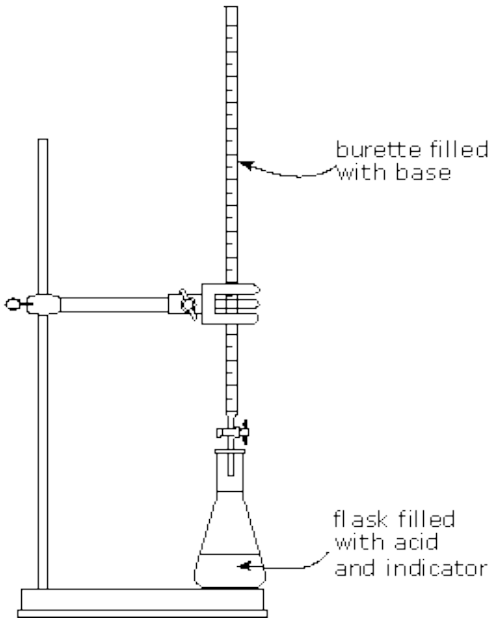
Method

You are provided with the following:

- Sodium Carbonate (Aq)
- Milk (Aged Between 0-5 Days)
- Phenolphthalein Indicator
- 100ml Conical Flask
- White Tile
- Paper Towel
- Burette
- 5ml syringe
- 1ml syringe
- 100ml beakers
- small funnel

Read these instructions carefully before you start work.

1. Set up the equipment as shown below.
2. Fill the burette with Na_2CO_3 (Sodium Carbonate) and note the starting volume.
3. Add 5ml of milk to the conical flask along with 1ml of phenolphthalein indicator.
4. Slowly add the acid from the burette to the alkali in the conical flask, swirling to mix.
5. Stop adding the Na_2CO_3 when the end-point is reached (the white solution should have gone and the solution now remains pink).
6. Note the final volume reading.
7. Repeat steps 1 to 6 two more times and for each age of milk.



Results

Milk Type	Volume of Na_2CO_3 (ml)									Average Volume of Na_2CO_3 (ml)
	Repeat 1			Repeat 2			Repeat 3			
	Start Volume	End Volume	Change in Volume	Start Volume	End Volume	Change in Volume	Start Volume	End Volume	Change in Volume	
Fresh										
1 Day Old										
2 Days Old										
3 Days Old										
4 Days Old										

GCSE Biology Required Practical Activities
AQA

Biology Department
Carmel College