Edexcel GCSE 9-1 Science

Biology Practicals

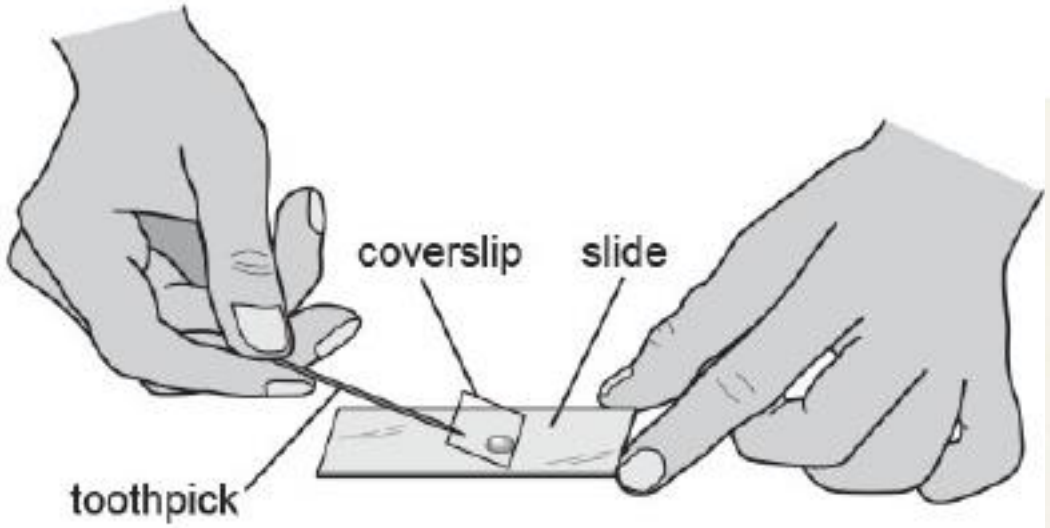
Looking at cells	Investigate biological specimens using microscopes including magnification calculations.
pH and enzyme activity	Investigate the effect of pH on enzyme activity using amylase (in solutions of different pH) to break down starch.
Food tests (Separate Only)	Investigate the use of chemical reagents to identify starch, reducing sugars, proteins and fats.
Osmosis in potato strips	Investigate osmosis in potatoes in different strength sugar solutions.
Microbial cultures (Separate Only)	Investigate the effects of antiseptics, antibiotics or plant extracts on microbial cultures using paper discs of the chemical on a bacterial plate.
Photosynthesis	Investigate the effect of light intensity on the rate of photosynthesis using pondweed.
Respiration	Investigate the rate of respiration in living organisms using woodlice.
Fieldwork	Investigate the relationship between organisms and their environment using field-work techniques, including quadrats and belt transects.

Practical 1

1.6	*Investigate biological specimens using microscopes including magnification calculations and labelled scientific drawings from observations*	This practical allows students to develop their skills in using a light microscope, preparing slides, and producing labelled scientific drawings. Students need to be familiar with the set-up and use of a light microscope, as well as to be able to identify structures that they see. Magnification calculations will also be required.

1. Microscopes

These are "objectives", they contain glass lenses



Remember to Aim!

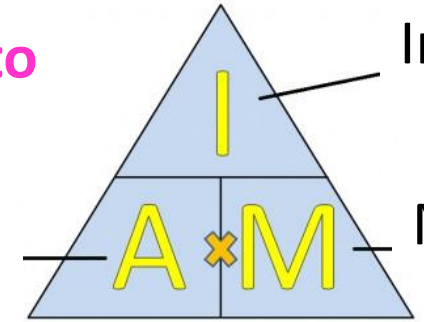


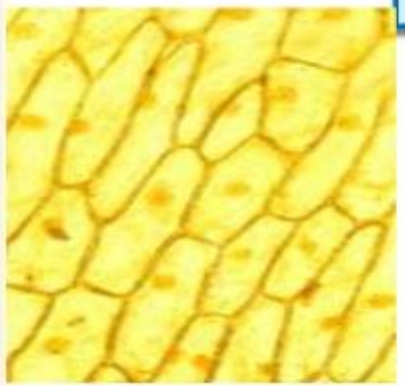
Image size

Actual size

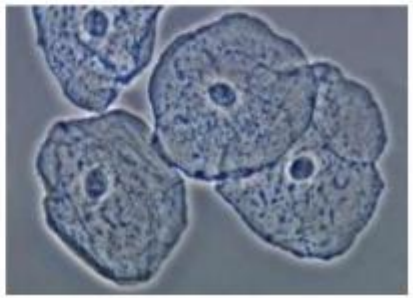
Magnification

- other cell structures which are not so obvious can often be shown up more clearly by the addition of dyes called **STAINS**

IODINE SOLUTION
To stain plant cells



METHYLENE BLUE
To stain animal cells



Answer these questions about the microscopes core practical

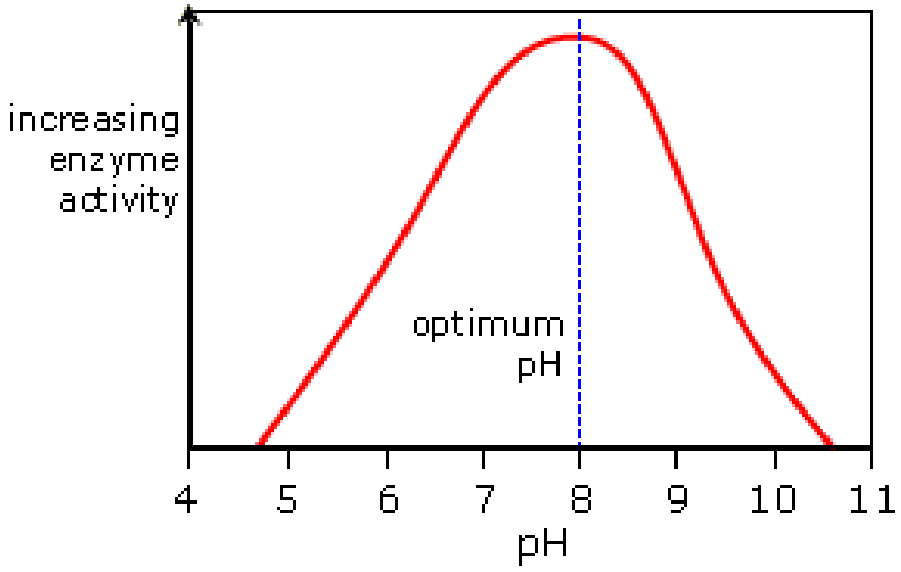
1. What is the practical trying to find out or demonstrate?
2. What equipment is used in the practical and what does it do?
3. Describe and explain the science underpinning the practical
4. Write down the key points of the method
5. What are the independent, dependent and Control variables?
6. What are the safety/risk factors that need to be taken into consideration?

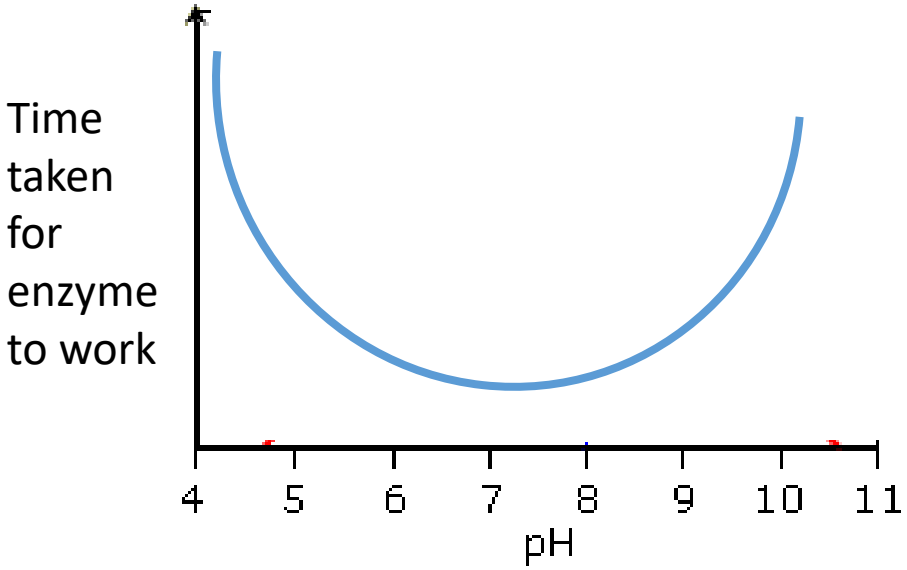
Practical 2

1.10	*Investigate the effect of pH on enzyme activity*	For this core practical students will investigate the effect of pH, however other variables can also be investigated to enhance practical work in this area. This method uses amylase (in solutions of different pH) to break down starch. The reaction can be monitored by using iodine to test the presence of starch in the solution with a continuous sampling method. To maintain the temperature of the solution, a Bunsen burner and water beaker must be used.

2. pH and enzymes

We did the SAME reaction at **DIFFERENT pHs**

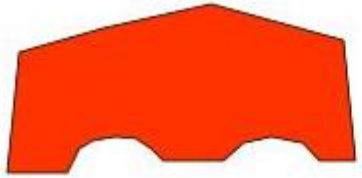




SPOTTING TILE!

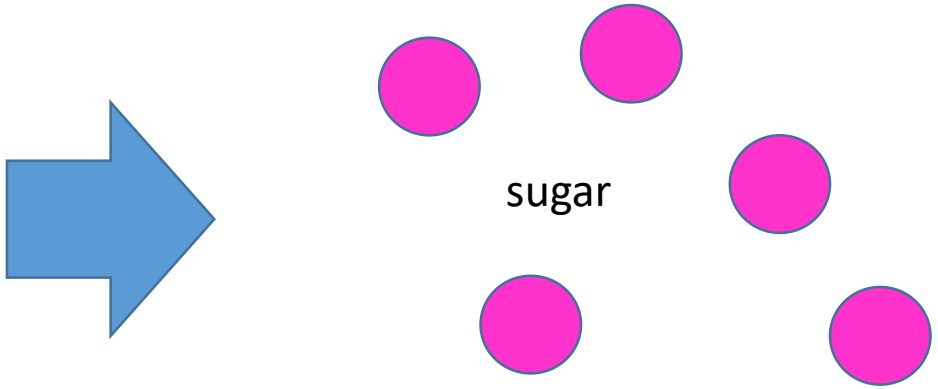
We took a sample every 20 sec.

Amylase enzyme



The enzyme fits over the substrate perfectly – like a key fits a lock.

Sugars joined together make STARCH, a carbohydrate



Answer these questions about the enzymes core practical

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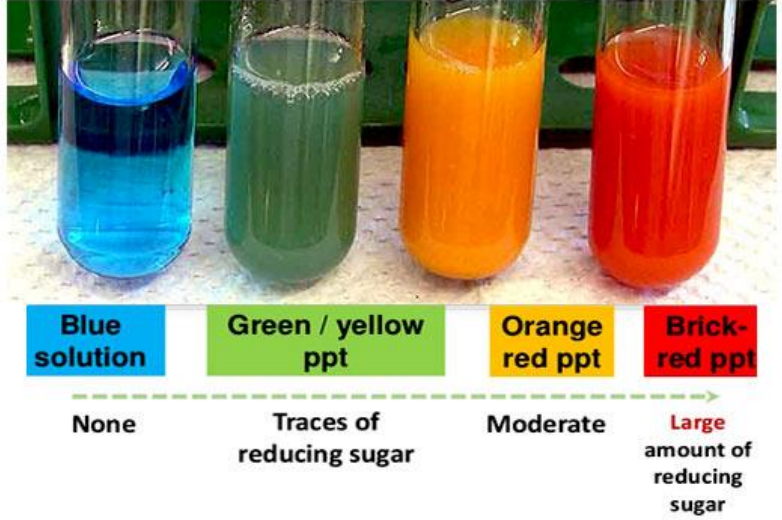
Practical 3

1.13B	*Investigate the use of chemical reagents to identify starch, reducing sugars, proteins and fats*	Carry out food tests shown below: 1. identify starch by using iodine solution 2. identify reducing sugars using Benedict's solution (and a water bath) 3. identify protein using the Biuret test (adding potassium hydroxide to a solution of the food, followed by copper sulfate) 4. identify fats and oils (lipids) using the emulsion test to show the formation of a precipitate

3. Testing foods (Separate Science)

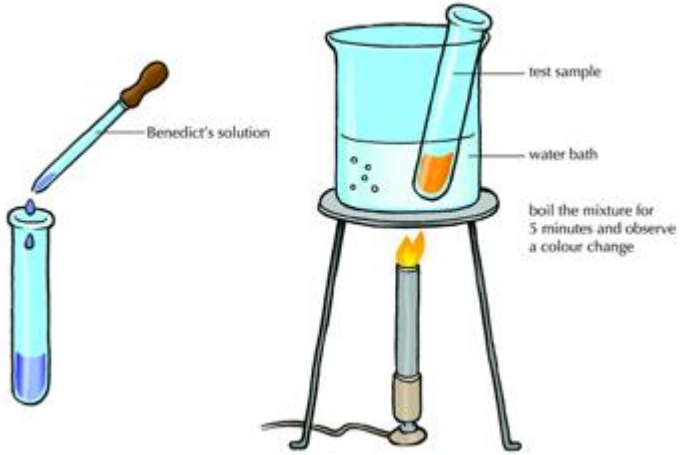
Iodine for starch



Benedicts test for sugars

Ethanol makes the fat precipitate

Emulsion test for lipids (or fats)



Biurette test for proteins

Answer these questions about the food tests core practical

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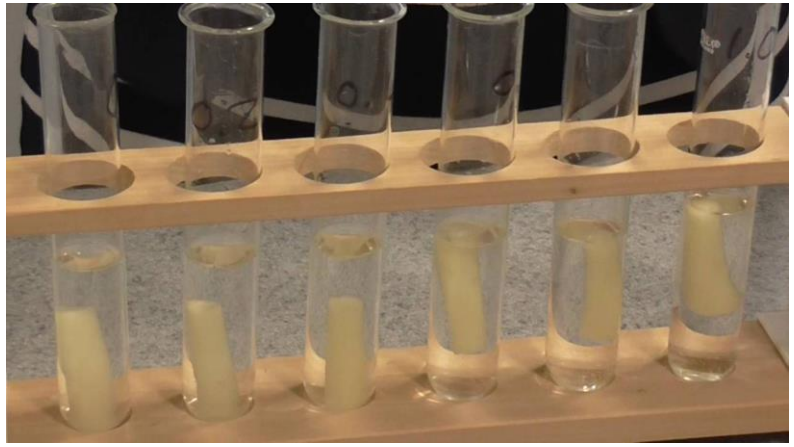
Practical 4

1.16	*Investigate osmosis in potatoes*	A known mass of potato must be added to sucrose solution, left for some time, and the final mass recorded to obtain the percentage change in mass. This investigation looks at the exchange of water between the potato and solution and allows the concentration of sucrose in the potato to be determined. The practical provides an opportunity for the appreciation of the need to control variables.

4. Osmosis in potato strips

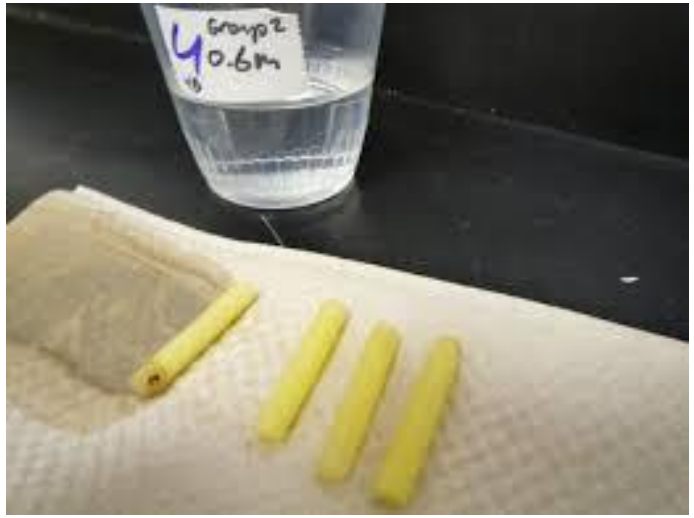


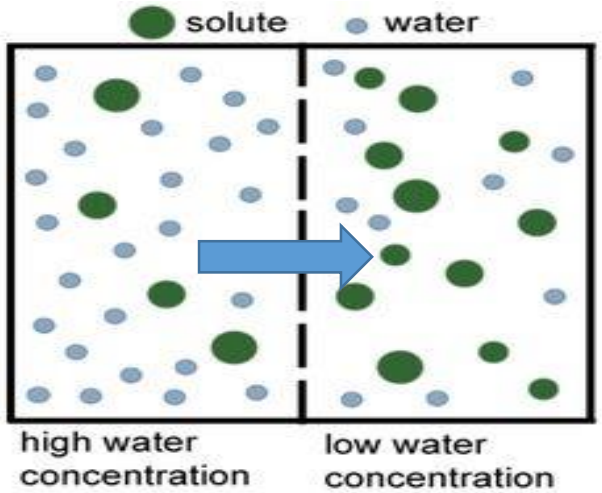
4 sucrose solutions: 0%, 40%, 80%, 100%

Calculate percentage change in mass

$$\frac{(\text{final mass} - \text{initial mass})}{\text{Start mass}} \times 100$$

Mass balance





Water diffuses from a high to a low concentration gradient through a semi-permeable membrane

Answer these questions about the osmosis core practical

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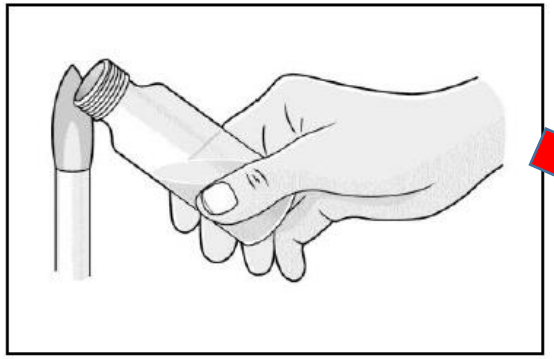
Practical 5

5.18B	*Investigate the effects of antiseptics, antibiotics or plant extracts on microbial cultures*	This practical provides the opportunity for learners to carry out aseptic techniques (Biology statement 5.17). Petri dishes pre-poured with agar must be inoculated with bacteria and discs of antiseptic/antibiotics/plant extracts can be used to determine their effect on bacterial growth. Sterile aseptic technique must include the use of a Bunsen burner.

5. Effect of disinfectants on microbes. (Separate science)

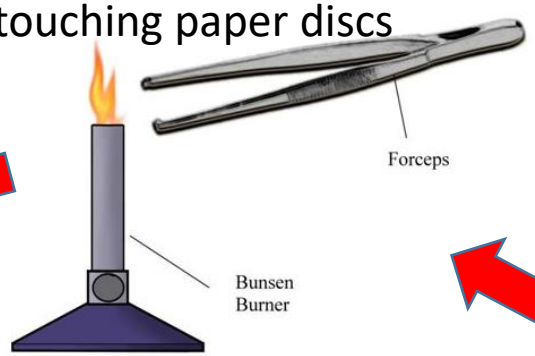
FLAME the neck of the AGAR bottle

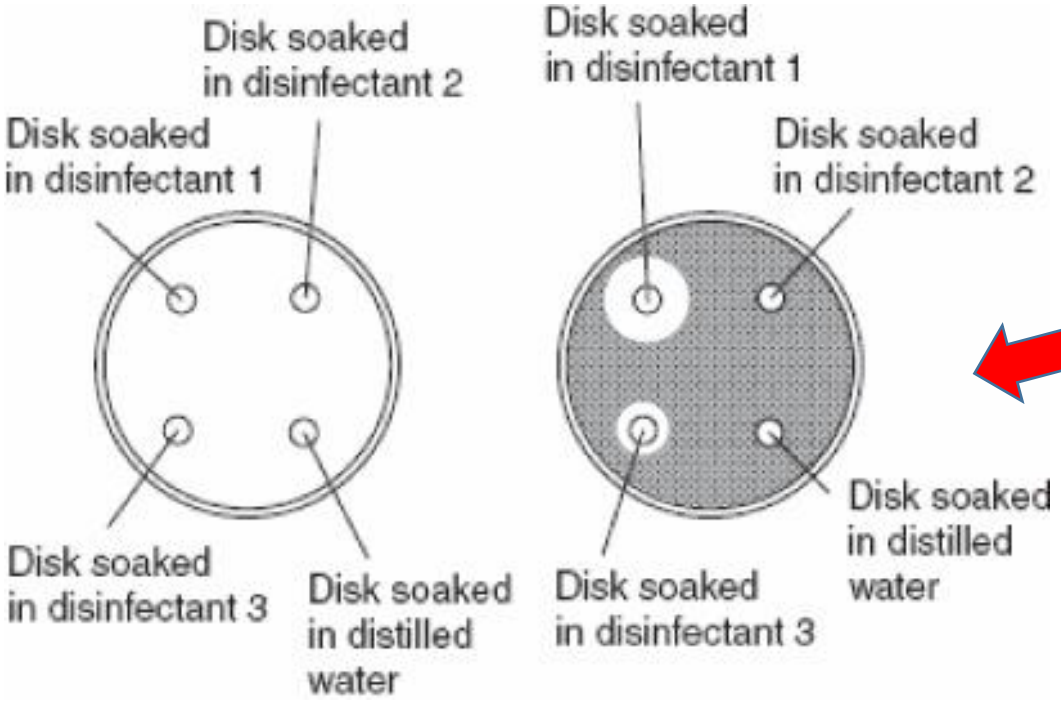


Pour the agar on to a sterile plate

When the agar jelly set we added bacterial culture

Flame forceps before touching paper discs





Recording your results

1 Measure the diameter of the circle around each disc where there is no bacterial growth.

2 Divide each diameter by 2 to calculate the radius (r) for each circle, and then calculate the area of no bacterial growth using the formula area = πr^2

3 Draw up and complete a table to record the area of no bacterial growth for each disc.

Answer these questions about the microorganisms core practical

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Practical 6

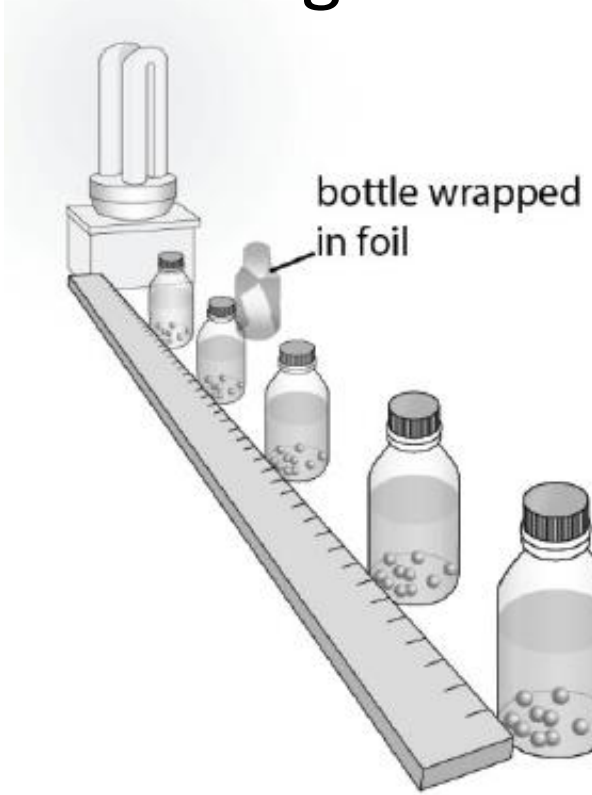
6.5	*Investigate the effect of light intensity on the rate of photosynthesis*	Algal balls (or similar) must be set up and placed at varying distances from a light source to investigate the effect of light intensity on the rate of photosynthesis. The rate must be measured and compared to the distance away from the light source.

Factors limiting photosynthesis. Three factors can limit the speed of photosynthesis: light intensity, carbon dioxide concentration and temperature. Without enough light, a plant cannot photosynthesise very quickly, even if there is plenty of water and carbon dioxide

6. How Light Intensity Affects Photosynthesis.

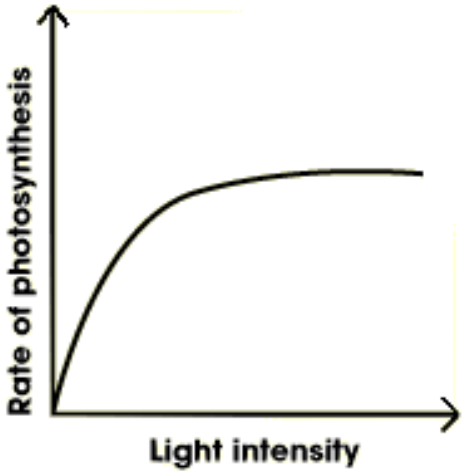
CONTROL VARIABLES

Same:
Mass of pondweed,
Volume of water,
Temp of water.
Type of lamp/bub.



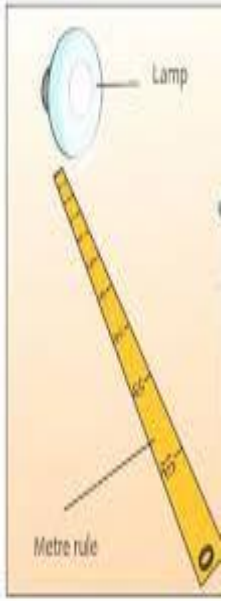
Distance from lamp to bottle (cm)		pH at start	pH at end	Rate of photosynthesis (change in pH/hour)

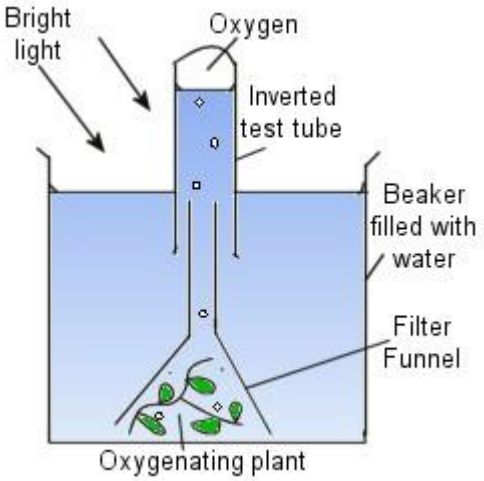
You can use bottles of algae which photosynthesise underwater. They produce CO2 which is acidic and changes the colour of water if we put indicator in it.



Or trap bubbles of oxygen from pondweed.

Use a measuring cylinder instead to measure the oxygen bubbles produced.





Answer these questions about the photosynthesis core practical

1. What is the practical trying to find out or demonstrate?
2. What equipment is used in the practical and what does it do?
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Practical 7

8.11	*Investigate the rate of respiration in living organisms*	Use of a simple respirometer to measure the effect of temperature on the oxygen consumption of some small organisms. A simple respirometer can be made using a tube with soda lime, cotton wool and organisms with a capillary tube to coloured liquid. Students can then track the progress of the liquid up the capillary tube over a set time. This experiment must be carried out using a water bath set at different temperatures. Safety and ethical considerations must also be covered.

7. Investigating Respiration at different temperatures

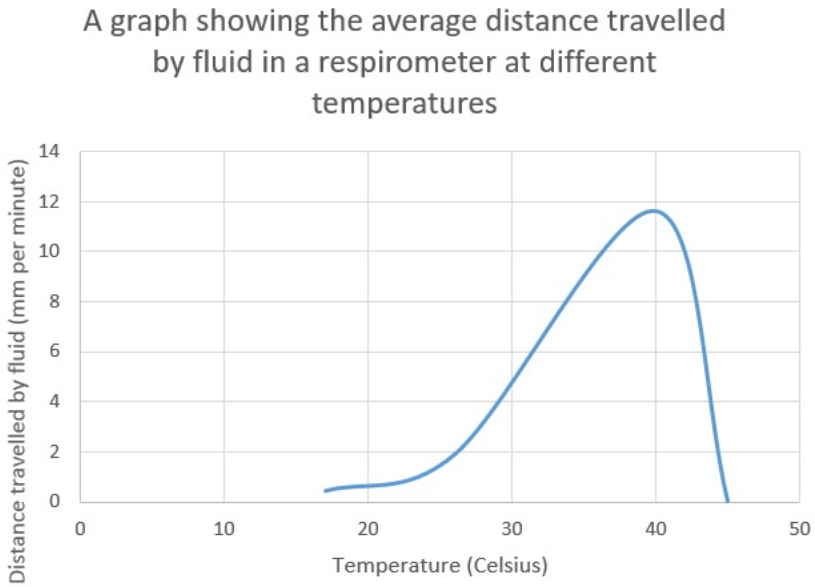
(glucose + oxygen -> carbon dioxide + water)

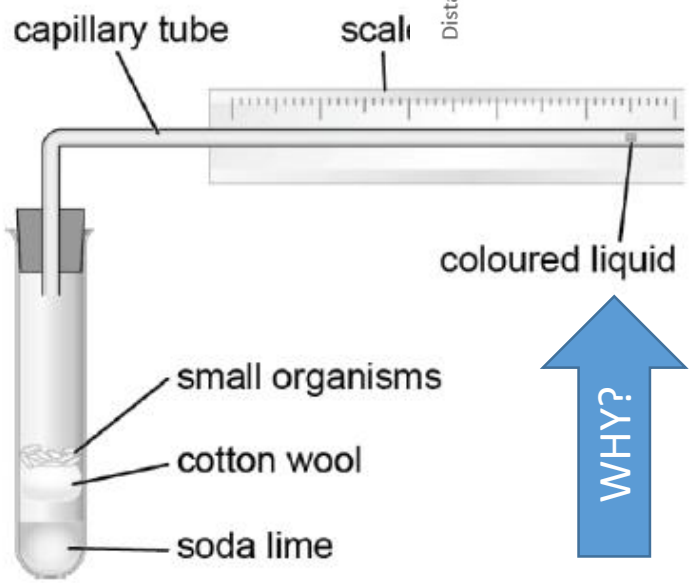
Safety

Treat living things with care.

Wash your hands after the practical.

Soda lime is corrosive.





WHY?

WHY?

WHY?

E Set up a control tube (without the organisms).

F Place both tubes into a rack in a water bath at a preset temperature. It is best to tilt the rack slightly so that the capillary tubes hang over the side of the water bath at an angle.

G Wait for five minutes to let the organisms adjust to the temperature of the water bath (maximum 40 °C).

Answer these questions about the respiration core practical

1. What is the practical trying to find out or demonstrate?
2. What equipment is used in the practical and what does it do?
3. Describe and explain the science underpinning the practical
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Practical 8

9.5	*Investigate the relationship between organisms and their environment using field-work techniques, including quadrats and belt transects*	This investigation involves the use of a belt transect along a gradient (e.g. shaded area to an area with no shade). It involves students thinking about how to sample their chosen area, including the identification and observation of plants/organisms.

8. Fieldwork

Distance along transect (m)	Soil pH	Light intensity (lux)	Number of plants
1			
5			
10			
15			

A If your teacher hasn't told you where to place the transect, look for somewhere that shows obvious variation in environmental conditions, such as from bright light to deep shade under a tree, or from an area that shows heavy trampling to an area where few people walk.

B Decide which environmental factors you will measure and how you will measure them.

C Peg out the tape measure along the ground to form the transect line.

D Measurements should be made at regular intervals along the transect line (as shown in the diagram). Decide on your measurement intervals, which may depend on how long the line is, and how much time you have to record information.

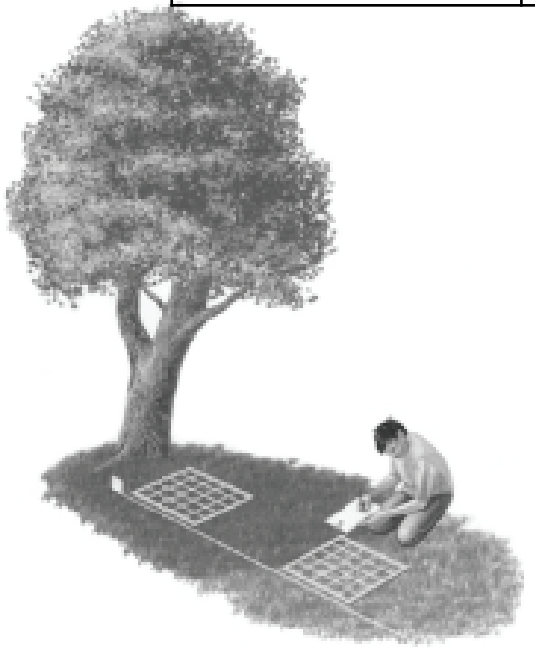
E Place the top left-hand corner of the quadrat at a measurement point on the transect line.

F Measure the environmental factors at that point and record them. Any soil samples should be collected using a trowel and placed in a sealed bag, one for each sample quadrat. Label each bag clearly to identify its position along the transect.

G Record the abundance of your selected organisms in the quadrat.

H Repeat steps E–G at each measurement point along the transect.

I In the lab, carry out suitable tests on any soil samples and record the results.



Suggest a reason why a change in light intensity will change the number of plants living on that patch of ground.

BELT TRANSECT

Answer these questions about the fieldwork core practical

1. What is the practical trying to find out or demonstrate?
2. What equipment is used in the practical and what does it do?
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Equipment challenge. Which practical are these pieces of apparatus from? What are they called and what do they do? Some are used in more than one practical.