

L.C. BIOLOGY MANDATORY ACTIVITIES

Unit 1

FOOD TESTS

CONDUCT A QUALITATIVE TEST FOR (a) STARCH, (b) FAT, (c) REDUCING SUGAR, (d) PROTEIN

(a) Qualitative test for STARCH

CHEMICALS

Starch solution
Iodine
Water

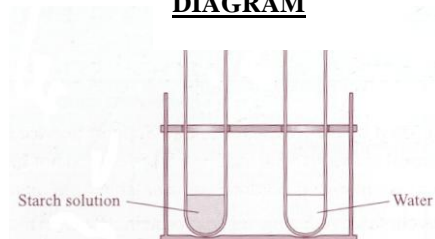
PROCEDURE

1. I added **starch solution** into tube A.
2. I added water into tube B. This acted as a control.
3. I added 2-3 drops of **iodine solution** to each tube.
4. I recorded my result.

RESULT

Sample	Initial colour	Final colour
A – Starch solution	Brown	Blue black
B - Water	Brown	Brown

DIAGRAM



Test for Starch
Starch + Iodine = Blue black

(b) Qualitative test for FAT

CHEMICALS /MATERIALS

Vegetable oil
Brown paper
Water

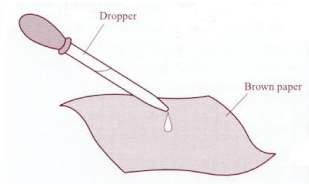
PROCEDURE

1. I placed a drop of **oil** on one piece of **brown paper**
2. I placed a drop of water on the other piece of paper. This acted as a **control**.
3. I left both aside to dry.
4. I held both pieces up to the light.
5. I recorded my result.

RESULT

Sample	Presence of Translucent spot	
	Before drying	After drying
Oil	No	Yes
Water	No	No

DIAGRAM



Test for Fat
Fat + Brown paper = Translucent spot

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Unit 1

FOOD TESTS (cont)

(c) Qualitative test for A REDUCING SUGAR e.g. glucose

CHEMICALS

Glucose solution
Benedict's reagent
Water

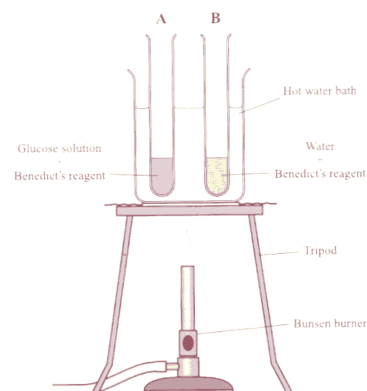
PROCEDURE

1. I placed **glucose** solution into tube A.
2. I placed water into tube B. This acted as a control.
3. I added **Benedict's reagent** to each tube.
4. I placed both tubes in the hot water bath and heated for 5 minutes.
5. I recorded my result.

RESULT

Sample	Initial colour	Final colour
A – Glucose solution	Blue	Brick red
B - Water	Blue	Blue

DIAGRAM



Test for reducing sugar
Glucose + Benedicts = Brick red

(d) Qualitative test for PROTEIN

CHEMICALS

Protein solution e.g. milk
Biuret reagent
Water

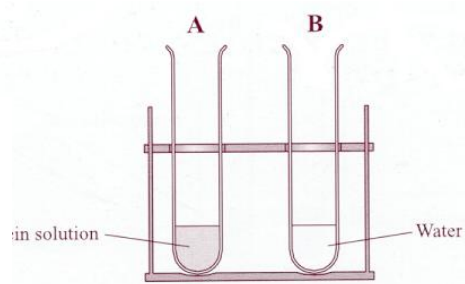
PROCEDURE

1. I placed the **milk** into tube A.
2. I placed water into tube B. This acted as a control.
3. I added **Biuret reagent** to each tube
4. I recorded my results.

RESULT

Sample	Initial colour	Final colour
A – Protein solution	Blue	Lilac
B - Water	Blue	Blue

DIAGRAM



Test for Protein
Protein + Biuret = Lilac

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ECOLOGY

(a) (i) IDENTIFY ANY 5 FAUNA AND ANY FIVE FLORA USING SIMPLE KEYS (ii) IDENTIFY A VARIETY OF HABITATS WITHIN THE SELECTED ECOSYSTEM

MATERIALS/EQUIPMENT

Identification keys

PROCEDURE

1. I used a key consisting of a series of questions relating to the organism I was trying to identify
2. I answered 'yes' or 'no' to pairs of questions relating to the selected organism
3. I then looked to the right of the set of questions, and using the number indicated, moved down to the correct set of alternatives.
4. I continued to do this until a name was reached.
5. I noted the habitat of the organism.
6. I repeated this procedure to identify 5 flora and 5 fauna.
7. I recorded my results.

RESULT

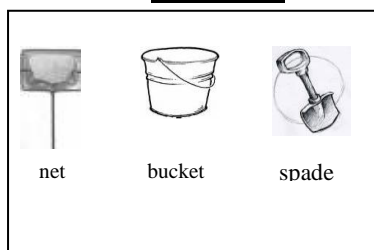
Organism name	Habitat	Adaptation feature
Crab	Under rock – lower shore	Hard shell - protection
Bladder wrack	Attached to rocks –middle shore	Air bladders – buoyancy for photosynthesis

(b) IDENTIFY AND USE VARIOUS APPARATUS REQUIRED FOR COLLECTION METHODS IN AN ECOLOGICAL STUDY

MATERIALS

Fish net
Bucket
Spade

DIAGRAM



PROCEDURE

1. I used a net to catch butterfish by sweeping the net through the water.
2. I transferred the butterfish to a bucket
3. I used a spade to collect crabs and transferred them to a bucket

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Unit 1

ECOLOGY (cont.)

(c) CONDUCT A QUANTITATIVE STUDY OF PLANTS AND ANIMALS OF A SAMPLE AREA OF THE SELECTED ECOSYSTEM

EQUIPMENT

Quadrat

DIAGRAM



Quadrat

PROCEDURE

1. I threw a quadrat randomly in the sample area of the selected ecosystem.
2. I recorded the presence or absence of the named plants and animals within each quadrat.
3. I repeated for a number of throws
4. I recorded my results

RESULT

Organism Name	Quadrat Throw										Total	Frequency	% Frequency
	1	2	3	4	5	6	7	8	9	10			
Limpet	✓	✓	x	✓	x	✓	x	x	x	x	4	$\frac{4}{10}$	$\frac{4}{10} \times 100 = 40\%$

Frequency = $\frac{\text{No. of quadrats containing organism}}{\text{No. of quadrats thrown}}$

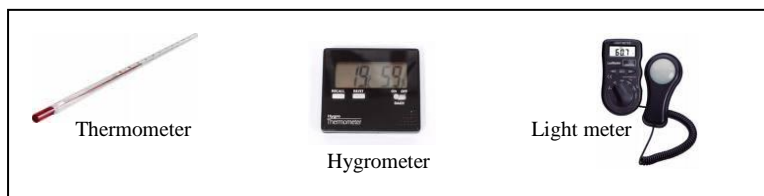
If percent is required multiply frequency by 100

(d) (i) INVESTIGATE ANY THREE ABIOTIC FACTORS PRESENT IN THE SELECTED ECOSYSTEM, AS LISTED (ii) RELATE RESULTS TO CHOICE OF HABITAT SELECTED BY EACH ORGANISM IDENTIFIED IN THIS STUDY

MATERIALS/EQUIPMENT

Thermometer
Digital Hygrometer
Digital Light meter

DIAGRAM



PROCEDURE

1. I choose three abiotic factors present in my selected ecosystem to measure e.g. temperature, humidity and light intensity.
2. I placed the thermometer in the habitat of the identified organism.
3. I switched on the hygrometer and light meter and placed them in the habitat of the identified organism.
4. I recorded my results.

RESULTS

Organism Name	Suitability of Habitat	Abiotic factors and measurements		
		Temperature (°C)	Humidity (%)	Light Intensity (Lux)
Lichen	Yes	12	70	1005

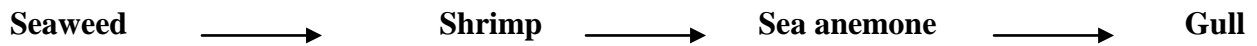
L.C. BIOLOGY MANDATORY ACTIVITIES

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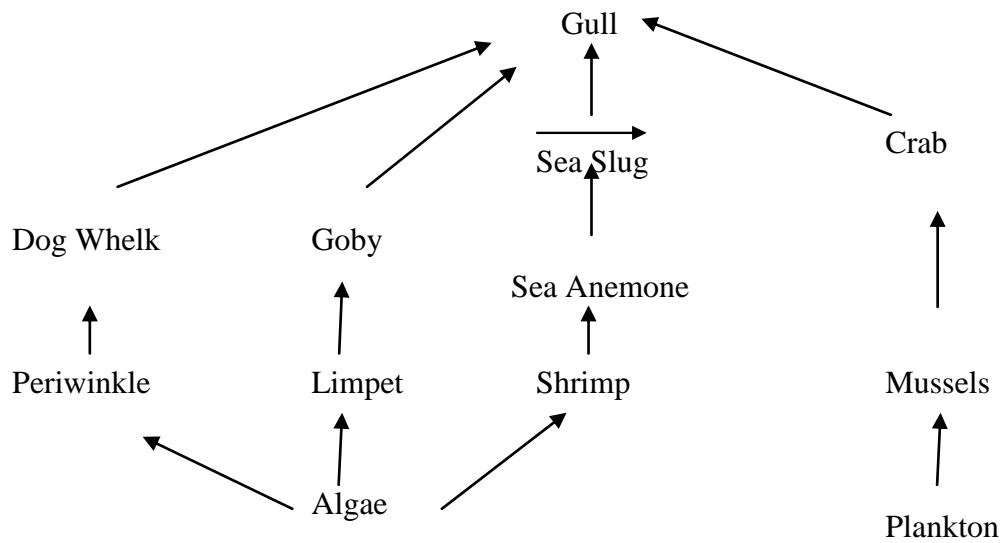
ECOLOGY (cont.)

(e) CONSTRUCT A (i) FOOD CHAIN, (ii) A FOOD WEB AND (iii) A PYRAMID OF NUMBERS

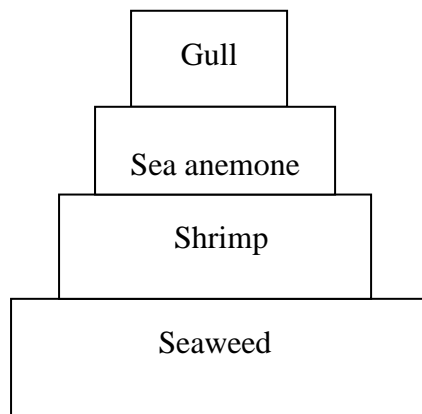
(i) FOOD CHAIN



(ii) FOOD WEB



(iii) PYRAMID OF NUMBERS



L.C. BIOLOGY MANDATORY ACTIVITIES

Unit 1

MICROSCOPE

(a) BE FAMILIAR WITH AND USE THE LIGHT MICROSCOPE

MATERIALS

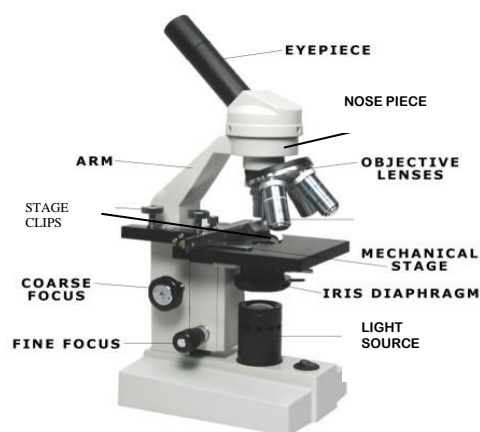
Microscope
Prepared microscope slides

Magnification
= Magnification of objective lens X magnification of eyepiece

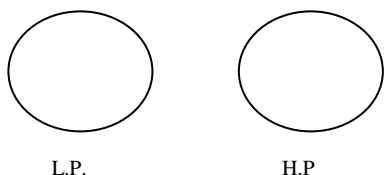
PROCEDURE

1. I switched on the **light source**.
2. I rotated the **nosepiece** so that the low power lens was used.
3. I put a prepared microscope slide on the stage of the microscope above the hole.
4. I used the **stage clips** to hold the slide in place.
5. I used the **coarse adjustment wheel**, to ensure that the low power lens is at the closest setting to the slide.
6. I looked down the **eyepiece** and adjusted the **iris diaphragm** for correct illumination.
7. I used the **coarse adjustment wheel** to focus the object as sharply as possible and then used the **fine adjustment wheel** to sharpen the focus.
8. I repeated steps 6-7 using the other objective lenses.
9. I drew diagrams of my observations under L.P. and H.P.

DIAGRAM



RESULTS



(b) PREPARE AND EXAMINE ONE ANIMAL CELL (i) UNSTAINED AND (ii) STAINED USING THE LIGHT MICROSCOPE (X100, X400)

(i) PREPARE AND EXAMINE UNSTAINED ANIMAL CELL

MATERIALS/EQUIPMENT

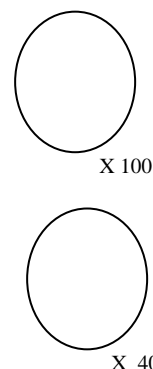
Microscope
Microscope slides
Cover slips

PROCEDURE

1. I set up the microscope.
2. I swabbed the inside of my cheek surface and transferred the sample to the slide
3. I covered the sample with a drop of water.
4. I applied the coverslip as follows:
 - I placed the coverslip at the edge of the water at an angle of 45° to the slide.
 - I lowered the coverslip onto the water, supporting it with a mounted needle, until it was in place. This helps to avoid trapping air bubbles.
5. I examined the slide and I drew labelled diagrams of what I saw under x100 and at x400.



RESULTS



L.C. BIOLOGY MANDATORY ACTIVITIES

Unit 1

MICROSCOPE (cont.)

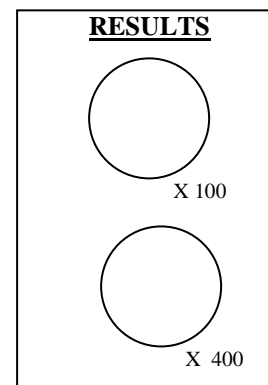
(ii) PREPARE AND EXAMINE STAINED ANIMAL CELL

MATERIALS/EQUIPMENT

Microscope
Microscope slides
Cover slips
Methylene blue stain

PROCEDURE

1. I swabbed my inside cheek surface and transferred the sample onto a second slide.
2. I covered the sample with one drop of methylene blue solution.
3. I allowed it to stand for one minute.
4. Using a wash bottle, I washed excess stain from the slide.
5. I applied a cover slip.
6. I examined it under the microscope and drew labelled diagrams of what I saw at x100 and at x400.



(b) PREPARE AND EXAMINE ONE PLANT CELL (i) UNSTAINED AND (ii) STAINED USING THE LIGHT MICROSCOPE (X100, X400)

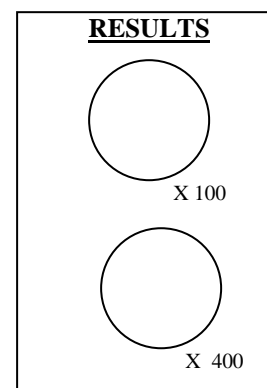
(i) PREPARE AND EXAMINE UNSTAINED PLANT CELL

MATERIALS/EQUIPMENT

Microscope
2 Microscope slides
2 Cover slips

PROCEDURE

1. I set up the microscope.
2. I cut the onion and located the epidermis.
3. I cut the epidermis into small pieces and put these pieces into water.
4. I transferred one piece into the drop of water on the slide.
5. I applied the cover slip.
6. I examined the slide under the microscope and I drew labelled diagrams of what I saw at x100 and x400

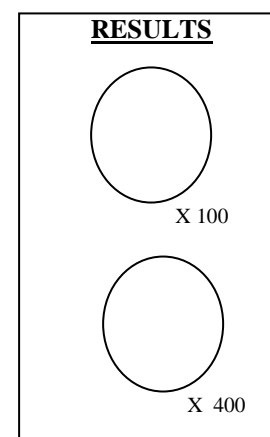
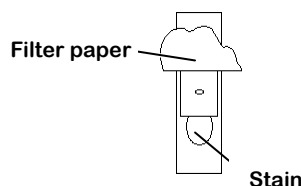


(ii) PREPARE AND EXAMINE STAINED PLANT CELL

MATERIALS/EQUIPMENT Microscope, 2 slides, 2 Cover slips , Iodine stain

PROCEDURE

1. I set up the microscope.
2. I cut the onion and located the epidermis.
3. I cut the epidermis into small pieces and placed them in water.
4. I transferred one piece onto a slide.
5. I applied a coverslip.
6. I applied the stain as follows:
I placed a drop of iodine solution at one end of the cover slip and drew it across the plant tissue by placing the edge of the filter paper at the opposite side of the cover slip.
7. I examined the slide under the microscope and I drew labelled diagrams of what I saw at x100, x400



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UNIT 2

ENZYMES

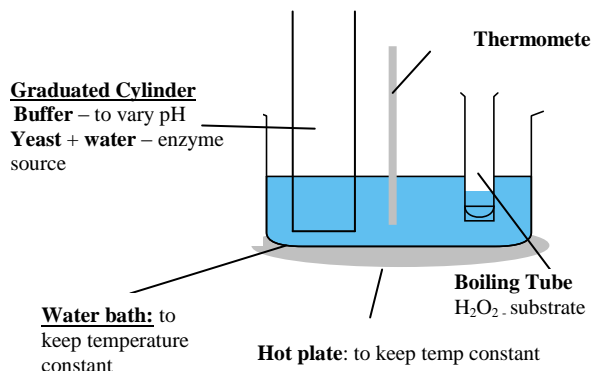
(a) INVESTIGATE THE EFFECT OF pH ON THE RATE OF CATALASE ACTIVITY.

MATERIALS: Enzyme source (Yeast), Hydrogen peroxide (substrate)
Range of buffer solutions (vary pH), Water bath (temp constant)

PROCEDURE

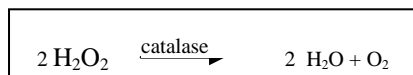
1. Add yeast and water and one of the buffers to the cylinder.
2. Add hydrogen peroxide to a boiling tube.
3. Stand the cylinder and boiling tube in the beaker of water at 25°C
4. Add the hydrogen peroxide to the cylinder.
5. Note the volume in the cylinder immediately and record.
6. Read the volume again after a set time and record.
7. Calculate the height of foam (activity of enzyme).
8. Repeat the procedure for different pH buffers.
9. Record results

Control: Used boiled yeast

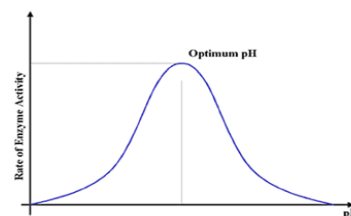


RESULTS

pH of buffer	Initial volume (cm ³)	Final volume (cm ³)	Volume of foam produced
9	20	30	10



GRAPH



(b) INVESTIGATE THE EFFECT OF TEMPERATURE ON THE RATE OF CATALASE ACTIVITY.

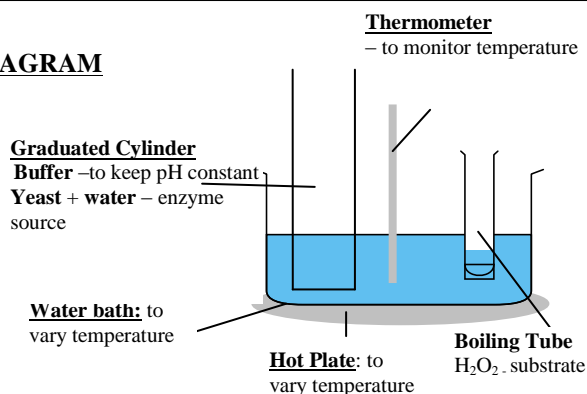
MATERIALS: Enzyme source (yeast), Hydrogen peroxide (substrate), Buffer pH 9 (constant pH), Water bath (vary temp)

PROCEDURE

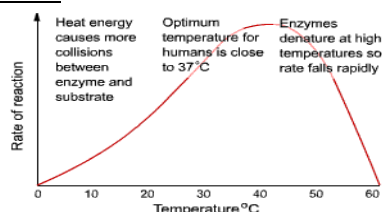
1. Add yeast, water and pH 9 buffer to the cylinder.
2. Add hydrogen peroxide to a boiling tube.
3. Stand the cylinder and boiling tube in an ice-cold water bath until the desired temperature (0°C) is reached.
4. Add the hydrogen peroxide into the cylinder.
5. Note the volume in the cylinder immediately and record.
6. Read the volume again after 2 minutes and record.
7. Calculate the height of foam (activity of enzyme).
8. Repeat the procedure for other temperatures.
9. Record results

Control: Used boiled yeast

DIAGRAM



GRAPH



RESULTS

Temperature	Initial volume (cm ³)	Final volume (cm ³)	Volume of foam produced
0	20	20	0

L.C. BIOLOGY MANDATORY ACTIVITIES

UNIT 2

ENZYMES (cont.)

(c) PREPARE ONE (i) ENZYME IMMOBILISATION AND (ii) EXAMINE ITS APPLICATION

MATERIALS

Yeast
Sodium alginate
Calcium chloride
Sucrose

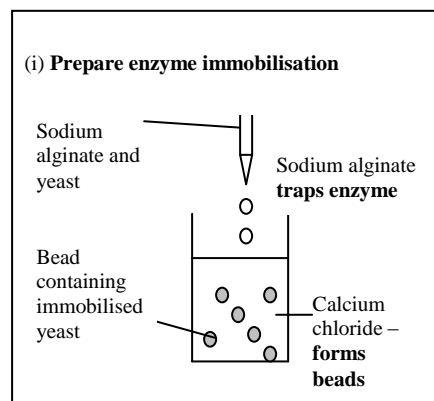
NOTE:

Easy to recover and reuse immobilised enzymes

PROCEDURE

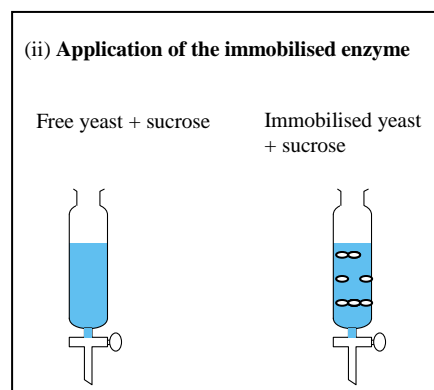
(i) Prepare enzyme immobilisation

- Mix sodium alginate and water and yeast in a beaker.
- Draw the mixture into a syringe.
- Release the mixture from the syringe, one drop at a time, into the calcium chloride solution. Beads containing yeast cells will form.
- Leave the beads to harden.
- Filter the beads through a sieve and rinse with distilled water.



(ii) Application of the immobilised enzyme – production of glucose from sucrose

- Mix yeast and water and pour into a separating funnel (Free yeast).
- Place the beads into another separating funnel (Immobilised yeast).
- Pour sucrose solution into each of the separating funnels.
- Using Clinistix, immediately test samples from each funnel for glucose.
- Repeat the test at intervals until glucose appears in both.
- Record result.
- Run off the remaining product from each funnel into the beakers.
- Compare the turbidity of the solutions from both funnels.



RESULTS

Time (minutes)	Free yeast – presence of glucose	Immobilised yeast – presence of glucose
0	Yes	No
2	Yes	Yes

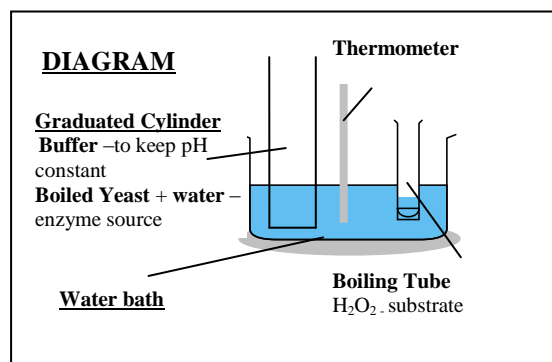
	Free yeast	Immobilised yeast
Turbidity of solution	Cloudy	Clear

(d) INVESTIGATE THE EFFECT OF HEAT DENATURATION ON THE RATE OF CATALASE ACTIVITY

MATERIALS Enzyme source (yeast), Hydrogen peroxide ,(substrate),Buffer pH 9 (constant pH), Water bath

PROCEDURE

- Place yeast in a boiling tube and place into the water bath at 100°C.
- Add the heated yeast and the buffer to the graduated cylinder.
- Add hydrogen peroxide to a boiling tube.
- Stand the cylinder and boiling tube in the water bath until the desired temperature (25°C) is reached.
- Add the hydrogen peroxide into the cylinder.
- Note the presence or absence of foam formation and record.
- Repeat the procedure using an unheated radish sample.



RESULTS

	Unheated enzyme	Heated enzyme
Foam formation	Foam produced	No foam produced

L.C. BIOLOGY MANDATORY ACTIVITIES

UNIT 2

PHOTOSYNTHESIS

INVESTIGATE THE INFLUENCE OF LIGHT INTENSITY ON THE RATE OF PHOTOSYNTHESIS

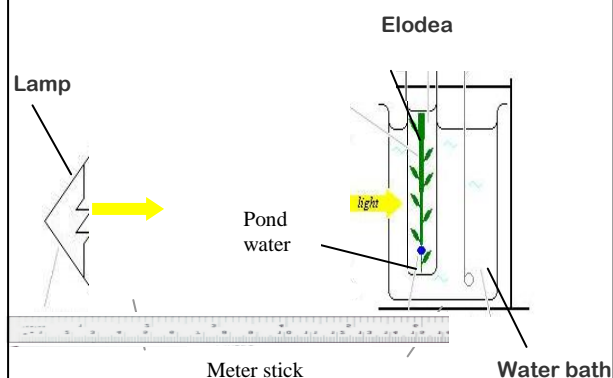
MATERIALS/EQUIPMENT

Elodea (Pondweed)
Strong light source
Metre stick
Pond water

PROCEDURE

1. Place the *Elodea* into the boiling tube with pond water, cut end pointing upwards.
2. Place this tube into the water bath and switch on lamp.
3. Place the boiling tube containing the pondweed at a measured distance from the light source e.g. 15 cm.
4. Allow the plant to adjust for at least 5 minutes and count the bubbles released from the cut end of the stem.
5. Record the number of bubbles released per minute. Repeat twice.
6. Calculate and record the average number of bubbles released per minute.
7. Measure the light intensity at this distance using the light meter
8. Record the result.
9. Repeat the procedure at other measured distances
10. Draw a graph of the rate of bubble production against light intensity.

DIAGRAM

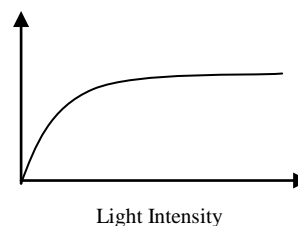


RESULT

Distance from light source (cm)	Average number of bobbles produced / min
15	20
30	10

GRAPH

Rate of bubble production



Note:

During this investigation only one factor (light intensity) should be varied – temperature and carbon dioxide concentration must be kept constant.

To keep the temperature constant, use a water bath @ 25°C.

To keep the carbon dioxide concentration constant use pond water and complete the investigation over a short period of time **or** add Sodium Hydrogen carbonate .

L.C. BIOLOGY MANDATORY ACTIVITIES

UNIT 2

RESPIRATION

(i) PREPARE AND (ii) SHOW THE PRODUCTION OF ALCOHOL BY YEAST

MATERIALS/EQUIPMENT

Yeast
Glucose
Sodium hypochlorite solution
Potassium iodide solution
Fermentation locks

PROCEDURE

(i) To prepare alcohol using yeast

1. Add yeast and glucose to conical flask A.
2. Add glucose to flask B. This acts as a control .
3. Attach a fermentation lock to each flask.
4. Place both flasks in the incubator at 30 °C overnight.

(ii) To show the presence of alcohol: Iodoform test for alcohol

1. Filter the contents of each flask into test tubes.
2. To each test tube, add **potassium iodide** solution and **sodium hypochlorite** solution.
3. Transfer to a water bath for 4-5 minutes.
4. Allow to cool.
5. Record and compare results.
6. Replicate the investigation.

DIAGRAM

(i) To prepare alcohol using yeast

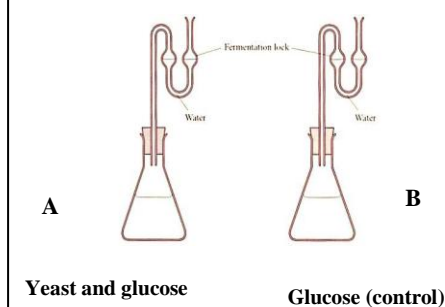
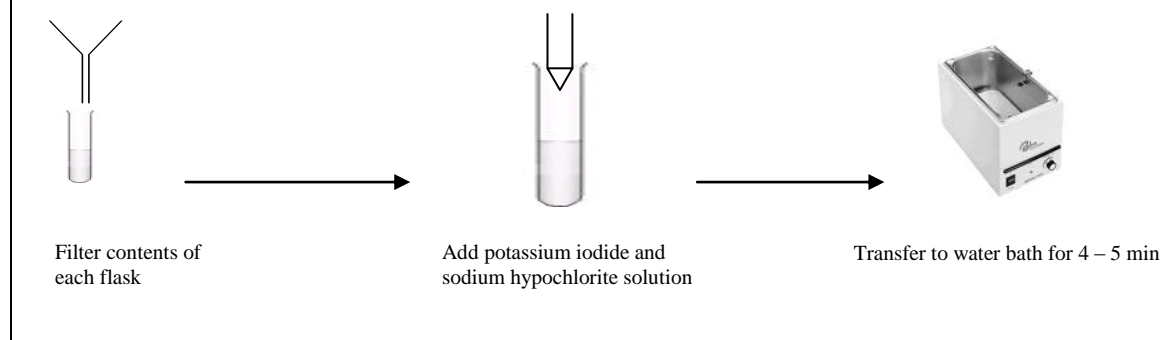


DIAGRAM (Summary)

(ii) To show the presence of alcohol: Iodoform test for alcohol



RESULTS

Flask	Original colour of filtrate	Final colour filtrate
Yeast and glucose solution	Clear	Yellow crystals
Control (no yeast)	Clear	Clear

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UNIT 2

GENETICS

ISOLATE DNA FROM PLANT TISSUE

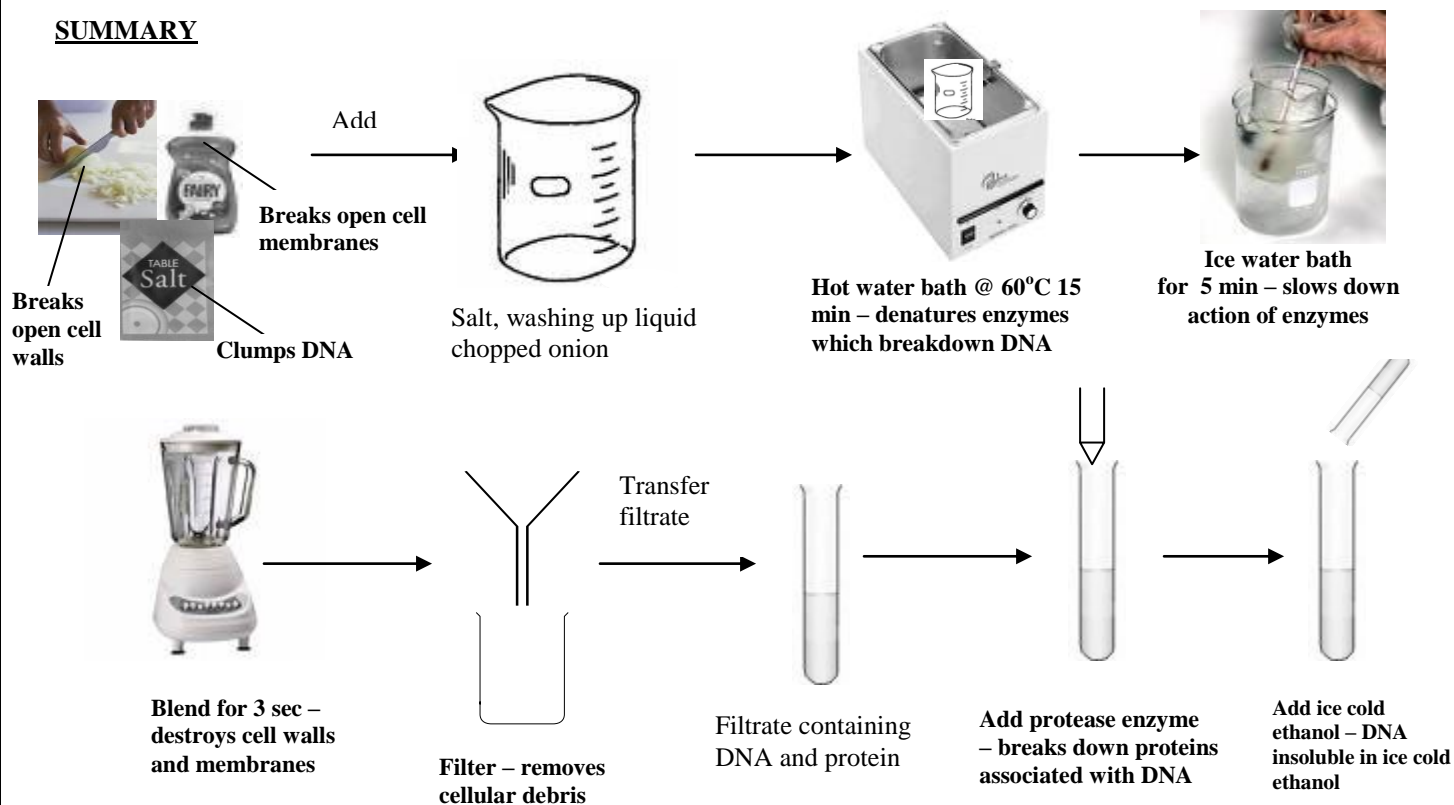
CHEMICALS/MATERIALS

Onion
Washing up liquid
Table salt
Protease enzyme
Ice cold ethanol

PROCEDURE

1. Chop the onions into small pieces.
2. Add the chopped onion to the beaker with the salt and washing up liquid solution and stir.
3. Put the beaker in the water bath at 60°C for exactly 15 minutes.
4. Cool the mixture by standing the beaker in the ice-water bath for 5 minutes.
5. Pour the mixture into the blender and blend it for no more than 3 seconds.
6. Carefully filter the mixture into the second beaker.
7. Transfer some of this filtrate into the boiling tube.
8. Add 2-3 drops of protease.
9. Trickle the ice cold alcohol down the side of the boiling tube
10. Observe any changes that take place at the interface of the alcohol and the filtrate.
11. Using the glass rod, gently draw the DNA out from the alcohol.
12. Record the result.

SUMMARY



L.C. BIOLOGY MANDATORY ACTIVITIES

UNIT 2

MOVEMENT THROUGH CELL MEMBRANES

CONDUCT ANY ACTIVITY TO DEMONSTRATE OSMOSIS

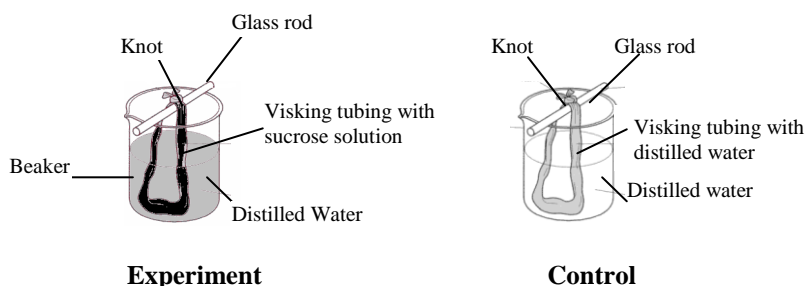
MATERIALS/EQUIPMENT

Distilled water
Sucrose solution
Visking tubing

PROCEDURE

1. I softened 2 strips of visking tubing by soaking them in water.
2. I tied a knot at one end of each strip.
3. I half-filled one piece of tubing with the sucrose solution and the other with distilled water (**Control**).
4. I eliminated air from the tubes and tie a knot at the open end.
5. I washed off any sucrose solution from the outside of the tubes and dried.
6. I recorded the turgidity of each tube.
7. I recorded the mass of each tube .
8. I suspended each tube in a beaker of distilled water.
9. After 20 min I removed the tubes and dried.
10. I recorded the turgidity of each tube.
11. I recorded the mass of each tube .
12. I repeated the investigation.

DIAGRAM



RESULTS

Tube contents	Turgidity at start	Turgidity after test period	Mass at start (g)	Mass after test period (g)
Sucrose solution	No	Yes	10	40
Distilled water	No	No	10	10

L.C. BIOLOGY MANDATORY ACTIVITIES

UNIT 3

FUNGI

INVESTIGATE THE GROWTH OF LEAF YEAST USING AGAR PLATES AND CONTROLS

MATERIALS/EQUIPMENT

Fresh leaves
2 Sterile malt agar plates

PROCEDURE

1. I swabbed the laboratory bench with disinfectant. (*Kills microorganisms*)
2. I left one sterile malt agar plate unopened. (*This acted as a control.*)
3. I sterilised the scissors, cork borer and forceps by flaming and allowed to cool.
4. I carefully cut a leaf (e.g. Ash) using the sterile scissors and transferred it to the lab using a sterile forceps. (I was careful not to dislodge the yeast)
5. I cut some discs from the leaf using a sterile cork borer..
6. I opened the lid of one of the plates slightly and using the forceps, smeared small blobs of vaseline on the inside of the lid.
7. I replaced the lid and re-flamed the forceps.
8. I again opened the lid slightly and using the forceps, attached a leaf disc to each of the blobs of vaseline.
9. I closed and sealed the plate.
10. I left the plates for approximately 24 hours. (*Spores can drop onto agar from the leaf discs*).
11. After 24 hours I inverted the plates and incubated them at $18^{\circ}\text{C} - 20^{\circ}\text{C}$, for three days. (*Allow the leaf yeast to grow*)
12. I recorded the result. (*Leaf yeast will grow as pink glistening colonies.*)
13. I repeated the investigation.

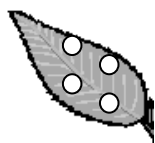
RESULTS

Agar plate	Appearance of colonies
Control	No
Experiment	Pink colonies

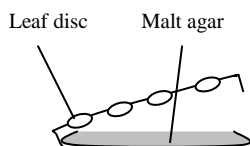
SUMMARY



Cut leaf using sterile scissors



Cut discs using sterile cork borer



Attach discs to vaseline on lid of plate



Leave plates for 24 hours to allow spores fall onto agar



Invert and Incubate the plates @ $18^{\circ}\text{C} - 20^{\circ}\text{C}$ for 3 days to allow yeast grow

L.C. BIOLOGY MANDATORY ACTIVITIES

UNIT 3

ANIMAL BIOLOGY

(a) INVESTIGATE THE EFFECT OF EXERCISE ON THE PULSE OF A HUMAN

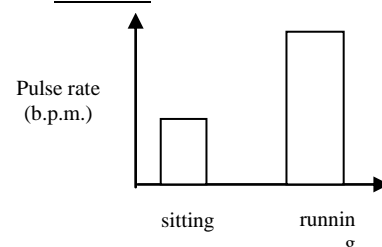
MATERIALS/EQUIPMENT

Timer

PROCEDURE

1. I sat on a chair. I took 5 minutes to settle.
2. I counted the number of pulses per minute and recorded.
3. I repeated twice and calculated the average number of pulses per minute and recorded (This is my resting heart rate).
4. I ran for 5 minutes. I immediately measured my pulse rate and recorded. (This is my pulse rate after exercise)
5. I compared the pulse rates before and after exercise.
6. I drew a bar chart of my results.

GRAPH



RESULT

	Average
Resting pulse rate (bpm)	72
Pulse rate after exercise (bpm)	100

(b) DISSECT, DISPLAY AND IDENTIFY A SHEEPS HEART

MATERIALS/EQUIPMENT

Sheep's heart

Dissecting board

Scalpel

PROCEDURE

1. I placed the heart on the dissection board so that the front (ventral) side is facing up.
2. To identify the front side:
 - (i) I felt the sidewalls - The left side will feel much firmer than the right side.
 - (ii) I found a groove that extends from the right side of the heart downward.
3. I located the four chambers of the heart and the main blood vessels .
4. I drew a labeled sketch of the external structure of the heart.
5. I made a shallow cut in the left ventricle and left atrium (See diagram)
6. I opened the heart at the cut to examine the internal structure.
7. I observed the different sizes of the chambers and recorded my results.
8. I located the bicuspid valve between the left atrium and left ventricle. (I looked for two flaps).
9. I inserted my finger under the chordae tendinae and notice that they extend from the valve, to the papillary muscles.
10. I made a shallow cut on the right side of heart (See diagram)
11. I located the tricuspid valve between she right atrium and the right ventricle. (I looked for three flaps).
12. I found the septum, a thick muscular wall, which separates the right and left ventricles.
13. I used the scalpel to cut open the aorta and observed the semi-lunar valve. (I looked for the three half-moon shaped flaps of this valve)
14. I found two small openings at the base of the aorta just above the semi-lunar valve. These lead into the coronary arteries. I inserted a seeker into a coronary artery to trace its pathway.
15. I drew a labelled diagram of the internal structure of the heart.
16. I washed and sterilised the dissecting instruments after use.

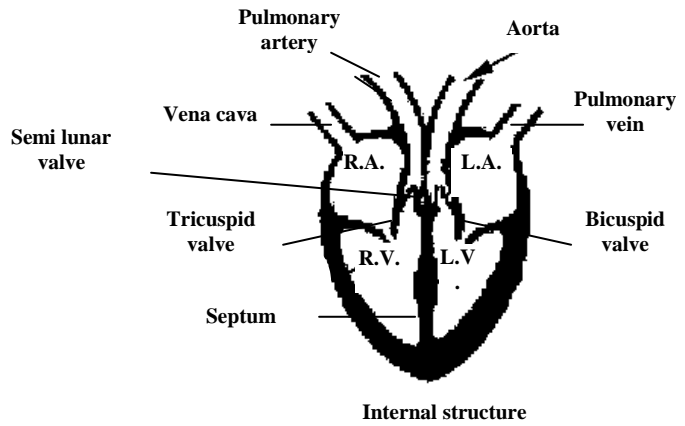
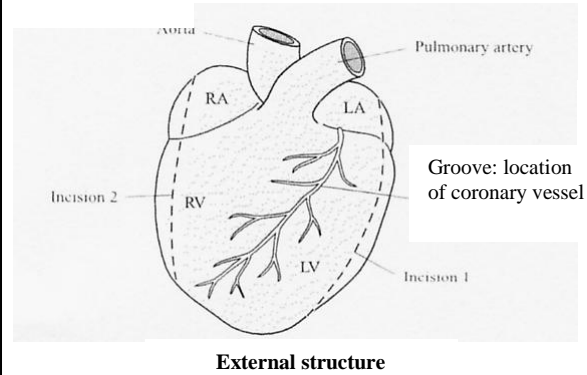
L.C. BIOLOGY MANDATORY ACTIVITIES

UNIT 3

ANIMAL BIOLOGY (cont.)

(b) DISSECT, DISPLAY AND IDENTIFY A SHEEPS HEART (cont.)

DIAGRAM



RESULTS

Chamber	Wall - thick/thin
Left atrium	thin
Right atrium	thin
Left ventricle	thick
Right ventricle	thin

Valve type	Number of flaps
Bicuspid	2
Tricuspid	3
Semi-lunar	3

L.C. BIOLOGY MANDATORY ACTIVITIES

UNIT 3

PLANT BIOLOGY

(a) PREPARE AND EXAMINE MICROSCOPICALLY THE TRANSVERSE SECTION OF A DICOTYLEDENOUS STEM (X100, X400)

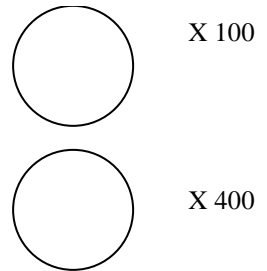
MATERIALS/EQUIPMENT

Dicotyledenous stems
Microscope slides
Cover slips
Microscope

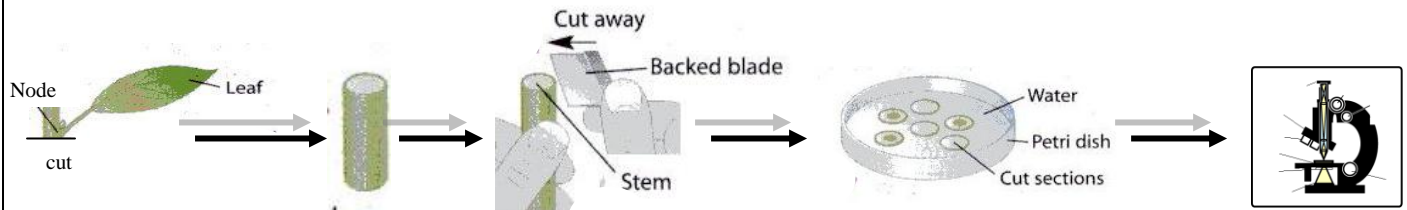
PROCEDURE

1. I cut a number of short lengths of wet stem using the blade.
(*Cut at the node, at right angles to the stem, away from the body, to get a very thin transverse section.*)
2. I placed the cut sections in a petri dish of water (*Prevents drying out.*)
3. I removed the thinnest section from the water and placed it on a microscope slide in a drop of water.
4. I added a coverslip.
5. I examined under the microscope.
6. I drew labelled diagrams of what I saw.

RESULTS



SUMMARY



L.C. BIOLOGY MANDATORY ACTIVITIES

UNIT 3

PLANT BIOLOGY (cont.)

(b) INVESTIGATE THE EFFECT OF I.A.A. GROWTH REGULATOR ON PLANT TISSUE. (OPTION 1)

MATERIALS/EQUIPMENT

Radish seeds
IAA solution

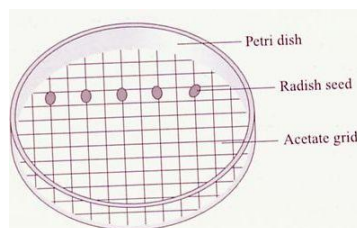
PROCEDURE

- I labelled 8 petri dishes and 8 bottles as in diagram.
- I added 10 cm³ of the IAA solution to the first bottle.
- I added 9 cm³ of distilled water to each of the next seven bottles.
- I removed 1cm³ of the IAA solution from the first bottle and add it to the second bottle.
- I removed 1 cm³ of solution from the second bottle and add it to the third bottle
- I repeated this serial dilution procedure for the fourth fifth, sixth and seventh bottles (using a different dropper each time).
- I discarded 1cm³ of solution from the seventh bottle so that each bottle now contains 9 cm³ of solution.
- I fitted a circular acetate grid inside the lid of each dish.
- I placed five radish seeds in each dish as shown in diagram.
- I placed a filter paper and cotton wool on top of the seeds in each dish.
- I added each solution to its matching dish
- I stood the dishes vertically on their edge, *(to ensure the roots grow down)*.
- I placed the dishes in the incubator for 2-3 days @ 25⁰C. *(allow germination)*.
- I measured the length of the roots and shoots of the seedlings in each dish and recorded
- I calculated the percentage stimulation or inhibition of root and shoot growth in each dish using the following formula:

NOTE
The 8th bottle acted as a control

Percentage stimulation/inhibition

$$= \frac{(\text{Average length} - \text{average length of control}) \times 100}{\text{Average length of control}}$$



- I drew a graph of percentage stimulation and inhibition of root and shoot growth against IAA concentration

RESULTS

Conc IAA (ppm)	Length root/shoot (mm)										Total length	Average length	% stimulation/inhibition
	Seed 1		Seed 2		Seed 3		Seed 4		Seed 5				
	Root	Shoot	Root	Shoot	Root	Shoot	Root	Shoot	Root	Shoot			
0													
10 ⁻⁴													
10 ⁻³													
10 ⁻²													
10 ⁻¹													
1													
10													
10 ²													

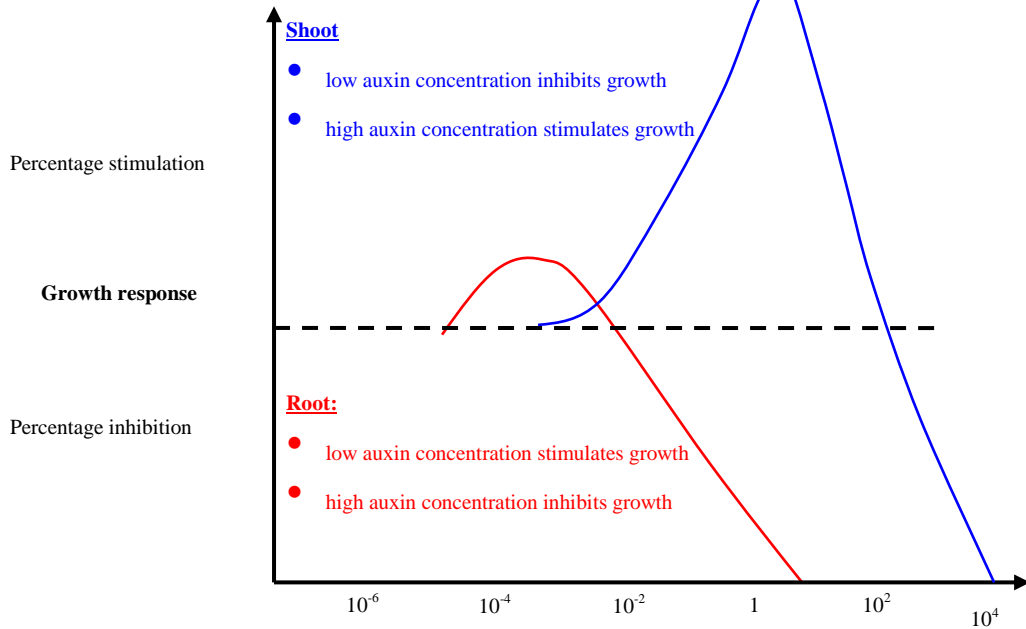
L.C. BIOLOGY MANDATORY ACTIVITIES

UNIT 3

PLANT BIOLOGY (cont.)

**(b) INVESTIGATE THE EFFECT OF I.A.A. GROWTH REGULATOR ON PLANT TISSUE
(Option 1 cont.)**

GRAPH



L.C. BIOLOGY MANDATORY ACTIVITIES

UNIT 3

PLANT BIOLOGY (cont)

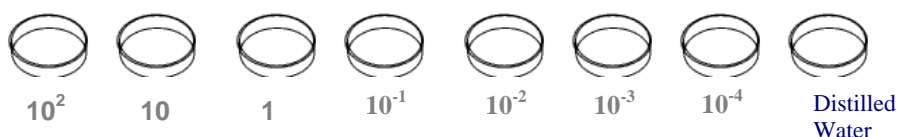
(b) INVESTIGATE THE EFFECT OF I.A.A. GROWTH REGULATOR ON PLANT TISSUE. (Option 2)

MATERIALS/EQUIPMENT

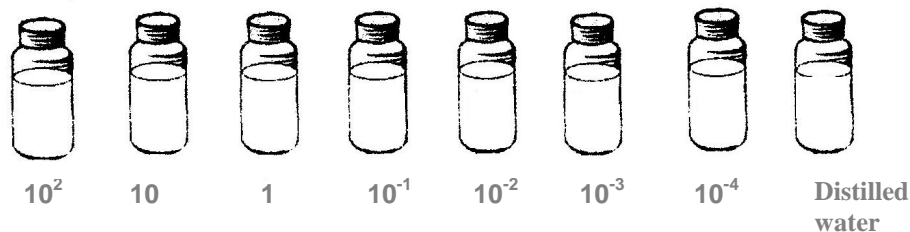
Radish seeds
IAA solution

PROCEDURE

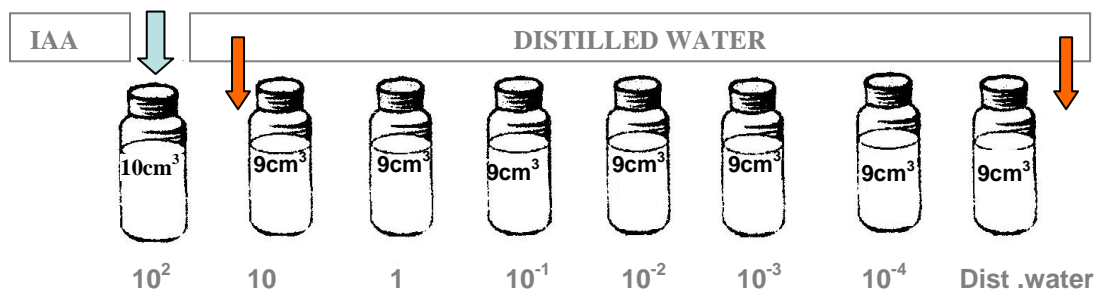
1. I labelled 8 petri dishes: 10^2 ppm, 10 ppm, 1 ppm, 10^{-1} ppm, 10^{-2} ppm, 10^{-3} ppm, 10^{-4} ppm, distilled water



2. I labelled 8 bottles in the same way



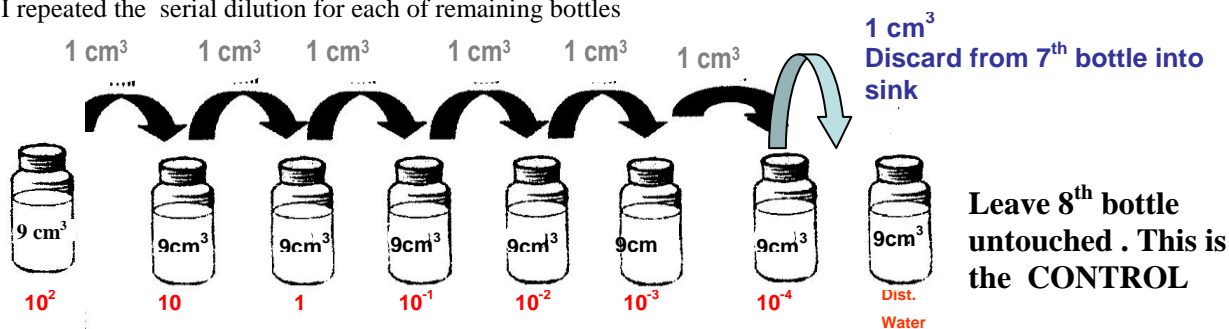
3. I added 10 cm^3 of IAA solution to first bottle and added 9 cm^3 of dist. water to each of the next / bottles



4. I removed 1 cm^3 from 1st bottle and added to second bottle and mixed

5. I removed 1 cm^3 from 2nd and added to 3rd and mixed.

1. I repeated the serial dilution for each of remaining bottles



L.C. BIOLOGY MANDATORY ACTIVITIES

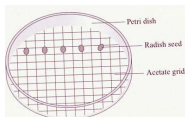
UNIT 3

PLANT BIOLOGY (cont.)

INVESTIGATE THE EFFECT OF I.A.A. GROWTH REGULATOR ON PLANT TISSUE. (Option 2 cont.)

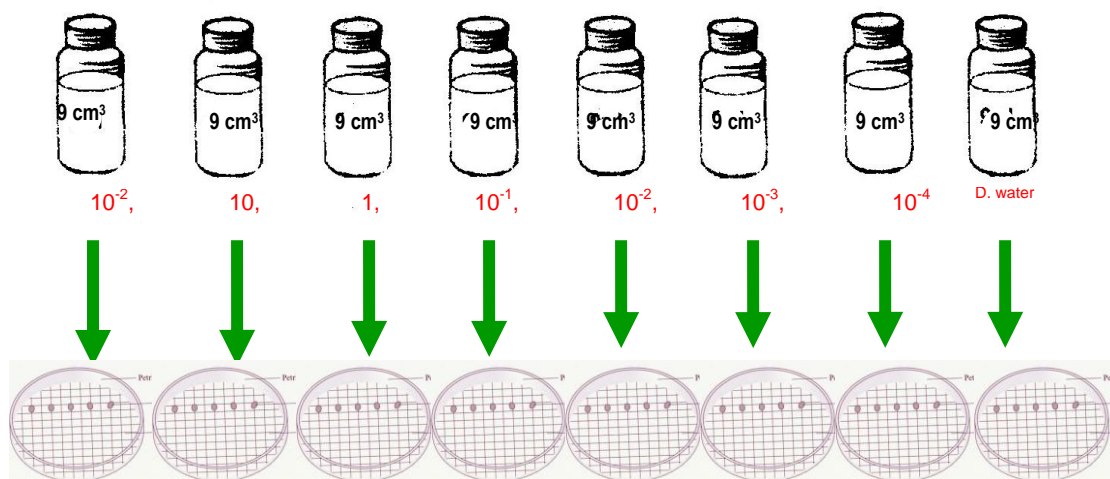
7. I discarded 1 cm³ from 7th bottle and left the 8th bottle untouched as a **control**. Note: Each bottle now contains 9 cm³

8. I fitted a circular acetate grid inside the lid of each dish and place 5 radish seeds in each dish

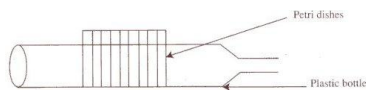


9. I placed a filter paper and cotton wool on top of the seeds on each dish.

10. I added each solution in the bottle to its matching dish



11. I stood the dishes vertically on their edges (*to allow roots grow down*)



12. I incubated for a few days @ 25⁰C. (*to allow germination*)

13. I measured the length of the roots and shoots of the seedlings in each dish and recorded

14. I estimated the percentage stimulation or inhibition of root and shoot growth in each dish using the following formula:

Percentage stimulation/inhibition

$$= \frac{(\text{Average length} - \text{average length of control}) \times 100}{\text{Average length of control}}$$

15. I drew a graph of percentage stimulation and inhibition of root and shoot growth against IAA concentration

L.C. BIOLOGY MANDATORY ACTIVITIES

UNIT 3

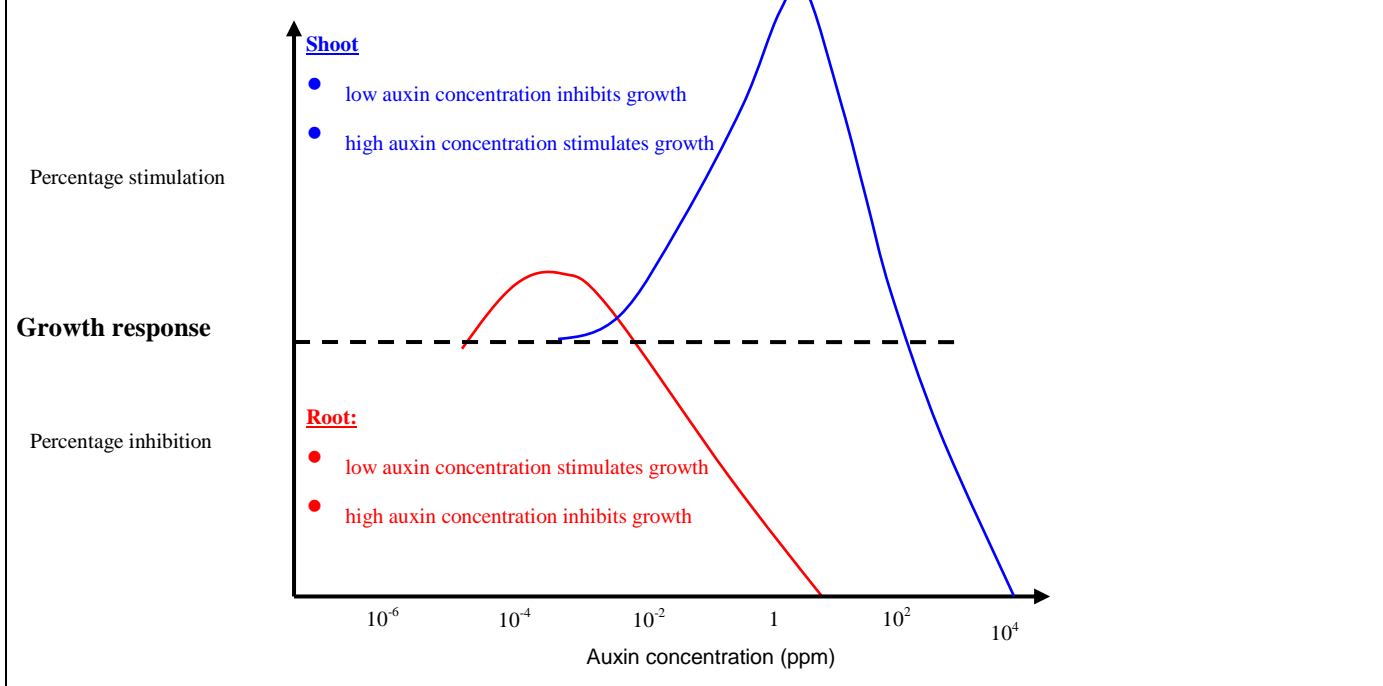
PLANT BIOLOGY (cont.)

**(b) INVESTIGATE THE EFFECT OF I.A.A. GROWTH REGULATOR ON PLANT TISSUE.
(Option 2 cont.)**

RESULTS

Conc IAA (ppm)	Length root/shoot (mm)										Total length	Average length	% stimulation/inhibition
	Seed 1		Seed 2		Seed 3		Seed 4		Seed 5				
	Root	Shoot	Root	Shoot	Root	Shoot	Root	Shoot	Root	Shoot			
0													
10 ⁻⁴													
10 ⁻³													
10 ⁻²													
10 ⁻¹													
1													
10													
10 ²													

GRAPH



L.C. BIOLOGY MANDATORY ACTIVITIES

UNIT 3

PLANT BIOLOGY (cont)

(c) INVESTIGATE THE EFFECT OF WATER, OXYGEN AND TEMPERATURE ON GERMINATION.

MATERIALS/EQUIPMENT

Seeds e.g. radish
Anaerobic jar/GasPack
4 Petri dishes

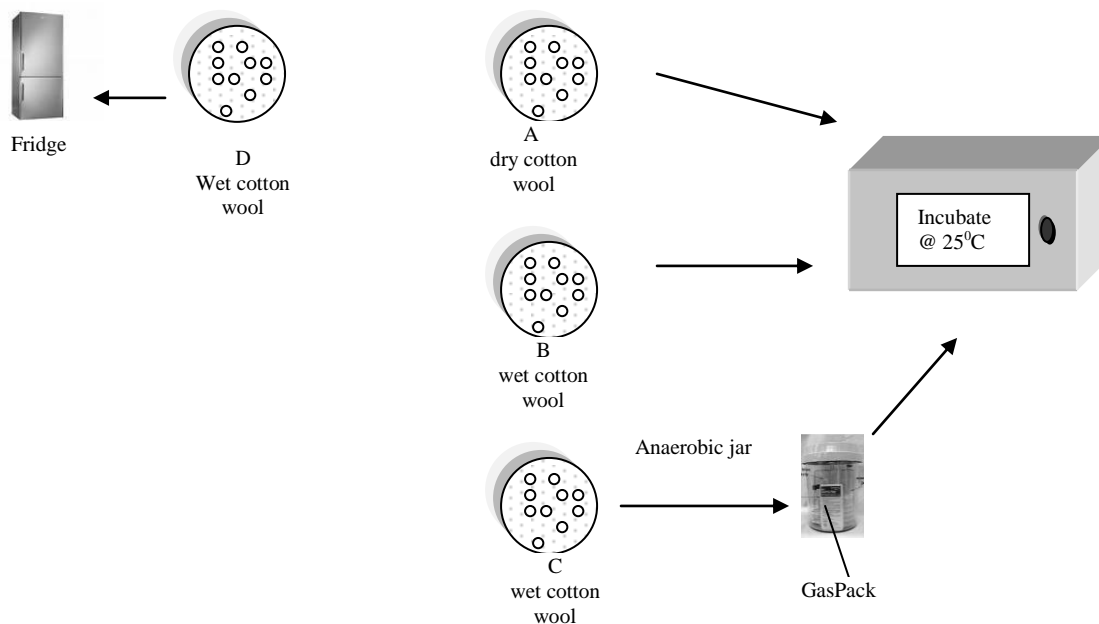
PROCEDURE

1. I set up the four Petri dishes with cotton wool in each.
2. I labelled the dishes A,B,C,D.
3. In dish A, I left the cotton wool dry – seeds lacking water.
4. I wet the cotton wool in each of the other dishes.
5. I placed 10 seeds in each dish.
6. I placed dish D in the fridge – seeds lacking a suitable temperature.
7. I placed C in the anaerobic jar with a GasPack to create an anaerobic environment – seeds lacking oxygen.
8. I placed dishes A,B and C, in the incubator at 25°C for a few days. (*Dish B acts as a control – all conditions for germination present.*)
9. I recorded the results.
10. Replicated the investigation

RESULT

Dish	Germination
A- with oxygen and suitable temperature (no water)	NO
B- with water, oxygen, and a suitable temperature.	NO
C- with water and suitable temperature (no oxygen)	NO
D- with water and oxygen (unsuitable temperature)	YES

DIAGRAM



L.C. BIOLOGY MANDATORY ACTIVITIES

UNIT 3

PLANT BIOLOGY (cont)

(d) USE STARCH AGAR OR SKIMMED MILK PLATES TO SHOW DIGESTIVE ACTIVITY DURING GERMINATION

MATERIALS/EQUIPMENT

Soaked broad bean seeds

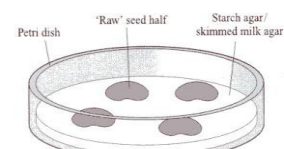
Sterile starch agar plates

Iodine solution

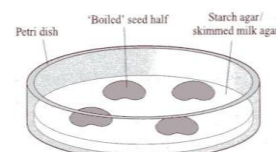
PROCEDURE

1. I cleaned the lab bench with disinfectant (*kill microorganisms*).
2. I got 2 sterile starch agar plates and labelled them unboiled and boiled.
3. I got 4 soaked seeds.
4. I boiled 2 of the seeds. These acted as **controls**.
5. I split each seed in half (*to separate the cotyledons*).
6. I sterilised all seeds by soaking them in disinfectant and then rinsed them (*kills microorganisms on surface of seed*).
7. I sterilised the forceps by flaming it in a Bunsen flame..
8. With minimal opening, I placed all the seed halves facing down on the agar plates (*minimises contamination*).
9. I incubated the plates upright at 18°C-20°C for 48 hours (*allow germination*).
10. I removed the seeds from the plates.
11. I flooded the plates with iodine solution (*to test for starch*).
12. I poured off the iodine solution.
13. I recorded my results.

DIAGRAM



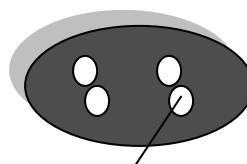
Unboiled



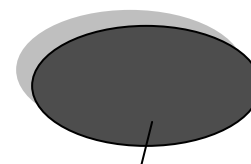
Boiled

RESULTS

Unboiled: Test with iodine	Boiled: Test with iodine
Blue black clear areas under seed where starch digestion took place	All blue black – no clear areas



Unboiled: clear areas under seeds indicating starch digestion



Boiled: All blue black indicating no starch digestion