Natural Sciences Department

Biology Laboratory Manual

Warning

Any breakages in the science laboratory will result in the replacement paid for by the candidate handling the apparatus

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Preface

I have made every effort to make this biology Laboratory Manual as effective, clear, and readable as possible; to show the beauty and logic of biology practical; and to make biology enjoyable to learn. 'Personally, I am always ready to learn, although I do not always like being taught.' I believe that 'to teach is to learn twice'.

Working in the biology laboratory can be enjoyable part of your biology experiences. This biology laboratory manual is for your laboratory work both worthy and enjoyable. The biology laboratory tasks as presented in this manual are designed to test your abilities, but use the skills and values which you will acquire in biology to solve problems in everyday life. The manual for biology for senior secondary school examination has been produced to support practical work required to be done from grade 10 to 12.

This biology laboratory manual is for use in strengthening teaching competencies, skills and subject knowledge of teachers of biology at the senior secondary school level through school-based assessments (SBA).

Additionally, the biology laboratory manual is also designed to help teachers acquire competences and skills in designing differentiated activities for learners with special education needs to enhance meaningful participation in learning activities.

Acknowledgments

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Appreciation of safety in the biology laboratory

Safety is the state of non-exposure to hazards or to danger. It can also be described as the state of being safe.

Safety rules in the biology laboratory

1. Enter a laboratory only when a teacher says so.
2. Always wear closed shoes. No one wearing open footwear such as slippers and sandals enters the laboratory. This is in order to reduce the chance of occurrence of foot injuries.
3. Wear protective clothes.
4. Do not run or play in the laboratory.
5. Do not perform any experiment without permission from the teacher, and always follow the instructions carefully. Avoid handling any unfamiliar equipment in the laboratory.
6. Do not drink, eat or taste anything in the laboratory except when allowed to by the teacher. The food might be contaminated with chemicals which are harmful to human beings. When you suspect poisoning, note the suspected poisoning agent and call your teacher immediately.
7. Always add acid to water and not water to acid. Never add water to concentrated acid as doing so may result into an accident since the little water coming into contact with the acid may boil immediately splashing the acid into your face.
8. Accidents and breakages must be immediately reported to the teacher.
9. Never point the mouth of a test tube containing a substance being heated towards another person or yourself.
10. Do not hold very hot objects with your hand. Hold them with a test tube holder, tongs or a piece of cloth or place them on a heat proof mat.
11. When smelling a substance, do not hold it very near the nose. Hold it about 20cm from the nose and with the hand wave the vapour towards the nose and sniff carefully.
12. Use specified or small amounts of substances in reactions to avoid waste and reactions which cannot be controlled.
13. Make sure you know the substances being used unless you are advised to use it as unknown
14. Any chemical accidentally taken into the mouth or spilt onto any part of the body should be washed off immediately with water and reported to the teacher. Seek medical attention.
15. Do not use broken glass-ware. Glassware should frequently be checked. Broken pieces of glassware should be put a vessel such as a bucket and kept securely for later disposal.
16. Do not bring flammable substances near a flame. If fires breaks out accidentally, quickly turn off the gas, electricity or water if necessary. Electrical installations in the laboratory should be checked for faults on a daily basis. This is in order to avoid the incidence of such accidents as fire resulting from a short circuit.
17. Wear eye protection when you are told to and keep it on until you are told to take it off when the practical is finished. Where a foreign matter enters the eye, flush with plenty of water. Use an eye wash bottle or fountain.
18. When you are told to use a Bunsen burner, make sure hair, cardigans, scarves, ties etc. are tied back or tacked in to keep them well away from the frame.
19. When you are working with liquids, always stand up and never sit. That way you can move out of the way easily if something spills.
20. Always put any waste solids in the correct liter bin and not in the sink.
21. Bottles should be never held by the neck.
22. Be careful that the name or label on the bottle is exactly the same as that of the chemical you require. Avoiding use of unlabeled chemicals. Any of such should be treated as potentially dangerous.

23. Before leaving the laboratory, clean the apparatus, work surface and your hands well. Nothing must be taken from the laboratory.
24. Make sure that no piece of apparatus is placed on the edge of a work bench. Apparatus that are not in use should be stored in the correct designated places. Those that are in use should be placed far from the bench edges.
25. Gangways should always be free of obstacles on which a person can stumble.
26. Gas taps should be kept closed at all times other than when gas burners are in use. It is also important to ensure that there are no leaking points in the gas pipes.
27. Avoiding overcrowding work benches with such things as bags and pieces of apparatus which are not in use.
28. When one suffers from burns, apply cold water. Call your teacher immediately.
29. When one has cuts and bruises, stop any bleeding by applying direct pressure. Cover cuts with a clean dressing. Call your teacher immediately. Due to possibility of infection, disposable gloves should be worn whenever there is a chance of contact with body fluids such as blood.
30. When one faints, leave the person laying down. Loosen any tight clothing and keep clowds away. Call your teacher immediately.
31. Any spills on skin, flush with large amounts of water or use safety shower. Call your teacher immediately.

Reasons why laboratory accidents may occur

- Lack of awareness
- Lack of control
- Lack of knowledge
- Lack of right attitude

Laboratories are delicate places. Carelessness can lead to serious accidents. To avoid such accidents, simple procedures or instructions should be followed strictly.

Drawings

- The section, **draw**, should be a correct one i.e. transverse section (T.S) or longitudinal section (L.S)
- The drawing should be realistic. It should resemble the actual specimen provided.
- The drawing should be large enough to cover the given space provided in the question paper
- The drawing should be clearly visible and must not have double lines, dirty rubbings, markings or shading except when showing a contrast e.g. in variegated leaves
- The drawing must be continuous i.e. without broken lines

Label lines

- Label lines should not have arrow heads
- Label lines should touch the appropriate structures. Hanging label lines do not earn any marks
- Label lines should be horizontal and must be parallel to each other. This means that label lines should not cross each other
- No label lines will be considered if the question specifically says no labeling is required
- The drawings and label lines should be done using the **HB** sharp pencil. Labels must be in pen

Magnification

Symbol: M

Units: Magnification has no units because the units cancel each other in the working steps

Definition: Magnification is the ratio of the size of the drawing to the size of the specimen

Magnification of the drawing means the number of times the drawing is enlarged compared to the specimen.

Formula: Magnification = $\frac{\text{Length of drawing}}{\text{Length of specimen}}$

Magnification = $\frac{\text{Diameter of drawing}}{\text{Diameter of specimen}}$

Procedure when calculating magnification

- Measure and record the longest length of the specimen in centimeters rounded off to one decimal place .e.g. 10.2cm or in millimeters with no decimal place e.g. 102mm
- Measure and record the longest length of the drawing in centimeters rounded off to one decimal place .e.g. 13.6cm or in millimeters with no decimal place e.g. 136mm
- Substitute the recorded values in the formula:

Magnification = $\frac{\text{Size of drawing (cm)/ (mm)}}{\text{Size of specimen (cm)/ (mm)}}$ (Size refers to length or diameter)

$M = \frac{13.6\text{cm}}{10.2\text{cm}}$ *or* $M = \frac{136\text{mm}}{102\text{cm}}$

M = 1.3333333 M = 1.3333333

Answers for magnification are recorded with a multiplication sign and represented and rounded off to one decimal place as:

- X1.3
- 1.3X
- 1.3 times
- times 1.3

Note

The specimen is the actual object given

When;

- M = 1, then the drawing and the specimen are of the same size
- M > 1, then the drawing is larger than the specimen
- M < 1, then the drawing is smaller the specimen

Making comparison

- In making comparisons, the power of observation should be used
- You should compare the colours, shapes, textures, size and parts and their arrangements
- You should look for parts that occur in one but do not occur in the other or if they occur in both, they could be more or less in one specimen than in the other
- If you are comparing fruits, consider the number of seeds, the size of seeds, the arrangement of seeds and the pericarp
- You should compare the outer skin, rings of tissue, zone etc. when examining slices of fruits or tubes

Preparation of food test reagents and solutions

1. **Recipe for Preparation of One Litre of Benedict's Solution**
   - Dissolve 173.0 g sodium citrate and 100.0 g sodium carbonate in 800 ml warm distilled water;
   - Separately dissolve 17.3 g copper (II) sulphate pentahydrate in 100 ml distilled water;
   - Slowly pour the first solution into the second solution with constant stirring;
   - Make the volume to 1 litre with distilled water.
2. **Recipe for Preparation of One Litre of Biuret Reagent**
   - Dissolve 1.5g copper (II) sulphate pentahydrate ($CuSO_4.5H_2O$) and 6.0g sodium potassium tartrate in 500ml distilled water;
   - Add 300ml 10 % (w/v) sodium hydroxide;
   - Make the volume to 1 litre with distilled water;
   - Add 1.0g potassium iodide to inhibit the reduction of copper.
3. **Recipe for the Preparation of One Litre of Iodine Solution**
   - Dissolve 6.0g potassium iodide in 200 ml distilled water;
   - Add 3.0g iodine crystals;
   - Make the volume to 1 litre with distilled water.
4. **Recipe for Preparation of One Litre of 1 % copper (II) sulphate solution**
   - Dissolve 10g of copper (II) sulphate in one liter of distilled water and shake thoroughly to mix or completely dissolve the contents.
5. **Recipe for Preparation of One Litre of 10 % sodium hydroxide solution**
   - Dissolve 100g of sodium hydroxide in one liter of distilled water and shake thoroughly to mix or completely dissolve the contents.
6. **Recipe for Preparation of One Litre of lime water**
   - Add 2.5g of calcium hydroxide to one liter of distilled water. Shake periodically over a 24 hour period. After settling, the lime water is ready for use.
7. **Recipe for Preparation of One Litre of 1% starch solution by weight**
   - Mix 10g analar soluble starch with 50ml distilled water. Boil 800ml distilled water and pour the mixture (starch-distilled water) into the boiling water;
   - Allow the contents to cool and make up to one litre with distilled water.

Food tests

Alternative term: *Biochemical food tests*

Definition: Food tests are experiments carried out to determine the presence or absence of a food nutrient in a food sample.

A nutrient is a substance which provides food for an organism

There are several types of food tests, but the main ones include the following:

1. test for starch – iodine test
2. test for proteins – biuret test
3. test for lipids/fats – emulsion test
4. test for reducing or simple sugars – Benedict's test
5. test for non – reducing or complex sugars

Facts on food tests

The procedure for each food test should be known.

If the food test requires heating, you should know the heating should be done

The sequence of the food test should be correct. If the procedure is wrong, observations and conclusions will also be wrong even though they are correct.

The amount of reagent for each food test should be known

Statements such as no change, no reaction are not accepted

The terms observations, results and conclusions (inference or deductions) should be known.

Test for starch

<table>
<tr><th>Test Method</th><th>Observation</th><th>Conclusion</th></tr>
<tr><td rowspan="2">[if a solution is given]
Put 2cm^3 of the solution in the test tube
Add three drops of iodine solution to the solution in the test tube</td><td>The solution turns blue/black</td><td>Starch present</td></tr>
<tr><td>The solution turns brown / yellow</td><td>Starch absent</td></tr>
<tr><td rowspan="2">[if a powder is given]
Put a little of the powder on a clean white tile
Add 3 drops of iodine solution to the powder</td><td>The powder stain blue / black</td><td>Starch present</td></tr>
<tr><td>The powder stain brown / yellow</td><td>Starch absent</td></tr>
<tr><td rowspan="2">[if a leaf is given]
Dip the leaf in boiling water in a beaker for one minute using a pair of forceps. The leaf is dipped in boiling water to kill the protoplasm in order to stop all the chemical reactions (chemical reactions are stopped so that starch is not converted to glucose)
Then take the leaf, roll it up loosely and place it in 20cm^{3}of alcohol in a test tube and boil the leaf for 3 minutes using a water bath to remove chlorophyll. The top of the test tube should be plugged loosely with cotton wool. The leaf appears white when chlorophyll is removed from it before adding iodine solution in order to observe the colour changes or to make a leaf permeable to iodine solution. The water bath is used because alcohol is highly inflammable.
Remove the leaf from alcohol in the test tube and dip it in hot water to make it soft since alcohol makes the leaf brittle.
Spread breached leaf on a clean white tile
Add three drops of iodine solution to the leaf.</td><td>The leaf stains blue / black</td><td>Starch present</td></tr>
<tr><td>The leaf stains brown</td><td>Starch absent</td></tr>
</table>

Test for proteins

Test Method	Observation	Conclusion
[if a solution is given] Put 2cm^3 of the solution in the test tube Add 2cm^3 of sodium hydroxide solution to the solution in the test tube and then add copper(II) sulphate solution drop by drop by while shaking after each drop or Put 2cm^3 of the solution in the test tube Add biuret reagent to the solution in the test tube and shake.	The solution turns purple or violet	Proteins present
[if a solid is given e.g. ground nut] Crush the solid into smaller pieces to increase the surface area Put the crushed materials in 2cm^3 of distilled water to make a solution in the test tube. Filer the contents of this test tube to have a clear solution. Add 2cm^3 of sodium hydroxide solution to the content in the test tube and then add copper (II) sulphate solution drop by drop while shaking after each drop	The solution remains blue	Proteins absent

Test for lipids / fats

Test method	Observation	Conclusion
1. Emulsion test ***[if a solution is given]*** Put 2cm^3 of the solution in the test tube Add 2cm^3 of ethanol to the solution in the test tube and shake thoroughly to dissolve the fat/lipid and then add three drops of water ***[if a solid is given e.g. ground nut]*** Crush the solid into smaller pieces to increase the surface area	A white / cloudy emulsion forms	Lipids / fats present
Put the crushed materials in 2cm^3 of distilled water in the test tube to make a solution Add 2cm^3 of ethanol to the contents in the test tube and shake thoroughly to dissolve the fats/lipids Filter off the contents of this test tube to have a clear solution Add three drops of water	No white / cloudy emulsion forms	Lipids / fats absent
2. Grease spot / translucent paper mark Press or rub the food sample against the white or khaki strip of paper	A permanent translucent spot / grease spot forms on the strip of paper	Lipids / fats present
	No permanent translucent spot / grease spot forms on the strip of paper	Lipids / fats absent

Test for reducing sugars

Test method	Observation	Conclusion
[if a solution is given] Put 2cm^3 of the solution in the test tube Add 2cm^3 of Benedict's solution to the solution in the test tube and heat the mixture gently.	The solution changes from blue to green, yellow, orange and finally to brick red	Reducing sugars present
[if a powder is given] Dissolve a little of the powder in 2cm^3 of water in a test tube to make a solution Add 2cm^3 of Benedict's solution to the solution in the test tube and heat the mixture gently.	The solution remains blue	Reducing sugars absent

Note

- *If the colour changes from blue to green, it means reducing sugars are present but in very small quantities*

Test for non - reducing sugars

Test method	Observation	Conclusion
[if a solution is given] Put 2cm^3 of the solution in the test tube Add 2cm^3 of Benedict's solution to the solution in the test tube and heat the mixture gently.	The solution remains blue	Non reducing sugars absent
Put 2cm^3 of the solution in the test tube Add dilute hydrochloric acid to the solution in the test tube and heat gently to convert non reducing sugars to reducing sugars Add sodium hydroxide to neutralize the acid Add 2cm^3 of Benedict's solution to the contents in the test tube and heat the mixture gently.	The solution changes from blue to green, yellow, orange and finally to brick red	Non reducing sugars present

Note

- *Sodium carbonate can also be used in place of sodium hydroxide. You should stop adding sodium carbonate when fizzing stops*

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MINISTRY OF GENERAL EDUCATION
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BIOLOGY SCHOOL BASED ASSESSMENT

TASK NUMBER		DATE	

You are provided with

- Iodine solution
- Solution X (Water)
- Solution Y (Starch solution)
- Two test tubes

(a) Test solution X and Y for starch and complete the table below.

Solution	Method	Observation	Conclusion
X	Add 2cm^3 of solution X into a clean and dry test tube. Add 3 drops of iodine solution into the test tube containing solution X and shake.		
Y	Add 2cm^3 of solution Y into a clean and dry test tube. Add 3 drops of iodine solution into the test tube solution Y and shake.		

[4]

(b) Which solution would you recommend for a manual worker?
…… [1]

(c) Give a reason for you answer in (a) above
…….. [1]

(d) Name any three food staff which contain starch.
(I) …….. [1]
(II) …….. [1]
(III) …….. [1]

(e) State the nutrition deficiency disease caused by lack of starch in the diet.
…… [1]

[Total = 10 Marks]

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BIOLOGY SCHOOL BASED ASSESSMENT

TASK NUMBER		DATE	

You are provided with

- Specimen **Z** (a common leaf)

(a) Using a hand lens, examine specimen **Z**. Make a large labeled drawing of the lower part of **Z** to show as many structures as possible.

[5]

(b) Measure and record the length of the drawing of specimen **Z** in (a) above
(Draw a line on the diagram showing the measured length)
Length: …… [1]

(c) Measure and record the longest length of specimen **Z**
Length: …… [1]

(d) Calculate the magnification of your drawing
(Show all the steps followed in arriving at your answer)
……
……
……
……
……
……
……
……
…….. [3]

[Total = 10 Marks]

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TASK NUMBER		DATE	

You are provided with

- Specimen **Z** (bone of skeleton – femur)

(a) Draw the structure of specimen **Z** and label it

[5]

(b) Name the organism where part **Z** could have been extracted from
…… [1]

(c) State any two functions of a skeletal system
(I) …… [1]
(II) …… [1]

(d) State two types of skeletons that make up the organism where part **Z** could have been extracted from
(I) ……... [1]
(II) …….. [1]

[Total = 10 Marks]

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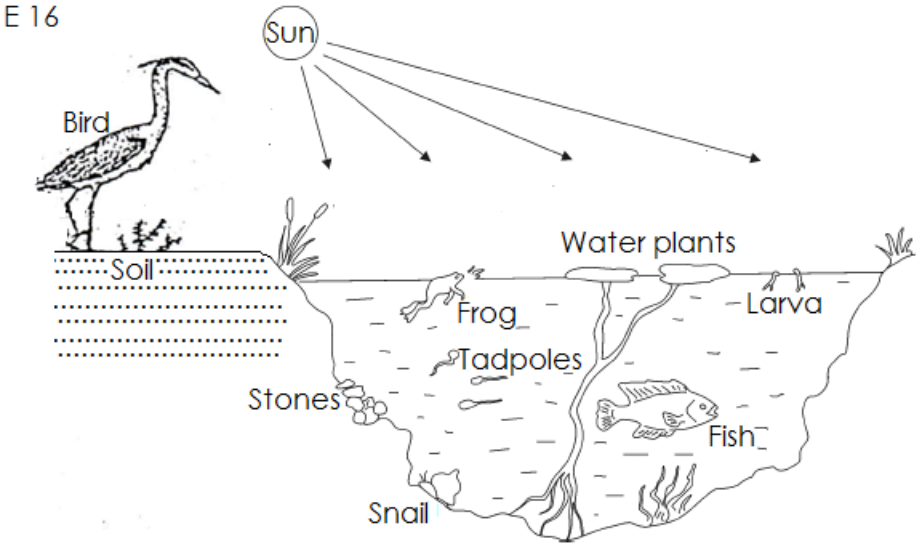
BIOLOGY SCHOOL BASED ASSESSMENT

TASK NUMBER		DATE	

You are provided with

- E16 (as an arrangement representing an ecosystem consisting of biotic and abiotic factors)

E 16



(a) Name the biotic components in E16 and state their roles

(I) Name: ..... [1]
Role:..... [1]

(II) Name: ..... [1]
Role:..... [1]

(b) State any two abiotic components you can see in E16

(I) ..... [1]

(II) ..... [1]

(c) Describe the importance of having a variety of living organisms in E16

.....
..... [1]

(d) Using any three organisms in E16, construct a food chain to illustrate feeding relationships that exists within an ecosystem.

.....
.....
.....
.....
.....
..... [3]

[Total = 10 Marks]

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BIOLOGY SCHOOL BASED ASSESSMENT

TASK NUMBER		DATE	

You are provided with

- A mirror

Method

With the left hand, cover the eye. Then with uncovered eye, look into the mirror.

(a) Make a large labeled drawing showing the external structure of the eye

[5]

(b) State two composition of tears

(I) ……..…….. [1]

(II) ……. [1]

(c) Identify the eye disorder caused by lack of vitamin **A** in the diet

……. [1]

(d) Explain the roles of the following:

(I) convex lens

…… [1]

(II) concave lens

…….. [1]

[Total = 10 Marks]

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BIOLOGY SCHOOL BASED ASSESSMENT

TASK NUMBER		DATE	

You are provided with

- Piece of Irish potato tissue 4cm long soaked for 24 hours solution A (Solution A is distilled water)
- Piece of Irish potato tissue 4cm long soaked for 24 hours solution B (Solution B is concentrated salt solution)
- Tissue paper
- White tile / petri dish

In this experiment, you are to determine the effects of osmosis on the piece of Irish potato tissues placed in different solutions of different concentrations.

(a) You are provided with 2 pieces of Irish potato tissues which are immersed in solutions A and B. Each piece of potato tissue was 4cm in length before they were put in solutions A and B

(I) Remove the piece in solution A and then gently remove excess solution from the piece using tissue paper. Measure its length and record your measurement in the appropriate column in the table below

(II) Repeat the process described in (a) (I) above for the piece in solution B

	Original length (cm)	Length after immersion (cm)	Difference (cm)
Potato tissue from solution A	4		
Potato tissue from solution B	4		

[2]

(b) Describe the concentration of solution A and B in relation to the cell sap concentration of the potato tissue

Solution A:…….. [1]

Solution B:…….. [1]

(c) Explain your answer in (b) for solution A

…….. [1]

(d) Explain answer in (b) for solution B

…….. [1]

(e) Feel the texture of the pieces of potato tissues and state your results

(I) Potato tissue from solution A

…….. [1]

(II) Potato tissue from solution B

…….. [1]

(f) Explain your results in (e) in terms of the cells of the potato tissue

(I) Potato tissue from solution A

…….. [1]

(II) Potato tissue from solution B

…….. [1]

[Total = 10 Marks]

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TASK NUMBER		DATE	

You are provided with

- W31 (house fly)

(a) Specimen W31 is the adult form of an animal. To what class does specimen W31 belong?
…… [1]

(b) State one visible structural feature of the specimen which were used to classify the specimen in (a)
…….. [1]

(c) State one structural feature of specimen W31 which play a role in the spread of disease.
…….. [1]

(d) Make a large labelled drawing of the dorsal side of specimen W31 in the space provided.

[3]

(e) Using a ruler, measure and record the length of the drawing
Measurement of drawing = **……** [1]

(f) Using a ruler, measure and record the length of specimen W31
Measurement of W31 = **……** [1]

(g) Calculate the magnification

[1]

(h) What role does W31 play in the spread of diseases
…… [1]

[Total = 10 Marks]

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TASK NUMBER		DATE	

You are provided with

- Solution A (water)
- Solution B (glucose solution)
- Solution C (egg albumen solution)
- Biuret reagent
- Sodium hydroxide
- Copper (II) sulphate)
- Benedict's solution
- Source of heat

Solutions A, B and C represent urine of people suspended to have a kidney problem or diabetes mellitus, while the third person was of good health.

Method

(a) Carry out food test for reducing sugars and proteins for solution **A, B** and **C**

Test	Solution	Test method	Observation	Conclusion
Reducing sugars	A			
	B			
	C			
Proteins	A			
	B			
	C			

[7]

(b) Using the results from the table, identify the solution presenting a person (s) who;

(I) has/have a kidney problem

…… [1]

(II) is (are) suffering from Diabetes mellitus

…… [1[

(III) is (are) healthy

…….. [1]

[Total = 10 Marks]

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TASK NUMBER		DATE	

You are provided with

- Solution A (extract from carrot)
- Specimen W31 (carrot)
- Specimen W32 (bean seed soaked in distilled water for three days)
- Specimen W33 (bean seed soaked in one molar salt solution for three days)
- Benedicts solution
- Source of heat

In this experiment, you will identify reducing sugars in food samples

You are provided with solution A which is a juice from specimen W31. Carry out a food test to determine the presence of reducing sugars in sample solution A.

(a) State the test method, observation and conclusion in the table below.

Test method	Observation	Conclusion

[2]

(b) State the nutritional value to the human body of the reducing sugars.

…… [1]

(c) State one way in which the propagation of specimen W13 can be carried out.

……
…….. [1]

(d) Further practical test on solution A revealed that the food contained vitamin A.

(I) What is the importance of this vitamin to the human body?

…… [1]

(II) What is the chemical name of vitamin A

…… [1]

(III) What health problem could a person suffer if the vitamin A was lacking in the diet of humans?

…… [1]

(e) Specimen W32 was soaked in distilled water and left to stand for 3 days.
Specimen W33 was soaked in one molar salt solution and left to stand for 3 days.

(I) Carefully, observe specimen W32 and W33. Describe the appearance of specimen W32 and W33

…… [1]

(II) Explain why specimen W32 and W33 will appear in the state mentioned above

…… [1]

(III) Relate the appearance of specimen W32 to the germination of seeds in nature

……
…… [1]

[Total = 10 Marks]

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BIOLOGY SCHOOL BASED ASSESSMENT

TASK NUMBER		DATE	

You are provided with

- Powdered groundnut
- S_1 (Strip of paper)
- S_2 (Strip of paper)
- Distilled water
- Ethanol
- Filter paper
- Test tubes

In this experiment, you will identify lipids / fats in foods

(a) Take a sample of powdered ground nut and press it against one end of a strip of paper labeled S_1. Repeat this action on a second strip of paper labeled S_2.

(I) State what happens to both strips of paper

……
…… [1]

(II) What food test have you just carried out?

…… [1]

(b) Immerse and shake part of S_1 where the powdered ground nut was pressed in 5cm^3 of alcohol for 20 minutes. Remove excess liquid.

Observation (S_1):…… [1]

Reason:…… [1]

(c) Immerse and shake part of S_2 where the powdered ground nut was pressed in 5cm^3 of distilled water for 20 minutes. Remove excess liquid.

Observation (S_2):…… [1]

Reason:…… [1]

(d) Why was it necessary to shake strips S_1 and S_2 in the liquid?

…… [1]

(e) What was the purpose of using distilled water in the experiment?

…….. [1]

(f) Where in the human body is the nutrient you have identified digested?

…….. [1]

(g) Name the enzyme involved in the digestion of the nutrient

…… [1]

[Total = 10 Marks]

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BIOLOGY SCHOOL BASED ASSESSMENT

TASK NUMBER		DATE	

You are provided with

- W31 (Sugar cane)
- W32 (Bread)
- Knife / razor blade
- Benedict's solution
- Sodium hydroxide / sodium carbonate solution
- Dilute hydrochloric acid
- Source of heat

In this experiment, you will identify non reducing sugars in foods

Method

Using a knife or razor blade, cut specimen W31 and W32 separately into small pieces. Put the cut pieces in separate test tubes. Add $5cm^3$ of distilled water to each test tube and shake.

(a) Describe with full details how to carry out the test for non - reducing sugars.

……..
……..
……..
…….. [2]

(b) Test the two specimens for reducing sugars and record your observations and conclusions in the table below.

	Observation	Conclusion
W31		
W32		

[2]

(c) What was the purpose of adding the following to the test liquids?

(I) Dilute hydrochloric acid

…….. [1]

(II) Dilute sodium hydroxide

…….. [1]

(d) In what form does W31 store the carbohydrate that has tested positive?

…….. [1]

(I) Give a reason why this carbohydrate is stored in the form mentioned above

…….. [1]

(II) Name the storage organ W31

…….. [1]

(e) In what form are carbohydrates transported in plants?

…….. [1]

[Total = 10 Marks]

SN	NAME OF CANDIDATE	EXAMINATION NUMBER	CENTER NUMBER	SEX	CLASS

MINISTRY OF GENERAL EDUCATION
NATURAL SCIENCES DEPARTMENT
BIOLOGY SCHOOL BASED ASSESSMENT

TASK NUMBER		DATE	

You are provided with

- W31 (Egg)
- Biuret reagent
- Test tubes
- Spoon

In this experiment, you identify proteins in foods

(a) Draw the entire egg, exposing the inside without breaking it. Labels are required.

[4]

(b) To which class of animals does specimen W31 come from?

…… [1]

(c) Mention three features of the class of animals in (b) above

(I) …… [1]

(II) …… [1]

(III) …… [1]

(d) Break the egg and carry out the test for proteins from the white part (liquid)

(I) Observation:…… [1]

(II) Conclusion:…… [1]

[Total = 10 Marks]

SN	NAME OF CANDIDATE	EXAMINATION NUMBER	CENTER NUMBER	SEX	CLASS

MINISTRY OF GENERAL EDUCATION
NATURAL SCIENCES DEPARTMENT
BIOLOGY SCHOOL BASED ASSESSMENT

TASK NUMBER		DATE	

You are provided with

- W31 (Carrot)
- W32 (Onion)
- Iodine solution

In this experiment, you will study similarities and differences between specimen W31 and W32

Method

Cut W31 in half (transverse section). Cover one of these surfaces with few drops of iodine solution

(a) After one minute, rinse off the iodine solution with water and make a drawing of the stained surface in the space below. Use the hand lens to observe details and label

[4]

(b) Explain any differences which can be seen between the stained and unstained surface of specimen W31

……
…… [1]

(c) Make a drawing of the cut surface (T.S) of specimen W32

[3]

(d) Suggest how the carbohydrates which are present in W31 and W32 are important to the two plants

……
……
…… [2]

[Total = 10 Marks]

SN	NAME OF CANDIDATE	EXAMINATION NUMBER	CENTER NUMBER	SEX	CLASS

MINISTRY OF GENERAL EDUCATION
NATURAL SCIENCES DEPARTMENT
BIOLOGY SCHOOL BASED ASSESSMENT

TASK NUMBER		DATE	

You are provided with

- W31 (2cm internodes of bamboo which is 1.5cm in diameter)
- W32 (2cm internodes of cucurbit which is 1.5cm in diameter) (Alternatively, melon, marrow, squash or cucumber)
- Hand lens

In this experiment, you will compare the visible similarities and differences showing specimens or species

Method

(a) Using the hand lens, examine the cut end of W31 and make a large labeled drawing of the cut surface

[2]

(I) Measure and record the diameter of your drawing
Diameter:…… [1]

(II) Measure and record the diameter of specimen W31
Diameter:…… [1]

(III) Calculate the magnification of your drawing

[2]

(b) Using the hand lens, examine the cut surface end of W32 and make a large, labeled drawing of the cut surface

[2]

(c) State one visible similarity which is shown by W31 and W32
…… [1]

(d) State one differences between W31 an W32
……
…… [1]

[Total = 10 Marks]

SN	NAME OF CANDIDATE	EXAMINATION NUMBER	CENTER NUMBER	SEX	CLASS

MINISTRY OF GENERAL EDUCATION
NATURAL SCIENCES DEPARTMENT
BIOLOGY SCHOOL BASED ASSESSMENT

TASK NUMBER		DATE	

You are provided with

- W31 (Pea or bean fruit)
- W32 (Tomato)
- W33 (Orange or lemon)
- W34 (Combretum)

Theory

Fruit formation is an important phase of sexual reproduction in flowering plants. Fruits protect and help in seed distribution. Animals usually eat the fruits. Seeds are matured ovules which are normally enclosed within the fruit.

In this experiment, you will be required to:

- Examine the inside parts of pea, tomato and lemon fruits
- Examine the seeds of pea fruits
- Examine external features of the three fruits

Method

(a) Observe the external structure of specimen W31

(b) Open W31 and observe structures of the inside showing seeds in position

(c) Make a transverse section through the centre of specimen W32 and make a large labeled drawing of the cut surface.

[2]

(d) Measure the diameter of the drawing of specimen W32
Diameter of drawing =…….…… [1]

(e) Measure the diameter of the cut surface of specimen W32
Diameter of cut surface =…… [1]

(f) calculate the magnification of your drawing

[2]

(g) State the method of dispersal of W34
…… [1]

(h) Name one way in which W34 is adapted for the method of dispersal you have given in (g) above
…….. [1]

(i) State one structural difference between the cut surface of W32 and W33
…… [1]

(j) State one visible structural difference between the cut surface of W32 and W33
…… [1]

[Total = 10 Marks]

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MINISTRY OF GENERAL EDUCATION
NATURAL SCIENCES DEPARTMENT
BIOLOGY SCHOOL BASED ASSESSMENT

TASK NUMBER		DATE	

You are provided with

- W31 (Dicot leaf)
- W32 (Monocot leaf)
- Hand lens

In this experiment, you will study the structures of the dicot and monocot leaves and determine the magnification of W31

(a) Specimen W31 is common leaf. Using a hand lens, examine specimen W31. Make a large labeled drawing of the lower part of W31 to show as many structures as possible.

[3]

(b) Measure and record the length of the drawing of specimen W31 in (a) above
(Draw a line on the diagram showing the measured length)
Length:…… [1]

(c) Measure and record the longest length of specimen w31
Length:…… [1]

(d) Calculate the magnification of your drawing
(Show all the steps followed in arriving at your answer)

[2]

(e) Specimen W32 is another common leaf
Using a hand lens, compare specimen W31 and W32

(I) Describe one visible similarity between specimen W31 and W32
…… [1]

(II) Describe one visible difference between specimen W31 and W32
.....
…… [1]

(f) Mention one benefit of a plant having specimen W31
…… [1]

[Total = 10 Marks]

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MINISTRY OF GENERAL EDUCATION
NATURAL SCIENCES DEPARTMENT
BIOLOGY SCHOOL BASED ASSESSMENT

TASK NUMBER		DATE	

You are provided with

- Specimen W34 (Variegated leaf prepared by boiling in water, then in alcohol)
- Specimen W35 (Variegated leaf prepared by boiling in water)
- Iodine solution
- Water tile or petri dish

In this experiment, you will test a leaf for starch and determine the magnification of the leaf

You are provided with two leaves of the same species, W34 and W35, which after picking have been prepared in different ways. These are submerged in water in two petri dishes

(a) Describe how W34 differs in appearance from W35

……
…… [1]

(b) Drain the water from specimen W34 and add iodine solution until the specimen is just covered.

Observe carefully how the specimen changes colour over the next 2 or 3 minutes

(I) Record the colour changes you have observed
…… [1]

(II) Describe the appearance of specimen W34 when it was picked
…….. [1]

(III) What conclusion can you draw from these results?
…….. [1]

(IV) Describe how specimen W34 and W35 were prepared after being picked from the plant
……
……
…… [1]

(a) Make a large labeled drawing of the lower surface of specimen W35.

[2]

(b) Measure accurately the longest distance of the drawing
Longest distance:…… [1]

(c) Measure accurately the longest distance of specimen W35
Longest distance:…… [1]

(d) Use your measurement to calculate the magnification of your drawing.

[1]

[Total = 10 Marks]

SN	NAME OF CANDIDATE	EXAMINATION NUMBER	CENTER NUMBER	SEX	CLASS

MINISTRY OF GENERAL EDUCATION
NATURAL SCIENCES DEPARTMENT
BIOLOGY SCHOOL BASED ASSESSMENT

TASK NUMBER		DATE	

You are provided with

- Razor blade,
- Hand lens,
- Specimen **P** (Flower)

In this experiment, you will identify the reproductive structures of the flower and determine the magnification of the drawing

(a) using a razor blade, carefully cut a longitudinal section of specimen P. Examine the section using a magnifying hand lens and make a large labeled drawing to show the internal features

[2]

(b) Measure the length of P (Draw a line along the measured length)
Length:…… [1]

(c) Calculate the magnification of your drawing

[1]

(d) Name the agent of pollination of specimen P
…… [1]

(e) Give one reason for your answer in (d) above
…… [1]

(f) Complete the table below

Flower part	**Function**
Anther	
	Develops in a seed
Sepal	
	It is the passage of the pollen tubes and their nuclei to the ovary.

[4]

[Total = 10 Marks]

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MINISTRY OF GENERAL EDUCATION
NATURAL SCIENCES DEPARTMENT
BIOLOGY SCHOOL BASED ASSESSMENT

TASK NUMBER		DATE	

You are provided with

- W32 (Femur)
- W33 (Lumber vertebrate)
- Hand lens

In this experiment, you will study the structure of bones of the skeleton and you will determine the magnification of the bones

(a) Draw a well labeled diagram of specimen W33 in the space provided below. You may use a hand lens

[2]

(a) Measure the length of the drawing. (Draw a line along the length measured)
Length:…… [1]

(b) Measure the longest length of specimen W33
Length:…….. [1]

(c) Calculate the magnification of your drawing

[1]

(d) Which part of the mammalian skeleton do we find specimen W33?
…….. [1]

(e) The part of the mammalian skeleton mentioned in (d) is made up of bones named according to the part of the skeleton on which they lie. Name any two of these bones
…… [1]

(f) Mention one function of the mammalian skeleton
…….. [1]

(g) Specimen W32 is a bone of the mammalian skeleton

(I) Name the bone
…… [1]

(II) State one difference between specimen W32 and W33
…… [1]

[Total = 10 marks]

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MINISTRY OF GENERAL EDUCATION
NATURAL SCIENCES DEPARTMENT
BIOLOGY SCHOOL BASED ASSESSMENT

TASK NUMBER		DATE	

You are provided with

- D31 (Flight feather)
- D32 (Down feather)
- Hand lens

In this experiment, you will determine structure and functions of feathers of birds and determine the magnification of feathers

(a) Make a drawing of specimen D31 which is a feather from the wing of a bird, in the space provided below

[3]

(b) Measure and record the length of your drawing
Length:…… [1]

(c) Measure and record the length of specimen D31
Length:…….. [1]

(d) Calculate the magnification of your drawing

[2]

(e) Examine specimen D31 with a hand lens. Draw an enlargement of a small part of the specimen to show how the side structures are attached to the central support

(f) Suggest how the structure of specimen is related to its function.
…… [1]

(g) Specimen D32 is a different type of feather from another part of the bird.

(I) State one similarity in the structure between specimen D31 and D32
…… [1]

(II) State one difference in the structure between specimen D31 and D32
…… [1]

[Total = 10 marks]

SN	NAME OF CANDIDATE	EXAMINATION NUMBER	CENTER NUMBER	SEX	CLASS

MINISTRY OF GENERAL EDUCATION
NATURAL SCIENCES DEPARTMENT
BIOLOGY SCHOOL BASED ASSESSMENT

TASK NUMBER		DATE	

You are provided with

- White maize
- Yellow maize

In maize plants, the allele **M**, for white seeds is dominant over the allele **m** for yellow seeds.100 heterozygous plants were self-pollinated and 250 yellow seeds were collected.

(a) Draw a well labeled genetic diagram to show the result of crossing of heterozygous plants.

[4]

(b) What is the expected ratio of white seeds to yellow seeds?

……
……
……
……
……
…… [2]

(c) What is the expected number of white seeds?

……
……
……
……
……
…… [2]

(d) What is the expected total number of seeds?

……
……
……
……
……
…… [2]

[Total = 10 marks]

SN	NAME OF CANDIDATE	EXAMINATION NUMBER	CENTER NUMBER	SEX	CLASS

MINISTRY OF GENERAL EDUCATION
NATURAL SCIENCES DEPARTMENT
BIOLOGY SCHOOL BASED ASSESSMENT

TASK NUMBER		DATE	

You are provided with

- Seeds (e.g. maize or sunflower)
- Organic fertilizers
- Inorganic fertilizers
- Three pots
- Soil
- Meter rule
- Source of water

In this experiment, you will show the effect of organic and inorganic fertilizers

Method

1. Place an equal amount of the top soil collected from the same point and mix thoroughly
2. Water the three pots with an equal amount of water
3. Plant the seeds at the same depth in the three pots
4. Label the three pots e.g. organic, inorganic and control
5. Water the plants every after one day
6. To each potted plant:
   (I) Apply organic fertilizer to the pot labeled organic
   (II) Apply inorganic fertilizer to the pot labelled inorganic
   (III) Don't apply fertilizer to the pot labelled control
7. Water the plants at the same time every after 1 day
8. Take measurements of each plant every after 7 days
   (a) Measure the height of each plant every after 7 days
   (b) Count the number of leaves on each plant every after 7 days
9. Repeat steps 8(a) and 8(b) for 28 days
10. Record your observations in the table below:

Plant	Height in cm				Number of leaves				Any other observations
	Day 7	Day 14	Day 21	Day 28	Day 7	Day 14	Day 21	Day 28	
Organic									
Inorganic									
Control									

[10]

[Total = 10 marks]

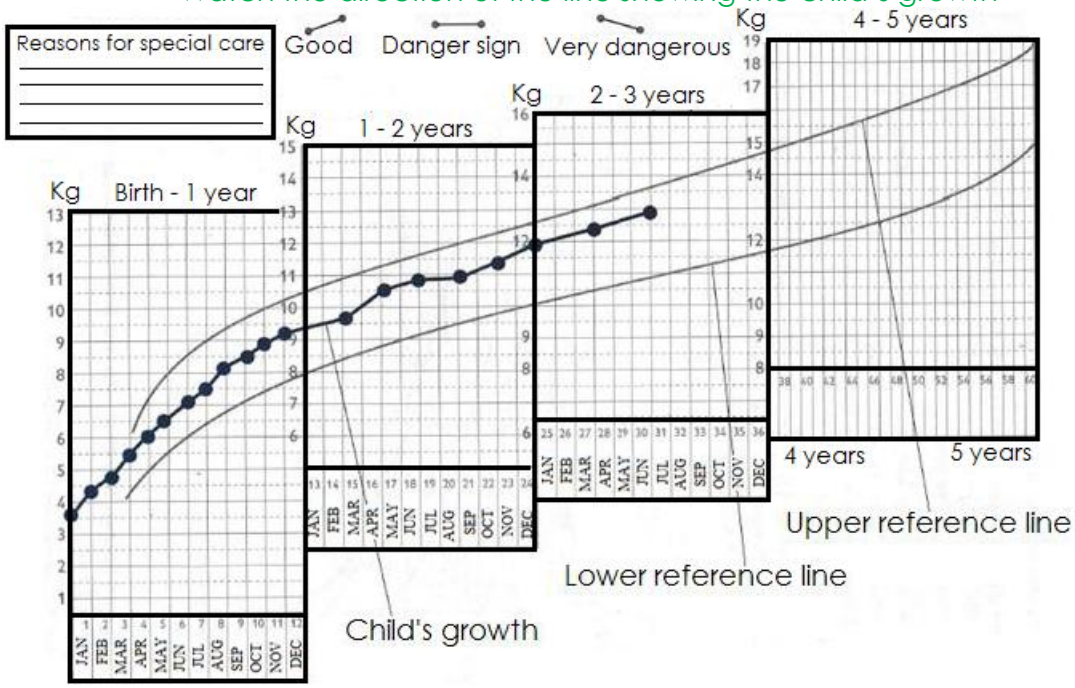
SN	NAME OF CANDIDATE	EXAMINATION NUMBER	CENTER NUMBER	SEX	CLASS

MINISTRY OF GENERAL EDUCATION
NATURAL SCIENCES DEPARTMENT
BIOLOGYSCHOOL BASED ASSESSMENT

TASK NUMBER		DATE	

You are provided with the Children's Under-Five Clinic Card below

Watch the direction of the line showing the child's growth



(a) What was the maximum age on the card?

…… [1]

(b) During which period was the growth of the child most rapid?

…… [1]

(c) At what age is the child going to experience another rapid growth?

…… [1]

(d) How heavy was the child when he was last weighed?

…… [1]

(e) How heavy was the child when he was six months?

…… [1]

(f) What is the change in weight of the child between the 17th month and 18th month in its second year?

…… [1]

(g) Which period on the card identifies the part which describes "danger Sign" for the child's health?

…… [1]

(h) In what other way can growth of an organism be measured apart from the one shown in the diagram above?

…… [1]

(i) Apart from tuberculosis, name one any other disease that a child is immunized against and the information recorded on the clinic card

Name of disease: …… [1]

Information recorded on the clinic card:……

…… [1]

[Total = 10 Marks]

SN	NAME OF CANDIDATE	EXAMINATION NUMBER	CENTER NUMBER	SEX	CLASS

MINISTRY OF GENERAL EDUCATION
NATURAL SCIENCES DEPARTMENT
BIOLOGY SCHOOL BASED ASSESSMENT

TASK NUMBER		DATE	

You are provided with the following

Apparatus	**Materials**
Test tube	W31 (Detached leaf)
Source of heat	Ethanol / Alcohol
Tripod stand and wire gauze	Water
Test tube holder	Iodine solution
Stop watch	Dropper
Beaker	White tile

Method

Examine specimen W31 carefully and record your observations below

(a) Describe W31 in terms of:
- (I) External appearance: ……. [1]
- (II) Texture: …… [1]

(b) Dip W31 in boiling water for one minute using a pair of forceps
- (I) Record any observable changes

  ……..
  ……. [1]

(c) Boil alcohol (20cm^3 of ethanol) in a beaker using a water bath. Put W31 in the boiling alcohol for about 3 minutes
- (I) Record any observable changes

  ……..
  ……. [1]
- (II) Why did you put W31 in boiling alcohol?

  ……..
  ……. [1]

(d) Put W31 in boiling water for about one minute.
- (I) Why did you put W31 in boiling water for one minute?

  ……..
  ……. [1]
- (II) Record the texture of W31

  ……..
  ……. [1]

(e) Spread W31 on a white tile and add 3 drops of iodine solution. Allow the experiments to stand for a few minutes
- (I) Observation: …….. [1]
- (II) Conclusion: …… [1]

(f) Why was the water bath used to boil the alcohol in (c) above?

……..
……. [1]

[Total = 10marks]

SN	NAME OF CANDIDATE	EXAMINATION NUMBER	CENTER NUMBER	SEX	CLASS

MINISTRY OF GENERAL EDUCATION
NATURAL SCIENCES DEPARTMENT
BIOLOGY SCHOOL BASED ASSESSMENT

TASK NUMBER		DATE	

You are provided with

- White tile
- Magnifying glass
- D 31 (dicot leaf)
- D32 (monocot leaf)

In this experiment, you will calculate the magnification of the drawing

Method

(a) Draw a large labelled diagram of specimen D31

[4]

(a) Measure and record the longest part of the drawing, then draw a thick line on the diagram of the part you measured. Label this line as L
Longest length of drawing of specimen D31 = …….. [1]

(b) Measure and record the longest part of specimen D31
Longest length of D31 = …….. [1]

(c) Using the length of specimen D31 and that of the drawing, calculate the magnification of your drawing using the formula,

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

[2]

(d) Compare and contrast the features observed on specimen D31 and D32 by writing down:

(I) one difference between D31 and D32
……
…… [1]

(II) one similarity between D31 and D32
……
…… [1]

[Total = 10 marks]

SN	NAME OF CANDIDATE	EXAMINATION NUMBER	CENTER NUMBER	SEX	CLASS

MINISTRY OF GENERAL EDUCATION
NATURAL SCIENCES DEPARTMENT
BIOLOGY SCHOOL BASED ASSESSMENT

TASK NUMBER		DATE	

You are provided with

- Onion
- Glass slide
- Iodine solution
- Water
- Razor blade
- Microscope

In this experiment, you will use a microscope to examine the structure of a plant cell

Method

1. Peel a piece of thin layer of from the onion. Place it carefully on a glass slide
2. Add two drops of drops of iodine to the specimen and place the specimen on the stage of the microscope.
3. Turn the adjusting knob to focus the image clearly
4. Observe the different parts of the plant cell

(a) Draw the structures of the cell that you see under the microscope and label the following: nucleus, vacuole, cell membrane, cell wall and cytoplasm

[5]

(b) State the functions of following parts:

(I) Nucleus

…… [1]

(II) Vacuole

…… [1]

(III) cell membrane

…… [1]

(IV) cell wall

…… [1]

(V) cytoplasm

…… [1]

[Total = 10 marks]

SN	NAME OF CANDIDATE	EXAMINATION NUMBER	CENTER NUMBER	SEX	CLASS

MINISTRY OF GENERAL EDUCATION
NATURAL SCIENCES DEPARTMENT
BIOLOGY SCHOOL BASED ASSESSMENT

TASK NUMBER		DATE	

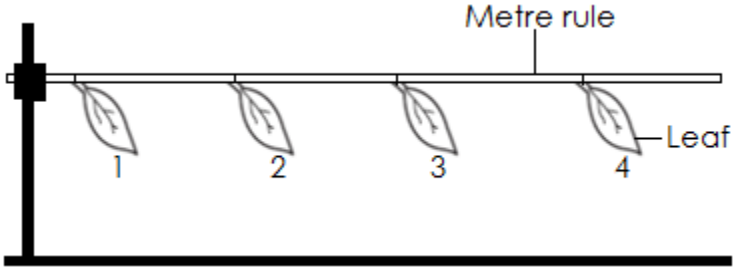
You are provided with

- Four fresh leaves of the same size from the same plant
- Cotton thread
- Vaseline
- Metre rule
- Clamp and stand
- Cello tape
- Pair of forceps
- Two equal pieces of cobalt chloride paper

In this experiment, you will prove that plants loss water through the leaves by transpiration

Method

1. Fix the metre rule onto the clamp stand
2. Tie the leaves with the cotton thread and let them hang on the meter rule well-spaced from each other as shown in the diagram below



3. Smear some Vaseline on the shiny surface of the first leaf
4. Smear the second leaf with Vaseline on the dull surface only
5. Smear the third leaf with Vaseline on both surfaces
6. Do not smear any Vaseline on the fourth leaf
7. Leave the whole set by the side of a window for a period of not less than 24 hours.

(a) What was the purpose of smearing Vaseline on some surfaces of the leaves?

……
…… [2]

(b) Why was one leaf left without Vaseline?

…… [2]

(c) How do you tell that a leaf has lost a lot of water?

……
…… [2]

(d) Why did leaf 1 and 2 lose different amounts of water?

……
…… [1]

(e) From your observations, which surface of a leaf has more stomata?

……
…… [2]

(f) What do we call the process by which plants lose water through stomata?

……
…… [1]

[Total = 10 marks]

SN	NAME OF CANDIDATE	EXAMINATION NUMBER	CENTER NUMBER	SEX	CLASS

MINISTRY OF GENERAL EDUCATION
NATURAL SCIENCES DEPARTMENT
BIOLOGY SCHOOL BASED ASSESSMENT

TASK NUMBER		DATE	

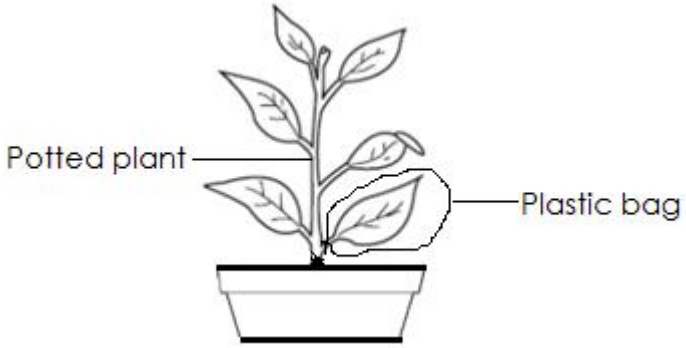
You are provided with

- Transparent plastic bag
- Potted plant

In this experiment, you will prove that plants loss water through the leaves by transpiration

Method

1. Enclose the a leaf of the potted plant with a clean, dry transparent plastic bag and tie the mouth of the plastic bag around the branch of the plant as shown below.



2. Leave the set up for 2 hours in the sun.
3. Examine the inside of the plastic bag

(a) What did you observe inside the plastic bag?

……..
……..
…….. [2]

(b) Explain these observations

……..
……..
…….. [2]

(c) How can you confirm the products in the bag?

……..
……..
…….. [2]

(d) Design a control experiment for the above

[4]

[Total = 10 marks]

SN	NAME OF CANDIDATE	EXAMINATION NUMBER	CENTER NUMBER	SEX	CLASS

MINISTRY OF GENERAL EDUCATION
NATURAL SCIENCES DEPARTMENT
BIOLOGY SCHOOL BASED ASSESSMENT

TASK NUMBER		DATE	

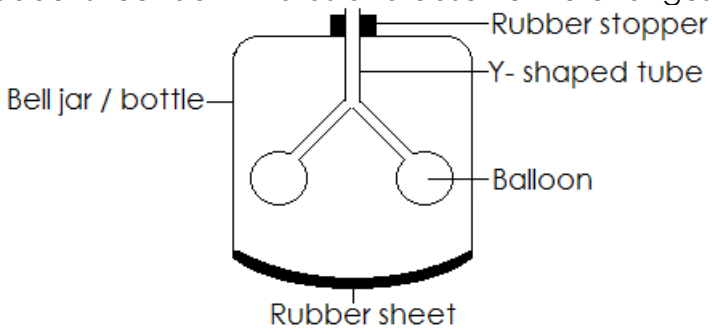
You are provided with

- Y- shaped glass tube, bell jar / bottle / plastic bag, two rubber bands, rubber sheet, string, pair of scissors, rubber stopper, two balloons, rubber stopper with a hole in the middle to fit the bell jar

In this experiment, you will use a bell jar model to demonstrate inhalation and exhalation.

Method

1. Using the string, tightly tie the balloons to the ends of the Y glass tube
2. Fix the rubber stopper into the neck of the bell jar by pushing the Y shaped tube up through the bottom of stopper
3. Tie the rubber sheet onto the bottom of the bell jar
4. Push the rubber sheet upwards and observe the changes
5. Push the rubber sheet downwards and observe the changes



(a) What happens to the balloons when the rubber sheet is pulled down?
…… [1]

(b) What happens to the balloons if you push the rubber sheet up into the bell jar?
…… [1]

(c) Compare the model with the chest.

(I) What does the bell jar represent?
…… [1]

(II) What does the long tube represent?
…… [1]

(III) What do the two branches of the Y tube represent?
…… [1]

(IV) What do the two balloons represent?
…… [1]

(V) What does the rubber sheet represent?
…… [1]

(VI) Explain the observations you made when the rubber sheet was pulled up and down
……
…… [3]

[Total = 10 marks]

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MINISTRY OF GENERAL EDUCATION
NATURAL SCIENCES DEPARTMENT
BIOLOGY SCHOOL BASED ASSESSMENT

TASK NUMBER		DATE	

You are provided with

- Two potted plants of the same size and species
- Card box painted black inside

In this experiment, you will demonstrate the effect of light on the stem

Method

1. Place the plants on the shelf in the laboratory near a narrow window
2. Cover one of the plants with a cardboard with a hole facing the window. Leave the plants for three days
3. After three days, remove the cardboard and observe the plants
   (a) Draw the two observed potted plants

[4]

(b) What can you conclude from your observations?

……..
……..
…….. [2]

(c) Explain the purpose of leaving the other plant uncovered?

……
……
…… [2]

(d) What is meant by the term phototropism?

……
……
…… [2]

[Total = 10 marks]

SN	NAME OF CANDIDATE	EXAMINATION NUMBER	CENTER NUMBER	SEX	CLASS

MINISTRY OF GENERAL EDUCATION
NATURAL SCIENCES DEPARTMENT
BIOLOGY SCHOOL BASED ASSESSMENT

TASK NUMBER		DATE	

You are provided with

- Two beakers / glass bottles
- Red / blue ink or any dye / potassium permanganate
- Chalk particles
- Scalpel or razor blade
- Two small plants e.g. black jack (*Biden pilosa*)
- Hand lens
- Water

In this experiment, you show that plants absorb water and mineral salts

Method

1. Pour 300ml of water into the two beakers
2. Add 3 drops of red / blue ink or 3 crystals of potassium permanganate into one beaker
3. In each beaker, carefully place one plant of the same type and size
4. Place the two beakers on the window sill in the classroom or preferably in a well-lit place. Allow the beakers to stand for 2 hours
5. Remove the plants from each beaker and place them on the a white tile
6. Using a razor blade, cut the cross section of the tap root. Using a hand lens, observe the cut surfaces (see figure 1)
7. Using a razor blade, cut the cross section of the stem. Using a hand lens, observe the cut surfaces. (see figure 2)

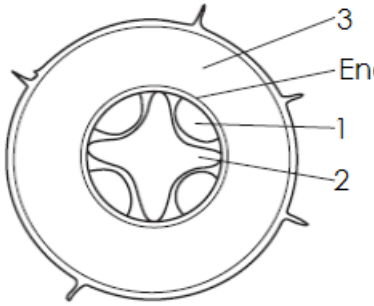

Figure 1

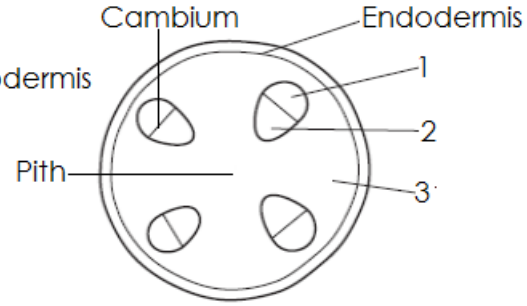

Figure 2

(a) Identify the parts labelled 1, 2 and 3

(I) 1: ..... [2]
(II) 2: ..... [2]
(III) 3: ..... [2]

(b) What conclusion can you make from the observations in figure 1 above

.....
..... [2]

(c) What conclusion can you make from the observations in figure 2 above

.....
..... [2]

[Total = 10 marks]

SN	NAME OF CANDIDATE	EXAMINATION NUMBER	CENTER NUMBER	SEX	CLASS

MINISTRY OF GENERAL EDUCATION
NATURAL SCIENCES DEPARTMENT
BIOLOGY SCHOOL BASED ASSESSMENT

TASK NUMBER		DATE	

You are provided with

- Blue cobalt chloride paper
- Paper stickers
- Elastic bands / cello tape
- Cover slips / glass slide
- Potted plant (Geranium / coleus)

In this experiment, you will compare the rate transpiration on the lower and upper leaf surface using anhydrous cobalt chloride paper

Method

1. From the potted plant (Geranium) identify two leaves of the same size and label them A and B using paper stickers
2. To leaf A cover the lower surface with cobalt chloride paper
3. To leaf B cover the upper part
4. Attach a blue anhydrous cobalt chloride paper on either side of the leaf surface. Observe any changes and take note the time taken for any change to take place
5. Hold them tightly with a cello tape or elastic band

(a) What changes did you observe on the blue cobalt chloride paper on the lower and upper surface of the leaf?

……..
……..
……..
…… [3]

(b) What conclusion can you make from the observation?

……..
……..
…… [2]

(c) Where is the concentration of the stomata highest on the leaf?

……..
……..
…… [2]

(d) From the experiment, give the possible definition of transpiration

……..
……..
…… [3]

[Total = 10marks]

Darlington Naosa

About the author

Darlington Naosa grew up in Kafue District, Lusaka Province. He did his primary education at Nakatete Primary School in Kafue from 1989 to 1995. He went to Naboye Secondary School for his junior secondary education in Kafue from 1996 to 1997. He continued his senior secondary education at Naboye Secondary School from 1998 to 2000. He went to Nkrumah Teachers College from 2002 to 2003 where he obtained the Secondary Teachers Diploma and graduated as a best student in Science. He went to the University of Zambia from 2012 to 2016 where he obtained the Bachelor's Degree in Chemistry Education. He is currently doing his Master of Science in Chemistry with The Copperbelt University.

He has been Head of Department for Natural Sciences at Namushakende Secondary School from 2019. He has taught chemistry, physics and biology at Namushakende Secondary School since 2019. He has been teaching chemistry and physics at Kambule Technical Secondary School from 2009 to 2019. He has been lecturing chemistry at Zambian College of Open Learning (ZAMCOL) in Mongu from 2015 and he has also been a chemistry tutor at the University of Barotseland from 2018. He has been a marker for integrated science with the Examinations Council of Zambia (ECZ) from 2009. He previously taught environmental science at Kanyonyo Basic School from 2007 to 2009. He also taught chemistry and biology at Naboye Secondary School from 2004 to 2007.