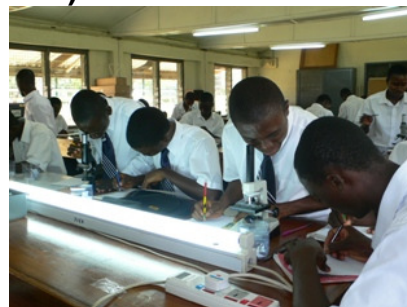
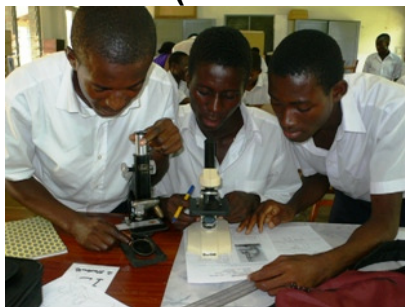


## MICROSCOPE (3 x 2 hour lesson)



### 1ST WEEK (2 HOUR): PRINCIPLE OF MICROSCOPE AND BASIC QUIZ

Principle of microscope

Make a simple microscope using two convex lenses to learn the principle of microscope.

Identification of the parts and their functions

Draw a microscope on A5 sheet and indicate the main parts' name.

Students must summarize how to handle microscope and how to adjust focus on the objects through answering practical quiz sheets.

Confirm the direction of the object movement in the visual field when you slide a preparation on microscope stage to various directions.

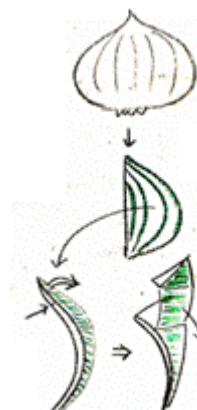
Measure the diameter of visual fields of microscope in different magnifications.

### 2ND WEEK (2 HOUR): HOW TO MAKE WET SLIDES (ONION EPIDERMAL TISSUE)

How to make single cell layer plant tissue wet slide

Demonstrate how to make wet slide

- Cut a red onion bulb into crescent shapes.
- Pick up a piece which has red epidermis.
- Fold the upper part of the piece and peel the single layer epidermis.
- Paste the layer on a slide.
- Cut the thick part off to leave the layer only.
- Drop some water on the layer and stretch it with tweezers.
- Mount a cover slip slowly to avoid air bubbles.
- If the water is too much, remove it with a piece of filter paper



How to record the observation using drawings (sketches)

Tell students the following rules

- Come to lab with your pencil.
- Do not sharpen the pencils in the lab.
- Collect waste from your rubber.
- Put used cover slips and slides in the proper container.
- Use sketch paper portrait and write the following on top of the sheet; date, your microscope number, your class, your index number, your full name.

Draw the sketch as large as possible.

Make students record their observation with sketches.

### 3RD WEEK (2 HOUR): MICROSCOPE HANDLING TEST

Individual test to examine if the student can obtain bright and clear object image within restricted seconds

Group activity (microscope handling general quiz)

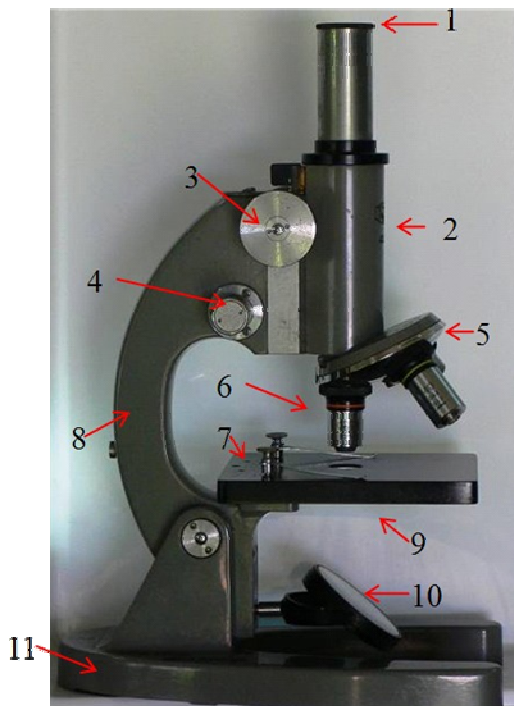
# MICROSCOPE

Class: \_\_\_\_\_ Microscope No. \_\_\_\_\_ Date: \_\_\_\_\_

Names of group member (fill in block letters)			
Index number	First name	Middle name	Last name

1. Indicate the microscope parts name using the following words.

Aperture diaphragm, arm/limb, base, body tube, coarse focus adjustment, eyepiece, fine focus adjustment, objectives (object lenses), reflex mirror, revolving nosepiece, stage



1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
6. \_\_\_\_\_
7. \_\_\_\_\_
8. \_\_\_\_\_
9. \_\_\_\_\_
10. \_\_\_\_\_
11. \_\_\_\_\_

2. Fill in the brackets with the most suitable words below.

Words: arm/limb, gently, lenses, mirrors, one hand, two hands, tilt, wash

- 1) ( ) your hands before using microscopes.
- 2) Carry the microscope with ( ). Support the base with one hand and grasp the ( ) with another hand.
- 3) While carrying the microscope do not ( ) it.
- 4) Place microscope on the lab table ( ).
- 5) Do not touch ( ) with fingers.

3. The following sentences show how to focus the microscope. Fill in the brackets with the most suitable words below.

Words: aperture diaphragm, down, eyepiece, lower, minimum, nosepiece, preparation, raise, reflex mirror, up

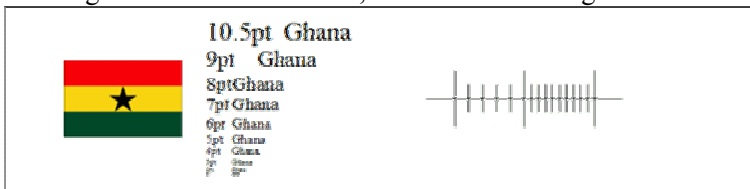
- 1) Revolve the ( ) to place the ( ) power objective lens on the hole of stage
- 2) Open the ( ) wider.
- 3) Peering through the ( ), adjust the ( ) in order to make the visual field of microscope brighter.
- 4) Put a sheet of ( ) on the stage.
- 5) Viewing microscope laterally, ( ) the body tube as close as possible to the preparation.
- 6) Peering through eyepiece, focus on preparation with sliding ( ) body tube very slowly.

4. The following sentences show how to draw biological sketches. Fill in the brackets with the most suitable words below.

Words: air bubbles, circle, dots, extraordinaire, large, shadow, small, typical

- (a) Use white paper (Kent is the best) and a fine pencil.
- (b) Write date, grade, class and your index number and name on the upper right of the white paper.
- (c) Do not draw a ( ) which seems to express the rim of visual field.
- (d) Draw the sketch with thin clear line, do not add ( ) nor duplicate the lines.
- (e) If you want to show perspective or make stereoscopic drawing, use small clear uniform ( ).
- (f) Check some samples, and sketch the most ( ) object.
- (g) Ignore ( ) and broken parts.
- (h) Draw the sketch as ( ) as possible.
- (i) When you draw only small part of one organism, check the position and the direction of the part among whole body.
- (j) Describe any observation that you saw.

5. Using the sheet shown below, check the following



1) Place the sheet on microscope stage. Make sure to put it in such a way that you can read the letters normally. Observe the sheet with the lowest magnification.

Draw a letter "G" in the field	Slide the sheet like below and record the direction of the sheet movement in the field.
	Shift the sheet <span style="color: red;">result</span> to upward (further than you) ( ) To downward (to you) ( ) To the right ( ) To the left ( ) To the upper (further) right ( ) To the lower (bottom) left ( )

2) Measure the diameter of the visual field of microscope in different power using the ruler printed on the sheet.

Microscope number ( )			
Eyepiece magnification	10 X	10 X	10 X
Objective lens magnification			
Total magnification			
Diameter of the field (mm)			

6. Select stains which can dye chromosomes from the list below.

List: Acetocarmine, hematoxylin, methylene blue, eosin, indigo carmine, safranine, fast green

7. Explain the function of fixative solution.

## Sample answers

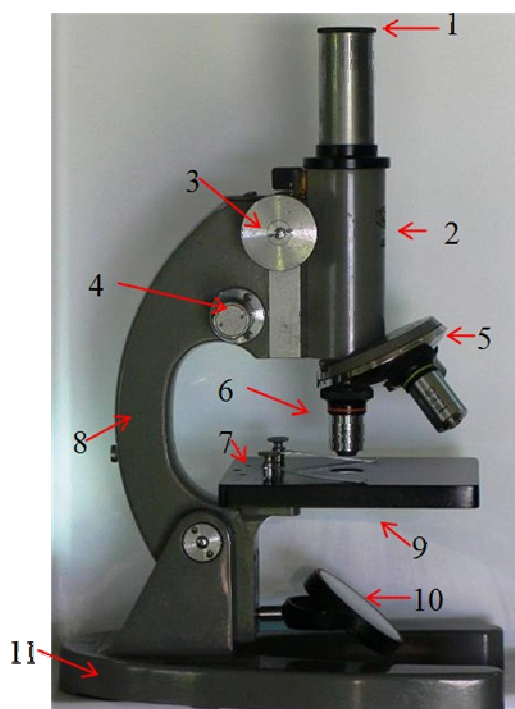
# MICROSCOPE

Class: \_\_\_\_\_ Microscope No. \_\_\_\_\_ Date: \_\_\_\_\_

Names of group member (fill in block letters)			
Index number	First name	Middle name	Last name

1. Indicate the microscope parts name using the following words.

Aperture diaphragm, arm/limb, base, body tube, coarse focus adjustment, eyepiece, fine focus adjustment, objectives (object lenses), reflex mirror, revolving nosepiece, stage



1. Eyepiece
2. Body tube
3. Coarse focus adjustment
4. Fine focus adjustment
5. Revolving nosepiece
6. Objective lenses
7. Stage
8. Arm/limb
9. Aperture diaphragm
10. Reflex mirror
11. Base

2. Fill in the brackets with the most suitable words below.

Words: arm/limb, gently, lenses, mirrors, one hand, two hands, tilt, wash

- 1) (Wash) your hands before using microscopes.
- 2) Carry the microscope with (two hands). Support the base with one hand and grasp the (arm/limb) with another hand.
- 3) While carrying the microscope do not (tilt) it.
- 4) Place microscope on the lab table (gently).
- 5) Do not touch (lenses and mirrors) with fingers.

3. The following sentences show how to focus the microscope. Fill in the brackets with the most suitable words below.

Words: aperture diaphragm, down, eyepiece, lower, minimum, nosepiece, preparation, raise, reflex mirror, up

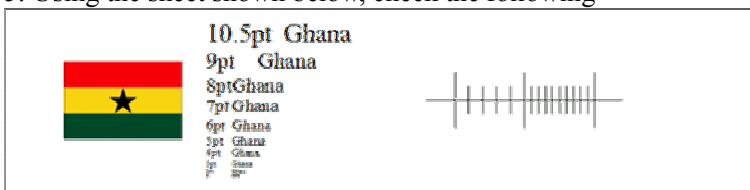
- 1) Revolve the (nosepiece) to place the (minimum) power objective lens on the hole of stage
- 2) Open the (aperture diaphragm) wider.
- 3) Peering through the (eyepiece), adjust the (reflex mirror) in order to make the visual field of microscope brighter.
- 4) Put a sheet of (preparation) on the stage.
- 5) Viewing microscope laterally, (lower) the body tube as close as possible to the preparation.
- 6) Peering through eyepiece, focus on preparation with sliding (up) body tube very slowly.

4. The following sentences show how to draw biological sketches. Fill in the brackets with the most suitable words below.

Words: air bubbles, circle, dots, extraordinaire, large, shadow, small, typical

- Use white paper (Kent is the best) and a fine pencil.
- Write date, grade, class and your index number and name on the upper right of the white paper.
- Do not draw a (circle) which seems to express the rim of visual field.
- Draw the sketch with thin clear line, do not add (shadow) nor duplicate the lines.
- If you want to show perspective or make stereoscopic drawing, use small clear uniform (dots).
- Check some samples, and sketch the most (typical) object.
- Ignore (air bubbles) and broken parts.
- Draw the sketch as (large) as possible.
- When you draw only small part of one organism, check the position and the direction of the part among whole body.
- Describe any observation that you saw.

5. Using the sheet shown below, check the following



1) Place the sheet on microscope stage. Make sure to put it in such a way that you can read the letters normally. Observe the sheet with the lowest magnification.

Draw a letter "G" in the field	Slide the sheet like below and record the direction of the sheet movement in the field.														
	<table border="0"> <tr> <td>Shift the sheet</td> <td style="text-align: right;"><b>result</b></td> </tr> <tr> <td>to upward (further than you)</td> <td style="text-align: right;">( down )</td> </tr> <tr> <td>To downward (to you)</td> <td style="text-align: right;">( up )</td> </tr> <tr> <td>To the right</td> <td style="text-align: right;">( left )</td> </tr> <tr> <td>To the left</td> <td style="text-align: right;">( right )</td> </tr> <tr> <td>To the upper (further) right</td> <td style="text-align: right;">( lower left )</td> </tr> <tr> <td>To the lower (bottom) left</td> <td style="text-align: right;">( upper right )</td> </tr> </table>	Shift the sheet	<b>result</b>	to upward (further than you)	( down )	To downward (to you)	( up )	To the right	( left )	To the left	( right )	To the upper (further) right	( lower left )	To the lower (bottom) left	( upper right )
Shift the sheet	<b>result</b>														
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To the left	( right )														
To the upper (further) right	( lower left )														
To the lower (bottom) left	( upper right )														

2) Measure the diameter of the visual field of microscope in different power using the ruler printed on the sheet.

	Microscope number ( )		
Eyepiece magnification	10 X	10 X	10 X
Objective lens magnification	4 X	10 X	40 X
Total magnification	40 X	100 X	400 X
Diameter of the field (mm)	Approximately 3.5mm	Approximately 1.5mm	Approximately 0.4mm

6. Select stains which can dye chromosomes from the list below.

List: Acetocarmine, hematoxylin, methylene blue, eosin, indigo carmine, safranine, fast green

Answer: Acetocarmine, hematoxylin, methylene blue, indigo carmine, and safranine

7. Explain the function of fixative solution.

Fixative solutions are used to preserve tissues or cells as close to their natural state as possible in the process of preparing materials for examination.

## MICROSCOPE HANDLING TEST

Date: \_\_\_\_\_ Class: \_\_\_\_\_

Index number	First name	Middle name	Last name

### A. Handling test (individually)

1. Pick two preparation slides from four samples. Sample slides are transversal sections of the following; “monocotyledonous stem”, “dicotyledonous stem”, “mono cotyledon us root” and “dicotyledonous root”. Place two slides on different microscope stages one by one, and then adjust the focus to observe bright and clear images using the maximum power of objective lens.
2. Describe what you are observing under the microscope. Sample answer; “I am observing monocotyledonous vascular bundles.”

### Review: How to focus the microscope.

- 1) Revolve the nosepiece to place the minimum power objective lens on the hole of stage.
- 2) Open the aperture diaphragm wider.
- 3) Peering through the eyepiece, adjust the reflex mirror in order to make the visual field of microscope brighter.
- 4) Put a sheet of preparation on the stage.
- 5) Viewing microscope laterally, lower the body tube as close as possible to the preparation. When you revolve the focus adjustment, use both hands.
- 6) Peering through eyepiece, focus on preparation with sliding up body tube very slowly.

### B. Questions on microscope instruction (group work)

(Write your answers in clear block letters! Keep the sentences short and simple.)

1. Describe how to avoid air bubbles in preparations.
2. Explain why we must not tilt the microscope too much.
3. Explain why we must not keep removing the eyepiece for too long.
4. Explain why we must not touch the lenses' and mirrors' surfaces.
5. Explain why we should use minimum power objective lens first.

6. Explain why we should make the distance between the preparation and the objective lens as near as possible before we adjust the focus.
7. Which objective lens has the wider visual field area, the minimum power lens or the maximum power lens?
8. When we use the maximum power objective lens, which mirror should we use, the plain mirror or the concave mirror?
9. If you do not immerse the object on the slide in water, what inconvenience will happen to the observer?
10. Explain why we should use single cell layer sheet of the tissue when we examine onion cells under microscopes?
11. If the object is thoroughly transparent, what should we do to observe inner structure of the object through microscopes?
12. In order to observe plasmolysis, what kind of tissue should we use?
13. In order to use microscope as long as possible, what should we do after using microscopes?

## Sample Answers for "B. Questions"

### B. Questions on microscope instruction (group work)

(Write your answers in clear block letters! Keep the sentences short and simple.)

1. Describe how to avoid air bubbles in preparations.  
Put down the cover slip gently on the slide using a pair of tweezers.
2. Explain why we must not tilt the microscope too much.  
We must not tilt the microscope too much in order to prevent the eyepiece from falling.
3. Explain why we must not keep removing the eyepiece for too long.  
We must not keep removing the eyepiece too long in order to prevent dust coming into the body tube.
4. Explain why we must not touch the lenses' and mirrors' surfaces.  
Oil and sweat of the fingers can grow the mould on lenses and mirrors.
5. Explain why we should use minimum power objective lens first.  
Since the minimum power objective lens has the widest visibility, we can use it to check the overview of the specimen. It does not break the preparations because the lens is the shortest.
6. Explain why we should make the distance between the preparation and the objective lens as near as possible before we adjust the focus.  
After we make the distance between the preparation and the objective lens shortest, we can make the distance bigger very slowly to focus on the object and in order not to break the preparations when you focus on the object.
7. Which objective lens has the wider visual field area, the minimum power lens or the maximum power lens?  
The minimum power lens has the wider visual field area.
8. When we use the maximum power objective lens, which mirror should we use, the plain mirror or the concave mirror?  
As the visual field area of the maximum power objective lens is very small, we should use the concave mirror to collect stronger light in a small area.
9. If you do not immerse the object on the slide in water, what inconvenience will happen to the observer?  
We cannot have the clear image because of diffused reflection of light.
10. Explain why we should use single cell layer sheet of the tissue when we examine onion cells under microscopes?  
We should use single cell layer sheet in order not to use overlapped cells. The single cell layer sheet gives us almost transparent image of the cells and complete picture of the cells.
11. If the object is thoroughly transparent, what should we do to observe inner structure of the object through microscopes?  
We should use proper stain (dye or colour) to clarify the inner structure of the object.
12. In order to observe plasmolysis, what kind of tissue should we use?  
We use living thin plant tissue which has coloured vacuoles. The cells of the tissue must have hypotonic intracellular liquid to extra-cellular fluid.
13. In order to use microscope as long as possible, what should we do after using microscopes?  
After using microscopes we should wipe eyepieces, mirrors, stages and arms with soft cloth and ethanol. When we store microscopes we should remove lenses and store them in a desiccator. Microscopes should be stored in a dustless, cool and dry room.