Using a Light Microscope

Name: _____ **Class:** _____ **Date:** _____ **Total: 40 marks**

Equipment

- Light microscope
- Clean slide and coverslip
- Small piece of onion epidermis supplied by your teacher
- Dropper and water
- Forceps
- Paper towel
- Lens tissue

Safety: Handle slides and coverslips carefully. Report broken glass to your teacher. Carry the microscope with one hand holding the arm and the other supporting the base. Keep water away from electrical equipment.

A. Prepare Your Specimen — 6 marks

Method

1. Place a clean slide flat on the bench.
2. Add one small drop of water to the centre.
3. Use forceps to place a small, thin piece of onion epidermis in the water. Spread it flat.
4. Hold a coverslip at an angle. Touch one edge to the water, then gently lower it over the specimen.
5. Carefully absorb excess water at the edge using a paper towel.

Use only water for this activity unless your teacher provides separate instructions for a stain.

1. Why should the onion epidermis be thin and spread flat? (2 marks)

2. Why is the coverslip lowered at an angle? (1 mark)

3. Give one purpose of the coverslip. (1 mark)

4. Ask your teacher or partner to check your slide. (2 marks)

Preparation check	Tick
The specimen is in water and spread flat.	☐
The coverslip is in place, with few or no large air bubbles.	☐

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Using a Light Microscope

B. Find and Focus the Specimen — 8 marks

Method

1. Place the microscope on a stable surface away from the edge.
2. Select the lowest-power objective.
3. Turn on the light and adjust it to a comfortable brightness.
4. Place the slide on the stage and secure it.
5. Centre the specimen over the light opening.
6. Looking from the side, check the gap between the objective and slide.
7. Follow your teacher's instructions for initial focusing. Look through the eyepiece and focus slowly using coarse adjustment at low power.
8. Use fine adjustment to sharpen the image.
9. Centre an interesting group of cells before increasing magnification.
10. Rotate the nosepiece until the next objective clicks into position. Check clearance from the side and use fine adjustment to sharpen the image.

Never allow an objective lens to touch the slide. Use fine adjustment when working at high power.

1. Why should you start with the lowest-power objective? (1 mark)

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2. Why should the cells be centred before increasing magnification? (1 mark)

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3. Which adjustment knob should you use to sharpen the image at high power? (1 mark)

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4. Why should you check the objective–slide gap from the side? (1 mark)

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5. Complete the table using your microscope. (4 marks)

Total magnification = eyepiece magnification × objective magnification

Setting	Eyepiece magnification	Objective magnification	Total magnification
Lowest power			
Higher power			

For each row: 1 mark for correctly recording both lens powers and 1 mark for total magnification.

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Using a Light Microscope

C. Improve the Image — 8 marks

1. Match each problem to the best action. (4 marks)

Problem	Answer letter
A. The view is uncomfortably bright.	
B. The specimen is slightly blurred at high power.	
C. The specimen disappears after increasing magnification.	
D. The slide moves during observation.	

Actions

1. Secure the slide using the stage clips or slide holder.
2. Return to low power, find the specimen, and centre it.
3. Reduce illumination using the brightness control or diaphragm.
4. Use the fine adjustment knob.

2. With a clear image in view, change the diaphragm opening slightly. Describe one change you observe. (1 mark)

3. Adjust the illumination until cell boundaries are easy to see. Explain why the brightest setting is not always the best setting. (1 mark)

4. Compare the same specimen at low and higher power. Complete the sentences. (2 marks)

At higher power, each cell appears _____.

At higher power, the number of cells visible usually _____.

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Using a Light Microscope

D. Record Your Observations — 10 marks

Observation Record

Specimen: _____

1. Describe what you actually observe. (2 marks)

Include the cells' shape and arrangement.

Biological Drawing

2. Draw a small group of neighbouring cells in the space below. (6 marks)

- Use a sharp pencil and clear, single lines.
- Make the drawing large enough to show the structures clearly.
- Draw only what you can see.
- Keep proportions reasonably accurate.
- Use straight label lines that do not cross.
- Include a title and the total microscope magnification used.

Label the cell wall if visible. Add other labels only when you can identify those structures in your specimen.

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Using a Light Microscope

Title: _____

Total microscope magnification used: _____

3. A student cannot see a nucleus but adds one to the drawing because "all onion cells have one." Explain why this is poor scientific recording. (2 marks)

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Using a Light Microscope

E. Safe and Effective Use — 8 marks

1. Your partner starts carrying the microscope by the eyepiece. Describe the correct carrying method. (2 marks)

2. A glass coverslip breaks. State two safe actions. (2 marks)

3. Complete this practical checklist before leaving. (4 marks)

Practical skill	Teacher/partner tick
Uses appropriate focusing controls without touching the slide with the objective.	☐
Adjusts illumination to obtain a useful image.	☐
Removes the slide and leaves the lowest-power objective selected.	☐
Switches off the light, leaves the equipment dry, and stores it as instructed.	☐

Teacher/partner initials: _____

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Using a Light Microscope

Teacher Answer Key

A. Prepare Your Specimen — 6 marks

1. A thin specimen allows light to pass through **(1)**. Spreading it flat reduces overlapping layers so individual cells are easier to distinguish **(1)**.

2. To reduce trapped air bubbles. **(1)**

3. Accept one: holds the specimen flat, helps keep it in position, or slows drying. **(1)**

4. Award **1 mark per preparation check** demonstrated.

B. Find and Focus — 8 marks

1. Low power provides a wider field of view, making the specimen easier to locate. Accept greater working distance as an alternative. **(1)**

2. The field of view becomes smaller at higher magnification; an off-centre specimen may disappear from view. **(1)**

3. Fine adjustment knob. **(1)**

4. To prevent contact between the objective and slide, which could damage the lens or break the slide. **(1)**

5. Answers depend on the microscope. For example:

Setting	Eyepiece	Objective	Total
Lowest power	10×	4×	40×
Higher power	10×	40×	400×

Award **2 marks per row** as indicated on the worksheet.

C. Improve the Image — 8 marks

1. A–3, B–4, C–2, D–1. **(4)**

2. Accept an accurate observed change, such as the image becoming brighter or dimmer, or cell boundaries becoming more or less distinct. **(1)**

3. Excessive brightness can make a transparent specimen's features difficult to distinguish. Suitable illumination improves visibility and comfort. **(1)**

4. Cells appear **larger (1)**; the number visible usually **decreases (1)**.

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Using a Light Microscope

D. Record Observations — 10 marks

1. Award **1 mark for shape** and **1 for arrangement**, based on the actual specimen. Typical onion epidermal cells appear elongated or rectangular and closely packed.

2. Drawing rubric: Award **1 mark each** for:

- Recognisable neighbouring cells based on observation
- Reasonably accurate proportions and arrangement
- Clear, single lines without decorative shading
- Accurate labels of visible structures with suitable label lines
- Appropriate title
- Correct total microscope magnification recorded

3. Scientific drawings should record observed evidence **(1)**. Adding an unseen nucleus misrepresents what was visible **(1)**.

Note: Unstained onion epidermis may not show nuclei clearly. Onion bulb epidermal cells usually lack chloroplasts. Do not require students to draw either structure.

E. Safe and Effective Use — 8 marks

1. Hold the arm with one hand **(1)** and support the base with the other **(1)**.

2. Award **1 mark each** for two suitable actions: tell the teacher, keep hands away, warn others, or keep the area clear while the teacher arranges safe collection.

3. Award **1 mark per practical skill** demonstrated.

Equipment note: Initial focusing procedures depend on whether the microscope moves the stage or lens assembly. Demonstrate the correct procedure for your model before students begin.

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