Lab 3: Introduction to Light Microscopy

BIOL-8

Name: _____ **Date:** _____

Learning Objectives

By the end of this lab, you will be able to:

1. **Identify and label the parts** of a compound light microscope
2. **Describe the function** of each microscope component
3. **Demonstrate proper microscope handling** and focusing techniques
4. **Calculate total magnification** using eyepiece and objective powers
5. **Observe and draw biological cells** at different magnifications
6. **Prepare wet mount slides** for microscopic observation

> ***Connection to Human Biology:*** *The compound microscope is the foundational tool for studying cells and tissues. Every discovery about human anatomy—from the structure of blood cells to the organization of muscle fibers—began with careful microscopic observation. The skills you develop today will be essential for understanding how the human body works at the cellular level.*

Materials

- Compound light microscope (1 per student or pair)
- Prepared slides (cells, tissues)
- Blank glass slides and coverslips
- Lens paper
- Dropper bottle with water
- Optional specimens for wet mounts (newspaper, onion skin, cheek cells)

Essential Rules for Microscopy

> ***CRITICAL:*** *Following these rules protects expensive equipment and ensures successful observations.*

The Golden Rules

Rule	Why It Matters
1. Always start with the scanning objective (4×)	Prevents lens damage and helps you find specimens quickly
2. Never use coarse adjustment on high power	The high-power objective is very close to the slide—coarse adjustment can crack the slide or damage the lens
3. Lower the stage before switching objectives	Prevents the new objective from hitting the slide
4. Only use lens paper on objectives	Paper towels and tissues scratch the lens coatings
5. Always center the specimen before increasing magnification	What you see at low power may not be visible at high power if it's not centered
6. Carry the microscope with two hands	One hand on the arm, one under the base—microscopes are expensive and delicate

Focusing Procedure (memorize this!)

1. **Start with 4× objective** (scanning power)
2. **Use coarse adjustment** to bring specimen into approximate focus
3. **Use fine adjustment** to sharpen the image
4. **Center** the part of the specimen you want to examine closely
5. **Switch to 10× objective** (low power)
6. **Use fine adjustment ONLY** to refocus
7. **Center again**, then switch to **40× objective** (high power)
8. **Use fine adjustment ONLY** to refocus

Part 1: Microscope Anatomy & Labeling

> ***Learning Goal:*** *Become familiar with the parts of a compound light microscope and their functions.*

Using the microscope at your station, examine its parts carefully. In the large box below, **draw your microscope** and label it using the terms from the list.

Draw your compound light microscope here:

Terms to Label on Your Drawing

Use the following terms to label your drawing. Draw lines from each part to its label on your diagram.

Term	Function
Eyepiece (Ocular Lens)	Lens you look through; typically 10× magnification
Objective Lenses	Rotating lenses providing different magnifications (4×, 10×, 40×)

Term	Function
Revolving Nosepiece	Rotates to change objective lenses
Stage	Platform where the slide is placed
Stage Clips	Hold the slide in place on the stage
Coarse Adjustment Knob	Large knob for rough focusing (use only with low power)
Fine Adjustment Knob	Small knob for precise focusing
Diaphragm/Iris	Controls the amount of light passing through specimen
Light Source	Illuminates the specimen from below
Arm	Used to carry the microscope; connects body to base
Base	Bottom support of the microscope

Magnification Calculations

Calculate the total magnification for each objective lens. The eyepiece on your microscope is **10×**.

Formula: Total Magnification = Eyepiece Power × Objective Power

Objective Lens	Objective Power	Eyepiece Power	Total Magnification
Scanning (red band)	4×	10×	_____×
Low Power (yellow band)	10×	10×	_____×
High Power (blue band)	40×	10×	_____×

Reflection Questions:

1. Why should you always start focusing with the lowest power objective lens?

1. Why is it important to never use the coarse adjustment knob with high power objectives?

1. What happens to the field of view (area you can see) as you increase magnification?

Part 2: Observing Prepared Cell Slides

> ***Learning Goal:*** *Practice proper microscopy technique while observing and accurately drawing biological cells.*

For each specimen, follow the focusing procedure from the Essential Rules section. Draw what you observe at two magnifications, and answer the reflection questions.

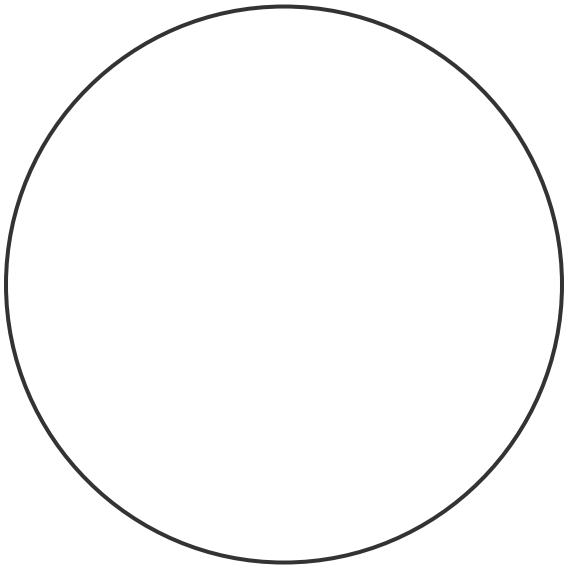
Specimen A: _____

Slide Description: _____

Observation Drawings

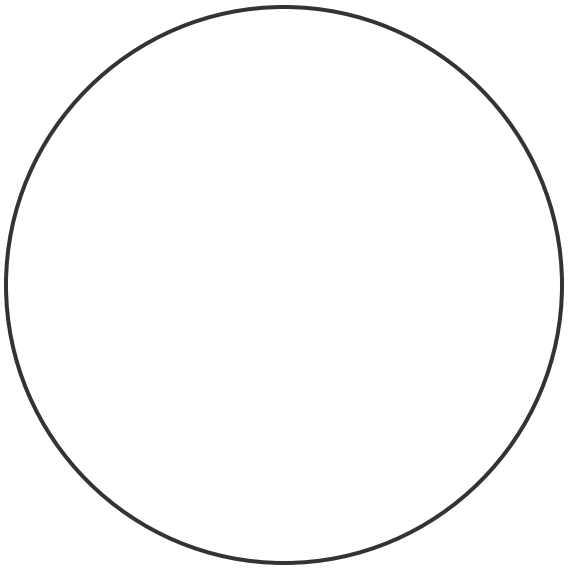
In the circles below, draw what you see at **low power** and **high power**. Your drawings should accurately represent what you observe—include details like cell shapes, structures, colors, and relative sizes. Label any identifiable structures.

Low Power (Total Magnification: ____×)



Magnification used: _____

High Power (Total Magnification: ____×)



Magnification used:

Observations for Specimen A:

1. Describe the overall shape of the cells:

1. What structures can you identify inside the cells (e.g., nucleus, cell membrane, cytoplasm)?

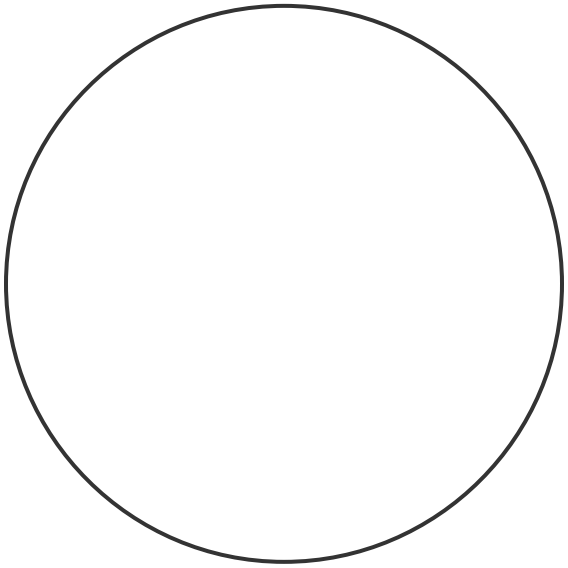
1. Approximately how many cells fit across the diameter of your field of view at high power?

Specimen B:

Slide Description:

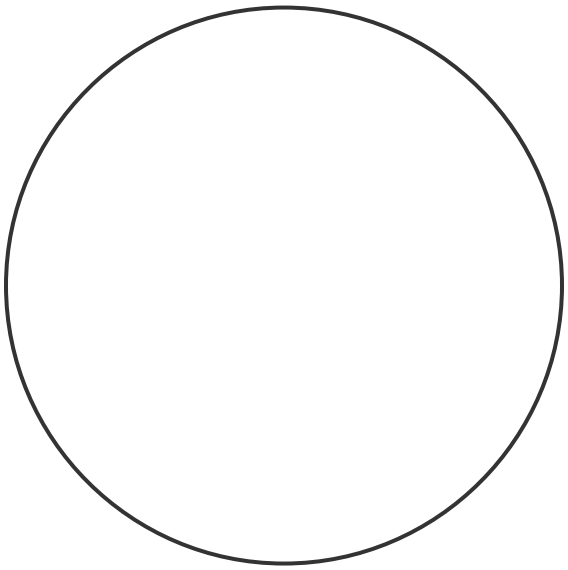
Observation Drawings

Low Power (Total Magnification: ____×)



Magnification used:

High Power (Total Magnification: ____×)



Magnification used:

Observations for Specimen B:

1. Describe the overall shape of the cells:

1. What structures can you identify inside the cells?

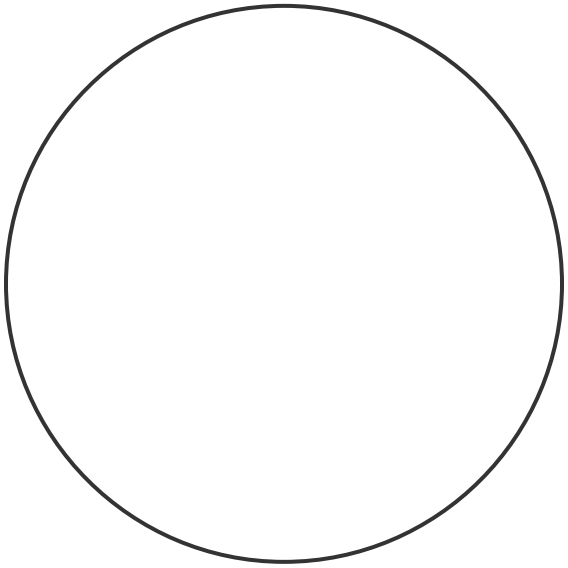
1. How do these cells compare to Specimen A in terms of shape and size?

Specimen C:

Slide Description:

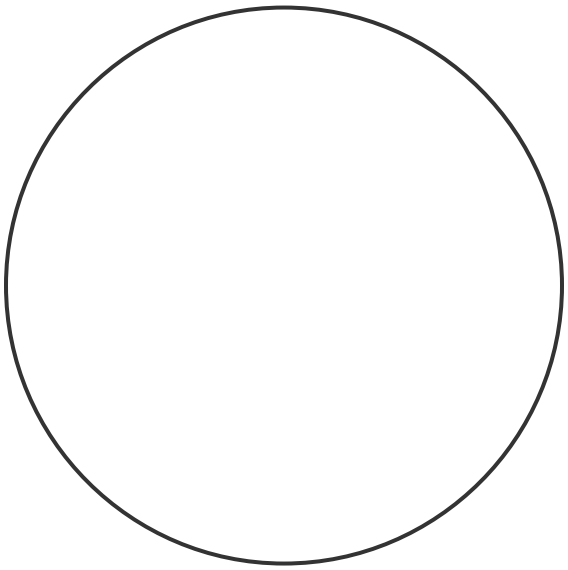
Observation Drawings

Low Power (Total Magnification: ____×)



Magnification used:

High Power (Total Magnification: ____×)



Magnification used:

Observations for Specimen C:

1. Describe the overall shape of the cells:

1. What structures can you identify inside the cells?

1. What is unique or interesting about this specimen compared to the others?

Part 3: Making and Observing Your Own Slide

> ***Learning Goal:*** *Learn to prepare wet mount slides and explore specimens of your choosing.*

Wet Mount Procedure

1. Place a **clean glass slide** on a flat surface
2. Add **ONE small drop of water** to the center of the slide
3. Place the specimen **in the water drop**
4. Hold a coverslip at a **45° angle**, touching one edge to the water
5. **Slowly lower** the coverslip to avoid trapping air bubbles
6. Blot excess water with a paper towel if needed

Tip: If you see large circular objects that are all the same size, those are likely air bubbles, not cells!

Your Specimen: _____

What material did you use? (Examples: newspaper print, onion skin, cheek cells, plant material, etc.)

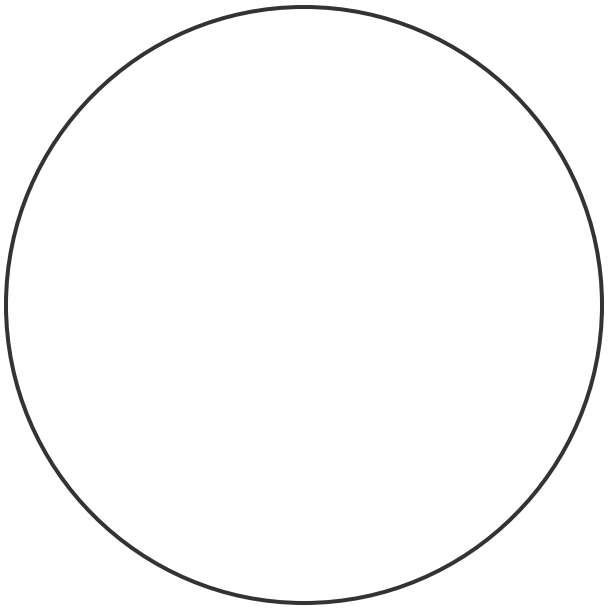
_____

Why did you choose this specimen?

_____

Observation Drawing

Magnification: ____×



Total magnification used:

Reflection Questions:

1. Describe what you observed in your specimen:

1. Were there any challenges with preparing or viewing this specimen? How did you solve them?

1. If you could look at anything under a microscope, what would you choose and why?

Part 4: Microscope Care and Storage

> ***Learning Goal:*** *Learn proper care and storage procedures to maintain microscope function.*

End-of-Lab Checklist

Before putting away your microscope, complete the following:

- [ ] Rotate to the **lowest power objective (4×)**
- [ ] Remove slide from stage and return prepared slides
- [ ] Dispose of any wet mount slides properly
- [ ] **Lower the stage** to its lowest position
- [ ] Clean lenses with **lens paper only** (never paper towels or tissues!)
- [ ] **Turn off the light source**
- [ ] Wrap the cord neatly
- [ ] Cover the microscope (if covers are used)
- [ ] Return to the proper storage cabinet, **carrying with two hands**

Reflection Question:

1. Why is it important to store the microscope on the lowest power objective with the stage lowered?

Conclusions

Final Reflection Questions:

1. Summarize in your own words how the compound microscope creates a magnified image:

1. Of all the specimens you observed today, which was most interesting to you? Why?

1. How might microscopy be used in medical settings? Give two specific examples:

1. What was the most challenging part of today's lab, and how did you overcome it?

1. Based on what you learned today, why is microscopy considered essential for understanding human biology?

Quick Reference Card

Magnification Formula

Total Magnification = Eyepiece Power × Objective Power

Common Objective Lens Colors

Objective	Color Band	Magnification	When to Use
Scanning	Red	4×	Finding specimens, initial viewing
Low Power	Yellow	10×	Getting the full picture
High Power	Blue	40×	Seeing cellular detail

The Focusing Mantra

"Start LOW, go SLOW, FINE at 4-0"

- Start with the **LOW**est power objective
- Go **SLOW**ly when adjusting focus
- Only use **FINE** adjustment at **40**× (high power)

> ***Looking Ahead:*** *The microscopy skills you learned today will be applied throughout this course. In upcoming labs, you will use the microscope to examine specific human tissues—epithelial, connective, muscle, and nervous tissue—and understand how their cellular structure relates to their function in the human body.*

Lab adapted for BIOL-8: Human Biology, Spring 2026