Purpose of the Lab

This lab will familiarize you with the basic units of the metric system and how to convert between them. You will also learn how to measure length, weight, volume, and temperature with an acceptable level of scientific accuracy.

Materials

Metric ruler
Meter stick
Bone
Wooden paddles
Test tube
Thermometer (Celsius)
Triple-beam balance
Plexiglass block
Fossil
Warm-water bath
Bucket with ice
Graduated cylinder
Plastic pipettes
Pipette Pump
Water

Lab Procedures and Data

Length

Measure the length of this line: 8 cm

Convert this measurement to .08 mm and .00000008 nm.

Measuring irregularly shaped three-dimensional objects can be tricky. To make an accurate measurement, we will use a meter stick and two wooden paddles.

1. First, place the meter stick on a flat surface.
2. Sandwich the object you are measuring between the two paddles, making sure the paddles are at a right angle to the object you are measuring (or as close as possible).
3. Place the object and paddles along the meter stick, and note the location of the inner edges of the paddles.
4. Subtract to find the length of the object.

Starch Test: If a test is positive for starch the solution will turn blue-black. The color of the negative test will be yellow-brown.

Test reagent: iodine

Test procedure:

The following solutions will be tested to determine if they contain or do not contain starch: glucose (test tube 1), starch suspension (test tube 2), unknown (test tube 3), distilled water (test tube 4), onion juice (test tube 5), and potato juice (test tube 6).

Hypothesis: *Of the above solutions, which do you think will contain starch?* onion juice, potato juice, starch suspension

1) Label six test tubes with the numbers 1 through 6.
2) Add 1.5 mL of the correct solution to tubes 1-6. Make sure to stir the solutions well before pipetting them and rinse the pipette after each use.
3) Record the initial appearance of each solution in the table below.
4) At this point add 10 drops of iodine to each test tube. Swirl each test tube to mix.
5) Record the color change in each test tube. In the results column of the table, indicate whether each solution tests positive or negative for starch.

Results of the Iodine Test for Starch				
Tube Number	**Solution**	**Initial appearance of solution**	**Final appearance of solution**	**Results**
1	Glucose	clear	yellow	Negative
2	Starch Suspension	clear	black	Positive
3	Unknown	clear	black	Positive
4	Distilled Water	clear	light yellow	Negative
5	Onion Juice	yellow	yellow-cloudy	Negative
6	Potato Juice	pinkish	brown-cloudy	Negative

What was the control for this experiment? Did it yield the expected result?_____

_____

What would be another way to test if a solution contains lipids (HINT: are lipids hydrophobic or hydrophilic)?_____

_____

_____

Summary of Results on the Unknown Solution		
Test	**Observations**	**Conclusions**
Biuret/Protein		
Iodine/Starch		
Benedict/Sugars		
Brown Paper/Lipid		

Unknown solution:_____

Post-Lab Cleanup

Clean all test tubes with soap and water either in the sink in your lab table or the sinks along the edges of the room. MAKE SURE ALL WAX PENCIL MARKS ARE REMOVED. Place test tubes upside down in rack to dry. Ethanol the desks and push in the chairs.

Post-Lab Review Questions

1. What reagent is used to test for proteins?_____
2. What color indicates the presence of protein? _____
3. Is this color a positive or negative test result for protein? _____
4. What color indicates the absence of protein? _____
5. Is this color a positive or negative test result for protein? _____
6. What reagent is used to test for starch?_____
7. What color indicates the presence of starch? _____

Lab Report Materials

General Instructions for Writing Lab Reports

Writing a lab report is a standard feature of science lab classes. It will be part of your grade for each lab practical this semester, because it is the best way to organize all of the information needed to understand the lab procedures and results. A person should be able to read your lab report and:

- Know exactly how to do this experiment
- Find a table, graph or photo of your results
- Know what you concluded at the end of your experiment
- Know what experiment you would do next to follow up on these results

Science writing is somewhat different from writing for other disciplines. What are the major differences that you should look out for?

- The passive voice is used. So instead of writing, "I measured the bone with the meter stick," it would be "The bone was measured with a meter stick". The report is about the work, not about you.
- Methods and Results should be written in the past tense because these are things that have already happened.
- Sentences should be as short as possible, and only the most relevant information is included.
- **Direct quotes are never used.**
- **Everything must be rewritten in your own words.** Directly copying (or only slightly modifying) someone else's work (including the work of other students) is **plagiarism** and **will result in a grade of 0**. Two or more students who turn in nearly identical lab reports will count as **collusion** and both students **will receive a grade of 0.**

The format of a lab report is also different. These are the seven headings that you will use to write the lab report:

Purpose of this lab: What did you learn from this lab? What did the experiments teach you about biology? This section should consist of only one or two sentences.

Introduction: This part gives background information about the particular subject that the lab covers and the experiment being performed. You will need references for this section. Your references may NOT include the lab manual.

Materials: The equipment and supplies used should be listed. Specific information should be given as to amounts, concentrations, and so on. Make sure you include ALL of the materials used in the procedure outlined in your lab report. Likewise, make sure you include ONLY the materials used in the procedure outlined in your lab report.

Methods: The write-up of the methods should be similar to a detailed recipe. It must be written in paragraph form. A person who has never done this lab should be able to read this section and know exactly what equipment and supplies are needed and how to perform the experiment.

APA Style for Citations and References

For this course you should never use direct quotations in your lab reports. Please use your words and only your words in your reports. When you use information (not words) from a source, **it must be referenced AND cited.**

References are listed alphabetically at the end of the lab report. They can be used by anyone who reads your document to find your original sources. Each reference should contain at minimum the following: Author name or names, title of work, and publication date. Anything taken from the internet should include the URL and the date the work was referenced.

Citations appear in the text of the document and refer the reader to the reference that was the source of the preceding information. The correct format for in-text citations is to include the author's name (or an abbreviated version of the title if no author is available) and the year of publications. It should be immediately obvious what reference a citation is referring to; if this is not the case then you are doing something wrong.

Here are some examples for how to reference and cite some common materials you may use in writing your lab report.

Books and Journals

The reference needs to include enough information to ensure a reader can find it quickly, easily and specifically. If only part of a work is referenced (e.g. a chapter of a book) that should be noted.

Author name or names. (Year of publication). Title of article or chapter. *Title of journal or book*, Volume (issue), page numbers.

Brooker, Robert, Eric Widmaier, Linda Graham, and Peter Stiling. (2014). Simple Patterns of Inheritance. *Biology* 3rd Edition, 321-342.

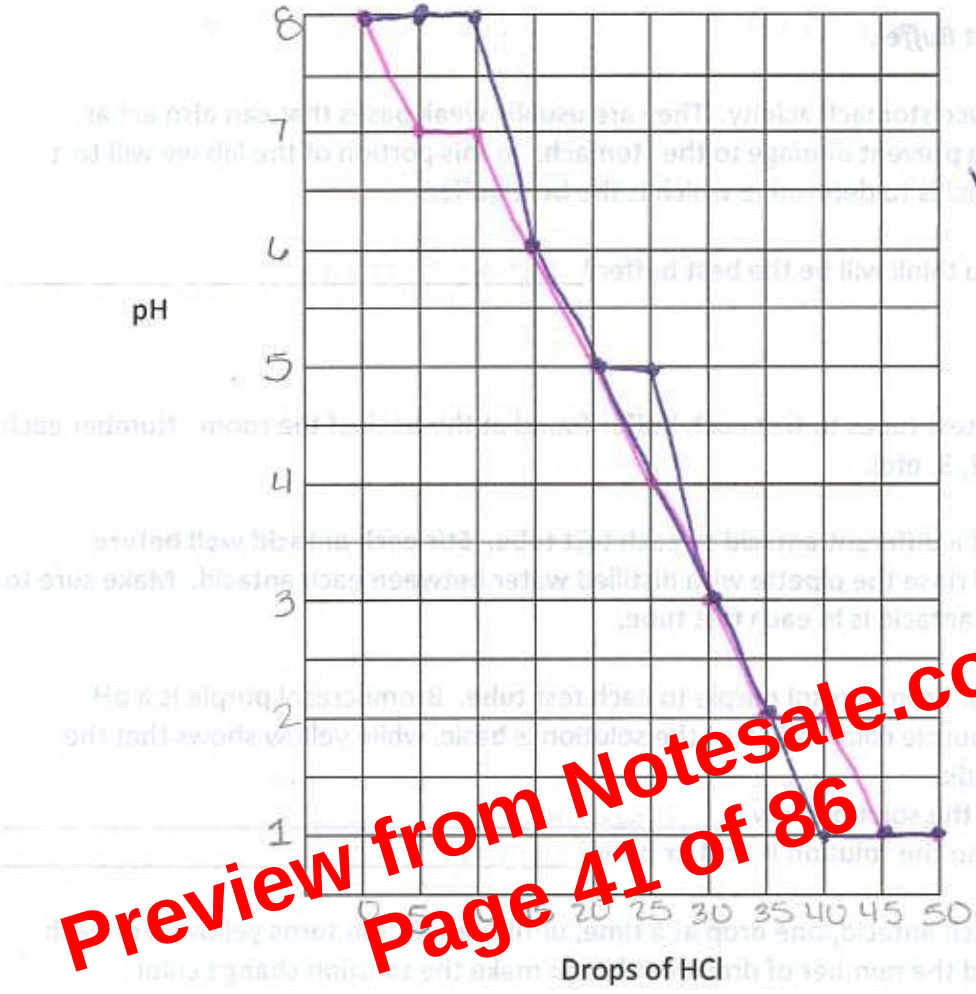
Herbst-Damm, K.L., & Kulik, J.A. (2005). Volunteer support, marital status, and the survival times of terminally ill patients. *Health Psychology, 24*, 225-229.

In-text citations should use the format (author, year of publication).

Gregor Mendel made thousands of crosses of peas in his lifetime (Brooker, 2014).

People survive difficult times better when they have a support network (Herbst-Damm & Kulik, 2005).

Comparison of Organic and Inorganic Buffers		
Number of Drops	pH in Beaker 2 (Inorganic buffer)	pH in Beaker 3 (Organic buffer)
0 (Initial pH from previous table)	8 (b)	8 (b)
5 (Ending pH from previous table)	8 (b)	7 (n)
10	8 (b)	7 (n)
15	6 (a)	6 (a)
20	5 (a)	5 (a)
25	4 (a)	4 (a)
30	3 (a)	3 (a)
35	2 (a)	2 (a)
40	1 (a)	2 (a)
45	1 (a)	1 (a)
50	1 (a)	1 (a)



What was the effect of having a buffer (either organic or inorganic) in the solution? it took it awhile to turn acidic

Which buffer became acidic faster, the organic or the inorganic? inorganic

Which was the better buffer, the organic or the inorganic? How do you know? Organic. it has natural compounds in it while the inorganic doesn't

6. Are you allowed to have food and drink in the laboratory? NO
7. How many hands should you use when carrying a microscope around the classroom? Where should they be located? 2, the arm & bottom of the microscope
8. What two things should you use to clean a microscope? cleaning solution and Lens paper

Materials

Microscope lab handout
Microscope
Plant Root slide
Slides
Coverslips
Protoslo™ or Detain™
Pond water
Lens paper
Lens cleaning solution

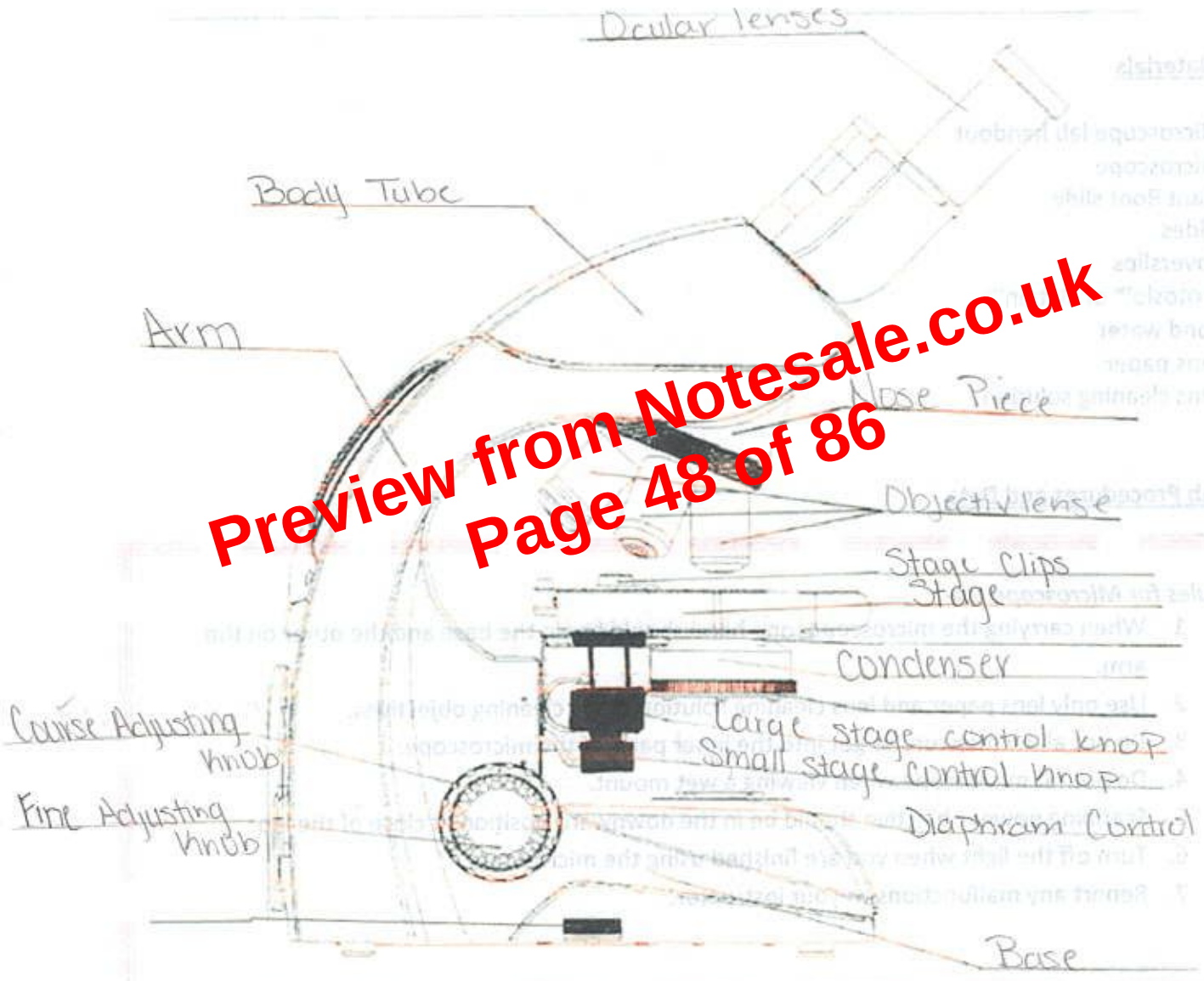
Lab Procedures and Data

Rules for Microscope Use

1. When carrying the microscope, one hand should be on the base and the other on the arm.
2. Use only lens paper and lens cleaning solution when cleaning objectives.
3. Do not allow moisture to get into the inner parts of the microscope.
4. Do not tilt microscope when viewing a wet mount.
5. Scanning power objective should be in the downward position at close of the lab.
6. Turn off the light when you are finished using the microscope.
7. Report any malfunctions to your instructor.

Parts of the Microscope

Use the diagram below to label all the parts of the microscope:



Lab Procedures and Data

Review the "Making a Wet Mount" section of Lab #5 – Microscopy before beginning. We will be using the same procedure to create slides of living protists and animal cells in this lab.

Prokaryotic Cells

Anabaena spherica

Anabaena is a genus of bacteria that contains several different species. All *Anabaena* are photosynthetic, meaning they can get energy from sunlight. This means *Anabaena* are **autotrophs** – they can make their own food. Members of this genus are found all over the world, usually as a type of algae or plankton.

We will be looking at both prepared and stained specimens of *Anabaena* and living (wet mount) specimens.

Prepared slide of **Anabaena**

Anabaena is best viewed at 400x total magnification. (Remember, always start at with the 4x scanning objective until you find a specimen on the slide, then zoom in step-by-step.) Use the space below to sketch a filament (line) of *Anabaena* cells. **Label the prokaryotic cells.**

40

400

Do these cells have a nucleus? No

Post-Lab Cleanup

Make sure all prepared, labeled slides are returned to the appropriate slide box. Return the microscope to the CORRECT spot in the cabinet (with the 4x objective in the viewing position). All slides used in making wet mounts should be put in the buckets at the back of the room, and all used cover slips should go in the trash. Ethanol the desks and push in the chairs.

Post-Lab Review Questions

1. Differentiate between prokaryotic and eukaryotic cells. Eukaryotic cells have a nucleus while prokaryotic have no nucleus
2. Do the cells in *Anabaena* have a nucleus? no
3. Are *Anabaena* cells prokaryotic or eukaryotic? prokaryotic
4. Are *Paramecium* protists or a bacteria? Give one piece of evidence for your answer. protists because they have cilia
5. How do smooth and rough endoplasmic reticulum differ? Smooth ER:

   Rough ER:
6. Which of the cells that we looked at today had a nucleus? Euglena, Parmecium, Amoeba, Epithelial Cell
7. What was unique about the *Paramecium* nucleus? It has a micronucleus & a macronucleus
8. Which type of cell has a nucleoid region? Human Epithelial Cell
9. Which cells that we looked at today were heterotrophs?
10. Which cells that we looked at today were autotrophs?

References

Brooker, Robert, Eric Widmaier, Linda Graham, and Peter Stiling. (2014). General Features of Cells. *Biology* 3rd Edition, 66-96.

Hoobler, Cynthia, Karen Duston, Adam Eiler, Jennie Plunkett, Kirsten Raines, and Mary Wisgirda. (2007). Prokaryotic and Animal Cells. *General Biology I and II*. 33-40.

Review for Lab Practical #1

How a lab practical works

Here are some things you need to know in order to prepare for a lab practical in General Biology I or II. **30** stations will be set up, so each student has his/her own spot to start at. There will be an index card with 2 questions on it -- so there is a total of 60 questions on the exam. Students stand, not sit, to take the exam. That is why the chairs have been pushed out of the way.

Lab practicals are not multiple choice. Answer sheets will be provided. Answers are usually a single word or short phrase (food vacuole, nucleus, fine focus, etc.).

Examples of stations:

- A microscope with a slide, focused, pointer pointing at a structure on the slide.
- A model or specimen with a piece of tape or a numbered pin attached to a structure.
- Test tubes containing solutions that represent the outcome of an experiment.
- A piece of equipment that was used in an experiment.

The material for exam questions is derived from the lab manual. Students are responsible for knowing everything covered by the lab manual.

In Bio I, many questions are about the materials and equipment used and the outcome of the experiment, asking the student to interpret the results. Students will not be asked to perform experiments or find specimens on microscope slides. For example, questions about the lab on Chemical Composition of Cells might include:

- Name the reagent used to test for the presence of proteins.
- Of the two test tubes here, which one shows a positive test for proteins?
- Of the two test tubes here, which one is the control?

Questions about the *Paramecium* might include:

- Name this organism.
- Name the structure at the tip of the pointer (macronucleus, contractile vacuole, etc.).

The lab practical is timed with a stopwatch. When the instructor says "Move", all students move to the next station at the same time. There will be 10 minutes at the end of the exam to go back to stations to recheck questions. Only one student is allowed per station at a time.

Skills tests: During the lab review period, you will be asked to perform certain lab skills that you have used repeatedly in the lab. **Each student will be tested individually**, so you need to be able to do all of these things. For this lab practical, the skills tested will be:

- Using a pipette to measure a volume of a solution accurately.
- Finding a specimen under the microscope at the correct magnification, centered, focused, and with an appropriate light level.
- Using the microscope pointer to identify a specific structure in a cell.

Microscopy

Know the **parts** of the compound light microscope we use in lab.
Arm, Body Tube, Nose Piece, Ocular Lens, Objective Lens, Stage, Stage clip
Know the **function** of each part. Condenser, Diaphragm Control, Fine & Course Adjustment kn
Pg. 50-51 Large & Small Stage Control knob
Know how to determine the **total magnification** when using different objective lenses.

Why is the word **compound** used to describe our microscope?
Be able to name the **two types of lenses** in our compound scope. Ocular & Objective
What is meant when it is said that our microscopes are **parfocal?**

Prokaryotic Cells

Be able to recognize *Anabaena* when looking through the microscope.
Recognize *Anabaena* on the prepared slide and on a fresh mount of *Anabaena*.
Know that *Anabaena* is a type of bacteria.
Do the cells in *Anabaena* have a nucleus? Are *Anabaena* cells prokaryotic or eukaryotic?
No, Prokaryotic

Eukaryotic Cells

Protists

Know that protists are eukaryotic.
Be able to recognize the following organisms and know these organisms are protists.

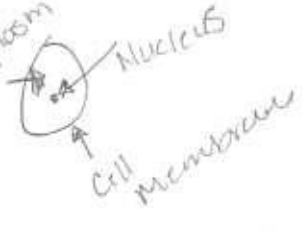
Amoeba — prepared slide and model
Parts to identify on both the model and slide:
cytoplasm, nucleus, pseudopodium, contractile vacuole, food vacuole

Paramecium — prepared slide and model
Parts to identify on model: cilia, oral groove, macronucleus, micronucleus, food vacuole, contractile vacuole
Parts to identify on slide: cilia, oral groove, contractile vacuole, macronucleus.

Euglena — prepared slide and model
Parts to identify on model: flagellum, eyespot, contractile vacuole, nucleus, chloroplast
Parts to identify on slide: nucleus

Animal Cells

Know that animal cells are eukaryotic.
Be able to recognize **squamous epithelial cells** taken from the inside of the cheek.
Parts to identify: cell membrane, nucleus, cytoplasm



Answers to the practice conversion problems:

1 cm = 10 mm	1 mm = 1000 um	1 um = 1000 nm
1mm = 0.1 cm	1 um = 0.001 mm	1 nm = 0.001 um
23 cm = 230 mm	3 nm = 0.003 um	368 mm = 368,000 um
185 mm = 18.5 cm	6 um = 6000 nm	0.7 mm = 700 um