

Common techniques used in the study of biology - information and resources

Review the following techniques, using the videos and other resources as needed to prepare for the questions in the CBO exam about laboratory techniques used in the study of biology.

Technique #1: Measuring volumes

Many biology experiments require the accurate measurement of volumes including the measurement of very small volumes of solutions. The tool used for measuring volume varies depending on the volume measured. Typically:

- Cylinders (glass or plastic) are used to measure volumes between 1 mL to 2 L (there are different sizes of cylinder for the different volumes)
- Serological pipettes (glass or plastic), in conjunction with a bulb or pump, are used to measure volumes between 0.1 mL to 10 mL (there are different sizes of pipette for the different volumes)
- Micropipettes with tips are used to measure volumes between 0.1 μ L to 1000 μ L (1000 μ L = 1 mL); (there are different sizes of micropipettes for the different volumes).

A. Pipetting using a serological pipettes:

Watch the following videos to learn about serological pipettes and how to use them to measure accurate volumes of solution.

<https://www.youtube.com/watch?v=WGLivRvsh5w>

https://www.youtube.com/watch?v=4VTTE_oWs58

Make sure to learn:

- How to use a serological pipette
- Understand the two sets of graduation
- How to use different pipette pumps for accurate measurement.

B. Pipetting using a micropipette:

Micropipettes consist of a barrel, which houses a spring loaded-piston attached to a plunger on the top of the pipettor.

Watch the video to learn about the different types of micropipettes and tips, how to set up the volume and how to pipette accurately.

http://www.youtube.com/watch?v=uEy_NGDfo_8&feature=related

Review some common errors here:

https://www.youtube.com/watch?v=05oolv_y4Pk

Make sure to learn:

- How to identify which pipettor to use for a given volume
- How to set up the correct volumes
- How to add the tip to the pipette and which tip to add to a given pipettor
- How to pipette accurately and the proper use of the 2 stops

Technique #2: Using a spectrophotometer

A spectrophotometer makes use of the absorption/transmission of light through a solution to determine the concentration of a solute of interest in the solution.

Watch the following videos to learn about spectrophotometry and how to use a spectrophotometer.

<https://www.jove.com/v/5038/spectrophotometer-principle-instrumentation-and-applications>

<https://www.youtube.com/watch?v=-et7jDXOLB4>

Make sure to learn:

- How a spectrophotometer works
- How absorbance is related to concentration
- What a blank is and how to prepare a blank
- How to set up a spectrophotometer and the use of cuvettes to measure the absorbance of a solution

Technique #3: Setting up and using a standard curve

A standard curve is used to identify the concentration/amount/activity of an unknown solution using solutions of known concentrations/amounts/activities. It is commonly used in spectrophotometry experiments (e.g., when determining the concentration of proteins using the Bradford reagent). It can also be used to determine the molecular weight of DNA bands obtained on an agarose gel.

Watch the following videos to learn how to create and use a standard curve.

<http://www.wellesley.edu/Biology/Concepts/Html/standardcurve.html>

<https://www.youtube.com/watch?v=0luczWOo0rQ> (this video is very clear and has many good points but note that the standard curve must always pass through zero!)

Make sure to learn:

- How to set up an experiment in order to create a standard curve
- What the standard curve should look like
- How to use a standard curve to determine the concentration/amount/ activity of an unknown solution

Technique #4: Microscopy

Microscopes are tools that allow us to look more closely at objects too small to be visible with the naked eye. In this section, you will learn about microscopy and more specifically about compound light microscopes. Understanding the concept of resolution and magnification is essential to understand microscopy as well as learning to relate the size of a microscopic object seen in a drawing or a picture to its actual size by determining magnification and scale bar.

Introduction to compound light microscopy:

[https://bio.libretexts.org/Courses/Coalinga_College/Fundamentals_of_Biology_Lab_Manual_\(Marks_and_Hochman_Adler\)/03%3A_On_the_Small_Side_-_Introduction_to_Microscopy/3.02%3A_The_Compound_Light_Microscope](https://bio.libretexts.org/Courses/Coalinga_College/Fundamentals_of_Biology_Lab_Manual_(Marks_and_Hochman_Adler)/03%3A_On_the_Small_Side_-_Introduction_to_Microscopy/3.02%3A_The_Compound_Light_Microscope)

How to focus a microscope:

<https://www.youtube.com/watch?v=zxL3s2WHmDU>

<https://www.youtube.com/watch?v=zzamomqlwxU>

Resolution and magnification:

<https://microscopecrew.com/magnification-vs-resolution/>

<https://www.sciencelearn.org.nz/resources/495-magnification-and-resolution>

Measuring microscopic objects and scale bar:

<https://moticmicroscopes.com/blogs/articles/measuring-the-size-of-specimens-viewed-with-a-microscope-and-adding-scale-bars-to-photomicrographs>

<https://www.youtube.com/watch?v=0ootY7X9eGw>

Make sure to learn:

- The different part of a compound light microscope
- How to focus a microscope using the 10X and 40X objectives
- The difference between magnification and resolution
- Measuring object with the field of view and ocular micrometer of a microscope
- Drawing microscopic observations and determining the magnification of the drawing and scale bar

Technique #5: Counting cells using a hemocytometer

A hemocytometer is a special slide, engraved with a grid on which a very small and defined volume of cell suspension can be applied in order to determine the number of cells in a solution. The name hemocytometer comes from the fact that this counting slide was originally designed to perform blood cell counts.

Watch the following videos to learn how to prepare a sample, load the slide, and calculate the concentration of cells in a solution.

<https://chemometec.com/how-to-count-cells-with-a-hemocytometer/>

<https://www.youtube.com/watch?v=rR1ov4VEJXQ>

<https://www.youtube.com/watch?v=WWS9sZbGi6A>

Technique #6: Math essentials for biology labs

Scientific notation, rounding numbers and significant figure, and conversion of units

In order to work in a biology lab, you are expected to know basic mathematical skills including scientific notations, rounding numbers and significant figures, and conversion of units. You can review these mathematical skills in the following postings:

Scientific notation

<https://nool.ontariotechu.ca/mathematics/basic/scientific-notation.php>

Rounding numbers and significant figures

<https://nool.ontariotechu.ca/mathematics/basic/rounding-and-significant-figures.php>

Conversion of units

<https://nool.ontariotechu.ca/mathematics/basic/unit-conversion/index.php>

Make sure to learn:

- Can easily convert numbers to its scientific notation and perform calculations with exponential numbers.
- Know the rules for rounding up numbers and determining significant figures.
- Be familiar with the different units used in biology and can easily convert from one unit to the next.