SWIFT
OPTICAL INSTRUMENTS

More than Mitosis: Examining Plant Cell Mitosis Using a Digital Format

BIOLOGY

1. Examine a prepared slide of an onion root tip.
2. Start at low power magnification (10X) and locate the meristematic region just inside the root cap where most of the dividing cells can be found.
3. Focus on the zone of cell division and switch to high power magnification (400X).
4. Using figures from the reference guide, look through the meristematic region and find a cell that matches those pictured for interphase and the four stages of mitosis.
5. Label your image to show the various stages of mitosis that you can identify. (You may not have all stages in your image at one time.)
6. Measure several of the cells in the region you captured to analyze the average size of cells in different stages of development.

SWIFT
OPTICAL INSTRUMENTS

It's Finally Spring in Boston! Observing Monocot Leaf Structures with Digital Microscopy

BIOLOGY

1. Examine the prepared slide of the leaf in cross section under low power magnification (10X).
2. Use your tablet's annotation and text tools to identify the various tissues and cells that make up your leaf. (Upper and lower epidermal cells, palisades layer of cells, mesophyll layer of cells, vascular bundle, guard cells and stomate opening, etc.)
3. Use your tablet measurement tools to measure several of the upper and several of the lower epidermal cells to see if the upper and lower cells are similar in size.

SWIFT OPTICAL INSTRUMENTS

Exploring the Charles River: Digitally Capture Living Organisms in Local Waters

BIOLOGY

1. Examine the culture tube of pond water under low power magnification (10X).
2. Capture images of various organisms.
3. Use the key provided to identify the organisms. Use the text tool on your tablet to identify the organisms and any organelles.
4. Use the measurement tool on your tablet to record the relative length of the specimen.
5. Compare measurements of the various organisms and be able to provide information on the type of movement they display during your observation. (Cilia, Flagella, Psuedopods, Gliding)

SWIFT OPTICAL INSTRUMENTS

Peeling Back the Layers: Using Tablets to Show How Onion Cells Exhibit Plasmolysis and Turgor

BIOLOGY

1. Obtain a section of red onion cells. Observe the structure of the onion cell in water on your slide.
2. Capture an image on your tablet of the onion cell under low power magnification (10X).
3. Label the organelles of the onion cell that you can identify. For example, cell membrane, cell wall, nucleus, and cytoplasm. Measure the average size of onion cells using the tablet's measuring tool.
4. Add 10% saline solution and now observe the onion cell to see if there's any difference.
5. Label the organelles that you observe in this salty environment. Measure the average size of various onion cells using the tablet's measuring tool.
6. Be able to explain what you have observed and provide an explanation of the event.

SWIFT
OPTICAL INSTRUMENTS

Stop to Smell the Flowers: Using Digital Image Capture and Tablets to Examine the Anatomy of a Flower

BIOLOGY

1. The flower is the reproductive part of the plant.
2. Capture an image on your tablet and use the tablet annotation tools to label your images of the male (anther and filament) and female (stigma, style, and ovary) parts of the flower.
3. Use a microscope slide and cover slip to view some of the pollen grains under the microscope at low power magnification (10X) and high power magnification (400X).
4. Capture an image and measure the size of the individual pollen grains to get an average size for this specimen.

SWIFT
OPTICAL INSTRUMENTS

A Day at the Beach: Digitally Digging. Investigating Sand Composition.

EARTH SCIENCE

Use the M3-B under 1X, 4X or 10X. Capture images to your tablets of the four types of sand.

1. Capture an image of the sand mixture.
2. Use the tablet's annotation tools to analyze particles of sand. Label the image with sand type and magnification.
3. Use the tablet's measuring tools to measure several particles of the sand sample.
4. Use the tablet's annotation tools to analyze the particles of the sand mixture. Again, measure several of the sand grains.
5. Using the measurements and your observations of the samples, determine which sand types were found in the mixture.

SWIFT
OPTICAL INSTRUMENTS

Are They Really That Old? Using Tablets and Digital Format to Examine Fossils

EARTH SCIENCE

Use the Moticam X with cup attachment or M3-B microscope under 1X.

1. Capture images of fossils to your tablet.
2. With your tablet tools, label the images of the fossil and make measurements to identify the specimen.
3. See if you can tell which geographical era the fossil belongs.
4. Make a geographical time line of the fossils with respect to their existence on earth.

SWIFT OPTICAL INSTRUMENTS

Ain't That Sweet! Looking at the Crystal Structure of Sugar Using Digital WiFi

CHEMISTRY

Use the M3-B microscope with 10X objective.

1. Using the three samples of sugar provided, capture an image of each type of sugar to the tablet and identify each.
2. Use the tablet's annotation tools to label the image, including sugar type and magnification.
3. Use the tablet's measurement tools to measure the relative size of the sample crystals.
4. Make a comparison of the results regarding structure and relative size.

SWIFT OPTICAL INSTRUMENTS

All That Glitters Isn't Gold: Chemical Reactions of Silver Nitrate and Copper

CHEMISTRY

Use the M3-B microscope with a 1X objective lens.

1. Using a piece of pure thin copper wire, place it on the depression slide and add a few drops of Silver Nitrate.
2. Capture images of the reaction as it appears on your tablet.
3. Wait one minute and capture another image on your tablet.
4. Use the tablet's measurement tool to measure the rate of growth as observed from image one to image two.
5. Record a 10 second video of the reaction on your tablet.
6. Write a brief explanation of the chemical reaction you are observing.
7. Write a chemical equation to explain the reaction taking place in the video.

The silver nitrate is in the solution, and the metallic copper will dissolve to form copper nitrate. As it does so, the silver in the solution will be precipitated out as metallic silver. That is, the silver in the solution is exchanged for copper and the copper that is not in the solution is substituted for silver.

Using solid Copper, the complete reaction would be:

$Cu^{(0)} + 2AgNO_3 = Cu(NO_3)_2 + Ag^{(0)}$

SWIFT
OPTICAL INSTRUMENTS

Forensics: More Than Just a Crime Scene.
A Guide to Digital Identification and Comparison.

FORENSICS

Obtain two bullets: "A" Crime Scene and "B" Suspect.

1. Use the M3-B and the 1X objective.
2. Capture an image of Bullet A and Bullet B using the striations.
3. Use the tablet's annotation tools to label the images and magnification.
4. Use the tablet's measurement tools to measure the striations of the bullets.
5. Can you conclude that these bullets were fired from the same gun? Why or why not?

Obtain two shell casings: "A" Crime Scene and "B" Suspect.

1. Use the M3-B and the 1X objective.
2. Replace the black or white plate with the clear plastic cup.
3. Place the casing so that you can capture an image of the strike of the firing pin up.
4. Use the tablet's annotation tools to label the images with magnification.
5. Capture an image of casing A and casing B.
6. Use the tablet's measurement tools to measure the circle of the firing pin strike.
7. Note if there are any similarities or difference in where the firing pin struck the bullet.
8. Can you conclude that these two casings were fired by the same gun? Why or why not?

SWIFT OPTICAL INSTRUMENTS

Snell's Law: Demonstrating New Ways to Shed Light on an Old Equation

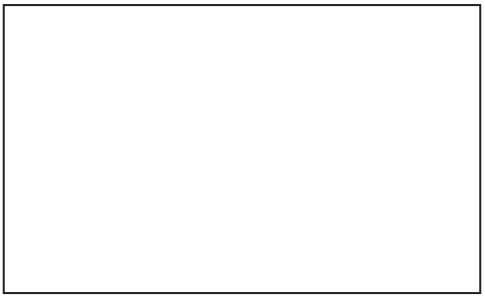
PHYSICS

This activity will allow you to trace a ray of light through a lens. By measuring the angle of incidence into the lens, and measuring the angle of refraction that the ray makes at the surface, you can calculate the index of the refraction of the lens.

Then, by following the ray through the lens and measuring the angle of incidence the ray makes hitting the second surface of the lens, and measuring the angle of refraction that the ray makes as it exits the lens, you will be able to again calculate the index of refraction of the lens.

You will determine the average index of refraction of the lens, and then try and determine the material of the lens.

1. Place the lens on the pattern shown.
2. Align the laser so that it enters the lens on the right side of the lens at an angle greater than 30° making sure that it exits on the right hand side of the lens.
3. Plot the ray into the lens, and the ray exiting the lens.
4. Remove the laser and lens.
5. Draw the ray that enters the lens and the ray that exits the lens.
6. Connect the two rays to see the path of the light through the lens.



SWIFT OPTICAL INSTRUMENTS

Snell's Law: Demonstrating New Ways to Shed Light on an Old Equation

PHYSICS

Analysis of rays:

You have two events. The light entering the lens and the light exiting the lens. Draw a normal at the point where the light enters the lens. Continue the normal through the surface into the lens.

Measure the angle of incidence. _____

Measure the angle of refraction. _____

Calculate the index of refraction of the lens. _____

Draw a normal at the point where the light exits the lens. Continue the normal through the surface of the lens into the air.

Measure the angle of incidence. _____

Measure the angle of refraction. _____

Calculate the index of refraction of the lens. _____

Calculate the average index of refraction. _____

Determine the material that most closely matches. _____

Repeat the activity using the Moticam X, gooseneck stand, and the tablet to capture images. Analyze using the tablet's annotation and measuring tools to see if you results are the same.

SWIFT
OPTICAL INSTRUMENTS

Digital Dissection: Demonstrating STEM Principles Using a Pig Heart

BIOLOGY

1. Capture an image of the pig heart on your tablet.
2. Using the annotation tools on your tablet, label the external anatomy of the pig heart.
3. With the heart dissected, capture an image of the right atrium and right ventricle.
4. Using your tablet's text tool, label the known structures: tricuspid valve, chordae tendineae (look like string), and papillary muscles.
5. Using your tablet's measurement tool, measure the size of the tricuspid valve and chordae tendineae.
6. Capture an image of the left atrium and left ventricle.
7. Using your tablet's text tool, label the known structures: mitral (bicuspid) valve, chordae tendineae, and papillary muscles.
8. Using your tablet's measurement tool, measure the size of the mitral valve.