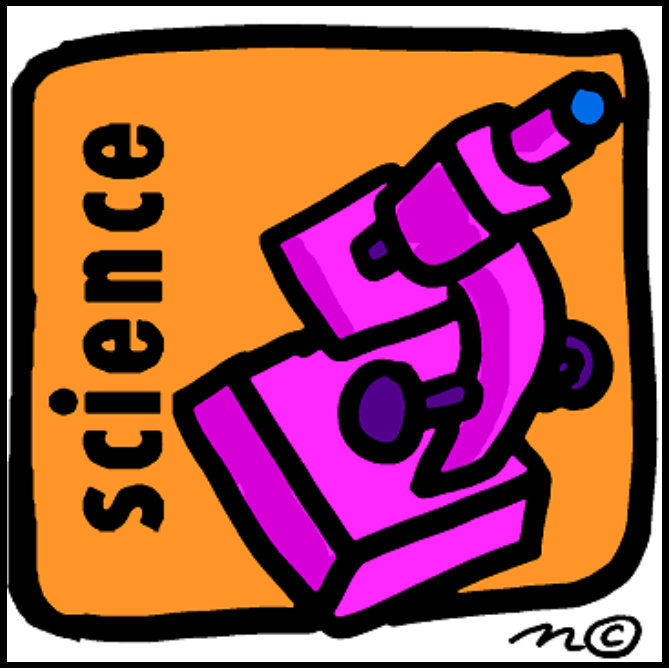
Scientific Inquiry

Standards B – 1.2 & B – 1.9

Scientific Inquiry

The student will demonstrate an understanding of how scientific inquiry and technological design, including mathematical analysis, can be used appropriately to pose questions, seek answers, and develop solutions.



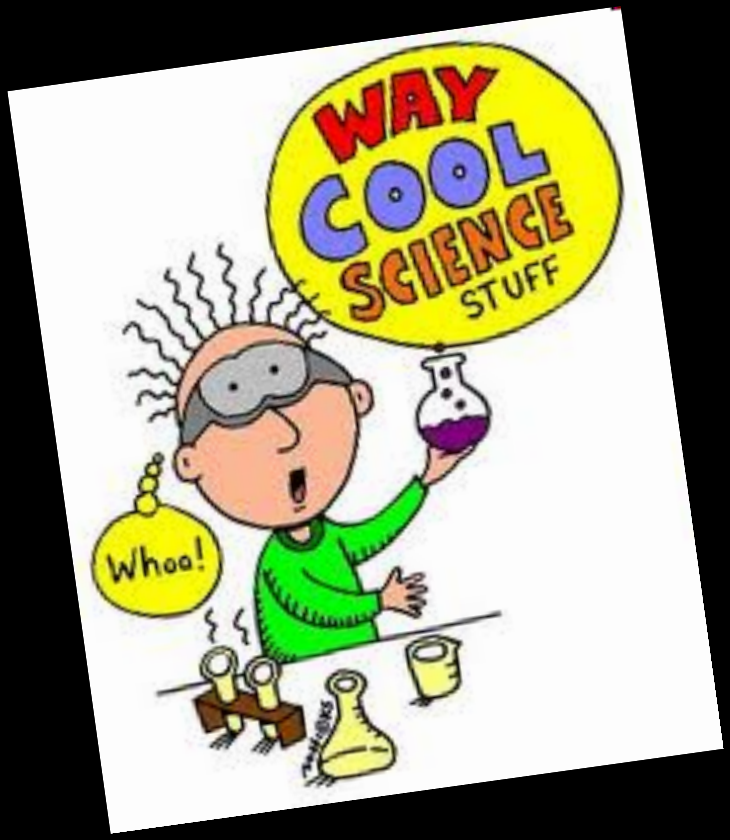
B-1.2
Use appropriate laboratory apparatuses, technology, and techniques safely and accurately when conducting a scientific investigation.

B-1.9
Use appropriate safety procedures when conducting investigations.

Key Concepts

- Laboratory Apparatus
- Laboratory Techniques
- Laboratory Technology
- Laboratory Investigation

What You Already Know!



You have been learning about different tools used in science since kindergarten. With more complex scientific investigations come more complex scientific tools.

What You Should Understand After This Lesson

- Use appropriately and identify various laboratory apparatuses and materials appropriate for biology.
- Use identified laboratory apparatuses in an investigation safely and accurately with associated technology such as computers, calculators, and other devices for collecting, graphing, and analyzing data.
- Use appropriate techniques that are useful for understanding biological concepts, such as using a microscope appropriately.

Objective

- ***Identify*** an appartus from a description or illustration.
- ***Recognize*** appropriate laboratory apparatuses, technology, and techniques for given procedures.
- ***Recognize*** safety guidelines associated with use of laboratory apparatuses, technology, and techniques.

Vocabulary

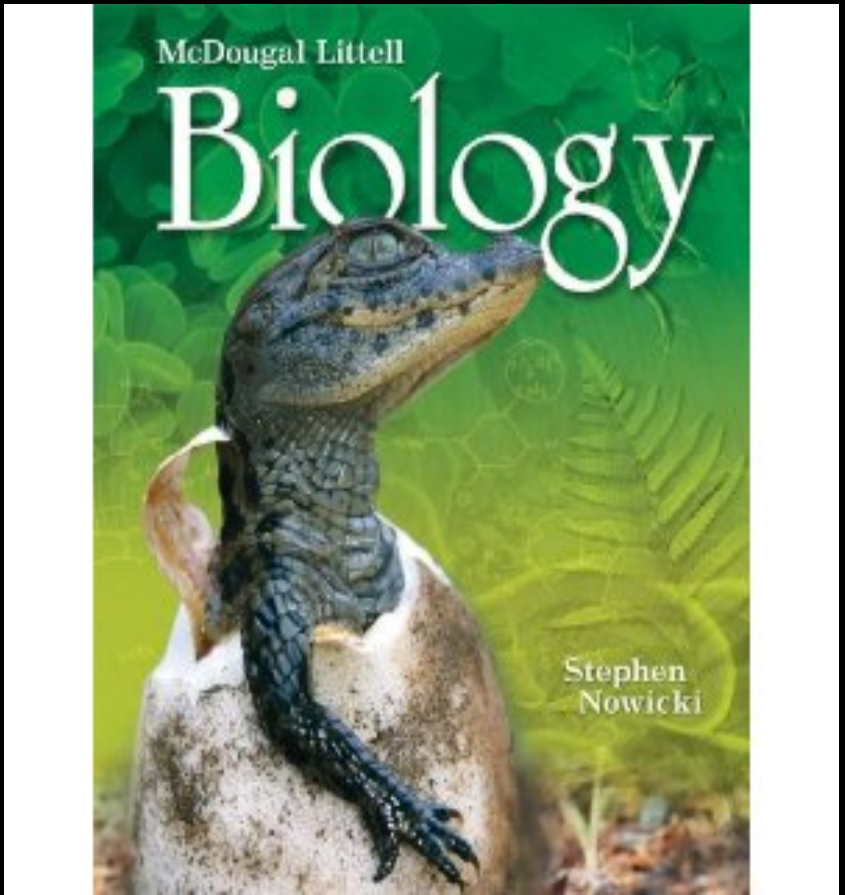
1. Microscope

Lab Safety

One of the first things a scientist learns is how a lab operates. This includes being safe in the lab. While working in the lab can be very exciting, it can also be very dangerous if proper safety rules are not followed correctly. The next few slides will discuss some of the safety precautions for this science lab.

Textbook Pages

Where in your textbook does it discuss lab safety and provides pictures of lab safety symbols?



General Lab Procedures

1. Know where all safety equipment and the first aid kit are located. Tell the teacher IMMEDIATELY of any injury.
2. Read all directions BEFORE conducting the lab. Follow only the directions in the lab.
3. Do not begin any lab until you are instructed to do so.
4. Follow all rules set for the lab. Any deviation from the rules will result in your removal from the lab.
5. No one leaves the classroom until the lab is all cleaned up. Everyone is responsible for cleaning up before they leave.

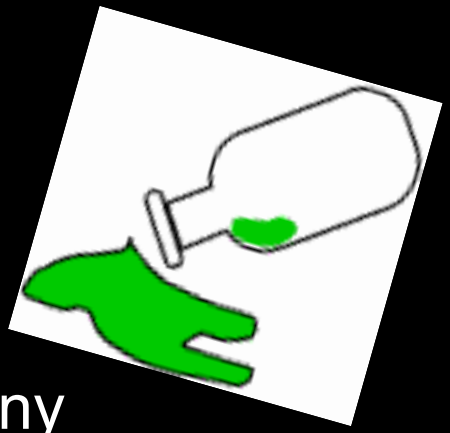
Dress Code

1. Wear safety goggles whenever you are working with any substance which can get into your eye.
2. Wear a laboratory apron or coat whenever you are working with materials which can get onto your clothing.
3. Tie back long hair.
4. Remove necklaces and bracelets which can hang down and touch the materials being used.

Heating and Fire Safety

1. Keep your work area neat, clean, and free of extra materials.
2. Never reach across a flame or heat source.
3. Point objects that are being heated away from yourself and others.
4. Never pick up a hot test tube with your bear hands; use something heat-resistant.
5. After heating test tubes, place them in a test tube rack.

Chemical Safety



1. Always wear goggles when working with any chemical.
2. Stand when you are working with chemicals.
3. Pour chemicals over the sink and not over the floor. If any spills on the floor or work area, clean it up properly.
4. If chemicals get into your eyes, immediately wash them out at the eye wash station.
5. Only used chemicals instructed by the teacher. Make sure the container is properly labeled.
6. Always wash your hands after handling ANY type of chemicals.

Glassware and Sharp Objects

1. Use only clean glassware that is instructed per the procedures of the lab.
2. If you break glass, tell the teacher IMMEDIATELY. Do NOT try to clean it up yourself.
3. When using sharp objects, point them away from yourself and wear goggles at all times.
4. After using glassware, clean it according to the teacher’s instructions.

Disposal Alert

This symbol appears when care must be taken to dispose of materials properly.

Biological Hazard

This symbol appears when there is danger involving bacteria, fungi, or protists.

Open Flame Alert

This symbol appears when use of an open flame could cause a fire or an explosion.

Thermal Safety

This symbol appears as a reminder to use caution when handling hot objects.

Sharp Object Safety

This symbol appears when a danger of cuts or punctures caused by the use of sharp objects exists.

Fume Safety

This symbol appears when chemicals or chemical reactions could cause dangerous fumes.

Electrical Safety

This symbol appears when care should be taken when using electrical equipment.

Plant Safety

This symbol appears when poisonous plants or plants with thorns are handled.

Animal Safety

This symbol appears whenever live animals are studied and the safety of the animals and the students must be ensured.

Radioactive Safety

This symbol appears when radioactive materials are used.

Clothing Protection Safety

This symbol appears when substances used could stain or burn clothing.

Fire Safety

This symbol appears when care should be taken around open flames.

Explosion Safety

This symbol appears when the misuse of chemicals could cause an explosion.

Eye Safety

This symbol appears when a danger to the eyes exists. Safety goggles should be worn when this symbol appears.

Poison Safety

This symbol appears when poisonous substances are used.

Chemical Safety

This symbol appears when chemicals used can cause burns or are poisonous if absorbed through the skin.

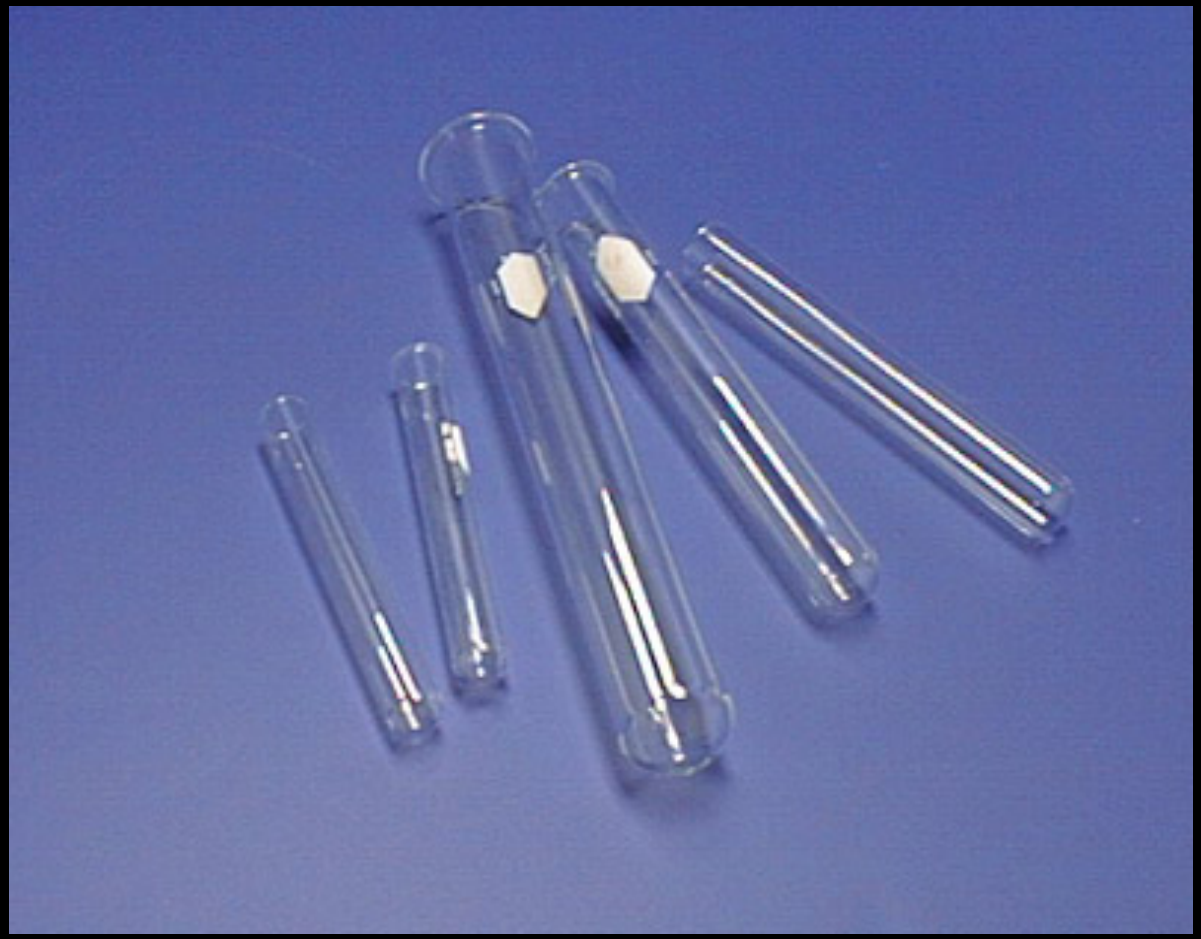
Lab Safety Contract

In order to participate in laboratory activities in class, you must first sign a lab safety contract. Let's do that now.

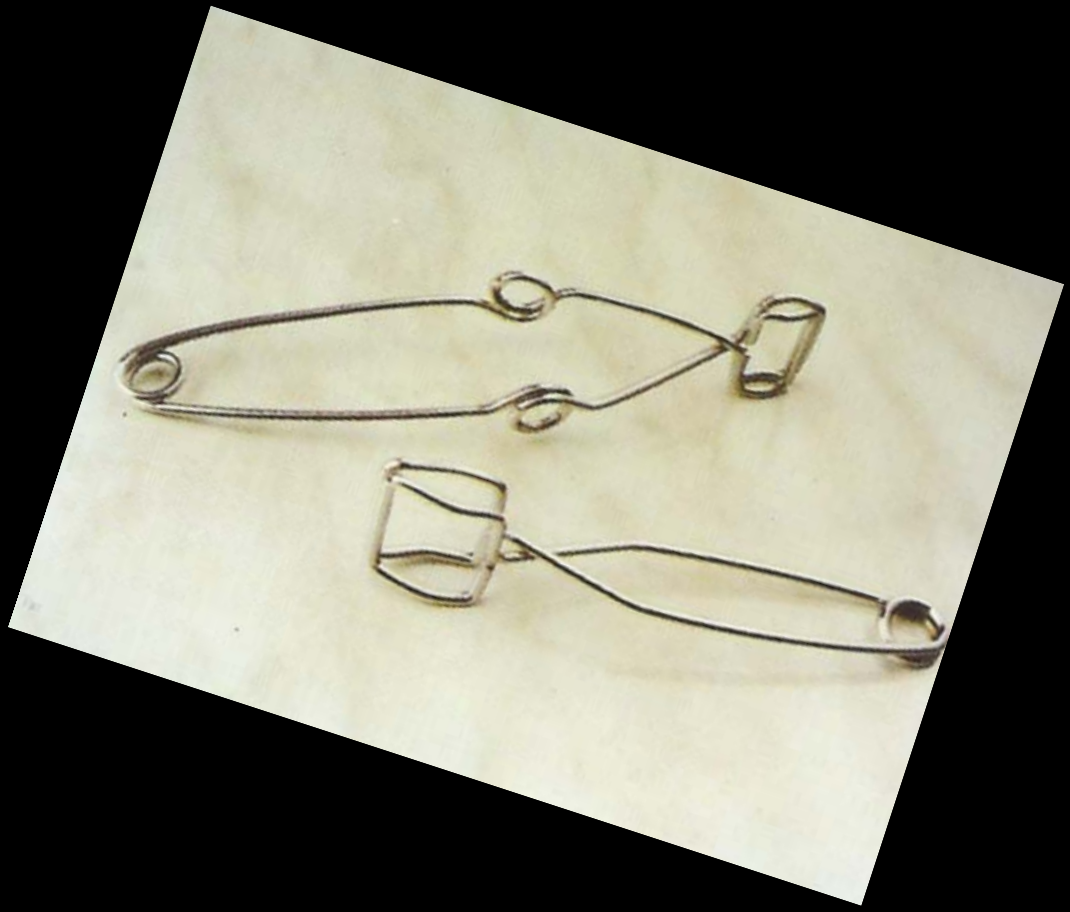
Lab Equipment

When working in any lab, it is important to be familiar with the equipment. The next few slides will introduce you to some of the equipment we will be using this semester.

Test Tubes



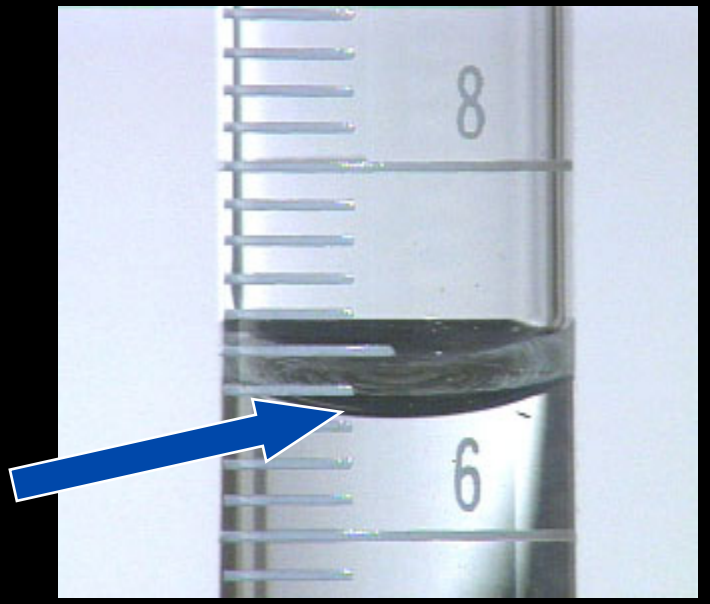
Test Tube Rack and Clamp



Beakers

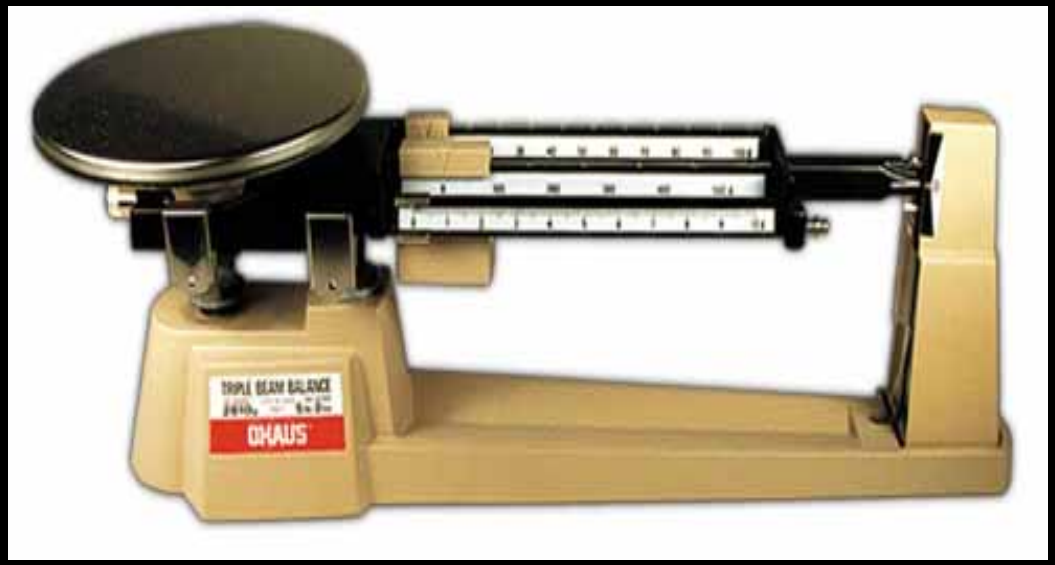

400 ml
PYREX®
USA
No. 1000
300 ml
±5%
250
200
150
100
50
250 mL
KIMAX®
KIMBLE
NO. 14005
MADE IN MEXICO
APPROXIMATE VOLUMES
150 ML
PYREX

Graduated Cylinders

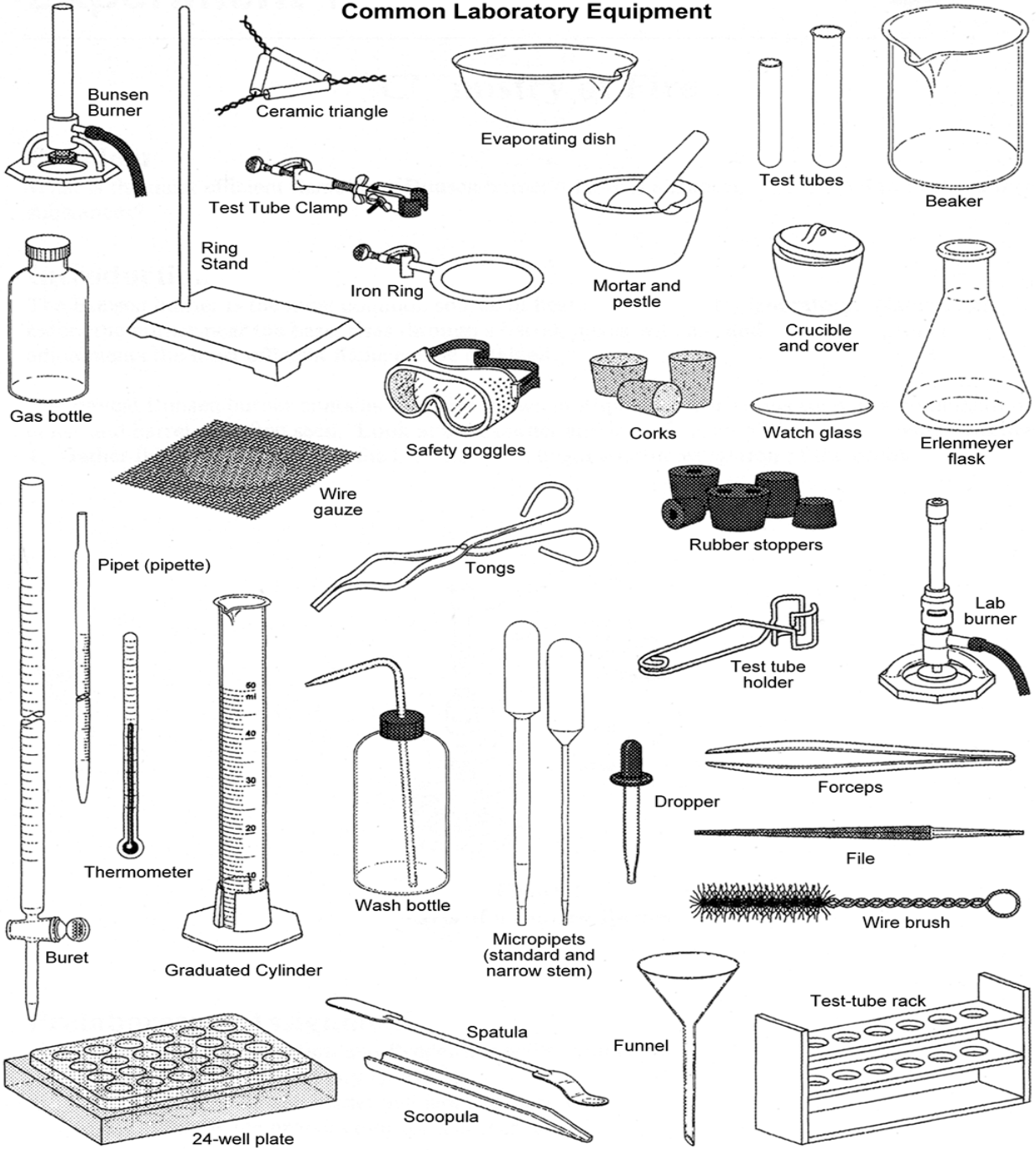


Determine the volume contained in a graduated cylinder by reading the bottom of the meniscus at eye level.

Triple Beam Balance
&
Electric Scale



Common Laboratory Equipment



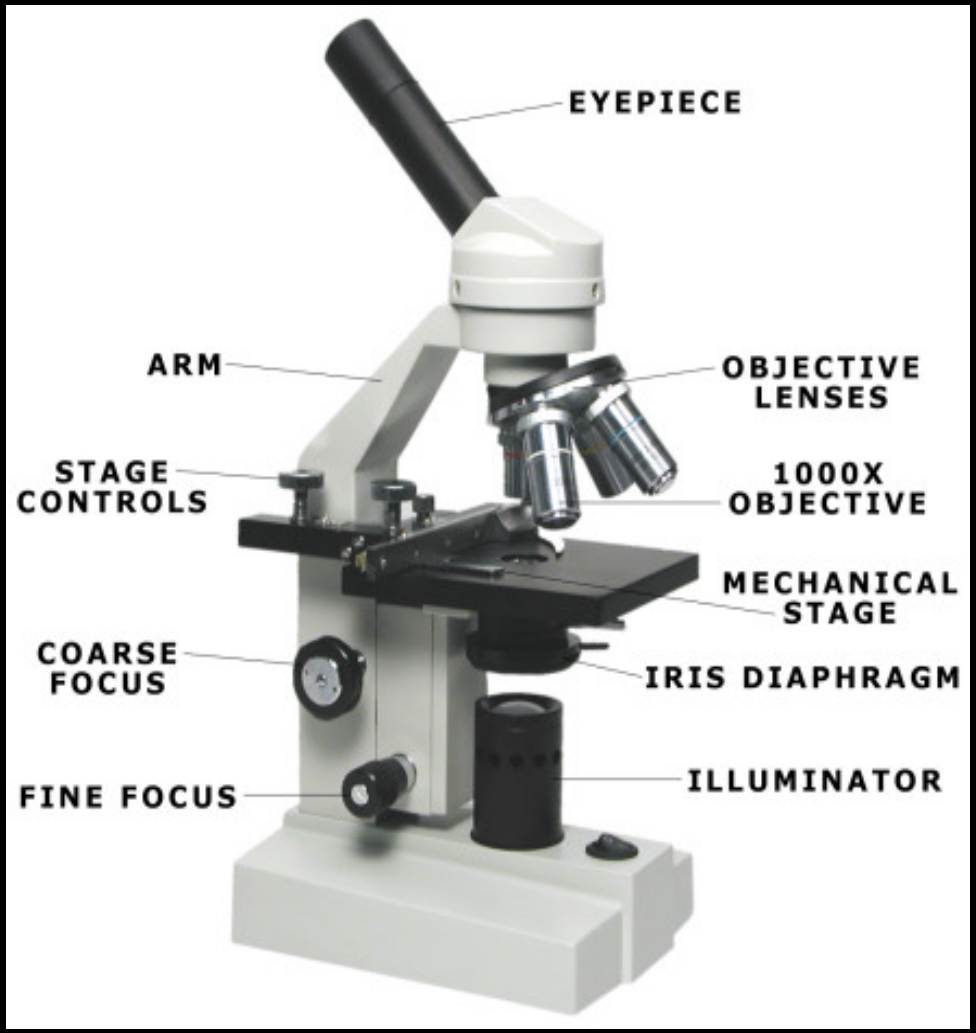
Microscopes as Tools

- Tools are objects used to improve the performance of a task.
- Microscopes are tools that extend human vision by making enlarged images of objects:
  - Compound light **microscope**
  - Scanning electron microscope (SEM)
  - Transmission electron microscope (TEM)
  - Dissecting microscope (DM)

Compound Light Microscope

- Developed in the 1800s.
- Used to see small organisms and cells.
- Used to view living or dead/preserved organisms.
- Clearly magnify specimens up to about 1500 times their actual size.
- Uses a combination of lenses.
- Samples are often stained to show specific parts.

Compound Light Microscope



http://www.southwestschools.org/jsfaculty/Microscopes/compoundscope.html

Electron Microscopes

- Developed in the 1950s
- Uses a beam of electrons instead of light to magnify objects.
- Used to view dead/preserved specimens only.
- Two main types: SEM and TEM

Electron Microscope

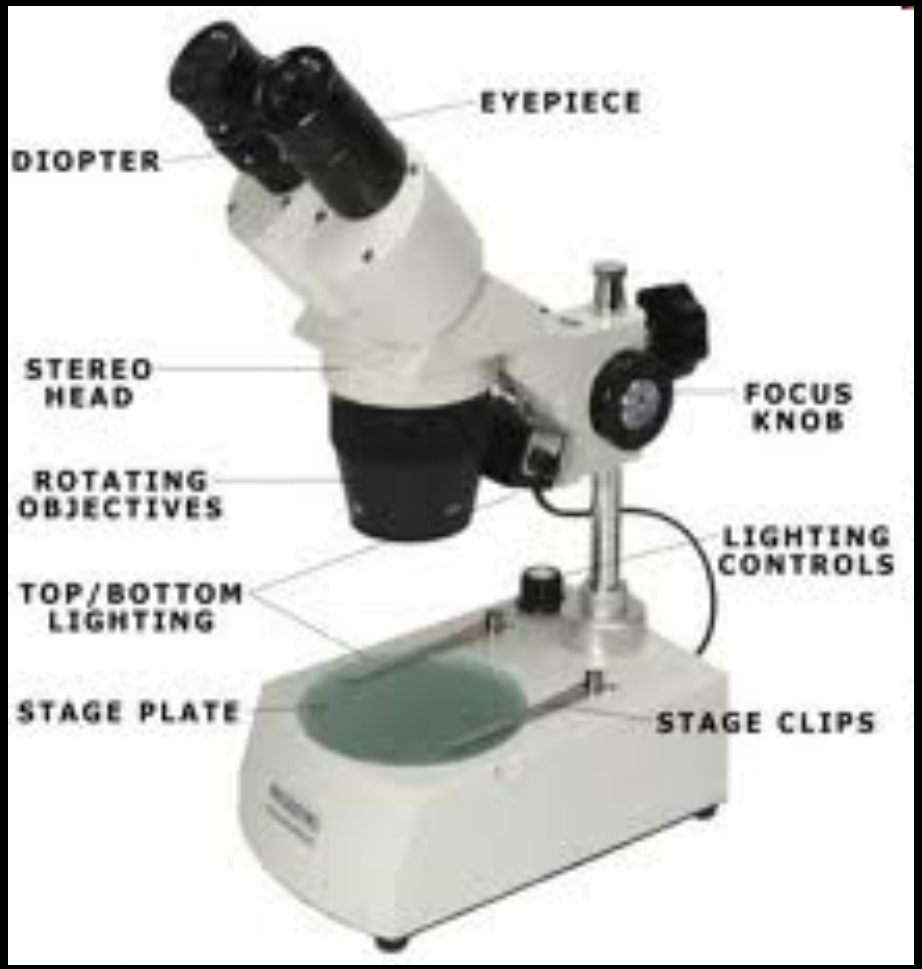
- SEM
  - Passes a beam of elctrons over the surface of the object
  - Produces a 3-D picture of the specimen
  - Can magnify up to 100,000 times actual size.
- TEM
  - Transmits electrons through a specimen
  - Can magnify up to 200,000 times actual size.

Electron Microscopes

SEM

TEM

Dissecting Microscope



- Low Power
- Cannot produce 3D images nor look through a specimen
- Used to view living specimens mainly.

Microscopes

To look at some examples, click on the following link:

http://www.classzone.com/cz/books/bio_07/resources/htmls/animated_biology/unit1/bio_ch01_0021_ab_cells.html