Name:____Period:_________

Ms. Randall **Living Environment** **2014-2015**

Unit 1: Biology is a Science

Unit Objectives:

- Follow safety rule sin the laboratory
- Make observations and relate to biological processes
- State an appropriate hypothesis
- Collect, organize and analyze data using proper lab equipment
- Organize data through the use of data tables and graphs
- Analyze results from expressed data
- Formulate conclusion based on experimental data
- Recognize and describe the parts of a valid experiment and its limitations

Focus Questions for the Unit:

- Why do we study science?
- How does scientific inquiry help us to understand the world around us?

Enduring Understanding:

- Problem solving is a part of everyday life.
- The scientific method is an organized way to solve a problem.

<u>Define the following vocabulary:</u>

- Meter
- Liter
- Gram
- Mass
- Weight
- Volume
- Density
- Hypothesis
- Controlled experiment
- Data
- Independent variable
- Dependent variable

Learning Styles Survey
(Modified from Marcia Conner, www.agelesslearner.com)

Information: Learning style refers to the ways you prefer to approach new information. Each of us learns and processes information in our own special style, although we share some learning patterns, preferences, and approaches. Knowing your own style also can help you to realize that other people may approach the same situation in a different way from your own.

Directions: Take a few minutes to complete the following questionnaire to assess your preferred learning style. Begin by reading the words in the left-hand column. Of the three responses to the right, circle the one that best characterizes you, answering as honestly as possible with the description that applies to you right now. Count the number of circled items and write your total at the bottom of each column. The answers you prefer provide insight into how you learn.

Activity	Choice A	Choice B	Choice C
1. While I concentrate...	I am distracted by clutter and movement. I notice things around me.	I get distracted by sounds. I like to control the amount and type of noise around me.	I become distracted by commotion. I tend to retreat inside myself.
2. While visualizing...	I see vivid & detailed pictures in my thoughts.	I think in (hear) sounds and voices.	I see images in my thoughts showing interactions.
3. When I talk to someone...	I dislike listening for a long time.	I enjoy listening or I may get impatient to talk.	I use hand gestures and other expressive movements.
4. When I contact people...	I prefer face-to-face meetings.	I prefer speaking by telephone.	I like to walk or do an activity while talking.
5. When I see someone...	I tend to forget names but usually remember faces and where we met.	I tend to remember names and I usually remember what conversations we have had.	I tend to remember what things we have done together, and I get a "feel" about our relationship.
6. When I relax...	I watch TV or go to a movie.	I listen to music, read, or talk on the phone.	I play sports, go on line, build something, or do something active.
7. While I read...	I like descriptive scenes and tend to stop reading to imagine the setting.	I enjoy books that have dialogue. I can "hear" the characters talking.	I rarely read for pleasure, but I may read a book that has a lot of movement – a fast reading book.
8. When I spell...	I try to see the word in my mind – I may close my eyes to "see" it.	I sound out the word – sometimes out loud. I tend to remember the rules of spelling.	I need to spell out the word on paper or in the air – or I need to pretend to type it.
9. When I am doing something for the first time...	I like pictures or diagrams to guide me.	I like verbal or written directions.	I try to do it by myself first – trying a variety of different techniques.
10. When I am interpreting someone's mood...	I mostly look at his or her face.	I listen to the tone of the voice.	I watch the body language.

11. When I teach others how to do something...	I prefer to show them how to do it or diagram it out for them.	I prefer to tell them or I will write it out.	I will briefly demonstrate and then have them try.
12. When giving directions...	I draw maps.	I use words and street names.	I use hand gestures and may turn my body to demonstrate.
TOTALS:			

What do your totals mean for you?! →
COLUMN A = VISUAL   COLUMN B = AUDITORY   COLUMN C = TACTILE/KINESTHETIC

The column with the highest total represents your primary processing style. The column with the second-most choices is your secondary style.

Your primary learning style: ________________________________

Your secondary learning style: ________________________________

Now that you know which learning style you rely on, you can boost your learning potential when working to learn more.

What are the three types of learner?

Visual Learners – rely heavily on visual cues. Teacher expressions, gestures, and body language are important for understanding. You learn best when you use diagrams, pictures, tables, and videos.

Auditory Learners – you learn well from the traditional lecture. You enjoy discussions. Reading the textbook is not enjoyable – you would rather just listen to the information from the teacher.

Tactile Learners – learn best when you are actively participating or doing something hands-on. You bore easily during lectures – you find yourself day dreaming, fidgeting, or nodding off during lectures.

Strategies for classroom and home studying:

Visual –

During mini-lessons or lectures -	Get close (up front); watch the teacher and the presentation Take notes but use diagrams to help remember things
Reading the text-	Stop reading every so often and look at the diagrams or charts in the reading Make concept maps or charts to organize your thoughts

Studying –	Make flash cards Make study notes that label diagrams/organizesteps/matching terms Watch any videos available online

Auditory –

During mini-lessons or lectures –	Listen, then take a set of teacher notes with you (or copy them from a classmate afterward) Read applicable material *before* you come to class – you can have any questions answered during the mini-lesson/lecture
Reading the text –	Read it aloud
Studying –	Read – out loud – your notes or available PowerPoint Start discussion groups (or teach someone else) Review with any available videos online

Tactile –

During mini-lessons or lectures –	Hand write your own notes – stay busy Use highlighters to mark up class notes
Reading the text –	Take notes during your reading (make an outline)
Studying –	Rewrite your notes (or retype them) Make flash cards, draw diagrams, build models Use any available online interactive activities

Tips for Studying:

Result (Grade) = Effort of Student x (Text Quality + Time of Day of Class + Teacher + # of Friends in Class + YOU!!!!)

The point is that the most important variable here is **YOUR EFFORT! If your effort is zero,** then your grade will be **zero**. I think it is interesting **how "A" students tend to get those grades, regardless of the teacher.** They take **responsibility for their own learning** rather than blaming external factors for their lack of success**.**

Therefore, you need to approach school with a serious attitude and:

1) Be consistent in your study efforts.
2) Practice, practice and practice those homework problems!
I find that the most common reasons for failure are:
1) Too little study time. I recommend that you study a minimum of 15 minutes per night, for a total of 75 minutes per week. All of us tend to underestimate how much time we

study. Remember, Einstein said that 99 % of success is perspiration and 1% is inspiration. Reading your notes as a method of study is worse than useless, unless you have a photographic memory. ACTIVE studying is the only method that really works.

2) Lack of student preparation. I find that the major deficit is math and reading comprehension skills. You need to be comfortable with numbers and basic reading.

3) Lack of consistent effort. Study regularly and consistently. Our brains work in-between study times, i.e. in the shower, while walking to class, etc. It's amazing how sometimes our brain just needs simple time to digest a concept. Make your time work for you.

4) The wrong approach to studying. Rereading the text and taking notes from the text are not the best way to study. The most important thing you can do for your learning is to do the homework problems and practice tests.

5) Overconfidence in understanding the material. It is fine to start solving problems with the teacher's guidance, but you must put in time at home. On the test, you need to be able to do homework problems without the teacher's help.

Here are some ideas for ensuring your success:

1) Come to after-school help with specific questions about the course material and homework problems.

2) Rewrite your class-notes and rework through the class exercises.

3) In order to understand a concept rather than simply memorize a definition, try either writing an explanation in your own words or explaining it to someone else.

4) Study groups can be good because many of us learn by talking and discussing. However, beware that this can be a timewaster if you tend to drift away from chemistry.

5) Retake old quizzes, old tests and review sheets.

6) Create a "cheat sheet" in which you will have all of the things you need to know for the test.

7) Be prepared to do work in class and pay attention to all details being presented. Ask questions when you need to.

Goal setting: Based upon your learning style results and the information above list at least two techniques you plan to use to study during this unit.

1.
2.

What grade would you like to achieve on this unit based on your efforts? _______%

Lesson 1: **Safety Rules** **Date:____________**

Objective: To identify and describe how to avoid safety hazards in the chemistry classroom.

1. Report all accidents regardless of how minor to your teacher.

2. Work in the lab only when the teacher is present or when you have permission to do so.

3. Never indulge in horseplay or behavior that could lead to injury of others.

4. Before beginning work in lab, clean the lab bench top and your glassware.

5. Use goggles and lab aprons when instructed to do so.

6. Due to the dangers of broken glass and corrosive liquid spills in the lab, open sandals or bare feet are not permitted in the lab.

7. Learn the location and proper usage of the eyewash fountain, fire extinguisher, safety shower, fire alarm box, office intercom button, evacuation routes, clean-up brush and dust pan, glass/chemical disposal can.

8. For minor skin burns, immediately plunge the burned area into cold water and notify the teacher.

9. If you get any chemical in your eye, immediately wash the eye with the eye-wash fountain and notify the teacher.

10. Never look directly into a test tube. View the contents from the side.

11. Never smell a material in a test tube or flask directly. Instead, with your hand, "waft" some of the fumes to your nose carefully.

12. Immediately notify the teacher of any chemical spill and clean up the spill as directed.

13. Never take chemical stock bottles to the lab benches.

14. Use equipment only as directed:

    a. never place chemicals directly on the pan balances. Use weigh boats or weigh paper.

    b. be cautious of glassware that has been heated.

    c. point test tubes that are being heated away from you and others.

15. Never taste any material in the lab. Food, drink and gum are prohibited in lab.

16. Never add water to concentrated acid solutions. The heat generated may cause spattering. Instead, as you stir, add the acid slowly to water.

17. Read the label on chemical bottles at least twice before using the chemical. Many chemicals have names that are easily confused.

18. Return all lab materials and equipment to their proper places after use.

19. Upon completion of work, wash and dry all equipment, your lab bench and your clean-up area.

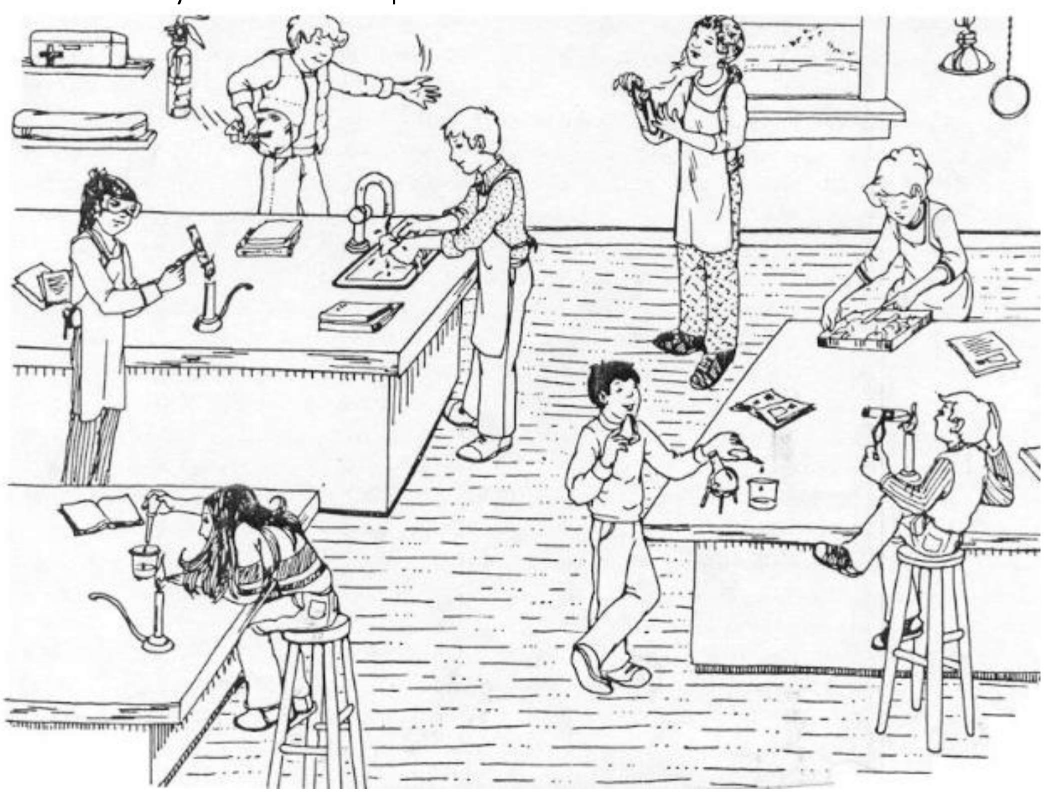
PANIC BUSTERS

What do I do when . . .

- **a fire occurs?** In the event of a fire, alert the teacher and leave the laboratory immediately.
- **my clothes are on fire?** Stop-Drop-Roll! Stop immediately, drop to the floor, and roll. This is the quickest way to smother a fire.
- **my lab partner's clothes or hair is on fire?** Grab the nearest fire blanket, and use it to extinguish the flames. Inform your teacher.
- **a chemical comes in contact with my eyes?** Wash your eyes with water for at least 15 minutes. Inform your teacher.
- **I spill a chemical on my body?** Rinse the affected area for at least 15 minutes. Inform your teacher.
- **I spill a chemical on the floor?** Keep your classmates away from the area, and alert your teacher immediately.

Check your understanding:

Circle the safety violations in the picture below:



Practice: Safety First!

Directions: Read the following story and underline/highlight all lab safety violations.

The bell rang, students sat in their seats, and they began to write down their homework. Ryan eagerly asked Mr. Jones, "What are we doing today?" Mr. Jones impatiently said, "As always Ryan it is listed on the board under AGENDA." Ryan responded, "Oh yeah, there it is, we have a Chemistry lab."

Mr. Jones gave the class a brief overview of what they would be doing during the lab and he stressed to the class, "Please be sure to follow appropriate lab safety procedures." Ryan and John sprinted to a lab station, yelling, "We got this station!" Once at the station, Ryan asked John if he read the lab last night for homework to which John replied, "Nope, did you?" Ryan responded to John's question by saying, "Are you serious, I never read anything for this class." They both looked at each other and decided to just start the lab.

"Ryan, you go get the chemicals and I'll light up the Bunsen burner," said John. Even though all of their classmates went to the safety goggle cabinet prior to starting the lab, Ryan and John decided not to go. John said in a smug way, "Forget the goggles; we are too cool to wear those things." Ryan walked up to the front lab bench where the chemicals were, removed the lids, picked up the flasks, and started to smell the different chemicals. "I am just going to bring back the ones that smell the best," said Ryan. Little did Ryan know that one of the chemicals was sulfuric acid, and after taking a deep breath, he thought that his nose hairs were on fire. "Hey Ryan, you didn't even put the lid back on," yelled Mr. Jones. Ryan ignored Mr. Jones and somehow he made it back to his lab station without passing out. Upon making his way back to the lab station, Ryan saw John trying to light the Bunsen burner.
"John, John, your hair!" Ryan yelled in an excited voice.

"That was a close one," said John. "My mother has been telling me to get a haircut. I guess I really need one now that I just lost a big chunk of my hair." The two partners then proceeded with the lab. Ryan reached across the flame in order to get a beaker filled with acetic acid while John grabbed a test tube to put the chemical in. "Oops!" said Ryan, "I just spilled some of the chemicals on the tabletop. I'll just wipe it up with my shirt sleeve." "Should you tell Mr. Jones?" John asked. "No, it isn't a big deal, I already wiped it up," Ryan nonchalantly said. A few seconds later, Ryan said, "Man, my arm is warm." In an excited voice, John said, "Oh my God, look at your shirt, there is a hole in it. That chemical you wiped up must have eaten through your shirt. How is your arm?"
Ryan said, "It hurts a little, but I will be fine." "Should we tell Mr. Jones?" asked John. "No, I'll be fine," Ryan said confidently.

The lab partners then poured some chemicals into a test tube to begin heating. "Ryan, do you see that crack in the test tube?" questioned John. "Who cares," Ryan whispered. "As long as the test tube is not leaking, it must be fine." The boys proceeded to heat the test tube. Ryan asked, "Is anything happening?" "I don't know, point the test tube in this direction so that I can look into the opening," John replied. "Maybe we should just add some of the other chemicals if nothing is happening yet," said Ryan. "Should we ask Mr. Jones?" wondered John.

"No, he is annoying," Ryan smugly said. Ryan then continued, "He will first ask us if we read all of the procedures and then he will say, 'I put a lot of time and effort into writing these labs for you guys and the least you could do is read them. If you have read it and then have additional questions, I would be more than happy to help you, but you have to do your part first.' I certainly don't want to hear all of that, do you?" "Definitely not, I hate when teachers go ranting," said John.

The lab partners proceeded to add some random chemicals to the test tube. Shortly thereafter, the contents of the test tube began to bubble over. "Wow that was amazing!" Ryan yelled. "Yeah, that was pretty cool, but it is everywhere," John said in a concerned voice. "Good thing we have all of these papers laying around our lab station because most of the chemicals have just spilled onto them. We can just throw all of the papers into the garbage," Ryan said confidently.

"Hey, it got onto my planner," John said in an annoyed voice. "Who cares, just go to guidance and buy another one for four dollars and fifty cents. Oh, I'm sorry, I mean you can get one for four dollars and Fitty Cent. Get it, Get it!" Ryan said in a joking manner.

The students began to clean up the spilled chemicals when John said, "This stuff smells really good, kind of like lemonade." "Well, if it smells like lemonade, it must be lemonade, just taste it," Ryan said in a convincing manner.

John proceeded to taste the chemical mixture by sipping what was left in the test tube. "Oh man, the bell is going to ring soon," Ryan said in a rushed voice. "Just leave it, I really want to go to lunch because it is Taco Day," John said. "Are you sure?" Ryan questioned. "Yeah let's just get out of here; the next class is going to be doing the lab again anyway, so they can clean it up," John said.

Without washing their hands, Ryan and John left the classroom and headed to lunch.

List 3 Safety Rules for the Science lab:

Objective: To convert between units of measurement within the metric system using the conversion ladder

Qualitative Data	Quantitative Data
• Deals with descriptions. • Data can be observed but not measured. • Colors, textures, smells, tastes, appearance, beauty, etc. • **Qualit**ative → **Qualit**y	• Deals with numbers. • Data which can be measured. • Length, height, area, volume, weight, speed, time, temperature, humidity, sound levels, cost, members, ages, etc. • **Quantit**ative → **Quantit**y

Quantitative Measurements in Science:

The metric system is the world standard for measurement. Not only is it used by scientists throughout the world, but most nations have adopted it as their standard of measurement. All of the measurements done in this course will use the metric system.

1. Volume-the amount of space matter (an object) takes up

Metric base units of volume are: liters

2. Mass- the amount of matter an object contains (different than weight, which is mass + gravity… more on this in physics!)

Metric base units of mass are: grams

3. Length-the distance from one end of something to the other end

Metric base units of length are: meters

4. **Time**- a measure in which events can be ordered from the past through the present into the future

Metric base units of time are:seconds

5. **Temperature**-measure of the average kinetic energy of an object

Metric base units of temperature are: Celcius

The table below shows the standard unit of length, mass, volume, and temperature in the metric system. It also shows the English equivalent.

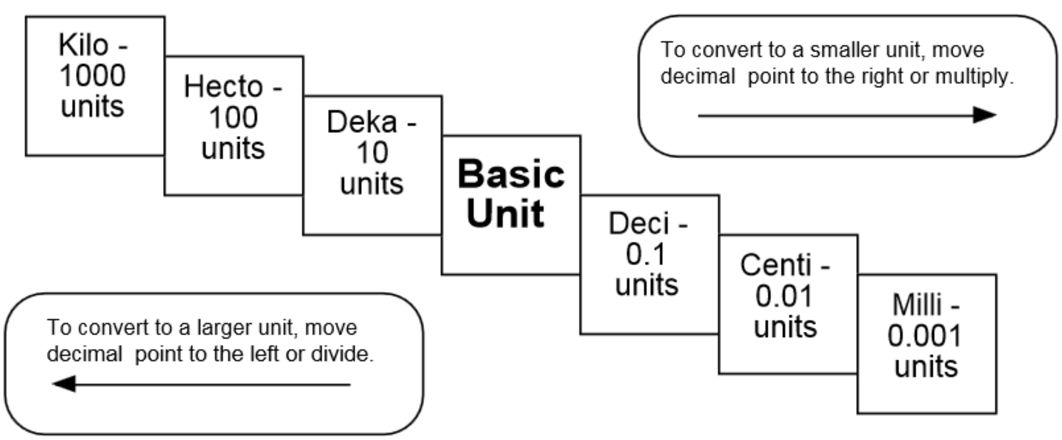
	Metric	English
Length	meter	39.37 inches
Mass	gram	0.03527 ounces
Volume	liter	1.0567 quarts
Temperature	degree (Centigrade)	1.8 degrees Fahrenheit

Meters, grams, and liters (see the table above) form the basis for larger or smaller units. The units are named using these prefixes:

Kilo = 1000
Deci = 1/10
Centi = 1/100
Milli = 1/1,000
Micro = 1/1,000,000

Designed during the French Revolution of the 1790's, the metric system brought order out of the conflicting and confusing traditional systems of weights and measures then being used in Europe. Prior to the introduction of the metric system, it was common for units of length, land area, and weight to vary, not just from one country to another but from one region to another within the same country. As the modern nations were gradually assembled from smaller kingdoms and principalities, confusion simply multiplied. Merchants, scientists, and educated people throughout Europe realized that a uniform system was needed, but it was only in the climate of a complete political upheaval that such a radical change could actually be considered. In Chemistry we measure matter using SI units. This is an abbreviation for System International. The Metric System of measurement is based on multiples of 10. Prefixes are used to indicate what multiple of 10 the base unit is being multiplied by.

Basic unit= meter, liter, gram



Methods for conversions:

<u>Staircase method instructions</u>-Look at the prefix you have and count how many steps you need to get to the prefix you want. Then move the decimal that many steps and in the same direction to convert the number to the new unit.

<u>Example: </u>Convert 52 mm to km

- starting at milli- it is 6 steps up the staircase to get to kilo
- move the decimal six places to the left
- so 52 becomes 0.000052km

Example: In the word kilometer, the root word base unit) is "meter" and the prefix is "kilo." Kilo means multiply the root word by 1000. Therefore, one kilometer is 1000 meters (1 km = 1000 m).

<u>Check your understanding</u>

1. Give the unit used to describe the following:

    a. Mass ________ d. Time: ______

    b. Volume ________ e. Temperature: ______

    c. Energy ________ f. Pressure: ______

2. If a substance weighs 2.00 grams and you need the mass in kilograms, will the number appear to become smaller or larger? Explain your answer.

3. If a liquid has a volume of 5800 mL and you need the mass in Liters, will the number appear to become smaller or larger? Explain your answer.

4. If a substance has a mass of 0.00235 grams and you need the mass in milligrams, will the number appear to become smaller or larger? Explain your answer.

<u>Practice:</u> Match the terms in Column II with the descriptions in Column I. Write the letters of the correct term in the blank on the left.

Column I	**Column II**
_____ 1. Distance between two points	a. time
_____ 2. SI unit of length	b. volume
_____ 3. Tool used to measure length	c. mass
	d. density
_____4. Amount of space occupied by an object	e. meter
_____ 5. Unit used to express volume	f. kilogram
_____ 6. SI unit of mass	g. liter
_____ 7. Amount of matter in an object	h second
_____ 8. Mass per unit of volume	i. length
	j. balance
_____ 9. Instrument used to measure mass	k.. meter stick
_____ 10. Interval between two events	l. thermometer
_____ 11. SI unit of temperature	m.Celcius
_____ 12. SI unit of time	
_____ 13. Instrument used to measure temperature	

<u>Show all work and report with the *proper units*.</u>

1. Convert a measurement of 100 cm to its equivalent in m.

2. Convert a measurement of 0.001 m to its equivalent in mm.

3. Convert a measurement of 10. L to its equivalent in mL.

4. Convert a measurement of 1000 g to its equivalent in kg.

5. Convert a measurement of 50 cm to its equivalent in mm.

6. Convert 24 mg to g.

7. Convert a measurement of 36 mL to its equivalent in L.

8. Convert a measurement of 0.00883 km to its equivalent in cm.

9. Convert a measurement of 350.0 mg to its equivalent in kg.

10. How many mL are in 0.0895 L?

11. Convert 1258 cm to meters.

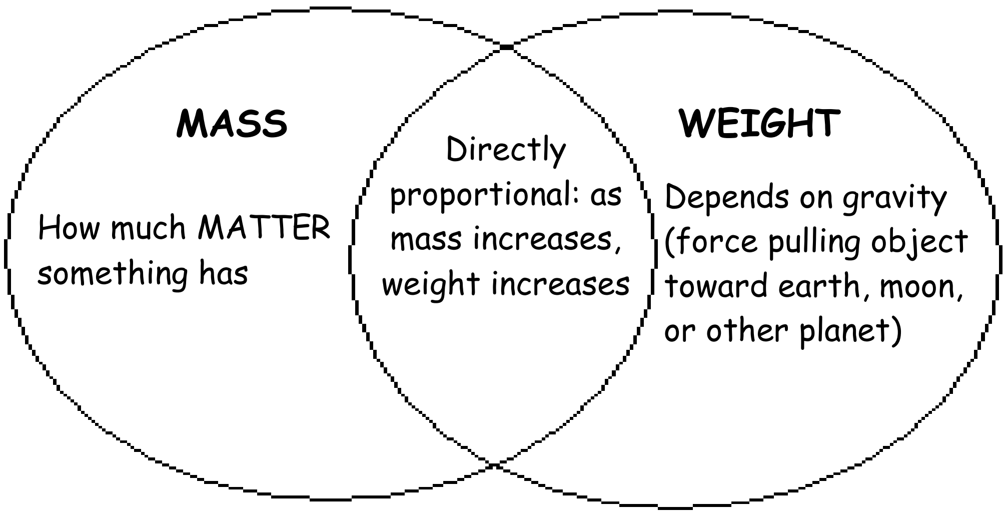
12. Convert 2500 mL to liters.

13. Convert 0.0290m to millimeters.

Lesson 3: Measuring Matter Date:____________

Objective: To calculate density as a property of matter

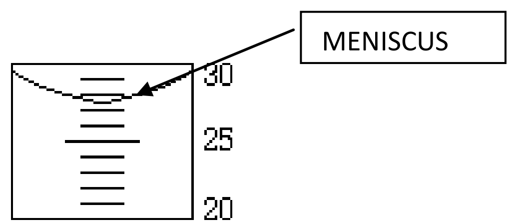
1. **Mass vs. Weight**



2. **Volume** - amount of SPACE an object takes up
   - Techniques:

     a. Liquids → use graduated cylinder

     Reading a graduated cylinder:

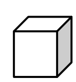


► Measurements are read from the bottom of the MENISCUS

b. Regular Solids → measure dimensions and use l x w x h formula

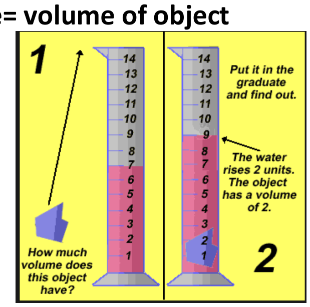
***you need to MEMORIZE:

1 cubic cm (1cm x 1cm x 1cm) = 1 cm^3 = 1 milliLiter (mL)



c. Irregular Solids → Displacement method

Intial volume-final volume= volume of object



3. **Density**: amount of mass in a given volume (space); ratio of mass to volume.

$$density = \frac{mass}{volume}$$

or, in short form:

$$d = \frac{m}{v}$$

Example: What is the density of an object with a mass of 60 g and a volume of 2 cm^3?

D=M/V

D=60g/2 cm^3

D=30g/cm^3

<u>**Check your understanding:**</u>

1. What is the difference between mass and weight?

2. When reading any volume in the laboratory, we always read where the bottom of the water curve falls. This is called the ________________.

3. A 2.75 kg sample of a substance occupies a volume of 250.0 cm^3. Find its density in g/cm^3.

Practice:

1. Under certain conditions, oxygen gas (O_2)has a density of 0.00134 g/mL. Find the volume occupied by 250.0 g of O2 under the same conditions.

2. 30.0 g of each of the following acids are needed. Find the volume of each that must be measured out in a graduated cylinder.

   a. hydrochloric acid (HCl), density = 1.164 g/mL

   b. sulfuric acid (H_2SO_4), density = 1.834 g/mL

3. A rectangular block of lead (Pb) measures 20.0 mm X 30.0 mm X 45.0 mm. If the density of Pb is 11.34 g/cm^3, calculate the mass of the block.

4. A cube of gold Au) has a side length of 1.55 cm. If the sample is found to have a mass of 71.9 g, find the density of Au.

Objective: To define the parts of a light microscope and their functions

In about 1590, two Dutch spectacle makers, Zaccharias Janssen and his son Hans, while experimenting with several lenses in a tube, discovered that nearby objects appeared greatly enlarged. That was the forerunner of the compound microscope and of the telescope . In 1609, Galileo , father of modern physics and astronomy, heard of these early experiments, worked out the principles of lenses, and made a much better instrument with a focusing device.

Anton van Leeuwenhoek (1632-1723)

The father of microscopy, Anton van Leeuwenhoek of Holland, started as an apprentice in a dry goods store where magnifying glasses were used to count the threads in cloth. He taught himself new methods for grinding and polishing tiny lenses of great curvature which gave magnifications up to 270 diameters, the finest known at that time. These led to the building of his microscopes and the biological discoveries for which he is famous. He was the first to see and describe bacteria, yeast plants, the teeming life in a drop of water, and the circulation of blood cells in capillaries. During a long life he used his lenses to make pioneer studies on an extraordinary variety of things, both living and non-living, and reported his findings in over a hundred letters to the Royal Society of England and the French Academy.

Robert Hooke

Robert Hooke , the English father of microscopy, re-confirmed Anton van Leeuwenhoek's discoveries of the existence of tiny living organisms in a drop of water. Hooke made a copy of Leeuwenhoek's light microscope and then improved upon his design.

Beyond the Light Microscope

A light microscope, even one with perfect lenses and perfect illumination, simply cannot be used to distinguish objects that are smaller than half the wavelength of light. White light has an average wavelength of 0.55 micrometers, half of which is 0.275 micrometers. (One micrometer is a thousandth of a millimeter, and there are about 25,000 micrometers to an inch. Micrometers are also called microns.) Any two lines that are closer together than 0.275 micrometers will be seen as a single line, and any object with a diameter smaller than 0.275 micrometers will be invisible or, at best, show up as a blur. To see tiny particles under a microscope, scientists must bypass light altogether and use a different sort of "illumination," one with a shorter wavelength. This is usually done with an electron microscope.

Microscope – device used to view objects which are too small to see or explore with your eye alone.

Compound – when a scope has a minimum to two magnifying lenses.

Binocular – two eyepieces.

Monocular – one eyepiece.

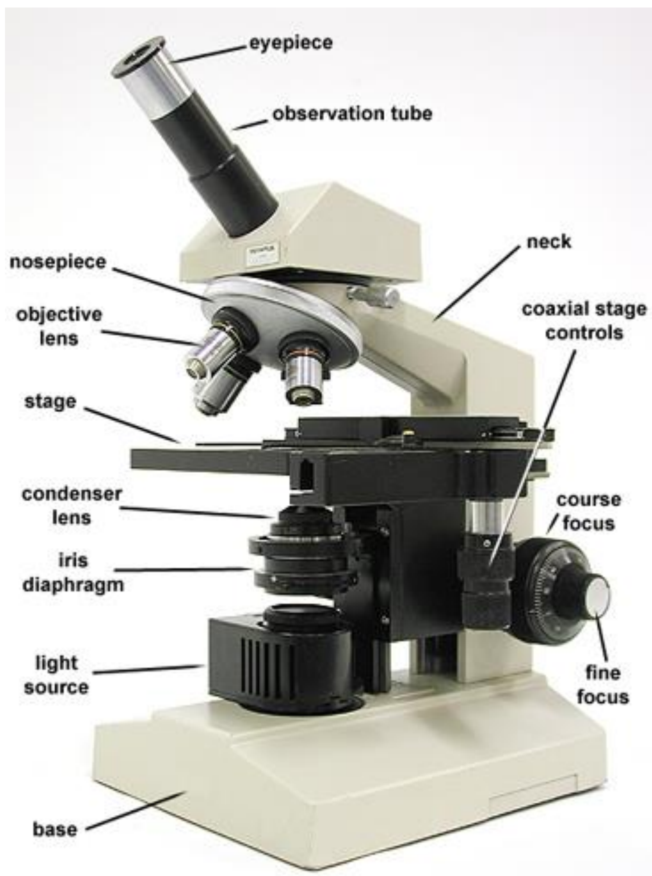
Magnification – the ratio of the image size to the actual size; apparent enlargement of an object.

Resolution - the ability of a microscope to distinguish between two very close points.

Electron microscope – microscope that uses electrons as a source of illumination.

Parts of the compound microscope

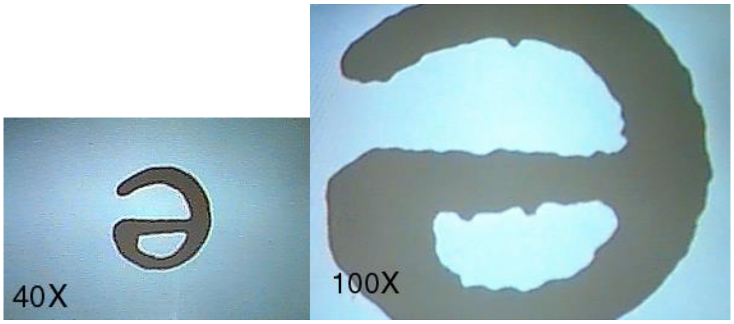
A compound microscope is composed of many important, functional components. There are at least two lenses – the ocular lens and objective lens. The ocular lens is in the eyepiece; it is usually 10x power. The objective lenses are near the stage on the revolving nosepiece. There are usually multiple objective lenses that are used to vary the magnification; on many microscopes the objectives are 4x, 10x and 40x magnification. The condenser and iris diaphragm are important devices used to adjust how light hits the sample, thus influencing the visualization of the sample.



Using a compound microscope

To use a microscope, you must know how to focus on the sample, adjust the condenser and diaphragm to optimize visualization of the sample. For binocular scopes, you must also set the appropriate interpupillary distance and adjust the diopter ring to focus both eyes on the sample.

The image you see through the microscope is inverted, which should be kept in mind when moving the stage and sample. The field of view and depth of field decrease as the magnification increases; by knowing the diameter (mm) of the field of view for each objective lens, the size of objects can be measured.



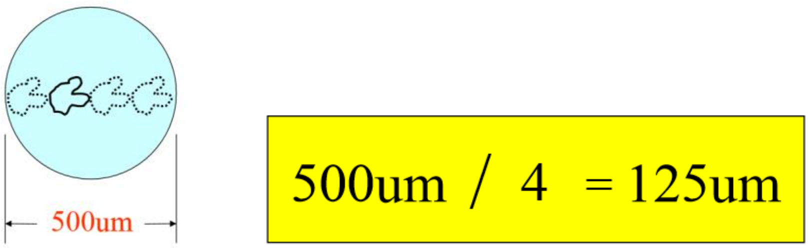
Measuring and the Microscope

Watch this! [Measuring and the Microscope]

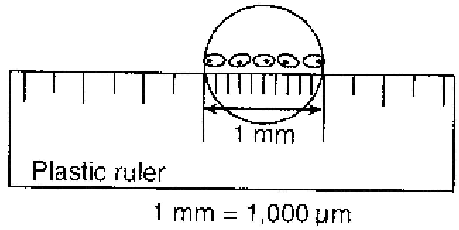
Estimating the Size of the Specimen under Observation

Remember: 1 millimeter = 1000 micrometers

1. Determine the objective being used
2. Determine the field diameter in micrometers
3. Estimate how many would fit across the field diameter
4. Divide the field diameter by the number that would fit across High Power field of view



Example:



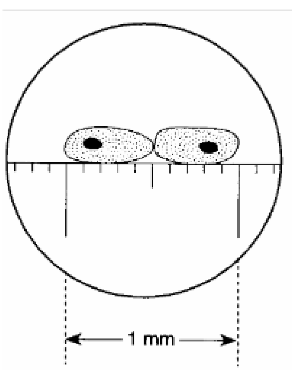
What is the average length of a single cell in µm?
Since there are 5 cells in 1mm(1000 µm) each one is 1/5 of 1000. Each cell is 200 µm!

Check your understanding:

1. What are the possible magnifications of a microscope with an ocular marked 10X and objectives marked 5X, 15X, 30X and 60X?

2. Convert the following measurements: 1mm = 1000µm
    a. 9.2 mm = ______________
    b. 5900 µm =______________
    c. 0.083 mm =______________
    d. 61000 µm=______________

3. What is the length of one cell?
   ______mm
   _______________ µm



Practice:

1. What is the total magnification for each of the following?

A) 10X objective, 15X eyepiece _______
B) 40X objective, 5X eyepiece _______
C) 4X objective, 10X eyepiece _______

2. Draw the following patterns as they would appear when viewed through a compound microscope:

A) h

D) 

G) H

B) X

E) m

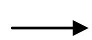
H) 2

C) 

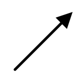
F) 4

I) 

3. In what direction would you move the slide if you are observing an organism moving in the following directions through the compound microscope and you wish to keep the organism from moving out of the field?

A) 

B) 

C) 

4. Fill in the following:

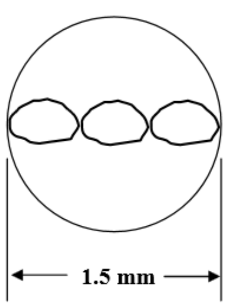
A) 3 mm = ______mm

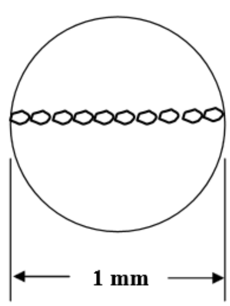
C) ____mm = 500 mm

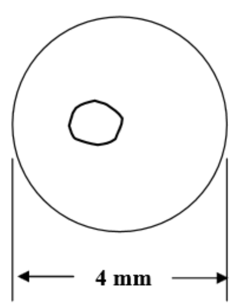
B) _______mm = 4000mm

D) 0.25 mm = _______mm

5. What is the size of each cell in the following diagrams?





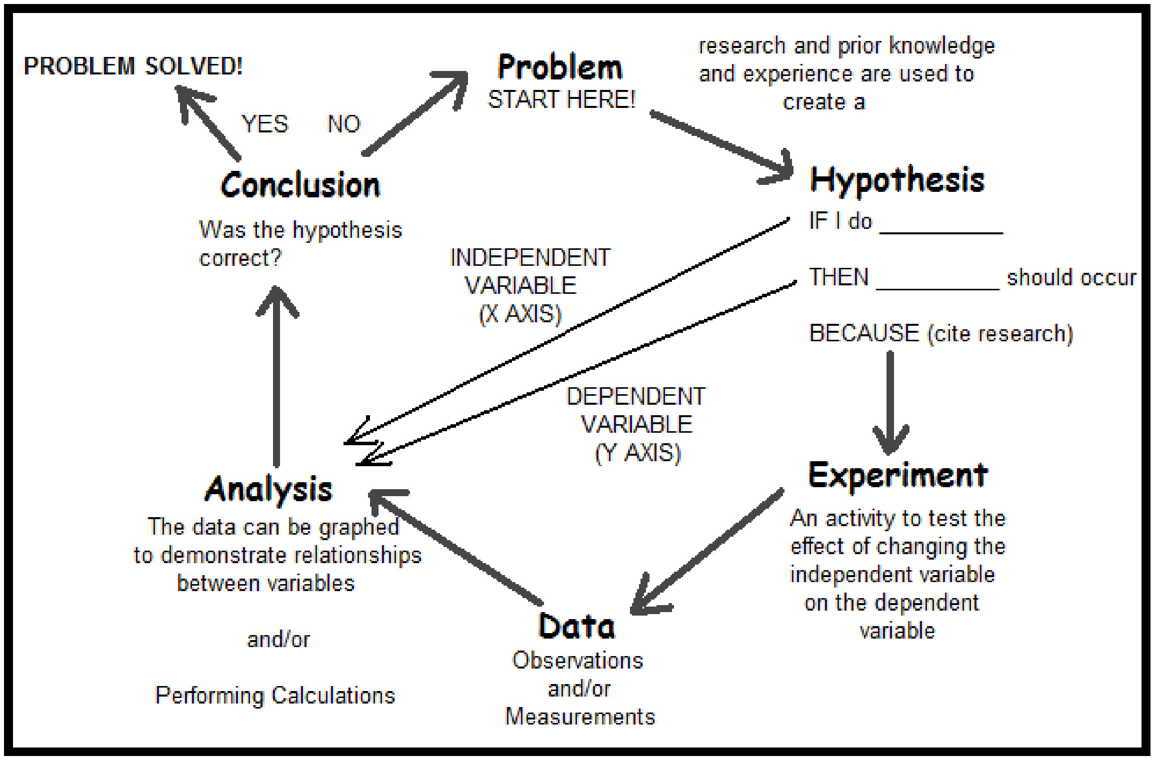


______________ um ______________ um ______________ um

Lesson 5: Scientific Method: **Date:** ______

You got a problem? YOU GOT A PROBLEM???? Then solve it, using the Scientific Method! It is a logical sequence of steps designed specifically to solve problems!

Watch the following video tutorial! [Scientific Method]



The scientific method is a way to ask and answer scientific questions by making observations and doing experiments.

The steps of the scientific method are to:

- **Ask a Question**
- **Do Background Research**
- **Construct a Hypothesis**
- **Test Your Hypothesis by Doing an Experiment**
- **Analyze Your Data and Draw a Conclusion**
- **Communicate Your Results**

Who uses the Scientific method?

- Pharmaceutical companies apply the scientific method in determining what the best medications for a condition are, and what the best dosage is.
- Automotive mechanics use the scientific method to diagnose and repair car problems.
- Computer technicians use the scientific method to diagnose and repair computer problems.
- Doctors use the scientific method to diagnose and heal illnesses or injuries.
- Politicians use the scientific method to craft their election campaigns.

- Arson investigators use the scientific method to determine the cause of fires and determine their point of origin.
- Forensic investigators use the scientific method to determine the nature and perpetrators of crime.
- Business executives use the scientific method to analyze profit reports and create new business plans.

Definitions:

Data/Observations Information gathered in an experiment or before an experiment begins. It must be reliable. Be aware of the difference between observations and interpretations.

A **Hypothesis** is a prediction about the outcome of a cause and effect relationship.

Conclusions are interpretation of a set of information ("what it means")

Experiment a way of testing a hypothesis in order to gather reliable information. Here are some ways to get reliable information:

- Eliminate all *uncontrolled variables* (see below)
- Make sure your hypothesis is falsifiable (could be proven wrong)
- Make sure that the experiment always gives the same results ("repeatability")
- If there are unavoidable variables (such as testing people), use a large sample.

Independent Variable: is a variable in an experiment that **you** choose or apply. For example, if you wanted to test how far different kinds of balls (baseballs, tennis balls, golf balls, etc) will go when you hit them with a bat, the independent variable is the type of ball, because you *choose* what kind of ball you are going to use. It is the treatment or "cause."

Dependent Variable: is a variable that changes as a result of your deliberate changes to the independent variable. In the example with hitting balls, the dependent variable is how far the balls go, because how far it goes is a result of, or *depends on*, what kind of ball you use.

Control group: is a variable that has been kept constant in different trials of the experiment. In the baseball bat experiment, you would want to use the same exact bat and swing just as hard every time, for example

Experimental Errors: errors in an experiment's data caused by uncontrolled variables.

Law: a concise statement that summarizes the results of many experiments. It explains what happens, not why.

Theory: an explanation for why things happen in a certain way, backed up by numerous experiments. (In science, "theory" doesn't merely mean "an idea".)

Check your understanding:

1. Using the flow chart shown earlier, list the steps of the scientific method in order.

2. What is the difference between a law and a theory?

Practice:

1. Suppose you work for a Blabbit Labs, the developer of many different pharmaceutical products. Your research division has stumbled across a new drug that you believe cures male pattern baldness. Before you can start selling the drug, you must demonstrate to the U.S. Food and Drug Administration that the drug is effective.

a. What is the question being asked?

b. What is the hypothesis?

2. You design an experiment with 500 men who have been diagnosed with male pattern baldness. They are divided up into two groups, group A men receiving the drug while group B men receive a placebo, a drug that is known not to effect baldness. The drug is referred to as the ***experimental variable***, since this is what is being tested. As a hint, the hypothesis will usually identify the experimental variable of a study.

In this study, the men receive the drug or a placebo once a day. All of the men will have the number of hairs per square inch of scalp measured in a clinic once per week. The number of hairs per square inch will be the ***dependent variable*** since this variable depends on the effectiveness of the experimental variable. The dependent variable is also what we use to determine if the experimental variable is actually acting according to the hypothesis and the data collected will usually tell what the dependent variable is.

Men in group A belong to the ***experimental group***, since they received the experimental variable. Men in group B belong to the ***control group***. The control group is important since it gives the researchers something to compare the experimental group to. For instance, if the men in the experimental group were shown to have hair growth, then that would indicate that the hypothesis was supported and the drug grows more hair. However, if the control group also grew hair, then something in the environment besides the drug was responsible for hair growth.

a. Define dependent and experimental variables.

b. Compare and contrast the experimental and control group.

3. You are conducting an experiment to determine if increased ultraviolet radiation from the decrease in the ozone layer is killing off frog tadpoles. After examining all of the data available in the library, you decide to go with a hypothesis that increased ultraviolet radiation from the sun is killing off the tadpoles.

You design an experiment with a control and an experimental group. Group 1 involves 100 tadpoles in a five gallon container of water, which is covered by glass (knowing that the glass will filter out the ultraviolet radiation). Group 2 will be set up exactly like group 1, except that instead of being covered with glass, it is covered with an acrylic plexiglass, which will not filter out the U.V. radiation. You then place the groups outside for a period of a month, and observe the results.

Results

	Group 1	**Group 2**
Number of tadpoles started with	100	100
Number finished	96	96

Using the information given, answer the following questions.

a. What is the experimental variable and what is the dependant variable?

b. Does the information from this experiment support the hypothesis?

c. If no, then what might be causing the decrease in frog populations?

Unit Study Guide

Law, Theories, BIG ideas	**Equations, Calculations**
Laws:	Equation: (When to use & units)
Theories:	Calculations (When to use)
BIG ideas:	Reference Table (Hints & tricks)

Helpful tips, sayings, shortcuts

Things I always forget…

Unit Project: Due Date:________

As you know, we rely on units of measure and devices to help make measurements on a daily basis. Therefore, awareness of such things is an integral part of living day to day. This knowledge of units and measurements can range from using the appropriate measuring cup for making a cake to determining how much wood should be purchased for a home project. Whatever the case may be, these units and measurements are an essential part of our everyday lives.

For this project you must create a unit (or units) for measure, along with the unit relationships. This should be based on something that you think is worthy of being measured and having its own set of units, but is not currently in existence. Once you decide on the unit(s), you must provide a Proposal to the International Committee for Weights and Measures*. This proposal should provide evidence supporting your rational for your unit(s).

Your proposal should:

- Be presented using in a minimum of two paragraphs detailing the importance and benefits of your unit(s) – (persuasive argument)
- Include a model or picture of a device used to measure your unit(s) and an explanation of how it is used (ex. – a ruler is a device used to measure length and it works by counting the lines that have designated values)
- Highlight whether your unit (or units) is based in the metric or U.S. system and include examples of how you would convert your unit(s) of measure

Your work will be graded using the following rubric:

	3	2	1
Persuasive Argument	Convincing argument that provides an excellent rationale for the acceptance of the new unit(s) by the committee	Reasonable argument that provides decent rationale for the acceptance of the new unit(s), but would benefit from additional supporting evidence	Questionable argument that does not clearly articulate the benefits of the unit(s) in question
Model/Visual of Device	Appropriate model/visual with a clear description of the device, given the context of the unit(s) and measurements	Logical model/visual with a reasonable description of how the device works, however some questions remain	Confusing model/visual with an unclear description of how the device works
Unit Relationships & Conversion Examples	Clearly illustrates unit relationships and examples of the method for converting the unit(s)	Adequate unit relationships and examples of the method for converting the unit(s), however some confusion remains	Unclear or inappropriate unit relationships and examples of the method for converting the unit(s)
Neatness	Extremely neat and meticulously put together; project appears to have taken a lot of time and effort	Neatly put together, but does have the potential to be neater	Messy project that appears to have been completed at the last minute
Mechanics	No misspellings or grammatical errors	One to two misspellings and/or grammatical errors	Three or more misspellings and/or grammatical errors
Creativity	Extremely clever and composed with originality; uniquely made project	Added a few original touches to enhance the project	Little creative energy used during this project

Total score:________/18

*One of the three organizations established to maintain the International System of Units (SI) under the terms of the Convention du Mètre (Metre Convention) of 1875. It meets in Paris every four to six years. Its principal task is to ensure world-wide uniformity in units of measurement and it does this by direct action or by submitting proposals to the General Conference on Weights and Measures