STEM Readiness - Science
SYLLABUS

COURSE:	**CPDV:716 STEM Readiness – Health Science/Life Science**
COURSE DESCRIPTION:	This course introduces students to a variety of scientific disciplines, scientific thinking, and the scientific method. Students will learn to apply basic scientific principles to solve problems, complete tasks and conduct simple experiments in a laboratory setting. The activities are designed to strengthen skills in preparation for post-secondary STEM related technical programs and ultimately in STEM related careers.
CREDITS:	The STEM Readiness – Science course is offered through the Workforce Solutions Group as a non-credit program in the MoSTEMWINs Portal program of study.
INSTRUCTOR:	**Vamadu (Ahmed) Sheriff, MBA** Director, Biosciences and Technology Training Programs Family Workforce Centers of America vsheriff@metcenterstl.com, 314-746-0772

MOSTEMWINS DIRECTOR:	**Dianne Lee** dlee@stlcc.edu	**CAREER PATHWAY COACH:**	**Laurie Hawkins** lhawkins55@stlcc.edu 314-644-9288

LOCATION:	Metropolitan Education and Training (MET) Center 6347 Plymouth Ave. St. Louis, MO 63133
SCHEDULE:	Class meets Monday – Thursday from 8 am – noon for two weeks. **If, for any reason, you cannot maintain this schedule, you must immediately notify your career pathway coach and instructor.**
REQUIRED MATERIALS:	Pen or pencil. All course materials will be provided and/or available in Blackboard.
GRADING:	Final grades will be recorded as **SC** (Successfully Completed) or **NC** (Not Successfully Completed) on the College's official non-credit transcript. Successful completion of this course is based on: 1. **Participation**—Daily attendance and full participation in all instructional activities. 2. **Hands-on Experiments**—Completion of hands-on experiments including written lab reports.

NETIQUETTE:

netiquette *n.* proper or polite behavior on the Internet

Communication is very important in this course. To maintain a positive online environment, each of us is expected to follow these netiquette guidelines. Be advised that rules for student conduct apply in the online environment. Any use of electronic communication on STLCC network, which includes Blackboard, STLCC email, etc. for flaming or other kinds of harassment may be treated as a student conduct violation under the Student Conduct Code (accessible via http://www.stlcc.edu/Student_Resources/Policies_and_Procedures/Student_Rights_and_Responsibilities.html).

- Show respect for the instructor, other students, and for the privacy of those in the online environment. Nothing threatening is ever appropriate.
- Express differences of opinion in a polite and rational way, maintaining a supportive academic environment.
- Stay focused by avoiding irrelevant topics in discussion or collaborative activities
- Use proper capitalization and punctuation rules. Use of all uppercase in a message is the equivalent of shouting and is considered offensive.

Students are required to check college email and Blackboard announcements on a daily basis.

SEVERE WEATHER CLOSING PROCEDURES:

St. Louis Community College will remain open except under very severe weather conditions. Official announcements will be broadcast on KMOX-AM (1120) Radio, and television Channels 2, 4 and 5. On television, announcements are broadcast as early as possible at the bottom of the screen. Severe weather announcements are announced by campus. You can sign up for text alerts of closings and other emergency information by texting "follow STLCCAlert" (without the quotes) to 40404 - or follow @STLCCAlert on Twitter. Only "alerts" messages will be sent. All other communications will be sent from @STLCC. Updates also will be posted on the home page of the STLCC website and on the main page for each campus as well as a broadcast email when feasible. Below are the procedures for school closing and delayed schedule.

COLLEGE IS CLOSED

Means all classes are canceled for the day. No classes or labs, library, student center, writing center or any other service will be open. Classes in the evening also are canceled.

COLLEGE IS NOT CLOSED BUT IS ON delayed SCHEDULE

If a delayed schedule is announced, the location will delay opening until 9:30 a.m. Classes beginning before 9:30 a.m. will be canceled for that day. In the absence of any announcement, students should assume the college is operating on its normal schedule.

If the St. Louis Community College campuses (Florissant Valley, Forest Park, Meramec and Wildwood) cancel classes due to severe weather, the STEM Readiness class at the MET Center will be cancelled.

ACADEMIC INTEGRITY STATEMENT:

St. Louis Community College recognizes that the core value of academic integrity is essential to all activities of an academic community and provides the cornerstone for teaching and learning. It is characterized by upholding the foundational principles of honesty, equity, mutual responsibility, respect, and personal integrity. Advancing the principles of academic integrity is essential because doing so enhances academic discourse, the quality of academic work, institutional operations, and the assessment of educational goals. Observing academic integrity involves:

- Maintaining the standards of the College's degrees, certificates, and awards to preserve the academic credibility and reputation of the College;
- Communicating expectations, best practices, and procedures in order to promote the principles of academic integrity and ensure compliance;
- Providing environments, instruction, and access to resources necessary for maintaining integrity in learning;
- Taking responsibility and personal accountability for the merit and authenticity of one's work;
- Giving proper acknowledgement and attribution to those who directly contribute to a project, or whose work is used in the completion of a project;
- Recognizing what compromises academic integrity, whether intentional or unintentional (plagiarism, cheating, and uncivil behavior).

It is the shared duty of faculty, students, and staff of the College to understand, abide by, and endorse academic integrity.

ADA STATEMENT/ ACCESSIBILITY:

St. Louis Community College makes every effort to accommodate individuals with disabilities. The college is committed to compliance with the Americans with Disabilities Act (ADA) and will provide opportunities for qualified persons with disabilities in all activities, programs, or services operated or sponsored by the college, including academic series and programs, and student services. A student with a disability must contact the Access office at his/her campus of enrollment in order to begin the formal request for accommodation process. Each request for accommodation will be evaluated on a case-by-case basis by the Access office. Information about Access Office services is available on the Student Services tab as Disability Information or http://www.stlcc.edu/disAbility/Index.html. Instructions for contacting your campus Access office are available at: http://www.stlcc.edu/disAbility/Access_Office/Contact.html. Students are invited to privately discuss their accommodation needs with the career pathway coach, who will help them navigate the process. All information shared will be held in the strictest confidence.

NON-DISCRIMINATION STATEMENT: St. Louis Community College is committed to non-discrimination in its admissions, educational programs, activities and employment regardless of race, color, creed, religion, sex, sexual orientation, national origin, ancestry, age, disability or status as disabled veteran and shall take action necessary to ensure non-discrimination.

FERPA STATEMENT: The Family Educational Rights and Privacy Act ("FERPA") affords eligible students certain rights with respect to their education records. (An "eligible student" under FERPA is a student who is 18 years of age or older or who attends a postsecondary institution.) Information about records and information that may or may not be disclosed and other information regarding the confidentiality of student records, please see Section G.11 of the College Administrative Procedures. http://www.stlcc.edu/Document_Library/FERPA-Notification.pdf.

SEXUAL HARASSMENT POLICY: St. Louis Community College is committed to providing an academic and work environment that is free from sexual harassment. In keeping with this commitment, the college prohibits sexual harassment of any member of the college community. Sexual harassment in any form, including verbal, written, physical or visual harassment will not be tolerated. Sexual harassment may include, without limitation, unwelcome sexual advances, attempts to coerce any member of the college community into a sexual relationship or to punish such persons for refusing to submit to sexual advances, or conduct of a sexual nature which creates an intimidating, hostile or offensive academic or work environment.

Any member of the college community who has a sexual harassment complaint may obtain redress through administrative procedures of the college. The college will respond to sexual harassment complaints promptly and in an equitable manner. All information regarding complaints of sexual harassment is confidential and will be revealed only to those directly involved with the investigation and/or resolution of the complaint. Breaches of confidentiality may result in disciplinary action. Retaliation against anyone who brings a complaint of sexual harassment is prohibited. A student or employee of the college found to have violated this policy will be subject to disciplinary action, up to and including dismissal from the college or termination of employment.

Any part of this syllabus is subject to change at the discretion of the instructor.

STEM Readiness - Science
SYLLABUS

Course Outline

Day 1 Welcome to the Lab
- Safety
- Personal Protective Equipment (PPE)
- Lab Notebook
- Lab

Day 2 Scientific Method
- Labware
- Measurement
- Volume
- Weight
- Temperature
- Lab

Day 3 Biology
- The Cell (microscope activities)
- Plant
- Animal
- Definition of Life
- DNA and RNA
- Chemistry in Biology
- Lab

Day 4 Human Systems
- Anatomy
- Body Systems
- Terminology
- Prefixes/Suffixes
- Lab

Day 5 Chemistry
- Periodic Table
- Groups
- Properties
- Bonding
- pH
- Acids and Bases
- Lab

Day 6 Physics
- Basics
- Newton's Law of Motions
- Theory of Relativity
- Gravity, Forces
- Friction (video)
- Density – Different Drops
- Lab

Day 7 Project
- Select an Experiment
- Design Rubric
- Scientific Method
- Data Collection
- Labware
- Safety
- Notebook

Day 8 Presentation

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CPDV: 716
STEM Readiness - Science
Student Learning Outcomes

Student identifies safe and unsafe laboratory practices.
Student understands what personal protective equipment is and when it should be worn.
Student maintains a laboratory notebook using good laboratory practices (GLP).
Student applies scientific method to a problem/observation.
Student can identify peer-reviewed sources of information.
Student identifies different kinds of labware.
Student uses the correct tools, methods and metric system units for measuring volume, weight, and temperature.
Student compares and contrasts plant and animal cells.
Student identifies major cellular organelles/parts.
Student explains why something is considered living.
Student knows what DNA and RNA are and what they do generally.
Students can differentiate between organic and inorganic chemistry and can identify the four major organic molecule groups and the biological importance of each group.
Students know the major body systems and a major function of each system.
Students understand prefix and suffix definitions to dissect words.
Students identify different groups within the periodic table and properties of those groups.
Students understand different types of chemical bonds.
Students know the pH scale and understand that it is a logarithmic scale.
Students define acids and bases.
Students understand basic principles of Newtonian mechanics.
Students understand the basic principles of relativity.
Students understand physical forces and can manipulate the results of an experiment based on that understanding.
Students apply the understanding of density.

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Day 1
Date ____________

Objectives

1. Identify safe and unsafe laboratory practices.
2. Learn what personal protective equipment (PPE) is and when it should be worn.
3. Learn how to make an entry in a laboratory notebook using good laboratory practices (GLP).
4. Understand the difference between peer-reviewed and non-peer-reviewed resources.

Outline:

Laboratory Materials Needed:

Laboratory notebook page

Laboratory Protocol:

The instructor will demonstrate a simple experiment in front of the class. The students must then enter the experiment onto the laboratory notebook page using good laboratory practices (GLP). After the experiment has been entered onto the notebook page(s), students should exchange pages and review the entry they receive.

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Day 2

Date ____________

Objectives

1. Learn the steps of the Scientific Method and apply those steps to a problem.
2. Identify different kinds of labware.
3. Learn how to measure volume, weight, and temperature.
4. Learn the appropriate units for measuring volume, weight, and temperature in science.

Outline:

Laboratory Materials Needed:

Thermometers	Beakers
Graduated Cylinder	Meter stick

Small objects for weighing [can be anything: a roll of tape, a wad of paper, a pack of gum, etc.]

Triple or Quadruple Beam Balance	Ice
Assorted coins to add to water	Salt

Sheet of paper for measuring

Laboratory Protocol:

Measurement Lab

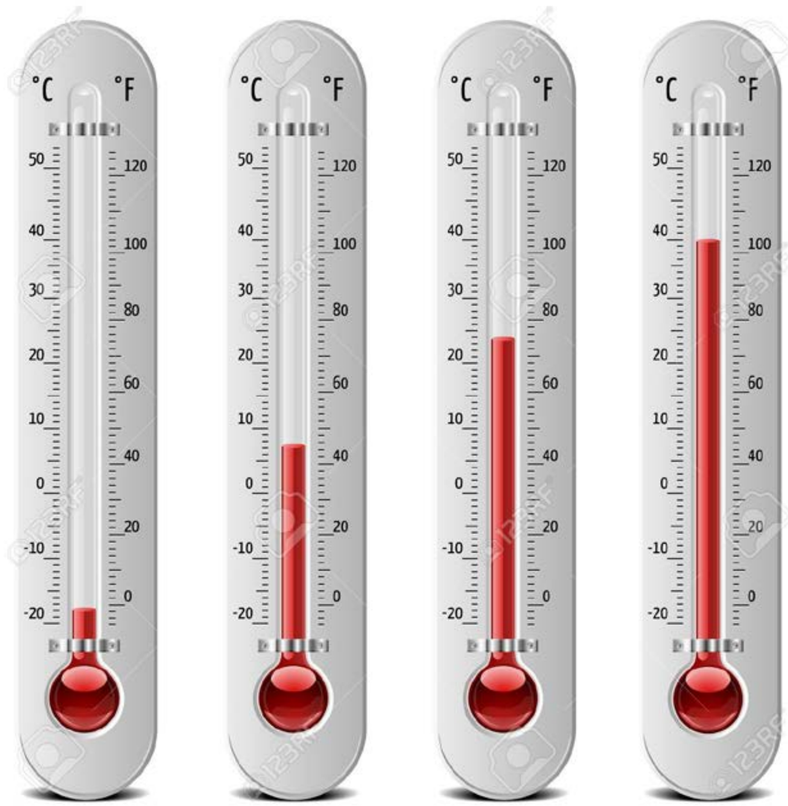
Part I: The Celsius Thermometer

Rules for the proper use of a thermometer.

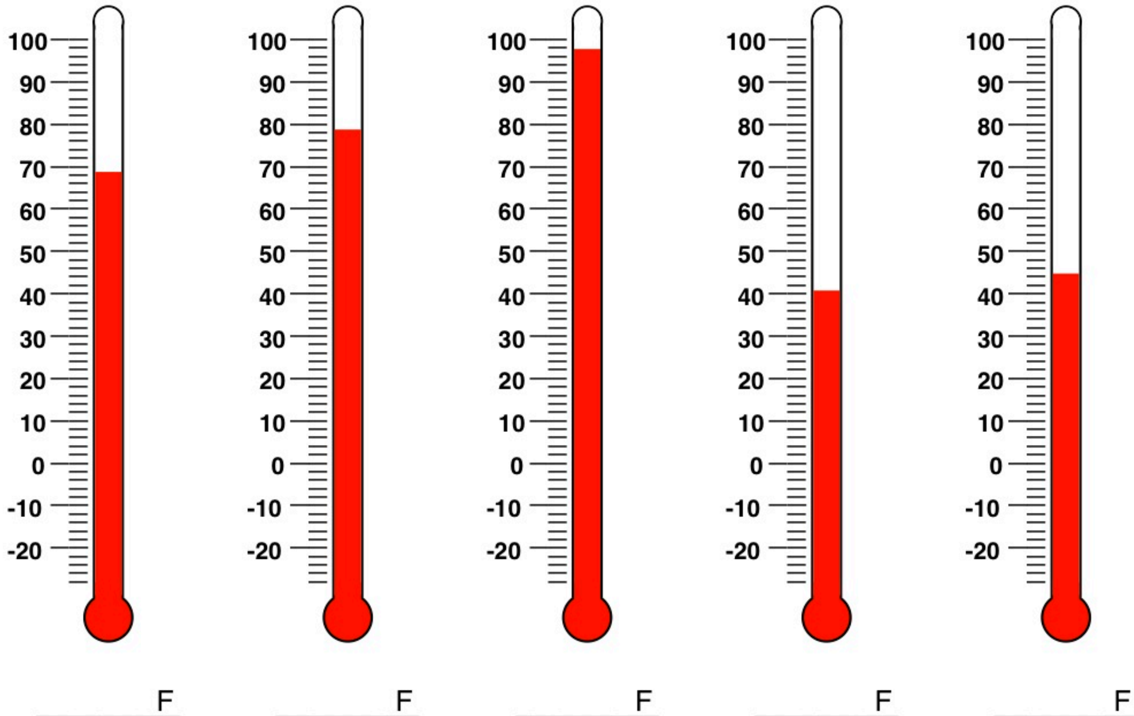
1. Never "shake down" a thermometer to reset it.
2. Never use a thermometer to stir a liquid.
3. Never allow a thermometer to touch the bottom of a container that is being heated.
4. Place the bulb end of the thermometer into the object with an unknown temperature.
5. Wait several minutes for the thermometer to adjust to the temperature of the object.
6. Without removing the thermometer from the object, note the number nearest the top of the column of liquid in the thermometer.

Answer the following questions on your notebook paper or on the worksheet provided.

1. What are the temperatures shown by these thermometers?



Find the temperature for each thermometer.



There are three beakers that are labeled "A" and "B" and "C". A=tap water, B= ice water, C= ice water with salt.
Use your thermometer correctly to complete the following:

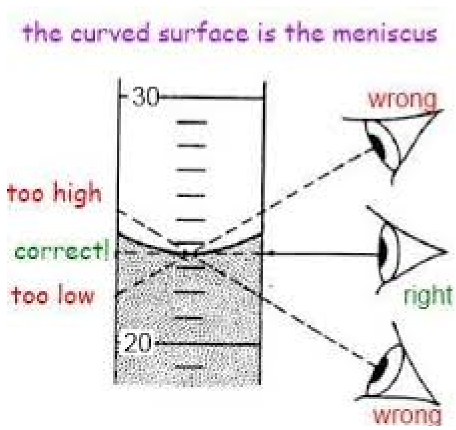
2. What is the temp of beaker A? Beaker B? Beaker C?
3. Why must you read the temperature without removing the thermometer from the solution?
4. Why should the thermometer never be used to stir a liquid?
5. Why should the thermometer never touch the bottom of a container that is being heated?

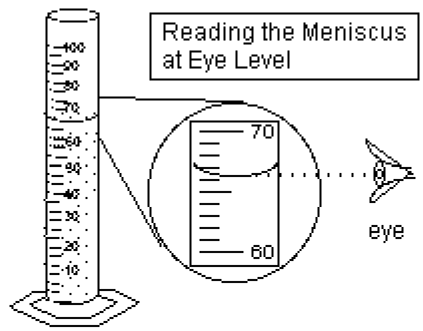
Part II: The Graduated Cylinder

Directions for using and reading a graduated cylinder:

1. Place the cylinder on a flat surface.

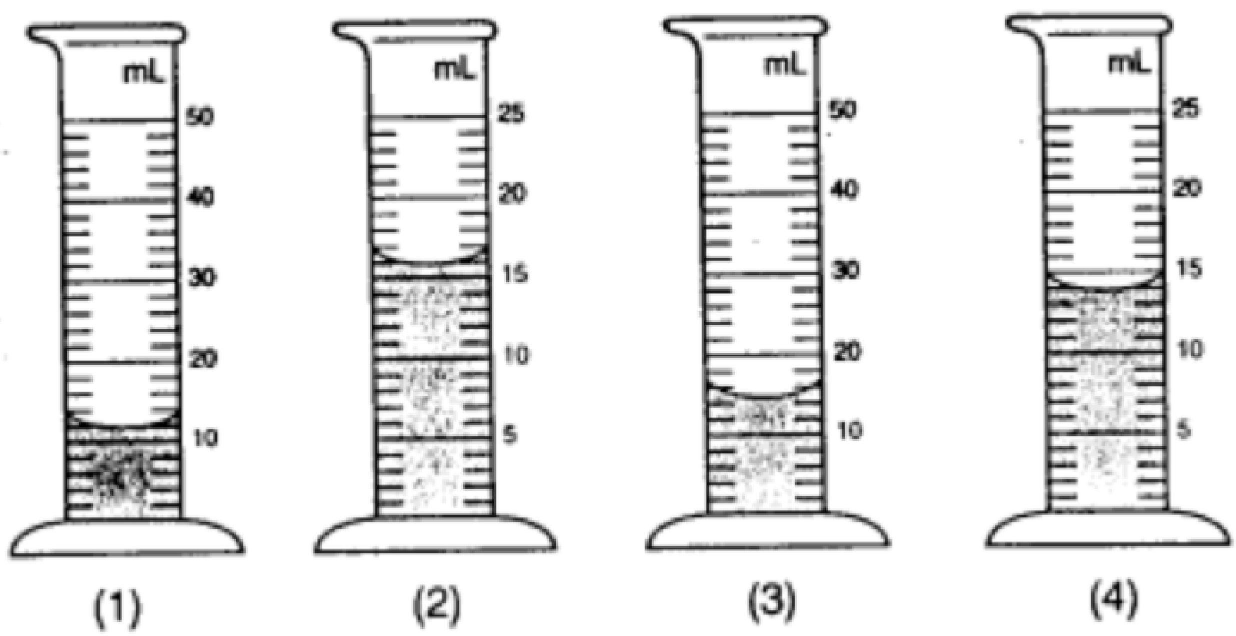
2. Look at the cylinder from the side at eye level. The top of the liquid should be at eye level. The view of the surface of the liquid will be curved. This curved surface is called the "meniscus".
3. Read the graduated cylinder at the bottom of the meniscus.





Answer the following:

1. How much liquid is represented in each of the following graduated cylinders?



PART IIA – Graduated cylinder hands on

To read a graduated cylinder, set the cylinder on a flat surface and bring your eyes even with the liquid level. The liquid forms a curve called a <u>meniscus</u>. The volume of the liquid is read from the bottom of the curve or meniscus.

1. Look at the graduated cylinder you are using in the lab.
   a. How much liquid can it hold?

2. Look at the markings on the side of the cylinder.
   a. How many smaller units are between the larger units?
   b. What do you call these smaller units?

3. Fill a 50 mL beaker with tap water until it reaches the line indicating 40 mL. Pour the water into a graduated cylinder. What is the volume of water in the graduated cylinder? Does it really equal 40mL?

There are three beakers that are labeled "A", "B" and "C". Use your graduated cylinder to complete the following:

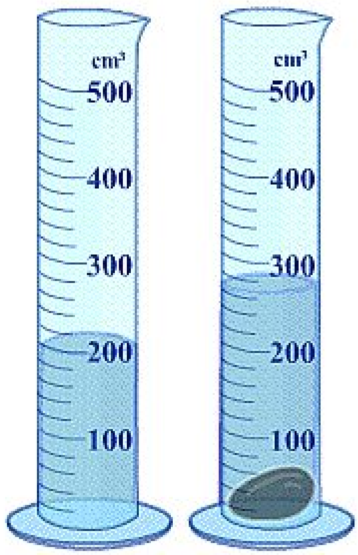
2. Measure the amount of water in each of the three beakers on your table. What is the amount of water in beaker A? Beaker B? Beaker C?
3. What is the smallest volume of liquid your graduated cylinder can measure?

PART IIB: VOLUME OF A SOLID USING THE DISPLACEMENT METHOD

An object placed under water will cause the water level to increase. The difference in the water level before and after the object is added is equal to the volume of the object. This method is used to determine the volume of objects having irregular shapes.

1. Fill a graduated cylinder with water and record the volume. [Do not fill to top line- try to stay no more than ¾ full!]
2. Carefully place one or more coins in the water. Record the volume.
3. Calculate the volume of the solid. (Final volume - initial volume = Volume of lead object)

Example:



Part III: The – Top-loader Balance

Balances must be handled with care as they can be very sensitive equipment.

Read the following rules for the proper use of a balance.

1. Never place a powder or liquid directly on the pan. Powders should be placed on weighing paper and liquids should be in a container.
2. Place all objects on the pan gently.
3. The adjustment knob is used to zero the balance.

Read the following directions for using and reading a balance.

1. Place the item or a container that will be used to measure a substance on the balance.
2. If a container is used, zero the balance with the container on it by pressing the zero button.
3. Add substance to container.
4. Note measurement.

Answer the following:

1. Use the balance on your table to determine the mass of several objects:
2. What place value does this balance measure?
3. What is the mass of a wooden cube?
4. What is the mass of a beaker with 50 ml of water?
5. What is the mass of 50 ml of water?
6. Write down the mass of another object that your group chooses.

Part IV: The Metric Ruler

All of our measurements will be made using the metric system. The meter stick on your table is one meter long. Note the following: (a) a meter consists of a 100 centimeters, and (b) a meter consists of 1000 millimeters.

Answer the following:

1. How long is the meter stick in inches?
2. How long is one centimeter in inches?
3. What is the width of a piece of paper in meters, centimeters, and millimeters?
5. What is the width of the lab table in meters, centimeters, and millimeters?

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Day 3
Date ____________

Objectives

1. Define living vs non-living.
2. Describe Cell Theory.
3. Know the basic parts of a cell.
4. Describe DNA and RNA and how they function.
5. Determine the differences between plant and animal cells.
6. Learn how to use a microscope.
7. Know the difference between organic and inorganic molecules.
8. Know the four major organic molecule groups.

Outline:

Laboratory Materials Needed:

Microscope
Onion
Toothpicks
Methylene blue
Iodine
Slides
Coverslips

Laboratory Protocol:

1. Collect all materials needed.
2. Place two slides on the table top.
3. On one slide place 1-2 drops of methylene blue
    a. Using a toothpick, gently rub the toothpick inside of your cheek.
    b. Take toothpick that you rubbed inside your cheek and swirl it in the methylene blue on the slide.
    c. Place a coverslip on the slide by carefully angling it down over the methylene blue so no air bubbles occur under the coverslip.
4. On the other slide, take a small slice of the "skin" between the layers on an onion and place it on the iodine
    a. Place 1-2 drops of iodine on the slice of onion on the slide.
    b. Place a coverslip on the slide by carefully angling it down over the onion slice so no air bubbles occur under the coverslip.
5. View each slide through a microscope.
6. Make an entry on laboratory manual pages. Make sure you note your observations between the two types of cells.

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Day 3

Date ____________

Strawberry DNA Extraction

All living things have DNA- Deoxyribonucleic acid- the chemical instructions on how to make that living thing. This incredible chemical molecule can be easily seen with the naked eye when collected from thousands of cells. This simple method quickly gives some visible proof that plants have DNA.

Objectives

1. Define living vs non-living.
2. Describe Cell Theory.
3. Know the basic parts of a cell.
4. Describe DNA and RNA and how they function.
5. Determine the differences between plant and animal cells.
6. Know the difference between organic and inorganic molecules.
7. Know the four major organic molecule groups.

Outline:

Laboratory Materials Needed:

Strawberries
Zip-closure sandwich bags
DNA extracting solution (mix about 1 cup of dish detergent and ¼ cup salt into a gallon of water)
Funnels
Plastic cups
Gauze or cheesecloth
Test tubes
Droppers
Denatured alcohol
Paper towels

Laboratory Protocol:

1. Place a strawberry in a zip-closure bag and remove most of the air before you seal the bag.
2. Mash the strawberry through the bag in your hand. Do not hit against the table.
3. Add 2 Tablespoons of the DNA extracting solution.
4. Continue mixing and mashing the bag in your hand.
5. Place a piece of gauze over the large opening of the funnel.
6. Place funnel in plastic cup. It should sit on the rim.
7. Carefully pour the strawberry mixture into the funnel making sure to catch the solids with the gauze.
8. Take a dropper full of the liquid in the cup and place in the test tube.
9. Add a dropper full of the alcohol to the test tube. Take care not to tilt or tip the test tube; do not mix the two liquids.
10. Observe the line between the strawberry mixture and the alcohol. You will notice a white thread-like cloud appearing at this line. This is strawberry DNA. The DNA will clump together and float to the top of the alcohol layer.
11. Observe the test tubes of others around you. Do you notice any differences?
12. When finished observing the DNA, you may collect the DNA and place into a small tube to take with you. Please dispose of all items as staff indicates.

SAINT LOUIS sciencenter

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MoSTEMWin
Biology Prefixes and Suffixes

Prefix

Prefix	Meaning	Example and definition of example
-a	Without, negative, not	Asexual (without sex)
Ab-	Away from	Abnormal (departing from normally_
Ad-	Toward, near	Adrenal (toward the kidneys)
Aer-	Aerobic	(with oxygen)
Ambi-	On both sides	Ambidextrous (capable of using both hands)
Amphi-	Double, both	Amphibian (lives on both land and water)
Amyl-	Starch	Amylase (starch enzyme)
Ana-	Upward, back, again	Anaplasia (cell reverting to an immature form, as seen in malignant tumors)
Andr-	Man	Androgen (male hormone)
Angio-	Vessel	Angiotensin (neurotransmitter vessel peptide)
Ante-	Before	Antenatal (before birth)
Anthro-	Flower	Anthrophyta (flowering plants division)
Anti-	Against	Antibodies (proteins that work against invaders)
Arth-	Joint	Arthritis (joint inflammation)
Asco-	Sac, bag	Ascomycete (fungi whose spores are produed in a sac)
Auto-	Self	Autotroph (self nourishing)
Bi-	Two	Biennial (two year life span plant)
Bio-	Life	Biology (the study of life)
Brachia-	Upper arm, forelimb	Brachium (arm-like part of an animal)
Brady-	Slow	Bradycardia (slow heart beat)
Bronchi-	windpipe	bronchioles (small tubes in the lungs)
Bryo-	Moss	Byrophyte (mosses)
Calor-	Heat	Calorie
Cardi-	Heart	Cardiovascular
Carp-	Fruit	Carples
Cata-	Down, lower, under	Catabolic
Caud-	Tail	Caudal
Cephal-	Head	Cephalization
Chlor-	Green	Chlorophyll
chole	Bile	Cholesterol
Chondr-	Cartilage	Chondroma
Chrom-	Color	chromoplast
Circum-	Around	Circumcise

Cole-	Hollow	Coelom (body cavity that seperates the gut from the outer body wall)
Con-	With, together	Conjugation
Contra-	Against	contraception
Cost-	Rib	Costal
Counter-	Against	Countercurrent exchange
Crani-	Skull	Craniometer (instrument used to measure the skull)
Crypt-	Hidden	Cryptozoology
Cut-	Skin	cutical
Cyst-	Sac or vesicle, bladder	cystocele
Cyto-	Cell	Cytosol
Dactyl-	Finger, toe, digit	Dactylogram
Derm-	Skin	dermis
di-	Two	disaccharide
Dia-	Across, through	diaphragm
Diplo-	Double	Diploid cell
Dys-	Abnormal, impaired, difficulty	dysplasia
Un-	Not	Unsaturated (not saturated; capable of dissolving more of a substance)
Uni-	One	Unicellular (having a single cell)
Ur-	Urine	Ureter (duct leading from the kidneys to the urinary bladder)
Vas-	vessel	vasodilation (dilation of a blood vessel
Vit-	Life	Vitalism
Xanth-	Yellow	Xanthophyll (yellow plant pigment)
Xeno-	Strange, foreign	xenotransplantation (surgical removal and transplantation of an organ or tissue from one species to a different species)
Xero-	Dry	Xeroderma (abnormally dry skin)
Zoo-	Animal	Zoologist (a person who studies animals and animal life)
Zyg-	Yoke, union	Zygote (a fertilized cell)
Zym-	Ferment	zymurgy (branch of chemistry concerned with fermentation processes)
Macro-	Large	Macroeudution
Mal-	Bad, Abnormal	Malformation
Meg-	Great, large	Megaloncephaly
Melan-	Black	Melanin
Mening-	Membrane	Meninges

Ment-	Mind	Mental
Mer-	Part, partial	Meropia
Mesa-	Middle	Mesaphyll
Meta-	After, behind	Metastasis
Micro-	Small	Microscopic
Mill-	Thousand	Milliliter
Mono-	One	Monocots
Morph-	Form, shape	Morphogenesis
Myc-	Fungi	Mycorrhize
Myo-	Muscle	Myoglobin
Fil-	Thread	Filum(a thread-like anatomical structure)
Flagell-	Whip	Flagella (whiplike structures)
Flav-	Yellow	Flavin (water-soluble yellow pigments)
Re-	Back again	Regeneration (Re-growth of a body part)
Retro-	Backward, behind	Retrolental (occurring behind the lens of the eye)
Rhiz-	Root	Rhizoids (root-like structures in some fungi)
Ecto-	Outer, external	Ectotherm (An organism that uses external heat to regulate it's body temperature)
En-	In	Endothelium (Innermost layer of cells lining blood vessels)
Encephal-	Brain	Encephalogram (A graphical recording of the brain's electrical activity)
End-, Endo-	within	Endotherm (Organism that generates heat internally to maintain a constant body temperature)
Epi-	Above	Epiphyte (A plant that grows on the surface of another plant for support)
Erythro-	red	Erythrocyte (red blood cell)
Eu-	Good, well, true	Eukaryote (Organism whose cells contains a "true" membrane bound nucleus)
Ex-	Out of, outer	Exoskeleton (hard outer surface that provides support or protection for an organism)
Extra-	Outside, beyond	Extracellular (locating or occurring outside a cell)
Gam-	United, jointed, sexual	Gametes (egg or sperm that unite during sexual reproduction)
Gastr	Stomach, Belly	Gastric juice (Acidic fluid secretes by the stomach)
Gemm-	bud	Gemmule (A small bud-like reproductive structure found in some sponges)
Gen-	Produce, to give birth	Genital (Of or relating to biological reproductive organs)
Geo-	Earth	Geothermal
Glyco-	Sugar, sweet	Glycolysis (metabolic pathway that involves the splitting of sugars (glucose) into pyruvic acid)

Gnath-	jaw	Agnatha (A superclass of fish that lack jaws)
Gono-	Seed, sexual, reproductive	Gonophore (a structure within a reproductive organ or part)
Gymno-	Naked	gymnosperms (vascular plants that bear naked or unenclosed seeds
Gyn-	women	gynecology (branch of science that deals with diseases and disorders of the female reproductive organs)
Haplo-	Single	haploid (having a single set of chromosomes
Hem-	Blood	hemoglobin (iron containing protein in red blood cells)
Hemi-	Half, partial	hemiparasite (organism that is able to live either as a parasite or independently)
Hepat-	Liver	hepatitis (inflammation of the liver)
Hetero-	Other, different	heterozygous (having two different alleles for a given trait)
Hist-	Tissue	histoma (tumor derived from mature tissue)
Holo-	Whole	holotrophs (organisms that eat other organisms whole or in pieces)
Homo-	Same	homozygous (having two alleles for a given trait that are the same)
Hydro-	Water	hydrophilic (having an affinity for water; water loving)
Hyper-	Above, excessive	hyperthyroidism (condition resulting from the excessive production of thyroid hormones)
Hypo-	Under, beneath, lacking	hypodermic (of or pertaining to the parts under the skin)
Im-	Not	Immobile (not moving)
Infra-	Below, beneath, inferior	infrasonic (having frequencies below those of audible sound)
Inter-	Between	interstitial fluid (fluid filling space between cells)
Intra-	Within	intraocular (occurring within the eyeball)
Iso-	Equal	isogamy (fusion of male and female gametes that are the same size and structure)
Karyo-	Nucleus, nut	karyogamy (uniting of cell nuclei; fertilization)
Kerat-	Horn, cornea	keratectomy (removal of a part of the cornea)
Lact-	Milk	lactose (milk sugar)
Leuk-	White	leukocytes (white blood cells)
Lith-	Stone; joint or limb	lithosphere (the solid rocky crust of the earth)
Lute-	Yellow	lutein (yellow carotenoid pigment found in egg yolk, body fats and the tissues of the corpus

		luteum)
Necro-	Death, corpse	necrobiosis (natural death of cells through the process of aging)
Nemat-	Thread, thread-like	nematocytes (thread-like stinging cells found in Hydra)
Neo-	New	neonatal (of or relating to newborn infants)
Neph-	Kidney	neonatal (of or relating to newborn infants)
Neuro-	Nerve	neuroblast (embryonic cell that develops into a nerve cell)
Ocul-	eye	Oculus (an eye)
Odont-	tooth	Odontoid (tooth-like)
Olig-	Few, little	oligosaccharide (a carbohydrate that contains a small number of component sugars)
oo-	Egg, ovum	oogenesis (formation and development of an ovum)
Ophthalm-	Eye, eyeball	ophthalmoscope (instrument for examining the retina of the eye
Orb-	Circle, sphere	orbis (round, ring, rotation; world)
Ortho-	Normal, straight, upright	orthostatic (relating to standing upright)
Oste-	Bone	osteoporosis (abnormal reduction in the amount of bone mass resulting in fragile porous bones)
Ov-	Egg	Ovum (female gamete, egg)
Para-	Around, near, beside	parathyroid (near or within the thyroid gland)
Path-	Disease	pathogen (disease causing agent)
Ped-	Child, children; foot	pediatrics (branch of medicine dealing with infant and child care) pedestrian (one who travels on foot)
Pell-	Skin	pellagra (disease caused by a deficiency of protein and niacin resulting in skin lesions)
Peri-	Around	pericardium (membranous sac surrounding the heart)
Phago-	Eating	phagocyte (a cell that engulfs and digests waste materials and microorganisms)
Phil-	Love	philoprogenitive (relating to the love of children)
Phob-	Fear	phobia (abnormal irrational fear of a specific thing)
Phren-	Mind	phrenic (of or relating to the mind)
Phyto-	Plant	phytochrome (pigment involved in many plant responses to light)
Platy-	Flat	platypus (semiaquatic mammal with a broad flat tail and a snout resembling a duck's bill)
Pleur-	Rib, side, lateral	pleurodont (teeth that are attached by their sides

		to the inner side of the jaw)
Pneum-	Lung	pneumococcus (microorganism that causes a disease of the lungs called bacterial pneumonia)
Pod-	Foot, foot-like	podia (structures that resemble or function as feet)
Polio-	Gray	poliomyelitis (viral disease that causes inflammation of the motor neurons or gray matter of the brainstem and spinal cord)
Poly-	Many	polysome (many ribosomes attached to a messenger RNA)
Post-	After	postmortem (occurring after death)
Pre-	Before, prior	prepuce (foreskin covering the human penis)
Pro-	Before, primary	protoderm (outer most primary meristem that forms the epidermis of roots and shoots)
Pseudo-	False	pseudoscience (practice that resembles science but is considered to be without scientific foundation)
Psych-	Soul, mind	psychology (science that deals with mental processes and behavior)
Pterido-	Fern	pteridology (the study of ferns)
Pub-	Adult	puberty (stage of adolescence marked by the functioning of sex glands; sexual maturation into adulthood)
Per-	Pus	pyoderma (skin diseases associated with the formation of or caused by pus)
Pyro-	Fire, heat	pyrosis (burning sensation in the chest, heartburn)
Sacchar-	Sugar	disaccharide (double sugar, example: sucrose - composed of glucose and fructose)
Sapro-	Decay, rotten	saprophyte (organism that absorbs nutrients from dead or decaying matter)
Schis-	Split	schizocarp (fruit that splits into several closed one-seeded portions upon maturation)

Suffix

Suffix	Meaning	Example and definition of example
-asis	Affected with, with	Homeostasis (with a steady state)
Blast	Bud or germ	Osteoblast (a cell from which bone is derived)
-duct	To lead	aqueduct
-Ferent	Carry, bring	Afferent (carry inward to a central organ or region)
-form	Shape	Bacilliform (rod shape)
-rrhagia	Excessive Flow	Menorrhagia (abnormally heavy menstruation)
-rrhea	Flow, discharge	Diarrhea (frequent and watery bowel movements)
-ectomy	Remove, excise	Tonsillectomy (removal of the tonsils)
-emia	blood	Leukemia (form of cancer characterized by an abnormal increase In the number of white blood cells in the body)
-genic	Producing, generating	carcinogenic (a cancer producing substance or agent)
-gram	Write, record	angiogram (an X-ray representation of the blood vessels
-itis	Inflammation	appendicitis (inflammation of the appendix)
-kinesis	Movement, motion	cytokinesis (cell motion; division of the cytoplasm)
-logy	Science of, study of	biology (science of life and living organisms)
-lunar	Of or relating to the moon	semilunar (shaped like a half moon; crescent shaped)
-lysis	Decomposition, dissolving, destruction	chemolysis (decomposition of organic substances through the use of chemical agents)
-oma	Tumor	adenoma (a benign glandular epithelial tumor)
-osis	Affected with, condition, abnormal process	cirrhosis (chronic disease affecting the liver)
-otomy	Act of cutting, incision	gastrotomy (incision in the stomach)
-ous	Characterized by, full of	homozygous (union characterized by the joining of identical alleles for a single trait)
-pathy	Disease	neuropathy (disease of the nervous system)
-ped	Foot	centipede (worm-like arthropod with a large number of feet)
-penia	lacking, deficiency	leukopenia (abnormally low white blood cell count)
-phagia	Eating, swallowing	dysphagia (difficultly in swallowing)
-philic	Love	thermophilic (relating to the love of heat or hot environments)
-phore	Carry, bear	chromatophores (pigment-bearing structures)
-phyll	Leaf	sporophyll (leaf that contains spores)
-plasm	Material forming cells	cytoplasm (contents of a cell excluding the nucleus)
-pnea	Air, breathing	apnea (to temporarily stop breathing)
-poiesis	Production, creation, formation	hematopoiesis (formation of blood or blood cells)

https://www.linnmar.k12.ia.us/files/2AC4B69381D148CEB20B9496F235D9A9/prefixes%20suffixes.doc

Day 4
Date ____________

Objectives

1. Know the major body systems and a major function of each system.
2. Learn Latin and Greek prefixes and suffixes in order to understand complex scientific words.

Outline:

Laboratory Materials Needed:

Labeled human anatomy diagram
Suffixes and prefixes worksheet

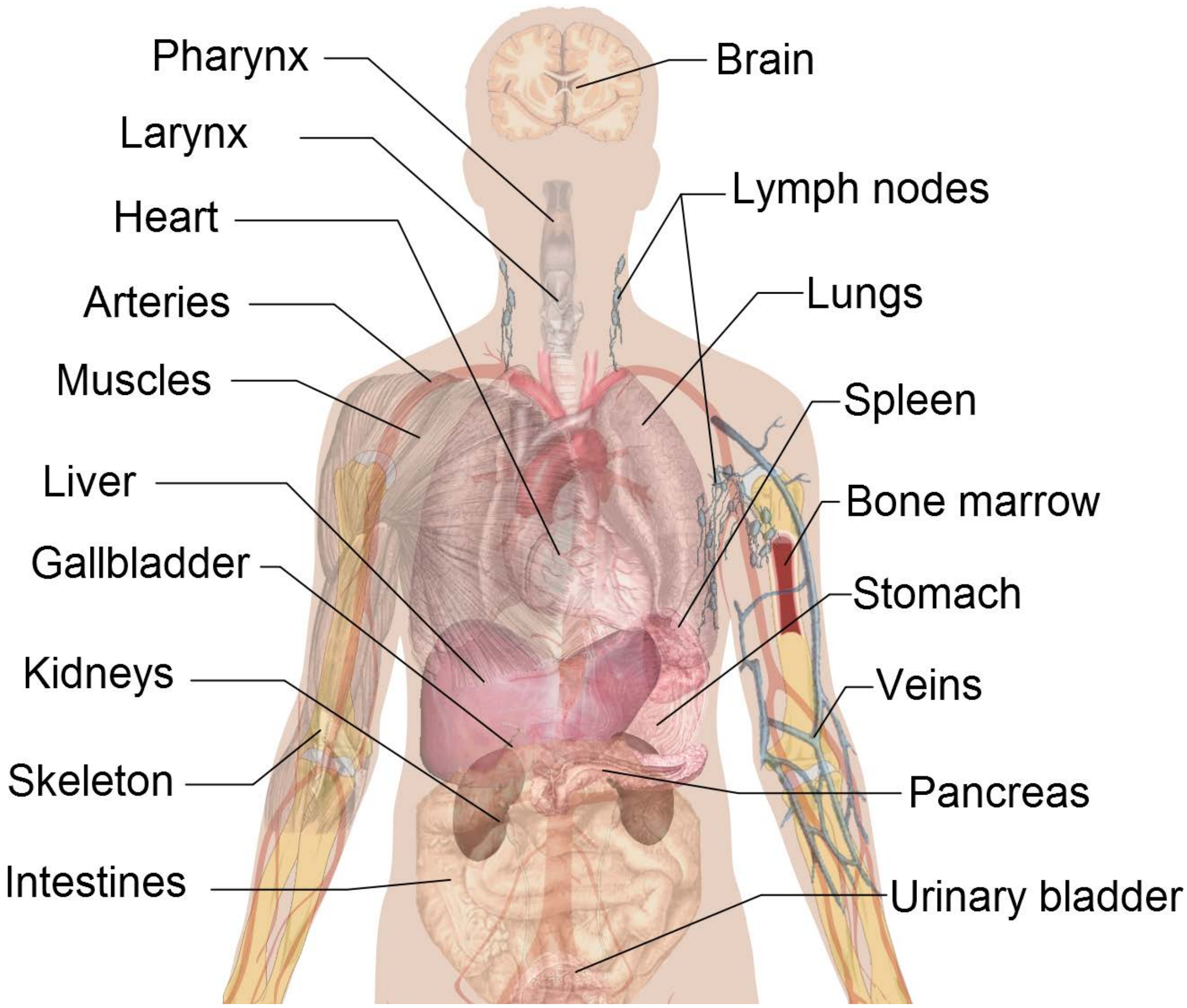
Laboratory Protocol:

1. Using the labeled human anatomy diagram, write down which of the following body systems the labeled part belongs to.

Integumentary system
Skeletal system
Muscular system
Nervous system
Endocrine system (may overlap with others)
Circulatory system
Lymphatic system
Respiratory system
Urinary system
Digestive system
(Reproductive system is not included)

2. Using the prefix and suffix worksheet, match the prefix or suffix with its meaning. Write down five words that use a prefix and/or suffix that you have studied.

Human anatomy



Prefix and Suffix Worksheet

a-	across
sub-	recording of
baro-	different, other, various
cyto-	no, not, without
-elle	process
-gram	water
hetero-	below
hydro-	around
-ose	small
peri-	pressure
-tion	recording of
trans-	cell

1.___________________________________

2.___________________________________

3.___________________________________

4.___________________________________

5.___________________________________

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Day 5

Date ____________

Objectives

1. Learn about the periodic table by identifying groups within the table and properties of those groups.
2. Know the different types of chemical bonds that can form.
3. Define the terms acid and base.
4. Know how the pH scale applies to acids and bases and that the scale is logarithmic.

Outline:

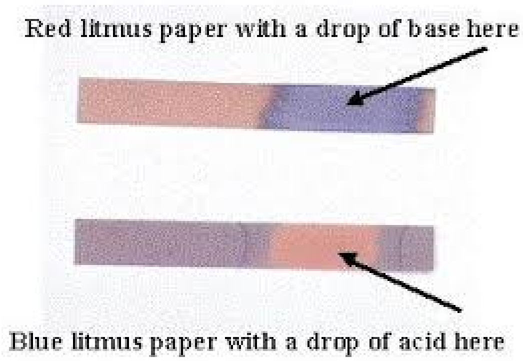
Laboratory Materials Needed:

Litmus paper
pH strips
Ammonia
Apple juice [or an assortment of juices of your choice with varying acidities like lemon juice, orange juice, grape juice, etc.]
Vinegar
Water
Bleach
Coke

Laboratory Protocol:

Part 1: Litmus Paper Test
Procedures:

1. Dip the litmus paper in the given solutions
2. Observe and record the color change
3. Decide if the solution is acidic, basic, or neutral



Data: [Adjust table as needed to accommodate addition or subtraction of different liquids]

1. Ammonia (NH_4OH)
    a. Blue litmus paper turned ___________________
    b. Red litmus paper turned ___________________
    c. Acid, base, or neutral? ____________________

2. Apple Juice ($C_6H_8O_7$)
    a. Blue litmus paper turned ___________________
    b. Red litmus paper turned ___________________
    c. Acid, base, or neutral? ____________________

3. Vinegar (CH_2COOH)
    a. Blue litmus paper turned ___________________
    b. Red litmus paper turned ___________________
    c. Acid, base, or neutral? ____________________

4. Water (H_2O)
    a. Blue litmus paper turned ___________________
    b. Red litmus paper turned ___________________
    c. Acid, base, or neutral? ____________________

5. Bleach (NaOCl)
    a. Blue litmus paper turned ___________________
    b. Red litmus paper turned ___________________
    c. Acid, base, or neutral? ____________________

6. Coke (H_3PO_4)
    a. Blue litmus paper turned ___________________
    b. Red litmus paper turned ___________________
    c. Acid, base, or neutral? ____________________

Concentration of Hydrogen ions compared to distilled water	pH	Examples of solutions at this pH
10,000,000	pH= 0	Battery acid, Strong Hydrofluoric Acid
1,000,000	pH = 1	Hydrochloric acid secreted by stomach lining
100,000	pH = 2	Lemon Juice, Gastric Acid Vineger
10,000	pH = 3	Grapefruit, Orange Juice, Soda
1,000	pH = 4	Acid rain Tomato Juice
100	pH = 5	Soft drinking water Black Coffee
10	pH = 6	Urine Saliva
1	pH = 7	"Pure" water
1/10	pH = 8	Sea water
1/100	pH = 9	Baking soda
1/1,000	pH = 10	Great Salt Lake Milk of Magnesia
1/10,000	pH = 11	Ammonia solution
1/100,000	pH = 12	Soapy water
1/1,000,000	pH =13	Bleaches Oven cleaner
1/10,000,000	pH = 14	Liquid drain cleaner

Part 2: pH Paper Test

Procedures:

1. Dip the pH paper into the given liquids
2. Match the color change with the pH chart
3. Record the pH of the solution
4. Rank the liquids from strongest base → strongest acid

Data: [adjust table as needed to accommodate changes in liquids]

1. Ammonia
   pH _______________
2. Apple Juice
   pH _______________
3. Vinegar
   pH _______________
4. Water
   pH _______________
5. Bleach
   pH _______________
6. Coke
   pH _______________

Strongest Acid	1. ______________________
	2. ______________________
	3. ______________________
	4. ______________________
	5. ______________________
Strongest Base	6. ______________________

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Day 6

Date ____________

Objectives

1. Define the study of physics.
2. Understand the basic principles of Newtonian mechanics.
3. Understand the basic concepts regarding friction and gravity.
4. Learn about density and displacement.

Outline:

Motion and Pressure

Objective:
To understand the relationship between external forces and movement.

Laboratory Materials Needed:
Water
Empty water bottles

Background Information:

What causes blood to move in blood vessels? We can use a physics equation to understand this mathematically, Flow = pressure/resistance. Simply put, our blood pressure (created by the heart) pushes on the blood to make it move, but we also need to be aware that there are things that create resistance (an opposition) to that movement.

Laboratory Protocol:

1. Begin by putting a small amount of water in an empty water bottle.
2. Squeeze the bottle.
3. Write down your observations.
4. Now, add more water to the bottle and squeeze the bottle.
5. Write down your observations.
6. Finally, place a cap on the bottle with a small amount of water in the bottle and squeeze the bottle.
7. Write down your observations.
8. Can you cause the water to flow out of the bottle with the cap on the bottle? If so, what did you have to do for this to occur?
9. How does this relate to blood flow? Can you think of things that might create resistance to blood flow?

Boyle's Law

Objective:
To understand the relationship between a force (pressure) and volume.

Laboratory Materials Needed:

50 ml syringes
Mini marshmallows
Duct tape

Background Information:

Boyle's Law state that pressure and volume are inversely related. This means that as the volume of something increases, the pressure inside of that area decreases. When we breathe, our chest expands (increases volume) and the pressure inside our lungs decreases. This causes the air outside our bodies to move inside because it wants to move to where there is less pressure. Molecules move according to pressure changes.

Laboratory Protocol:
1. Use duct tape to seal the end of the syringe where a needle would be placed
2. Place 2 marshmallows inside of the syringe by removing the plunger.
3. Place plunger on syringe and push.
4. Write down observations.
5. Remove duct tape.
6. Push plunger in to near the marshmallows.
7. Replace the duct tape on the needle end of the syringe.
8. Pull plunger to increase the volume inside the syringe.
9. Write down observations.
10. What happened to the marshmallows in each case?
11. What was the role of the plunger?

Density

Objective:

To understand the term density and how it relates to liquids of differing densities.

Laboratory Materials Needed:

200 ml beaker
Water
Vegetable oil
Dish soap
Rubbing alcohol
Food coloring

Background Information:

Density of a substance is the mass of a particular volume of that substance. In healthcare, there are tests that use density to determine if a particular body fluid is in the normal range of density (they use a test called specific gravity which measures density of the body fluid compared to the density of water).

Laboratory Protocol:

1. You can add food coloring to liquids to help visualize them better.
2. Add 50 ml of each liquid in the following sequence:
    - Dish soap
    - Water
    - Vegetable oil
    - Rubbing alcohol
3. What do you notice?
4. Why does this occur?
5. Enter your observations onto a lab notebook page.

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Collecting and Computing Data – Level I: Excel, Day-7

Overview:

1. Collecting data
2. Graphing in Excel

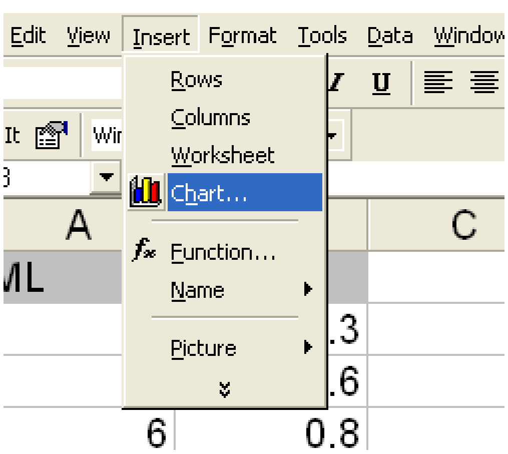
I. Collection of Data and Graphing

Used to chart and graph data

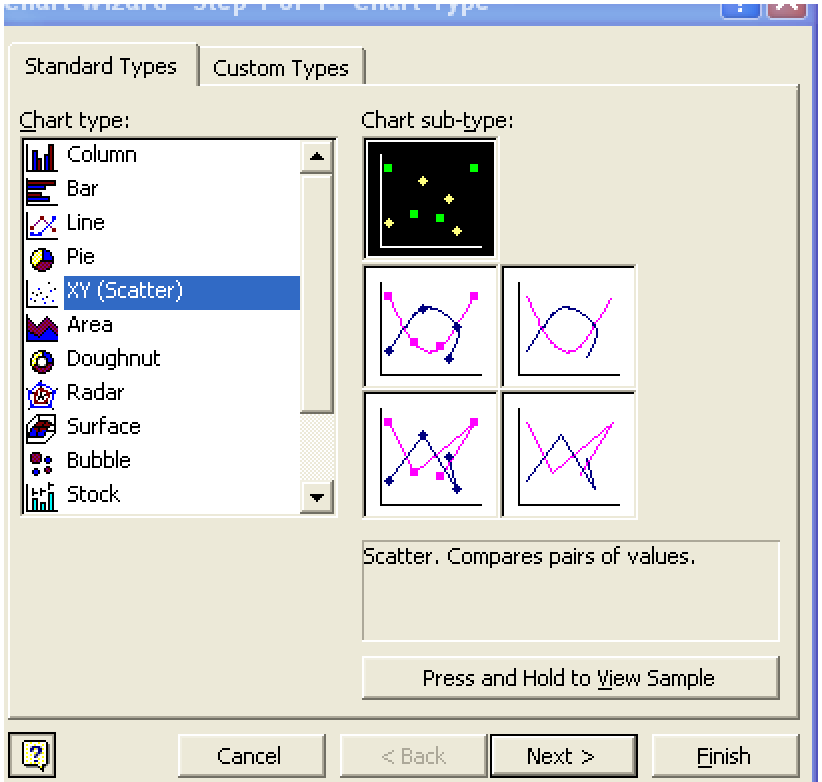
A. Enter the data

	A	B
1	ML	#
2	2	0.3
3	4	0.6
4	6	0.8
5	9	1.2
6	15	1.4
7	27	1.98
8	39	2.25
9		
10		

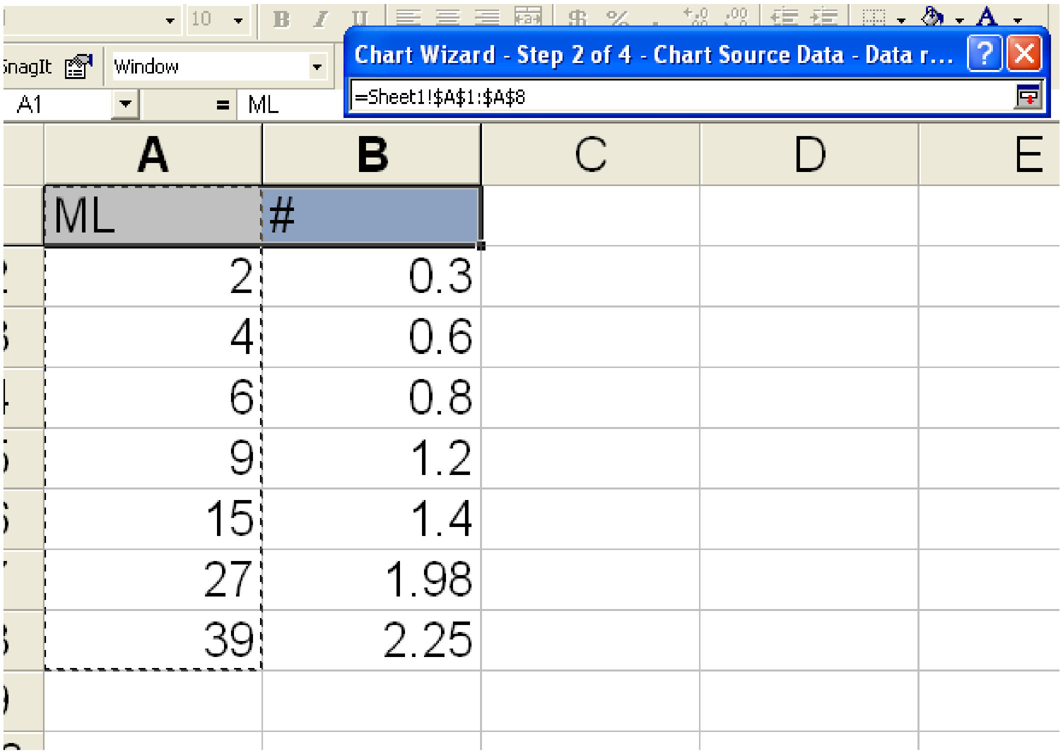
B. Click on the chart option in Insert



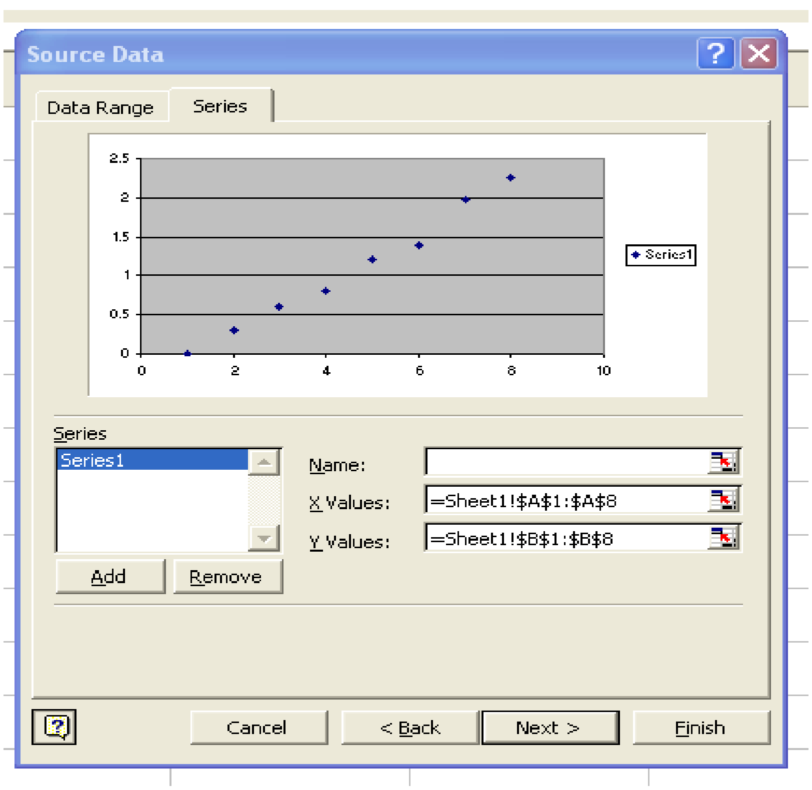
C. Click on XY (scatter)



D. Select Column A then Select Column B



E. It should look like that this



F. Place a name in value (X) = ml and value (Y) = #

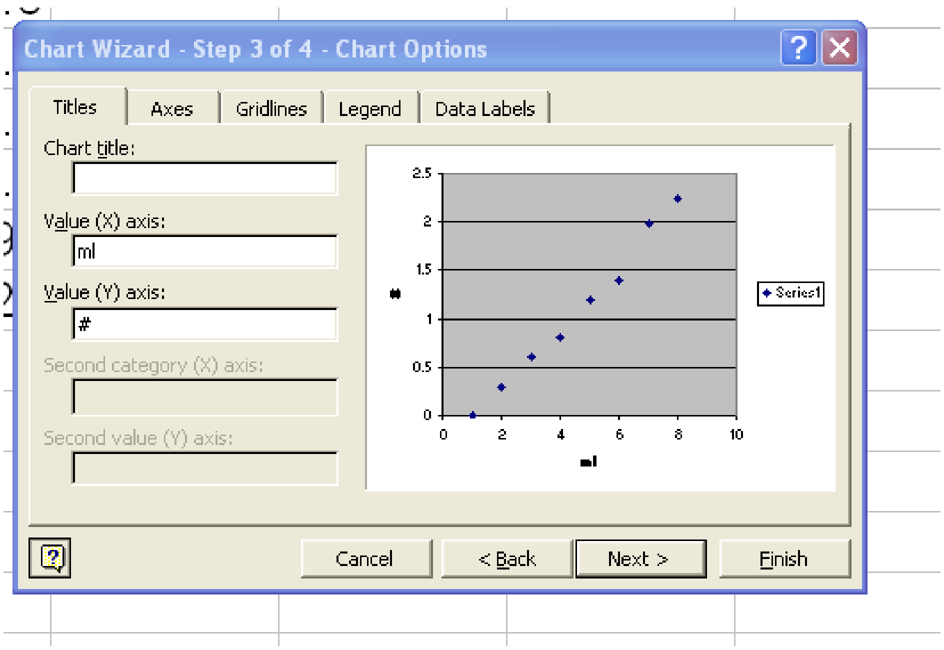
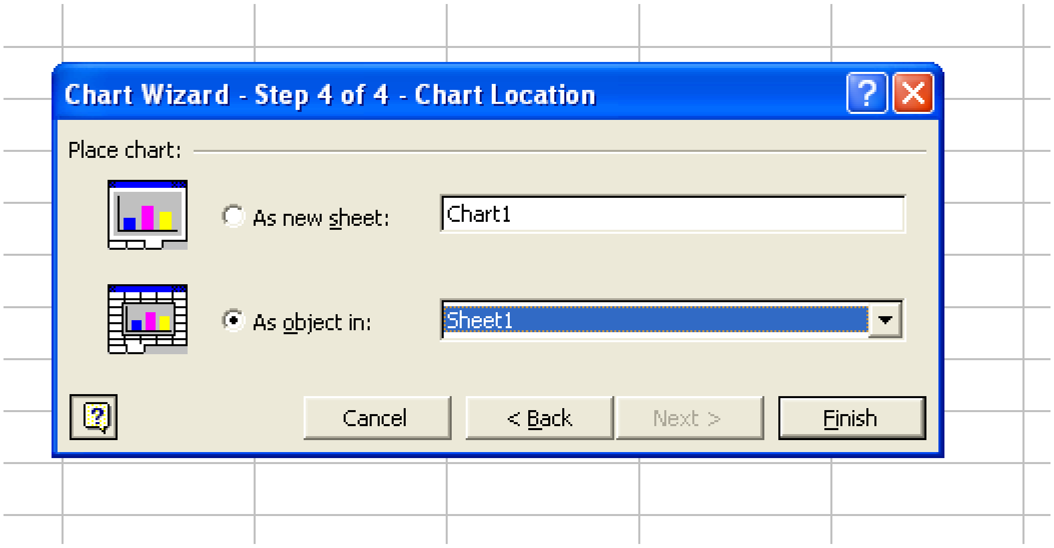
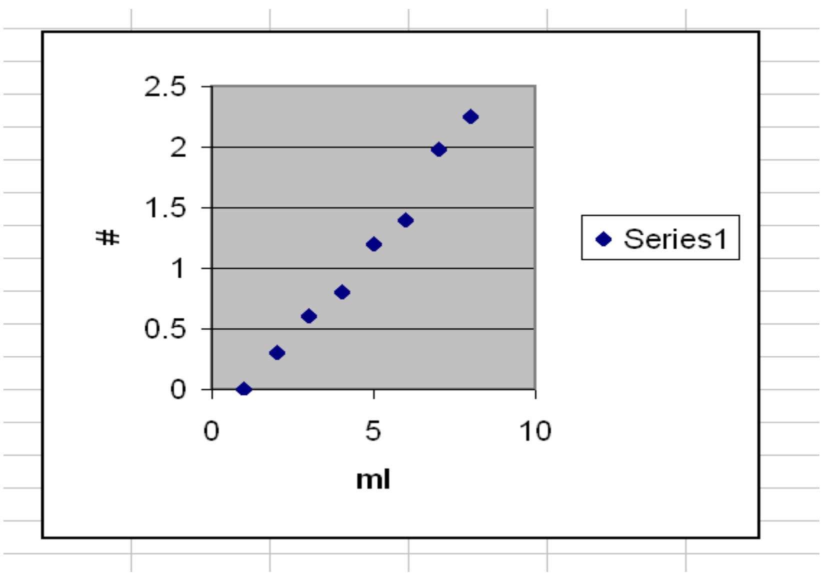


Chart Wizard - Step 3 of 4 - Chart Options
Titles
Axes
Gridlines
Legend
Data Labels
Chart title:
Value (X) axis:
ml
Value (Y) axis:
#
Second category (X) axis:
Second value (Y) axis:
2.5
2
1.5
1
0.5
0
0
2
4
6
8
10
ml
Series1
Cancel
< Back
Next >
Finish

G. Where do you want your chart to be placed on the same sheet or on a new sheet:



H. The chart



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Day 7
Date ____________

Objectives
- Select an Experiment
- Design Rubric
- Scientific Method
- Data Collection
- Lab ware
- Safety
- Notebook

Outline:

I. Laboratory Materials Needed:

1. 100 mL Beaker
2. 5 or 10 mL Pipette
3. **Acid Solution** (50 mL) label as **solution—A**
4. **Base Solution** (50 mL) label as **solution—B**
5. 100 ml Water
6. pH Paper (at least 5 strips per experiment)
7. pH chart

II. Laboratory Protocol

- **Prepare a solution as follows:**

Step-a): Add 10 mL of the solution labeled as solution—A (given by the instructor) to 40 mL of water, swirl till completely dissolved and label as Sol#1.
Step-b): Determine the pH of this solution (labeled as Sol#1) using the pH strip paper, and record the resulting pH in your lab notebook as shown in the table below.
Step-c): Add 1 mL of solution solution—B to Sol#1, swirl for a few times and allow to settle down.
Step-d): Determine the pH again using a separate pH paper and record the result in the table below.
Step-e): Repeat **step-c)** and **Step-d)** above two (2) more times with total of 3 mL of solution—B added to Sol#1.

Independent Variable	Independent Variable
Total Volume of Solution—B Added	Values of the pH
0.0	
1.0	
2.0	
3.0	

III. Plotting Resulting graph in the space below:

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Date ____________

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5. 100 ml Water
6. pH Paper (at least 5 strips per experiment)
7. pH chart

II. Laboratory Protocol

- **Prepare a solution as follows:**

Step-a): Add 10 mL of the solution labeled as solution—B (given by the instructor) to 40 mL of water, swirl till completely dissolved and label as Sol#1.
Step-b): Determine the pH of this solution (labeled as Sol#1) using the pH strip paper, and record the resulting pH in your lab notebook as shown in the table below.
Step-c): Add 1 mL of solution solution—A to Sol#1, swirl a few times and allow to settle down.
Step-d): Determine the pH again using a separate pH paper and record the result in the table below.
Step-e): Repeat **step-c)** and **Step-d)** above two (2) more times with total of 3 mL of solution—A added to Sol#1.

Total Volume of Solution—A Added	Values of the pH
0.0	
1.0	
2.0	
3.0	

III. Plotting Resulting graph in the space below:

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