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Teacher Contact

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* **Was this course Previously Approved by UC?** No

* **Course Title:**	Medical Chemistry
* **Transcript Title /Abbreviation:**	**Transcript Title /Abbreviation:** Medical Chem **Course Code** 00000
* **Seeking "Honors" Distinction:**	No
* **Subject Area:**	Laboratory Science
* **Category:**	Chemistry
* **Grade Level for which this course has been designed:**	☐ 9 ☑ 10 ☑ 11 ☑ 12
* **Unit Value:**	1.0 (one year, 2 semesters, or 3 trimesters equiv.)

*** Is this course, or any separate section of this course, taught in an online learning environment:** No

*** Is this course classified as a Career Technical Education:** No

*** Brief Course Description**

Throughout the course students will apply the basics of chemistry to the human body, health, and medical careers. By the end of the course students will have the tools to be successful in post high school science courses including: an understanding of basic chemistry principles, study tools, and a vision for how the information can apply to a career they are interested in.

Pre-Requisites

Medical Biology - Recommended

Physics - Recommended

Co-Requisites

Kinesiology - Recommended

Context for Course (optional)

This course will be part of a pathway that includes: Medical Biology, Kinesiology and Sports Medicine.

History of Course Development (optional)

This course is primarily based on the HASPI curriculum.

Textbooks

TEXTBOOK 1

*** Title:**

	Chemistry: An Introduction to General, Organic, and Biological Chemistry
* **Edition:**	11th edition
* **Publication Date:**	2011
* **Publisher:**	Prentice Hall
* **Author(s):**	Karen C. Timberlake
URL Resource:	
* **Usage:**	Primary Text Read in entirety or near entirety

Supplemental Instructional Materials

* **Course Purpose**

Medical Chemistry is a class that tackles the basics of chemistry and applies them to the medical field. The purpose of the class is to attract students who are interested in a medical career ranging from X-ray technician, nursing, physical therapy, to physicians and surgeons.

Throughout the course students will apply the basics of chemistry to the human body, health, and medical careers. By the end of the course students will have the tools to be successful in post high school science courses including: an understanding of basic chemistry principles, study tools, and a vision for how the information can apply to a career they are interested in.

As a result of this class we would expect to see: increased enrollment in other

medical related courses such as Medical Biology, Kinesiology, and Sports Medicine, better success in those classes, increased amount of students volunteering or working in the Medical Field while in high school. Ultimately we would also see a higher number of students pursuing a post high school education leading to a career in the medical field.

* **Course Outline**

Semester 1

Unit 1: Investigation and Experimentation

Units (Students know the SI (*Systeme Internationale)* units used for length, volume, mass, temperature and time. Students know the definition of each SI unit prefix. (i.e. *kilo-*

means 1000)

Scientific Notation (Students know how to determine the standard notation and scientific notation of a number. Calculations (including significant figures, prefixes, equalities)

Conversions, including moles/molar mass (Students know how to convert units of measurement by using dimensional analysis, ex: students can determine dosage conversions)

Density (Students know how to calculate density and how that applies to a bone density scan.)

Unit 2: Energy and Matter (fulfills NGSS HS – PS1-5: Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.

Energy and Temperature

Specific Heat (which leads to Energy and Nutritional Calories)

Matter Classification, including states, their properties, and change of states (Students know that matter can be a solid, liquid, or gas)

Unit 3: Atoms and Elements (Fulfills NGSS HS-PS1-1:Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms. And HS – PS1-4 Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.**)**

Symbols

Atoms, including atomic and mass number (Students know how elements are made up of one type of atom and compounds are made up of molecules. Students know the three basic subatomic particles: protons, neutrons, and electrons. Students know the relative masses and charges of the subatomic particles as well as their relative positions in the atom.)

The Periodic Table (Students know how the periodic table is arranged into periods and groups/families and how the elements share common or differing characteristics. Students will communicate the significance of elements in body composition and in healthcare.)

Isotopes

Electron Energy levels and configured rings (Students know how to identify an element based on its electron configuration as well as compose the electron configuration of a given element. Students can determine the number of valence electrons there are in an element based on its electron configuration.)

Electronegativity/Bond Polarity, including shapes and polarity of molecules and forces in compounds (Students know types of bonding including nonpolar covalent bonds (London dispersion forces), polar covalent bonds (dipole forces), hydrogen bonds (dipole-dipole) and intermolecular attractions as well as their relative strength.)

Unit 4: Compounds and Bonds (Fulfills NGSS HS-PS1-3 Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.

Octet Rule/Ions (students know the significance of the octet rule, they can distinguish between a cation and anion. Students know how to determine the ionic charge of an ion)

Ionic Compounds (How it relates to nutrition) (Students can differentiate between ions and neutral atoms . Students will explore how elements, sometimes in the form of ions or as part of molecules, are necessary for body structure and physiological functioning. Students understand the role of ions in the human body and how they are necessary for optimal physiological functioning. Students know how ions in the body are known as electrolytes and how they are able to form.)

Naming/Writing Ionic Formulas (Students know how to determine the subscripts in a chemical formula for an ionic compound from its ionic charge.Students know how to determine the chemical formula for an ionic compound that contains a metal as well as a polyatomic ion.

Polyatomic Ions

Covalent Compounds (formulas) (Students know how to name covalent compounds, ionic compounds, and polyatomic ions.)

Unit 5: Solutions

Water in the Body (relates to Kidneys) (Students can explain how kidney dialysis works in terms of solutions.)

Solubility (Students know the concept of "like dissolves like" and how polar and non-polar substances are not soluble. Students must know and understand how to read the solubility curve.)

Concentrations (Students must be able to make concentrated solutions and perform dilutions. Students understand the significance of molarity used to make solutions administered to patients through IV drips. Students understand how ingesting highly-concentrated fluids results in dehydration.)

Acids-bases (Students investigate the effectiveness of antacids as buffers. Students are able to perform a titration of common over-the counter buffers and medications, such as antacids or aspirin. Students know the significance of homeostasis in the pH level of blood and the digestive system. Students know how to characterize soaps and other detergents and their role in human health and hygiene. Students can explain how neutralization processes between acids, bases and buffers maintain homeostasis in the human body.)

Unit 6 Organic Molecules (Fulfills NGSS HS-PS 2-6 Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.)

(Students can identify and construct the chemical structure of carbohydrates, lipids, proteins and nucleic acids. Students know why nutrition, in the form of macromolecules, is so important for optimal health. Students will understand the molecular structure of organic compounds, including covalent bonds that hold the atoms together, the identification of functional groups, how to read the short form representation of organic compounds, and their significance in pharmaceuticals, smells, and other organic substances. Students know that polymers are broken down during the process of hydrolysis and produced from monomers during the process of dehydration synthesis.)

Carbohydrates, Lipids, Proteins (students can draw and label the structure of an amino acid), **Nucleic Acids**

Semester 2

Unit 1: Chemical Reactions (Fulfills NGSS HS-PS1-7:Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. And NGSS HS – PS1-2: Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.)

(Students know that chemical reactions constantly occur within the human body.)

Types(Students know how to identify chemical reactions as synthesis, decomposition, single displacement (replacement), double displacement (replacement), and combustion.

Oxidative/Reductive

Moles in chemical reactions (calculations) (Students can calculate the number of moles of oxygen and/or carbon dioxide that is exhaled in one single exhalation.

% yield/limiting reactions

Energy Changes (Students can identify exothermic and endothermic reactions that

occur in the body. Students can apply exothermic reactions to their use in hot packs and endothermic reactions and their use in cold packs. Students can

identify and explain the phases of an exothermic and endothermic graph

Unit 2: Gases (relating to the Pulmonary System)

Properties

Pressure/Volume (Boyles law) (Students know how Boyle's law relates to respiration. Students can design and build a respiratory model that represents how Boyle's Law is significant to the respiratory system.)

Temperature and Volume (Charles Law)

Temperature and Pressure (Students understand the risks of scuba diving in terms of pressure and how quick ascent can be fatal.)

Combined Gas Law

Volume and Moles (Avagadros Law)

The ideal gas law

Partial Pressure (Daltons Law)

(Students know how gas laws relate to blood gases and the significance of blood gas results. Students know how a hyperbaric chamber works and how gas laws are significant in other medical devices, including syringes, blood pressure cuffs, breathing machines, venodynes, etc.

Unit 3: Chemical Equilibrium (relates to Oxygen – Hemoglobin levels regarding hypoxia and Insulin/sugar levels, fulfills NGSS HS-PS1-6: Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.)

Rates

Chemical Equilibrium/Constants (Students understand how buffers in the human body help maintain chemical equilibrium. Students understand that ion transport, blood composition and conditions, such as hypoxia, rely on chemical equilibrium within the body to maintain homeostasis. Students know that elements in ion form must maintain homeostasis, such as calcium, potassium, sodium, etc. for proper physiology functioning.

Le Chatelier's Principle

Unit 4: Enzymes and Vitamins

Enzyme Structure (Students know what environmental conditions denature enzymes affecting their ability to function)

Enzyme Purpose (Students know how enzymes are used in various aspects of healthcare and industry as well as in the human body, Students understand the process of enzyme-naming.)

Vitamin Purpose (Students know how some vitamins serve as coenzymes in the human body to aid in chemical processes.)

Unit 5: Nucleic acids and Protein Synthesis

DNA Structure and Function

Protein Structure (students know the levels of structure in a protein: primary, secondary, tertiary, and quaternary)

Unit 6: Nuclear Chemistry (Fulfills NGSS HS-PS1-8: Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.)

Nuclear Reactions (Students know how nuclear medicine is used for diagnosis and treatment.

Radiation Measurement (Students know how alpha, beta, and gamma particles affect the human body. Students can identify the types of materials that each radioactive particle can penetrate.)

Natural Radioactivity (Students can explain how radiation can be a cause of cancer and a treatment of cancerous cells. Students understand that the expiration date on pharmaceuticals is based on the principles of radioactive decay)

Half-Life of a Radioisotope

Nuclear Fission and Fusion

* **Laboratory Activities**

Semester 1 - Unit 1

Lab 00 Investigation and Experimentation

Playing the role of forensic chemist, students will perform an inquiry-based,

introductory laboratory investigation that sets the stage for the entire year in Medical Chemistry. Students will be able to explore the physical and chemical characteristics of some common over-the-counter pharmaceuticals by making observations, collecting data and comparing results to draw conclusions. Four over-the-counter pharmaceuticals will be tested for solubility, pH, reactivity, conductivity, and physical components using indicators and appropriate scientific tools. Students will also investigate the properties of an unknown substance and hypothesize its identity based on prior knowledge and scientific experiences.

Semester 1 - Unit 4

Lab 02 – Chemical Bonds

It's Electrifying! Electrical Signals in the Human Body

Lab 2a "It's Electrifying…"is ideal as an inquiry-based laboratory activity to jump start the chemical bonding unit or as a comprehensive review to summarize the unit. Students visit eight conductivity stations where they test a solution's ability to conduct electricity. Not only will students compare ionic and covalent

characteristics but students will also practice deciphering chemical formulas, identifying element features using the periodic table, and constructing Lewis dot structures. Ionic and covalent terminology will eventually lend to the more medically-applicable language of electrolytes and nonelectrolytes that are necessary to maintain homeostasis in the human body. Students will explore common electrolytes and nonelectrolytes and their significance in optimal functioning.

Lab 2b "Electrolyte Infusion…" allows students to construct a simulated intracellular and extracellular environment using permeable plastic bags filled with one sports drink each which claim in marketing ploys to have the greatest ability to rehydrate the body and replace lost electrolytes during strenuous physical activity. Students will be using highly-sensitive conductivity testers to determine each sports drinks' ability to permeate its plastic barrier and, therefore, its overall probable effectiveness in the body as well.

Semester 1 - Unit 2

Lab 03 – Conservation of Matter and Stoichiometry

Lab 3a Culinary Chemistry: Stoichiometry Made Simple Students explore stoichiometry and law of conservation of matter and energy through the scope of pharmacy and dentistry. The chemical reaction between baking soda and vinegar provides an opportunity for students to focus on measuring and performing calculations that will help them conceptualize the law of conservation and percent yield. Team members will become dentists while finding the molar mass of several molecules and balancing chemical equations. Additionally, learners will practice mole-mole, gram-gram, and gram-mole stoichiometric conversions.

Lab 3b Synthesis of Aspirin Students become pharmacists as they explore the history of aspirin and participate in its synthesis. Although the protocol is designed for microscale quantities, fume hoods and strict safety measures are required for this laboratory activity. Aspirin is synthesized by combining salicylic acid and acetyl chloride. After a recrystallization process, students may extract wintergreen oil from salicylic acid. Wafting will ensure your lab groups' success. Post-lab analysis will require students not only to calculate percent yield, but they will also self-assess mastery in types of chemical reactions, lethal dosage calculations, and medical applications of aspirin and wintergreen.

Semester 2 – Unit 2

Lab 04 – Gases and Their Properties

Lung Capacity: Molar Volume and Human Lungs

Students use balloons to investigate tidal volume, expiratory reserve volume and vital capacity and practice geometric content standards for an interdisciplinary

connection. Assuming that air from your lungs behaves as an ideal gas, students determine molar volume at standard temperature and pressure. Additionally, learners explain how Boyle's Law applies to respiration during inhalation and exhalation and how disease can affect a person's ability to efficiently inhale oxygen and exhale carbon dioxide.

Semester 1 – Unit 5

Lab 05 – Acids and Bases

Titration of Aspirin

Students transform into pharmacists as they use a known concentration of sodium hydroxide to neutralize acetyl salicylic acid, the active ingredient in aspirin, by utilizing titration. Since different strengths of aspirin are based on the concentration of active ingredients that they contain, students may hypothesize which type of aspirin is most likely to reach the point of neutralization with the least amount of a known base concentration. Students will not only practice mass and volume measurement and molar conversions, but they will also perform dilution calculations and explore acids/bases characteristics.

Semester 1 Unit 5

Lab 06 – Solutions

IV Drips: Making Molar Solutions

"IV Drips…" may be implemented as an inquiry-based laboratory experiment or as a formative assessment to test mastery. Students become pharmacists as they explore the significance of making solutions in the scientific and healthcare community. Students are taken through an interactive step-by-step process of producing a 1M NaCl solution. Then, lab members receive guidance in order to

accurately make varying concentrations of sucrose solutions. A Gummy Bear of a known mass is submerged in each solution overnight and their change in mass is recorded and discussed. Connections may be made to Cell Biology by revisiting tonicity and osmosis while extending the conversation to dehydration. Accurate solution concentrations are essential in proper treatment of patient disease and injury. Students will read patient case scenarios and calculate the molarity of the IV solution that the patient should receive. Finally, learners will discover how to determine IV flow rates for a patient.

Semester 1 – Unit 2

Lab 07 – Chemical Thermodynamics

Counting Calories

By burning food, the chemical energy stored in chemical bonds is released as heat and light. The more calories a food contains, the more heat it gives off. Students will use calorimetry in order to measure the amount of stored energy in

a single Flamin' Hot Cheeto'. The energy that the food gives off is taken in by the water as the water changes temperature. By knowing the mass of the water used and the change in temperature of the water, the amount of energy (calories) that the water gains can be determined by the following formula: **q = mcrt.** Students practice calculating specific heat and percent error. Additionally, they will explore how food energy is expressed in Calories as well as how they can interpret nutritional food labels for lifetime health and fitness.

Semester 2 – Unit 1

Lab 08 – Reaction Rates

The Effect of Concentration and Temperature on Reaction Rate

This is a two-part laboratory activity that will familiarize students with the effects of concentration and temperature on reaction rate. Both may be implemented during any portion of your unit.

Lab 8a forms a bridge between enzyme concepts learned in Medical Biology and their role in reaction rates, a Medical Chemistry standard. An additional fusion of biochemistry and chemical reactions concepts remind students of the interconnectivity of content learned throughout the year in Medical Chemistry. Using the catalase enzyme from potatoes and hydrogen peroxide as the substrate, students will gather quantitative data on the effects of enzyme concentration on reaction rate. Paper disks soaked in the catalase solution are slowly propelled to the surface of the hydrogen peroxide giving lab members adequate time to collect information using timers. Since catalase is also found in human skin tissue, students make the short leap to its medical connection and its role in breaking down its substrate, hydrogen peroxide (H2O2), which is a naturally-occurring poison. The decomposition reaction catalyzed by the enzyme catalase produces water and oxygen gas. In this experiment, students will be reacting catalase in varying concentrations of potato extract with hydrogen peroxide. The purpose is to discover how the concentration of the enzyme (catalase) affects the rate of reaction with an unchanging amount of substrate (H2O2). Post lab analysis assesses students on their understanding of the effects of concentration on reaction rate and the action occurring on a molecular level.

Lab 8b allows students an interactive exploration with the effects of temperature on reaction rate. Where some labs provide an "Aha moment," this one will provide the "Wow factor!" A safety warning and introductory demonstration may help guide students toward successful activity completion. Team members will use film canisters, water and Alka-Seltzer® tablets to quantitatively measure the effects of temperature on reaction rate. An ice water bath, room temperature water bath, and heated water bath will each provide the variables during reaction rate trials and the basis for which data is collected. As ingredients in the tablet and the water react, carbon dioxide builds within the film canister and the popping lid determines the stop-time. Post-lab analysis will demonstrate the effects of temperature on reaction rate and will reflect in a student-produced graph while standards-based post-lab questions assess student understanding.

Semester 2 – Unit 3

Lab 09 – Chemical Equilibrium

Lab 09 – Chemical Equilibrium

Stress Management: Chemical Equilibrium and Buffers

Students will investigate LeChatelier's principle by exploring the effects of concentration and temperature on chemical equilibrium. Lab members will predict color change as the concentration of reactants and products are added or removed once a chemical reaction has reached equilibrium. Additionally, student researchers will use an ice bath and warm water bath to observe and predict dynamic color changes in an endothermic chemical reaction. Further, students will be exposed to a buffering mechanism within the human body that helps reflect LeChatelier's principle. Learners will simulate the body's use of bicarbonate (H_2CO_3) and carbonate (HCO_3^-) to help maintain blood pH within the normal range. For this, lab teams will produce three buffer solutions and determine which has the greatest buffering capacity by collecting the pH level before equilibrium is disrupted and after equilibrium is disrupted. Post-lab analysis will assess students' ability to predict equilibrium shift based on the stress factor placed on that system.

Semester 2 – Unit 5

Lab 10 – Chemistry and Biochemistry

Lab 10a Food Chemistry: The Identification of Macromolecules Students will use indicators, a common experimental technique, to reveal and record the characteristics of starch, glucose, lipids, and proteins in context of a urinalysis. Then, given an unknown "urine" sample, students will analyze the substance for existing macromolecules and determine diagnosis and treatment for their patient based on their test results. Learners will explore the connection between food chemistry made available by the digestive system and the excretion of nutrients in urine. Graphic organizers included at the completion of this lab will help students visually organize content regarding macromolecules which will further remind students to make connections between Medical Biology and Medical Chemistry.

Lab 10b Sensable Smells: The Chemistry of Fragrances Highly-engaging, inquiry-based lab that would be ideal to implement during California state standard 10 as it focuses on organic chemistry or during California state standard

2 Chemical Bonding. In this activity, students dissect short-hand and full atom versions of molecular structures while using their senses to identify various extracts that are represented by those structures. Students also discover the physiology behind the olfactory system as well as practice concepts such as valence electrons, Lewis dot structures and chemical bonding in context. Teachers who have attended the professional development trainin

Key Assignments

Each unit will include:

Lecture with Cornell notes

Textbook reading with guided questions

Case- studies and real life scenarios

Labs – see above descriptions

Projects – See details below

Reading scientific articles and current events

Semester 1

Unit 1: Investigation and Experimentation

Students create a flyer designed to teach Junior High students how to convert numbers using dimensional analysis. Flyers must include step by step directions (min of 5 steps), color, pictures, and one sample problem worked out using the steps.

Unit 2: Energy and Matter

Students create a foldable, each flap describes the different states of matter. Students must include examples of medicine for each state, and describe the benefits of administrating the medicine in that state.

Unit 3: Atoms and Elements

Periodic Table Assignment: Throughout the unit students will research elements, starting with elements that are common in the human body and then addressing

important vitamins/nutrients, toxins, and finally medical uses. Students will create their own poster describing how elements are found and used in the human body, Each element will be placed in its correct position on the Periodic table and will include: Atomic Number, Atomic Mass, Appearance in pure form (if applicable), and use/location in the body.

Unit 4: Compounds and Bonds

Chemical Dating: In groups of two students create a profile for an element seeking a partner in life. Students anthropomorphize elements, ex: an atom with 7 valence electrons is described as needy, and quick to establish a relationship. In class each element starts the dating process, where the students find good matches between profiles, and evaluate what kind of bond might be formed.

Unit 5: Solutions

Blood Analysis: Students research the different components of blood, focusing on how the different components are mixed together, and what job they do for the body. Students then prepare advertising materials for an upcoming school wide blood drive. Materials may include: posters, flyers, video announcements, and may be expanded depending on school supplies.

Unit 6 Organic Molecules

Food Fundamentals Presentation: In groups of four students create the "perfect meal" in front of the class they will use indicator solutions to identify the major biological molecules present in their meal and explain to the class how those molecules are used by the body, and how they are chemically different from each other.

Semester 2

Unit 1: Chemical Reactions

In groups of four students plan a demonstration of simple (and safe) chemical reactions that are common among cleaning products. They need to describe: what the reactants and products are, and describe how the atoms are rearranging.

Unit 2: Gases

Students make a model of the Respiratory System. Students are provided some basic materials such as plastic cups, straws balloons and tape. With these supplies students are directed to design and construct a model which represents

supplies students are directed to design and construct a model which represents how your diaphragm interacts with the lungs to allow respiration to occur. Conclusion questions include: Which of the gas laws best explains how the respiratory system works? And: In biological warfare, neurotoxins disrupt the ability of muscles to contract in the human body. Knowing that the diaphragm is a muscle what would be the fate of a soldier who is exposed to this type of biological warfare? Use the terms pressure and volumein your answer.

Unit 3: Chemical Equilibrium

Students create a brochure advertising the risks of Hypoxia, including altitude sickness and deep sea diving. The brochure must include: an explanation of LeChatelier's Principle and how that affects the oxygen supply needed by the cells, a description of physical problems associated with Hypoxia, treatments available, and ways to prevent Hypoxia.

Unit 4: Enzymes and Vitamins

Enzyme Models: Students build models of enzymes using common household items. When presenting to the class students must explain what the model does for the human body.

Unit 5: Nucleic acids and Protein Synthesis

Gene Research: Students create a PowerPoint presentation researching a specific gene. Each group must research the following questions: Where is the gene located? Approximately how long is it? How is the gene transcribed and translated into a protein? What does the protein look like? What does the protein do? Are there common mutations? Common genetic disorders? If so describe the disorder. Students then present to the class.

Unit 6: Metabolic Pathways

Students create maps of different metabolic pathways, each map must include a key (describing what each molecule is represented by), beginning product, end product, illustration of how the process works and is monitored, and how the pathway aids in homeostasis.

Unit 7: Nuclear Chemistry

Nuclear Energy: the Good, the Bad, and the Debatable

Students are divided into groups of 6. Each group will research and prepare to debate in front of the group the pros and cons of the following issues: Nuclear Energy Production, From dose to death, how much is too much radiation?, and Nuclear energy uses.

*** Instructional Methods and/or Strategies**

In order for students to be able to succeed in a post-high school education they will be required to be able to understand and retain information from the following sources: reading text books, lecture, and research.

In Medical Chemistry students will be required to take notes during PowerPoint lectures in the Cornell Notes style. This requires students to think about and process information as it is presented and in the days following. Students add their own information, questions, examples to their notes. The goal is for students to interact with the information rather than just record it.

In order to be prepared for post high school classes in nursing programs, EMT

programs, or four year universities there will be a large emphasis on reading science text. Weekly assignments will include reading from the text book and taking notes in a format that shows understanding. Students will also read scientific articles and current event articles that support the content while increasing reading fluency.

In the Medical Chemistry class students will often be required to research for projects (ex: Periodic Table project). These projects will require students to find resources, evaluate their reliability, learn what the source is teaching, and then present that information to the class.

*** Assessment Methods and/or Tools**

In order for students to succeed in post high school classes related to the medical field students will need to understand, retain, and relay a large amount of information. Unit assessments in large part will mimic those found at the university level. Unit tests and finals will be largely multiple choice, matching, and a few short answer questions. This will allow students to see how their study skills serve them, and they will have the ability to fine tune their study skills so that they will be able to succeed in future classes.

Assessments will also include short essays, ex: Evaluate the benefits and risk of a food fad, or diet plan. This will allow the teacher to see how they use the information learned in class to form their own positions, if they can defend their opinion, and explain it in a clear way.

Another way for the teacher to monitor student learning will be to evaluate their presentations. In many post high school programs students will be required to work in groups or individually to create presentations to the class. There are several times that students will be presenting information to the class, such as the Enzymes Models, and Nuclear Energy Debate. The teacher will be able to evaluate the students understanding of the material as well giving them an opportunity to be comfortable talking in front of groups. The following is a sample rubric:

Presentation Rubric

Incomplete...1 Almost there...3 Complete!...5 Score:

1. Visual Aid:

Powerpoint	Less than two slides are completed, unorganized, not well put together	At least four slides are complete, lacking some organization	All five slides are creative, complete, complete, neat and organized
Poster or brochure	Incomplete, not colored, no pictures, or illegible	Organized, readable, and includes either color or pictures	Creative, neat, organized, with colors and pictures
2. Presentation Skills			
Eye Contact	The speaker looks down at the floor and makes no eye contact with the class	The student attempts some eye contact with the class	The student makes regular eye contact with the class
Voice	The speaker's voice is too quiet for the class to hear them, and many words are	The speaker's voice is loud enough for the class to hear	Speaker's voice is loud and clear. Words are pronouced correctly.

	words are incorrectly pronounced	most of the time, but the words are not very clear, or pronounced incorrectly	
			Speaker uses bullet points on slides as a reference and adds more information when presenting
	The speaker is reading long sentences directly off their slides, without adding any additional information	The speaker has bullet points on their slides/poster but reads directly off the visual aid and adds little additional information while presenting	
Delivery			
3. Participation	Only one member of the group is speaking	More than one member of the group is speaking, but the speaking is not equally divided	All members are speaking and equal amount
4. Content	Presentation only includes 1-2 of the components specified in the reasearch	Presentation only includes 3-4 of the components specified in the research	Presentation includes all components specified in the research assignment

assignment assignment

On a day to day basis the Cornell Notes style of taking notes allows the teacher to evaluate the students understanding by seeing what types of questions they are asking, or what information they might be skipping over. This will allow the teacher to make changes to the instruction so that it best serves the students.

A minimum of once a semester, students will complete a full scientific lab write up. This will familiarize the students with the way scientific papers are organized and written. The teacher will be able to evaluate student learning by reading the student's analysis and reflections in the conclusion section of the lab write up. The following is a sample rubric

Lab Report Rubric

	Excellent (4 pts)	Good (3 pts)	Adequate (2 pts)	Needs Work (1 pt)	Not attempted (0)

Introduction	1. Includes the question to be answered by the lab 2. states hypothesis that is based on research and/or sound reasoning 3. title is relevant.	One of the "excellent" conditions is not met, two conditions met	Two of the "excellent" conditions is not met , one is met	Introduction present, no exemplary conditions met
Methods	Description or step-by-step process is included, could be repeated by another scientist	Description included, some steps are vague or unclear	The description gives generalities, enough for reader to understand how the experiment was conducted	Would be difficult to repeat, reader must guess at how the data was gathered or experiment conducted
Data and Analysis	Results and data are clearly recorded, organized so it is easy for the reader to see trends. All appropriate labels are included	Results are clear and labeled, trends are not obvious or there are minor errors in organization	Results are unclear, missing labels, trends are not obvious, disorganized, there is enough data to show the experiment was conducted	Results are disorganized or poorly recorded, do not make sense ; not enough data was taken to justify results
Conclusions	1. Summarizes data used to draw conclusions 2. Conclusions follow data (not wild guesses or leaps of logic), 3. Discusses applications or real world connections 4. Hypothesis is rejected or accepted based on the data.	3 of 4 of the "excellent" conditions is met	2 of the 4 excellent conditions met	1 of the 4 excellent conditions met

Format and Lab Protocols	Lab report submitted as directed, and on time. Directions were followed, stations were cleaned. All safety protocols followed.	Most of the excellent conditions were met; possible minor errors in format or procedures	Some of the excellent conditions met, directions were not explicitly followed, lab stations may have been left unclean or group not practicing good safety (such as not wearing goggles)	Student did not follow directions, practiced unsafe procedures, goofed around in the lab, left a mess or equipment lost

Total (out of 20)

Medical Chemistry will also incorporate new programs available to evaluate students learning through online tests, and online group discussions. Using this technology will familiarize students with other methods that may be used for online programs or classes, this comfort will give them better success in future classes.

Print Close

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