

## SCIENCE – ADVANCED CHEMISTRY – GRADES 11-12

Week	Content	Performance Standards Addressed	Skills for Student Achievement	Assessment
Week 1	<ul style="list-style-type: none"> <li>• Formulas and Equations</li> <li>• Solubility</li> <li>• Ionization and Dissociation</li> <li>• Heat of solution</li> </ul>	A.12.5 Show how themes of science can be used to make real life decisions A.12.6 A.12.7 Re-examine the evidence and reasoning that led to conclusions drawn from investigations using the science themes B.12.5 Explain and describe how science is based on assumptions about the natural world C.12.1-C.12.6 When studying science, ask questions, build hypotheses, design possible investigations, suggest ways to make any needed improvements, choose the best data collection procedures, calculate the degree of precision; use the explanations and models for the results of investigations; present the results of the investigations D.12.10 Using science themes, illustrate the law of conservation of energy during chemical and nuclear reactions D.12.11 Using the science themes, explain common occurrences in the physical world	<ul style="list-style-type: none"> <li>• Write chemical formulas and equations given the names and the names given the formulas</li> <li>• Describe the solution process</li> <li>• Explain what contributes to the heat of solution of an ionic compound and what determines whether the solution process is exothermic or endothermic</li> <li>• Write net ionic equations and identify precipitates</li> <li>• Describe and contrast dissociation and ionization</li> </ul>	<ul style="list-style-type: none"> <li>• <b>LAB:</b> Ionization of Solutions</li> </ul>
Week 2	<ul style="list-style-type: none"> <li>• Electrolytes</li> <li>• Acids and Bases</li> </ul>	A.12.1 Apply themes of science to develop defensible vision of the future A.12.2 Show how opinions and decisions have diverse effects on an individual, a community, and a country, both now and in the future A.12.6 Identify and replace inaccurate personal models and	<ul style="list-style-type: none"> <li>• Distinguish between strong and weak electrolytes</li> <li>• Calculate the expected freezing-point depression of an electrolytic solution</li> <li>• Explain expected and experimentally observed colligative properties of electrolyte solutions and apply to everyday use</li> </ul>	<ul style="list-style-type: none"> <li>• <b>LAB:</b> Indicators</li> </ul>

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		<p>explanations of science related phenomena using evidence learned or discovered</p> <p>B.12.1 Show how cultures and individual have contributed to the development of major ideas in the sciences</p> <p>B.12.4 Show how basic research and applied research contribute to new discoveries</p> <p>C.12.1 When studying science ask questions, build hypotheses and design possible investigations</p> <p>C.12.3 Suggest ways to make needed improvements</p> <p>C.12.4 Choose the best data collection procedures and calculate the degree of precision</p> <p>C.12.5 Use the explanation and models for the results of investigations</p> <p>C.12.6 Present the results of investigations</p> <p>C.12.7 Evaluate articles and reports in the popular press</p> <p>D.12.4 Explain how substances interact with one another to produce new substances</p> <p>D.12.6 Through investigations, identify the types of chemical interactions</p> <p>D.12.7 Quantitatively and qualitatively analyze changes in the motion of objects and the forces that act on them</p> <p>D.12.10 Using science themes, illustrate the law of conservation of energy during chemical and nuclear reactions</p> <p>D.12.11 Using science themes, explain common occurrences in the physical world</p>	<ul style="list-style-type: none"> <li>• Define acids and bases according to Arrhenius and Bronsted-Lowrey</li> <li>• List and discuss relevance of properties of aqueous acids and bases</li> <li>• Name common Binary and Oxyacids</li> <li>• Write equations and predict products for reactions involving acids and bases</li> </ul>	

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		G.12.1 Identify personal interests in science and technology G.12.2 Design, build, evaluate, and revise models and explanations related to the sciences G.12.3 Analyze the costs, benefits, or problems resulting from a scientific or technological innovation H.12.2 Evaluate proposed policy recommendations in science and technology H.12.4 Advocate a solution or combination of solutions to a problem in science or technology H.12.6 Evaluate data and sources of information when making decisions H.12.7 Construct a plan that includes the use of current scientific knowledge and reasoning		
Week 3	<ul style="list-style-type: none"> <li>• Acids and Bases</li> <li>• Acid Dissociation Constants</li> <li>• Ion Dissociation Constants</li> <li>• pH</li> </ul>	Continued from above	<ul style="list-style-type: none"> <li>• Define conjugate acid, conjugate base, and conjugate acid-base pair</li> <li>• Explain and give examples why proton-transfer reactions favor the production of the weaker acid and the weaker base</li> <li>• Define an amphoteric substance, and give examples</li> <li>• Discuss how ulcers in the intestinal tract are formed and treated</li> <li>• Define Acid Dissociation constant and algebraically determine Ion Dissociation constants</li> <li>• Calculate pH of a solution given Hydronium Ion concentration, Hydroxide ion concentration</li> <li>•</li> </ul>	<ul style="list-style-type: none"> <li>• <b>LAB:</b> Hydronium Ion Concentration</li> </ul>

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Week 4	<ul style="list-style-type: none"> <li>Molarity</li> <li>Molality</li> <li>Titrations</li> </ul>	Continued from above	<ul style="list-style-type: none"> <li>Calculate the concentration of solutions</li> <li>State the relationship between normality and molarity</li> <li>Calculate solution normality from solution concentration for a given acid or base</li> <li>List common indicators and the range of pH values in which they will detect</li> <li>Define equivalent and equivalent mass</li> <li>Perform an acid-base titration</li> <li>Calculate molarity and normality of a solution from titration data</li> </ul>	<ul style="list-style-type: none"> <li><b>LAB:</b> Standardization of NaOH</li> <li><b>LAB:</b> Titration of a strong Binary acid with a strong base</li> </ul>
Week 5	<ul style="list-style-type: none"> <li>Buffers</li> </ul>	Continued from above	<ul style="list-style-type: none"> <li>Define a buffer and explain how they are used to maintain pH</li> <li>Describe how the buffering systems within our bodies work</li> <li>Define acidosis and alkalosis and describe short/long term effects of each</li> </ul>	<ul style="list-style-type: none"> <li><b>LAB:</b> Titration of an weak Oxyacid with a strong base</li> </ul>
Week 6	<ul style="list-style-type: none"> <li>Acid Rain</li> <li>Scientific Research with Primary Journals</li> </ul>	Continued from above	<ul style="list-style-type: none"> <li>Determine where continental acid rain precipitation is the greatest</li> <li>Discuss and provide reasons for the varying levels of acidity and detrimental effects thereof</li> <li>Utilize EBSCO and MedLine to locate primary journals for research</li> <li>Write a bibliography according to scientific protocol</li> </ul>	<ul style="list-style-type: none"> <li>Mid Term I</li> </ul>
Week 7	<ul style="list-style-type: none"> <li>Nature of Organic Molecules</li> <li>Functional Groups</li> <li>Alkane Isomers</li> <li>Esters</li> </ul>	A.12.1 Apply themes of science to develop defensible vision of the future A.12.2 Show how opinions and decisions have diverse effects on an individual, a community, and a country, both now and in the future	<ul style="list-style-type: none"> <li>Classify organic molecules into functional group families</li> <li>Recognize and draw constitutional isomers</li> <li>Formulate protocol to produce different Esters in Laboratory conditions</li> <li>Describe the process and the use</li> </ul>	<ul style="list-style-type: none"> <li><b>LAB:</b> Chromatography</li> </ul>

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		<p>A.12.6 Identify and replace inaccurate personal models and explanations of science related phenomena using evidence learned or discovered</p> <p>B.12.1 Show how cultures and individual have contributed to the development of major ideas in the sciences</p> <p>B.12.4 Show how basic research and applied research contribute to new discoveries</p> <p>C.12.1 When studying science ask questions, build hypotheses and design possible investigations</p> <p>C.12.3 Suggest ways to make needed improvements</p> <p>C.12.4 Choose the best data collection procedures and calculate the degree of precision</p> <p>C.12.5 Use the explanation and models for the results of investigations</p> <p>C.12.7 Evaluate articles and reports in the popular press</p> <p>D.12.10 Using science themes, illustrate the law of conservation of energy during chemical and nuclear reactions</p> <p>G.12.1 Identify personal interests in science and technology</p> <p>G.12.2 Design, build, evaluate, and revise models and explanations related to the sciences</p> <p>G.12.3 Analyze the costs, benefits, or problems resulting from a scientific or technological innovation</p> <p>H.12.2 Evaluate proposed policy recommendations in science and technology</p> <p>H.12.4 Advocate a solution or</p>	<p>of Chromatography in science</p>	

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		combination of solutions to a problem in science or technology H.12.6 Evaluate data and sources of information when making decisions H.12.7 Construct a plan that includes the use of current scientific knowledge and reasoning		
Week 8	<ul style="list-style-type: none"> <li>• Alkane Nomenclature</li> <li>• Alkane Reactions</li> <li>• Properties of Alkanes</li> <li>• Petroleum</li> </ul>	C.12.6 Present the results of investigations D.12.4 Explain how substances interact with one another to produce new substances D.12.6 Through investigations, identify the types of chemical interactions D.12.7 Quantitatively and qualitatively analyze changes in the motion of objects and the forces that act on them D.12.11 Using science themes, explain common occurrences in the physical world	<ul style="list-style-type: none"> <li>• Produce different aromas (esters) in the lab</li> <li>• Name an alkane from its structure or write the structure</li> <li>• Describe chemical and physical properties of alkanes, including polarity solubility, and flammability</li> <li>• Predict and describe products formed in combustion and halogenation of alkanes</li> <li>• List types of petroleum and classify</li> </ul>	<ul style="list-style-type: none"> <li>• <b>LAB:</b> Esters</li> </ul>
Week 9	<ul style="list-style-type: none"> <li>• Alkene and Alkyne Nomenclature</li> <li>• Cis and trans Isomerism</li> <li>• Properties of Alkenes and Alkynes</li> <li>• Vision</li> </ul>	Continued from above	<ul style="list-style-type: none"> <li>• Name alkene, alkynes from its structure or write the structure given the name</li> <li>• Describe and compare properties of alkenes and alkynes as above and including bonding</li> <li>• Distinguish between cis and trans isomers</li> <li>• Discuss and diagram how 11-cisretinol is converted to transretinol in vision</li> <li>• Explain how natural products are isolated for manufacturing purposes</li> </ul>	<ul style="list-style-type: none"> <li>• <b>LAB:</b> Isolation of Natural Products – Eugenol, Caffeine, Nicotine</li> </ul>

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Week 10	<ul style="list-style-type: none"> <li>Alkene and Alkyne Reactions</li> <li>Cycloalkanes and Aromatics Nomenclature</li> </ul>	Continued from above	<ul style="list-style-type: none"> <li>Predict products of reactions of alkenes and alkynes, cycloalkanes</li> <li>Show how addition reactions occur and describe the difference between addition and substitution reactions</li> <li>Name Cycloalkanes and Aromatics given the structures and write structures given the names</li> </ul>	<ul style="list-style-type: none"> <li><b>LAB:</b> Synthesis of Acetylsalicylic Acid (ASA)</li> </ul>
Week 11	<ul style="list-style-type: none"> <li>Aromatic Reactions</li> <li>Drugs: Carboxylic Acids, Esters and Amides</li> </ul>	Continued from above	<ul style="list-style-type: none"> <li>Predict products of aromatic reactions</li> <li>List steps in a multi stepped reaction for the synthesis of different organic compounds</li> <li>Explain the effects of Acetylsalicylic acid on the human body</li> </ul>	<ul style="list-style-type: none"> <li></li> </ul>
Week 12	<ul style="list-style-type: none"> <li>Neurophysiology and Drug Interactions</li> <li>Brain Amines and Related Drugs</li> </ul>	Continued from above	<ul style="list-style-type: none"> <li>Explain and draw the structure of a parasympathetic nerve and detail how drugs affect the neurotransmitter release within the synaptic gap</li> <li>Discuss importance of agonists and antagonists in neurotransmitter function</li> <li>Discuss relevance of Prozac in today's society</li> <li>Discuss and draw mechanism of action of Prozac</li> </ul>	<ul style="list-style-type: none"> <li>Mid Term II</li> </ul>
Week 13	<ul style="list-style-type: none"> <li>Biotechnology – History and advancements</li> <li>Protein structure</li> <li>Classification of proteins</li> </ul>	A.12.1 Apply themes of science to develop defensible vision of the future A.12.2 Show how opinions and decisions have diverse effects on an individual, a community, and a country, both now and in the future A.12.6 Identify and replace inaccurate personal models and	<ul style="list-style-type: none"> <li>Explain how shape discrimination plays an important role in biochemical reaction</li> <li>Classify proteins according to function and provide examples of each</li> <li>List the four types of protein structure</li> </ul>	<ul style="list-style-type: none"> <li><b>LAB:</b> Amino Acid Sequencing</li> </ul>

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		<p>H.12.4 Advocate a solution or combination of solutions to a problem in science or technology</p> <p>H.12.6 Evaluate data and sources of information when making decisions</p> <p>H.12.7 Construct a plan that includes the use of current scientific knowledge and reasoning</p>		
Week 14	<ul style="list-style-type: none"> <li>• Amino Acids</li> <li>• Molecular Handedness of Amino Acids</li> <li>• Primary Protein Structure</li> </ul>	<p>C.12.6 Present the results of investigations</p> <p>D.12.4 Explain how substances interact with one another to produce new substances</p> <p>D.12.6 Through investigations, identify the types of chemical interactions</p> <p>D.12.7 Quantitatively and qualitatively analyze changes in the motion of objects and the forces that act on them</p> <p>D.12.11 Using science themes, explain common occurrences in the physical world</p>	<ul style="list-style-type: none"> <li>• Name and recognize the 20 alpha amino acids</li> <li>• Define handedness and explain how this affects symmetry in molecules and function</li> <li>• Describe Primary protein structure</li> <li>• Discuss traits and causes of Sickle-cell anemia</li> <li>• Discuss history of use and development of Bovine Insulin and genetically engineered Human Insulin</li> </ul>	<ul style="list-style-type: none"> <li>• <b>LAB:</b> Electrophoresis Basics</li> <li>• <b>LAB:</b> Genomic DNA Isolation from mammalian tissue</li> </ul>
Week 15	<ul style="list-style-type: none"> <li>• Secondary, Tertiary, and Quaternary Protein Structure</li> <li>• Electrophoresis</li> <li>• Chemical Properties of Proteins</li> </ul>	Continued from above	<ul style="list-style-type: none"> <li>• Describe how electrophoresis may be used in protein analysis</li> <li>• Describe secondary, tertiary and quaternary structure of protein providing examples of each</li> <li>• Define a Zwitterion</li> <li>• Define and explain how disulfide bridges, hydrogen bonding, ionic attractions and hydrophobic interactions regulate protein shape</li> <li>• Explain how to denature a protein</li> </ul>	<ul style="list-style-type: none"> <li>• <b>LAB:</b> Transformation of E.coli with pFluoroGreen and pFluoroBlue</li> </ul>

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Week 16	<ul style="list-style-type: none"> <li>• DNA, Chromosomes, and Genes – a brief History</li> <li>• Watson-Crick Model</li> <li>• Replication of DNA</li> <li>• Polymerase Chain Reaction</li> </ul>	Continued from above	<ul style="list-style-type: none"> <li>• Describe nucleic acid synthesis including description of nucleosides, nucleotides, sugars and bases</li> <li>• Explain how nucleic acids are involved in transcription and translation of genetic information</li> <li>• Describe how the Polymerase Chain reaction works and provide uses for this technique</li> </ul>	<ul style="list-style-type: none"> <li>• <b>LAB:</b> DNA Fingerpringing – Usage of Restriction Enzymes in DNA Fingerpringing Analysis</li> <li>• Research Report</li> </ul>
Week 17	<ul style="list-style-type: none"> <li>• Tools of Molecular Biology: Plasmids, Vectors, Polymerases, Liagase and Bacteria</li> <li>• Recombinant DNA</li> </ul>	Continued from above	<ul style="list-style-type: none"> <li>• Describe the uses of various tools used in molecular biology and how to use them</li> <li>• Transfect E-coli bacteria with a recombinant plasmid and replicate</li> <li>• Analyze DNA fingerprints using restriction enzymes</li> </ul>	<ul style="list-style-type: none"> <li>• <b>LAB:</b> Construction and Cloning of a Recombinant DNA</li> </ul>
Week 18	<ul style="list-style-type: none"> <li>• Cloning</li> </ul>		<ul style="list-style-type: none"> <li>• Clone Aequorea victoria</li> </ul>	<ul style="list-style-type: none"> <li>• Mid Term III</li> <li>• Final Exam</li> </ul>