

INTRODUCTION TO NANOSCALE SCIENCE & ENGINEERING NANOCHEMISTRY SEMESTER

MONTH	CONTENT	LAB THEMES	SKILLS	ASSESSMENTS
September	<p><u><i>Nano-Intro (Same topics for nanophysics and nanochem)</i></u></p> <p><u>Topic I: NAN-OH!! WHAT?</u></p> <p><u>Unit 1 Nano -The Unit</u></p> <ul style="list-style-type: none"> ➤ SI System of Units ➤ Unit Conversions ➤ Intro to NanoBook ➤ NanoDefinitions ➤ Scaling from Macro to Nano <p><u>Unit 2 Nano-The next Big Thing</u></p> <ul style="list-style-type: none"> ➤ NanoScience in our lives ➤ Nanotechnology overview ➤ Branches of NanoScience ➤ Tools and Fabrication overview ➤ Intro NanoTerminology 	<ul style="list-style-type: none"> ❖ Math Tool Kit ❖ Cutting it Down to Nano ❖ NanoAnalogies 1 (familiarize nanoscale objects) ❖ NanoAnalogies 2 (scale own objects) ❖ NanoAnalogies 3 (nano applications) 	<ul style="list-style-type: none"> ❑ Understand the approximate values of micro and nano ❑ Use algebraic and geometric representations to describe and compare data to solve problems. ❑ Convert using small scale metric units ❑ Understand and use basic NanoTerminology ❑ Compare and Contrast various branches of the Nanotechnology ❑ Understand the basic equipment and use of such in NanoScience 	<p>Nano Pre Quiz</p> <p>Reading Comprehension, from the text and from scientific articles</p> <p>Lab Activities</p> <p>Homework</p> <p>Unit Tests</p> <p>Quizzes</p> <p>Marking Period Exam</p> <p>NanoComp Book</p>

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<p style="font-size: 2em; font-weight: bold;"><u>October</u> February</p>	<p><u>NanoChemistry Content</u></p> <p><u>Topic II: THE SKINNY ON NANO</u></p> <p><u>Unit 3 Tiny Atoms</u></p> <ul style="list-style-type: none"> ➤ Subatomic Particles ➤ Protons ➤ neutrons ➤ electron ➤ Structure of the atom ➤ Plum Pudding Model ➤ Bohr Model ➤ Wave Mechanical Model <p><u>Unit 4 Periodic Table</u></p> <ul style="list-style-type: none"> ➤ Organization of The Periodic Table of Elements Properties ➤ Atomic number ➤ Atomic Mass ➤ Electron Configuration ➤ Elements important to Nanotechnology Cu, Al, Au, Si and C. 	<ul style="list-style-type: none"> ❖ Atom Model Lab ❖ Can you Identify without seeing? ❖ Mystery Element ❖ Martian Periodic Table ❖ Flame Test 	<ul style="list-style-type: none"> ○ Describe the charge, location and other properties of the subatomic particles. ○ Recognize and explain the Plum Pudding, Bohr, and Wave Mechanical models of the atom. ○ Create models to simplify and organize concepts. ○ Identify unknown elements based on atomic number, atomic mass, and electron configuration. ○ Identify and describe the important roles of Cu, Al, Au, Si and C in nanotechnology 	<p>Reading Comprehension, from the text and from scientific articles</p> <p>Worksheets</p> <p>Homework</p> <p>Vocabulary Lists</p> <p>Lab Reports</p> <p>NanoComposition Book</p> <p>Quizzes</p> <p>Unit exam</p>

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<div style="writing-mode: vertical-rl; transform: rotate(180deg); font-size: 48pt; font-weight: bold;">November March</div>	<p><u>Topic III: e⁻ Nano</u></p> <p><u>Unit 5 Smaller than small Electrons</u></p> <ul style="list-style-type: none"> ➤ Excited/Ground State ➤ Valance Electrons ➤ Octet Rule ➤ Ionic Bonding (Transfer of electrons) ➤ Covalent Bonding (Sharing of electrons) ➤ Electron pairs ➤ Hydrogen Bonding <p><u>Unit 6 Amazing Carbon</u></p> <ul style="list-style-type: none"> ➤ The Bonding of Carbon Single, Double and Triple Bonds. ➤ Electrons and electricity ➤ Delocalized electrons ➤ The formation, properties, and uses of Buckyballs and Carbon Nanotubes ➤ The shapes of Carbon Nanotubes including Armchair, Zigzag and Chiral ➤ NanoTerminolgy 	<ul style="list-style-type: none"> ❖ Compound Modeling Lab ❖ Showing Hydrogen Bonding Through Water Tension ❖ Making Slime ❖ Conductivity Test ❖ Lego Nanotubes 	<ul style="list-style-type: none"> ○ Identify an element in the ground state and in the excited state. ○ Predict the group of an element given its electron configuration. ○ Distinguish between ionic, covalent, and hydrogen bonds. ○ Distinguish between single, double, and triple covalent bonds. ○ Create Models to depict the shape of nano sized particles. ○ Describe the properties and applications of Buckyballs and Carbon Nanotubes. 	<p>Reading Comprehension, from the text and from scientific articles</p> <p>Worksheets</p> <p>Homework</p> <p>Vocabulary Lists</p> <p>Lab Reports</p> <p>NanoComposition Book</p> <p>Quizzes</p> <p>Unit exam</p>

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<div style="display: flex; flex-direction: column; align-items: center;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg); font-size: 2em; font-weight: bold; text-decoration: underline;">December</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg); font-size: 2em; font-weight: bold;">April</div> </div>	<p><u>Topic IV: NANO MATTERS</u></p> <p><u>Unit 7 IT's Physical and Chemical</u></p> <ul style="list-style-type: none"> ➤ Physical and Chemical properties ➤ Physical and Chemical reactions ➤ Phase Changes including melting, freezing, vaporizing, condensing, sublimation and deposition. <p><u>Unit 8 Reactions</u></p> <ul style="list-style-type: none"> ➤ Chemical Reactions Single replacement, double replacement, synthesis and decomposition. With a focus on Synthesis reactions. ➤ Manipulating a reaction Temp., Conc., Surface Area, and Catalysts ➤ Nano Reactions. Building specific compounds one atom at a time. ➤ Self assembly 	<ul style="list-style-type: none"> ❖ Serial Dilution ❖ Chemical and Physical Reactions ❖ Dry Ice and Sublimation ❖ Building a Compound one Atom at a Time ❖ Lego Compounds ❖ Bubble Self Assembly ❖ Manipulating Reactions, mini Labs. 	<ul style="list-style-type: none"> ○ Distinguish between a physical and a chemical property and reaction. ○ Define, identify and describe the various phase changes that can occur. ○ Define, identify and describe single replacement, double replacement, decomposition and synthesis reactions. ○ Describe the various ways to manipulate a chemical reaction. ○ Build a specific compound ○ using the principle of one atom at a time. 	<p>Reading Comprehension, from the text and from scientific articles</p> <p>Worksheets</p> <p>Homework</p> <p>Vocabulary Lists</p> <p>Lab Reports</p> <p>NanoComposition Book</p> <p>Quizzes</p> <p>Unit exam</p>

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<p style="font-size: 2em; font-weight: bold;"><u>January</u> May</p>	<p><u>Topic V: YOU ARE WHAT YOU NANO</u></p> <p><u>Unit 9 The chemistry of wafers</u></p> <ul style="list-style-type: none"> ➤ Reactions of Silicon ➤ Bonding the wafer together ➤ Building a wafer from the ground up <p><u>Unit 10 Nano research</u></p> <ul style="list-style-type: none"> ➤ Student Research in a nanofield of interest. 	<p>❖ Play-Doh Wafer</p>	<ul style="list-style-type: none"> ○ Identify and describe the various stages in the manufacturing of a wafer. ○ Understand and use NanoTerminology related to the creation of a wafer ○ Compose an original research paper / project. ○ Use an appropriate format for citing the work of others. 	<p>Reading Comprehension, from the text and from scientific articles</p> <p>Lab Reports</p> <p>Homework</p> <p>Vocabulary Lists</p> <p>NanoComposition Book</p> <p>Student Research Project</p>

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June	<p><u>Topic VI: NANOFUTURE</u></p> <p><u>Unit 11 NanoProducts</u></p> <ul style="list-style-type: none"> ➤ Commercial ➤ Military ➤ Medical ➤ Existing vs. Future <p><u>Unit 12 NanoPolitics</u></p> <ul style="list-style-type: none"> ➤ Initiatives ➤ Objectives ➤ Vision ➤ Measures ➤ Environmental Impact 	<ul style="list-style-type: none"> ❖ NanoPants Lab ❖ Cutting Edge Lab ❖ Societal Impact Study 	<ul style="list-style-type: none"> ○ List, and Categorize Nano-Products currently in use ○ List, and Categorize Nano-Products being developed ○ List and Categorize Nano-Products being conceptualized ○ Compare and Contrast the objectives of involved organizations ○ Discuss the EPA stance on nanotechnology as it pertains to environmental issues 	<p>Reading Comprehension, from the text and from scientific articles</p> <p>Lab Reports</p> <p>Homework</p> <p>NanoComposition Book</p> <p>Quizzes</p> <p>Unit Assessment</p>