

ADVANCED NANOSCALE SCIENCE & ENGINEERING NANOPHYSICS 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: GOT NANO?</u></p> <p><u>Unit 1 Nano -Calculations</u></p> <ul style="list-style-type: none"> ➤ Metric Review ➤ 2 Dimensional Analysis ➤ 3 Dimensional Analysis ➤ Sci. Not. & Sig. Figs. ➤ NanoDefinitions ➤ Scaling from Macro to Nano ➤ Basic NanoTerminology <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 ➤ Advanced NanoTerminology 	<ul style="list-style-type: none"> ❖ Cutting it Down to Nano Lab ❖ NanoLinear Measurements Lab (scale own objects) ❖ NanoAnalogies 1,2, and 3 (nano applications) ❖ NanoNotations Lab 	<ul style="list-style-type: none"> ❑ Understand the approximate values of micro and nano ❑ Convert using small scale metric units ❑ Correctly present values in scientific notation ❑ Correctly present values in scientific notation ❑ Define Basic NanoTerminology ❑ Compare and Contrast various branches of the Nanotechnology ❑ Understand the basic and Advanced equipment and use of such in NanoScience ❑ Define Advanced NanoTerminology 	<p>Nano Pre Quiz</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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<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;">October</div> <hr style="width: 50%; margin: 5px 0;"/> <div style="writing-mode: vertical-rl; transform: rotate(180deg); font-size: 2em; font-weight: bold;">February</div> </div>	<p><u>NanoPhysics Content</u></p> <p><u>Topic II: NANO BREAKIN THE LAW</u></p> <p><u>Unit 3 Size NanoKinematics</u></p> <ul style="list-style-type: none"> ➤ Movement (velocity, acceleration, gravity) ➤ Forces ➤ Hooke’s Law ➤ Cantilevers ➤ Surface Area ➤ NanoDefinitions <p><u>Unit 4 Physical Properties at the Nanoscale (physical)</u></p> <ul style="list-style-type: none"> ➤ Scale Diagrams ➤ Objects to Scale ➤ Size Dependent Properties ➤ NanoSensors ➤ Building Small ➤ Applications 	<ul style="list-style-type: none"> ❖ NanoComparative Lego Lab ❖ LED Lab 1 and 2 ❖ Hooke’s Law Lab ❖ NanoTubes Lab ❖ Surface Area Lab ❖ FerroFluid Lab ❖ (Fancy Pants Lab) 	<ul style="list-style-type: none"> ○ Understand the approximate values of 1 nanometer and 1 micrometer ○ Graphically Analyze linear movement at the nanoscale vs time ○ Calculate forces at the NanoScale ○ Demonstrate how a cantilever employs Hooke’s Law ○ Compare and Contrast surface area of Macro scale objects vs NanoScale objects ○ Order by scale various NanoScale objects ○ Define applications of tools for various NanoScale activites ○ Advanced NanoTerminology 	<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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<div style="display: flex; flex-direction: column; align-items: center;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg); font-size: 48pt; font-weight: bold; margin-bottom: 20px;">November</div> <hr style="width: 50%; margin: 0;"/> <div style="writing-mode: vertical-rl; transform: rotate(180deg); font-size: 48pt; font-weight: bold;">March</div> </div>	<p><u>Topic III: NANO GOES VOGUE</u></p> <p><u>Unit 5 NanoTools, NanoScopic</u></p> <ul style="list-style-type: none"> ➤ Mapping the Unknown ➤ Atomic Force Microscope ➤ Scanning Tunnel Microscope ➤ Scanning Probe Microscope ➤ Electron Microscope ➤ Lithography (optical, e-beam, UV, Ion Beam, X-Ray) ➤ Diffraction Limits <p><u>Unit 6 NanoFabrication</u></p> <ul style="list-style-type: none"> ➤ Top Down ➤ Bottom Up ➤ Self Assembly ➤ MEMS vs NEMS ➤ Micro- and Nano-electromechanical systems 	<ul style="list-style-type: none"> ❖ SPM Lego Lab ❖ LASER/Cantilever Assembly ❖ AFM Lab (cornell version) ❖ Computer Dissection ❖ NanoSmores 	<ul style="list-style-type: none"> ○ Identify uses and capabilities of the various probe devices ○ Identify Forces existing at the NanoScale level ○ Explain frictional forces for affected scopes ○ Graphically represent Hooke's Law as it applies to cantilevers ○ Graphically and Analytically represent surface topography ○ Describe the affects of friction on NanoScale mechanical devices ○ Compare and contrast the various types of assembly 	<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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June	<p><u>Unit 11 NanoProducts</u></p> <ul style="list-style-type: none"> ➤ Commercial ➤ Military ➤ Medical ➤ Existing vs. Future ➤ Material Applications ➤ Computer Applications ➤ NanoRobotics ➤ Nubots <p><u>Unit 12 NanoPolitics</u></p> <ul style="list-style-type: none"> ➤ US marketing initiatives ➤ European marketing 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 ○ Discuss current theory, research and development of nubots ○ Compare and Contrast NanoRobotics facts from fiction ○ Compare and Contrast the US vs. Euro visions ○ Discuss the EPA stance on nanotechnology 	<p>Lab Activities</p> <p>Homework</p> <p>Unit Tests</p> <p>Quizzes</p> <p>Marking Period Exam</p> <p>NanoComp Book</p>