Instructional Planning Sheet

Course Name: Introduction to Nanotechnology for HS Credit – 1

TEKS No.	TEKS Objective	Lesson Focus
120.26 119.68 (c)(2)(A) (c)(2)(B)	• Describe the science of nanotechnology • Understand the mechanics of nanotechnology • Knowledge of the basics of chemistry, physics and molecular biology and the application of these principles in the nanotechnology industry • Demonstration of basic laboratory skills of nanotechnology	**UNIT 1: What is Nanotechnology?** • Introduction • Viewing Website/Handout • Vocabulary Building/Development/Discussion **Key Concepts:** • Define Nanotechnology • Raw materials of Nanotechnology • Nanotechnology products • Potential Nanotechnology boom • Nanotechnology on the horizon – Latest advances • Bioethics and Regulations **Activity 1** • Nanotech products demonstration **Quick Lab (2 days)**: • Making buckyball with paper. • Making nanotube with ballons.
120.82	· Identify career development and entrepreneurship opportunities in the various fields of nanotechnology · Identify employers' expectations, appropriate work habits, and good citizenship skills ·Express thoughts logically and sequentially in preparing a formal report	**Activity 2** • Research/Investigate careers in Nanotechnology utilizing appropriate internet search engines • Relate how technological skills correlate to careers in nanotechnology • Prepare a formatted report (include and identify workplaces/companies/products that employ and/or are associated with professionals in Nanotechnology)
120.26	· Demonstrate mastery of basic grammar, including use of grammar, including use of punctuation marks, keying of numbers and symbols, and capitalization when composing. · Format all pages of a report, including a title page, a reference page, and bibliography.	**Assessment**: Express yourself verbally, in electronic media, and in writing what you think Nanotechnology is. **Materials/Supplies/Resources**: Handouts/Website: www.nano.gov www.nnin.org cnst.rice.edu/whatshot.cfm www.ccmr.cornell.edu/education/ask/ www.nsec.northwestern.edu/education.htm

		Enrichment/Reinforcement: **Nanotech Online** **<u>The discovery of buckminsterfullerenes (buckyball – C_{60})</u>** • Read how buckyball was discovered by Richard E. Smalley, Robert F. Curl and Harold W. Kroto in 1985 at Rice University. • List the reasons why they conducted the study.

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TEKS No.	**TEKS Objective**	**Lesson Focus**
120.26	· Format all pages of a report, including a title page, a reference page, and bibliography	**UNIT 2: How is Nanotechnology Applied?** • Introduction • Viewing Website/Handout • Vocabulary Building/Development • Discuss/Key Vocabulary **Key Concepts:** • Doing Nanotechnology/Scientific methodology • How companies select products to manufacture • Clinical trials • Marketing Nanotechnology products • Careers in Nanotechnology • Nanotechnology workplace • Salary range/Stock options
120.82	· Identify employers' expectations, appropriate work habits, and good citizenship skills	**Activity 1** • Using prior information (from Unit 1) go to a job finding website and identify the role of Nanotechnology in modern society • Create a table comparing company requirements, duties, salaries
	·Express thoughts logically and sequentially in preparing a formal report	**Activity 2** • Oral presentation of findings in your table from Activity 1
120.26	· Demonstrate mastery of basic grammar, including use of grammar, including use of punctuation marks, keying of numbers and symbols, and capitalization when composing.	**Assessment:** Based upon student performance – oral/electronic - rubric **Materials/Supplies/Resources**: Handouts/Website: www.nano.gov www.nnin.org cnst.rice.edu/whatshot.cfm www.ccmr.cornell.edu/education/ask/ www.nsec.northwestern.edu/education.htm **Enrichment/Reinforcement**: **Nanotech Online Finding "Hot" Jobs** • See www.biospace.com and www.sciencejobs.com for want ads for nanotechnology employment.

Instructional Planning Sheet

Course Name: Introduction to Nanotechnology for HS Credit – 1

TEKS No.	TEKS Objective	Lesson Focus **Unit 3: Basic chemistry and physics**
119.68 (c)(2)(A) (c)(2)(B)	• Knowledge of the basics of chemistry, physics and molecular and cell biology and the application of these principles in the nanotechnology industry • Demonstration of basic laboratory skills of nanotechnology	• Introduction • Viewing Film/Website/Handout • Vocabulary Building/Development/Discussion **Key Concepts:** • review structure of an atom • chemical bonds and carbon compounds (graphite, diamond and buckyball, nanotubes and various nanocompounds) • examine electromagnetic spectrum in relation to spectroscopy • Infrared (IR) spectroscopy: Feel the heat • Raman spectroscopy: Where's the energy? • UltraViolet-Visible spectroscopy: What's there? • Atomic force microscope (AFM) • Scanning electron microscope (SEM) • Transmission electron microscope (TEM) • Scanning tunneling microscope • Magnetic resonance force microscope (MRFM) **Resources:** • Booker and Boysen. Nanotechnology for Dummies. 2005. Wiley Publishing, Inc. • Ellyn Daugherty. Biotechnology – Science for the New Millennium. Paradigm Publishing. 2007. **Field Trip to Rice University (1 Day):** • Visit Rice Central Equipment Lab • Visit various nanotechnology research labs **Nanotechnology Lab 1 - Laboratory Techniques (2 days)** **Making liquid crystal** • Lab safety • Clean techniques • Pipetting and titrating skills • Converting units • Making solutions • Solutions of a given mass/volume concentration • Solutions of differing % mass/volume concentration • Dilutions of concentrated solutions **Enrichment/Reinforcement: Nanotech Online**

		<u>Nanomedicine brings hope to patients</u> • Go on the web to learn how much a nanotechnology product can improve a patient's life. Select a story to read and summarize. **<u>Bioethics</u>** • Essay writing: Is honesty always the best policy? – Cancer research based on Nanotechnology. **Assessment/Evaluation:** • Unit test – multiple choice questions

Instructional Planning Sheet

Course Name: Introduction to Nanotechnology for HS Credit – 1

TEKS No.	TEKS Objective	Lesson Focus **Unit 4: Cell Biology and Membranes**
119.68 (c)(2)(A) (c)(2)(B)	• Knowledge of the basics of cell biology and the application of these principles in the nanotechnology industry • Demonstration of basic laboratory skills of nanotechnology	• Introduction • Viewing Website/Handout • Vocabulary Building/Development/Discussion **Key Concepts:** • Cell organelles • Membrane structure and function • Movement through membranes • Formation of cell membranes • Membrane transport mechanisms • Membrane roles in energy transfer **Resources:** • Cambell and Reece. Biology – 6th edition, 2007. Benjamin Cummings Press. • Textbook's website, www.campbellbiology.com. AP virtual school site, www.apexvs.com. • Ellyn Daugherty. Biotechnology – Science for the New Millennium. Paradigm Publishing. 2007. • Teaching DVD: Encore Version 1.0 **Nanotechnology Lab 3 (2 Days)** • Investigating organelle structure and function with electron micrographs and model building • Investigating nanomoleclues and function with electron micrographs and model building **Nanotechnology In Medicine Lab 4 (2 Days)** • Simulating killing cancerous cells with nanoshell • The process doctors use to arrive at diagnoses based on nanoimaging (nanoscattering) **Enrichment/Reinforcement: Nanotech Online** **Nanosensors and nano test tubes!** • Conduct a web research on the latest breakthrough in nanosensors and nanotesttubes. • Write a report of your findings. **Assessment:** • Unit test – multiple choice questions

Instructional Planning Sheet

Course Name: Introduction to Nanotechnology for HS. Credit – 1 Semester Hour

TEKS No.	TEKS Objective	Lesson Focus **Unit 12: Other Advances and Applications of Nanotechnology**
119.68 (c)(2)(A) (c)(2)(B)	• Knowledge of the basics of molecular biology and the application of these principles in the nanotechnology industry	• Introduction • Viewing Film/Website/Handout • Vocabulary Building/Development/Discussion **Key Concepts:** • RNA Interference and Genomics? • Stem Cell Research? • Forensics Science • Environmental remediation • Regulatory Aspects and Ethical Issues of Nanotechnology **Assignment 1: <u>"Party Bacteria…..Green Party That Is"</u>** • Genetically engineered bacteria are released during an oil spill to help breakdown and remove the oil pollutant. The use of bacteria and other organisms to restore environmental conditions is called **bioremediation**. Other applications include greenhouse effect and soil pollution. Compare and contrast environmental remediation using Nanotechnology and bioremediation • Go to www/school.discovery.com/lessonplans/programs/understanding-bacteria. Find and read "Oil Spill Lunch" and answer the questions. **Assessment:** • No unit test