Understanding by Design

6-Page Template, Page 1

Unit Title: __ Nanotechnology and Chemistry       Grade Levels: __10-12_____

Topic/Subject Areas: ___Chemistry I ____________________________

Key Words: _______________________________________________________

Designed By: _Lorri Hurst and Beth Suggs_____ Time Frame: _ Throughout year

School District: __Burke County_____ School: __Burke County High School_____

Brief Summary of Unit (including curricular context and unit goals):

Thread the concept of nanotechnology throughout the year by incorporating a minimum of one day every three weeks. The plan:
- August-Introduction to nanoscale and nanotechnology
- September- Periodic Trends using nanoscale and nanotechnology
- October-Stations to spark more interest
- November-Solubility on the nanoscale
- December-Reaction rates on the nanoscale
- January=Solids, liquids and gases on the nanoscale
- March-Solutions on nanoscale
- April-Acids and Bases on the nanoscale

The goal is to expose the student in Burke County to nanoscale and nanotechnology in hopes of sparking interest in industry (local, national or international) since there are multiple industries in Burke County that use nanoscale technology.

Unit design status:  □ Completed template pages – stages 1, 2, 3

□ Completed blueprint for each performance task       □ Completed rubrics
□ Directions to students and teacher       □ Materials and resources listed
□ Suggested accommodations       □ Suggested extensions

Status: □ Initial draft (date: ____________)       ○ Revised draft (date: ____________)
□ Peer Reviewed □ Content Reviewed □ Field Tested □ Validated □ Anchored
Established Goals:

SC1 Students will analyze the nature of matter and its classifications. a. Identify substances based on chemical and physical properties.
SC3 Students will use the modern atomic theory to explain the characteristics of atoms. a. Discriminate between the relative size, charge, and position of protons, neutrons, and electrons in the atom. b. Use the orbital configuration of neutral atoms to explain its effect on the atom’s chemical properties. e. Compare and contrast types of chemical bonds (i.e. ionic, covalent). f. Relate light emission and the movement of electrons to element identification.
SC4 Students will use the organization of the Periodic Table to predict properties of elements. a. Use the Periodic Table to predict periodic trends including atomic radii, ionic radii, ionization energy, and electronegativity of various elements. b. Compare and contrast trends in the chemical and physical properties of elements and their placement on the Periodic Table.
SC6 Students will understand the effects motion of atoms and molecules in chemical and physical processes. a. Compare and contrast atomic/molecular motion in solids, liquids, gases, and plasmas. b. Collect data and calculate the amount of heat given off or taken in by chemical or physical processes.
SC7 Students will characterize the properties that describe solutions and the nature of acids and bases. a. Explain the process of dissolving in terms of solute/solvent interactions: • Observe factors that effect the rate at which a solute dissolves in a specific solvent, • Express concentrations as molarities, • Prepare and properly label solutions of specified molar concentration, • Relate molality to colligative properties.

What understandings are desired?

Students will understand that:
- nanoscale technology impacts the structure of matter.
- nanoscale technology affects them in real life.
- nanoscale technology has interdisciplinary effects.
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What essential questions will be considered?

Due to the threading of the information there will be multiple essential questions:
- How small is nanoscale technology?
- How is nanoscale technology studied?
- How do forces at the nanoscale level alter our knowledge?
- Why do atoms act differently than the actual object?

Overarching Essential for all of the threading:
- Why does the invention of nanoscale technology impact you as a student in Burke County High School?

What key knowledge and skills will students acquire as a result of this unit?

Students will know...
- The size of nanoscale technology
- The methods of study for nanoscale technology
- That forces exist at the nanoscale level
- That matter is made up of atoms of varying sizes

Students will be able to...
- Correctly compare nanoscale technology to regular measurement systems
- Identify equipment and materials used for studying nanoscale technology
- Identify the effects of the forces applied at the nanoscale level
- Explain the difference in atomic behavior and the behavior of the macroscale product
Stage 2 – Determine acceptable Evidence

What evidence will show that students understand?

Performance Task*
An ABC Book which will contain the following:
- Word and picture
- How is this used in the nanoscale world?
- What variety of applications from the nanoscale world might affect you?
- List at least 3 areas this particular type of nanoscale technology is used in or derived from.
- Is it a greater benefit or risk? Explain.
- List 2 other significant facts or points of interest.

*Incentive to excel throughout the study of nanoscale technology will include:
- Students with an A will be allowed to omit 9 letters of their choosing
- Students with a B will be allowed to omit 7 letters of their choosing
- Students with a C will be allowed to omit 5 letters of their choosing
- Students with less than a C will be allowed to omit 3 letters of their choosing

*Complete a Performance Tasks Blueprint for each task (next page)

Other Evidence (quizzes, tests, prompts, observations, dialogues, work samples)

- the nanoscale technology will be included in the regular quizzes, tests, etc. for the class
- tickets out the door
- lab reports and other written activities throughout the thread
- observations during activities threaded throughout the year
- conversations to correct the misconceptions continuously when spotted

Student Self-Assessment and Reflection:

- with the thread throughout the year, the students will be in groups and discuss with each other the different nanoscale technologies incorporated, as well as the various activities from the regular content of the class
- students will complete a “Make Beliefs Comix” to share with others their understanding of nanoscale technology
- as part of the stations the students will do in October, students will complete a reflection of how each station could be beneficial in their own lives
- as part of the performance task (ABC book), students will have a classmate provide feedback on the content of the ABC book as part of the rubric
### Performance Task Blueprint

**What understandings and goals will be assessed through this task?**

- Students will understand that a variety of applications of nanoscale technology exists in the real world.
- Student understanding will be enhanced through the interdisciplinary effects of nanoscale technology.

**What criteria are implied in the standards and understandings *regardless* of the task specifics?**

- Student will demonstrate proficient knowledge of:
  - Scale/size comparison
  - Differences in properties between nanoscale and macroscale
  - Differences in movement of particles between nanoscale and macroscale

- Student must be able to show real life uses and interdisciplinary connections for the variety of nanoscale technologies identified in the ABC book.

**Through what authentic performance task will students demonstrate understanding?**

An ABC Book which will contain the following:
- Word and picture
- How is this used in the nanoscale world?
- What variety of applications from the nanoscale world might affect you?
- List at least 3 areas this particular type of nanoscale technology is used in or derived from.
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**What student products and performances will provide evidence of desired understanding?**

- **Product:** ABC Book
- **Performances:** Students will show the connection to real life examples and applications that would personally impact their lives.

**By what criteria will student products and performances be evaluated?**

- **See Rubric**
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Stage 3 – Plan Learning Experiences and Instruction