- CH.1.01
- Week 01 - Week 02

  Comment(s):
  Learning Outcome: Describe what characterizes science and its methods and use a quantitative observation with measurement by SI units.
  Key Concepts:

  - 1. Science.
  - 2. Scientific methods.
  - 3. Scientific law.
  - 4. Scientific theory.
  - 5. Relations between variables.
  - 6. Uncertainty.
  - 7. SI units.
  - 8. Instrumentation (precision, accuracy, significant figures).
  - 9. Types of variables.
  - 10. Density.
  - 11. Specific gravity.

    Skills: 1. Use laboratory equipment to get measurement data 2. Represent data on data tables and graphs correctly 3. Differentiate scientific from non-scientific reasoning 4. Develop a chart of main processes in scientific thinking 5. Demonstrate proper use of quantitative instrumentation 6. Conduct and analyze series of measurements 7. Evaluate scientific reports as to their use of quantitative instruments reporting and analysis of findings. 8. Determine number of significant figures 9. Measure and calculate densities of materials 10. Compare densities of solids, regular and irregular and liquid materials by their behavior and gross observation

    Essential Questions: What if everyone in the government used the scientific method to analyze and solve society’s problems, and politics were never involved in the solutions? How would this be different from the present situation, and would it be better or worse?

    Textbook and Resource Materials: What if everyone in the government used the scientific method to analyze and solve society’s problems, and politics were never involved in the solutions? How would this be different from the present situation, and would it be better or worse?

    Evidence of Learning: R: Students will ABLE TO GIVE DEFINITION FOR SCIENCE. BA: Represent in graph the relation between pressure and volume of the gas at the room temp. BA: How chemistry can help in digging tunnels and collapse old buildings quickly and safely. ST: Students will read two brief articles and develop an argument using examples to justify their decision as to which is based on scientific and which is based on non-scientific reasoning. BA: Zumdahl Chemistry (exercise page 32 and 4 to 5) Lab Write-up

    Capstone Connection: Use of measurement and use of scientific method to make decisions in design
    Relations: ME.1.01; (Study the scientific concepts and graph parameters. MA.1.05; (Variables) BIO.1.02; (Measurement and SI units) PH. 1.01; () PH. 1.05; ()

- CH.1.02
  Week 03 - Week 04

  Comment(s):

  Learning Outcome: Demonstrate understanding of atomic structure, subatomic particles, their arrangements and the evidence that scientists that enabled scientists to discover them.

  Key Concepts:

    - 1. Atoms.
    - 2. Atomic Structure.
    - 3. Isotopes.
    - 4. Isobar.
    - 5. Isotones.
    - 6. Alpha.
    - 7. Beta.
    - 8. Gamma.

      Skills: 1. Explore 2. Measure 3. Measure and filter 4. Compare data 5. Test theory 6. Apply concept to data 7. Determine behavior of cathode ray 8. Develop historical story of the discovery of current atomic theory

      Essential Questions: How is an atom similar to and different from a solar system?

      Textbook and Resource Materials: How is an atom similar to and different from a solar system?

      Evidence of Learning: Lab BA: design a model for the atom SA: Compare and contrast contemporary understanding of the atom with the solar system

      Capstone Connection:

      Relations: ES.1.02; (Chemical structure, mixture, parameters of compounds like minerals, chemical reactions and intermolecular and intramolecular forces, respectively.) ES.1.04; () ES.1.05; () ES.1.06; (Chemical structure, types of bonds and parameters of mixtures.) ES.1.08; (The stoichiometry of mineral ores.) BIO.1.02; (Structure and Functions) MA.1.05; (Structure and Functions)

      SEC Topic & Code: HSST-CH 1.02; HSST-CH 1.11

- CH.1.03 -
  Week 05 - Week 06

  Comment(s):

  Learning Outcome: Demonstrate their understanding of the electromagnetic spectrum and the particle nature of light by explaining how atoms of different elements are able to produce light of different colors.

  Key Concepts:

    - 1. Electron configuration.
    - 2. Valence numbers.
    - 3. Quantum numbers.
    - 4. Electromagnetic spectrum.
    - 5. Frequency.
    - 6. Wavelength.
    - 7. Photon Absorption.
    - 8. Emission.
    - 9. Energy, frequency and wavelength relations.
    - 10. Photoelectric phenomenon.
    - 11. Flame test.
    - 12. Excited state.

      Skills: 1. Conduct spectral analysis 2. Use correct laboratory producers to conduct flame test to identify metal ions 3. Explain emission of light by electrons in terms of ground and excited states

      Essential Questions: How do fireworks create different colors?

      Textbook and Resource Materials: How do fireworks create different colors?

      Evidence of Learning: Conduct flame tests to determine the identity of different elements. Explain photoelectric effect

      Capstone Connection: Material properties of building materials (and paints and other surface treatments) impact how light energy is reflected or absorbed, impacting the thermal properties of the dwelling.

      Relations:

      SEC Topic & Code: HSST-CH 1.02

- CH.1.04 -

  Week 07 - Week 08

  Comment(s):

  Learning Outcome: Through laboratory investigations develop operational definitions of chemical elements, differentiate between metals/nonmetals and chemical and physical properties of unknown elements based on their position and atomic structures in the periodic table.

  Key Concepts:

  - 1. Structure of the periodic table.
  - 2. Trends and Periodicity.
  - 3. Atomic Radius.
  - 4. Ionization Energy.
  - 5. Electronegativity.
  - 6. Electron Affinity.
  - 7. Metal, nonmetal and metalloid.
  - 8. Electron affinity.

    Skills: 1. Draw and describe simple electronic configuration. 2. Describe the basis of the arrangement of elements 3. Use the periodic table to predict the properties of elements 4. Distinguish between metals and non-metals according to appearance

    Essential Questions: What are the ways that people can sort a variety of things?

    Textbook and Resource Materials: What are the ways that people can sort a variety of things?

    Evidence of Learning: R: Students cans describe how elements are named R: Students cans describe how elements are grouped R: Students can differentiate between atomic mass and atomic number R: Differentiate between metals and nonmetals, and chemical and physical properties and can identify regions on the periodic table where different types of elements are located BA: Relate laboratory observations of chemical and physical properties of elements to their position in the Periodic Table. BA: Experimentally determine the chemical properties of the oxides of metals and non-metals and relate to electron configuration and placement in the periodic table. ST: Students can identify the application of metals in real life and explain how properties relate

    Capstone Connection: Differentiate between chemical and physical properties, metals and non-metals when thinking about construction materials for structure.

    Relations: MA.1.05; (Using step function way in the trends of the periodic table)

    SEC Topic & Code: HSST-CH 1.02

Organic Chemistry

- CH.1.05
  Week 09 - Week10

  Comment(s): Zumdahl Ch 8 may be a good reference for the teacher, but not for students. Section 6, for instance, talks about electronegativity, but that is referred to in section 8.2. Zumdahl Ch 22 Section 1 is ok as long as this does not turn into simply a memorization activity. Section 4 is far too technical for students at this point and goes way beyond the learning outcome. I don't know what the reference is to Sec 29, as there is no chapter or section of this number. Again, I think this resource is better for the teacher as a resource and not for students

  Learning Outcome: Describe how to determine chemical behavior according to valence electrons and how and why atoms interact with each other.

  Key Concepts:

    - 1. Chemical bond.
    - 2. Ionic and Covalent bond.
    - 3. Electron dot diagram.
    - 4. Nomenclature of alkanes (IUPAC common name).
    - 5. Isomers of alkanes.
    - 6. Cis and Trans.
    - 7. Structure Isomers and Chains.

      Skills: 1. Correlate electron configuration with ionization energies and chemical properties 2. Determine valence numbers from electron configuration 3. Compare organization of the periodic table according to valence numbers with physical and chemical properties and predict formulas for binary compounds 4. Contrast ionic bonding and covalent bonding 5. Draw electron-dot diagrams for simple molecules with covalent bonding and ionic bonding 6. Student can compare between organic and inorganic substance 7. Detect practically C and H in organic substance 8. Distinguish between molecular, structural and empirical formula 9. Draw formulas for isomers of a compound. (structure chain, cis and trans) 10. Name simple alkanes according to IUPAC nomenclature rules

      Essential Questions: Why and how do things react?
      Textbook and Resource Materials: Why and how do things react?

      Evidence of Learning: -Students can describe and give explanations for the chemical behaviors of elements. -Students are able to explain which element of a pair has the more stable electron arrangement. -Students can explain relative sizes of first, second, and third ionization energies of an element. -Students are able to explain the difference between ionic and covalent bonding. -Students are able to draw electron-dot diagrams for several compounds. -Exercise in Zumdahl Chemistry (22.1 - 22.2 - 22.3 - 22.4 - 22.5 - 22.6)
      Capstone Connection: Organic materials have unique chemical and physical properties based on molecular bonding
      Relations: ES.1.10; (Principles of organic chemistry and use it in the minerals and rocks.) ES.1.04; () ES.1.05; () ES.1.06; (Chemical structure, types of bonds and parameters of mixtures.)
      SEC Topic & Code: HSST-CH 1.03; HSST-CH 2.09

Nuclear Chemistry

- CH.1.06
  Week 11 - Week 12

  Comment(s):

  Learning Outcome: Select and use data to construct an argument for the existence of strong nuclear forces.

  Key Concepts:

    - 1. Radioactive.
    - 2. Unstable Atoms.
    - 3. Fusion reaction.
    - 4. Fission reaction.
    - 5. Half-life.
    - 6. Nuclear forces.

      Skills: 1. Research the properties of major nuclear particles 2. Explain what isotopes are and why some are stable and some not 3. Interpret and use symbolic representation of isotopes 4. Calculate the average atomic mass of an element from the percent abundance of its isotopes 5. Define half-life and use decay rates to solve simple decay problems 6. Draw inference of nuclear forces based on the repulsion of like charges.

      Essential Questions: What makes things radioactive?

      Textbook and Resource Materials: What makes things radioactive?

      Evidence of Learning: R: Students use examples and explanation to differentiate fission and fusion BA: Students are able to calculate average atomic mass and explain why atomic masses are not always whole numbers. ST: Students create a data-based argument for the presence of the strong nuclear force

      Capstone Connection: Students understand that attractive and repulsive forces are at work in all materials and are responsible for the physical and chemical properties of materials.

      Relations: ME.1.05; () Me.1.09; (Acceleration of particles and using it in different fields such as Nuclear Chemistry.)

      SEC Topic & Code: HSST-CH 1.11

Introduction to Chemical Reactions

- CH.1.07
  Week 13 - Week 14

  Comment(s):

  Learning Outcome: Explain how the physical properties of different types of elements, compounds and groups of elements (in both normal and nanosize) can be used to identify them and can be used in commercial applications.

  Key Concepts:

  - 1. Element.
  - 2. Compound.
  - 3. Electrolysis.
  - 4. Chemical formula.
  - 5. Chemical equation.
  - 6. Law of Conservation of Mass.
  - 7. Temperature.
  - 8. Kinetic energy.
  - 9. Vaporization.
  - 10. Sublimation.
  - 11. Heating Curve of Water.

    Skills: 1. Decompose water by electrolysis a. Test elements to determine identity b. Determine chemical formula by relative volume of gases produced 2. Compare properties of elements with compounds 3. Burn measured quantity magnesium and determine chemical formula of magnesium oxide 4. Write and interpret chemical formulas 5. Demonstrate safe laboratory practices 6. Describe the States of Matter: Solid, Liquid, and Gas 7. Explain the purpose of balancing a chemical equation. 8. Relate balancing an equation to the Law of Conservation of Matter. 9. Differentiate chemical from mathematical equations - how similar, how different 10. Balance a chemical equation.

    Essential Questions: Why are chemical symbols like letters and compounds like words? How is a chemical equation like a sentence?

    Textbook and Resource Materials: Why are chemical symbols like letters and compounds like words? How is a chemical equation like a sentence?

    Evidence of Learning: -Students isolate hydrogen and oxygen products by electrolysis of water in expected ratio and analyze findings. -Students conduct appropriate tests to identify hydrogen and oxygen. -Students are able to create flipbooks that depict particle movement. Animations of solid and liquid match description required. -Students collect data and correctly graph a heating curve for water. -Students observe and identify various changes of state and can explain the causes of phase change in terms of addition or removal of heat energy. -Students correctly identify the energy transformations occurring in different segments of a heating curve for a material. -Students are able to explain how the addition of heat changes the volume of air and why the piston moves.

    Capstone Connection: Material properties at Nano and Macro levels impact

effectiveness for different roles of different building needs (eg. support material vs. connectors, roof vs. foundation, conductors vs. insulators vs. crystalline vs. transparent, etc.).

Relations: MA.1.05; (Using function and relation from math in the gas law studies.)

SEC Topic & Code: HSST-CH 1.03; HSST-CH 1.08; HSST-CH 3.04.