Biology
Theme: Introduction/Chemistry
Timeline: 4 weeks

Inquiry Questions:
1. How are rates of enzyme activity in cells affected by various factors such as pH or temperature?
2. How does one know that enzymes speed up chemical reactions?
3. What are the building blocks of each biomolecule, and how is each digested and utilized within a living organism?

Vocabulary:
- adhesion
- carbohydrate
- atoms
- pH
- surface tension
- lipid
- molecules
- buffer
- enzyme
- nucleic acid
- bond
- polar
- denature
- digestion
- acid
- electronegativity
- protein
- hydrolysis
- base
- cohesion

Standard: 3
Grade Level Expectations (GLE):
- Cellular metabolic activities are carried out by biomolecules produced by organisms.
- Cells, tissues, organs, and organ systems maintain relatively stable internal environments, even in the face of changing external environments.

Assessments

Common Assessment 1
Analysis of Enzyme Action in Digestion

Labs/Activities
- Starch & Spit Lab/Liver Lab
- Penny Activity/Needle Activity
- Cabbage Juice Lab/Household Products Lab
- Fish Dissection
- Trash Bag Simulation

Evidence Outcomes
- Identify biomolecules and their precursors/building blocks.
- Develop, communicate, and justify an evidence-based explanation that biomolecules follow the same rules of chemistry as any other molecule.
- Develop, communicate, and justify an evidence-based explanation regarding the optimal conditions required for enzyme activity.
- Infer the consequences to organisms of suboptimal enzyme function - such as altered blood pH or high fever - using direct and indirect evidence.
- Analyze and interpret data on the body’s utilization of carbohydrates, lipids, and proteins.

Instruction
- Introduction (Expectations and relationship building)/Chemistry of Life Unit
  - Homeostasis (theme) - Lab on Scientific Method/Experimental Design
  - Chemistry of Life
    - Atoms, Molecules, Bonds
      - Lecture, Cornell Notes, Review
    - Biological Molecules (Biomolecules/Macromolecules)
      - Polymers (Paper Chain Demo and or Create a Gift Lab)
      - Carbohydrates (Benedict’s Test for Simple Sugars/Iodine Test for Starch)
      - Proteins/Enzymes (Biuret Test for Protein and Enzyme Activity Lab using a carbohydrate test)
        - Starch/Spit Lab or Liver Lab
      - Lipids (Paper Bag Test)
      - Nucleic Acids (Strawberry DNA Lab also in Unit 3 DNA Replication)
    - Properties of Water
      - Penny or Needle Activity (surface tension/hydrogen bonding)
      - Demos of other properties (solubility, heat capacity, density in phase changes)
    - Acids, Bases, pH scale
      - Cabbage Juice or Household Products Lab
    - Digestive System in Animals
      - Major Organs
        - Fish Dissection
      - Chemical Digestion and Absorption
<table>
<thead>
<tr>
<th>Resources:</th>
<th>Trash Bag Simulation</th>
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<tbody>
<tr>
<td>Macromolecule and Enzyme Labs: test tubes, test tube holders, test tube racks, droppers, beakers, hot plates, ice, plastic tubs, Benedict’s Solution, iodine, Biuret Solution, starch, simple sugar, protein sample, liver, crackers, water</td>
<td>Common Assessment 1: Enzyme Activity in the Digestive System</td>
</tr>
<tr>
<td>Penny/Needle activity: droppers, pennies, needles, water, cups, soap</td>
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<tr>
<td>Cabbage Juice/Household Items Lab: red cabbage, blender, beakers, strainer/filter paper, droppers, various pH solutions or household items (in solution), pH paper (litmus)</td>
<td></td>
</tr>
<tr>
<td>Fish Dissection: Fish, dissection kits, dissection trays, dissection guide</td>
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<tr>
<td>Trash Bag Simulation: Trash bags, spray bottles, zip lock bags, M&amp;M's, newspaper</td>
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</tr>
<tr>
<td>Demonstrations: Pipe cleaners for enzyme structure and denaturing, Acid/Heat on the Egg for Denaturing, Eating a cracker, Paper Chain Polymers, Feed Classroom animals, Butcher Paper Person Outline (for body systems), Jar of oil and water (dyed)</td>
<td></td>
</tr>
</tbody>
</table>
**Theme:** Cells & Division of Labor (Energetics/Transport)  
**Timeline:** 8 weeks

**Inquiry Questions:**
1. What energy transformations occur in cells?  
2. How is carbon cycled through living organisms?  
3. What variables can be manipulated to change the rate of photosynthesis?  
4. What variables affect the rate of cell respiration?  
5. How does body heat relate to cellular respiration?  
6. What variables affect the rate of transport across a membrane?  
7. Why is it important that cell membranes are selectively permeable?

**Vocabulary:**
- Organelle  
- Prokaryotic  
- Eukaryotic  
- Aerobic  
- Anaerobic  
- Fermentation  
- Mitochondria  
- Glycolysis  
- Krebs’s Cycle  
- Electron Transport Chain  
- Calvin Cycle  
- Light Dependent/Independent Reactions  
- Chloroplast  
- Chlorophyll  
- Pigment  
- Osmosis  
- Diffusion  
- Plasma Membrane  
- Lipid Bilayer  
- Phospholipid  
- Turgor Pressure  
- Iso/Hypo/Hyper tonic  
- Gradient

**Standard:** 3  
**Grade Level Expectations (GLE):**
- Matter tends to be cycled within an ecosystem, while energy is transformed and eventually exits an ecosystem.  
- Cellular metabolic activities are carried out by biomolecules produced by organisms.  
- The energy for life primarily derives from the interrelated processes of photosynthesis and cellular respiration. Photosynthesis transforms the sun’s light energy into the chemical energy of molecular bonds. Cellular respiration allows cells to utilize chemical energy when these bonds are broken.  
- Cells use the passive and active transport of substances across membranes to maintain relatively stable intracellular environments.  
- Cells, tissues, organs, and organ systems maintain relatively stable internal environments, even in the face of changing external environments.

**Assessments**

<table>
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<tr>
<th>Performance Tasks</th>
<th>Evidence Outcomes</th>
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</table>
| Common Assessment 2  
Yeast Cell Respiration or Cell Transport | Define and distinguish between matter and energy, and how they are cycled or lost through life processes  
Describe how carbon, nitrogen, phosphorus, and water cycles work  
Develop, communicate, and justify an evidence-based scientific explanation the optimal environment for photosynthetic activity  
Discuss the interdependence of autotrophic and heterotrophic life forms such as depicting the flow of a carbon atom from the atmosphere, to a leaf, through the food chain, and back to the atmosphere  
Explain how carbon compounds are gradually oxidized to provide energy in the form of adenosine triphosphate (ATP), which drives many chemical reactions in the cell  
Analyze and interpret data to determine the energy requirements and/or rates of substance transport across cell membranes.  
Compare organisms that live in freshwater and marine environments, and identify the challenges of osmotic regulation for these organisms.  
Diagram the cell membrane schematically, and highlight receptor proteins as targets of hormones, neurotransmitters, or drugs that serve as active links between intra and extracellular environments.  
Use tools to gather, view, analyze, and interpret data produced | Cells and the Division of Labor  
- Cell Structure and Function (Theme)  
- Energetics  
  o Cellular Respiration  
    ▪ Bean Respiration Lab  
    ▪ Muscles (# of mitochondria in muscle cells, types of muscle cells)  
  o Photosynthesis  
    ▪ Leaf Disk Lab or Elodea Lab  
    ✓ Flow of Carbon  
    ✓ Structure of Leaves in Plants (Leaf Dissection)  
- Common Assessment 2: Photosynthesis Data Analysis and Inquiry Lab Design  
- Membrane Transport (computer Simulations/videos)  
  o Passive Transport  
    ▪ Carrot/Potato Lab  
    ✓ Movement of water in plants  
      ▪ Roots, Leaves, Stems  
      ▪ Turgor Pressure  
  o Active Transport  
    ▪ Pumps, Endo/Exocytosis |
during scientific investigations that involve passive and active transport.
  - Use computer simulations and models to analyze cell transport mechanisms.
  - Identify biomolecules and their precursors/building blocks.
  - Develop, communicate, and justify an evidence-based explanation that biomolecules follow the same rules of chemistry as any other molecule.
  - Infer the consequences to organisms of suboptimal enzyme function - such as altered blood pH or high fever - using direct and indirect evidence.
  - Analyze and interpret data on the body’s utilization of carbohydrates, lipids, and proteins.
  - Analyze and interpret data on homeostatic mechanisms using direct and indirect evidence to develop and support claims about the effectiveness of feedback loops to maintain homeostasis.
  - Distinguish between causation and correlation in epidemiological data, such as examining scientifically valid evidence regarding disrupted homeostasis in particular diseases.

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<th>Importance of Energy</th>
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<tr>
<td>Excretory Systems in Animals</td>
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<td>Major Organs</td>
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<td>Grasshopper Dissection</td>
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<td>Osmotic Regulation</td>
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<td>Salt water vs. Freshwater fish</td>
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</table>

### Classroom Assessment

#### Resources:
- **Bean Respiration Lab**: Beans, Test tubes, Water, Bromothymal Blue Indicator, CO₂ Probes
- **Leaf Disk Lab/Elodea lab**: Leaves (living), hole punch, water, baking soda, dish soap, cups, lamps, test tubes, Elodea plant
- **Carrot/Potato Lab**: carrots, potatoes, cups, salt or sugar solutions, scale
- **Grasshopper Dissection**: Grasshoppers to dissect, dissection kits, dissection trays, dissection guide
- **Videos**: *Magic School Bus*: “Gets Planted”, various educational videos in school library
- **Demonstrations**: Egg Transport, Dialysis Tubing, Beaker with food coloring, Agar Gel Cube Diffusion
### Theme: Cell Reproduction/One celled organisms

#### Inquiry Questions:
1. How are rates of enzyme activity in cells affected by temperature?
2. What is the role of the immune system in maintaining homeostasis?
3. How do cells form the lymphatic and cardiovascular systems play a role in immunity?
4. Why are human offspring not genetic clones of their parents or siblings?
5. How are DNA molecules replicated in all organisms?

#### Timeline: 4 weeks

#### Vocabulary:
- **diploid**
- **antibody**
- **binary fission**
- **chromatid**
- **cytokinesis**
- **monera**
- **mitosis**
- **DNA**
- **vaccine**
- **archaeabacteria**
- **meiosis**
- **gamete**
- **antibiotic**
- **extremophiles**
- **PMAT**
- **somatic cell**
- **pathogen**
- **eubacteria**
- **chromosome**
- **zygote**
- **antigen**
- **Protista**
- **binary fission**
- **mitosis**
- **meiosis**
- **PMAT**
- **chromosome**
- **chromatin**
- **zygote**
- **haploid**

### Standard: 3

#### Grade Level Expectations (GLE):
- Cellular metabolic activities are carried out by biomolecules produced by organisms.
- Cells, tissues, organs, and organ systems maintain relatively stable internal environments, even in the face of changing external environments.
- Physical and behavioral characteristics of an organism are influenced to varying degrees by heritable genes, many of which encode instructions for the production of proteins.

### Assessments

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<tr>
<th>Performance Tasks</th>
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<tr>
<td>DNA Replication Model</td>
<td>Infer the consequences to organisms of suboptimal enzyme function - such as altered blood pH or high fever - using direct and indirect evidence.</td>
<td>Cell Reproduction and Unicellular Organisms</td>
</tr>
</tbody>
</table>
| Paper Plate Mitosis/Prepared slides (onion root/white fish) | Discuss how two or more body systems interact to promote health for the whole organism. | - DNA Replication
  - DNA Models
  - Practice Problems
  - DNA Extraction (strawberry DNA Lab also in Unit 1 Macromolecules) |
| Bacteria/Protists Slides/Pond Water | Distinguish between causation and correlation in epidemiological data, such as examining scientifically valid evidence regarding disrupted homeostasis in particular diseases. | - Mitosis and Meiosis
  - Paper Plate Mitosis Activity
  - Venn Diagram/t-chart comparison and contrast of mitosis and meiosis |
| Semester Final Disease Project/Presentation | Analyze and interpret data on the processes of DNA replication, transcription, translation, and gene regulation, and show how these processes are the same in all organisms. | - Monerans (Archeabacteria/Eubacteria)/Protists
  - View prepared slides
  - Pond water samples for organism identification |
|                             | Evaluate data showing that offspring are not clones of their parents or siblings due to the meiotic processes of independent assortment of chromosomes, crossing over, and mutations. | - Immune System in Animals
  - Immune Responses
    - Relate to homeostasis and feedback loops |

### Resources:
- **DNA Models:** Packets (4 different nucleic acids, 4 sets of directions/questions), colored pencils, tape, scissors
- **Paper Plate Mitosis:** paper plates (4 or 5 per group), string, construction paper, colored pencils, markers, scissors, tape, glue
- **Bacteria/Protists Slides:** prepared slides of various bacteria and protists, microscopes, slides, coverslips, beakers, pond water samples, protist identification keys, microscope observation sheets
- **Videos:** *The Coming Plague, Understanding Bacteria, NOVA Evolution Series (TB multi-resistance)*, Various Mitosis/Meiosis Educational Videos in school library
- **Demonstrations:** Chromosome Fingers, Velcro (different colors), DNA sentences (THE DOG BIT THE CAT, PM = THE DOG BIT THE CAR, FS = THE DOB ITT HEC AT)
### Theme: Transfer of Information and Technology

#### Inquiry Questions:
1. **Why is it possible for a cell from one species to express genes from another species as in genetic modification of organisms?**
2. **Why are human offspring not genetic clones of their parents or siblings?**
3. **Why is it possible to clone a whole organism from an undifferentiated cell?**
4. **Why are stem cells sought by researchers as potential cures to medical problems?**
5. **Explain how genetic mutations and Cancer can be caused by a variety of environmental agents?**

#### Timeline: 8 weeks

<table>
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<th>Vocabulary:</th>
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<td>multiple alleles</td>
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<tr>
<td>sex-linkage</td>
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<tr>
<td>inheritance</td>
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<td>pedigree</td>
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<td>punnett square</td>
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<td>cloning</td>
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<td>stem cells</td>
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<td>genetic engineering</td>
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<td>gel electrophoresis</td>
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<td>polymerase chain reaction</td>
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<tr>
<td>protein synthesis</td>
</tr>
<tr>
<td>dna</td>
</tr>
<tr>
<td>rna (m, r, and t)</td>
</tr>
<tr>
<td>codon</td>
</tr>
<tr>
<td>anticodon</td>
</tr>
<tr>
<td>amino acid</td>
</tr>
<tr>
<td>mutation (point, frame shift, chromosomal)</td>
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<tr>
<td>cancer</td>
</tr>
</tbody>
</table>

### Standard: 3

#### Grade Level Expectations (GLE):
- Cellular metabolic activities are carried out by biomolecules produced by organisms.
- Cells, tissues, organs, and organ systems maintain relatively stable internal environments, even in the face of changing external environments.
- Physical and behavioral characteristics of an organism are influenced to varying degrees by heritable genes, many of which encode instructions for the production of proteins.
- Multicellularity makes possible a division of labor at the cellular level through the expression of select genes, but not the entire genome.

#### Assessments

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<td><strong>Labs/Activities</strong></td>
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<td>Genetic Problems</td>
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<td>Let’s Make a Baby Lab/Reebops</td>
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<td>Pedigree Analysis/Construction</td>
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<td>Genetic Disorder Research Project</td>
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<td>Cloning a Mouse Simulation</td>
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<tr>
<td>Paternity/Crime Scene DNA Analysis</td>
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<tr>
<td>Protein Synthesis Races/M&amp;M Activity</td>
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</table>

#### Evidence Outcomes

- Distinguish between causation and correlation in epidemiological data, such as examining scientifically valid evidence regarding disrupted homeostasis in particular diseases.
- Analyze and interpret data that genes are expressed portions of DNA.
- Analyze and interpret data on the processes of DNA replication, transcription, translation, and gene regulation, and show how these processes are the same in all organisms.
- Recognize that proteins carry out most cell activities and mediate the effect of genes on physical and behavioral traits in an organism.
- Evaluate data showing that offspring are not clones of their parents or siblings due to the meiotic processes of independent assortment of chromosomes, crossing over, and mutations.
- Explain using examples how genetic mutations can benefit, harm, or have neutral effects on an organism
- Develop, communicate, and justify an evidence-based conclusion

#### Instruction

- Genetics
  - Patterns of Inheritance
  - Probability and Punnett Squares
  - Let’s Make a Baby Lab/Reebops
  - Pedigree Analysis/Construction
- Genetic Disorders (Research Project and Presentation)
- Classroom Assessment
- Genetic Engineering
  - Cloning (Click and Clone a Mouse computer simulation)
  - Stem Cells
  - PCR
  - Electro Gel Phoresis (Paternity/Crime Scene Analysis)
- Gene Expression and Regulation
  - Protein Synthesis
  - Protein Synthesis Relay Races or M&M Activity
  - Mutations
  - Mutagens (Superhero Clips)
  - Cancer
| Scientific explanation of how cells form specialized tissues due to the expression of some genes and not others.  
- Analyze and interpret data that show most eukaryotic deoxyribonucleic acid (DNA) does not actively code for proteins within cells.  
- Develop, communicate, and justify an evidence-based scientific explanation for how a whole organism can be cloned from a differentiated - or adult - cell.  
- Analyze and interpret data on medical problems using direct and indirect evidence in developing and supporting claims that genetic mutations and cancer are brought about by exposure to environmental toxins, radiation, or smoking. | • Blood (Disorders/Types)  
  - Components of Blood  
  - Multiple Allele Inheritance  
**Common Assessment 3: Genetic Engineering Legislation Assessment** |

| **Resources:**  
Probabilities Lab: Pennies, Probability worksheet  
Genetics Problems: Punnett Square examples, Genetic problems worksheets  
Let’s Make a Baby Lab: Trait worksheet, Dominance/Recessive Key, pennies, Drawing paper, Colored Pencils, Markers  
Reebops: Pipe cleaners, toothpicks, large white marshmallows, colored and white small marshmallows, markers  
Pedigree Analysis/Construction: example pedigrees  
Cloning a Mouse Simulation: Worksheet, Weblink: [http://learn.genetics.utah.edu/content/tech/cloning/clickandclone/](http://learn.genetics.utah.edu/content/tech/cloning/clickandclone/)  
Videos: Designer Babies (Discover Channel), Clone (Nat. Geo.), Greatest Discoveries: Genetics (Bill Nye narrated), Superhero video clips for mutagens (Spider-Man, Green Goblin, Hulk, Fantastic 4), Monster Bug Wars (Discovery Channel)  
Demonstration: corn snakes live specimen activity, karyotypes |
## Theme: Evolution

### Inquiry Questions:
- How can a mutation cause change in a population?
- 1. How do subtle differences among closely-related fossil species provide evidence of environmental change and speciation?
- 2. How does studying extinct species contribute to our current understanding of evolution?
- 3. How can patterns of characteristics shared among organisms be used to categorize life's diversity according to relatedness?

### Timeline: 4 weeks

### Vocabulary:
- evolution
- Darwinism
- natural selection
- adaptation
- speciation
- population
- mutation

### Standard: 3

#### Grade Level Expectations (GLE):
- Physical and behavioral characteristics of an organism are influenced to varying degrees by heritable genes, many of which encode instructions for the production of proteins.
- Evolution occurs as the heritable characteristics of populations change across generations and can lead populations to become better adapted to their environment.

#### Assessments

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<td>Organisms Change Over Time</td>
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<td>• Evolution</td>
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<td><strong>Labs/Activities</strong></td>
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<td>o Darwin (Darwin Award Reading)</td>
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<tr>
<td>Darwin Awards</td>
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<td>o Natural Selection</td>
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<tr>
<td>Design an Organism</td>
<td></td>
<td>✓ Peppered Moths Lab</td>
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<tr>
<td>Peppered Moth Lab/Rabbit Phet Simulation</td>
<td></td>
<td>✓ Rabbits and Wolves Phet Simulation</td>
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<tr>
<td>DNA Homology (Gorilla Lab)</td>
<td></td>
<td>✓ Design an Organism</td>
</tr>
<tr>
<td>Salamander Speciation</td>
<td></td>
<td>o Evidence and Examples</td>
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<tr>
<td>Squid Dissection</td>
<td></td>
<td>✓ DNA Homology Lab (Gorilla Lab)</td>
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<td>✓ Vistigal Organs/Structures</td>
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<tr>
<td></td>
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<td>✓ Fossils</td>
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<td></td>
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<td>✓ Homologous Structures</td>
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</table>

#### Embryological Development
- Speciation
- Geographic and Reproductive Isolation
- California Salamander Speciation Lab
- Cardiovascular System in Animals
- Major Organs (Squid Dissection)
- Relation to evolution
- Open vs. Closed Circulatory System
- 2 vs. 3 vs. 4 Chambered Heart
- Cold vs. Warm Blooded

#### Common Assessment 4: Extended Constructed Response (ECR) on Evolution
Resources:
- **Darwin Award Reading**: Darwin Awards of various reading levels
- **Design an Organism**: Paper, colored pencils, markers, etc.
- **Peppered Moth Lab**: white paper & hole punch holes, newspaper & hole punch holes, Worksheet, Dry Lab with data included also available for absent students
- **DNA Homology Lab (Gorilla Lab)**: 4 different colors of paper clips in cups, worksheets, tape
- **Salamander Speciation Lab**: Directions sheet, questions sheet, grided maps of California, colored pencils, color maps of salamanders and their locations, color key of salamanders
- **Squid Dissection Lab**: Squid to dissect, dissection kits, dissection trays, dissection guide

Videos:
- The Future is Wild (Discover Channel)
- Neanderthal: The Rebirth (Discover Channel)
- Darwin’s Tree of Life (Discovery Channel)
- The Greatest Discoveries: Evolution (Bill Nye Narrated)
- NOVA Evolution Series (Great Transformations, Evolutionary Arms Race)
- Stan Lee’s Super Humans
- Cosmos (Carl Segan)
- clip on Samurai Crabs/Artificial Selection
- Idiocracy (beginning human evolution clip)

Demonstration: Vestigal Organ Examples, Structure Examples, Cladograms, Fossils
**Theme:** Ecology  
**Timeline:** 4 weeks

**Inquiry Questions:**
1. How does a change in abiotic factors influence the stability or progression of an ecosystem?
2. What happens when the cycling of matter in ecosystems is disrupted?
3. What energy transformations occur in ecosystems?
4. How do keystone species maintain balance in ecosystems?
5. How does the introduction of a non-native species influence the balance of an ecosystem?
6. How is the succession of local organisms altered in an area that is disturbed or destroyed?
7. What would be the possible consequences for an increase in human population for the planet?
8. In terms of carbon, explain how autotrophic and heterotrophic organisms are linked in terms of the food chain.

**Vocabulary:**
- biotic
- abiotic
- density dependent/independent factors
- biodiversity
- producer/consumer
- niche
- food web
- energy pyramid
- autotroph/heterotroph
- symbiosis
- predation
- community
- decomposition
- parasitism
- invasive species

**Standard:** 3  
**Grade Level Expectations (GLE):**
- Matter tends to be cycled within an ecosystem, while energy is transformed and eventually exits an ecosystem.
- The size and persistence of populations depend on their interactions with each other and on the abiotic factors in an ecosystem.
- The energy for life primarily derives from the interrelated processes of photosynthesis and cellular respiration. Photosynthesis transforms the sun’s light energy into the chemical energy of molecular bonds. Cellular respiration allows cells to utilize chemical energy when these bonds are broken.
- Cells, tissues, organs, and organ systems maintain relatively stable internal environments, even in the face of changing external environments.

**Assessments**

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| **Labs/Activities** | - Analyze how energy flows through trophic levels.  
   - Evaluate the potential ecological impacts of a plant-based or meat-based diet.  
   - Analyze and interpret data from experiments on ecosystems where matter such as fertilizer has been added or withdrawn such as through drought.  
   - Develop, communicate, and justify an evidence-based scientific explanation showing how ecosystems follow the laws of conservation of matter and energy.  
   - Define and distinguish between matter and energy, and how they are cycled or lost through life processes.  
   - Describe how carbon, nitrogen, phosphorus, and water cycles work.  
   - Use computer simulations to analyze how energy flows through trophic levels.  
   - Analyze and interpret data about the impact of removing keystone species from an ecosystem or introducing non-native species into an ecosystem.  
   - Describe or evaluate communities in terms of primary and secondary succession as they progress over time.  
| **Semester Final** | Biome Project/Presentation | Ecology  
   - Ecosystems  
     - Hierarchy of Organization (individuals, populations, communities, biomes, biosphere)  
     - Succession  
     - Primary vs. Secondary  
     - Climax Community  
   - Energy Flow (Energy Pyramid)  
     - Trophic Levels  
     - Food Chains and Food Webs  
   - Nutrient Cycles  
     - Fungi and other decomposers  
     - Mushroom dissection  
   - Effects of Fertilizer Use  
   - Biological Communities  
     - Relationships/Interactions (Biotic)  
     - Predator/Prey Lab  
     - Parasitic Worms  
     - Plant Pollination  

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High School Biology Curriculum Guide
- Evaluate data and assumptions regarding different scenarios for future human population growth and their projected consequences.
- Examine, evaluate, question, and ethically use information from a variety of sources and media to investigate ecosystem interactions.
- Discuss the interdependence of autotrophic and heterotrophic life forms such as depicting the flow of a carbon atom from the atmosphere, to a leaf, through the food chain, and back to the atmosphere.

Resources:
- **Mushroom Dissection**: Mushrooms to dissect, dissection kits, dissection trays, dissection guides
- **Predator/Prey Lab**: Plastic forks/knives/spoons, white beans, pinto beans, macaroni, dried green peas, rice, cups, carpet squares, timer(stopwatch), calculators
- **Flower Dissection**: Asterlomeria flowers to dissect, dissection kits, dissection trays, dissection guides, part collection/label sheet, microscopes, slides, water, coverslips
- **Frog Dissection**: Frogs to dissect, dissection kits, dissection trays, dissection guides, dissection guide answer sheets
- **PLC Biodiversity of Aquatic Organisms**: (Being created this year 2011-2012) but will most likely need transportation to PLC, Leaf Pack Bags, Leaf Litter, Rocks as weights, Biodiversity Field Notebook, Petri Dishes, Forceps, Classification keys
- **Nature Walk**: Area to go/view, worksheet

Videos:
- Life Without People (History)
- Mimic Octopus (Discovery Channel)
- The Future is Wild (Discovery Channel)
- Assignment Discovery: Biomes (30 minutes per Biome) (Discovery Channel)
- Life/Blue Planet/Planet Earth (BBC)
- The Private Life of Plants
- The Monsters Inside Me (Discovery Channel)

Demonstrations: Dominos on the overhead for density dependent/independent factors

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- **Flower Dissection**
  - Nervous System in Animals
    - Major Organs (Frog Dissection **Review other Systems**)”
    - Response to Stimuli Focus
  - Nature Walk - Ecology Review
**Poudre Learning Center Visits - Biodiversity of Aquatic Organisms (being worked on 2011-2012)**

Semester Final Assessment: Biome Project/Presentation
Chemistry
### Unit 1: Foundations of Chemistry, & Mathematical Skills

**Timeline:** 4 weeks

**Inquiry Questions:**
- What role do units play in problem solving?
- How can graphs be used to observe patterns and properties of matter?
- What do precision and accuracy tell us about a measurement or a series of measurements?

**Vocabulary:**
- matter, density, melting point, boiling point, conductivity, pH, atoms, molecules, compounds, physical and chemical properties, precision & accuracy, errors, units, significant figures, scientific notation

---

**Standard:** 1. Physical Science: Students know and understand common properties, forms and changes in matter and energy.

**Grade Level Expectations (GLE):**
- **Physical Science #2:** Matter has definite structure that determines characteristic physical and chemical properties.
- **Physical Science #4:** Atoms bond in different ways to form molecules and compounds that have definite properties.

**Assessments**
- Performance assessments on measurement, formative assessments on mathematical skills & foundation topics; summative assessment - 15 questions.

**Evidence Outcomes**
- Students will be able to (1.2.b): gather, analyze and interpret data on chemical and physical properties of elements such as density, melting point, boiling point, and conductivity.
- Students will be able to (1.2.c): use characteristic physical and chemical properties to develop predictions and supporting claims about elements’ positions on the periodic table.
- Students will be able to (1.4.b): gather, analyze, and interpret data on chemical and physical properties of different compounds such as density, melting point, boiling point, pH, and conductivity.

**Instruction**
- Lab/Activity: Over the Rainbow
- Lab/Activity: Thickness of a Metal Foil
- Lab/Activity: Identification of an Unknown Metal
- Lab/Activity: Accuracy, Precision & Error
- Activity: Using EXCEL
- Activity: Why Graph?
- Activities/Worksheets: Significant Figures and Scientific Notation
- Lab/Activity: Reaction in a Bag: Note: This activity can be used as part of Unit 1 or as a bridge to the next unit or as an introduction to Unit 2.

**Resources:**
- See individual lab/activity sheets.

*Bolded Text* = Potential assessment items
### Unit 2: Classification of Matter & Energy Relationships

**Timeline:** 2 weeks

**Inquiry Questions:**
- What evidence can indicate whether a change is physical or chemical & what are the accompanying energy changes/exchanges?
- What techniques can be used to separate mixtures of substances based on their properties?
- Which properties are the most useful in trying to separate mixtures of substances?

**Vocabulary:**
- Matter: atoms, elements, compounds, mixtures, substances, chromatography, physical & chemical properties, energy: endothermic vs. exothermic, heating curves, potential energy diagrams, potential vs. kinetic energy, system vs. surroundings

**Standard:** Physical Science: Students know and understand common properties, forms and changes in matter and energy.

**Grade Level Expectations (GLE):**
- GLE #2: Matter has definite structure that determines characteristic physical and chemical properties.
- GLE #3: Matter can change form through chemical or nuclear reaction abiding by the laws of conservation of mass and energy.

### Assessments
- Performance assessments on calorimetry & chromatography, formative assessments on mathematical skills of energy topics; summative assessment - 15 questions

### Evidence Outcomes
- Students will be able to.....(1.2.d) Develop a model that differentiates atoms and molecules, elements and compounds, and pure substances and mixtures.

### Instruction
- Lab/Activity: Elements_Compounds_Mixtures_v1
- Lab/Activity: Fig 1 for cutting 2009 2x per sheet (this is a sheet that is used in conjunction with the “Elements, Compounds, & Mixtures” Lab).
- Lab/Activity: M&M Chromatography Lab

### Resources:
- See individual lab/activity sheets.

**Bolded Text** = Potential assessment items
# Unit 3: Atomic Structure

**Timeline:** 3 weeks

**Inquiry Questions:**
- What patterns can be observed in the properties of elements and families in the periodic table?
- How have new technologies led to evidence that has helped develop our current understanding of atomic and molecular structure over time?
- What patterns of nuclear reactions exist?
- How are chemical reactions distinguished from nuclear reactions?

**Vocabulary:** matter: atoms, atomic & molecular structure, physical & chemical reactions, nuclear reactions, isotopes & half-life, physical & chemical properties, conservation of mass and energy, models of atoms

**Standard:** Physical Science: Students know and understand common properties, forms and changes in matter and energy.

**Grade Level Expectations (GLE):**
1.2: Matter has definite structure that determines characteristic physical and chemical properties.
1.3: Matter can change form through chemical or nuclear reactions abiding by the laws of conservation of mass and energy.

<table>
<thead>
<tr>
<th>Assessments</th>
<th>Evidence Outcomes</th>
<th>Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>formative assessments on atomic structure, balanced nuclear equations &amp; half-life; summative assessment -15 questions</td>
<td>Students will be able to... (1.2.a) develop, communicate, and justify an evidence-based scientific explanation supporting <strong>the current model of an atom.</strong>&lt;br&gt;&lt;br&gt;Students will be able to... (1.3.a) recognize, analyze, interpret, and balance chemical equations (synthesis, decomposition, combustion, and replacement) or nuclear equations (fusion and fission)&lt;br&gt;&lt;br&gt;Students will be able to .... (1.3.b) predict <strong>reactants and products</strong> for different types of chemical and nuclear reactions.</td>
<td>Possible PowerPoints that could be used:&lt;br&gt;AtomStructureHistorical Perspective2010&lt;br&gt;Modern AtomicTheory2010&lt;br&gt;Modern Atomic Theory ‘10 Handouts&lt;br&gt;Nuclear Reactions2010&lt;br&gt;Half Life problems 2009&lt;br&gt;Possible Activities That Can Be Used:&lt;br&gt;Paper Plate Models 2009&lt;br&gt;IsotopesForPaperPlateModels_2009&lt;br&gt;PaperPlateModels_Gradingsheet_2009&lt;br&gt;What Does Half Life Mean, the Penney Decay Lab</td>
</tr>
</tbody>
</table>

**Resources:**
See individual lab/activity attachments.

**Bolded Text** = Potential assessment items
**Unit 4: A New Approach to the Atom, Electron Structure**

**Timeline:** 3 weeks

**Inquiry Questions:**
From the standards document)
- What patterns can be observed in the properties of elements and families in the periodic table?
- What factors can be measured to determine the amount of energy associated with an electron?
- What makes some forms of energy hard to measure?
- Scientists or engineers often say energy is “lost.” Is there a word that might be better than “lost?” Why?
- How does the law of conservation of energy help us solve problems involving complex systems?

**Vocabulary:** EMR, wavelength, frequency, energy, spectroscopy, electron configuration; energy: mechanical, chemical, electrical, radiant, thermal, nuclear, work, heat; families on the Periodic table, electrons, orbitals

**Standard: Physical Science:** Students know and understand common properties, forms and changes in matter and energy.

**Grade Level Expectations (GLE):**
- 1.2 Matter has definite structure that determines characteristic physical and chemical properties
- 1.5: Energy exists in many forms such as mechanical, chemical, electrical, radiant, thermal, and nuclear, that can be quantified and experimentally determined
- 1.6 When energy changes form, it is neither created nor destroyed; however, because some is necessarily lost as heat, the amount of energy available to do work decreases

**Assessments**

formative assessments on mathematical skills of wave mechanics; summative assessment - 15 questions

**Evidence Outcomes**

Students will be able to:
- 1.2.a: Develop, communicate, and justify an evidence-based scientific explanation supporting the current model of an atom.
- 1.2.c: Use characteristic physical and chemical properties to develop predictions and supporting claims about elements' positions on the periodic table.
- 1.5.d: Identify different energy forms, and calculate their amounts by measuring their defining characteristics
- 1.6.d: Differentiate among the characteristics of mechanical and electromagnetic waves that determine their energy

**Instruction**

The following instructional resources can be found with this Curriculum Guide.
- Activity/Lab: Hog Hilton
- PowerPoint: Another Look 2011

**Resources:**
See individual lab/activity attachments.

**Bolded Text** = Potential assessment items
<table>
<thead>
<tr>
<th>Theme: Unit V: The Periodic Table</th>
<th>Timeline: 4 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inquiry Questions: (From the standards document)</td>
<td></td>
</tr>
<tr>
<td>What patterns can be observed in the properties of elements and families in the periodic table?</td>
<td></td>
</tr>
<tr>
<td>What role do electrons play in the organization of our present day periodic table?</td>
<td></td>
</tr>
<tr>
<td>How has our current understanding of the periodicity of atomic structure, physical and chemical properties of the elements developed over time?</td>
<td></td>
</tr>
<tr>
<td>Vocabulary: families or groups, periods, valence electrons, orbitals, periodicity, atomic structure, trends, physical &amp; chemical properties,</td>
<td></td>
</tr>
</tbody>
</table>

**Standard:** Physical Science: Students know and understand common properties, forms and changes in matter and energy.  
**Grade Level Expectations (GLE):**  1.2: Matter has definite structure that determines characteristic physical and chemical properties.

<table>
<thead>
<tr>
<th>Assessments</th>
<th>Evidence Outcomes</th>
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</tr>
</thead>
<tbody>
<tr>
<td>formative assessments on periodicity using a “cut and paste”; summative assessment -15 questions</td>
<td>Students will be able to…..(1.2.c) use characteristic physical and chemical properties to develop predictions and supporting claims about elements’ positions on the periodic table.</td>
<td>Activity/Lab: Cycling_Through_the_Periodic_Table (there are three documents, one is the Teacher Resource with answers, one ends with “10 font”, this allows the activity to be placed on one piece of paper, and the third document is the “Cards” that are needed for the activity. Activity/Lab: Periodic Trends Activity (two documents, the “Handout” for students and the “Key” for teachers. PowerPoints: Periodic Trends 2011: this PPT goes over the Periodic Trends. Unit5_Review_PeriodicTable_2011: this is a review for the Unit.</td>
</tr>
</tbody>
</table>

**Resources:** See individual lab/activity attachments.

**Bolded Text** = Potential assessment items
**Unit 1: Chemical Bonding**

**Timeline:** 4 weeks

**Inquiry Questions: (From the standards document)**
- How can various substances be classified as ionic or covalent compounds?
- What role do electrons play in different types of chemical bonds?
- What is responsible for holding metal atoms together in a metallic substance or alloys?

**Vocabulary:** ions, ionic compounds, valence electrons, formula unit, molecule, covalent bond, diatomic molecule, metals, metallic bonding, electron, electrical conductivity, malleable, ductile, brittle, shared pair, single, double and triple bond, electron dot structure, cations, ions, octet rule

**Standard: 1. Physical Science:** Students know and understand common properties, forms and changes in matter and energy.

**Grade Level Expectations (GLE):** 1.4: Atoms bond in different ways to form molecules and compounds that have definite properties.

**Assessments**

<table>
<thead>
<tr>
<th>Evidence Outcomes</th>
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<tbody>
<tr>
<td>Students will be able to…..(1.4.a) develop, communicate, and justify an evidence-based scientific explanation supporting the current models of <strong>chemical bonding</strong>.</td>
<td><strong>Activity/Lab:</strong> Analysis of Anions and Cations: This is a small scale lab and is not available in electronic format at this time.</td>
</tr>
<tr>
<td>Students will be able to…..(1.4.b) gather, analyze, and interpret data on <strong>chemical and physical properties</strong> of different compounds such as density, melting point, boiling point, pH, and conductivity.</td>
<td><strong>Activity/Lab:</strong> Formula of an Ionic Compound: This lab is available in electronic format. Good lab for visually determining formula of a PbI₂ cmpd.</td>
</tr>
<tr>
<td>Students will be able to…..(1.4.c) use characteristic <strong>physical and chemical properties</strong> to develop predictions and supporting claims about compounds' classification as <strong>ionic, polar or covalent</strong>.</td>
<td></td>
</tr>
<tr>
<td>Students will be able to…..(1.4.d) describe the role <strong>electrons</strong> play in <strong>atomic bonding</strong>.</td>
<td></td>
</tr>
<tr>
<td>Students will be able to…..(1.4.e) predict the <strong>type of bonding</strong> that will occur among elements based on their <strong>position in the periodic table</strong>.</td>
<td></td>
</tr>
</tbody>
</table>

**Resources:**

*Bolded Text* = Potential assessment items
**Unit 2: Molecular Structure, Polarity & Intermolecular Forces**
**Timeline: 2 weeks**

**Inquiry Questions: (From the standards document)**
- What patterns can be observed in the properties of elements and families in the periodic table?
- How can various substances be classified as ionic or covalent compounds?
- What role do electrons play in different types of chemical bonds?
- What makes a bond polar?
- What makes a molecule polar?
- What special properties does polarity impart to a molecule?

**Vocabulary:** Covalent Bonds, Molecules, Polar Bonds, Geometry, Shape, Electronegativity, Polar Bonds, Polar Molecules, bonding pairs, nonbonding pairs, Lewis structures, tetrahedral, linear, bent, trigonal bipyramid, octahedral, trigonal planar, IMF’s

**Standard: 1. Physical Science:** Students know and understand common properties, forms and changes in matter and energy.

**Grade Level Expectations (GLE):**
1.2: Matter has definite structure that determines characteristic physical and chemical properties.
1.4: Atoms bond in different ways to form molecules and compounds that have definite properties.

**Assessments | Evidence Outcomes | Instruction**
--- | --- | ---
Students will be able to…..(1.2.d): Develop a model that differentiates atoms and molecules, elements and compounds and pure substances and mixtures.
(1.4.a): Develop, communicate, and justify an evidence-based scientific explanation supporting the current models of chemical bonding.
(1.4.b): Gather, analyze, and interpret data on chemical and physical properties of different compounds such as density, melting point, boiling point, pH, and conductivity.
(1.4.c): Use characteristic physical and chemical properties to develop predictions and supporting claims about compounds’ classification as ionic, polar or covalent.
(1.4.d): Describe the role electrons play in atomic bonding
(1.4.e): Predict the type of bonding that will occur among elements based on their position in the periodic table.

**Resources:**

**Bolded Text** = Potential assessment items
### Unit 3: Chemical Reactions and Equations

<table>
<thead>
<tr>
<th>Inquiry Questions:</th>
<th>Timeline: 3 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>(From the standards document) What patterns of chemical reaction exist?</td>
<td></td>
</tr>
<tr>
<td>How are chemical reactions distinguished from nuclear reactions?</td>
<td></td>
</tr>
<tr>
<td>How can various substances be classified as ionic or covalent compounds?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vocabulary:</th>
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<tbody>
<tr>
<td>chemical formula, chemical equation, subscript, coefficient, balanced chemical equation, law of conservation of mass, ionic compound, molecular compound, ionic bonds, covalent bonds,</td>
</tr>
</tbody>
</table>

**Standard: 1. Physical Science:** Students know and understand common properties, forms and changes in matter and energy.

1.3: matter can change form through chemical or nuclear reactions abiding by the laws of conservation of mass and energy.

1.4: Atoms bond in different ways to form molecules and compounds that have definite properties.

<table>
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<tr>
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<tr>
<td>Students will be able to....(1.3.a) recognize, analyze, interpret, and balance chemical equations (synthesis, decomposition, combustion, and replacement) or nuclear equations (fusion &amp; fission). Students will be able to....(1.3.b) predict reactants and products for different types of chemical and nuclear reactions. Students will be able to....(1.3.d) examine, evaluate, question, and ethical use information from a variety of sources and media to investigate the conservation of mass and energy. Students will be able to ....(1.4.c.) use characteristic physical and chemical properties to develop predictions and supporting claims about compounds’ classification as ionic, polar or covalent.</td>
<td></td>
</tr>
<tr>
<td><strong>Instruction</strong></td>
<td></td>
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</tbody>
</table>

**Resources:**

**Bolded Text** = Potential assessment items
## Unit 4: The Mole

**Timeline:** 3 weeks

### Inquiry Questions: (From the standards document)
- What patterns of chemical reactions exist?
- What information does the formula of a compound tell us?
- How can we determine the formula of a compound after breaking it down into its elemental components?
- How is solution concentration notated (Molarity)?

### Vocabulary:
- mole, Avogadro’s number, percent composition, empirical formula, molecular formula, molarity

### Standard:
1. **Physical Science:** Students know and understand common properties, forms and changes in matter and energy.

### Grade Level Expectations (GLE):
1.3: Matter can change form through chemical or nuclear reactions abiding by the laws of conservation of mass and energy.

<table>
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<tr>
<td>Students will be able to.....(1.3.a) recognize, analyze, interpret, and balance chemical equations(synthesis, decomposition, combustion, and replacement) or nuclear equations(fusion &amp; fission). Students will be able to ....((1.3.c) predict and calculate the amount of products produced in a chemical reaction based on the amount of reactants. Students will be able to .....(1.3.d) examine, question and ethically use information from a variety of sources and media to investigate the conservation of mass and energy.</td>
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</tbody>
</table>

### Resources:

**Bolded Text** = Potential assessment items
### Inquiry Questions:
(From the standards document) What patterns of chemical reactions exist?
How can we calculate the percent composition by mass of a compound?
How can we predict the amount of product that will be produced in a chemical Rxn?

### Vocabulary:
moles, grams, liters, molarity, % composition, empirical & molecular formula, subscripts, coefficients, molar mass, atomic mass, molecular mass, STP, molar volume, gas law(s), dimensional analysis,

### Standard:
1. Physical Science: Students know and understand common properties, forms and changes in matter and energy.

### Grade Level Expectations (GLE):
1.3: Matter can change form through chemical or nuclear reactions abiding by the laws of conservation of mass and energy.

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<td>Students will be able to.....(1.3.c) predict and calculate the amount of products produced in a chemical reaction based on the amount of reactants. Students will be able to .... (1.3.d) examine, evaluate, question, and ethically use information from a variety of sources and media to investigate the conservation of mass and energy.</td>
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</table>

### Resources:

**Bolded Text** = Potential assessment items
Earth
Unit 1: The History of the Universe, Solar System, and Earth

Timeline:

Enduring Concept (Big Idea): How do we determine the ages of terrestrial bodies?

Grade Level Expectations (GLE): The History of the universe, solar system, and Earth can be inferred from the evidence left from past events.

Inquiry Question(s): (From the standards document)
1. How do we know the age of the Earth, Sun and universe?
2. How did the information of Earth help shape its features today?
3. How can we interpret the geologic history of an area?

Vocabulary:
Big bang theory, solar nebula, planetesimals, protoplanets, moons, Uniformitarianism, unconformity, crosscutting, original horizontality, superposition, index fossil

Assessments

Performance Tasks
a. Modeling Earth’s geographic time scale. (see application lab #1)
b. Modeling the Solar System’s time scale. (see Application lab #1)
   a. Using the same scale from the Earth’s time scale.
   a. Develop your own timeline.
b. Using the same scale you used in the Earth and Solar System
d. Research the different methods scientists use to determine the major events in the history of the universe, solar system, and the Earth.
e. Modeling the geographic time scale. (see Application lab #1)
   a. Complete the questions.
f. SCR: What historical evidence can we use to determine how the Rocky Mountains were formed?
g. SCR: What are some of the methods scientists use to determine the Rocky Mountain’s age?

Other Assessments
a. Unit Test (Galileo)
b. Unit quizzes (Galileo)

evidence Outcomes

Students can:
a. Develop, communicate, and justify an evidence-based scientific explanation addressing questions about Earth’s history
b. Analyze and interpret data regarding Earth’s history using direct and indirect evidence
c. Analyze and interpret data regarding the history of the universe using direct and indirect evidence
d. Seek, evaluate, and use a variety of specialized resources available from libraries, the Internet, and the community to find scientific information on Earth’s history
e. Examine, evaluate, question, and ethically use information from a variety of sources and media to investigate the history of the universe, solar system and Earth

Instruction

Key teaching and Learning Experiences that embed 21st Century Skills

Direct Instruction:
Formation of the Universe (PP)
Geologic Time (PP)

Student Centered:
Earth, Solar System, and Universe Timelines
Student Research Project

Resources:
Formation of the Universe (PP) o 1.3 o 17.1 o 18.2
Geologic Time (PP) o 27.2 o 17.2 o 19.1
Textbook: Modern Earth Science o 27.3 o 17.3 o 19.2
o Chapters:
   o 28.3 o 18.1 o 19.3

Bolded Text = Potential assessment items for 2012
<table>
<thead>
<tr>
<th><strong>Unit 2: Plate Tectonics</strong></th>
<th><strong>Enduring Concept:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Timeline:</strong></td>
<td></td>
</tr>
</tbody>
</table>

Grade Level Expectations (GLE) The theory of plate tectonics helps explain geological, physical, and geographical features of Earth

**Inquiry Question(s):** *(From the standards document)*
1. How do the different types of plate boundaries create different landforms on Earth?
2. How have scientists “discovered” the layers of Earth?
3. What drives plate motion?
4. What might happen to Earth’s landforms in the future?

**Vocabulary:**

**Assessments** | **Evidence Outcomes**
--- | ---
**Performance Tasks** | Students can:
--- | ---
**Other Assessments** | a. Develop, communicate, and justify an evidence-based scientific explanation about the theory of plate tectonics and how it can be used to understand geological, physical, and geographical features of Earth
--- | ---
b. Analyze and interpret data on plate tectonics and the geological, physical, and geographical features of Earth
c. Understand the role plate tectonics has had with respect to long-term global changes in Earth’s systems such as continental buildup, glaciations, sea-level fluctuations, and climate change
d. Investigate and explain how new conceptual interpretations of data and innovative geophysical technologies led to the current theory of plate tectonics

**Instruction**
Key teaching and Learning Experiences that embed 21st Century Skills

**Resources**
**Textbook:** Modern Earth Science
- Chapter
  o 2.1

**Bolded Text** = Potential assessment items for 2012
<table>
<thead>
<tr>
<th>Assessments</th>
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</thead>
<tbody>
<tr>
<td><strong>Performance Tasks</strong></td>
<td>Students can:</td>
</tr>
<tr>
<td><strong>Other Assessments</strong></td>
<td>a. Develop, communicate, and justify an evidence-based scientific explanation regarding the costs and benefits of exploration, development, and consumption of renewable and nonrenewable resources</td>
</tr>
<tr>
<td></td>
<td>b. Evaluate positive and negative impacts on the geosphere, atmosphere, hydrosphere, and biosphere in regards to resource use</td>
</tr>
<tr>
<td></td>
<td>c. Create a plan to reduce environmental impacts due to resource consumption</td>
</tr>
<tr>
<td></td>
<td>d. Analyze and interpret data about the effect of resource consumption and development on resource reserves to draw conclusions about sustainable use</td>
</tr>
</tbody>
</table>

**Instruction**

Key teaching and Learning Experiences that embed 21st Century Skills

**Bolded Text** = Potential assessment items for 2012
## Enduring Concept:
Grade Level Expectations (GLE) There are costs, benefits, and consequences of exploration, development, and consumption of renewable and nonrenewable resources

### Inquiry Question(s): (From the standards document)
1. How do humans use resources?
2. How can humans reduce the impact of resource use?
3. How are resources used in our community?
4. What are the advantages and disadvantages of using different types of energy?

### Grade Level Expectations (GLE)
There are costs, benefits, and consequences of exploration, development, and consumption of renewable and nonrenewable resources

### Vocabulary:

### Assessments
- **Performance Tasks**
  - Students can:
    - a. Develop, communicate, and justify an evidence-based scientific explanation regarding the costs and benefits of exploration, development, and consumption of renewable and nonrenewable resources
    - b. Evaluate positive and negative impacts on the geosphere, atmosphere, hydrosphere, and biosphere in regards to resource use
    - c. Create a plan to reduce environmental impacts due to resource consumption
    - d. Analyze and interpret data about the effect of resource consumption and development on resource reserves to draw conclusions about sustainable use

### Evidence Outcomes

### Instruction
Key teaching and Learning Experiences that embed 21st Century Skills

**Bolded Text** = Potential assessment items for 2012
## Unit 5: Erosion

**Timeline:**

Grade Level Expectations (GLE) The interaction of Earth's surface with water, air, gravity, and biological activity causes physical and chemical changes.

**Enduring Concept:**

The interaction of Earth's surface with water, air, gravity, and biological activity causes physical and chemical changes.

**Inquiry Question(s):** (From the standards document)

1. How do Earth’s systems interact to create new landforms?
2. What are positive changes on Earth’s geosphere due to water, air, gravity, and biological activity?
3. What are negative changes on Earth’s geosphere due to water, air, gravity, and biological activity?

**Vocabulary:**

**Assessments**

- **Performance Tasks**
  - Students can:
    - a. Develop, communicate, and justify an evidence-based scientific explanation addressing questions regarding the interaction of Earth’s surface with water, air, gravity, and biological activity.
    - b. Analyze and interpret data, maps, and models concerning the direct and indirect evidence produced by physical and chemical changes that water, air, gravity, and biological activity create.
    - c. Evaluate negative and positive consequences of physical and chemical changes on the geosphere.
    - d. Use remote sensing and geographic information systems (GIS) data to interpret landforms and landform impact on human activity.

**Evidence Outcomes**

- **Instruction**
  - Key teaching and Learning Experiences that embed 21st Century Skills

**Resources**

**Bolded Text** = Potential assessment items for 2012
### Unit 6: Natural Hazards

<table>
<thead>
<tr>
<th>Timeline:</th>
<th>Enduring Concept: How do natural hazards affect local, national, and global communities?</th>
</tr>
</thead>
</table>

Grade Level Expectations (GLE) Natural hazards have local, national and global impacts such as volcanoes, earthquakes, tsunamis, hurricanes, and thunderstorms.

<table>
<thead>
<tr>
<th>Inquiry Question(s): (From the standards document)</th>
<th>Vocabulary:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Why are some natural hazards difficult to predict, while others are easier to predict?</td>
<td></td>
</tr>
<tr>
<td>2. How are humans impacted by natural hazards?</td>
<td></td>
</tr>
<tr>
<td>3. How can we prepare for natural hazards?</td>
<td></td>
</tr>
<tr>
<td>4. How is climate change expected to change the incidence of natural hazards?</td>
<td></td>
</tr>
</tbody>
</table>

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<td>Students can:</td>
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<tr>
<td>Other Assessments</td>
<td>a. Develop, communicate, and justify an evidence-based scientific explanation regarding natural hazards, and explain their potential local and global impacts</td>
</tr>
<tr>
<td></td>
<td>b. Analyze and interpret data about natural hazards using direct and indirect evidence</td>
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<td></td>
<td>c. Make predictions and draw conclusions about the impact of natural hazards on human activity - locally and globally</td>
</tr>
</tbody>
</table>

**Instruction**

Key teaching and Learning Experiences that embed 21st Century Skills

**Resources**

Bolded Text = Potential assessment items for 2012
Physics
**Theme:** Electrostatics and Electricity  
**Timeline:** 4 weeks

**Inquiry Questions:**
1. What factors determine the amount of potential and kinetic energy of an object?
2. How does the law of conservation of energy help us solve problems in complex systems?
3. What role do electrons play in electrical circuits and energy transfer/transformations?
4. Why is 100 percent efficiency impossible in an energy transformation?
5. How does the law of conservation of energy help us solve problems involving complex systems?
6. Scientists or engineers often say energy is “lost.” Is there a word that might be better than “lost?” Why?
7. What factors can be measured to determine the amount of energy associated with an object?
8. What are the most common forms of energy in our physical world?
9. What makes an energy form renewable or nonrenewable?
10. What makes some forms of energy hard to measure?

**Vocabulary:**
- proton, neutron, electron, nucleus, Coulomb, Volt (potential difference), Amp, Ohm, resistor, induced charge, polarization, series, parallel, combination circuits, ground, battery, voltmeter, ammeter

**Standard: Physical Science**  
**Grade Level Expectations (GLE):**
P5 Energy exists in many forms such as mechanical, chemical, electrical, radiant, thermal, and nuclear, that can be quantified and experimentally determined.

P6 When energy changes form, it is neither created not destroyed; however, because some is necessarily lost as heat, the amount of energy available to do work decreases.

P3 Matter can change form through chemical or nuclear reactions abiding by the laws of conservation of mass and energy.

<table>
<thead>
<tr>
<th>Assessments</th>
<th>Evidence Outcomes</th>
<th>Instruction</th>
</tr>
</thead>
</table>
| Performance Assessments | **P5** | a. Develop, communicate, and justify an evidence-based scientific explanation regarding the potential and kinetic nature of mechanical energy  
b. Use appropriate measurements, equations and graphs to gather, analyze, and interpret data on the quantity of energy in a system or an object  
c. Use direct and indirect evidence to develop predictions of the types of energy associated with objects  
d. Identify different energy forms, and calculate their amounts by measuring their defining characteristics | a. Week 1: (1/9)  
i. Cover sheet  
ii. Intro lab (spring/pendulum lab)  
iii. Minilabs Electrostatics | b. Week 2: (1/16 3days)  
i. Van de Graaf generator/Coulomb's law  
ii. Practice problems  
iii. Vectors/Inverse square idea | c. Week 3: (1/23)  
i. Quiz: Electrostatics  
ii. Circuit Lab  
iii. Ohm’s law | d. Week 4: (1/30 3days)  
i. Circuit lab #2 (combo circuits)  
ii. Practice problems (Ohm’s) | e. Week 5: (2/6)  
i. Electrostatics and Electricity exam |

**Resources:**
- Fur  
- Tape  
- String  
- Test tube  
- Plastic rods or strips  
- Van de Graaf  
- Styrofoam  
- Wires  
- Bulbs and holders  
- Batteries  
- Resistors  
- Capacitors  
- Multimeters  
- Computer access for PhET Labs
**Theme:** Energy  
**Timeline:** 5 weeks

<table>
<thead>
<tr>
<th>Inquiry Questions</th>
<th>Vocabulary:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What factors determine the amount of potential and kinetic energy of an object?</td>
<td>Kinetic, Potential, Work, Power, Joule, Newton, Watt, machine, efficiency, mechanical advantage, ideal mechanical advantage,</td>
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<tr>
<td>2. How does the law of conservation of energy help us solve problems in complex systems</td>
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<tr>
<td>3. What makes an energy form renewable or nonrenewable?</td>
<td></td>
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<tr>
<td>4. What makes some forms of energy hard to measure?</td>
<td></td>
</tr>
<tr>
<td>1. Why is 100 percent efficiency impossible in an energy transformation?</td>
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<tr>
<td>2. How does the law of conservation of energy help us solve problems involving complex systems?</td>
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<tr>
<td>3. Scientists or engineers often say energy is “lost.” Is there a word that might be better than “lost?” Why?</td>
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</tbody>
</table>

**Standard: Physical Science**  
**Grade Level Expectations (GLE):**

**P5** Energy exists in many forms such as mechanical, chemical, electrical, radiant, thermal, and nuclear, that can be quantified and experimentally determined.

**P6** When energy changes form, it is neither created not destroyed; however, because some is necessarily lost as heat, the amount of energy available to do work decreases.

**P3** Matter can change form through chemical or nuclear reactions abiding by the laws of conservation of mass and energy.

### Assessments | Evidence Outcomes | Instruction
--- | --- | ---
Performance assessments  
Conservation of energy lab  
Power lab  
Simple machines lab | P5  
a. Develop, communicate, and justify an evidence-based scientific explanation regarding the potential and kinetic nature of mechanical energy  
b. Use appropriate measurements, equations and graphs to gather, analyze, and interpret data on the quantity of energy in a system or an object  
c. Use direct and indirect evidence to develop predictions of the types of energy associated with objects  
d. Identify different energy forms, and calculate their amounts by measuring their defining characteristics | m. Week 1 (14 overall)  
i. Kinetic and Potential Energy  
ii. Conservation of energy lab  
iii. Practice Problems  
n. Week 2 (15 overall)  
i. Work  
ii. Power  
iii. Power Lab activity  
o. Week 3 (16 overall)  
i. Mouse trap cars (begin, common assessment possible)  
ii. Simple Machines  
iii. Levers, ramps, gears, pulleys  
p. Week 4 (17 overall)  
i. Simple machine Labs  
q. Week 5 (18 overall)  
i. Run mouse trap cars  
ii. Galileo  
iii. Final review  
s. Week 6 (19 overall)  
i. Common Final Assessment |
d. Examine, evaluate, question, and ethically use information from a variety of sources and media to investigate the conservation of mass and energy

<table>
<thead>
<tr>
<th>Resources:</th>
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<tbody>
<tr>
<td>Meter stick</td>
<td>Bowling balls</td>
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<tr>
<td>Timers</td>
<td>Air track with carts</td>
</tr>
<tr>
<td>Eggs</td>
<td>Dynamics carts</td>
</tr>
<tr>
<td>Balance</td>
<td>Pulleys</td>
</tr>
<tr>
<td>Balloons, Straws</td>
<td>Eggs</td>
</tr>
<tr>
<td>Paper clips</td>
<td>Balloons</td>
</tr>
<tr>
<td>Tape</td>
<td>Tape</td>
</tr>
<tr>
<td>String</td>
<td>Straws</td>
</tr>
<tr>
<td>Spring scales</td>
<td>Paperclips</td>
</tr>
<tr>
<td>Inertia ball</td>
<td>Gear set</td>
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<tr>
<td>Table cloth and place setting</td>
<td>Meter stick fulcrum</td>
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<td>Clamps</td>
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<tr>
<td>Theme: Fluid Mechanics</td>
<td>Timeline: 2 weeks</td>
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<td>------------------------</td>
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<tr>
<td>Inquiry Questions:</td>
<td></td>
</tr>
<tr>
<td>1. How can forces be acting on an object without changing the object’s motion?</td>
<td>Vocabulary:</td>
</tr>
<tr>
<td>2. Why do equal but opposite action and reaction forces not cancel?</td>
<td>Net Force, gravity, component, free-body diagram, inertia, paired forces, pressure, mass, weight, buoyant force, density, equilibrium</td>
</tr>
</tbody>
</table>

**Standard: Physical Science**  
**Grade Level Expectations (GLE):**  
P1 Newton’s laws of motion and gravitation describe the relationships among forces acting on and between objects, their masses, and changes in their motion—but have limitations

<table>
<thead>
<tr>
<th>Assessments</th>
<th>Evidence Outcomes</th>
<th>Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density activity</td>
<td>a. Gather, analyze and interpret data and create graphs regarding position, velocity and acceleration of moving objects</td>
<td>Last of 4 units 2nd semester</td>
</tr>
<tr>
<td>Pressure</td>
<td>b. Develop, communicate and justify an evidence-based analysis of the forces acting on an object and the resultant acceleration produced by a net force</td>
<td>i. Density discussion/practice</td>
</tr>
<tr>
<td>Buoyancy activity</td>
<td>c. Develop, communicate and justify an evidence-based scientific prediction regarding the effects of the action-reaction force pairs on the motion of two interacting objects</td>
<td>ii. Density kits (activity)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>iii. Hydrostatic pressure/problems</td>
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<tr>
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<td>b. Week 16:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>i. Archimedes principle notes</td>
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<tr>
<td></td>
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<td>ii. Lab: Floatation/Achimedes principle</td>
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<td>iii. Pascal’s principle</td>
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<td></td>
<td>i. Review for final exam</td>
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<td>e. Week 19: (5/21)</td>
</tr>
</tbody>
</table>

**Resources:**

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Greeley-Evans School District 6  
2012-2013  
Physics Curriculum Guide
### Theme: Kinematics

#### Inquiry Questions:
1. What are the patterns between displacement, velocity, acceleration, and time?
2. What are the effects of forces on motion?

#### Vocabulary:
- distance, displacement, speed, velocity, acceleration, slope, metric prefix, theory, law, hypothesis, precision, accuracy, error, magnitude, direction, Resultant, Pythagorean Theorem, sine, cosine, tangent, gravity, free-fall, component, resolution

#### Standard:
**Grade Level Expectations (GLE):** P1 Newton’s laws of motion and gravitation describe the relationships among forces acting on and between objects, their masses, and changes in their motion, but have limitations

### Assessments | Evidence Outcomes | Instruction
--- | --- | ---
Performance Tasks
Graphing/Measurement Lab
Physics 500 lab *(what is this?)*
Vector Map Activity
Projectile motion lab
Kinematics Exam

Other Assessments
Lab: Measurement of time *(what is this?)*

P1
- a. Gather, analyze and interpret data and create graphs regarding position, velocity and acceleration of moving objects
- b. Develop, communicate and justify an evidence-based analysis of the forces acting on an object and the resultant acceleration produced by a net force

### Resources:
- Collection of round objects
- Foil
- Spring scales
- Dynamics carts
- Straws
- Class set of timers
- Graduated cylinders
- Wires
- Inertia ball
- Pulleys
- Paperclips
- Class set of meter sticks
- Ticker timers
- Electromagnets
- Table cloth and place setting
- Eggs
- Gear set
- Wood blocks
- Weight sets
- Tin can lids
- Bowling balls
- Balloons
- Meter stick fulcrum
- Calipers
- Motion detector with calculator projector
- Ring stands
- Air track with carts
- Tape
- Clamps
- String
- Plastic tube
- Plastic tube
- Plastic tube
### Theme: Newton’s Laws

<table>
<thead>
<tr>
<th>Inquiry Questions</th>
<th>Timeline: 6 wks</th>
</tr>
</thead>
</table>
| 1. How can forces be acting on an object without changing the object’s motion?  
2. Why do equal but opposite action and reaction forces not cancel?  
3. What are the effects of forces on motion? | |

### Vocabulary:
- Force, magnitude, direction, Resultant, Pythagorean Theorem, sine, cosine, tangent, Net Force, gravity, normal force, applied force, component, resolution, friction, static, kinetic, free-body diagram, inertia, paired forces, pressure, mass, weight, Impulse, Momentum, Conservation, Elastic, Inelastic

### Standard:

**Grade Level Expectations (GLE):**

P1 Newton’s laws of motion and gravitation describe the relationships among forces acting on and between objects, their masses, and changes in their motion— but have limitations

E2. As part of the solar system, Earth interacts with various extraterrestrial forces and energies such as gravity, solar phenomena, electromagnetic radiation, and impact events that influence the planet’s geosphere, atmosphere, and biosphere in a variety of ways

### Assessments & Evidence Outcomes

<table>
<thead>
<tr>
<th>Assessments</th>
<th>Evidence Outcomes</th>
<th>Instruction</th>
</tr>
</thead>
</table>
| Performance Assessments  
2nd Law Lab  
Conservations of Momentum Lab  
Egg Drop Lab (Common Assessment?)  
Newton’s Law and Momentum Exam | P1  
b. Develop, communicate and justify an evidence-based analysis of the forces acting on an object and the resultant acceleration produced by a net force  
c. Develop, communicate and justify an evidence-based scientific prediction regarding the effects of the action-reaction force pairs on the motion of two interacting objects  
d. Examine the effect of changing masses and distance when applying Newton’s law of universal gravitation to a system of two bodies Identify the limitations of Newton’s laws in extreme situations  
E2  
a. Develop, communicate, and justify an evidence-based scientific explanation addressing questions around the extraterrestrial forces and energies that influence Earth  
b. Analyze and interpret data regarding extraterrestrial forces and energies | h. Week 1 (8 overall)  
i. Scientist Research Project (homework) why?  
ii. Newton’s 1st Law Lecture/Demo  
iii. 2nd Law, Mass/Weight  
i. Week 2 (9 overall)  
i. Net Force  
ii. Coefficient of friction lab or 2nd law motion lab  
j. Week 3 (10 overall)  
i. 2nd Law Practice problems  
k. Week 4 (11 overall)  
i. 3rd Law lecture/demo  
ii. Newton’s Laws Test  
l. Week 5 (12 overall)  
i. Momentum Lecture/Practice Problems  
ii. Collisions  
iii. Egg drop (Common Assessment)  
m. Week 6 (13 overall)  
i. Universal gravitation  
ii. Kepler’s Laws? |

### Resources:

- Spring scales  
- Inertia ball  
- Table cloth and place setting  
- Bowling balls  
- Air track with carts  
- Dynamics carts  
- Class set of timers  
- Class set of meter sticks
### Inquiry Questions:
1. What factors determine the amount of potential and kinetic energy of an object?
2. How does the law of conservation of energy help us solve problems in complex systems?
3. Scientists or engineers often say energy is “lost.” Is there a word that might be better than “lost?” Why?
4. What factors can be measured to determine the amount of energy associated with an object?
5. What are the most common forms of energy in our physical world?
6. What makes an energy form renewable or nonrenewable?
7. What makes some forms of energy hard to measure?

### Vocabulary:
- thermal/internal energy
- calorie
- Kelvin
- Celsius
- Fahrenheit
- Absolute zero
- specific heat capacity
- phase
- solid
- liquid
- gas
- conductor
- insulator
- conduction
- convection
- radiant heat

### Standard: Physical Science

#### Grade Level Expectations (GLE):

**P5** Energy exists in many forms such as mechanical, chemical, electrical, radiant, thermal, and nuclear, that can be quantified and experimentally determined.

**P6** When energy changes form, it is neither created nor destroyed; however, because some is necessarily lost as heat, the amount of energy available to do work decreases.

**P3** Matter can change form through chemical or nuclear reactions abiding by the laws of conservation of mass and energy.

### Assessments

<table>
<thead>
<tr>
<th>Assessments</th>
<th>Evidence Outcomes</th>
<th>Instruction</th>
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</thead>
</table>
| Temperature Scale Research Heat Mixing Lab Specific Heat Capacity/Heat Transfer Lab Phase Change Lab | P5 | a. Week 1: (2/6)
  i. Temperature introduction
  ii. Temperature scale research (homework)
  iii. Conduction, convection, radiation |
| Thermodynamics Exam | b. Use appropriate measurements, equations and graphs to gather, analyze, and interpret data on the quantity of energy in a system or an object |
| | c. Use direct and indirect evidence to develop predictions of the types of energy associated with objects |
| | d. Identify different energy forms, and calculate their amounts by measuring their defining characteristics |
| | P6 |
| | a. develop and support claims about the conservation of energy in a variety of systems, including transformations to heat |
| | b. Evaluate the energy conversion efficiency of a variety of energy transformations |
| | c. Describe energy transformations both quantitatively and qualitatively |
| | e. Examine, evaluate, question, and ethically use information from a variety of sources and media to investigate energy conservation and loss |
| | P3 |
| | d. Examine, evaluate, question, and ethically use information from a variety of sources and media to investigate the conservation of mass and energy |

### Resources:

- Thermometers
- Calorimeters
- Mass sets for specific heat (various metals)
- Graduated cylinders
- Hot plates
- Safety glasses
- Beakers
- Non-contact thermometers
### Theme: Waves and Optics

#### Inquiry Questions:
1. What are the categories of waves and how can we distinguish between them?
2. What are the practical consequences of the properties of electromagnetic waves?
   1. What factors can be measured to determine the amount of energy associated with an object?
   2. What are the most common forms of energy in our physical world?
   3. What makes an energy form renewable or nonrenewable?
   4. What makes some forms of energy hard to measure?

#### Timeline: 6 weeks

#### Vocabulary:
- crest, trough, amplitude, wave height, frequency, period, wavelength, wave speed/velocity, longitudinal, transverse, mechanical, electromagnetic, E-M spectrum, compressions, rarefactions, constructive interference, destructive interference, standing wave, reflection, antinode, node, refraction, resonance, harmonics, speed of light, speed of sound, index of refraction, Snell's Law, angle of incidence, angle of refraction/reflection, converging, diverging, parallel ray, focal ray, vertex ray, center ray, focal point, center of curvature, optical/principal axis

### Standard: Physical Science and Earth Systems

#### Grade Level Expectations (GLE):
P6 When energy changes form, it is neither created nor destroyed; however, because some is necessarily lost as heat, the amount of energy available to do work decreases.

E2 As part of the solar system, Earth interacts with various extraterrestrial forces and energies such as gravity, solar phenomena, electromagnetic radiation, and impact events that influence the planet's geosphere, atmosphere, and biosphere in a variety of ways

### Assessments

<table>
<thead>
<tr>
<th>Performance Tasks</th>
<th>Evidence Outcomes</th>
<th>Instruction</th>
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</thead>
<tbody>
<tr>
<td>Standing Wave Lab</td>
<td>P6 d. Differentiate among the characteristics of mechanical and electromagnetic waves that determine their energy</td>
<td>a. Week 1: (3/5)</td>
</tr>
<tr>
<td>Interference Quiz</td>
<td>a. Develop, communicate, and justify an evidence-based scientific explanation addressing questions around the extraterrestrial forces and energies that influence Earth</td>
<td>i. Wave property notes</td>
</tr>
<tr>
<td>Physical Ray Lab</td>
<td>b. Analyze and interpret data regarding extraterrestrial forces and energies</td>
<td>ii. Wave speed equation practice</td>
</tr>
<tr>
<td>Ray Diagram Assessment</td>
<td></td>
<td>iii. Speed of sound</td>
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<tr>
<td>Mirror Mini Labs</td>
<td></td>
<td>iv. Interference (concept sheet) and standing waves</td>
</tr>
<tr>
<td>Lenses Mini Labs</td>
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<td>b. Week 2: (3/12 CSAP 3 days)</td>
</tr>
<tr>
<td>Other Assessments</td>
<td></td>
<td>i. Standing wave lab</td>
</tr>
<tr>
<td>Waves and Optics Exam</td>
<td></td>
<td>ii. Electromagnetic Spectrum notes</td>
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<td>iii. Duality of light/Photoelectric effect</td>
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<td>c. Week 3: (3/19)</td>
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<td>i. Reflection/ Ray diagrams mirrors (converging/diverging)</td>
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<td>ii. Mirror labs (ray boxes)</td>
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<td>d. Week 4: (3/26)</td>
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<td></td>
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<td>i. Mirror homework (ray diagram)</td>
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<td>ii. Mathematical method and practice</td>
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<td>iii. Refraction/Snell's law practice</td>
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<td>e. Week 5: (4/2 3 day week)</td>
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<td></td>
<td>i. Confirmation of index of refraction activity</td>
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<td>ii. Mathematical method lenses</td>
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<td>iii. Lenses minilab/Lab-Blind spot</td>
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<td>e. Week 6: (4/16 3 day week)</td>
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<td>i. Finish minilab/Applications to optics (cameras, telescopes, the eye)</td>
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<td>ii. Practice and review day Optics</td>
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<td></td>
<td>iii. Exam Waves and Optics</td>
</tr>
</tbody>
</table>
Resources:
Slinky
Long springs
Timers
Meter sticks
Tuning forks
Graduated cylinders
Plastic tubes
Music box
Lenses converging and diverging
Mirrors concave, convex, and plane
Ray boxes