Seventh Grade Science

1.0 Understand the fundamental structures, functions, classifications, and mechanisms found in living things.

1.1 Identify basic cell organelles and their functions.
-observe cells (cell membrane, cell wall, cytoplasm, vacuoles, nucleus)
-Describe the function of the cell membrane to include active transport and passive transport (diffusion, osmosis)
-Describe cell walls as providing support and shape
-Describe cytoplasm
-Describe vacuoles
-Describe the function of the nucleus
-Introduce DNA replication, protein synthesis, transcription/translation endoplasmic reticulum, lysosomes, chloroplasts role in photosynthesis, mitochondria role in respiration

1.2 Identify and explain the function of the human systems and the organs within each system.
-skeletal
-muscular
-digestive
-respiratory
-circulatory
-reproductive
Introduce (endocrine, immune, nervous, excretory, integumentary)

1.3 Classify organism by using the kingdoms (6 kingdoms)

1.4 Describe and identify the structure of vascular and non-vascular plants.
-structures of root stems, leaves, and flowers

2.0 Analyze various patterns and products of natural and induced biological change.

2.1 Distinguish processes involved in sexual and asexual reproduction.
-model the process of cell division
-mitosis and meiosis
-Introduce the role of genetics in the transmission of traits and characteristics in organisms.

3.0 Analyze how organisms are linked to one another and the environment.

3.1 Predict the effects of biotic and abiotic factors on a species' survival.

-adaptations, genetics defects, population disturbances, over-reproduction, animal behavior, flooding, global warming, oil spills, human activity

-Describe processes by which matter and energy flow through an ecosystem.
-Use geospatial technologies to investigate natural phenomena.

4.0 Understand the nature and origin of scientific knowledge.
-Describe societal response to major scientific findings or theories.
-Investigate important contributions to the advancement of science.

5.0 Apply the skills necessary to conduct scientific investigations.
5.1 Conduct scientific investigations using given procedures.
-use appropriate supportive technologies
-determine the limits of accuracy inherent in a particular measuring device or procedure
-control variables to test hypotheses by repeated trials
-identify sources of experimental error
-interpret to make predictions and/or justify conclusions
-use research methods to investigate practical and/or personal scientific problems
-demonstrate appropriate use of apparatus and technologies for investigations
-use proper safety procedures in all investigations
-wear appropriate attire.

Seventh Grade
Life Science
August-September

Unit: Safety Procedures, Equipment usage, and Investigations

Resources:

Pieces of Science equipment
Safety rules handout
Scientific method handout
Scientific method lab pg 1

Standards:

7.N.2.1 Students are able to conduct scientific investigations using given procedures.

Essential Questions:

What are the safety procedures necessary to follow during science class?
What pieces of equipment will we use?
What are variables and how do they affect our lab?

Skills needed:

Students will identify pieces of equipment.
Students will apply the safety rules to a lab situation.
Students will demonstrate accurate measurements within the lab.
Students will interpret the information and justify their conclusions.

Activities:

Students will create science equipment booklet.
Students will identify safety symbols.
Students will use proper safety procedures.
Students will hypothesize, test, observe, and draw conclusions from the cabbage juice lab.

Assessments:

Cabbage Juice Activity and lab sheet

Seventh Grade
Life Science
September

Unit: Classification

Resources:

Chapter 1.4 textbook-classification
Pages

Animal pg 330	Fungi pg 223	Archaebacteria pg 191
Plant pg 240-241	Protist pg 210-211	Eubacteria pg 189

Standards:

7.L.1.3 Students are able to classify organisms by using the currently recognized kingdoms. (6 kingdoms)

Essential Questions:

What are the six kingdoms?
How do they differ and how are they similar?
What are the basic characteristics of each?

Skills:

Students will compare and contrast the kingdoms.
Students will identify an organism by using a dichotomous key.
Students will identify the different levels of a kingdom.

Activity:

Students will collect and organize information of each kingdom.
Students will create a table of characteristics describing each kingdom.
Students will create a mnemonic device to remember the different levels of a kingdom.
Students will complete classification lab activity in exploring and classifying life along with activity sheet.

Assessment:

Students will complete the mnemonic device according to the rubric.
Students will complete the kingdom table according to the rubric.

Seventh grade
Life Science
October

Unit: Cells

Resources:

Chapter 2 and 3 textbook
Video
Microscope and prepared slide
Microviewer and prepared slides
www.cellsalive.com internet site
page 45 cells to system

Standards:

7.L.1.1 Identify basic cell organelles and their functions.

Essential questions:

How do cells work?
How do the different parts of a cell work together?
What do cells look like under a microscope?
How does a cell become a system?

Skills:

Students will identify basic cell organelles and their functions.
Students will describe active and passive transport. (chapter 3.2)
Students will observe cells using a compound microscope.
Students will describe the function of the cell membrane including Active and passive transport.
Students will describe cell walls.
Students will describe cytoplasm.
Students will describe vacuoles.
Students will understand the function of the nucleus.

Activity:

Students will observe parts of the cells using a microscope.
Students will watch the video to reinforce the functions of the organelles.

Students will create a poster depicting the plant and animal cell with organelles labeled and functions described
Diffusion lab activity 1 page 15

Assessments:

Students will create a poster according to the rubric.
Students will take a paper test.

Seventh Grade
Life Science
November/December

Unit: Mitosis and Meiosis

Resources:

Chapter 4.1 (mitosis), 4.2(meiosis), 4.3(intro:DNA), 5.1-5.2(genetics-punnett squares-multiple traits-pedigrees), 6.1(natural selection)
Lake Area Tech blood typing
Video-different sections
Cd Rom
Models of different stages that students manipulate
Microviewer of mitosis and chromosomes and genes

Standards:

7.L.2.1 Students are able to distinquish between processes involved in sexual and asexual reproduction.

Essential Questions:

What is mitosis and meiosis?
How do these processes affect cells?
What are the different stages of mitosis?
Why do are cells replicate?
How many parent cells are involved in sexual and asexual reproduction?
What process results in the formation of the sperm and egg?

Skills:

Students will explain why mitosis is important.
Students will examine the steps of mitosis
Students will list examples of asexual reproduction
Students will describe the stages of meiosis and how sex cells are produced.
Students will model the process of cell division.
Students will be introduced to the role of genetics in the transmission of traits and characteristics in organisms.

Activities:

Students will utilize the Cdrom regarding mitosis/meiosis.

Students will manipulate models of mitosis
Students will utilize the microviewer
Students will create punnett squares
Students will understand the benefits of genetic research – 5 paragraph research.
Students will analyze traits of fellow students within the classroom.
Students will analyze traits of student's family.

Assessments:

Students will create a mitosis drawing utilizing a rubric
Students will write a research Paper
Students will complete a summary utilizing the Cdrom.
Students will accurately identify mitosis from prepared slides.

Seventh Grade
Life Science
January, February, March

Unit: Body Systems

Resources:

Textbook- required Chapters 17.2 muscles, skeleton 17.1, 18.2 digestive, 19.1 circulatory, 20.1 respiratory, reproductive 22.2 Expose to endocrine 22.1, 23.1 immune, nervous 21.1, excretory 20.2, and integumentary 17.3
Body System Books
ADAM cd-rom
9 month miracle cd-rom
Muscle Action lab act 2 book pg 99-100 voluntary and involuntary
Chapter Resource Structure and movement booklet
Measuring skin surface pg 501
Which brain side is dominant? Pg 125-126 lab act book
Fetal Development pg 137-138 lab act book
Launch labs from the book
Videos

Standards:

7.L.1.2 Students are able to identify the function of the human systems and the organs within each system.

Essential Questions:

How does our body work?
How do our body systems work together?
Which organ is in each system?
Can an organ be in more than one system?
What will I see when I open up the frog? Will there be blood?

Skills:

Students will identify the systems of the body.
Students will observe the parts of the systems of the body.
Students will understand how the systems of the body operate.

Activity:

ADAM cd-rom
9 month miracle cd-rom
Muscle Action lab act 2 book pg 99-100 voluntary and involuntary
Chapter Resource Structure and movement booklet
Measuring skin surface pg 501
Which brain side is dominant? Pg 125-126 lab act book
Fetal Development pg 137-138 lab act book
Launch labs from the book
Videos
Dissection of the frogs and worms

Assessments:

Lab Reports
Worksheet completion
Chapter test

Seventh Grade
Life Science
April

Unit: Plants

Resources: Textbook-Chapter 9, Plants cd-rom

Standards:

7.L.1.4 Students are able to describe and identify the structure of vascular and non-vascular plants.

Skills:

Students are able to distinguish between vascular and non vascular plants.

Students will understand the structure and function of the root stem, leaves, and flowers.

Activity: Plant cd-rom

Assessments:

Students will go online and choose examples of nonvascular and vascular plants. They will also document characteristics of each.

Seventh Grade
Life Science
May

Unit: Abiotic and Biotic Factors

Resources: Chapter 25.1
Internet exploratory

Standards:

7.L.3.1 Students are able to predict the effects of biotic and abiotic factors on a species survival.

7.S.2.1 Students are able, given a scenario, to predict the consequences of human activity on the local, regional, or global environment.

Essential Questions:

How does science and technology solve world problems?
How does some human activity affect the environment?
How does some human activity affect a species survival?

Skills needed:

Students will utilize effective Internet research techniques
Students will write a five paragraph essay.
Students will use effective presentation skills
Students will analyze the cause and effect.
Students will describe the process by which matter and energy flow through an ecosystem.
Students will understand adaptations, genetic defects, population disturbances, over-reproduction, flooding, global warming, oil spills, and how human activity effect the world.
Students will use geospatial technologies to investigate natural phenomena.

Activities:

Conduct internet research to gather information on a specific topic
Report findings to class over five paragraph information with visual aid.

Eighth Grade Science

1.0 Describe structures and properties of, and changes in, matter. (Physical)

1.1 Classify matter as elements, compounds and mixtures. (review)
-element combinations
-elements
-difference between elements, compounds, mixtures
-solutions

1.2 Use Periodic Table to compare and contrast families of elements and Classify elements as metals, metalloids, or non-metals. (new)
-Bohr's model
-know where they are
-properties of metals, nonmetals, and metalloids

1.3 Compare properties of matter resulting from chemical and physical changes. (Review)
-Review terminology
-descriptors
-chemical versus physical
-indicators

2.0 Analyze various structures and process of the Earth System. (Earth)

2.1 Identify and classify minerals and rocks.
-rocks as sedimentary, igneous or metamorphic
-Rock Cycle
-minerals as carbonates or silicates
Intro: Minerals as oxides, sulfides, halides, sulfates

2.2 Explain the role of plate tectonics in shaping Earth.
-plate boundaries
-volcanoes
-earthquakes
-seismic waves
-mountains
-convection currents in the mantle
-changes over time

2.3 Explain the factors that create weather and the instruments and technologies that assess it.
-differentiate between climate and climate zones
Intro: effects of the ocean on weather, condensation, evaporation, cloud Formation

2.4 Examine the chemical and physical properties of the ocean to determine causes and effects of currents and waves.
-Intro: El Nino, ocean zones, ocean floor features

2.5 Explain the impact of weathering and erosion on the Earth.
-soil formation
-deposition
-land transformations (Grand Canyon)
-glaciation
Intro: use geospatial technologies to investigate natural phenomena.

3.0 Analyze essential principles and ideas about the composition and structure of the universe.

3.1 Compare celestial bodies within the solar system using composition, size, and orbital motion.
-describe the composition of the Sun, the planets, asteroids, and comets.
Intro: measurement in space, constellations, galaxies, life cycle of a star, HR Diagram, law of gravitation, Big Bang Theory, Doppler effect

3.2 Differentiate the influences of relative positions of the Earth, Moon, and Sun.
-lunar and solar eclipses,
-moon phases
-tides
-seasons

4.0 Understand the nature and origin of scientific knowledge.

4.1 Differentiate among facts, predictions, theory, and law/principles in scientific investigations.
-define fact, predictions, theory, and law/principle
-discuss how theory can become law.

1.0 Apply the skills necessary to conduct scientific investigations.

1.1 Design a replicable scientific investigation.
-use appropriate supportive technologies
-access the limits of accuracy inherent in a particular measuring device or procedure
-control variables to test hypotheses by repeated trials
-interpret date to justify predictions or conclusions
-identify sources of experimental error
-interpret to make predictions and/or justify conclusions
-use research methods to investigate practical and/or personal scientific problems
-demonstrate appropriate use of apparatus and technologies for

investigations
-use proper safety procedures in all investigations
-wear appropriate attire.

Eighth Grade Science
August

Unit: Nature of Science

Resources:

Chapter 1, Section 1 & 2
Scientific Method Video (elephant urine)
Posters
CD Rom: Discovery States of Matter

Standards:

4.1 Students are able to differentiate among facts, predictions, theory, and law/principals in scientific investigations.
5.1 Students are able to design a replicable scientific investigation.

Essential Questions:

Can you solve everyday issues using the Scientific Method?
Can you design an experiment that can be repeated to answer your question?
When does a hypothesis become a theory and finally a law?

Skills:

Students will design and conduct a replicable scientific investigation justifying facts, predictions, and theories.

Activities:

Inquiry Lab p.9
Quick Demo p.10
Demonstrate 6 steps of scientific method
Elephant Urine Video
Classroom (Lab) management skills/expectations

Assessments:

Create an experiment/ follow steps of scientific method to test hypothesis.

Eighth Grade Science
September/October

Unit: Structure/Properties/Changes in Matter

Resources:

- The Nature of Matter text
- Atom model kits
- Dry erase boards
- Periodic table
- Videos: Discovery Elements, Discovery Elements and Compounds, Atom: A Closer Look
- microviewers
- Internet sites: www.chemicalelements.com

Standards:

1.1Students are able to classify matter as elements, compounds, or mixtures.

1.2 Students are able to use the Periodic Table to compare and contrast families of elements and to classify elements as metals, metalloids, or non-metals.

1.3Students are able to compare properties of matter resulting from physical and chemical changes.

Essential Questions:

- Since they are unseen, how do we know all matter is composed of atoms?
- How do you distinguish elements from compounds from mixtures?
- How is the periodic table organized?
- Who developed the system?
- Is it evolving?
- What information is given for each element?
- What types of physical and chemical changes can be identified in everyday life?

Skills:

- Students will create models of elements, compounds, or mixtures.
- Students will explain the predictive nature of the periodic table.
- Students will predict properties of matter resulting from physical and chemical changes.

Students will understand elements, compounds, mixtures, and solutions.
Students will draw Bohr's model.
Students will understand the properties of metals, nonmetals, and metalloids.

Activities:

Students will complete an atom Booklet
Students will construct a Bohr models 1-18 on erase boards
Students will demonstrate Physical/Chemical Change
Students will prove something is a mixture (homogeneous /heterogeneous)
Students will create a ompound cooking example
Students will complete a Mystery Mixture Lab p.30
Students will complete a Finding the Difference Lab p.77
Students will understand vocabulary using a vocab foldable
Students will complete a Battle of the Toothpastes Lab p.89
Students will complete a Periodic Table Treasure Hunt
Students will sort Chemical/Physical Change
Studnets will utilize microviewers

Assessments:

Students will complete a station Inquiry test identifying elements/compounds/mixtures (24 stations—active test)
Students will esearch one element on its properties and complete report.

Eighth Grade Science
November

Unit: Rocks and Minerals

Resources:

- Chapter 3 & 4 (earth science)
- Micro viewers
- Videos—Shape of Land, Billy Nye Rock and Soil, Grand Canyon
- Rock kits & collection
- Streak Plates
- CD Rom: Rocks and Minerals
- earth.msscience.com (science online)
- Glencoe Lab Activities Manual 3&4
- Glencoe Chapter Resources: Minerals (Fast File) ""Rocks
- Glencoe Critical Thinking/Problem solving manual
- Glencoe Science Inquiry Lab Manual
- Cooperative Learning in the Science Classroom

Standards:

- 2.1 Students are able to identify and classify minerals and rocks.

Essential Questions:

- How do we use minerals/rocks in everyday life?
- What important natural resources minerals provide for us on Earth?
- What is the difference between a rock and a mineral?
- Do rocks change?
- What is the rock cycle?
- What are the 3 different types of rocks?
- How do you distinguish their characteristics?

Skills:

- Students will use classification methods, identify, and classify unknown minerals and rocks.
- Students will create the rock cycle.
- Students will understand minerals as carbonates or silicates.
- Students will be introduced to minerals as oxides and sulfides.

Activities:

Students will understand vocabulary using vocab foldables.
Students will complete Mini-Lab salt/sugar p. 63
Students will complete Rock Cycle Lab
Students will complete Igneous, Metamorphic, sedimentary Rock Labs
Students will complete the Virtual Lab: How are rocks classified p.96
Students will understand Metamorphism online p.100
Studnets will tour Watertown Monument Company.

Assessments:

Students will identify types of rocks and minerals (paper/pencil, groupings, charts)

Eighth Grade Science
December

Unit: Weathering/Erosion

Resources:

Chapter 7 & 8
Videos—Discovery Rocks, Weathering and Erosion
earth.msscience.com (science online)
Glencoe Lab Activities Manual
Glencoe Chapter Resources:
Glencoe Critical Thinking/Problem solving manual
Glencoe Science Inquiry Lab Manual

Standards:

2.5 Students are able to explain the impact of weathering and erosion on the Earth.

Essential Questions:

What is the difference between weathering and erosion?
How is soil formed? How is soil changed?

Skills:

Students will predict the consequences of weathering/erosion.
Students will describe the difference between weathering and erosion.
Students will understand soil formation, deposition, land transformation, and glaciation.
Students will be introduced to the use of geospatial technologies to investigate natural phenomena.

Activities:

Students will understand the use of Sedimentators
Students will complete Mini Lab p.190
Students will do Soil profiling.
Students will complete Lab Weathering Chalk p.200
Students will comprehend the causes/Effects/Preventions of soil erosion
Students will listen to a presentation by Chuck Langner.

Assessments:

Students will be able to profile the causes and effects of soil samples.

Eighth Grade Science
January/February

Unit: Plate Tectonics/Geologic changes of earth's surface

Resources:

Chapters 10, 11, 12, 13, 14--Unit 3&4
earth.msscience.com (science online)
Glencoe Lab Activities Manual 3&4
Glencoe Chapter Resources: Plate Tectonics (Fast File)
Glencoe Critical Thinking/Problem solving manual
Ocean Floor Relief maps
Video: Earth's crust, Bill Nye, textbook videos, Many Discovery videos,(refer to video library)
History of Earth CD ROM

Standards:

2.2 Students are able to explain the role of plate tectonics in shaping Earth.

Essential Questions:

What causes the surface of the Earth to change?
Is the surface still changing?
Are certain parts of the Earth more likely to have natural disasters compared to other parts?
What are safety measures you should know to protect you from these disasters?
What present day evidence tells that the earth's surface is changing?

Skills:

Students will give evidence that supports the theory of plate tectonics and its role in shaping earth.
Students will describe activities that occur along plate boundaries.
Students will understand plate boundaries, volcanoes, earthquakes, Seismic waves, mountains, convection currents in the Mantle, and changes over time.

Activities:

Students will complete a plate Tectonic Project (contract)
Students will complete a pangaea Cut/Paste

Students will models three ways plates move
Students will research and manipulate fossil Kits
Students will complete molds/casts
Students will utilize sedimentators
Students will classify fossils
Students will create a convection current (heat transfer, lava lamp)
Students will make your own game day

Assessments:

Studnets will complete a contracted plate tectonic project with class presentation.

Eighth Grade Science
March

Unit: Weather

Resources:

- Chapter 16 &17
- Videos—
- CD Rom: Weather
- Weather instruments
- Daily weather maps/logs
- Weatherunderground.com
- Keloland.com
- Earth.msscience.com (science online)
- Glencoe Lab Activities Manual
- Glencoe Chapter Resources:
- Glencoe Critical Thinking/Problem solving manual
- Glencoe Science Inquiry Lab Manual

Standards:

2.3 Students are able to explain the factors that create weather and the instruments and technologies that assess it.

2.4 Students are able to examine the chemical and physical properties of the ocean to determine causes and effects of currents and waves.

Essential Questions:

- What is weather?
- What causes weather?
- How do we measure weather?
- What is climate?
- What is a climate zone?
- What causes different climate zones?

Skills:

- Students will analyze weather maps and make basic predictions.
- Students will explain the factors that create weather and the instruments that assess it.
- Students will predict the climate of a coastal region based on ocean currents.

Students will examine the chemical and physical properties of the ocean to determine causes and effects of currents and waves.
Students will differentiate between climate and climate zones.
Students will be introduced to the effects of the ocean on weather, condensation, evaporation, and cloud formation.
Students will be introduced to El Nino, La Nina, ocean zones, and Ocean floor features.

Activities:

Students will chart the daily weather
Students will build a weather instrument

Assessments:

Students will complete a flip chart Research project
Using weather map, students will forecast weather for a specific area.

8th Grade Science
April/May

Unit: Astronomy

Resources:

Chapters 23, 24 &25
Celestial Globes
CD rom: Discovery The Universe
Videos: Discovery The Solar System, The Birth and Death of Stars, Discovering our Universe (many more refer to video library)
Constellation charts
Asteroid Deadly Impact Video
Birth and Death of Stars

Standards:

3.1 Students are able to compare celestial bodies within the solar system using composition, size and orbital motion.
3.2 Students are able to differentiate the influences of the relative positions of the Earth, Moon, and Sun.

Essential Questions:

What are the similarities/differences of the sun, earth and moon?
What relationships do the sun, moon, and earth have to one another?
How do they affect the life on Earth?
What is the composition of the sun, planets, asteroids, and comets?

Skills:

Students will construct a scale model of the solar system.
Students will predict the effect's on the Earth's environment if tilt, distance, or atmosphere were changed.
Students will describe the composition of the Sun, the planets, Asteroids and comets.
Students will be introduced to measurement in space, constellations, galaxies, life cycle of stars, HR diagram, law of gravitation, big bang theory, and Doppler effect.
Students will understand lunar and solar eclipses, moon phases, tides, and seasons.

Activities:

Students will list planet composition facts
Students will chart moon phases using Internet
Students will understand vocabulary using vocab foldables
Students will complete Lab Solar System distance model p. 714
Students will research internet, gather information, write a 5 paragraph report, report to class
Students will create your own constellation

Assessments:

Students will create a scale model of the solar system.
Students will create a research project.

BIOLOGY

AUGUST

UNIT 1: Science of Biology

RESOURCES:

- **Biology text**
  - Scientific Method pp. 3-5, 8-10, 14-15
  - Characteristics of Life pp. 16-19
  - Levels of Organization pp. 20-21
  - Microscope pp. 25-26

- **Online Resources/Tutorials/Simulations/Animations**
  - Scientific Method

    http://biology.clc.uc.edu/courses/bio104/sci_meth.htm

    Experimental Design and the Scientific Method
    http://www.scienceteacherprogram.org/biology/Perez03.html

  - Characteristics of Life

    Classifying Life
    http://www.pbs.org/wgbh/nova/orchid/classifying.html

  - Levels of Organization

    http://staff.jccc.net/PDECELL/lifeis/biorgnew.html

  - Microscope

    Types of microscopes
    http://sps.k12.ar.us/massengale/microscope_notes.htm

    http://www.microbeworld.org/htm/aboutmicro/tools/scopes.htm

    Microscopy Images of Cells and Tissue
    http://www.kumc.edu/instruction/medicine/anatomy/histoweb/

STANDARDS:

- Describe the role of observation and evidence in the development and modification of hypotheses, theories, and laws. (N.1.2)
- Apply science process skills to design and conduct student investigations. (N.2.1)
- Practice safe and effective laboratory techniques. (N.2.2)

ESSENTIAL QUESTIONS:

- How are sound scientific discoveries made?
- What makes those discoveries reliable and valid?
- Why is it important for scientific discoveries to be flexible?
- What is the difference between a theory and a law in science?
- What makes an organism alive? What "defines a living thing?"
- How is life organized?
- What is a hierarchy?
- What are the scientific uses of the microscope?
- What are the optical relationships in light microscopy? Resolution? Magnification? Field of view?

SKILLS:

1. Information and Communication Skills
2. Thinking and Problem-Solving Skills
3. Interpersonal and Self-Directional Skills
4. Correct techniques and procedures using scientific equipment
5. Utilize strategies to help themselves learn and apply information

** Skills addressed in the activities are indicated in the activity section below with the number corresponding to the skill.

ACTIVITIES:

- Race Track Playa ~ Scientific Method Activity (1,2,3)
  - SmartBoard discussion
  - Student inquiry (individual and group)
  - Web research
  - Oral presentation
- Biological Problems Problem Solving Activity (1,2,3,5)
- Light Microscopy Virtual Web Quest (1,2)
- Graphic Organizer of Levels of Organization Literacy/Thinking Strategy (1,2,3,5)
- Characteristics of Life Inquiry Activity (1,2,3)
- Classroom Performance System Unit Preview/Review (1,2,3)
- Blog essential question(s) (1,2,3,5)

LABS:

- How to Measure Microscopic Objects/Organisms with the Microscope Lab (4)
  - * Do Microscope Measurement Preview before lab
- Inquiry Plant Growth Lab
  - * Reinforce inquiry and scientific method, variables, independent and dependent variables, data collection, and graphing (1,2,3,4)
- Is Yeast Alive Investigation (1,2,3,4)

ASSESSMENTS:

- Microscope Practical Quiz
- Lab Procedure Assessment
- All activities and labs will be assessed
- Unit test
- Informal preview and review assessment using CPS

BIOLOGY

SEPTEMBER

UNIT 2: Taxonomy and Evolutionary Relationships

RESOURCES:

- **Biology text**
  - History of Classification pp. 446-449
  - Modern Classification pp. 451-454
  - Kingdoms pp. 457-459
  - Dichotomous keys pp. 462-463
  - Evolution pp. 368-372, 376

- **Online Resources/Tutorials/Simulations/Animations**
  - History of Classification
    http://anthro.palomar.edu/animal/animal_1.htm

  - Modern Classification/Taxonomy
    http://mclibrary.nhmccd.edu/taxonomy/taxonomy.html

    http://jrscience.wcp.muohio.edu/lab/TaxonomyLab.html

  - Kingdoms/Domains
    http://www.ucmp.berkeley.edu/alllife/threedomains.html

  - Dichotomous Keys
    Lab Lesson on Dichotomous Keys
    http://www.lamer.lsu.edu/classroom/edonahalfshell/dicotkey2.htm

  - Evolution
    Virtual Filed Trip to Galapogas Islands
    http://www.pbs.org/safarchive/galapagos.html

    Biology and Evolution
    http://www.talkorigins.org/origins/faqs-evolution.html

    EvoTutor
    http://www.evotutor.org/TutorA.html

    http://evolution.berkeley.edu/

    Evolution in Action
    http://www.pbs.org/wgbh/nova/link/evolution.html

Howard Hughes Medical Institute – Evolution
http://www.hhmi.org/biointeractive/evolution/index.html

Teaching Evolution and Making it Relevant
http://www.evoled.org/lessons/pathways.htm

STANDARDS:

- Classify organisms using characteristics and evolutionary relationship of major taxa. (L.1.2)
- Identify structures and function relationships within major taxa. (L.1.3)
- Evaluate a scientific discovery to determine and describe how societal, cultural, and personal beliefs influence scientific investigations and interpretations. (N.1.1)
- Describe the role of observation and evidence in the development and modification of hypotheses, theories, and laws. (N.1.2)
- Apply science process skills to design and conduct student investigations. (N.2.1)
- Practice safe and effective laboratory techniques. (N.2.2)
- Evaluate and describe the impact of scientific discoveries on historical events and social, economic, and ethical issues. (S.1.2)

ESSENTIAL QUESTIONS:

- Why are viruses not classified in any of the six kingdoms?
- What are the major differences in Darwin's and Lamarck's ideas of evolution?
- Why is there controversy in the number of classification taxon?
- What scientific proof is there to show evolutionary relationships between organisms?
- Why is Latin the language of taxonomy and why are common names not useful?
- How and why are dichotomous keys used?

SKILLS:

1. Information and Communication Skills
2. Thinking and Problem-Solving Skills
3. Interpersonal and Self-Directional Skills
4. Correct techniques and procedures using scientific equipment
5. Utilize strategies to help themselves learn and apply information

** Skills addressed in the activities are indicated in the activity section below with the number corresponding to the skill.

ACTIVITIES:

- Pre-check and Post-check History of Classification strategy (3,5)
- Taxonomic Organization Anticipation Guide (3,5)
- Taxonomy SmartBoard discussion (Find in History of Classification file) (1,3)
- Kindgom Project ~ students research the 6 kindoms and create a product using technology (ex. PowerPoint, Publisher document, Inspiration graphic organizer, Movie, etc.) (1,2,3,5)
- Evolutionary relationships Smartboard discussion (goes with note taking guide) (1,2,3)
- Theories of Evolution ~ Darwin vs. Lamarck Anticipation Guide (3,5)
- Darwin and Lamarck Web Quest (1,2,3,5)
- Classroom Performance System Unit Preview/Review (1,2,3)
- Blog essential question(s) (1,2,3,5)

LABS:

- Peppered Moth Lab
- Dichotomous Key Virtual Lab

ASSESSMENTS:

- Kindgom Project assessed with rubric
- All activities and labs will be assessed
- Unit test
- Informal preview and review assessment using CPS

BIOLOGY

SEPTEMEBER

UNIT 3: Environmental Ecological Studies

RESOURCES:

- **Biology text**
  - Levels of Organization p. 64
  - Food, Energy, and Chemical Cycles pp. 67-73
  - Cycles pp. 75-78
  - Biological Magnification p. 152
  - Energy flow pp. 67-73
  - Niche pp. 91
  - Feeding relationships pp. 93
  - Community interactions pp. 92

- **Environmental Science text**

- **Online Resources/Tutorials/Simulations/Animations**

  - Ecology

    http://biocab.org/Ecology_1.html

    Overview of Ecology
    http://www.troy.k12.ny.us/thsbiology/skinny/skinny_ecology.html

    http://www.fi.edu/tfi/units/life/habitat/habitat.html

    Environmental Education
    http://eelink.net/pages/Site+Map+New#teach

    Online Expeditions
    http://www.oneworldjourneys.com/expeditions/

    EPA
    http://www.epa.gov/airmarkets/index.html

  - Food, Energy, and Chemical Cycles

    Nutrient Cycles
    http://www.ppippic.org/ppiweb/ppibase.nsf/$webindex/article=5203CB87852569B50057E346C0116272

    http://www.greenfacts.org/glossary/def/environmental-cycles.htm

- Biological Magnification

Earth in Peril

http://www.pbs.org/wgbh/nova/worldbalance/earth.html

- Energy flow

http://www.eelsinc.org/id43.html

http://www.scienceclarified.com/Ex-Ga/Food-Web-and-Food-Chain.html

- Niche

http://ghs.gresham.k12.or.us/science/ps/sci/ibbio/ecology/notes/niche.htm

- Feeding relationships

http://www.le.ac.uk/se/centres/sci/selfstudy/eco3.htm

- Community interactions

http://www.cals.ncsu.edu/course/ent591k/symbiosis.html

http://www.ms-starship.com/sciencenew/symbiosis.htm

STANDARDS:

- Identify factors that can cause changes in stability of populations, communities, and ecosystems. (L.3.1)
- Explain how elements and compounds cycle between living and non-living systems. (E.1.1)
- Assess how human activity has changed the land, ocean, and atmosphere of the Earth. (E.1.2)
- Evaluate and describe the impact of scientific discoveries on historical events and social, economic, and ethical issues. (S.1.2)
- Describe the immediate and long-term consequences of potential solutions for technological issues. (S.2.1)
- Apply science process skills to design and conduct student investigations. (N.2.1)
- Practice safe and effective laboratory techniques. (N.2.2)
- Describe the role of observation and evidence in the development and modification of hypotheses, theories, and laws. (N.1.2)
- Analyze and describe the benefits, limitations, cost, and conserving, or recycling resources. (S.2.3)

ESSENTIAL QUESTIONS:

- What is core of the Gaia Hypothesis?
- What different levels of organization do ecologists study?

- Where does the energy for life processes come from?
- How does energy flow through living systems?
- How efficient is the transfer of energy among organisms in an ecosystem?
- How does matter move among the living and nonliving parts of an ecosystem?
- How are nutrients important in living systems?
- How do biotic and abiotic factors influence an ecosystem?
- What interactions occur within communities?

SKILLS:

1. Information and Communication Skills
2. Thinking and Problem-Solving Skills
3. Interpersonal and Self-Directional Skills
4. Correct techniques and procedures using scientific equipment
5. Utilize strategies to help themselves learn and apply information

** Skills addressed in the activities are indicated in the activity section below with the number corresponding to the skill.

ACTIVITIES:

- Energy Flow Precheck and Postcheck strategy (5)
- Matter and Energy SmartBoard Discussion (with note outline/strategies) (1,3)
- Chemical Cycles Cubing Strategy (1,2,3,5)
- Cycles of Matter Comparison Matrix Strategy (1,2,3,5)
- Food, Energy, and Chemical Cycles SmartBoard discussion (add phosphorus cycle) (with note outline/strategies) (1,3)
- Niche and Feeding Relationships SmartBoard discussion (with note outline/strategies) (1,3)
- Classroom Performance System Unit Preview/Review (1,2,3)
- Blog essential question(s) (1,2,3,5)
- Environment Research Project ~ students work in pairs to research a non-native species (fire ants, lampreys, zebra mussels, killer bees, etc) on their environment and economic impact of the organism. (1,2,3,5)
- Pros and Cons of building dams and their affect on the environment Web Quest (1,2,5)
- Wooly Mammoth Extinction Web Quest (Use Mammoth Extinction sheet on line) (1,2)

LABS:

- The Atmosphere and Living Things Lab (analyze data, create graph, and develop questions and inferences based on the data) (1,2,3,4,)
- Oxygen and Carbon Dioxide Cycle Lab (1,2,3,4,)
- Capture – Recapture Method Lab (p. 29 in Environmental Science book) (1,2,3,4,)
- Observing Decomposition Inquiry Lab (reference – Lab Manual B p. 77) (1,2,3,4)

ASSESSMENTS:

- Environmental Research Project will be assessed with a rubric
- All activities and labs will be assessed
- Unit test
- Informal preview and review assessment using CPS

BIOLOGY

OCTOBER/NOVEMBER

UNIT 4: Cell Biology

RESOURCES:

- **Biology text**
  - Molecules of Life pp. 40-53
  - Transport/Cell Membrane pp. 183-189
  - Cell Structure and Function pp. 172-183
  - Energy/photosynthesis pp. 200-215
  - Energy/respiration pp. 220-233
  - DNA/RNA pp. 286-306
  - Cell Cycle pp. 240-248

- **Online Resources/Tutorials/Simulations/Animations**
  - Molecules of Life

    Enzymes
    http://www.lewport.wnyric.org/jwanamaker/animations/Enzyme%20activity.html

  - Transport/Cell Membrane

    http://www.wiley.com/legacy/college/boyer/0470003790/animations/membrane_trane_transport.swf

    http://www.emc.maricopa.edu/faculty/farabee/biobk/BioBooktransp.html

  - Cell Structure and Function

    http://personal.tmlp.com/Jimr57/textbook/chapter3/chapter3.htm

    http://www.cellsalive.com/

  - Energy/photosynthesis

    Illuminating Photosynthesis
    http://www.pbs.org/wgbh/nova/methuselah/photosynthesis.html

    http://www.mic-d.com/java/photosynthesis/index.html

  - Energy/respiration

    http://www.taylor.edu/academics/acadDepts/biology/energetics/

    http://www.biochemweb.org/metabolism.shtml

- DNA/RNA

Explore a Stretch of Code
http://www.pbs.org/wgbh/nova/genome/explore.html

DNA Interactive
http://www.dnai.org/

http://www.ncc.gmu.edu/dna/

http://www.dnalc.org/home.html

http://gslc.genetics.utah.edu/

http://www.accessexcellence.org/RC/VL/GG/

- Cell Cycle

Control of Cell Cycle
http://nobelprize.org/educational_games/medicine/2001/cellcycle.html

How Cancer Grows
http://www.pbs.org/wgbh/nova/cancer/grows.html

How Cells Divide
http://www.pbs.org/wgbh/nova/baby/divide.html

STANDARDS:

- Relate cellular functions and processes to specialized structures within cells. (L.1.1)
- Apply process skills to design and conduct student investigations. (N.2.1)
- Practice safe and effective laboratory techniques. (N.2.2)

ESSENTIAL QUESTIONS:

- Why are water molecules polar? How does that affect the arrangement of the cell membrane molecules?
- What are the functions of each group of organic macromolecules?
- Why are enzymes important to living things?
- What are the main functions of the cell membrane and the cell wall?
- What happens during diffusion and why?
- What happens during osmosis and why?
- What are the similarities and differences between passive and active transport?
- What are the characteristics of prokaryotes and eukaryotes?

- What are the similarities and differences between animal and plant cells?
- What are the functions of the major cell organelles?
- Where do plants get the energy they need to produce food?
- What is the role of ATP in cellular activities?
- What is the role of light, carbon dioxide, water, cholorphyll, glucose, oxygen, and enzymes in photosynthesis?
- What is cellular respiration?
- What are the two main types of fermentation?
- What is the structure of DNA and how does the structure allow DNA to pass on information to determine an organism's traits?
- What happens during DNA replication?
- What are the main three types of RNA and what are their functions?
- What is transcription?
- What is translation?
- What limits the size of cells?
- What are the main events in the cell cycle?
- How is the cell cycle regulated?

SKILLS:

1. Information and Communication Skills
2. Thinking and Problem-Solving Skills
3. Interpersonal and Self-Directional Skills
4. Correct techniques and procedures using scientific equipment
5. Utilize strategies to help themselves learn and apply information

** Skills addressed in the activities are indicated in the activity section below with the number corresponding to the skill.

ACTIVITIES:

- Classroom Performance System Unit Preview/Review (1,2,3)
- Blog essential question(s) (1,2,3,5)
- Macromolecules of Life Graphic Organizer with reading (see Jensi) (1,2,5)
- Enzyme Frayer Model (1,2,5)
- Building a Model of the Plasma Membrane on the wall (see Jensi) (1,2,5)
- Cellular Transport and Homeostasis Precheck and Postcheck or key words, Stump the Teacher, and Free Write strategies (1,2,5)
- Homeostasis SmartBoard discussion (1,2)
- Diffusion and Cell Transport Web Quest (imbedded Mini-lab within Web Quest – see below in lab section) (1,2,3,5)
- Active Transport Web Quest (1,2,3,5)
- Movement of Particles Concept Map/Word Sort SmartBoard Activity (1,2)
- Picture Notes over Cell Membrane (1,2,3,5)

- Cell Organelle Project with Rubric (1,2,3,5)
- Animal Cell Interactive Map (1,2,3,5)
- Food Chain Activity in relationship to photosynthesis and respiration (see Scott) (1,2,5)
- ATP Objectives, Key Words, Precheck and Postcheck Literacy Strategy (1,2,5)
- Biology.com visual aids for photosynthesis and respiration (1,2)
- DNA WebQuest (1,2,5)
- Exploring DNA Internet Activity (1,2,5)
- Transcription and Translation Online Exploration and Graphic Organizer (1,2,5)
- How has the Knowledge of DNA Changed Our World Project with Rubric (1,2,3,5)
- DNA and Replication SmartBoard Discussion (1,2)
- Transcription and Translation SmartBoard Discussion (1,2)
- Surface Area and Volume Activity (See Scott) (1,2,3,5)
- Onion Root Tip – Mitosis Activity (1,2)

LABS:

- Catalase Lab – Investigating Properties of Enzymes (Introduction Lab) (1,2,3,4)
- Investigating the Effect of Temperature on Enzyme Activity – using LabPro (reference – Probeware Lab Manual p. 21) (1,2,3,4)
- Observing and Comparing Different Cell Types Lab (1,2,3,4)
- Examine the Rate of Diffusion Inquiry (reference – p.150 Biology: Dynamics of Life text) (1,2,3,4)
- Movement of Molecules In and Out of Cells Inquiry Lab (1,2,3,4)
- Measuring the Effect of Light Intensity on Photosynthesis (reference – p. 91 Biology: Laboratory Manual A) (1,2,3,4)
- Observing Respiration (reference – p. 95 Biology: Laboratory Manual A) (1,2,3,4)
- How Does Exercise Affect Disposal of Wastes from Cellular Respiration? – using LabPro (reference – Probeware Lab Manual p. 27) (1,2,3,4)
- What Does DNA Look Like? DNA Extraction Lab (1,2,3,4)
- Mitosis SmartBoard Discussion (1,2,3,4)

ASSESSMENTS:

- All activities, projects, and labs will be assessed
- Unit test
- Informal preview and review assessment using CPS

BIOLOGY

DECEMBER

UNIT 5: Genetics

RESOURCES:

- **Biology text**
  - Mendel pp. 262-274
  - Meiosis pp. 275-278
  - Mutations pp. 307-308
  - Speciation pp. 404-405
  - Evidence for evolution pp. 382-385

- **Online Resources/Tutorials/Simulations/Animations**
  - Overview of Genetics
    http://www.kumc.edu/gec/

  - Mendel
    Biology Project – monohybrid crosses
    http://www.biology.arizona.edu/mendelian_genetics/problem_sets/monohybrid_cross/monohybrid_cross.html

  - Meiosis
    How Cells Divide
    http://www.pbs.org/wgbh/nova/baby/divide.html

  - Speciation
    http://www.globalchange.umich.edu/globalchange1/current/lectures/speciation/speciation.html
  - Evidence for evolution
    http://www.gate.net/~rwms/EvoEvidence.html

    http://newton.nap.edu/html/creationism/evidence.html

STANDARDS:

- Relate cellular functions and processes to specialized structures within cells. (L.1.1)
- Predict inheritance patterns using a single allele. (L.2.1)
- Describe how genetic recombination, mutations, and natural selections lead to adaptations, evolution, extinction, or the emergence of new species. (L.2.2)
- Identify factors that can cause changes in stability of populations, communities, and ecosystems. (L.3.1)

- Explain to explain ethical roles and responsibilities of scientists and scientific research. (S.1.1)
- Evaluate and describe the impact of scientific discoveries on historical events and social, economic, and ethical issues. (S.1.2)
- Describe immediate and long-term consequences of potential solutions for technological issues. (S.2.1)
- Analyze factors that could limit technological design. (S.2.2)
- Evaluate a scientific discovery to determine and describe how societal, cultural, and personal beliefs influence scientific investigations and interpretations. (N.1.1)
- Describe the role of observation and evidence in the development and modification of hypotheses, theories, and laws. (N.1.2)
- Apply science process skills to design and conduct student investigations. (N.2.1)
- Practice safe and effective laboratory techniques. (N.2.2)

ESSENTIAL QUESTIONS:

- How did Mendel contribute to genetics and our understanding of how traits are passed from generation to generation?
- How do geneticists use the principles of probability?
- How do geneticists use a Punnett square?
- What is the principle of segregation and independent assortment?
- What happens during the process of meiosis?
- How is meiosis different from mitosis?
- What are mutations?
- What factors are involved in the formation of new species?
- What are the evidences for evolution?

SKILLS:

1. Information and Communication Skills
2. Thinking and Problem-Solving Skills
3. Interpersonal and Self-Directional Skills
4. Correct techniques and procedures using scientific equipment
5. Utilize strategies to help themselves learn and apply information

** Skills addressed in the activities are indicated in the activity section below with the number corresponding to the skill.

ACTIVITIES:

- Classroom Performance System Unit Preview/Review (1,2,3)
- Blog essential question(s) (1,2,3,5)
- Mendelian Genetics Precheck and Postcheck with Anticipation Guide (1,2,4,5)
- Genetics Problems Part A – single allele (1,2)
- Drag and Drop Genetics Online (1,2,5)
- Blue People of Troublesome Creek Research (1,2,3)
- Blue People of Troublesome Creek Disorder Powerpoint (1,2)
- Meiosis Process Inspiration Sort w/ Key (1,2,5)
- Semantic Feature Analysis Grid – Comparing and contrasting Mitosis and Meiosis (1,2,5)
- Meiosis Modeling using pipe cleaners, beads, etc. (See Jensi) (1,2,5)
- Biology.com to see meiosis (2)
- Mutation Graphic Organizer – comparing and contrasting gene mutations and chromosome mutations (See Jensi) (1,2,5)
- Evidence for Evolution SmartBoard Discussion (See Scott) (1,2)

LABS:

- Investigating Inherited Traits (reference – Biology: Laboratory Manual A p. 107) or Build a Baby Lab (See Jensi) (1,2,3,4)
- DNA Fingerprinting Activity (optional?) (1,2,3,4)

ASSESSMENTS:

- All activities, projects, and labs will be assessed
- Unit test
- Informal preview and review assessment using CPS

ONLINE BIOLOGY RESOURSES

HANDS-ON BIOLOGY ACTIVITIES
http://serendip.brynmawr.edu/sci_edu/waldron/

INTERACTIVE BIOLOGY
http://serendip.brynmawr.edu/sci_edu/biosites.html#9

BIOLOGY REFERENCE SITES
http://science.nhmccd.edu/bioL/bio1.html

BIOLOGY RESOURCES
http://www.educationindex.com/biology/

ONLINE SCIENCE TUTORIALS (lots of links – scroll down for science)
http://www.khake.com/page67.html

SCIENCE ANIMATIONS, MOVIES, AND INTERACTIVE TUTORIALS (all science subjects)
http://science.nhmccd.edu/BioL/animatio.htm

WRITING LAB REPORTS
http://www.ncsu.edu/labwrite/index_labwrite.htm

DISCOVERY (all subjects)
http://school.discovery.com/schrockguide/sci-tech/scigs.html

SCIENCE FRIDAYS (audio from National Public Radio)
http://www.sciencefriday.com/

LAB VELOCITY (science tools)
http://researchlink.labvelocity.com/index.jhtml

VIRTUAL LIBRARY OF NATURAL SCIENCES (lots of links for all sciences)
http://vlib.org/Science

NATIONAL SCIENCE FOUNDATION
http://www.nsf.gov/

NATIONAL SCIENCE TEACHER ASSOCIATION
http://www.nsta.org/

SCIENCE DAILY (latest research news and science breakthroughs)
http://www.sciencedaily.com/

NATIONAL LIBRARY OF MEDICINE
http://www.nlm.nih.gov/

THE BIOLOGY PROJECT
http://www.biology.arizona.edu/default.html

BIOLOGY ANIMATIONS
http://www.stolaf.edu/people/giannini/biological%20anamations.html

http://www.sumanasinc.com/scienceinfocus/scienceinfocus.html

HOWARD HUGHES MEDICAL INSTITUTE
http://www.hhmi.org/

BIOLOGY REFERENCE SITES
http://science.nhmccd.edu/biol/bio1.html

http://www.biologymad.com/

TEACHONE – BIOLOGY LINKS
http://teachone.tripod.com/biology/

BIOLOGY

AUGUST

UNIT 1: Science of Biology

RESOURCES:

- **Biology text**
  - Scientific Method pp. 3-5, 8-10, 14-15
  - Characteristics of Life pp. 16-19
  - Levels of Organization pp. 20-21
  - Microscope pp. 25-26

- **Online Resources/Tutorials/Simulations/Animations**
  - Scientific Method

    http://biology.clc.uc.edu/courses/bio104/sci_meth.htm

    Experimental Design and the Scientific Method
    http://www.scienceteacherprogram.org/biology/Perez03.html

  - Characteristics of Life

    Classifying Life
    http://www.pbs.org/wgbh/nova/orchid/classifying.html

  - Levels of Organization

    http://staff.jccc.net/PDECELL/lifeis/biorgnew.html

  - Microscope

    Types of microscopes
    http://sps.k12.ar.us/massengale/microscope_notes.htm

    http://www.microbeworld.org/htm/aboutmicro/tools/scopes.htm

    Microscopy Images of Cells and Tissue
    http://www.kumc.edu/instruction/medicine/anatomy/histoweb/

STANDARDS:

- Describe the role of observation and evidence in the development and modification of hypotheses, theories, and laws. (N.1.2)
- Apply science process skills to design and conduct student investigations. (N.2.1)
- Practice safe and effective laboratory techniques. (N.2.2)

ESSENTIAL QUESTIONS:

- How are sound scientific discoveries made?
- What makes those discoveries reliable and valid?
- Why is it important for scientific discoveries to be flexible?
- What is the difference between a theory and a law in science?
- What makes an organism alive? What "defines a living thing?"
- How is life organized?
- What is a hierarchy?
- What are the scientific uses of the microscope?
- What are the optical relationships in light microscopy? Resolution? Magnification? Field of view?

SKILLS:

1. Information and Communication Skills
2. Thinking and Problem-Solving Skills
3. Interpersonal and Self-Directional Skills
4. Correct techniques and procedures using scientific equipment
5. Utilize strategies to help themselves learn and apply information

** Skills addressed in the activities are indicated in the activity section below with the number corresponding to the skill.

ACTIVITIES:

- Race Track Playa ~ Scientific Method Activity (1,2,3)
  - SmartBoard discussion
  - Student inquiry (individual and group)
  - Web research
  - Oral presentation
- Biological Problems Problem Solving Activity (1,2,3,5)
- Light Microscopy Virtual Web Quest (1,2)
- Graphic Organizer of Levels of Organization Literacy/Thinking Strategy (1,2,3,5)
- Characteristics of Life Inquiry Activity (1,2,3)
- Classroom Performance System Unit Preview/Review (1,2,3)
- Blog essential question(s) (1,2,3,5)

LABS:

- How to Measure Microscopic Objects/Organisms with the Microscope Lab (4)
  - * Do Microscope Measurement Preview before lab
- Inquiry Plant Growth Lab
  - * Reinforce inquiry and scientific method, variables, independent and dependent variables, data collection, and graphing (1,2,3,4)
- Is Yeast Alive Investigation (1,2,3,4)

ASSESSMENTS:

- Microscope Practical Quiz
- Lab Procedure Assessment
- All activities and labs will be assessed
- Unit test
- Informal preview and review assessment using CPS

BIOLOGY

SEPTEMBER

UNIT 2: Taxonomy and Evolutionary Relationships

RESOURCES:

- **Biology text**
  - History of Classification pp. 446-449
  - Modern Classification pp. 451-454
  - Kingdoms pp. 457-459
  - Dichotomous keys pp. 462-463
  - Evolution pp. 368-372, 376

- **Online Resources/Tutorials/Simulations/Animations**
  - History of Classification
    http://anthro.palomar.edu/animal/animal_1.htm

  - Modern Classification/Taxonomy
    http://mclibrary.nhmccd.edu/taxonomy/taxonomy.html

    http://jrscience.wcp.muohio.edu/lab/TaxonomyLab.html

  - Kingdoms/Domains
    http://www.ucmp.berkeley.edu/alllife/threedomains.html

  - Dichotomous Keys
    Lab Lesson on Dichotomous Keys
    http://www.lamer.lsu.edu/classroom/edonahalfshell/dicotkey2.htm

  - Evolution
    Virtual Filed Trip to Galapogas Islands
    http://www.pbs.org/safarchive/galapagos.html

    Biology and Evolution
    http://www.talkorigins.org/origins/faqs-evolution.html

    EvoTutor
    http://www.evotutor.org/TutorA.html

    http://evolution.berkeley.edu/

    Evolution in Action
    http://www.pbs.org/wgbh/nova/link/evolution.html

Howard Hughes Medical Institute – Evolution
http://www.hhmi.org/biointeractive/evolution/index.html

Teaching Evolution and Making it Relevant
http://www.evoled.org/lessons/pathways.htm

STANDARDS:

- Classify organisms using characteristics and evolutionary relationship of major taxa. (L.1.2)
- Identify structures and function relationships within major taxa. (L.1.3)
- Evaluate a scientific discovery to determine and describe how societal, cultural, and personal beliefs influence scientific investigations and interpretations. (N.1.1)
- Describe the role of observation and evidence in the development and modification of hypotheses, theories, and laws. (N.1.2)
- Apply science process skills to design and conduct student investigations. (N.2.1)
- Practice safe and effective laboratory techniques. (N.2.2)
- Evaluate and describe the impact of scientific discoveries on historical events and social, economic, and ethical issues. (S.1.2)

ESSENTIAL QUESTIONS:

- Why are viruses not classified in any of the six kingdoms?
- What are the major differences in Darwin's and Lamarck's ideas of evolution?
- Why is there controversy in the number of classification taxon?
- What scientific proof is there to show evolutionary relationships between organisms?
- Why is Latin the language of taxonomy and why are common names not useful?
- How and why are dichotomous keys used?

SKILLS:

1. Information and Communication Skills
2. Thinking and Problem-Solving Skills
3. Interpersonal and Self-Directional Skills
4. Correct techniques and procedures using scientific equipment
5. Utilize strategies to help themselves learn and apply information

** Skills addressed in the activities are indicated in the activity section below with the number corresponding to the skill.

ACTIVITIES:

- Pre-check and Post-check History of Classification strategy (3,5)
- Taxonomic Organization Anticipation Guide (3,5)
- Taxonomy SmartBoard discussion (Find in History of Classification file) (1,3)
- Kindgom Project ~ students research the 6 kindoms and create a product using technology (ex. PowerPoint, Publisher document, Inspiration graphic organizer, Movie, etc.) (1,2,3,5)
- Evolutionary relationships Smartboard discussion (goes with note taking guide) (1,2,3)
- Theories of Evolution ~ Darwin vs. Lamarck Anticipation Guide (3,5)
- Darwin and Lamarck Web Quest (1,2,3,5)
- Classroom Performance System Unit Preview/Review (1,2,3)
- Blog essential question(s) (1,2,3,5)

LABS:

- Peppered Moth Lab
- Dichotomous Key Virtual Lab

ASSESSMENTS:

- Kindgom Project assessed with rubric
- All activities and labs will be assessed
- Unit test
- Informal preview and review assessment using CPS

BIOLOGY

SEPTEMEBER

UNIT 3: Environmental Ecological Studies

RESOURCES:

- **Biology text**

- Levels of Organization	p. 64
- Food, Energy, and Chemical Cycles	pp. 67-73
- Cycles	pp. 75-78
- Biological Magnification	p. 152
- Energy flow	pp. 67-73
- Niche	pp. 91
- Feeding relationships	pp. 93
- Community interactions	pp. 92

- **Environmental Science text**

- **Online Resources/Tutorials/Simulations/Animations**

- Ecology

http://biocab.org/Ecology_1.html

Overview of Ecology
http://www.troy.k12.ny.us/thsbiology/skinny/skinny_ecology.html

http://www.fi.edu/tfi/units/life/habitat/habitat.html

Environmental Education
http://eelink.net/pages/Site+Map+New#teach

Online Expeditions
http://www.oneworldjourneys.com/expeditions/

EPA
http://www.epa.gov/airmarkets/index.html

- Food, Energy, and Chemical Cycles

Nutrient Cycles
http://www.ppippic.org/ppiweb/ppibase.nsf/$webindex/article=5203CB87852569B50057E346C0116272

http://www.greenfacts.org/glossary/def/environmental-cycles.htm

- Biological Magnification

Earth in Peril

http://www.pbs.org/wgbh/nova/worldbalance/earth.html

- Energy flow

http://www.eelsinc.org/id43.html

http://www.scienceclarified.com/Ex-Ga/Food-Web-and-Food-Chain.html

- Niche

http://ghs.gresham.k12.or.us/science/ps/sci/ibbio/ecology/notes/niche.htm

- Feeding relationships

http://www.le.ac.uk/se/centres/sci/selfstudy/eco3.htm

- Community interactions

http://www.cals.ncsu.edu/course/ent591k/symbiosis.html

http://www.ms-starship.com/sciencenew/symbiosis.htm

STANDARDS:

- Identify factors that can cause changes in stability of populations, communities, and ecosystems. (L.3.1)
- Explain how elements and compounds cycle between living and non-living systems. (E.1.1)
- Assess how human activity has changed the land, ocean, and atmosphere of the Earth. (E.1.2)
- Evaluate and describe the impact of scientific discoveries on historical events and social, economic, and ethical issues. (S.1.2)
- Describe the immediate and long-term consequences of potential solutions for technological issues. (S.2.1)
- Apply science process skills to design and conduct student investigations. (N.2.1)
- Practice safe and effective laboratory techniques. (N.2.2)
- Describe the role of observation and evidence in the development and modification of hypotheses, theories, and laws. (N.1.2)
- Analyze and describe the benefits, limitations, cost, and conserving, or recycling resources. (S.2.3)

ESSENTIAL QUESTIONS:

- What is core of the Gaia Hypothesis?
- What different levels of organization do ecologists study?

- Where does the energy for life processes come from?
- How does energy flow through living systems?
- How efficient is the transfer of energy among organisms in an ecosystem?
- How does matter move among the living and nonliving parts of an ecosystem?
- How are nutrients important in living systems?
- How do biotic and abiotic factors influence an ecosystem?
- What interactions occur within communities?

SKILLS:

1. Information and Communication Skills
2. Thinking and Problem-Solving Skills
3. Interpersonal and Self-Directional Skills
4. Correct techniques and procedures using scientific equipment
5. Utilize strategies to help themselves learn and apply information

** Skills addressed in the activities are indicated in the activity section below with the number corresponding to the skill.

ACTIVITIES:

- Energy Flow Precheck and Postcheck strategy (5)
- Matter and Energy SmartBoard Discussion (with note outline/strategies) (1,3)
- Chemical Cycles Cubing Strategy (1,2,3,5)
- Cycles of Matter Comparison Matrix Strategy (1,2,3,5)
- Food, Energy, and Chemical Cycles SmartBoard discussion (add phosphorus cycle) (with note outline/strategies) (1,3)
- Niche and Feeding Relationships SmartBoard discussion (with note outline/strategies) (1,3)
- Classroom Performance System Unit Preview/Review (1,2,3)
- Blog essential question(s) (1,2,3,5)
- Environment Research Project ~ students work in pairs to research a non-native species (fire ants, lampreys, zebra mussels, killer bees, etc) on their environment and economic impact of the organism. (1,2,3,5)
- Pros and Cons of building dams and their affect on the environment Web Quest (1,2,5)
- Wooly Mammoth Extinction Web Quest (Use Mammoth Extinction sheet on line) (1,2)

LABS:

- The Atmosphere and Living Things Lab (analyze data, create graph, and develop questions and inferences based on the data) (1,2,3,4,)
- Oxygen and Carbon Dioxide Cycle Lab (1,2,3,4,)
- Capture – Recapture Method Lab (p. 29 in Environmental Science book) (1,2,3,4,)
- Observing Decomposition Inquiry Lab (reference – Lab Manual B p. 77) (1,2,3,4)

ASSESSMENTS:

- Environmental Research Project will be assessed with a rubric
- All activities and labs will be assessed
- Unit test
- Informal preview and review assessment using CPS

BIOLOGY

OCTOBER/NOVEMBER

UNIT 4: Cell Biology

RESOURCES:

- **Biology text**
  - Molecules of Life pp. 40-53
  - Transport/Cell Membrane pp. 183-189
  - Cell Structure and Function pp. 172-183
  - Energy/photosynthesis pp. 200-215
  - Energy/respiration pp. 220-233
  - DNA/RNA pp. 286-306
  - Cell Cycle pp. 240-248

- **Online Resources/Tutorials/Simulations/Animations**
  - Molecules of Life

    Enzymes
    http://www.lewport.wnyric.org/jwanamaker/animations/Enzyme%20activity.html

  - Transport/Cell Membrane

    http://www.wiley.com/legacy/college/boyer/0470003790/animations/membrane_trane_transport.swf

    http://www.emc.maricopa.edu/faculty/farabee/biobk/BioBooktransp.html

  - Cell Structure and Function

    http://personal.tmlp.com/Jimr57/textbook/chapter3/chapter3.htm

    http://www.cellsalive.com/

  - Energy/photosynthesis

    Illuminating Photosynthesis
    http://www.pbs.org/wgbh/nova/methuselah/photosynthesis.html

    http://www.mic-d.com/java/photosynthesis/index.html

  - Energy/respiration

    http://www.taylor.edu/academics/acadDepts/biology/energetics/

    http://www.biochemweb.org/metabolism.shtml

- DNA/RNA

Explore a Stretch of Code
http://www.pbs.org/wgbh/nova/genome/explore.html

DNA Interactive
http://www.dnai.org/

http://www.ncc.gmu.edu/dna/

http://www.dnalc.org/home.html

http://gslc.genetics.utah.edu/

http://www.accessexcellence.org/RC/VL/GG/

- Cell Cycle

Control of Cell Cycle
http://nobelprize.org/educational_games/medicine/2001/cellcycle.html

How Cancer Grows
http://www.pbs.org/wgbh/nova/cancer/grows.html

How Cells Divide
http://www.pbs.org/wgbh/nova/baby/divide.html

STANDARDS:

- Relate cellular functions and processes to specialized structures within cells. (L.1.1)
- Apply process skills to design and conduct student investigations. (N.2.1)
- Practice safe and effective laboratory techniques. (N.2.2)

ESSENTIAL QUESTIONS:

- Why are water molecules polar? How does that affect the arrangement of the cell membrane molecules?
- What are the functions of each group of organic macromolecules?
- Why are enzymes important to living things?
- What are the main functions of the cell membrane and the cell wall?
- What happens during diffusion and why?
- What happens during osmosis and why?
- What are the similarities and differences between passive and active transport?
- What are the characteristics of prokaryotes and eukaryotes?

- What are the similarities and differences between animal and plant cells?
- What are the functions of the major cell organelles?
- Where do plants get the energy they need to produce food?
- What is the role of ATP in cellular activities?
- What is the role of light, carbon dioxide, water, cholorphyll, glucose, oxygen, and enzymes in photosynthesis?
- What is cellular respiration?
- What are the two main types of fermentation?
- What is the structure of DNA and how does the structure allow DNA to pass on information to determine an organism's traits?
- What happens during DNA replication?
- What are the main three types of RNA and what are their functions?
- What is transcription?
- What is translation?
- What limits the size of cells?
- What are the main events in the cell cycle?
- How is the cell cycle regulated?

SKILLS:

1. Information and Communication Skills
2. Thinking and Problem-Solving Skills
3. Interpersonal and Self-Directional Skills
4. Correct techniques and procedures using scientific equipment
5. Utilize strategies to help themselves learn and apply information

** Skills addressed in the activities are indicated in the activity section below with the number corresponding to the skill.

ACTIVITIES:

- Classroom Performance System Unit Preview/Review (1,2,3)
- Blog essential question(s) (1,2,3,5)
- Macromolecules of Life Graphic Organizer with reading (see Jensi) (1,2,5)
- Enzyme Frayer Model (1,2,5)
- Building a Model of the Plasma Membrane on the wall (see Jensi) (1,2,5)
- Cellular Transport and Homeostasis Precheck and Postcheck or key words, Stump the Teacher, and Free Write strategies (1,2,5)
- Homeostasis SmartBoard discussion (1,2)
- Diffusion and Cell Transport Web Quest (imbedded Mini-lab within Web Quest – see below in lab section) (1,2,3,5)
- Active Transport Web Quest (1,2,3,5)
- Movement of Particles Concept Map/Word Sort SmartBoard Activity (1,2)
- Picture Notes over Cell Membrane (1,2,3,5)

- Cell Organelle Project with Rubric (1,2,3,5)
- Animal Cell Interactive Map (1,2,3,5)
- Food Chain Activity in relationship to photosynthesis and respiration (see Scott) (1,2,5)
- ATP Objectives, Key Words, Precheck and Postcheck Literacy Strategy (1,2,5)
- Biology.com visual aids for photosynthesis and respiration (1,2)
- DNA WebQuest (1,2,5)
- Exploring DNA Internet Activity (1,2,5)
- Transcription and Translation Online Exploration and Graphic Organizer (1,2,5)
- How has the Knowledge of DNA Changed Our World Project with Rubric (1,2,3,5)
- DNA and Replication SmartBoard Discussion (1,2)
- Transcription and Translation SmartBoard Discussion (1,2)
- Surface Area and Volume Activity (See Scott) (1,2,3,5)
- Onion Root Tip – Mitosis Activity (1,2)

LABS:

- Catalase Lab – Investigating Properties of Enzymes (Introduction Lab) (1,2,3,4)
- Investigating the Effect of Temperature on Enzyme Activity – using LabPro (reference – Probeware Lab Manual p. 21) (1,2,3,4)
- Observing and Comparing Different Cell Types Lab (1,2,3,4)
- Examine the Rate of Diffusion Inquiry (reference – p.150 Biology: Dynamics of Life text) (1,2,3,4)
- Movement of Molecules In and Out of Cells Inquiry Lab (1,2,3,4)
- Measuring the Effect of Light Intensity on Photosynthesis (reference – p. 91 Biology: Laboratory Manual A) (1,2,3,4)
- Observing Respiration (reference – p. 95 Biology: Laboratory Manual A) (1,2,3,4)
- How Does Exercise Affect Disposal of Wastes from Cellular Respiration? – using LabPro (reference – Probeware Lab Manual p. 27) (1,2,3,4)
- What Does DNA Look Like? DNA Extraction Lab (1,2,3,4)
- Mitosis SmartBoard Discussion (1,2,3,4)

ASSESSMENTS:

- All activities, projects, and labs will be assessed
- Unit test
- Informal preview and review assessment using CPS

BIOLOGY

DECEMBER

UNIT 5: Genetics

RESOURCES:

- **Biology text**
  - Mendel pp. 262-274
  - Meiosis pp. 275-278
  - Mutations pp. 307-308
  - Speciation pp. 404-405
  - Evidence for evolution pp. 382-385

- **Online Resources/Tutorials/Simulations/Animations**
  - Overview of Genetics
    http://www.kumc.edu/gec/

  - Mendel
    Biology Project – monohybrid crosses
    http://www.biology.arizona.edu/mendelian_genetics/problem_sets/monohybrid_cross/monohybrid_cross.html

  - Meiosis
    How Cells Divide
    http://www.pbs.org/wgbh/nova/baby/divide.html

  - Speciation
    http://www.globalchange.umich.edu/globalchange1/current/lectures/speciation/speciation.html
  - Evidence for evolution
    http://www.gate.net/~rwms/EvoEvidence.html

    http://newton.nap.edu/html/creationism/evidence.html

STANDARDS:

- Relate cellular functions and processes to specialized structures within cells. (L.1.1)
- Predict inheritance patterns using a single allele. (L.2.1)
- Describe how genetic recombination, mutations, and natural selections lead to adaptations, evolution, extinction, or the emergence of new species. (L.2.2)
- Identify factors that can cause changes in stability of populations, communities, and ecosystems. (L.3.1)

- Explain to explain ethical roles and responsibilities of scientists and scientific research. (S.1.1)
- Evaluate and describe the impact of scientific discoveries on historical events and social, economic, and ethical issues. (S.1.2)
- Describe immediate and long-term consequences of potential solutions for technological issues. (S.2.1)
- Analyze factors that could limit technological design. (S.2.2)
- Evaluate a scientific discovery to determine and describe how societal, cultural, and personal beliefs influence scientific investigations and interpretations. (N.1.1)
- Describe the role of observation and evidence in the development and modification of hypotheses, theories, and laws. (N.1.2)
- Apply science process skills to design and conduct student investigations. (N.2.1)
- Practice safe and effective laboratory techniques. (N.2.2)

ESSENTIAL QUESTIONS:

- How did Mendel contribute to genetics and our understanding of how traits are passed from generation to generation?
- How do geneticists use the principles of probability?
- How do geneticists use a Punnett square?
- What is the principle of segregation and independent assortment?
- What happens during the process of meiosis?
- How is meiosis different from mitosis?
- What are mutations?
- What factors are involved in the formation of new species?
- What are the evidences for evolution?

SKILLS:

1. Information and Communication Skills
2. Thinking and Problem-Solving Skills
3. Interpersonal and Self-Directional Skills
4. Correct techniques and procedures using scientific equipment
5. Utilize strategies to help themselves learn and apply information

** Skills addressed in the activities are indicated in the activity section below with the number corresponding to the skill.

ACTIVITIES:

- Classroom Performance System Unit Preview/Review (1,2,3)
- Blog essential question(s) (1,2,3,5)
- Mendelian Genetics Precheck and Postcheck with Anticipation Guide (1,2,4,5)
- Genetics Problems Part A – single allele (1,2)
- Drag and Drop Genetics Online (1,2,5)
- Blue People of Troublesome Creek Research (1,2,3)
- Blue People of Troublesome Creek Disorder Powerpoint (1,2)
- Meiosis Process Inspiration Sort w/ Key (1,2,5)
- Semantic Feature Analysis Grid – Comparing and contrasting Mitosis and Meiosis (1,2,5)
- Meiosis Modeling using pipe cleaners, beads, etc. (See Jensi) (1,2,5)
- Biology.com to see meiosis (2)
- Mutation Graphic Organizer – comparing and contrasting gene mutations and chromosome mutations (See Jensi) (1,2,5)
- Evidence for Evolution SmartBoard Discussion (See Scott) (1,2)

LABS:

- Investigating Inherited Traits (reference – Biology: Laboratory Manual A p. 107) or Build a Baby Lab (See Jensi) (1,2,3,4)
- DNA Fingerprinting Activity (optional?) (1,2,3,4)

ASSESSMENTS:

- All activities, projects, and labs will be assessed
- Unit test
- Informal preview and review assessment using CPS

ONLINE BIOLOGY RESOURSES

HANDS-ON BIOLOGY ACTIVITIES
http://serendip.brynmawr.edu/sci_edu/waldron/

INTERACTIVE BIOLOGY
http://serendip.brynmawr.edu/sci_edu/biosites.html#9

BIOLOGY REFERENCE SITES
http://science.nhmccd.edu/bioL/bio1.html

BIOLOGY RESOURCES
http://www.educationindex.com/biology/

ONLINE SCIENCE TUTORIALS (lots of links – scroll down for science)
http://www.khake.com/page67.html

SCIENCE ANIMATIONS, MOVIES, AND INTERACTIVE TUTORIALS (all science subjects)
http://science.nhmccd.edu/BioL/animatio.htm

WRITING LAB REPORTS
http://www.ncsu.edu/labwrite/index_labwrite.htm

DISCOVERY (all subjects)
http://school.discovery.com/schrockguide/sci-tech/scigs.html

SCIENCE FRIDAYS (audio from National Public Radio)
http://www.sciencefriday.com/

LAB VELOCITY (science tools)
http://researchlink.labvelocity.com/index.jhtml

VIRTUAL LIBRARY OF NATURAL SCIENCES (lots of links for all sciences)
http://vlib.org/Science

NATIONAL SCIENCE FOUNDATION
http://www.nsf.gov/

NATIONAL SCIENCE TEACHER ASSOCIATION
http://www.nsta.org/

SCIENCE DAILY (latest research news and science breakthroughs)
http://www.sciencedaily.com/

NATIONAL LIBRARY OF MEDICINE
http://www.nlm.nih.gov/

THE BIOLOGY PROJECT
http://www.biology.arizona.edu/default.html

BIOLOGY ANIMATIONS
http://www.stolaf.edu/people/giannini/biological%20anamations.html

http://www.sumanasinc.com/scienceinfocus/scienceinfocus.html

HOWARD HUGHES MEDICAL INSTITUTE
http://www.hhmi.org/

BIOLOGY REFERENCE SITES
http://science.nhmccd.edu/biol/bio1.html

http://www.biologymad.com/

TEACHONE – BIOLOGY LINKS
http://teachone.tripod.com/biology/

Physical Science Curriculum

1. **Month**: August/September

2. **Unit**: Chemical and Physical Properties and Changes (Chapter 1-3)

3. **Resources**:

   a. Textbook/Lab Manual
   b. Computers
   c. Vernier Probes/Lab Manual
   d. Web/Microsoft Office
   e. Mary Barton Templates

4. **Standards**:

   1.Students are able to distinguish among chemical, physical, and nuclear changes.

   * *Differentiate between physical and chemical properties used to describe matter.*
   * *Identify key indicators of chemical and physical changes*
   * *Describe the effects of changing pressure, volume, or temperature upon gases*
   **Identify characteristics of a solution and factors that affect the rate of solution formation*
   **Explain the differences among chemical, and physical changes at the atomic level*

   2. Apply science process skills to design and conduct student investigations.

   * *Identify questions and concepts to guide the development of hypothesis*
   * *Analyze primary source of information to guide development of procedure*
   * *Select and use appropriate instruments*
   * *Revise explanations and models based on evidence and logic*
   * *Use technology and math skills to enhance investigations, communicate results, and defend conclusions*

   3. Practice safe and effective laboratory techniques

* *Handle hazardous materials properly*
* *Use safety equipment correctly*
* *Practice emergency procedure*
* *Wear appropriate attire*
* *Practice safe behaviors*

5. **Essential Questions**:
   a. What types of safety equipment are there in the classroom?
   b. What is a chemical/physical property?
   c. What is a chemical/physical change?
   d. How do chemical and physical changes affect our lives?
   e. Where do we see chemical and physical changes in our lives?
   f. How do we distinguish between elements/mixtures/compounds?
   g. How do elements/mixtures/compounds affect our lives?

6. **Skills**:

   a. Observation (Senses)
   b. Find mass and volume
   d. Use and read ruler/graduated cylinder/scale/balance
   e. Solve basic algebra problems
   f. Graphical/Data Analysis
   g. Compare and contrast various terms
   h. Predict
   g. Science Process Skills (Listed Above)

7. **Activities**:
   a. Recognizing Lab Safety (Lab book: xv)
   b. Reading Strategies (Example: Page 2)
   c. Writing Strategies (Example: Page 11)
   d. Phase Change Lab (Physical Science With Calculators: 2-1,3-1)
   e. Aluminum Foil Lab (Book Page 26-27)
   f. United Streaming Video (Chemical/Physical Changes)
   g. Physical/Chemical Change Lab/Sandwich Bags (Instructor Lab)
   h. Gas Law Web Simulation
      http://intro.chem.okstate.edu/1314F00/Laboratory/GLP.htm
   i. Nut Lab (Page 42)
   j. Factors that Increase Solubility of a Solution (Instructor Lab)

8. **Assessments**:

a. Standardized Test Prep (Page 31, 65, 97)
b. Labs/Questions
c. 1 Lab Report (Rubric)
e. Chapter Test
f. Safety Quiz/Contract
g. Reading/Writing Rubrics
h. Student Assessments (Textbook Website)

Physical Science Curriculum

1. **Month:** September/October

2. **Unit**: Atomic Structure and the Periodic Table (Chapters 4-5)

3. **Resources**:

   a. Textbook/Lab Manual
   b. Computers
   c. Vernier Probes/Lab Manual
   d. Web/Microsoft Office
   e. Mary Barton Templates

4. **Standard** :

   1. Students are able to use the Periodic Table to determine the atomic structure of elements, valence number, family relationships, and regions.

      * *Determine protons, neutrons, electrons, mass number, and atomic number from the periodic table.*

      * *Explain a nuclear change at the atomic level*

      * *Determine the number of valence electrons for elements in the main (s&p) blocks of the periodic table.*

      * *Identify the relative metallic character of an element based on its location on the periodic table.*

   2. Practice safe and effective laboratory techniques

      * *Handle hazardous materials properly*
      * *Use safety equipment correctly*
      * *Practice emergency procedure*
      * *Wear appropriate attire*
      * *Practice safe behaviors*

5. **Essential Questions:**

   a. What is the atom made of?
   b. What are the charges, location and mass of the subatomic particles?
   c. What is the atomic number and atomic mass number?
   d. What is an isotope?

e. How did scientists come up with the periodic table?
f. How can I use the periodic table?
g. How is the periodic table organized?
h. What is the difference between a metal, nonmetal, and metalloid
i. What are valence electrons?

6. **Skills**:

a. Compare and contrast various terms.
b. Understand and use the periodic table.
c. Basic math skills
d. Predict
e. Use a triple beam balance/electronic balance
f. Organization
g. Graphical/Data Analysis

7. **Activities:**

a. Atomic Structure Bead Activity (Instructor)
b. Construct a Model of the Atom (page 37)
c. Size of the Nucleus:Marble Activity (Instructor)
d. Beanium Lab: Isotopes (Instructor)
e. Making the Model of the Periodic Table(Internet Activity:*chemicalelements.com*)
f. Metal/Nonmetal/Metalloid ID Lab (Instructor)
g. Reading Strategy (Example: Page 100)
h. Writing Strategy (Example: Page 118)
i. Student Self Assessments (Textbook Website)

8. **Assessments**:

a. Standardized Test Prep (Page 97, 123)
a. Atomic/Periodic Table Models
b. Labs/Questions
c. Chapter Tests
d. Quizzes
e. Reading/Writing Rubrics

Physical Science Curriculum

Month: October

Unit: Chemical Bonds (Chapter 6)

Resources:

a. Textbook/Lab Manual
b. Computers
c. Vernier Probes/Lab Manual
d. Web/Microsoft Office
e. Mary Barton Templates

Standard:

1. Students are able to describe ways that atoms combine.

   * *Name and write formulas for binary ionic and covalent*
   * *Compare the roles of electrons in covalent, ionic, and metallic bonding.*

2. Practice safe and effective laboratory techniques

   * *Handle hazardous materials properly*
   * *Use safety equipment correctly*
   * *Practice emergency procedure*
   * *Wear appropriate attire*
   * *Practice safe behaviors*

Essential Questions:

a. What are ionic bonds, covalent bonds, and metallic bonds?
b. How are the bonds (above) formed?
c. How are formulas written for each type of bond?
d. How do we model ionic and covalent bonds?
e. How are ionic and covalent bonds named?

Skills:

a. Compare and Contrast Terms
b. Understand and Use the Periodic Table
c. Basic Math
d. Predict
   Cooperation with other students

Physical Science Curriculum

1. **Month**: October/November

2. **Unit**: Chemical Reactions (Chapter 7)

3. **Resources**:

   a. Textbook/Lab Manual
   b. Computers
   c. Vernier Probes/Manual
   d. Web/Microsoft Office
   e. Mary Barton Templates

4. **Standards**:

   1. Students are able to predict whether reactions will speed up or slow down as conditions change.

   2. Students are able to balance chemical equations by applying the Law of Conservation of Matter.

      * *Trace number of particles in diagrams and pictures of balanced equations.*
      * *Students will explain nuclear changes at the atomic level.*

   3. Practice safe and effective laboratory techniques

      * *Handle hazardous materials properly*
      * *Use safety equipment correctly*
      * *Practice emergency procedure*
      * *Wear appropriate attire*
      * *Practice safe behaviors*

5. **Essential Questions**:

   a. What causes chemical reactions to speed up or slow down?
   b. What is the Law of Conservation of Matter?
   c. How do you balance a chemical equation?
   d. Is there a time when the Law of Conservation of Matter not followed? (Nuclear Reactions)

6. **Skills**:

   a. Describe/Predict factors affecting chemical reactions
   b. Math
   c. Interpret Chemical Equations
   d. Balance Chemical Equations
   e. Classify Chemical Reactions as Endothermic or Exothermic
   f. Data and Graphical Analysis

7. **Activities**:

   a. Endothermic and Exothermic Reactions: (Physical Science with Calculators: 5-1)
   b. Law of Conservation of Mass Lab (Alka-seltzer Lab)
      (Talk about Nuclear Reactions/Mass Disappears)
   c. Balance Equation Manipulation Lab (Page 194: Teachers Edition)
   d. Reaction Rate Lab (Instructor Lab)
   e. Reading Strategy (Page 192)
   f. Writing Strategy (Page 215)

8. **Assessments**:

   1. Standardized Test Prep (Page 223)
   2. Student Self Assessments (Textbook Website)
   3. Chapter Test
   4. Lab/Questions
   5. 1 Lab Report
   6. Balancing Equation Practice Worksheet
   7. Reading/Writing Rubrics

Physical Science Curriculum

1. **Month:** November

2. **Unit:** Atmospheric Chemistry (Chapter 24)

3. **Resources:**

   a. Textbook (pages 143, 749-750, 782)/Lab Manual
   b. Computers
   c. Vernier Probes/Manual
   d. Web/Microsoft Office
   f. United Streaming

4. **Standard**:

   1. Analyze the various structures and processes of the Earth System. (Earth)

      * *Describe how atmospheric chemistry may affect global/global climate*

   2. Evaluate a scientific discovery to determine and describe how societal, cultural, and personal beliefs influence scientific investigations and interpretations

      * *recognize scientific knowledge is not merely a set of static facts but is dynamic and affords the best current explanations.*

      * *discuss how progress in science can be affected by societal* issues

   3. Describe the role of observation and evidence in the development and modification of hypotheses, theories, and laws

      * *Research, communicate, and support a scientific argument*
      * *Recognize and analyze alternative explanations and models*
      * *Evaluate the scientific accuracy of information relevant to a specific issue.*

   4. Practice safe and effective laboratory techniques

      * *Handle hazardous materials properly*
      * *Use safety equipment correctly*
      * *Practice emergency procedure*

* *Wear appropriate attire*
* *Practice safe behaviors*

5. **Essential Questions**:

a. What is global warming?
b. Is global warming real?
c. What are greenhouse gases
d. Is there a difference between global warming and the greenhouse effect?
e. How will global warming affect me?
f. What causes global warming?
g. What is the ozone layer?
h. What is the ozone hole?
i. What causes the ozone hole?
j. Can we fix either of these problems?

6. **Skills**:

a. Math
b. Read a thermometer
c. Data and Graphical Analysis
d. Reading Strategy Skills
e. Writing in Science Skills

7. **Activities**:

a. Atmospheric Graphing Lab (Instructor Lab/Levels of Atmosphere)
b. Modeling Global Warming Lab (Lab book: Page 257)
c. The Greenhouse Effect (Earth Science With Calculators: 24-1)
d. Research Global Warming/Position Paper or Debate
e. Ozone Video (United Streaming)

8. **Assessments**:

a. Quiz
b. Lab/questions
c. Research/Debate Rubri
d. Video questions

Physical Science Curriculum

1. **Month:** December

2. **Unit**: Motion (Chapter 11)

3. **Resources**:

a. Textbook/Lab Manual
b. Computers
c. Vernier Probe/Manual
d. Web/Microsoft Office
e. Mary Barton Templates

4. **Standards**:

1. Students are able to apply concepts of distance and time to the quantitative relationships of motion using appropriate mathematical formulas, equations, and unit.

   * *Evaluate speed, velocity, and acceleration both qualitatively and quantitatively.*

   * *Given distance and time, calculate the velocity or speed of an object*

   * *Create and interpret graphs of linear motion*

2. Apply science process skills to design and conduct student investigations.

   * *Identify questions and concepts to guide the development of hypothesis*
   * *Analyze primary source of information to guide development of procedure*
   * *Select and use appropriate instruments*
   * *Revise explanations and models based on evidence and logic*
   * *Use technology and math skills to enhance investigations, communicate results, and defend conclusions*

3. Practice safe and effective laboratory techniques

   * *Use safety equipment correctly*
   * *Practice emergency procedure*
   * *Wear appropriate attire*

** Practice safe behaviors*

5. Essential Questions:

a. What is the difference between speed and acceleration?
b. How do you get negative acceleration?
c. How does force effect acceleration?
d. What is the difference between speed and velocity?
e. Why do scientists use the SI system of measurement?

6. Skills:

a. Use and read a meter stick
b. Data and Graphical Analysis
c. Math
d. Read a stopwatch
d. Science Process Skills (listed above)

7. Activities:

a. Metric Measure Lab (Old Book)
b. Investigating Free Fall Lab(Lab Manual: Page 117)
c. Speed A L Carte Activity (Instructor)
d. Pendulum Lab (Lab Manual: Page 123)
e. Galileo's Hypothesis (Lab Manual: (Page 129)
f. Graphing Your Motion (Physical Science with Calculators: 35-1)
g. Velocity Lab (Physical Science with Calculators:36-1)
h. Reading Strategy (Example: Page 328: Textbook)
i. Writing Strategy (Example:Page 331: Textbook)

8. **Assessments:**

a. Standardized Test Prep (Page 353)
b. Student Self Assessments (Website)
c. Chapter Test
d. Lab/Questions
e. Quizzes
f. Math Worksheets
g. Reading/Writing Rubrics
h. Speed A La Carte Poster Project

Physical Science Curriculum

1. **Month:** January

2. **Unit**: Forces and Motion (Chapter 12)

3. **Resources**:

   a. Textbook/Lab Manual
   b. Computers
   c. Venier Probes/Manual
   d. Web/Microsoft Office
   e. Mary Barton Templates

4. **Standards**:

   1. Students are able to predict motion of an object using Newton's Laws.

   * *Distinguish between velocity and acceleration as related to force.*
   * *Describe how inertia is related to Newton's First Law.*
   * *Explain the effect of balanced and unbalanced forces.*
   * *Identify the forces at work on action/reaction pairs as distinguished from balanced forces.*
   * *Explain how force, mass and acceleration are related.*

   2. Practice safe and effective laboratory techniques

   * *Use safety equipment correctly*
   * *Practice emergency procedure*
   * *Wear appropriate attire*
   * *Practice safe behaviors*

5. **Essential Questions**:

   a. What are Newton's Three Laws of Motions?
   b. What is a force?
   c. What is the difference between a balanced force and an unbalanced force?
   d. What direction does gravity pull?
   e. What is an action/reaction pair?
   f. What does mass have to do with force and acceleration?
   g. What is friction and what causes it?
   h. What is momentum and what changes it?

6. **Skills**:

   a. Use and Read a force spring scale
   b. Data and Graphical Analysis
   c. Math
   d. Read a Stopwatch
   e. Use and read a meter stick
   f. Compare and Contrast

7. **Activities**:

   a. Forced to Accelerate Lab (Old Book)
   b. Give Me a Brake Lab (Friction) (Old Book)
   c. Newton's Scooter Project (Old Book)
   d. Bridge Builder Simulation (Download.com)
   e. Momentum (A Crash Lesson) (Physical Science with Calculators: 38-1)
   f. Newton's Second Law (Physical Science with Calculators: 39-1)
   g. Egg Drop Lab (Instructor)
   h. Roller Coaster Simulation *(http://www.funderstanding.com/k12/coaster/)*
   i. Reading Strategy (Example: Page 356: Textbook)
   j. Writing Strategy (Example: Page 375: Textbook)

8. **Assessment**:

   a. Standardized Test Prep (Page 387)
   b. Student Self Assessments (Website)
   c. Chapter Test
   d. Lab/Questions
   e. Quizzes
   f. Math Worksheets
   g. Reading/Writing Rubrics
   h. 1 Lab Report

Physical Science Curriculum

1. **Month**: February

2. **Unit**: Work, Power and Machines (Chapter 14)

3. **Resources**:

   a. Textbook/Lab Manual
   b. Computers
   c. Vernier Probes/Lab Manual
   d. Web/Microsoft Office
   e. Mary Barton Templates

4. **Standards:**

   1. Students are able to relate concepts of force, distance, and time to the quantitative relationships of work, energy, and power

   * *Apply appropriate mathematical formulas and equations to concepts using appropriate units.*
   * *Given the formulas, calculate the Mechanical Advantage and efficiency of selected systems.*

   2. Practice safe and effective laboratory techniques

      * *Use safety equipment correctly*
      * *Practice emergency procedure*
      * *Wear appropriate attire*
      * *Practice safe behaviors*

5. **Essential Questions**:

   a. How do ramps help you raise objects?
   b. What is power?
   c. How big is a horsepower?
   d. What is work?
   e. What is the difference between actual mechanical advantage and ideal mechanical advantage?
   f. What is the difference between a simple and compound machine?
   g. What are levers?
   h. How many simple machines are there?
   i. How does a pulley work?

6. **Skills**:

a. Use and read a force spring scale
b. Use and read a meter stick
c. Math
d. Data and Graphical Analysis

7. **Activities**:

a. Angling for Access Lab (Instructor: Old Book)
b. Comparing Mechanical Advantage of Levers (Page 145: Lab Manual or 20-1)
c. Pulley Lab (Physical Science with Calculators: 21-1)
d. Reading Strategy (Example: Textbook Page 412,417)
e. Writing in Science (Example: Textbook Page 423)
f. Determining MA of a Bike (Page 438)

8. **Assessment**:

a. Standardized Test Prep (Page 423)
b. Student Self Assessment (Website)
c. Chapter Test
d. Lab/Questions
e. Quizzes
f. Worksheets
g. Reading and Writing Rubrics

Physical Science Curriculum

1. **Month**: Febuary/March

2. **Unit**: Energy and Thermal Energy and Heat (Chapter 15 and 16)

3. **Resources**:

   a. Textbook/Lab Manual
   b. Computers
   c. Vernier Probes/Lab Manual
   d. Web/Microsoft Office
   e. Mary Barton Templates

4. **Standards**:

   1. Students are able to describe the relationships among potential energy, kinetic energy, and work as applied to the Law of Conservation of Energy.

      * *Describe how energy can be transferred and transformed to produce useful work.*

      * *Given the formulas, calculate the mechanical advantage and efficiency of selected systems.*

      * *Explain methods of heat transfer*

   2. Practice safe and effective laboratory techniques

      * *Use safety equipment correctly*
      * *Practice emergency procedure*
      * *Wear appropriate attire*
      * *Practice safe behaviors*

5. **Essential Questions**:

   a. What is energy?
   b. What is the difference between potential and kinetic energy?
   c. How is energy conserved?
   d. How does a roller coaster work?
   e. What are the differences between Convection, Conduction, and Radiation?

6. **Skills**:

1. Use and read a force spring scale.
2. Use and read a meter stick
3. Math
4. Data and Graphical Analysis
5. Read a thermometer

7. **Activities**:

a. Absorption of Radiant Energy (Physical Science with Calculators:11-1)
b. Insulated Cola Bottle (Physical Science with Calculators: 12-1)
c. Determining the effect of Mass on Kinetic Energy (Lab book: 157)
d. Determining the Kinetic Energy of a Pendulum (Lab book: 163)
e. Roller Coaster Simulation (*http://www.funderstanding.com/k12/coaster/)*
f. Boiling Water in a Paper Cup (Lab book: 173)
g. Seagull and Pole-vaulter Reading Activity (Textbook Page 456-457)
f. Writing Activity: Example: Wind farms: Textbook 465)

6. **Assessment**:

a. Standardized Test Prep (Page 471, 497)
b. Student Self Assessment (Website)
c. Chapter Test
d. Lab/Questions
e. Quizzes
f. Worksheets
g. Reading/Writing Rubrics
j. Roller Coaster Sim (Does it work!)

Physical Science Curriculum

1. **Month**: March/April

2. **Unit**: Mechanical Waves and Sound, The Electromagnetic Spectrum and Light (Chapter 17,18)

3. **Resources**:

   a. Textbook/Lab Manual
   b. Computers
   c. Vernier Probes/Manual
   d. Web/Microsoft Office
   e. Mary Barton Templates

4. **Standard**:

   1. Students are able to describe how characteristics of waves are related to one another.

   * *Relate wavelength, speed, and frequency*
   * *Distinguish between transverse and longitudinal waves*

   2. Practice safe and effective laboratory techniques

   * *Use safety equipment correctly*
   * *Practice emergency procedure*
   * *Wear appropriate attire*
   * *Practice safe behaviors*

5. **Essential Questions**:

   a. What is a wave and what causes it?
   b. Why isn't there sound in space?
   c. How is a sound wave different than a light wave?
   d. What are the parts of a wave?
   e. How does a Doppler Rader work?
   f. How does a radio work?
   g. Why do light waves travel faster than sound waves?
   h. Why are there different colors of light?
   i. What is a sonic boom?

6. **Skills**:

   a. Use and read a meter stick.
   b. Math
   c. Data and Graphical Analysis
   d. Observation of Waves

7. **Activities**:

   a. Measuring the Speed of Sound Lab (lab book: page 177)
   b. Wavy Motions Lab (Old Book)
   c. Sounds in Solids Lab (Lab Book: page 183)
   d. Reflectivity of Light (Calculators in Physical Science:23-1)
   e. Doppler Lab (Instructor Lab)
   f. Tuning Fork Lab (Old Book)
   g. Domino Activity: Sound in Space Instructor Demo
   h. Radio Waves (Visual: Page 540)
   i. Reading Strategy (Example: Textbook: page 532)
   j. Writing Strategy (Example: Textbook: page 553)

8. **Assessments**:

   a. Standardized Test Prep (Page 529,567)
   b. Student Self Assessment (Website)
   c. Chapter Test
   d. Lab/Questions
   e. Quizzes
   f. Worksheets
   g. Reading/Writing Rubrics

Physical Science Curriculum

1. **Month**: April/May

2. **Unit**: Electricity and Magnetism (Chapter 20,21)

3. **Resources**:

   a. Textbook/Lab Manual
   b. Computers
   c. Vernier Probes/Manual
   d. Web/Microsoft Office
   e. Mary Barton Templates

4. **Standard**:

   1. Students are able to describe electrical effects in terms of motion and concentrations of charged particles.

   * *Relate potential difference to current*
   * *Describe how static electricity is different from current electricity*
   * *Interpret and apply Ohm's Law*
   * *Describe electrical attractions and repulsions*
   * *Describe how magnetism originates from motion of charged particles*

   2. Practice safe and effective laboratory techniques

   * *Use safety equipment correctly*
   * *Practice emergency procedure*
   * *Wear appropriate attire*
   * *Practice safe behaviors*

5. **Essential Questions**:

   a. What is a conductor?
   b. What is electricity?
   c. What is static electricity?
   d. How does a difibulator work?
   e. How is current different from voltage?
   f. What is Ohm's Law?
   g. How does a light bulb work?
   h. What causes magnetism?

6. **Skills**:

   a. Math
   b. Read a voltmeter and ammeter
   c. Data and Graphical Analysis

7. **Activities**:

   a. Evaluating Electrical Safety (Page 623)
   b. Salt Water Conductivity (Physical Science with Calculators: 17-1)
   c. Constructing a Telephone (Lab Book: Page 211)
   d. Charging Objects (Lab Book: Page 215)
   e. Its Shocking (Writing: Textbook Page 603)
   f. Reversing the Battery Direction in a Flashlight (Textbook: Page 599)
   g. Studying Electromagnetic Induction (Lab Book: Page 221)
   h. Reading Strategy: (Example:Textbook: Page 600)
   i. Writing Strategy: (Example:Textbook: 607)

8. **Assessments**:

   a. Standardized Test Prep (Page 627,653)
   b. Student Self Assessment (Website)
   c. Chapter Test
   d. Lab/questions
   e. Quizzes
   f. Worksheets
   g. Reading/Writing Rubrics
   h. 1 Lab Report

Physical Science Curriculum

1. **Month:** May

2. **Unit:** Motion of the Solar System (Chapter 25)

3. **Resources:**

   a. Textbook/Lab Manual
   b. Computer
   c. Excel Program

4. **Standard**:

   1. Analyze essential principles and ideas about the composition and structure of the universe (Earth)

   * *Recognize how Newtonian mechanics can be applied to the study of the motions of the solar system.*
   * *Given a set of possible explanations or orbital motion (revolution), identify those that make use of gravitational forces and inertia.*
   -gravity
   -universal gravitation

   2. Practice safe and effective laboratory techniques

   * *Use safety equipment correctly*
   * *Practice emergency procedure*
   * *Wear appropriate attire*
   * *Practice safe behaviors*

5. **Essential Questions**:

   a. Why don't the planets fall into the sun?
   b. What holds the planets in place?

6. **Skills**:

   a. Math
   b. Data and Graphical Analysis
   c. Modeling

7. **Activities**:

    a. Exploring Orbits (Lab book: Page 267)
    b. Modeling Orbits (Textbook:Page 793)
    c. Reading Strategy (Example: Textbook: 790)
    d. Writing Strategy (Example: Textbook: 807)

8. **Assessments**:

    a. Lab/questions
    b. Quiz/test
    c. Reading/Writing Rubrics

Fundamentals of Physical Science

Month: Week 1

Unit 1: Science Skills

Resources:

1. Prentice Hall Physical Science: Concepts in Action, 2006
   By Michael Wysession, David Frank, and Sophia Yancopoulos
   Chapter 1 (Sections 2 & 3)
2. Websites:
   www.SciLinks.org
   PHSchool.com

South Dakota Science Standards:

9-12.N.1.2. Students are able to describe the role of observation and evidence in the development and modification of hypotheses, theories, and laws.

9-12.N.2.1. Students are able to apply science process skills to design and conduct student investigations.

- Select and use appropriate instruments to extend observations and measurements.
- Use technology and mathematic skills to enhance investigations, communicate results, and defend conclusions.

  Examples:

  Computer-based data collection

  Graphical analysis and representation

  Use appropriate technology to display data (i.e. spreadsheets, PowerPoint, web).

9-12.N.2.2. Students are able to practice safe and effective laboratory techniques.

- Handle hazardous materials properly.
- Use safety equipment correctly.
- Practice emergency procedure.
- Wear appropriate attire.
- Practice safe behaviors.

9-12.S.1.1. Students are able to explain ethical roles and responsibilities of scientists and scientific research.

Essential Questions:

- What is the scientific method?
- What units do scientists use for their measurements?

- How do scientists organize data?

Science Process Skills:

- **Observing**-Using the 5 senses (see, hear, touch, smell, taste) to find out about objects and events, their characteristics, properties, differences, similarities, and changes
- **Classifying**-Grouping or ordering objects or events according to similarities or differences in properties
- **Measuring**-Comparing an unknown quantity with a known (metric units, time, student- generated frames of reference) - Observations are quantified using proper measuring devices and techniques
- **Collecting Data**-Gathering and recording information about observations and measurements in a systematic way

Activities:

- Measuring Volume & Temperature
- The Compass
- Determining the Thickness of Aluminum Foil

Assessments:

- Students will describe the steps of a scientific method.
- Students will identify the SI units used in science and convert between common metric prefixes.
- Students will compare measurements on the Celsius, Kelvin, and Fahrenheit temperature scales.

Fundamentals of Physical Science

Month 2: Weeks 2, 3, & 4

Unit 2: Motion

Resources:
1. Prentice Hall Physical Science: Concepts in Action, 2006
   By Michael Wysession, David Frank, and Sophia Yancopoulos
   Chapter 11
2. Websites:
   www.SciLinks.org
   PHSchool.com

South Dakota Science Standards:
9-12.P.2.1. Students are able to apply concepts of distance and time to the quantitative relationships of motion using appropriate mathematical formulas, equations, and units.

- Evaluate speed, velocity, and acceleration both qualitatively and quantitatively.

  Examples:

  Calculate acceleration using the equation

  $A_{avg}=\Delta V/\Delta t$.

- Given distance and time, calculate the velocity or speed of an object.
- Create and interpret graphs of linear motion.

  Example:

  Given a velocity-time or a distance-time graph with different slopes, determine the motion of an object.

  - Distinguish between velocity and acceleration as related to force.

Essential Questions:
- What is needed to describe motion completely?
- How are instantaneous speed and average speed different?
- How can you find the speed from a distance-time graph?
- How are speed and velocity different?
- How can you calculate acceleration?
- How does a speed-time graph indicate acceleration?

Science Process Skills:
- **Observing**-Using the 5 senses (see, hear, touch, smell, taste) to find out about objects and events, their characteristics, properties, differences, similarities, and changes

- **Classifying**-Grouping or ordering objects or events according to similarities or differences in properties
- **Measuring**-Comparing an unknown quantity with a known (metric units, time, student- generated frames of reference) - Observations are quantified using proper measuring devices and techniques
- **Using Number Relationships**-Applying numbers and their mathematical relationships to make decisions
- **Collecting Data**-Gathering and recording information about observations and measurements in a systematic way

Activities:

- Investigating the Velocity of a Sinking Marble
- Using a Pendulum to Measure the Acceleration Due to the Force of Gravity

Assessments:

- Students will identify frames of reference and describe how they are used to measure motion.
- Students will compare and contrast average and instantaneous speed.
- Students will interpret distance-time graphs.
- Students will calculate the speed of an object.
- Students will identify changes in motion that produce acceleration.
- Students will describe examples of acceleration.
- Students will calculate the acceleration of an object.

Fundamentals of Physical Science

Month: Weeks 5, 6, & 7

Unit 3: Forces and Motion

Resources:
1. Prentice Hall Physical Science: Concepts in Action, 2006
   By Michael Wysession, David Frank, and Sophia Yancopoulos
   Chapter 12 (Sections 1, 2, & 3)
2. Websites:
   www.SciLinks.org
   PHSchool.com

South Dakota Science Standards:
9-12.P.2.2. Students are able to predict motion of an object using Newton's Laws.

- Describe how inertia is related to Newton's First Law.
- Explain the effect of balanced and unbalanced forces.
- Identify the forces at work on action/reaction pairs as distinguished from balanced forces.

  Examples:

  Draw a linear force diagram for the forces acting on an object in contact with another.

  Identify action/reaction pairs.
- Explain how force, mass, and acceleration are related.

9-12.E.2.1. Students are able to recognize how Newtonian mechanics can be applied to the study of the motions of the solar system.

- Given a set of possible explanations of orbital motion (revolution), identify those that make use of gravitational forces and inertia.

Essential Questions:
- How do forces affect the motion of an object?
- In what direction does Earth's gravity act?
- How do gravity and air resistance affect a falling object?
- What does Newton's first law tell about the motion of an object?
- How does Newton's second law relate force, mass, and acceleration?
- How are weight and mass related?
- What is Newton's third law of motion?
- What is needed for an object to have a large momentum?

Science Process Skills:

- **Observing**-Using the 5 senses (see, hear, touch, smell, taste) to find out about objects and events, their characteristics, properties, differences, similarities, and changes
- **Classifying**-Grouping or ordering objects or events according to similarities or differences in properties
- **Measuring**-Comparing an unknown quantity with a known (metric units, time, student- generated frames of reference) - Observations are quantified using proper measuring devices and techniques
- **Using Number Relationships**-Applying numbers and their mathematical relationships to make decisions
- **Making Models**-Constructing mental, verbal, or physical representations of ideas, objects, or events to clarify explanations or demonstrate relationships.
- **Collecting Data**-Gathering and recording information about observations and measurements in a systematic way

Activities:

- What Starts an Object Moving?
- Observing the Effects of Friction
- Investigating Inertia
- Terminal Speed
- Making Parachutes
- Newton's Third Law
- Investigating a Balloon Jet

Assessments:

- Students will describe examples of force.
- Students will explain how the motion of an object is affected when balanced and unbalanced forces act on it.
- Students will describe how Earth's gravity and air resistance affect falling objects.
- Students will describe Newton's first and second laws of motion.
- Students will relate the mass of an object to its weight.
- Students will explain how action and reaction forces are related according to Newton's third law of motion.

Fundamentals of Physical Science

Month: Weeks 8, 9, & 10

Unit 4: Work, Power, and Machines

Resources:
1. Prentice Hall Physical Science: Concepts in Action, 2006
   By Michael Wysession, David Frank, and Sophia Yancopoulos
   Chapter 14
2. Websites:
   www.SciLinks.org
   PHSchool.com

South Dakota Science Standards:
9-12.P.2.3. Students are able to relate concepts of force, distance, and time to the quantitative relationships of work, energy, and power.

- Apply appropriate mathematical formulas and equations to concepts using appropriate units.

  Examples:

  Calculate power given force, distance and time.

  Calculate work done on an object given force and distance.

9-12.P.3.1. Students are able to describe the relationships among potential energy, kinetic energy, and work as applied to the Law of Conservation of Energy.

- Given the formulas, calculate the mechanical advantage and efficiency of selected systems.
- Describe how energy can be transferred and transformed to produce useful work.

  Examples:

  Use simple machines as an example of the transmission of energy.

Essential Questions:
- When does a force do work?
- How are work and power related?
- How do machines make work easier?
- How does the actual mechanical advantage of a machine compare to its ideal mechanical advantage?
- Why is the efficiency of a machine always less than 100 percent?
- What are the six types of simple machines?
- What determines the mechanical advantage of the six types of simple machines?

Science Process Skills:

- **Observing**-Using the 5 senses (see, hear, touch, smell, taste) to find out about objects and events, their characteristics, properties, differences, similarities, and changes
- **Classifying**-Grouping or ordering objects or events according to similarities or differences in properties
- **Measuring**-Comparing an unknown quantity with a known (metric units, time, student- generated frames of reference) - Observations are quantified using proper measuring devices and techniques
- **Using Number Relationships**-Applying numbers and their mathematical relationships to make decisions
- **Making Models**-Constructing mental, verbal, or physical representations of ideas, objects, or events to clarify explanations or demonstrate relationships.
- **Collecting Data**-Gathering and recording information about observations and measurements in a systematic way

Activities:

- How Do Ramps Help You Raise Objects?
- Using Friction to Change Mechanical Advantage
- Comparing Lever Arms
- Determining Mechanical Advantage
- Comparing Pulleys

Assessments:

- Students will describe how work is done on an object.
- Students will calculate the work done on and the power of an object.
- Students will compare the units of watts and horsepower.
- Students will describe what a machine is and how it makes work easier to do.
- Students will calculate the ideal and actual mechanical advantages of various machines.
- Students will explain why the efficiency of a machine is always less than 100%.
- Students will calculate a machine's efficiency.
- Students will list and give examples of each of the six types of simple machines.
- Students will define and identify compound machines.

Fundamentals of Physical Science

Month: Weeks 11, 12, & 13

Unit 5: Energy

Resources:
1. Prentice Hall Physical Science: Concepts in Action, 2006
   By Michael Wysession, David Frank, and Sophia Yancopoulos
   Chapter 15 (Sections 1 & 2)
   Chapter 16 (Section 2)
2. Websites:
   www.SciLinks.org
   PHSchool.com

South Dakota Science Standards:
9-12.P.3.1. Students are able to describe the relationships among potential energy, kinetic energy, and work as applied to the Law of Conservation of Energy.

- Describe how energy can be transferred and transformed to produce useful work.

  Examples:

  Diagram simple energy transfers, describing the objects and the forms of energy gained and lost.

- Explain methods of heat transfer.

  Examples: conduction, radiation, and convection

Essential Questions:
- How are energy and work related?
- On what factors do the kinetic and potential energy of an object depend?
- How can energy be converted from one form into another?
- What is the law of conservation of energy?
- What are conduction, convection, and radiation?

Science Process Skills:
- **Observing**-Using the 5 senses (see, hear, touch, smell, taste) to find out about objects and events, their characteristics, properties, differences, similarities, and changes
- **Classifying**-Grouping or ordering objects or events according to similarities or differences in properties
- **Measuring**-Comparing an unknown quantity with a known (metric units, time, student- generated frames of reference) - Observations are quantified using proper measuring devices and techniques

- **Using Number Relationships**-Applying numbers and their mathematical relationships to make decisions
- **Collecting Data**-Gathering and recording information about observations and measurements in a systematic way

Activities:

- Investigating Elastic Potential Energy
- Burning a Peanut
- How Can Energy Change Form?
- Exploring Energy Conversion
- Observing Convection

Assessments:

- Students will describe the relationship between work and energy.
- Students will calculate the kinetic and potential energy of objects.
- Students will describe how energy is converted from one form to another.
- Students will describe conduction, convection, and radiation and will identify which of these is occurring in a given situation.

Fundamentals of Physical Science

Month: Weeks 14 & 15

Unit 6: Waves

Resources:

1. Prentice Hall Physical Science: Concepts in Action, 2006
   By Michael Wysession, David Frank, and Sophia Yancopoulos
   Chapter 17 (Sections 1, 2, & 4)
   Chapter 18 (Section 2)

2. Websites:
   www.SciLinks.org
   PHSchool.com

South Dakota Science Standards:

9-12.P.3.2. Students are able to describe how characteristics of waves are related to one another.

- Relate wavelength, speed, and frequency ($v=\lambda f$).
- Distinguish between transverse and longitudinal waves.

  Examples:

  Discuss changes in frequency of waves using the Doppler Effect.

  Compare the energy of different frequency ranges of waves with in the

  electromagnetic spectrum.

  Describe how different colors of light waves have different amounts of energy.

Essential Questions:

- What causes mechanical waves?
- What is the difference between a transverse and a longitudinal wave?
- How are frequency, wavelength, and speed related?
- How does the frequency of sound change for a moving source?
- What waves are included in the electromagnetic spectrum?
- How is each type of electromagnetic wave used?

Science Process Skills:

- **Observing**-Using the 5 senses (see, hear, touch, smell, taste) to find out about objects and events, their characteristics, properties, differences, similarities, and changes
- **Classifying**-Grouping or ordering objects or events according to similarities or differences in properties
- **Measuring**-Comparing an unknown quantity with a known (metric units, time, student- generated frames of reference) - Observations are quantified using proper measuring devices and techniques
- **Using Number Relationships**-Applying numbers and their mathematical relationships to make decisions
- **Making Models**-Constructing mental, verbal, or physical representations of ideas, objects, or events to clarify explanations or demonstrate relationships.
- **Collecting Data**-Gathering and recording information about observations and measurements in a systematic way

Activities:

- Build Crystal Radios
- How Does a Disturbance Produce Waves?
- Comparing Frequency and Wave Speed
- Investigating Sound Waves

Assessments:

- Students will describe transverse and longitudinal waves and discuss how they are produced.
- Students will define frequency, period, wavelength, and wave speed and describe these properties for different kinds of waves.
- Students will solve equations relating wave speed to wavelength and frequency.
- Students will explain how relative motion determines the frequency of sound an observer hears.
- Students will rank and classify electromagnetic waves based on their frequencies and wavelengths.
- Students will describe uses for different waves of the electromagnetic spectrum.

Fundamentals of Physical Science

Month: Weeks 16, 17, & 18

Unit 7: Electricity

Resources:
1. Prentice Hall Physical Science: Concepts in Action, 2006
   By Michael Wysession, David Frank, and Sophia Yancopoulos
   Chapter 20 (Sections 1 & 2)
   Chapter 21 (Section 2)
2. Websites:
   www.SciLinks.org
   PHSchool.com

South Dakota Science Standards:
9-12.P.3.3. Students are able to describe electrical effects in terms of motion and concentrations of charged particles.

- Relate potential difference to current.
- Describe how static electricity is different from current electricity.
- Interpret and apply Ohm's Law.
- Describe electrical attractions and repulsions.
- Describe how magnetism originates from motion of charged particles.

Essential Questions:
- What produces a net electric charge?
- What determines whether an electric force is attractive or repulsive?
- What causes an electric current?
- How are voltage, current, and resistance related?
- How can an electric charge create an electric field?

Science Process Skills:
- **Observing**-Using the 5 senses (see, hear, touch, smell, taste) to find out about objects and events, their characteristics, properties, differences, similarities, and changes
- **Classifying**-Grouping or ordering objects or events according to similarities or differences in properties
- **Measuring**-Comparing an unknown quantity with a known (metric units, time, student- generated frames of reference) - Observations are quantified using proper measuring devices and techniques
- **Using Number Relationships**-Applying numbers and their mathematical relationships to make decisions

- **Making Models**-Constructing mental, verbal, or physical representations of ideas, objects, or events to clarify explanations or demonstrate relationships.
- **Collecting Data**-Gathering and recording information about observations and measurements in a systematic way

Activities:

- Electric Attraction and Repulsion
- How Can You Reverse the Battery Direction in a Flashlight?
- Modeling Resistance in a Wire
- Making an Electromagnet
- Studying Electromagnetic Induction

Assessments:

- Students will describe ways electric charges can be produced.
- Students will predict whether given charges will attract or repel each other.
- Students will describe electric currents.
- Students will compare and contrast static and current electricity.
- Students will calculate voltage, current, and resistance using Ohm's law.
- Students will describe how a moving electric charge creates a magnetic field.

Essential Questions:

- How do physical properties differ from chemical properties?
- How do physical changes differ from chemical changes?
- What instruments are available, what are their limitations and how are these limitations expressed when recording data and performing calculations?

Science Process Skills:

- Observing- Using the 5 senses (see, hear, touch, smell, taste) to find out about objects and events, their characteristics, properties, differences, similarities, and changes
- Measuring- Comparing an unknown quantity with a known (metric units); Observations are quantified using proper measuring devices and techniques
- Collecting Data- Gathering and recording information about observations and measurements in a systematic way
- Using Number Relationships-Applying numbers and their mathematical relationships to make decisions
- Interpreting Data- Organizing, analyzing, and synthesizing data using tables, graphs, and diagrams to locate patterns that lead to the construction of inferences, predictions, or hypotheses

Activities:

- Alchemy or Alloy?, Counterfeit Coins & Let's Get Physical (CRISTALS)-evidence of physical & chemical changes
- Who's Ruling Whom? & Hit the Bull's Eye (CRISTALS)-accuracy & precisions in measuring & calculating
- Density Show "Stopper"-graphical mass/volume relationships

Assessments:

- Students will use observations of matter in the laboratory to classify chemical changes or physical changes and will give reasons to justify their classifications.
- Students will determine the density of a given material graphically from measurements of mass and volume.
- Students will identify an unknown metal element by determining its density.
- Students will record numerical measurements to the proper precision and will round calculations to the proper number of decimal places or significant figures.

General Chemistry

Month: August/September

Unit 1: Properties of Matter

Resources:

1. Holt Chemistry, 2006
   by R. Thomas Myers, Keith B. Oldham, & Salvatore Tocci
   Chapter 1 - Pages 6-19
   Chapter 2 - Pages 54-63

2. CRISTALS Lab Activities
   University of Northern Iowa
   Pages 15-22, 71-82

3. The World of Chemistry Video Series
   #3 "Measurement: The Foundation of Chemistry"

4. Websites:
   http://www.scilinks.org (SciLinks codes = HW4097, HW4140, HW4114)

5. Chem Matters Magazine Articles
   "The Weighty Matter of the Kilogram Standard", October 1999
   "The Unadulterated History of Food Dyes", December 1999

South Dakota State Science Standards:

Review:

9-12.P.1.5. Students are able to distinguish among chemical, physical, and nuclear changes.

- Differentiate between physical and chemical properties used to describe matter.
- Identify key indicators of chemical and physical changes.

New:

9-12.N.2.2A. Students are able to use statistical analysis of data to evaluate the validity of results.

- Use correlation coefficient with graphs.

9-12.N.2.3A. Students are able to demonstrate correct precision in measurements and calculations.

- Use significant digits to illustrate precision in measurement.
- Factor label conversion, scientific notation.

General Chemistry

Month: September/October

Unit 2: Atomic Structure & Periodic Table

Resources:

1. Holt Chemistry, 2006
   by R. Thomas Myers, Keith B. Oldham, & Salvatore Tocci
   Chapter 3 - Pages 73-104
   Chapter 4 - Pages 115-147
   Chapter 7 - Pages 224-235
   Chapter 18-Pages 643, 648-666

2. CRISTALS Lab Activities, University of Northern Iowa
   Pages 55-70, 83-118, 119-130, 131-148

3. The World of Chemistry Video Series
   #4 "Modeling the Unseen"
   #6 "The Atom"
   #7 "The Periodic Table"
   #11 "The Mole"

4. Websites:
   http://www.chemicool.com
   http://www.chemicalelements.com/
   http://www.scilinks.org (SciLinks codes = HW4017, HW4121, HW4148, HW4038, HW4014, HW4015, HW4051, HW4094, HW4170, HW4007, HW4008, HW4065, HW4083, HW4079, HW4168)

5. Chem Matters Magazine Articles
   "Colors Bursting in Air", October 1998
   "Radioactivity, It's a Natural", April 2000

South Dakota State Science Standards:
Review:
9-12.N.1.2. Students are able to describe the role of observation and evidence in the development and modification of hypotheses, theories, and laws.

9-12.P.1.1. Students are able to use the Periodic Table to determine the atomic structure of elements, valence number, family relationships, and regions (metals, nonmetals, and metalloids).

- Determine protons, neutrons, electrons, mass number, and atomic number from the Periodic Table.
- Determine the number of valence electrons for elements in the main (s&p) blocks of the Periodic Table
- Identify the relative metallic character of an element based on its location on the Periodic Table.

9-12.P.1.5. Students are able to distinguish among chemical, physical, and nuclear changes.

- Explain the differences among nuclear, chemical, and physical changes at the atomic level.

New:

9-12.P.1.1A. Students are able to distinguish between the changing models of the atom using the historical experimental evidence.

Examples: Dalton, Thompson, Rutherford, Bohr, wave-mechanical models

9-12.P.1.2A. Students are able to predict electron configuration, ion formation, reactivity, compound formation, periodic trends, and types of compounds formed based on location on the Periodic Table.

Examples: periodic trends including ionization, energy, electronegativity, atomic and ionic size, and shielding effect.

9-12.P.1.6A. Students are able to perform stoichiometric calculations.

- Convert between moles, mass, particles, volume.

9-12.E.1.2A. Students are able to compare, quantitatively and qualitatively, methods used to determine geological time.

Example: radioactive decay

Essential Questions:

- How was indirect scientific experimental evidence used to infer information about the parts of the atom?
- What are the basic building blocks of an atom?
- How are neutral atoms, ions and isotopes related?
- What is the relationship between valence electrons, electron configuration, and oxidation numbers?
- How is the mole used in chemical calculations?
- How is the periodic table arranged?
- How can chemical and physical properties be predicted based on the periodic table?

Science Process Skills:

- Observing- Using the 5 senses (see, hear, touch, smell, taste) to find out about objects and events, their characteristics, properties, differences, similarities, and changes
- Classifying-Grouping or ordering objects or events according to similarities or differences in properties
- Measuring- Comparing an unknown quantity with a known (metric units); Observations are quantified using proper measuring devices and techniques
- Inferring-Interpreting or explaining observations
- Using Number Relationships-Applying numbers and their mathematical relationships to make decisions
- Predicting-Forming an idea of an expected result - not a guess - but a belief of what will occur based upon present knowledge and understandings, observations and inferences
- Making Models-Constructing mental, verbal, or physical representations of ideas, objects, or events to clarify explanations or demonstrate relationships.

Activities:

- Inner Space?, Do You Catch Your Clippings?, Nuclear Marbles (CRISTALS)-atomic discovery simulations
- It's in the Bag (CRISTALS)-relationships between protons, neutron & electrons
- Somewhere in the Rainbow (CRISTALS)-flame tests
- Metallica, How Many Molecules are in Lake Erie? & Avogadro's Aluminum (CRISTALS)-relationships between mass, moles & number of particles
- Dmitri's Dilemma (CRISTALS), Heavy Metal or Soft Rock? (CRISTALS), On a Cycle Built for Two Hundred, Sibling Rivalry & Family Feud-periodic relationships in properties of elements
- Get a Half-Life (CRISTALS)-radioactive half-life simulation

Assessments:

- Students will make a time-line of the events leading to our current understanding of the atom.
- Students will use the periodic table to determine number of protons, neutrons and electrons in an atom.
- Students will use the number of subatomic particles to determine the atomic number, mass number, and oxidation number of an isotope or ion.
- Students will identify an unknown metal ion by using a flame test.
- Students will determine electron configurations of elements using the periodic table.
- Students will calculate the number of atoms in a known substance by measuring mass and using mole conversions.
- Students will draw atomic structures of metals and nonmetals and use them to explain their properties.
- Students will describe characteristic properties of alkali metals, alkaline earth metals, halogens, and noble gases and will draw electron configurations to show the relationship to their properties.
- Students will use shielding, nuclear charge, and distance of valence electrons from the nucleus to explain periodic trends in electronegativity, ionization energy, and atomic radius.
- Students will use periodic trends to predict properties of elements from their location on the periodic table.
- Students will graphically and numerically show how the amount of a radioactive isotope changes with time.

General Chemistry

Month: October

Unit 3: Bonding

Resources:

1. Holt Chemistry, 2006
   by R. Thomas Myers, Keith B. Oldham, & Salvatore Tocci
   Chapters 5 - Pages 157-180
   Chapter 6 - Pages 194-213
   Chapter 7 - Pages 236-248

2. CRISTALS Lab Activities, University of Northern Iowa
   Pages 175-234, 301-312

3. The World of Chemistry Video Series
   #8 "Chemical Bonds"

4. Websites:
   http://library.thinkquest.org/3659/structures/
   http://www.scilinks.org (SciLinks codes = HW5071, HW4072, HW4036, HW4081, HW4169, HW4080, HW4131, HW4028)

South Dakota State Science Standards:

Review:

9-12.P.1.2. Students are able to describe ways that atoms combine.

- Name and write formulas for binary ionic and covalent compounds.

  Example: sodium chloride (NaCl), carbon dioxide (CO_2)
- Compare the roles of electrons in covalent, ionic, and metallic bonding.
- Discuss the special nature of carbon covalent bonds.

New:

9-12.P.1.2A. Students are able to predict electron configuration, ion formation, reactivity, compound formation, periodic trends, and types of compounds formed

9-12.P.1.6A. Students are able to perform stoichiometric calculations.

- Calculate empirical and molecular formulas from mass percents.

9-12.P.1.8A. Students are able to use models to make predictions about molecular structure, chemical bonds, chemical reactivity, and polarity of molecules.

- Create Lewis structures for molecules and polyatomic ions.
- Determine molecular shape using VSEPR theory.
- Determine the polarity of a molecule.

Essential Questions:

- How does the type of bond between two elements determine the kind of compound formed?
- Why are the shapes important in determining the physical properties of compounds?
- How are different kinds of organic compounds formed?
- How can chemical formulas be determined from oxidation numbers and mass of components in a compound?
- How do electrons participate in chemical bonds?
- What rules/patterns determine how atoms bond?
- How are compounds named?

Science Process Skills:

- Observing-Using the 5 senses (see, hear, touch, smell, taste) to find out about objects and events, their characteristics, properties, differences, similarities, and changes
- Classifying-Grouping or ordering objects or events according to similarities or differences in properties
- Measuring-Observations are quantified using proper measuring devices and techniques
- Using Number Relationships-Applying numbers and their mathematical relationships to make decisions
- Making Models-Constructing mental, verbal, or physical representations of ideas, objects, or events to clarify explanations or demonstrate relationships.
- Collecting Data-Gathering and recording information about observations and measurements in a systematic way
- Interpreting Data-Organizing, analyzing, and synthesizing data using tables, graphs, and diagrams to locate patterns that lead to the construction of inferences, predictions, or hypotheses.

Activities:

- Formula Mania (CRISTALS)-use manipulatives to help write formulas for ionic compounds
- A Penny for Your Thoughts-find percent composition
- Water, Water Everywhere & Formula Forensics (CRISTALS)-find empirical formulas for compounds by decomposition into parts
- The Name is Bond, Chemical Bond (CRISTALS)-compare properties of ionic & covalent compounds
- Share and Share Alike-use molecular models to assist with finding molecular shapes and polarity of molecules

Assessments:

- Students will write formulas for ionic compounds using oxidation numbers obtained from periodic table location.
- Students will calculate percent composition of compounds or mixtures using experimental masses obtained by decomposition.
- Students will calculate formulas for hydrated salts using experimental masses obtained by decomposition of anhydrous salt and water.
- Students will compare and contrast properties of ionic and covalent compounds.
- Students will calculate molecular formulas for covalent compounds using experimental masses of elements obtained by decomposition and given molecular mass.
- Students will predict type of bonds in a compound using electronegativities of elements.
- Students will build molecular models of covalent compounds and describe shape and polarity of molecule using VSPER theory.
- Students will draw Lewis structures for covalent compounds.

General Chemistry

Month: October/November

Unit 4: Reactions & Stoichiometry

Resources:

1. Holt Chemistry, 2006
   by R. Thomas Myers, Keith B. Oldham, & Salvatore Tocci
   Chapter 1 - Pages 7-9
   Chapter 8 - Pages 260-285
   Chapter 9 - Pages 301-307,310-319

2. CRISTALS Lab Activities, University of Northern Iowa
   Pages 235-300

3. The World of Chemistry Video Series
   #8 "Chemical Bonds"

4. Websites:
   http://www.chemistry.ohio-state.edu/betha/chembal/shihome.html
   http://www.scilinks.org (SciLinks codes = HW4029, HW4033, HW4004, HW4163, HW4160, HW4141)

South Dakota State Science Standards:

Review:

9-12.P.1.4. Students are able to balance chemical equations by applying the Law of Conservation of Matter.

- Trace number of particles in diagrams and pictures of balanced equations.

  Example: Write out an equation with symbols:

  $Mg + 2HCL \rightarrow MgCl_2 + 2H_2$

New:

9-12.P.1.3A. Students are able to identify five basic types of chemical reactions and predict the products.

- Single replacement, double replacement, synthesis, decomposition, and combustion reactions
- Describe the properties and interactions of acids, bases, and salts.

9-12.P.1.6A. Students are able to perform stoichiometric calculations.

- Determine limiting and excess reactants and percent yield in chemical reactions.

Essential Questions:

- How is the mole used in chemical calculations?
- How are quantities of materials predicted in a chemical reaction?
- How do available materials limit the amount of products?
- How are the products of chemical reactions predicted?
- How are chemical reactions symbolically represented based on the Law of Conservation of Matter?

Science Process Skills:

- Observing-Using the 5 senses (see, hear, touch, smell, taste) to find out about objects and events, their characteristics, properties, differences, similarities, and changes
- Classifying-Grouping or ordering objects or events according to similarities or differences in properties
- Measuring-Observations are quantified using proper measuring devices and techniques
- Predicting-Forming an idea of an expected result - not a guess - but a belief of what will occur based upon present knowledge and understandings, observations and inferences
- Communicating-Using the written and spoken work, graphs, demonstrations, drawings, diagrams, or tables to transmit information and ideas to others
- Using Number Relationships-Applying numbers and their mathematical relationships to make decisions
- Collecting Data-Gathering and recording information about observations and measurements in a systematic way
- Interpreting Data-Organizing, analyzing, and synthesizing data using tables, graphs, and diagrams to locate patterns that lead to the construction of inferences, predictions, or hypotheses.

Activities:

- The Case of the Adulterated Baking Soda (CRISTALS)-find percent composition of a mixture using mass/mass stoichiometry
- Follow the Yellow Thick Mode & Plop, Plop, Fizz, Fizz (CRISTALS)-show Law of Conservation of Matter
- To Form or Not to Form & Class Action (CRISTALS)-observe, predict products and write reactions for five types of reactions

Assessments:

- Students will classify reactions as synthesis, decomposition, single replacement, double replacement or combustions given the reactants.
- Students will complete and balance reactions given the reactants.
- Students will calculate mass of a reactant or product in a reaction given the mass of any other reactant or product.
- Students will calculate percent yield of a reactions from experimental masses of reactants and products.

General Chemistry

Month: November

Unit 5: Energy in Reactions

Resources:

1. Holt Chemistry, 2006
   by R. Thomas Myers, Keith B. Oldham, & Salvatore Tocci
   Chapter 2 - Pages 38-45
   Chapter 10 - Pages 337-357
   Chapter 11 - Pages 378-392

2. CRISTALS Lab Activities, University of Northern Iowa
   Pages 345-356

3. The World of Chemistry Video Series
   #5 "A Matter of State"
   #13 "The Driving Forces"

4. Chemical Demonstrations: A Sourcebook for Teachers, Volume 1
   by Lee R. Summerlin and James L. Ealy, Jr.
   American Chemical Society
   Pages 66, 122

5. Websites:
   http://www.scilinks.org (SciLinks codes =HW4035, HW4119, HW4052, HW4056, HW4068, HW4120, HW4393, HW4130)

South Dakota State Science Standards:
New:

9-12.P.1.5A. Students are able to examine energy transfer as matter changes.

Examples:

Determine ΔH for thermo-chemical equations.

Calculate energy involved in phase changes.

Compare the specific heats of various substances.

- Describe physical and chemical processes that result in endothermic and exothermic changes.
- Describe energy transfer as matter changes from one phase to another.

Essential Questions:

- How is energy involved in physical and chemical changes?
- What is heat energy?
- How is heat capacity related to the materials around us?
- How can energy changes be used to predict spontaneity of reactions?

Science Process Skills:

- Classifying-Grouping or ordering objects or events according to similarities or differences in properties
- Measuring-Observations are quantified using proper measuring devices and techniques
- Predicting-Forming an idea of an expected result - not a guess - but a belief of what will occur based upon present knowledge and understandings, observations and inferences
- Communicating-Using the written and spoken work, graphs, demonstrations, drawings, diagrams, or tables to transmit information and ideas to others
- Using Number Relationships-Applying numbers and their mathematical relationships to make decisions
- Collecting Data-Gathering and recording information about observations and measurements in a systematic way
- Interpreting Data-Organizing, analyzing, and synthesizing data using tables, graphs, and diagrams to locate patterns that lead to the construction of inferences, predictions, or hypotheses.

Activities:

- Phased Out-phase change temperatures and graph
- When You're Hot, You're Hot-specific heat of a metal using calorimetry
- Heat of Combustion-heat transfer & molar heat of combustion

Assessments:

- Students will use observations of matter in the laboratory to classify endothermic or exothermic changes and will give reasons to justify their classifications.
- Students will graphically represent phase changes and use them to identify states of matter.
- Students will use calorimetry to calculate the specific heat capacity of a given metal.
- Students will use heat transfer measurements to calculate molar heat capacity from combustion.
- Students will use Hess's law to calculate net enthalpy change for a reaction.

General Chemistry

Month: November/December

Unit 6: Behavior of Gases

Resources:

1. Holt Chemistry, 2006
   by R. Thomas Myers, Keith B. Oldham, & Salvatore Tocci
   Chapter 9 - Pages 308-309
   Chapter 12 - Pages 416-435, 439-442

2. CRISTALS Lab Activities, University of Northern Iowa
   Pages 149-174

3. The World of Chemistry Video Series
   #17 "The Precious Envelope"

4. Websites:
   http://intro.chem.okstate.edu/NSFCCLI/GasLaw/GLP.htm
   http://www.scilinks.org (SciLinks codes = HW4152, HW4063, HW413, HW4013)

South Dakota State Science Standards:
Review:

9-12.P.1.5. Students are able to distinguish among chemical, physical, and nuclear changes.

- Describe the effects of changing pressure, volume, or temperature upon gases.

9-12.P.1.3. Students are able to predict whether reactions will speed up or slow down as conditions change.

Examples: temperature, concentration, surface area, and catalysts

9-12.E.1.2. Students are able to describe how atmospheric chemistry may affect global climate.

Examples: Greenhouse Effect & ozone depletion

New:

9-12.P.1.6A. Students are able to perform stoichiometric calculations.

- Convert between moles, mass, particles, volume.

9-12.P.1.7A. Students are able to apply the kinetic molecular theory to solve quantitative problems involving pressure, volume, temperature, and number of moles of gas.

- Apply Boyle's Law, Charles' Law, Gay-Lussac's Law, Combined Gas Law, and Ideal Gas Law.

9-12.N.2.2A. Students are able to use statistical analysis of data to evaluate the validity of results.

- Use correlation coefficient with graphs.
- Examples: determination of absolute zero

Essential Questions:

- How does the kinetic molecular theory describe ideal gas behavior?
- How are the pressure, volume and temperature of a gas related?

Science Process Skills:

- Predicting-Forming an idea of an expected result - not a guess - but a belief of what will occur based upon present knowledge and understandings, observations and inferences
- Using Number Relationships-Applying numbers and their mathematical relationships to make decisions
- Making Models-Constructing mental, verbal, or physical representations of ideas, objects, or events to clarify explanations or demonstrate relationships.
- Collecting Data-Gathering and recording information about observations and measurements in a systematic way
- Interpreting Data-Organizing, analyzing, and synthesizing data using tables, graphs, and diagrams to locate patterns that lead to the construction of inferences, predictions, or hypotheses.
- Identifying and Controlling Variables-Manipulating one factor to investigate the outcome of an event while other factors are held constant.
- Formulating Hypotheses (Hypothesizing)-Making educated guesses based on evidence that can be tested through experimentation.
- Experimenting-Designing one's own experiment to test a hypothesis using procedures to obtain reliable data

Activities:

- Fill 'er Up (CRISTALS)-show Avogadro's principle
- Plop, Plop, Fizz, Fizz-properties of gases
- It's a Gas-find percent error using mass/mass stoichiometry
- Gas Stations-observe changes in and relationships among volume, temperature and pressure of gases
- Flick Your Bic (CRISTALS)-find molar mass of a gas using Ideal gas law and Dalton's law of partial pressures
- Can You Take the Pressure?-use eudiometer, Dalton's law of partial pressures, Combined gas law, density, and mass/volume stoichiometry to find mass of gas produced and percent error.

Assessments:

- Students will use experimental data to show that equal volumes of gases contain the same number of particles.
- Students will describe changes in pressure, volume or temperature of a given gas when the other variables are changed.
- Student will use stoichiometry to calculate mass or volume of a reactant or product given the mass or volume of another reactant or product in a specified reaction.
- Students will use Dalton's law of partial pressures to calculate the pressure of a dry gas given the atmospheric pressure and water vapor pressure.
- Students will use the Ideal Gas Law to calculate pressure, volume, temperature or number of moles of a gas under fixed conditions given the other variables.
- Students will use the kinetic-molecular theory to describe conditions when a gas deviates from ideal behavior.

General Chemistry

Month: December/January

Unit 7: Solutions & Equilibrium

Resources:

1. Holt Chemistry, 2006
   by R. Thomas Myers, Keith B. Oldham, & Salvatore Tocci
   Chapter 1-Pages 21-28
   Chapter 8 - Pages 286-289
   Chapter 13 - Pages 454-477, 484-486
   Chapter 14-Pages 496-506, 512-518

2. CRISTALS Lab Activities, University of Northern Iowa
   Pages 313-344, 357-366

3. The World of Chemistry Video Series
   #12 "Water"
   #14 "Molecules in Action"

4. Websites:
   http://www.chm.davidson.edu/ChemistryApplets/equilibria/LeChatelier.html
   http://www.scilinks.org (SciLinks codes = HW4117, HW4057, HW4034, HW4153)

South Dakota State Science Standards:

Review:

9-12.P.1.5. Students are able to distinguish among chemical, physical, and nuclear changes.

- Identify characteristics of a solution and factors that affect the rate of solution formation.

  Examples: solute, solvent, concentrated, dilute, saturated, unsaturated, supersaturated

  Factors affecting rate: agitation, heating, particle size, pictures of particles

New:

9-12.P.1.4A. Students are able to describe factors that affect solution interactions.

- Calculate concentration of solutions.
- "Like dissolves like"
- Vander Waal's forces

9-12.P.1.9A. Students are able to describe the characteristics of equilibria.

- Apply LeChatelier's principle to equilibrium reactions.
- Identify factors that drive reactions toward completion.
- Calculate K_{eq} values for equilibrium reactions.

9-12.N.2.2A. Students are able to use statistical analysis of data to evaluate the validity of results.

- Use correlation coefficient with graphs.
- Examples: verify concentration of an unknown solution

Essential Questions:

- How can solutions of different concentrations be prepared in the laboratory?
- How can solubilities of substances be predicted?
- How can matter be classified and separated by state, properties and composition?
- How can net equations be written for substances in solutions?

Science Process Skills:

- Observing-Using the 5 senses (see, hear, touch, smell, taste) to find out about objects and events, their characteristics, properties, differences, similarities, and changes
- Classifying-Grouping or ordering objects or events according to similarities or differences in properties
- Measuring-Observations are quantified using proper measuring devices and techniques
- Inferring-Interpreting or explaining observations
- Predicting-Forming an idea of an expected result - not a guess - but a belief of what will occur based upon present knowledge and understandings, observations and inferences
- Communicating-Using the written and spoken work, graphs, demonstrations, drawings, diagrams, or tables to transmit information and ideas to others
- Making Models-Constructing mental, verbal, or physical representations of ideas, objects, or events to clarify explanations or demonstrate relationships.
- Collecting Data-Gathering and recording information about observations and measurements in a systematic way
- Interpreting Data-Organizing, analyzing, and synthesizing data using tables, graphs, and diagrams to locate patterns that lead to the construction of inferences, predictions, or hypotheses.
- Using Number Relationships-Applying numbers and their mathematical relationships to make decisions
- Identifying and Controlling Variables-Manipulating one factor to investigate the outcome of an event while other factors are held constant.
- Experimenting-Designing one's own experiment to test a hypothesis using procedures to obtain reliable data

Activities:

- To Dye For-separations of mixtures
- All Stirred Up, Mutual Attractions & Conduction Junction (CRISTALS)-factors that affect solubility
- Ice to See You-crystallizations temperatures and solubility graph construction
- Bottle Bewilderment (CRISTALS)-observing and writing net ionic equations for precipitate reactions in solution
- Holy Moley & Dilution Solution (CRISTALS)-solution concentrations and preparations
- Let the Transfer Begin (CRISTALS)-equilibrium simulation
- Stress Management (CRISTALS)-observing and predicting shifts in equilibrium

Assessments:

- Students will use various methods to separate matter in the laboratory and will use the method of separation and observations of the separation to classify matter as a heterogeneous mixture, homogeneous mixture, compound or element.
- Students will use collision theory to explain how solubility of solids or gases is affected by agitation, concentration, surface area, temperature and pressure.
- Students will construct a solubility curve from experimental data and will predict solubility of substances at given locations on solubility graph.
- Students will write net ionic equations for reactions occurring in solutions and describe the overall reaction which takes place.
- Students will calculate concentrations of solutions given amounts of solute and solvent.
- Students will use stoichiometry to determine the mass or solution volume of a reactant or product given the mass or solution volume of another reactant or product in a specific reaction.
- Students will use LeChatelier's Principle to predict direction of a shift for a reaction at equilibrium with changes in temperature, pressure, concentrations, addition of a common ion, neutralization, or formation of a precipitate.
- Students will calculate an equilibrium constant for a reaction at equilibrium given reactant and product concentrations.
- Students will use equilibrium constants to calculate concentrations of substances in solutions.
- Students will describe conditions necessary for a reaction to come to equilibrium.

General Chemistry

Month: January

Unit 8: Acids & Bases

Resources:

1. Holt Chemistry, 2006
   by R. Thomas Myers, Keith B. Oldham, & Salvatore Tocci
   Chapter 15-Pages 530-536, 539-555

2. CRISTALS Lab Activities, University of Northern Iowa
   Pages 369-398

3. The World of Chemistry Video Series
   #16 "The Proton in Chemistry"

4. Websites:
   http://www.scilinks.org (SciLinks codes = HW4002, HW4001, HW4020, HW4095, HW4125)

South Dakota State Science Standards:

9-12.P.1.3A. Students are able to identify five basic types of chemical reactions and predict the products.

- Calculate pH, pOH, $[H_3O^+]$, $[OH^-]$.
- Distinguish between Arrhenius, Bronsted-Lowry, and Lewis definitions of acids and bases.

Essential Questions:

- How do the properties of acids and bases compare?
- How do acids and bases react with one another?
- How does the concentration of the hydronium ion relate to pH?

Science Process Skills:

- Observing-Using the 5 senses (see, hear, touch, smell, taste) to find out about objects and events, their characteristics, properties, differences, similarities, and changes
- Classifying-Grouping or ordering objects or events according to similarities or differences in properties
- Measuring-Observations are quantified using proper measuring devices and techniques
- Inferring-Interpreting or explaining observations
- Using Number Relationships-Applying numbers and their mathematical relationships to make decisions
- Collecting Data-Gathering and recording information about observations and measurements in a systematic way
- Interpreting Data-Organizing, analyzing, and synthesizing data using tables, graphs, and diagrams to locate patterns that lead to the construction of inferences, predictions, or hypotheses.

Activities:

- It's a Maalox Moment, Whiff n' Proof, Sour Apples (CRISTALS)-titration to find the concentration of an acid or a base
- In Living Color (CRISTALS)-comparison of acid/base indicators
- What's the Difference? & Circling the Bases (CRISTALS)-compare and contrast properties of acids and bases.

Assessments:

- Students will compare and contrast the properties of acids and bases.
- Students will describe the difference between a strong and weak acid or base.
- Students will use the Arrhenius and Bronsted-Lowry definitions to describe the behavior of acids and bases in reactions and solutions.
- Students will calculate pH, hydronium ion concentration or hydroxide ion concentration given information about acidic or basic solutions.
- Students will choose indicators for titrations reactions and calculate unknown concentrations of acidic or basic solutions given the names of the acid and base reacted and one of the concentrations.

Fundamentals of Chemistry

Month: 1

Unit 1: Properties and States of Matter

Resources:

- Prentice Hall *Physical Science: Concepts in Action*, 2006
  - Chapter 2
  - Chapter 3
- www.scilinks.org
  - ccn-1021, cce-1022, ccn-1031, cce-1033
- Discovery Channel School Video Field Trip
  - Fresh-Squeezed Water
  - Up, Up and Away
- Science News Online Resources—www.phschool.com
  - Cce-1022, cce-1032

South Dakota State Science Standards:

- 9-12.P.1.5. Students are able to distinguish among chemical, physical, and nuclear changes.
  - Differentiate between physical and chemical properties used to describe matter.
  - Identify key indicators of chemical and physical changes.
  - Describe the effects of changing pressure, volume or temperature on gases.
  - Explain the different among nuclear, chemical and physical changes at the atomic level

Essential Questions:

- How are elements different from compounds?
- How do we know when a new compound is formed?
- Why don't all changes result in a new compound?
- Why are there different states of matter?
- Why doesn't the temperature change during a phase change?
- How is energy related to the phases of matter?
- What causes a phase change?

Science Process Skills:

- **Observing**--Using the 5 senses (see, hear, touch, smell, taste) to find out about objects and events, their characteristics, properties, differences, similarities, and changes
- **Classifying--**Grouping or ordering objects or events according to similarities or differences in properties
- **Measuring**--Comparing an unknown quantity with a known (metric units, time, student-generated frames of reference) - Observations are quantified using proper measuring devices and techniques
- **Inferring--**Interpreting or explaining observations
- **Predicting**--Forming an idea of an expected result - not a guess - but a belief of what will occur based upon present knowledge and understandings, observations and inferences
- **Communicating--**Using the written and spoken work, graphs, demonstrations, drawings, diagrams, or tables to transmit information and ideas to others
- **Making Models**--Constructing mental, verbal, or physical representations of ideas, objects, or events to clarify explanations or demonstrate relationships.
- **Collecting Data--**Gathering and recording information about observations and measurements in a systematic way
- **Interpreting Data--**Organizing, analyzing, and synthesizing data using tables, graphs, and diagrams to locate patterns that lead to the construction of inferences, predictions, or hypotheses

Activities:

- You're Nuts, Dirty Bubble Challenge, Counterfeit Coins, Butter Me Up!
    - Chemical and physical properties of materials.
- Let's Get Physical, Alchemy or Alloy?, Using Properties to Identify Materials
    - Chemical and physical changes.
- Gas Stations, Plop, Plop, Fizz, Fizz,
    - Changes in gases—temperature, pressure, volume
- I'm Melting!
    - Phase changes

Assessments:

- Students will identify the physical and chemical properties of a material.
- Students will be able to describe the evidence that indicates a physical change is taking place.
- Students will be able to describe the evidence that indicates a chemical change is taking place.
- Students will be able to distinguish chemical changes from physical changes
- Describe chemical, physical and nuclear changes at the atomic and macroscopic levels.
- Explain why change of state is a physical change.

Fundamentals of Chemistry

Month: 2

Unit : Atomic Structure and the Periodic Table

Resources:

- Prentice Hall *Physical Science: Concepts in Action*, 2006
  - Chapter 3
  - Chapter 4
- Discovery Channel School Video Field Trips
  - Go for the Gold
  - You Are What You Eat
- www.scilinks.org
  - ccn-1041, ccn-1043, ccn-1051, ccn-1052
- Science News Online Resources—www.phschool.com
  - Cce-1042, cce-1053
- ChemMatters Magazine
  - Colors Bursting in Air, October 1998

South Dakota State Science Standards:

- 9-12.P.1.1. Students are able to use the Periodic Table to determine the atomic structure of elements, valence number, family relationships, and regions (metals, nonmetals, and metalloids).
  - Determine protons, neutrons, electrons, mass number and atomic number from the periodic table.
  - Identify the relative metallic character of an element based on its location on the periodic table.
  - Determine the number of valence electrons for elements in the main (s & p) blocks of the periodic table.

Essential Questions:

- What are atoms composed of?
- How do we know what makes up an atom when we can't see them?
- Why is the periodic table so important?
- How is the periodic table arranged?
- What can we find out from the periodic table?
- How can chemical and physical properties be predicted based on the periodic table?

Science Process Skills:

- **Classifying--**Grouping or ordering objects or events according to similarities or differences in properties
- **Inferring--**Interpreting or explaining observations
- **Predicting**--Forming an idea of an expected result - not a guess - but a belief of what will occur based upon present knowledge and understandings, observations and inferences
- **Communicating--**Using the written and spoken work, graphs, demonstrations, drawings, diagrams, or tables to transmit information and ideas to others
- **Making Models**--Constructing mental, verbal, or physical representations of ideas, objects, or events to clarify explanations or demonstrate relationships.
- **Formulating Hypotheses (Hypothesizing)**--Making educated guesses based on evidence that can be tested through experimentation
- **Using Number Relationships**--Applying numbers and their mathematical relationships to make decisions

Activities:

- It's in the Bag, Made to Order, Secret Identity, Bean Salad
  - use the periodic table to determine atomic structure—protons, neutrons, electrons, atomic number and atomic mass
- Maybe, Maybe Not, Dalton's Playhouse, Over the Rainbow, Inner Space
  - development of the atomic model
- Color Me Periodic, The Periodic Table and Atomic Size, Sibling Rivalry, On a Cycle Built for Two (Hundred), Metal Mania
  - periodic properties
- Essential Elements
  - Exploring elements essential for good health
- Students will create trading cards about the different elements.

Assessments:

- Students will be able to list the main points of Dalton's atomic theory and describe his evidence for the existence of atoms.
- Students will be able to explain how Thomson and Rutherford used data from experiments to produce their atomic models.
- Students will be able to identify three subatomic particles and their properties.
- Students will be able to distinguish the atomic number from the mass number of an isotope and use these numbers to describe the structure of atoms.
- Students can explain how the electron cloud model represents the behavior and locations of electrons in atoms.
- Students will describe the arrangement of elements in the modern periodic table.
- Students will be able to identify general properties of metals, nonmetals and metalloids.
- Students can describe how properties of elements change across a period and down a column in the periodic table.
- Students can determine the number of valence electrons in the *s* and *p* orbitals.

Fundamentals of Chemistry

Month: 3

Unit : Chemical Bonds and Reactions

Resources:

- Prentice Hall *Physical Science: Concepts in Action*, 2006
  - Chapter 6
  - Chapter 7
- www.scilinks.org
  - ccn-1061, ccn-1062, ccn-1063, ccn-1071, ccn-1072, ccn-1074, ccn-1075, ccn-1076
- Discovery Channel School Video Field Trip
  - Good Conduct
  - Taming the Flames
- Science News Online Resources—www.phschool.com
  - Cce-1064, cce-1071
- ChemMatters Magazine Articles
  - The Unadulterated History of Food Dyes, December 1999

South Dakota State Science Standards:

- 9-12.P.1.2. Students are able to describe ways that atoms combine.
  - Name and write formulas for binary ionic and covalent compounds.
  - Compare roles of electrons in covalent, ionic and metallic bonding
- 9-12.P.1.4. Students are able to balance chemical equations by applying the Law of Conservation of Matter.
  - Trace number of particle in diagrams and pictures of balanced equations
- 9-12.P.1.3. Students are able to predict whether reactions will speed up or slow down as conditions change.

Essential Questions:

- How do electrons participate in chemical bonds?
- What rules/patterns determine how atoms bond?
- How are compounds named and symbolized?
- How does the type of bond between two elements determine the kind of compound formed?
- How can reactions be made to go faster?
- Why do equations have to be balanced?

Science Process Skills:

Observing--Using the 5 senses (see, hear, touch, smell, taste) to find out about objects and events, their characteristics, properties, differences, similarities, and changes

Classifying--Grouping or ordering objects or events according to similarities or differences in properties

Measuring--Comparing an unknown quantity with a known (metric units, time, student-generated frames of reference) - Observations are quantified using proper measuring devices and techniques

Inferring--Interpreting or explaining observations

Communicating--Using the written and spoken work, graphs, demonstrations, drawings, diagrams, or tables to transmit information and ideas to others

Using Number Relationships--Applying numbers and their mathematical relationships to make decisions

Making Models--Constructing mental, verbal, or physical representations of ideas, objects, or events to clarify explanations or demonstrate relationships.

Collecting Data--Gathering and recording information about observations and measurements in a systematic way

Interpreting Data--Organizing, analyzing, and synthesizing data using tables, graphs, and diagrams to locate patterns that lead to the construction of inferences, predictions, or hypotheses

Activities:

- Porcupions,
  - Formation of ions
- Formula Mania
  - Writing and naming ionic formulas
- Bond, Chemical Bond, To Dye For, Marbling
  - Properties of ionic and covalent compounds
- Share and Share Alike, Model Behavior
  - Structure of compounds
- Percentage of Water in Popcorn, The Nuts 'n' Bolts of Chemical Equations, To Form or Not to Form, Class Action
  - Conservation of mass, balancing equations
- Speed Control
  - Factors affecting the speed of a reactions

Assessments:

- Students can recognize stable electron configurations.
- Students are able to describe how an ionic bond forms.
- Students can correctly name and write the formula for binary ionic and covalent compounds.
- Students can determine the composition of an ionic compound from its chemical formula.
- Students are able to describe how covalent bonds form and how the properties of the compound are determined by the type of bond.
- Students can interpret chemical equations in terms of reactants, products and conservation of mass.
- Students are able to balance chemical equations by manipulating coefficients.
- Students can describe the energy changes that take place during chemical reactions.
- Students can describe the factors affecting chemical reaction rates.

Fundamentals of Chemistry

Month: 4

Unit : Solutions, Acids and Bases

Resources:

- Prentice Hall *Physical Science: Concepts in Action*, 2006
  - Chapter 8
- Discovery Channel School Video Field Trip
  - Suspended in Blood
- www.scilinks.org
  - ccn-1081, ccn-1083, ccn-1084

South Dakota State Science Standards:

- 9-12.P.1.5. Students are able to distinguish among chemical, physical and nuclear changes
  - Identify the characteristics of a solution and factors that affect the rate of solution formation

Essential Questions:

- How do the properties of acids and bases compare?
- How do acids and bases react with each other?
- How can solutions of different concentrations be prepared in the laboratory?

Science Process Skills:

- **Observing**--Using the 5 senses (see, hear, touch, smell, taste) to find out about objects and events, their characteristics, properties, differences, similarities, and changes
- **Classifying--**Grouping or ordering objects or events according to similarities or differences in properties
- **Measuring**--Comparing an unknown quantity with a known (metric units, time, student-generated frames of reference) - Observations are quantified using proper measuring devices and techniques
- **Inferring--**Interpreting or explaining observations

- **Predicting**--Forming an idea of an expected result - not a guess - but a belief of what will occur based upon present knowledge and understandings, observations and inferences
- **Communicating--**Using the written and spoken work, graphs, demonstrations, drawings, diagrams, or tables to transmit information and ideas to others
- **Making Models**--Constructing mental, verbal, or physical representations of ideas, objects, or events to clarify explanations or demonstrate relationships.

Activities:

- What's the Diff?, Circling the Bases, In Living Color, Cabbage Patch Chemistry
    - Characteristics of acids and bases
- All Stirred Up, Dilution Solution, You'll Get A Charge Out of This
    - Properties of solutions
- New Age Chemistry
    - Creation of borax crystals through a super-saturated solution
- Solubility of Vitamins

Assessments:

- Students are able to distinguish among the types of solutions by degree of concentration, dilute through supersaturated.
- Students can contrast the properties of acids and base
- Students are able to utilize and recognize indicators to identify acids and bases.
- Students can describe the pH scale.

General Physics

Month: August

Unit 1: Measurement

Resources:
1. Holt Physics, 2006
   by Raymond A. Serway and Jerry S. Faughn
   Chapter 1
2. Websites:
   www.scilinks.org

Standards:
9-12.N.2.3A. Students are able to demonstrate correct precision in measurements and calculations.

- Use significant digits to illustrate precision in measurement.
- Factor label conversion, scientific notation.

Essential Questions:
- What instruments would be appropriate to use for each type of measurement?
- What is the proper way to record measurements?
- What is the proper way to round calculations?
- How are numerical measurements labeled?
- How can units be converted from one type to another?

Science Process Skills:
- **Observing**-Using the 5 senses (see, hear, touch, smell, taste) to find out about objects and events, their characteristics, properties, differences, similarities, and changes
- **Classifying**-Grouping or ordering objects or events according to similarities or differences in properties
- **Measuring**-Comparing an unknown quantity with a known (metric units, time, student- generated frames of reference) - Observations are quantified using proper measuring devices and techniques
- **Inferring**-Interpreting or explaining observations
- **Using Number Relationships**-Applying numbers and their mathematical relationships to make decisions
- **Collecting Data**-Gathering and recording information about observations and measurements in a systematic way
- **Interpreting Data**-Organizing, analyzing, and synthesizing data using tables, graphs, and diagrams to locate patterns that lead to the construction of inferences, predictions, or hypotheses.

Activities:

- Circumference-Diameter Ratio of a Circle
- Metric Prefixes
- Physics & Measurement

Assessments:

- Students will list the basic SI units and the quantities they describe.
- Students will convert measurements into scientific notation.
- Students will distinguish between accuracy and precision.
- Students will record numerical measurements to the proper precision and will round calculations to the proper number of decimal places or significant figures.
- Students will interpret data in tables and graphs, and recognize the type of mathematical relationships represented by equations.
- Students will use dimensional analysis to determine units when performing calculations.

General Physics

Month: September

Unit 2: Motion

Resources:
1. Holt Physics, 2006
   by Raymond A. Serway and Jerry S. Faughn
   Chapter 2
   Chapter 3
   Chapter 7

2. Websites:
   www.scilinks.org

South Dakota Science Standards:
9-12.P.2.1. Students are able to apply concepts of distance and time to the quantitative relationships of motion using appropriate mathematical formulas, equations, and units.

- Evaluate speed, velocity, and acceleration both qualitatively and quantitatively.

  Examples:

  Identify the sign (+,-, 0) of an object's acceleration based on velocity information.

  Predict whether an object speeds up, slows down, or maintains a constant speed based on the forces acting upon it.

  Calculate acceleration using the equation

  $A_{avg}=\Delta V/\Delta t$.

- Given distance and time, calculate the velocity or speed of an object.
- Create and interpret graphs of linear motion.

  Example:

  Given a velocity-time or a distance-time graph with different slopes, determine the motion of an object.

9-12.E.2.1. Students are able to recognize how Newtonian mechanics can be applied to the study of the motions of the solar system.

- Given a set of possible explanations of orbital motion (revolution), identify those that make use of gravitational forces and inertia.

9-12.P.2.1A. Students are able to solve vector problems graphically and analytically.

- Define and manipulate vectors and scalars.

9-12.P.2.2A. Students are able to relate gravitational or centripetal force to projectile or uniform circular motion.

- Analyze and graph projectile motion.

Essential Questions:

- How do you describe the motion of an object?
- What fundamental difference exists between vector and scalar quantities?
- What quantities needed to be specified in order to predict the motion of an object?
- What are some examples of projectile motion?
- What are the factors that affect circular motion?
- How do you describe the motion of a rotating object?
- How does rotational motion apply to movement in space?

Science Process Skills:

- **Observing**-Using the 5 senses (see, hear, touch, smell, taste) to find out about objects and events, their characteristics, properties, differences, similarities, and changes
- **Classifying**-Grouping or ordering objects or events according to similarities or differences in properties
- **Measuring**-Comparing an unknown quantity with a known (metric units, time, student- generated frames of reference) - Observations are quantified using proper measuring devices and techniques
- **Inferring**-Interpreting or explaining observations
- **Predicting**-Forming an idea of an expected result - not a guess - but a belief of what will occur based upon present knowledge and understandings, observations and inferences
- **Communicating**-Using the written and spoken work, graphs, demonstrations, drawings, diagrams, or tables to transmit information and ideas to others
- **Using Number Relationships**-Applying numbers and their mathematical relationships to make decisions
- **Collecting Data**-Gathering and recording information about observations and measurements in a systematic way
- **Interpreting Data**-Organizing, analyzing, and synthesizing data using tables, graphs, and diagrams to locate patterns that lead to the construction of inferences, predictions, or hypotheses.
- **Identifying and Controlling Variables**-Manipulating one factor to investigate the outcome of an event while other factors are held constant.
- **Making Models**-Constructing mental, verbal, or physical representations of ideas, objects, or events to clarify explanations or demonstrate relationships.
- **Collecting Data**-Gathering and recording information about observations and measurements in a systematic way

- **Interpreting Data**-Organizing, analyzing, and synthesizing data using tables, graphs, and diagrams to locate patterns that lead to the construction of inferences, predictions, or hypotheses.
- **Identifying and Controlling Variables**-Manipulating one factor to investigate the outcome of an event while other factors are held constant.

Activities:

- Measuring Motion with a ticker-tape timer
- Circular Motion with centripetal force

Assessments:

- Students will measure, calculate and describe motion in terms of displacement, time, velocity and acceleration both quantitatively and graphically.
- Students will use vectors to solve problems with motion in one and two dimensions.
- Students will resolve projectile motion into its horizontal and vertical components.
- Students will describe velocities in terms of frame of reference.
- Students will calculate centripetal acceleration and centripetal force.
- Students will explain the motion of planets using Newton's law of universal gravitation and Kepler's laws of planetary motion.

General Physics

Month: October

Unit 3: Forces

Resources:
1. Holt Physics, 2006
   by Raymond A. Serway and Jerry S. Faughn
   Chapter 4
   Chapter 6
   Chapter 7

2. Websites:
   www.scilinks.org

South Dakota Science Standards:
9-12.P.2.2. Students are able to predict motion of an object using Newton's Laws.

- Describe how inertia is related to Newton's First Law.
- Explain the effect of balanced and unbalanced forces.
- Identify the forces at work on action/reaction pairs as distinguished from balanced forces.

  Examples:

  Draw a linear force diagram for the forces acting on an object in contact with another.

  Identify action/reaction pairs.
- Explain how force, mass, and acceleration are related.

9-12.P.2.1A. Students are able to solve vector problems graphically and analytically.

- Define and manipulate vectors and scalars.
- Determine if an object is in equilibrium and distinguish among stable, neutral, and unstable equilibria.

  Examples: center of mass, torque

Essential Questions:
- What is the meaning of equilibrium for a body?
- What causes changes in motion of an object?
- How are weight and mass related?
- How is acceleration related to force and mass?
- What is classified as a force?
- How does the conservation of momentum govern the interactions of bodies?

- How do torques affect rotary motion?

Science Process Skills:

- **Observing**-Using the 5 senses (see, hear, touch, smell, taste) to find out about objects and events, their characteristics, properties, differences, similarities, and changes
- **Classifying**-Grouping or ordering objects or events according to similarities or differences in properties
- **Measuring**-Comparing an unknown quantity with a known (metric units, time, student- generated frames of reference) - Observations are quantified using proper measuring devices and techniques
- **Inferring**-Interpreting or explaining observations
- **Predicting**-Forming an idea of an expected result - not a guess - but a belief of what will occur based upon present knowledge and understandings, observations and inferences
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- **Using Number Relationships**-Applying numbers and their mathematical relationships to make decisions
- **Making Models**-Constructing mental, verbal, or physical representations of ideas, objects, or events to clarify explanations or demonstrate relationships.
- **Collecting Data**-Gathering and recording information about observations and measurements in a systematic way
- **Interpreting Data**-Organizing, analyzing, and synthesizing data using tables, graphs, and diagrams to locate patterns that lead to the construction of inferences, predictions, or hypotheses.
- **Identifying and Controlling Variables**-Manipulating one factor to investigate the outcome of an event while other factors are held constant.

Activities:

- Force & Acceleration with dynamics carts
- Conservation of Momentum with spring-loaded carts
- Torque & Center of Mass
- The Rotating Egg Drop

Assessments:

- Students will describe how forces affect the motion of an object.
- Students will identify the forces acting on an object and construct a free-body diagram to illustrate and calculate them.
- Students will calculate force, mass or acceleration of an object given two of the quantities.
- Students will calculate the force required to bring an object into equilibrium.
- Students will use coefficients of friction to calculate frictional force.

- Students will calculate the momentum of objects using their mass and velocity.
- Students will determine how impulse changes momentum.
- Students will use the law of conservation of momentum to calculate final velocities of objects after collisions.
- Students will calculate the magnitude of a torque on an object.
- Students will distinguish between torque and force.

General Physics

Month: November

Unit 4: Energy

Resources:
1. Holt Physics, 2006
   by Raymond A. Serway and Jerry S. Faughn
   Chapter 5
   Chapter 7
   Chapter 9
   Chapter 10

2. Websites:
   www.scilinks.org

South Dakota Science Standards:
9-12.P.2.3. Students are able to relate concepts of force, distance, and time to the quantitative relationships of work, energy, and power.

- Apply appropriate mathematical formulas and equations to concepts using appropriate units.

  Examples:

  Calculate power given force, distance and time.

  Calculate work done on an object given force and distance.

9-12.P.3.1. Students are able to describe the relationships among potential energy, kinetic energy, and work as applied to the Law of Conservation of Energy.

- Describe how energy can be transferred and transformed to produce useful work.

  Examples:

  Diagram simple energy transfers, describing the objects and the forms of energy gained and lost.

  Use simple machines as an example of the transmission of energy.

- Given the formulas, calculate the mechanical advantage and efficiency of selected systems.

- Explain methods of heat transfer.

  Examples: conduction, radiation, and convection

Essential Questions:

- What is the relationship between work and energy?
- How are temperature and heat related to matter at the atomic level?
- How can energy change from one form to another?
- What is work?

Science Process Skills:

- **Observing**-Using the 5 senses (see, hear, touch, smell, taste) to find out about objects and events, their characteristics, properties, differences, similarities, and changes
- **Classifying**-Grouping or ordering objects or events according to similarities or differences in properties
- **Measuring**-Comparing an unknown quantity with a known (metric units, time, student- generated frames of reference) - Observations are quantified using proper measuring devices and techniques
- **Inferring**-Interpreting or explaining observations
- **Predicting**-Forming an idea of an expected result - not a guess - but a belief of what will occur based upon present knowledge and understandings, observations and inferences
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- **Using Number Relationships**-Applying numbers and their mathematical relationships to make decisions
- **Making Models**-Constructing mental, verbal, or physical representations of ideas, objects, or events to clarify explanations or demonstrate relationships.
- **Collecting Data**-Gathering and recording information about observations and measurements in a systematic way
- **Interpreting Data**-Organizing, analyzing, and synthesizing data using tables, graphs, and diagrams to locate patterns that lead to the construction of inferences, predictions, or hypotheses.
- **Identifying and Controlling Variables**-Manipulating one factor to investigate the outcome of an event while other factors are held constant.

Activities:

- Exploring Work & Energy by varying distance, mass, time and angle of inclination.
- Conservation of Mechanical Energy using Hooke's law apparatus.
- Pulleys-mechanical advantage and efficiency of different block and tackle systems.
- Specific Heat Capacity of a Metal

Assessments:

- Students will perform calculations with specific heat capacity.
- Students will identify phases of matter on heating and cooling graphs.

- Students will identify Fahrenheit, Celsius and Kelvin temperature scales, describe how they are related to one another and convert between Celsius and Kelvin units.
- Students will apply the first law of thermodynamics to describe cyclic processes such as internal combustion engines and refrigeration units.
- Students will give the scientific definitions of work and power.
- Students will identify and calculate net work done when forces are applied to an object.
- Students will distinguish between kinetic and potential energy and will identify several forms of each.
- Students will solve problems involving energy-work conversions.
- Students will calculate the potential energy of an object associated with its position.
- Students will use conservation of mechanical energy to solve problems involving kinetic and potential energy.
- Students will calculate power given force, distance and time.
- Students will identify the types of simple machines and calculate the mechanical advantage for each type.

General Physics

Month: December

Unit 5: Waves

Resources:
1. Holt Physics, 2006
   by Raymond A. Serway and Jerry S. Faughn
   Chapter 11
   Chapter 12
   Chapter 13
   Chapter 14
   Chapter 15

2. Websites:
   www.scilinks.org

South Dakota Science Standards:
9-12.P.3.2. Students are able to describe how characteristics of waves are related to one another.

- Relate wavelength, speed, and frequency ($v=\lambda f$).
- Distinguish between transverse and longitudinal waves.

  Examples:

  Discuss changes in frequency of waves using the Doppler Effect.

  Compare the energy of different frequency ranges of waves with in the

  electromagnetic spectrum.

  Describe how different colors of light waves have different amounts of energy.

9-12.P.3.1A. Students are able to explain wave behavior in the fundamental processes of reflection, refraction, diffraction, interference, resonance, and image formation.

- Construct ray diagrams to show the relationship between image and focal point.
- Compare properties of images (real vs. virtual).
- Identify situations when diffraction occurs.
- Identify conditions necessary for refraction to occur.

9-12.E.2.1A. Students are able to describe the evidence supporting the Big Bang theory.

- Doppler effect and expanding universe

Essential Questions:

- What is a wave?
- How is light related to other types of radiation such as radio waves and x-rays?
- In what ways do beams of light behave like waves in a material medium?
- How can light be focused to form images of physical objects?
- How is sound produced?
- How does sound travel?
- How do sounds interact?

Science Process Skills:

- **Observing**-Using the 5 senses (see, hear, touch, smell, taste) to find out about objects and events, their characteristics, properties, differences, similarities, and changes
- **Classifying**-Grouping or ordering objects or events according to similarities or differences in properties
- **Measuring**-Comparing an unknown quantity with a known (metric units, time, student- generated frames of reference) - Observations are quantified using proper measuring devices and techniques
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- **Identifying and Controlling Variables**-Manipulating one factor to investigate the outcome of an event while other factors are held constant.

Activities:

- Simple Harmonic Motion of a Pendulum
- Using Oscilloscope to measure frequency, demonstrate resonance and harmonics.
- Forming Images with Lenses and Mirrors.
- Using Ripple Tanks to demonstrate diffraction and interference.

Assessments:

- Students will explain how force, velocity and acceleration change as an object vibrates with simple harmonic motion.
- Students will calculate the spring force using Hooke's law.
- Students will explain the relationship between period, frequency and amplitude of an object with simple harmonic motion.
- Students will calculate period and frequency of an object in simple harmonic motion.
- Students will identify a wave as transverse or longitudinal.
- Students will calculate wave speed, frequency or wavelength given two of the quantities.
- Students will diagram the results of constructive and destructive interference on waves.
- Students will calculate the frequencies and wavelengths of harmonics and standing waves.
- Students will describe how sound waves are produced.
- Students will calculate the speed of sound in air at various temperatures.
- Students will calculate the frequency shift of a wave due to the Doppler effect and identify whether the source is moving toward or away from the observer.
- Students will calculate intensity of sound waves and relate it to the decibel level.
- Students will explain why one musical instrument sounds different than another.
- Students will apply the law of reflection to mirrors to predict the angle of reflected light rays and draw ray diagrams to find the images formed.
- Students will use Snell's law to determine the path of light when it passes from one medium to another.
- Students will use ray diagrams and the thin-lens equation to determine the size and location of images formed by lenses.
- Students will define diffraction and identify situations where it occurs.

General Physics

Month: January

Unit 6: Electromagnetism

Resources:
1. Holt Physics, 2006
   by Raymond A. Serway and Jerry S. Faughn
   Chapter 16
   Chapter 17
   Chapter 18

2. Websites:
   www.scilinks.org

South Dakota Science Standards:
9-12.P.3.3. Students are able to describe electrical effects in terms of motion and concentrations of charged particles.

- Relate potential difference to current.
- Describe how static electricity is different from current electricity.
- Interpret and apply Ohm's Law.
- Describe electrical attractions and repulsions.
- Describe how magnetism originates from motion of charged particles.

9-12.P.3.2A. Students are able to describe the relationship between charged particles, static electricity, and electric fields.

- Use Coulomb's Law to calculate forces.
- Explain methods of transferring charge.

  Examples: induction, conduction, friction, electron guns
- Describe the direction and general shape of electric fields.

9-12.P.3.3A. Students are able to describe the relationship between changing magnetic and electric fields.

- Explain the properties of magnetic fields.
- Describe how electric and magnetic fields can induce each other.

Essential Questions:

- What is Coulomb's law?
- What is an electric field?
- What is voltage?
- How are moving charges and magnetic fields related?
- How does electricity move through a circuit?

Science Process Skills:

- **Classifying**-Grouping or ordering objects or events according to similarities or differences in properties
- **Measuring**-Comparing an unknown quantity with a known (metric units, time, student- generated frames of reference) - Observations are quantified using proper measuring devices and techniques
- **Predicting**-Forming an idea of an expected result - not a guess - but a belief of what will occur based upon present knowledge and understandings, observations and inferences
- **Communicating**-Using the written and spoken work, graphs, demonstrations, drawings, diagrams, or tables to transmit information and ideas to others
- **Using Number Relationships**-Applying numbers and their mathematical relationships to make decisions
- **Making Models**-Constructing mental, verbal, or physical representations of ideas, objects, or events to clarify explanations or demonstrate relationships.
- **Collecting Data**-Gathering and recording information about observations and measurements in a systematic way
- **Interpreting Data**-Organizing, analyzing, and synthesizing data using tables, graphs, and diagrams to locate patterns that lead to the construction of inferences, predictions, or hypotheses.
- **Identifying and Controlling Variables**-Manipulating one factor to investigate the outcome of an event while other factors are held constant.

Activities:

- Electrostatics of plastics, fur, hair, balloons, and Van de Graf generator
- Resistors in Series and Parallel Circuits

Assessments:

- Students will use Coulomb's law to calculate electric force.
- Students will draw electric field lines to show the shape and direction of electric fields.
- Students will use Ohm's law to calculate resistance, current or potential difference in both series and parallel circuits.
- Students will calculate the power needed to convert electrical energy to heat or light.
- Students will use power to calculate the cost of operating electrical appliances.
- Students will construct schematic diagrams of both series and parallel electrical circuits.

- Students will use the right-hand rule to determine the direction of the magnetic field in a current-carrying wire.

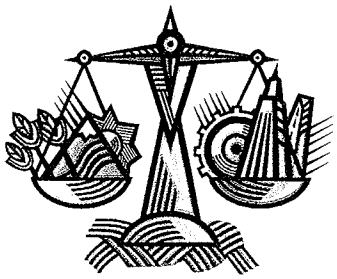
2006-2007 Advanced Placement Environmental Science Course Syllabus

Teacher: Mr. Chris Reidburn

`'/atertown High School - Watertown, South Dakota

ɒooks - *Environmental Science: Toward A Sustainable Future, 9th ed

**Environment: The Science Behind the Stories, 2nd ed



1. Classroom participation is ESSENTIAL!! (1/4th of course grade)
   - Complete note guides on discussions and videos
   - ACTIVE participation in class discussions
   - Complete homework assignments and other assigned problems

2. Laboratory and field trip reports will be COMPLETED and turned in to the instructor. (1/4th of course grade)

3. ALL chapter tests will be completed. (1/2 of course grade) Students will take two of the released Advanced Placement Environmental Science exams.

4. Students will be expected to save the above things in a three ring binder. Students are EXPECTED to take the Advanced Placement Environmental Science exam from the College Board and Educational Testing Services to earn college credit.

ɜOUT MAKE-UP WORK

ONLY excused absences that are school-approved qualify as make-up work. This is a college-level class and you are held with high expectations. "Late" work will not be accepted by the teacher. Make-up work will be assigned by the teacher and may consist of the following:

- Written reports approved by the teacher using textbooks, a literary book, or the internet as sources. Reports may be one to two pages in length depending on how much class time is devoted to the topic.
- Extra questions from the textbook that are not part of the regular assignments.

ALL of the questions assigned as make-up work will be completed in order to receive credit. The make-up work for chapter tests will be to complete the chapter tests.

Grading Scale:

A 90-100%

B 80-89%

C 70-79%

D 60-69%

F 0-59%

Let's have a GREAT semester!!

r Reidburn's AP Environmental website: http://cr043.k12.sd.us/APenvironsci.htm

Mr Reidburn's email: reidburc@wtn.k12.sd.us

2006-2007 Advanced Placement Environmental Science Course Syllabus

I. Earth Systems and Resources (10-15%)

A. **Earth Science Concepts** - Chapter 7: Environmental Systems and Ecosystem Ecology** PLATE TECTONICS Lab #2

B. **The Atmosphere** - Chapter 20: The Atmosphere: Climate, Climate Change...* POWERPLANT FIELD TRIP Lab #18

C. **Global Water Resources and Use** - Chapter 7: Water: Hydrologic Cycle...* WATER QUALITY TESTING Lab #12

D. **Soil and Soil Dynamics** - Chapter 8: Soil: Foundation for Land Ecosystems* SOIL ANALYSIS Lab #8

II. The Living World (10-15%)

A. **Ecosystem Structure** - Chapter 3: Ecosystems: How They Work* PARAMECIUM POPULATION GROWTH Lab #5

B. **Energy Flow** - Chapter 3: Ecosystems: How They Work* WILDLIFE JOURNALING Lab#1

C. **Ecosystem Diversity** - Chapter 2: Ecosystems: What They Are* ABIOTIC INFLEUNCES ON ORGANISMS Lab #4

D. **Natural Ecosystem Change** - Chapter 4: Ecosystems: How They Change*

E. **Natural Biochemical Cycles** - Chapter 3: Ecosystems: how They Work* WETLAND/GRASSLAND/LAKE SOIL TEST LAB

III. Populations (10-15%)

A. **Population Biology Concepts** - Chapter 4: Ecosystems: How They Change*

B. **Human Populations** - Chapter 5: The Human Population: Dimensions* CEMETERY AGES Lab#7

1. **Human Populations Dynamics** - Chpt 5: The Human Population: Dimensions*
2. **Population Size** - Chpt 6: Population and Development*
3. **Impacts of Population Growth** - Chpt 6: Population and Development*

IV. Land and Water Use (10-15%)

A. **Agriculture** - Chapter 8: The Production and Distribution of Food*

1. **Feeding a Growing Population** - Chapter 8: The Production and Distribution ...*
2. **Controlling Pests** - Chapter 16: Pest and Pest Control*

B. **Forestry** - Chapter 11: Ecosystem Capital: Use and Restoration* TREE ID LAB

C. **Rangelands** - Chapter 9: Soil and Agriculture** WETLAND/GRASSLAND/SOIL TEST LAB

D. **Other Land Use**

1. **Urban Land Use** - Chapter 23: Sustainable Communities and Lifestyles*
2. **Transportation Infrastructure** - Chpt 23: Sustainable Communities...*
3. **Public and Federal Lands** - Chapter 11: Ecosystem Capital: Use and ...*
4. **Land Conservation Options** - Chapter 8: Soil: Foundation for Land ...*
5. **Substainable Land-use Strategies** - Chpt 8: Soil: Foundation ...*

E. **Mining** - Chapter 12: Energy from Fossil Fuels GRANITE QUARRY FIELD TRIP

F. **Fishing** - Chapter 11: Ecosystem Capitol: Use and Restoration* GAME, FISH & PARKS TRIP

G. **Global Economics** - Chapter 22: Economics, Public Policy, and the Environment*

V. **Energy Resources and Consumption (10-15%)**

A. **Energy Concepts** - Chapter 12 : Energy from Fossil Fuels* IRRADIATED SEEDS Lab #17

B. **Energy Consumption** - Chapter 12: Energy from Fossil Fuels* POWER PLANT FIELD TRIP

1. **History** - Chapter 12: Energy from Fossil Fuels*
2. **Present Global Energy Needs** - Chapter 12: Energy from Fossil Fuels*
3. **Future Energy Needs** - Chapter 14: Renewable Energy*

C. **Fossil Fuel Resources and Uses** - Chapter 12: Energy from Fossil Fuels*

D. **Nuclear Energy** - Chapter 13: Energy from Nuclear Power*

E. **Hydroelectric Power** - Chapter 14: Renewable Energy*

F. **Energy Conservation** - Chapter 12: Energy from Fossil Fuels* PERSONAL ENERGY CONSUMPTION Lab #9

G. **Renewable Energy** - Chapter 14: Renewable Energy*

VI. Pollution (25-30%)

A. **Pollution Types** AIR POLLUTION Lab#10

1. **Air Pollution** - Chapter 21: Atmospheric Pollution* ACID DEPOSITION Lab#16
2. **Noise Pollution** - Class discussion; instructor notes; Noise Pollution Clearinghouse website http://www.nonoise.org/index.htm DECIBEL LAB
3. **Water Pollution** - Chapter 17: Water Pollution and Its Prevention*
4. **Solid Waste** - Chapter 18: Municipal Solid Waste: Disposal and Recovery* WASTE TREATMENT LAB FIELD TRIP

B. **Impacts on the Environment and Human Health**

1. **Hazards to Human Health** - Chapter 15: Environmental Hazards and Human...*
2. **Hazardous Chemicals in the Environment** - Chpt 19: Hazardous Chemicals: ...*

C. **Economic Impacts** - Chapter 19: Hazardous Chemicals: Pollution and Prevention*

VII. **Global Changes (10-15%)**

A. **Stratospheric Ozone** - Chapter 20: The Atmosphere: Climate, Climate Change...*

B. **Global Warming** - Chapter 20: The Atmosphere: Climate, Climate Change ...*

C. **Loss of Biodiversity** - Chapter 10: Wild Species and Biodiversity* BRAMBLE PARK ZOO FIELD TRIP

1. Habitat loss, overuse, pollution, introduced species, endangered and extinct species
2. Maintenance through conservation
3. Relevant laws and treaties

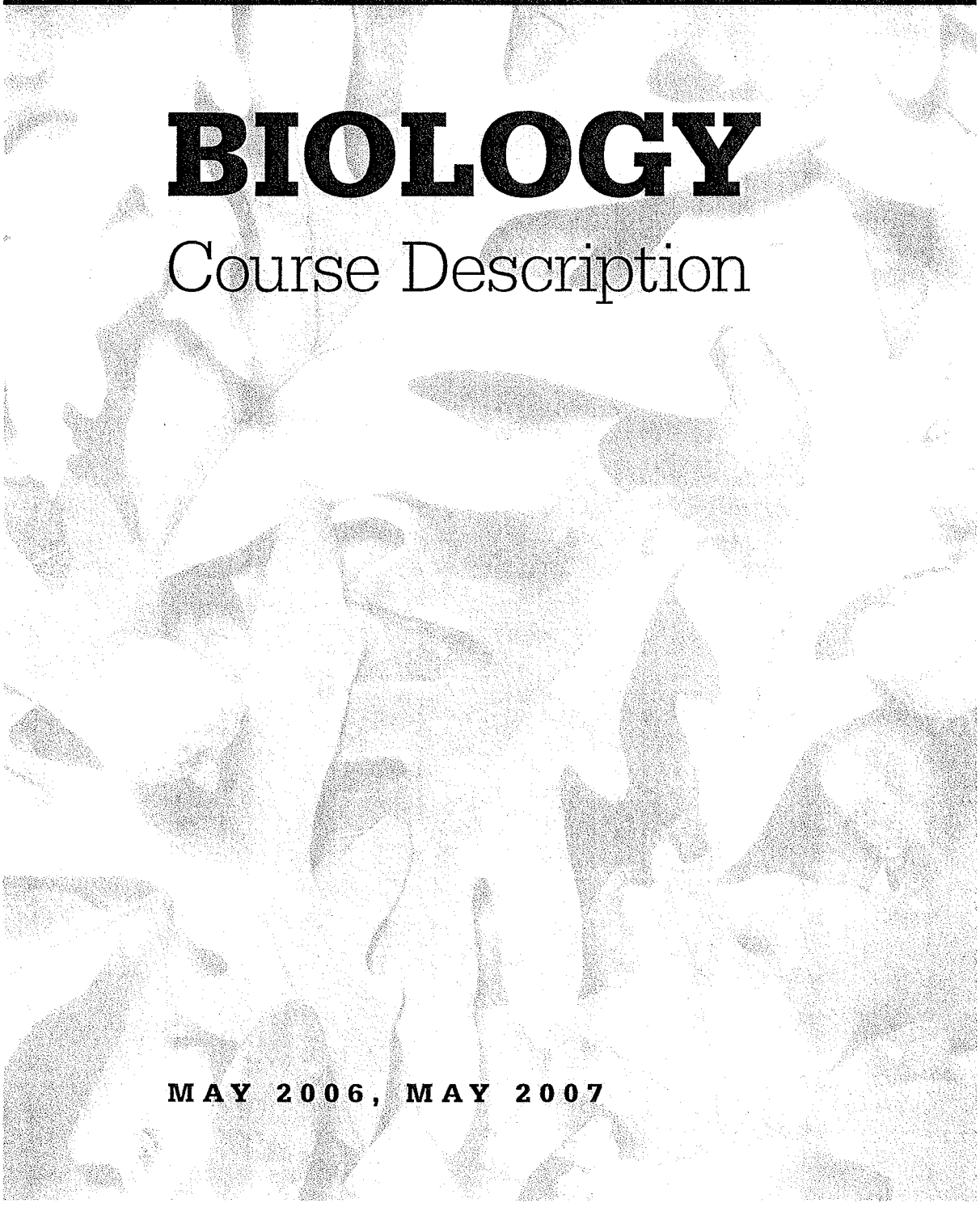
)oks - **Environmental Science: Toward A Sustainable Future, 9th ed*

***Environment: The Science Behind the Stories, 2nd ed*

CollegeBoard AP

BIOLOGY

Course Description



MAY 2006, MAY 2007

The next few sections of this book reinforce the relationships of themes and concepts to the topics in an AP Biology course. First is a suggested list of themes. Following this list is a topic outline that organizes biology into subject areas. Then there are explanations of the items in the suggested list of themes with a specific example for each one.

Major Themes

I. Science as a Process
II. Evolution
III. Energy Transfer
IV. Continuity and Change
V. Relationship of Structure to Function
VI. Regulation
VII. Interdependence in Nature
VIII. Science, Technology, and Society

Topic Outline

Topic	*Percentage of Course*
I. Molecules and Cells	25%
A. Chemistry of Life	7%
Water	
Organic molecules in organisms	
Free energy changes	
Enzymes	
B. Cells	10%
Prokaryotic and eukaryotic cells	
Membranes	
Subcellular organization	
Cell cycle and its regulation	
C. Cellular Energetics	8%
Coupled reactions	
Fermentation and cellular respiration	
Photosynthesis	

Topic	*Percentage of Course*
II. Heredity and Evolution	25%
A. Heredity	8%
Meiosis and gametogenesis	
Eukaryotic chromosomes	
Inheritance patterns	
B. Molecular Genetics	9%
RNA and DNA structure and function	
Gene regulation	
Mutation	
Viral structure and replication	
Nucleic acid technology and applications	
C. Evolutionary Biology	8%
Early evolution of life	
Evidence for evolution	
Mechanisms of evolution	
III. Organisms and Populations	50%
A. Diversity of Organisms	8%
Evolutionary patterns	
Survey of the diversity of life	
Phylogenetic classification	
Evolutionary relationships	
B. Structure and Function of Plants and Animals	32%
Reproduction, growth, and development	
Structural, physiological, and behavioral adaptations	
Response to the environment	
C. Ecology	10%
Population dynamics	
Communities and ecosystems	
Global issues	

Explanation of the Major Themes

The AP Biology Development Committee has identified eight major themes that recur throughout the course (see page 5). AP Biology teachers should emphasize the pervasiveness of the themes to assist students in organizing concepts and topics into a coherent conceptual framework.

I. **Science as a Process**—Science is a way of knowing. It can involve a discovery process using inductive reasoning, or it can be a process of hypothesis testing.

Example: The theory of evolution was developed based on observation and experimentation.

II. **Evolution**—Evolution is the biological change of organisms that occurs over time and is driven by the process of natural selection. Evolution accounts for the diversity of life on Earth.

Example: Widespread use of antibiotics has selected for antibiotic resistance in disease-causing bacteria.

III. **Energy Transfer**—Energy is the capacity to do work. All living organisms are active (living) because of their abilities to link energy reactions to the biochemical reactions that take place within their cells.

Example: The energy of sunlight, along with carbon dioxide and water, allows plant cells to make organic materials, synthesize chemical energy molecules, and ultimately release oxygen to the environment.

IV. **Continuity and Change**—All species tend to maintain themselves from generation to generation using the same genetic code. However, there are genetic mechanisms that lead to change over time, or evolution.

Example: Mitosis consistently replicates cells in an organism; meiosis (and hence sexual reproduction) results in genetic variability.

V. **Relationship of Structure to Function**—The structural levels from molecules to organisms ensure successful functioning in all living organisms and living systems.

Example: Aerodynamics of a bird's wing permits flight.

VI. **Regulation**—Everything from cells to organisms to ecosystems is in a state of dynamic balance that must be controlled by positive or negative feedback mechanisms.

Example: Body temperature is regulated by the brain via feedback mechanisms.

VII. **Interdependence in Nature**—Living organisms rarely exist alone in nature.

Example: Microscopic organisms can live in a symbiotic relationship in the intestinal tract of another organism; the host provides shelter and nutrients, and the microorganisms digest the food.

VIII. **Science, Technology, and Society**—Scientific research often leads to technological advances that can have positive and/or negative impacts upon society as a whole.

Example: Biotechnology has allowed the development of genetically modified plants.

Textbooks

A number of recently published textbooks are appropriate for college students enrolled in introductory courses for biology majors. The AP Biology teacher should examine a variety of textbooks and use one that will adequately cover the suggested AP syllabus in a manner and style satisfactory to the teacher and students. Among the major considerations to be used in choosing a text are: depth and breadth of coverage, quality of illustrations, level and attractiveness of writing, clarity of presentation, value of end-of-chapter questions, availability of other teaching aids, and capacity to stimulate the student's interest. Whenever possible, a recently published textbook should be chosen so as to ensure that the information it contains is current and accurate. School systems should recognize that the rapidly changing nature of biology requires frequent purchasing of new textbooks for AP Biology. While textbooks serve as valuable references, they cannot always be exhaustive and up to date. Professional development—especially remaining current with new discoveries and conceptual trends—is a responsibility of any AP instructor.

The Teachers' Resources section of AP Central (apcentral.collegeboard.com) also offers reviews of textbooks, articles, Web sites, and other teaching resources.

The Laboratory

Laboratory experience must be included in all AP Biology courses. Since one-fourth to one-third of the credit in most college introductory biology courses is derived from laboratory work, it follows that approximately the same degree of emphasis should be placed on laboratory experience in an AP course. Descriptive and experimental laboratory exercises should be assigned that will provide the maximum opportunity for students to learn a variety of skills and those facts, principles, and concepts of general biology covered in lectures, reading, and discussion. In addition, good laboratory exercises can present novel material not covered in other parts of the course. Laboratory work should encourage the development of important skills such as detailed observation, accurate recording, experimental design, manual manipulation, data interpretation, statistical analysis, and operation of technical equipment. Laboratory assignments offer the opportunity for students to learn about problem solving, the scientific method, the techniques of research, and the use of scientific literature. Laboratory investigations also encourage higher-order thinking, which may include evaluating and monitoring progress through an investigation, generating ideas, and formulating hypotheses.

Surveys confirmed that most colleges and universities have a laboratory component in their general biology courses that are taken by majors or by a combination of majors and nonmajors. In teaching AP Biology, teachers are challenged to teach a course that is equivalent to a college-level course in both quality and sophistication. In order to reflect these aspects, every AP Biology course should therefore have a substantial laboratory component. The AP Biology Development Committee has produced a set of 12 laboratories to provide a standard with which teachers can begin integrating laboratories more efficiently into the AP Biology curriculum.

School administrators should be aware that an AP college-level laboratory is significantly more expensive to operate than a typical high school biology laboratory and requires more time than nonlaboratory courses. The first-level college course consists of approximately 40 to 50 hours of lecture and 30 to 40 hours of laboratory work per quarter or semester. Proportional allocations of time for laboratory work should be accorded an AP Biology course. School administrators should provide the equivalent of two double periods a week for laboratory work.

Some of the laboratories will require equipment schools may not have; alternative ways of conducting the laboratories are therefore offered. Schools should try to purchase college-level laboratory equipment eventually. Many teachers have indicated that their administrations do not

fully realize the implications, in both cost and time, of incorporating serious laboratories into their programs. An AP course is a college course, and the equipment and time allotted to laboratories should be similar to that in a college course.

Many laboratories that teachers are already conducting are worthwhile and important. The laboratory section in this book describes the objectives of 12 laboratories that have been developed by the AP Biology Development Committee. The laboratories are not "perfect" or "ultimate" but exemplify experimental and quantitative, rather than descriptive, laboratory exercises. They are intended to challenge students' abilities to understand problems, develop and implement appropriate experimental designs, manipulate data, draw conclusions, think analytically, and develop hypotheses. In these laboratories, students are challenged to perform experiments drawn from some of the more important areas within modern biology, including biological chemistry, cell structure and function, energy transformation, molecular genetics, heredity, plant structure and physiology, animal structure and physiology, behavior, and ecology.

The laboratories should be considered basic introductions to, or springboards into, further experiments, studies, or independent projects. They are not intended to be ends in themselves. The AP Biology Development Committee thanks the countless AP Biology teachers who have supported and encouraged the committee's commitment to introduce and maintain a laboratory component in the AP Biology curriculum. The field testing and "hands-on" experiences of AP teachers have generated many of the suggestions that are incorporated into these laboratories. The committee welcomes feedback as to how effectively the laboratories work and how they have been integrated into a school's program. Such contributions and suggestions will be used to fine-tune or replace the laboratories over the coming years.

To allow students to show their mastery of laboratory science skills and knowledge, each year some questions on the objective portion of the AP Biology Exam and/or one or more of the four mandatory essay questions may reflect the topics and objectives associated with the 12 AP Biology laboratories. *This should not preclude AP Biology teachers from using their own existing laboratory exercises as long as they encompass the same topics and objectives.*

12 Recommended Biology Laboratories

Laboratory Topic

1. Diffusion and Osmosis
2. Enzyme Catalysis
3. Mitosis and Meiosis
4. Plant Pigments and Photosynthesis
5. Cell Respiration
6. Molecular Biology
7. Genetics of Organisms
8. Population Genetics and Evolution
9. Transpiration
10. Physiology of the Circulatory System
11. Animal Behavior
12. Dissolved Oxygen and Aquatic Primary Productivity

An overview and objectives are presented for each laboratory on the pages that follow. Teachers can use this information in conjunction with their own laboratories that address these topics and objectives, or in conjunction with the *AP Biology Laboratory Manual for Students* and the *AP Biology Laboratory Manual for Teachers* (go to AP Central for ordering information).

Laboratory 1. Diffusion and Osmosis

Overview

In this laboratory, students will investigate the processes of diffusion and osmosis in a model of a membrane system. They will also investigate the effect of solute concentration on water potential as it relates to living plant tissues.

Objectives

Before doing this laboratory, students should understand:

- the mechanisms of diffusion and osmosis and their importance to cells;
- the effects of solute size and concentration gradients on diffusion across selectively permeable membranes;
- the effects of a selectively permeable membrane on diffusion and osmosis between two solutions separated by the membrane;
- the concept of water potential;
- the relationship between solute concentration and pressure potential and the water potential of a solution; and
- the concept of molarity and its relationship to osmotic concentration.

After doing this laboratory, students should be able to:

- measure the water potential of a solution in a controlled experiment;
- determine the osmotic concentration of living tissue or an unknown solution from experimental data;
- describe the effects of water gain or loss in animal and plant cells; and
- relate osmotic potential to solute concentration and water potential.

Laboratory 2. Enzyme Catalysis

Overview

In this laboratory, students will observe the conversion of hydrogen peroxide (H_2O_2) to water and oxygen gas by the enzyme catalase. They will then measure the amount of oxygen generated and calculate the rate of the enzyme-catalyzed reaction.

Objectives

Before doing this laboratory, students should understand:

- the general functions and activities of enzymes;
- the relationship between the structure and function of enzymes;
- the concept of initial reaction rates of enzymes;
- how the concept of free energy relates to enzyme activity; and
- that changes in temperature, pH, enzyme concentration, and substrate concentration can affect the initial reaction rates of enzyme-catalyzed reactions.

After doing this laboratory, students should be able to:

- measure the effects of changes of temperature, pH, enzyme concentration, and substrate concentration on reaction rates of an enzyme-catalyzed reaction in a controlled experiment; and
- explain how environmental factors affect the rate of enzyme-catalyzed reactions.

Laboratory 3. Mitosis and Meiosis

Overview

In this laboratory, students will investigate the process of mitosis and meiosis. The first part is a study of mitosis. They will use prepared slides of onion root tips to study plant mitosis and to calculate the relative duration of the phases of mitosis in the meristem of root tissue. Prepared slides of the whitefish blastula will be used to study mitosis in animal cells and to compare animal mitosis with plant mitosis.

The second part is a study of meiosis. Students will simulate the stages of meiosis by using chromosome models. They will study the crossing over and recombination that occurs during meiosis. They will observe the arrangements of ascospores in the asci from a cross between wild type *Sordaria fimicola* and mutants for tan spore coat color in the fungus. These arrangements will be used to estimate the percentage of crossing over that occurs between the centromere and the gene that controls the tan spore color.

Objectives

Before doing this laboratory, students should understand:

- the events of mitosis in animal and plant cells;
- the events of meiosis (gametogenesis) in animal and plant cells; and
- the key mechanical and genetic differences between meiosis and mitosis.

After doing this laboratory, students should be able to:

- recognize the stages of mitosis in a plant or animal cell;
- calculate the relative duration of the cell cycle stages;
- describe how independent assortment and crossing over can generate genetic variation among the products of meiosis;
- use chromosome models to demonstrate the activity of chromosomes during meiosis I and meiosis II;
- relate chromosome activity to Mendelian segregation and independent assortment;
- demonstrate the role of meiosis in the formation of gametes in a controlled experiment, using a model organism;
- calculate the map distance of a particular gene from a chromosome's center or between two genes, using a model organism;
- compare and contrast the results of meiosis and mitosis in plant cells; and
- compare and contrast the results of meiosis and mitosis in animal cells.

Laboratory 4. Plant Pigments and Photosynthesis

Overview

In this laboratory, students will separate plant pigments using chromatography. They will also measure the rate of photosynthesis in isolated chloroplasts. The measurement technique involves the reduction of the dye, DPIP. The transfer of electrons during the light-dependent reactions of photosynthesis reduces DPIP, and it changes from blue to colorless.

Objectives

Before doing this laboratory, students should understand:

- how chromatography separates two or more compounds that are initially present in a mixture;
- the process of photosynthesis;
- the function of plant pigments;
- the relationship between light wavelength and photosynthetic rate; and
- the relationship between light intensity and photosynthetic rate.

After doing this laboratory, students should be able to:

- separate pigments and calculate their Rf values;
- describe a technique to determine photosynthetic rates;
- compare photosynthetic rates at different temperatures, or different light intensities, or different wavelengths of light using controlled experiments; and
- explain why the rate of photosynthesis varies under different environmental conditions.

Laboratory 5. Cell Respiration

Overview

In this experiment, students will work with seeds that are living but dormant. A seed contains an embryo plant and a food supply surrounded by a seed coat. When the necessary conditions are met, germination occurs, and the rate of cellular respiration greatly increases. In this laboratory, students will measure oxygen consumption during germination. They will measure the change in gas volume in respirometers containing either germinating or nongerminating peas. In addition, they will measure the respiration of these peas at two different temperatures.

Objectives

Before doing this laboratory, students should understand:

- how a respirometer works in terms of the gas laws; and
- the general processes of metabolism in living organisms.

After doing this laboratory, students should be able to:

- calculate the rate of cell respiration from experimental data;
- relate gas production to respiration rate; and
- test the effects of temperature on the rate of cell respiration in ungerminated versus germinated seeds in a controlled experiment.

Laboratory 6. Molecular Biology

Overview

In this laboratory, students will investigate some basic principles of genetic engineering. Plasmids containing specific fragments of foreign DNA will be used to transform *Escherichia coli* cells, conferring antibiotic (ampicillin) resistance. Restriction enzyme digests of phage lambda DNA will also be used to demonstrate techniques for separating and identifying DNA fragments using gel electrophoresis.

Objectives

Before doing this laboratory, students should understand:

- how gel electrophoresis separates DNA molecules present in a mixture;
- the principles of bacterial transformation;
- the conditions under which cells can be transformed;
- the process of competent cell preparation;
- how a plasmid can be engineered to include a piece of foreign DNA;
- how plasmid vectors are used to transfer genes;
- how antibiotic resistance is transferred between cells;
- how restriction endonucleases function; and
- the importance of restriction enzymes to genetic engineering experiments.

After doing this laboratory, students should be able to:

- use plasmids as vectors to transform bacteria with a gene for antibiotic resistance in a controlled experiment;
- demonstrate how restriction enzymes are used in genetic engineering;
- use electrophoresis to separate DNA fragments;
- describe the biological process of transformation in bacteria;
- calculate transformation efficiency;
- be able to use multiple experimental controls;
- design a procedure to select positively for antibiotic resistant transformed cells; and
- determine unknown DNA fragment sizes when given DNA fragments of known size.

Laboratory 7. Genetics of Organisms

Overview

In this laboratory, students will use living organisms to do genetic crosses. They will learn how to collect and manipulate the organisms, collect data from F1 and F2 generations, and analyze the results from a monohybrid, dihybrid, or sex-linked cross. The procedures that follow apply to fruit flies; teachers may substitute other procedures using different organisms.

Objectives

Before doing this laboratory, students should understand:

- chi-square analysis of data; and
- the life cycle of diploid organisms useful in genetics studies.

After doing this laboratory, students should be able to:

- investigate the independent assortment of two genes and determine whether the two genes are autosomal or sex-linked using a multi-generation experiment; and
- analyze the data from their genetic crosses using chi-square analysis techniques.

Laboratory 8. Population Genetics and Evolution

Overview

In this activity, students will learn about the Hardy-Weinberg law of genetic equilibrium and study the relationship between evolution and changes in allele frequency by using their class to represent a sample population.

Objectives

Before doing this laboratory, students should understand:

- how natural selection can alter allelic frequencies in a population;
- the Hardy-Weinberg equation and its use in determining the frequency of alleles in a population; and
- the effects on allelic frequencies of selection against the homozygous recessive or other genotypes.

After doing this laboratory, students should be able to:

- calculate the frequencies of alleles and genotypes in the gene pool of a population using the Hardy-Weinberg formula; and
- discuss natural selection and other causes of microevolution as deviations from the conditions required to maintain Hardy-Weinberg equilibrium.

Laboratory 9. Transpiration

Overview

In this laboratory, students will apply what they learned about water potential from Laboratory 1 (Diffusion and Osmosis) to the movement of water within the plant. They will measure transpiration under different laboratory conditions. They will also study the organization of the plant stem and leaf as it relates to these processes by observing sections of tissue.

Objectives

Before doing this laboratory, students should understand:

- how water moves from roots to leaves in terms of the physical/chemical properties of water and the forces provided by differences in water potential;
- the role of transpiration in the transport of water within a plant; and
- the structures used by plants to transport water and regulate water movement.

After doing this laboratory, students should be able to:

- test the effects of environmental variables on rates of transpiration using a controlled experiment; and
- make thin sections of stem, identify xylem and phloem cells, and relate the function of these vascular tissues to the structures of their cells.

Laboratory 10. Physiology of the Circulatory System

Overview

In Exercise 10A, students will learn how to measure blood pressure. In Exercise 10B, they will measure pulse rate under different conditions: standing, reclining, after the baroreceptor reflex, and during and immediately after exercise. The blood pressure and pulse rate will be analyzed and related to an index of relative fitness. In Exercise 10C, they will measure the effect of temperature on the heart rate of the water flea, *Daphnia magna.*

Objectives

Before doing this laboratory, students should understand:

- the relationship between temperature and the rates of physiological processes; and
- basic anatomy of various circulatory systems.

After doing this laboratory, students should be able to:

- measure heart rate and blood pressure in a human volunteer;
- describe the effect of changing body position on heart rate and blood pressure;
- explain how exercise changes heart rate;
- determine a human's fitness index;
- analyze cardiovascular data collected by the entire class; and
- discuss and explain the relationship between heart rate and temperature.

Laboratory 11. Animal Behavior

Overview

In this laboratory, students will observe some aspects of animal behavior. In Exercise 11A, they will observe pillbugs and design an experiment to investigate their responses to environmental variables. In Exercise 11B, they will also observe and investigate mating behavior in fruit flies. You may suggest other organisms or other types of animal behavior to study.

Objectives

Before doing this laboratory, students should understand:

- the concept of distribution of organisms in a resource gradient; and
- the difference between kinesis and taxis.

After doing this laboratory, students should be able to:

- describe some aspects of animal behavior, such as orientation behavior, agonistic behavior, dominance display, or mating behavior; and
- understand the adaptiveness of the behaviors they studied.

Laboratory 12. Dissolved Oxygen and Aquatic Primary Productivity

Overview

In Exercise 12A, students will measure and analyze the dissolved oxygen (DO) concentration in water samples at varying temperatures. In Exercise 12B, they will measure and analyze the primary productivity of natural waters or laboratory cultures using screens to simulate the attenuation of light with increasing depth.

Objectives

Before doing this laboratory, students should understand:

- the biological importance of carbon and oxygen cycling in ecosystems;
- how primary productivity relates to the metabolism of organisms in an ecosystem;
- the physical and biological factors that affect the solubility of gasses in aquatic ecosystems; and
- the relationship between dissolved oxygen and the process of photosynthesis and respiration and how these processes affect primary productivity.

After doing this laboratory, students should be able to:

- measure primary productivity based on changes in dissolved oxygen in a controlled experiment; and
- investigate the effects of changing light intensity and/or inorganic nutrient concentrations on primary productivity in a controlled experiment.