

SCIENCE CURRICULUM

SCIENCE COURSE OUTLINE

<u>Grade</u>	<u>Courses</u>
7	Life Science
8	Physical Science
9	Honors Biology or Biology
10	Honors Chemistry or Chemistry
11/12	AP Biology, Honors Physics, or AP Environmental Science, or Earth Science

SCIENCE CURRICULUM

Grade 7

Course:

Life Science

Course Goals:

This is an introductory course on Life Science and scientific methodology. The objectives are to impart knowledge of the basic life processes and the diversity of life. Skills are developed in the classroom, through home work reading, and interesting labs.

Text:

Exploring Life Science by Maton et al

Major Topics and/or Skills Taught:

- Scientific Method
- Metric System
- Safety in the Laboratory
- Characteristics and Chemistry of Living Things
- Cells
- Classification
- The Five Kingdoms
- Heredity and DNA
- Ecology (biomes, food webs, biodiversity)
- Environmental issues

Activities and Labs:

- The Scientific Method—Students make up a hypothetical situation and use the Scientific Method to find out if their hypotheses were right.
- The Metric System—Students use math to learn to convert between systems.
- Safety—Students and parents sign Safety Contracts for Lab Activities.
- Cell Structure—Students learn about the function of cell walls.
- Photosynthesis—Students learn about pigmentation and leaf color changes.
- Cell Growth and Division—Students learn about Mitosis and Cell Division.
- Osmosis & Diffusion—Students learn about the movement of molecules and water molecules.
- Classification of Living Things—students learn Taxonomy.
- Viruses, Monerans, and Protists—Student learn about Diseases by researching various diseases including how one catches, passes, and gets rid of viruses
- Bacteria—Students learn how Bacteria are both helpful and harmful.
- Molds—Students grow mold in sunlight and in a dark room.
- Fungi—Students learn about Fungus through interactive games and activities.

SCIENCE CURRICULUM

- Plants without Seeds—Students learn about Alga by finding out what is in foods that they eat.
- Plants with Seeds—Students learn about Vascular Tissue by observing and manipulating flowers and their environments.
 - Reproduction in Seed Plants—Students learn the male and female parts of a flower by dissecting it.

SCIENCE CURRICULUM

Grade 8

Course:

Physical Science

Course Goals:

This is an introduction to the Physical Sciences and scientific methodology. The objectives are to impart a basic knowledge of the physical properties and chemistry of matter. Skills are developed in the classroom, and reinforced through home work reading, and interesting labs that relate to everyday life.

Text:

Exploring Physical Science by Maton et al

Major Topics and/or Skills Taught:

- Scientific Method
- Metric System
- Matter
- Mass, Weight, Volume, and Density
- Phases of Matter
- Chemical Properties and Changes
- Mixtures; Elements and Compounds
- The Periodic Table
- Chemical Bonding
- Acids and Bases
- Motion; Momentum
- Newton's Laws of Motion
- Fluid Mechanics
- Work, Power, and Simple Machines

Activities and Labs:

- Scientific Method—Students make up a hypothetical situation and use the Scientific Method to find out if their hypotheses are correct.
- Metric System—Students use math and measurements to learn the Metric System.
- Density—Students do a Rock Lab to determine density. Also, they learn to determine the different Densities of liquids using water, alcohol, and ice.
- Safety—Student and parents must sign a Safety Contract for working in the Lab.
- Physical Properties—Students learn Physical Properties by doing a Cereal Lab with magnets.
- Physical and Chemical Changes of various elements through interactive activities.
- Gas Laws—Students learn about the Gas Laws .

SCIENCE CURRICULUM

- Atoms, Electrons, Elements, and Compounds—Students learn about the Periodic Table.
- Water—Students learn how to make a Survival Still and how to collect water from leaves on plants.
- Shelter—Students learn different items that can be used to make shelters.
- Orienteering—Students learn Orienteering Vocabulary, Coordinates, Topographic Maps, Compass Parts, directions, and degrees, Declination, and GPS's (Global Positioning Systems). Students get at least 2-Hands-On GPS Labs.
- Atoms and Bonding.
- Surface Area.
- Types of Chemical Reactions—Students will learn about Synthesis, Decomposition, Single Replacement and Double Replacement Reactions.
- Acids and Bases.
- Polymers.
- Natural and Synthetic Polymers—Students will compare their differences in strength, absorbency, and resistance to chemical change.
- Radioactive Elements—Students will learn about radioactivity by doing research.
- Students will learn:
 - Motion
 - Forces
 - Work, Power, and Simple Machines
 - Energy
 - Electricity & Magnetism
 - Sound & Lightby doing material based experiments involving action, fire, electricity, and waves.

SCIENCE CURRICULUM

Grade 9

Course:

Biology

Course Goals:

The objectives are to impart knowledge of the basic life processes, modern genetics, and basic anatomy and physiology. Skills are developed in the classroom, through home work reading, and interesting labs.

Text:

Biology; The Dynamics of Life by Biggs et al

Major Topics and/or Skills Taught:

- The Basis of Life (cells, photosynthesis, cellular respiration, cellular division)
- Genetics (DNA, heredity and protein synthesis)
- Change and Diversity (evolution, classification)
- Human Biology (digestion, respiratory, circulatory and nervous systems)
- Organisms and the Environment (the biosphere, populations and communities, ecosystems)

Activities and Labs:

- The Scientific Method—Students will make a Hypothesis about a made up situation, and then use the Scientific Method to see if they are right or wrong and why.
- Cells—Students will do a Cell Project that encourages creativity, individuality, and discussion of the major structures of cells.
- Mitosis & Meiosis.
- Diffusion & Osmosis.
- Photosynthesis.
- Respiration—Students will learn Aerobic and Anaerobic Respiration.
- Punnett Squares—Students will do several crosses involving one, two, and three traits.
- DNA and RNA—Students learn the difference between DNA and RNA by learning to match codes in a Decoding Lab.
- Heredity—Students learn traits and diseases that are passes through DNA and the guidelines that they follow.
- Botany Labs
- Dissections:
 - Fetal Pig

SCIENCE CURRICULUM

Grade 9

Course:

Honors Biology

Course Goals:

The objectives are to impart knowledge of the basic life processes, modern genetics, and basic anatomy and physiology. Skills are developed in the classroom, through home work reading, and interesting labs.

Honors Biology:

Students will study similar major topic areas in sufficient depth to prepare for the SAT II Subject exam.

Text:

Biology; The Dynamics of Life by Biggs et al

Major Topics and/or Skills Taught:

- The Basis of Life (cells, photosynthesis, cellular respiration, cellular division)
- Genetics (DNA, chromosomes, protein synthesis)
- Genetic Engineering and Technology
- Change and Diversity (evolution, classification)
- Five Kingdoms (Monerans, Protists, Fungi, Plants, Animals)
- Human Biology (digestion, respiratory, circulatory, immune, endocrine, nervous systems)
- Organisms and the Environment (the biosphere, populations and communities, ecosystems)

Activities and Labs:

- The Scientific Method—Students will make a Hypothesis about a made up situation, and then use the Scientific Method to see if they are right or wrong and why.
- Cells—Students will do a Cell Project that encourages creativity, individuality, and discussion of the major structures of cells.
- Mitosis & Meiosis.
- Diffusion & Osmosis.
- Photosynthesis.
- Respiration—Students will learn Aerobic and Anaerobic Respiration.
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- Heredity—Students learn traits and diseases that are passes through DNA and the guidelines that they follow.

SCIENCE CURRICULUM

- Botany Labs
- Dissections:
 - Fetal Pig

SCIENCE CURRICULUM

Grade 10

Course:

Honors Chemistry

Course Goals:

This course is designed to help students prepare for the SAT II Chemistry exam by providing a thorough experience with inorganic and some organic chemistry. This is a rigorous and quickly paced class. A strong math background in basic algebra and problem solving skills is highly recommended as a prerequisite for this class.

Text:

Chemistry by Wilbraham et al

Major Topics and/or Skills Taught:

- Atomic Structure and the Periodic Table
- Chemical Names and Formulas
- Chemical Quantities
- Chemical Reactions
- Stoichiometry
- States of Matter
- Thermochemistry
- Behavior of Gases
- Electrons in Atoms
- Chemical Periodicity
- Ionic Bonding and Ionic Compounds
- Covalent Bonding
- Solutions
- Reaction Rates
- Acids and Bases
- Neutralization
- Oxidation/Reduction Reactions
- Electrochemistry
- Introduction to Organic Chemistry

Activities and Labs:

- Physical and Chemical Change: students will investigate the criteria used to distinguish between physical and chemical changes in matter.
- Density: Students will determine the densities of unknown metals.
- Identification of Anions and Cations in solution: students will identify the ions in an unknown solution through the application of chemical tests

SCIENCE CURRICULUM

- Empirical Formula Determination: Students will determine the empirical formula of magnesium oxide
- The Specific Heat of a Metal: students will measure the specific heat of lead and an unknown metal
- Flame Tests for Metals: students will identify metallic ions using flame tests
- Periodic Structures: students will investigate the variation of density and solubility of compounds
- Factors affecting Solution Formation: students will investigate factors that influence the rate of solution formation.
- Factors affecting Reaction Rates: students will investigate factors that speed up or slow down chemical reactions.
- Enthalpy and Entropy: students will investigate the enthalpy and entropy of an exothermic and an endothermic reaction.
- Reactions of Acids and Acid-Base Titrations: students will investigate the reactions of acids, pH, and do an acid-base titration
- Oxidation-Reduction reactions: students will investigate and compare the relative reduction potentials of copper, lead and zinc.

SCIENCE CURRICULUM

Grade 10

Course:

Chemistry

Course Goals:

The goal of Conceptual Chemistry is to introduce students to foundational concepts in chemistry and to prepare for further education in science. Successful completion of Conceptual Chemistry will ensure the student's preparedness for future science electives including AP Biology.

Text:

Conceptual Chemistry: Understanding Our World of Atoms and Molecules by John Suchocki

Major Topics and/or Skills Taught:

- Chemistry is a Science
- Elements of Chemistry
- Discovering the Atom and Subatomic Particles
- The Atomic Nucleus
- Atomic Models
- Chemical Bonding and Molecular Shapes
- Molecular Mixing
- Those Incredible Water Molecules
- An Overview of Chemical Reactions
- Acids and Bases
- Oxidation and Reduction
- Organic Compounds

Activities and Labs:

- SCIENTIFIC METHOD LAB: Students will understand the Scientific Method by using their own observation.
- LAB PROCEDURES LAB: Students learn how to use equipment in the lab
- DENSITY CUBE LAB: Students learn how to determine what cubes are made of by first finding the density
- DENSITY OF UNKNOWN METALS: Students will determine unknown metals through determining densities.
- PHYSICAL AND CHEMICAL PROPERTIES: Students will understand physical and chemical properties of elements by observing physical and chemical reactions
- ALCHEMY LAB: Students learn how metals are plated with silver and gold
- FILTRATION LAB: Students learn how to separate compounds and mixtures and prepare for distillation labs.

SCIENCE CURRICULUM

- CHROMOTOGRAPHY LAB: Students will study substances that can be identified through the order in which they separate out of a solution.
- ACIDS AND BASES LAB: Students will learn how to determine which items are acids or bases
- pH LAB: Students learn precise pH measurements of unknown compounds.
- TITRATION LAB: Students will understand neutralization and endpoints
- RESEARCH PROJECT

SCIENCE CURRICULUM

Grade 11/12

Course:

Advanced Placement Biology

Course Goals:

This course will help students develop a conceptual framework for modern biology and will provide students with the opportunity to demonstrate college level achievement. Students will prepare for the College Board examination in AP Biology as well as developing an appreciation of science as an exciting and ongoing process.

Text:

Biology: The Unity and Diversity of Life by Starr and Taggart

Major Topics and/or Skills Taught:

- Molecules and Cells (Chemistry of Life, Cells, Cellular Energetics)
- Heredity and Evolution (Heredity, Molecular Genetics, Evolutionary Biology)
- Organisms and Populations (Diversity of Organisms, Structure and Function of Plants and Animals, Ecology)

Activities and labs:

- Lab 1-Enzyme Catalysis. Students will calculate the rate of conversion of hydrogen peroxide to water and oxygen gas by the enzyme catalase.
- Lab 2- Diffusion and Osmosis: 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.
- Lab3- Cell Respiration: Students will measure oxygen consumption during respiration as 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.
- Lab 4-Plant Pigments and Photosynthesis: Students will separate plant pigments using chromatography. They will also measure the rate of photosynthesis in isolated chloroplasts.
- Lab 5-Mitosis and Meiosis: Students will use a microscope and prepared slides to compare the stages of mitosis and meiosis.
- Lab 6-DNA extraction and electrophoresis: Students will take a field trip to The Institute for Genomic Research. They will take a tour, attend a lecture, and participate in a hands on lab.
- Lab 7-Population Genetics and Evolution: Students will use the class a sample population to study the Hardy-Weinberg law of genetic equilibrium and changes in allele frequency.

SCIENCE CURRICULUM

- Lab 8-Physiology of the Circulatory system: students will measure pulse rate and blood pressure under different physiological conditions.
- Lab 9-Animal behavior: Students will observe pill bugs and design an experiment to investigate their responses to environmental variables.

SCIENCE CURRICULUM
Grade 11/12

Course:

Honors Physics

Course Goals:

The goal of this class is to use a limited number of basic concepts, equations and assumptions to describe the physical world. Once the physical world has been described this way, the physics principles involved can be used to make predictions about a broad range of phenomena. Physics is a challenging science class and will prepare students for college level physical science courses.

Honors Physics: Students will study similar major topic materials in sufficient depth to prepare for the SAT II Subject exam.

Text:

Physics by Serway and Faughn

Major Topics and/or Skills Taught:

- The Science of Physics
- Motion in One Dimension
- Two-Dimensional Motion and Vectors
- Forces and the Laws of Motion
- Work and Energy
- Momentum and Collision
- Heat
- Thermodynamics
- Vibrations and Waves
- Sound
- Light and Reflection
- Electric Forces and Fields
- Current and Resistance
- Circuits and Circuit Elements
- Magnetism

Activities and Labs:

- Velocity and Acceleration
- Projectile Motion
- Heat and Calorimeters
- Fiber Optics
- Circuits and Electricity
- Hooke's Law
- Boyle's Law
- Archimedes' Principle
- Conservation of Momentum and Energy
- Electromagnetism

SCIENCE CURRICULUM

Grade 11/12

Course:

Advanced Placement Environmental Biology

Course Goals:

The goal of the AP Environmental Science course is to provide students with the scientific principles, concepts, and methodologies required to understand the interrelationships of the natural world, to identify and analyze environmental problems both natural and human-made, to evaluate the relative risks associated with these problems, and to examine alternative solution for resolving or preventing them.

Environmental science is interdisciplinary; it embraces a wide variety of topics from different areas of study. Yet there are several major unifying constructs, or themes, that cut across the many topics included in the study of environmental science

Text(s):

Miller, G. Tyler. *Living in the Environment*. By G. Miller and Tyler

Major Topics:

- Environmental Problems, Their Causes, And Sustainability
- Environmental History
- Science, Systems, Matter and Energy
- Biogeography: Weather, climate, biomes, and Terrestrial Biodiversity
- Aquatic Ecology: Biodiversity in Aquatic Systems
- Ecosystems: Components, Energy Flow, And Matter Cycling
- Evolution and Biodiversity” Origins, Niches, and Adaptation
- Community Ecology: Structure, species Interactions, succession, and Sustainability
- Population Dynamics, Carrying capacity and Conservation Biology
- The Human Population: Growth, Demography, and Carrying Capacity
- Geology: Processes, Hazards, and Soils
- Food Resources
- Water Resources
- Geologic resources: nonrenewable Mineral and Energy Resources
- Energy Efficiency and Renewable Energy
- Air and Air Pollution
- Water Pollution
- Pesticides and Pest control
- Risk, Toxicology, and Human Health
- Climate Change and Ozone Loss
- Solid and Hazardous Waste
- Sustaining Wild Species

SCIENCE CURRICULUM

- Sustaining terrestrial Biodiversity: The Ecosystem Approach

Activities and Labs:

- Lab 1: Coriolis Effect and Atmospheric Circulation
- Lab 2: Primary Consumer Energy Flow
- Lab 3: pH tolerance of Microbes
- Lab 4: Population growth in Lemna minor
- Lab 5: Population Estimates using Mark and Recapture
- Lab 6: Quadrat Sampling Methods
- Lab 7: Soil Porosity and Permeability
- Lab 8: Chemical Composition of Soils
- Lab 9: Home Energy Audit and Conservation Plan
- Lab 10: Acid Rain and Seed Germination
- Lab 11: Water Quality Monitoring
- Lab 12: Ozone levels

SCIENCE CURRICULUM

Grade 11/12

Course:

Earth Science

Course objectives: This course is designed to give an overview of Earth science, including, but not limited to, the materials of the Earth, the formation of the Earth, plate tectonics, meteorology and astronomy. The class will contain both lecture and lab components, as well as interactive activities.

Expected behavior

Students are expected to behave properly at all times in the classroom. If a student is causing a disturbance, such as talking in class, a warning will be given. If the student continues the disruption she will be asked to leave the classroom and may only return if she has a written note from either the principal or some other authority figure. If the disturbance continues then the parents will be called. If the disturbance still persists, a meeting will be set up between the teacher, parents and principal.

If a student is found with an object that distracts them from the class (such as passing notes or playing with objects under their desks) it will be confiscated and put on the teacher's desk to be retrieved at the end of class. At the second offense, the object will be taken and the student will have to ask the teacher for it back after class. If there is a third offense, the object will be given to the principal, and the student will have to ask for it back after school.

Schedule of classes*

Unit One: Earth's materials

Chapter 1: Introduction to Earth Science

- What is Earth Science?
- Representing the Earth's surface (maps)
- Scientific inquiry

Chapter 2: Minerals

- Matter, minerals and their properties

Chapter 3: Rocks

- Cycle of rocks
- Igneous rocks, sedimentary rocks and metamorphic rocks

Chapter 4: Earth's resources

- Energy and mineral resources
- Alternative energy sources
- Water air and land resources
- Protecting resources

Unit Two: Sculpturing Earth's surface

Chapter 5: Weathering, soil, and mass movements

Chapter 6: Running water and groundwater

- Running water and streams
- Water beneath the surface

SCIENCE CURRICULUM

Chapter 7: Glaciers, deserts, and wind

Unit Three: Forces within

Chapter 8: Earthquakes and Earth's interior

- Definition and measurement of earthquakes
- Earth's layered structure

Chapter 9: Plate tectonics

- Continental drift and plate tectonics
- Actions at plate boundaries and mechanism of plate motion

Chapter 10: Volcanoes and other igneous activity

Chapter 11: Mountain building

- Rock deformation
- Types of mountains and their formation

Unit Five: Oceanography

Chapter 14: Ocean floor

Chapter 15: Ocean water and ocean life

- The composition of seawater
- Diversity of ocean life

Chapter 16: The dynamic oceans

- Ocean circulation
- Waves and tides
- The shoreline and its features

Unit Six: Meteorology

Chapter 17: The atmosphere

- Atmosphere characteristics
- Heating the atmosphere
- Temperature controls

Chapter 18: Moisture, clouds and precipitation

- Water in the atmosphere
- Cloud types, formation, and precipitation

Chapter 19: Air pressure and wind

- Pressure centers and regional wind systems

Chapter 20: Weather patterns and severe storms

Chapter 21: Climate

- Factors that affect climate
- World climate and climate changes (global warming)

Unit Seven: Astronomy

Chapter 22: Origin of modern Astronomy

- Early astronomy
- The Earth-Moon-Sun system
- Earth's moon (calculating *Rosh Chodesh*)

Chapter 23: Touring our solar system

- The terrestrial planets
- The outer planets
- Minor members of the solar system

Chapter 24: The Sun

Chapter 25: Beyond our solar system

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- Properties of stars
- Stellar evolution
- The universe

* Dates are not included as part of the syllabus as the pace of teaching is difficult to calculate. Quizzes or other forms of grading will be given at the end of each section, and a test will be given at the end of each unit.

Grading

65 %	tests and quizzes
10%	daily drills
25%	projects and class participation

Letter grades will be determined according to the following scale

A	90%- 100%
B	80%- 89%
C	70%- 79%
D	60%-69%
F	Less than 60%

Cheating and Plagiarism

Any form of cheating or plagiarism on an exam or assignment will result in a zero on that test or assignment. Questions as to what constitutes plagiarism or cheating should be brought to the attention of the teacher.

Penalty for late assignments

If an assignment is turned in late, a penalty will be deducted for every school day that the work is not turned in. If there are extenuating circumstances for why an assignment is late, a written note by a parent or staff must be turned in **AT THE TIME THE ASSIGNMENT IS DUE.**

How to contest grading

If a student believes they were graded incorrectly, they have **one week** after they receive the grade to provide a written statement of rebuttal, explaining why they think they deserve credit for their answers. **Oral arguments will not be entertained.** Written comments will not be accepted on the day that a graded item is returned to allow the student to collect her thoughts.

Attendance

Students are expected to arrive on time for class. In the event that they have a valid excuse for not coming to class on time, a note signed by a teacher is required explaining the delay. If no note is presented to the teacher, the student will be recorded as "late". After three unexcused late attendances, 2% of the overall grade will be deducted. If a student is more than ten minutes late to class with no signed note, the offence will be recorded as skipping class, and a 2% deduction will be taken off the grade.

SCIENCE CURRICULUM

Drill

When students come into the classroom they are expected to answer the drill on the board. Each drill will be 3 questions which may be answered using notes. Not every drill will be collected everyday. Drills will be taken at random, recorded and handed back the next day.