Course Title: Advanced STEAM

Course #: 1507-1508

Course Description:
Students will expand on concepts and skills developed in the Introduction to STEAM course. This is a fast-paced course that will take a more comprehensive look into JAVA programming, CAD designing, metal fabrication, mechanical and electrical engineering, and real-world applications. Students will complete the STEAM program by competing in a two-month robotics competition during the spring semester. During the competition, the students utilize the skills they have developed to strategize, design, build, program, and compete in a rigorous robotics competition. The competition will require after school and Saturday meeting times.

UC/CSU Approval: “d” approved

Grade Level: 10-12

Estimated Homework Per Week: 1-3 hours

Prerequisite: Completion of Introduction to STEAM with a grade of “C” or higher both semesters.

Recommended Prerequisite Skills: Good analytical skills and attention to detail.

Course Grade Categories:
- Homework: 15%
- Tests/Quizzes: 15%
- Projects: 50%
- Final Project: 20%

Major Assessments/Units/Topics:
Advanced STEAM is a very project based class that builds on concept and skill development first learned in Intro to STEAM. In addition to identifying problems and creating solutions, students will document their process in an Engineering Design Notebook. There will also be 4-6 quizzes per semester.
Unit 1: Prototyping and Testing
- In this unit students learn the importance and techniques to developing prototypes and testing models during the design process of solving problems. Students continue to enhance the CAD skills with 3D models and 2D drawings. The unit includes a quiz and culminates in a small project.

Unit 2: Conceptual Physics
- In this unit, students learn about the applications of projectile motion and kinematic equations. There are multiple quizzes and the unit wraps up with an extensive projectile project where students engage in team competition making siege machines launching projectiles at various targets.

Unit 3: Introduction to Robotics:
- In this large unit students will create projects in each area of robotics identified below. There will also be quizzes to assess content in each area.
  - 3.1 Programming: Students will be introduced to the LabView programming language
  - 3.2 Electrical: Students will learn how to identify, calculate, and fabricate optimal, functioning circuits used in robotic capacities.
  - 3.3 Pneumatics: Students will learn the numbers and the manufacturing of how pneumatic systems operate.
  - 3.4 Sensors: Students will learn the different types and importance of various sensors used to help advance robotic functions.
  - 3.5 Motors: Students will learn the different options of motors to use and what motors work best in different situations.

Semester 1 Final Project: Students will design robotic mechanisms that are represented by the different areas of robotics. They will select simple tasks to perform and design a robotic element to perform said task.

Unit 4: Robotic Projects:
- The second semester of Advanced STEAM consists of problem solving using the concepts and skills learned in the previous semester. Students will be given tasks and must work in groups to create efficient mechanisms to complete the tasks. Students will go through the entire design process thoroughly, documenting along the way their ideas, calculations, design, testing, results, modifications, and solution.
  - There will be 3 large projects that make up the semester:
    1 - Robotics simple tasks
    2 - Environmental Challenge
    3 - Final project - Complex robotic task

Semester 2 Final Project: This will encompass all the skills and concepts attained throughout the year to complete complex solution to an identified problem.
Course Title: Anatomy & Physiology

Course #: 1535-1536

Course Description: Students engage in further exploration of the concepts associated with human anatomy and physiology. It is a rigorous second year Biology course for students interested in human biology, medicine and its related professions. Extensive reading and study are required.

UC/CSU Approval: “d” approved

Grade Level: 10-12

Estimated Homework Per Week: Approximately 2 hours per week

Prerequisite: Completion of Biology with a grade of “C” of higher

Recommended Prerequisite Skills: Grade-level reading comprehension

Course Grade Scale:
- Class Assignments & Homework: 10%
- Quizzes: 20%
- Labs & Projects: 20%
- Tests: 30%
- Semester Exam: 20%

Major Assessments/Units/Topics:
Each unit will encompass hands-on laboratory activities and will culminate in a summative unit test. The semester final exams are cumulative; the spring semester exam includes concepts from the spring semester only. An approximation of content by unit is given below:

Units of Study:
- Overview of Human Body - An introduction to regional and directional terminology, homeostasis, and conditions necessary for life.
- Body Tissues - Learning the structural and functional characteristics of the four tissue types that make up the human body.
• Integumentary System - The skin, its accessories and the complex functions the integumentary system performs to protect the body while allowing it to interact with/respond to its environment.

• Skeletal System - In addition to learning the arrangement of the bones and connective tissue that holds them together, this unit also explores the many dynamic functions that the human skeletal system performs to support other body systems.

• Blood - Students will learn about how this dynamic fluid performs many functions in support of all cells in the body.

• Immune System - Both the innate and adaptive immune systems will be investigated. This unit culminates with students doing a project to share an immune challenge or disorder with the class.

• Cardiovascular System - This unit begins with the structure of the heart and blood vessels, then progresses to show how the cardiovascular system supports the needs of cells in every tissue of the body.

• Respiratory System - In addition to the structures of the respiratory system, this unit looks at the respiratory zones where gas exchange happens both in the lungs and at the cellular level.

• Digestive System - Essential to the functioning of all cells is the acquisition and absorption of nutrients necessary for cellular processes. The mechanical and chemical digestion of nutrients, plus the importance of absorption in the intestines, is a key focus of this chapter. This unit ends with students completing a dietary analysis of their own food intake.

• Organization of the Nervous System - The anatomy of the brain, plus an overview of how sensory input is translated into appropriate responses by the body, is the main focus of this unit.

• Muscular System - This unit not only studies the major muscles and the actions they produce, but also investigates neuromuscular junctions, the relationship between the nervous system and the muscles it commands.
Course Title: Anatomy & Physiology Honors

Course #: 1537-1538

Course Description:
Students in grades 11-12 who have a strong interest in human physiology and are planning to pursue a career in the life sciences or health related professions will benefit from this accelerated, in-depth study of the human body. Students will explore the structural and functional relationships of all the organ systems and how they dynamically work together to sustain life. In addition, how the human body responds to pathophysiological imbalances and ultimately maintains homeostasis will be studied.

*Honors Anatomy is NOT intended as a second year anatomy course. Completion of the college prep Anatomy & Physiology precludes you from taking the honors course.

UC/CSU Approval: “d” approved

Grade Level: 10-12

Estimated Homework Per Week: 5 hours per week

Prerequisite: Completion of both Biology & Chemistry with a grade of “C” or higher

Recommended Prerequisite Skills:
College level reading skills
Self-directed learner
Willingness to study even when there is no assigned homework due for next class
Good rote memorization

Course Grade Scale:
Grades each semester will be determined by the possible points you were able to earn in each category as weighted in the following way:
- Class Assignments & Homework: 10%
- Quizzes: 10%
- Labs & Projects: 15%
- Unit Tests: 45%
- Semester Exam: 20%
Major Assessments/Units/Topics:
Each unit will encompass hands-on laboratory activities and will culminate in a summative unit test. The semester final exams are cumulative; the spring semester exam includes concepts from the spring semester only. An approximation of content by unit is given below:

Units of Study:
- Overview of Human Body - An introduction to regional and directional terminology, homeostasis, and conditions necessary for life.
- Chemistry Review - Chemistry concepts essential to understanding the biochemistry of the human body will be reviewed briefly.
- Biology Review - The semipermeable cell membrane, cellular transport topics, intercellular junctions, and structure of major biomolecules will be reviewed.
- Body Tissues - Learning the structural and functional characteristics of the four tissue types that make up the human body.
- Integumentary System - The skin, its accessories and the complex functions the integumentary system performs to protect the body while allowing it to interact with/respond to its environment.
- Digestive System - Essential to the functioning of all cells is the acquisition and absorption of nutrients necessary for cellular processes. The mechanical and chemical digestion of nutrients, plus the importance of absorption in the intestines, is a key focus of this chapter. Also included is the role that various vitamins and minerals play in various, vital human body functions is included, as well as a review of cellular respiration and the role it plays in converting ingested nutrients into chemical energy and waste products. The endocrine system is inserted in terms of how digestive activities are regulated.
- Organization of the Nervous System - The anatomy of the brain, plus an overview of how sensory input is translated into appropriate responses by the body is discussed. The chemical conditions involved in an action potential are discussed, in addition to the role played in myelination of a neuron and importance of synapses in nervous system integration.
- Muscular System - This unit not only studies the major muscles and the actions they produce, but also investigates neuromuscular junctions, the structures and chemistry of the sliding filament theory, and the relationship between the nervous system and the muscles it commands.
• Neurochemical Investigation - Students will be assigned to research and present information on one of a variety of neurochemicals (natural or synthetic) that affect neurotransmitter activity. The investigation will include an explanation of the symptoms that result.

• Skeletal System - In addition to learning the arrangement of the bones and connective tissue that holds them together, this unit also explores the many dynamic functions that the human skeletal system performs to support other body systems. The endocrine system is inserted into this unit by studying the regulation of blood calcium levels.

• Blood - Students will learn about how this dynamic fluid performs many functions in support of all cells in the body. Also included will be the delicate balance in the chemical composition of blood plasma. The endocrine system is inserted in terms of the regulation red blood cell production.

• Immune System - Both the innate and adaptive immune systems will be investigated, as well as cellular communication involved in an immune response. This unit culminates with students exploring epidemiology by preparing a presentation on various emerging infectious diseases and conditions, whether social, political, or economic, that contribute to outbreaks and epidemics.

• Biotechnology Unit - Students will conduct an infectious disease simulation that exposes them to the ELISA technique and how medical diagnostics are generated and used. This unit also allows students to conduct a protein purification process, including isolating bacterial colonies with favorable traits, culminating with chromatography column isolation of the desired protein.

• Cardiovascular System - This unit begins with the structure of the heart and blood vessels, then progresses to show how the cardiovascular system supports the needs of cells in every tissue of the body. The endocrine system is inserted in terms of its role in regulating blood pressure.

• Respiratory System - In addition to the structures of the respiratory system, this unit looks at the respiratory zones where gas exchange happens both in the lungs and at the cellular level.
Course Title: AP Biology

Course #: 1561-1562

Course Description: AP Biology is an introductory college-level biology course. Students cultivate their understanding of biology through inquiry-based investigations as they explore the following topics: evolution, cellular processes, energy and communication, genetics, information transfer, ecology, and interactions. The course is lab-based and focuses on application of concepts. Students are strongly encouraged to take the AP Exam in May.

UC/CSU Approval: “d” approved

Grade Level: 10-12

Estimated Homework Per Week: Approximately 6-8 hrs, depending on student skill level, including all course preparation such as assigned work and individual studying

Prerequisite: Completion of Biology or Biology Honors with a grade of “B” or higher AND Completion of Chemistry or Chemistry Honors with a grade of “B” or higher

Recommended Prerequisite Skills: None

Course Grade Scale:
- Class Assignments/Homework: 10%
- Labs & Projects: 25%
- Tests & Quizzes: 50%
- Semester Exams: 15%

Major Assessments/Units/Topics:

Big Idea 1: Evolution
The process of evolution drives the diversity and unity of life.

Big Idea 2: Cellular Processes: Energy and Communication
Biological systems utilize free energy and molecular building blocks to grow, to reproduce, and to maintain dynamic homeostasis.

Big Idea 3: Genetics and Information Transfer
Living systems store, retrieve, transmit, and respond to information essential to life processes.

**Big Idea 4: Interactions**

Biological systems interact, and these systems and their interactions possess complex properties.

To understand the four Big Ideas, the curriculum emphasizes inquiry-based learning. Students develop advanced reasoning skills through the following Science Practices:

- Explain biological concepts, processes, and models presented in written format.
- Analyze visual representations of biological concepts and processes.
- Determine scientific questions and methods.
- Represent and describe data.
- Perform statistical tests and mathematical calculations to analyze and interpret data.
- Develop and justify scientific arguments using evidence.

(Please note that pacing, labs, and activities are subject to change)

**Fall Semester**

**UNIT 0: COURSE INTRODUCTION**

Readings in *Biology in Focus 2e*:

- Chapter 1-Introduction: Evolution and the Foundations of Biology
- Chapter 2-The Chemical Context of Life
- Chapter 19-Descent with Modification  **QUIZZAM #1**

Activities/Labs:

- Properties of Water: How many drops of water fit on a penny?
- Birds and Worms

**UNIT I: ORGANIC CHEMISTRY AND CELL BIOLOGY**

Readings in *Biology in Focus 2e*:

- Chapter 3-Carbon and the Molecular Diversity of Life
- Chapter 4-A Tour of the Cell
- Chapter 5.1-5.5-Membrane Transport and Cell Signaling  **TEST #1**

Activities/Labs

- Macromolecules Activity
- Investigative Lab #4: Diffusion and Osmosis

UNIT II: CELLULAR PROCESSES
Readings in *Biology in Focus 2e*:

- Chapter 6-An Introduction to Metabolism
- Chapter 7-Cellular Respiration and Fermentation
- Chapter 8-Photosynthesis **TEST #2**
- Chapter 5.6-Cell Signaling
- Chapter 9-The Cell Cycle **QUIZZAM #2**

Activities/Labs:

- Respiration and Photosynthesis Model Creation
- Investigative Lab #5 Photosynthesis
- Investigative Lab #6 Cellular Respiration (online lab)
- Investigative Lab #13: Enzyme Activity
- M&M Chi Square (with onion root lab results)

UNIT III: GENETICS/MOLECULAR BIOLOGY

Readings in *Biology in Focus 2e*:

- Chapter 10-Meiosis and Sexual Life Cycles
- Chapter 11-Mendel and the Gene Idea
- Chapter 12-The Chromosomal Basis of Inheritance **TEST #3**
- Chapter 13-The Molecular Basis of Inheritance
- Chapter 14-Gene Expression: From Gene to Protein

Activities/Labs:

- Sickle Cell HHMI Activity
- Meiosis on the Table Activity
- Investigative Lab #7: Mitosis and Meiosis (online; and slide viewing)

**SEMESTER EXAM** (inclusive of all chapters listed above; including 13-14)
Spring Semester

UNIT III: GENETICS/MOLECULAR BIOLOGY (continued)

- Chapter 15-Regulation of Gene Expression
- Chapter 16-Development

QUIZZAM #1

Activities/Labs:

- Investigative Lab #9: Biotechnology: Restriction Enzyme Analysis of DNA (PCR and gel analysis)

UNIT IV: Evolution

Readings in Biology in Focus 2e:

- Chapter 20-Phylogeny
- Chapter 21-Evolution of Populations
- Chapter 22-Origin of the Species
- Chapter 23-Broad Patterns of Evolution
- Chapter 24.1-.3-Early Life and the Diversification of Prokaryotes

TEST #1

TEST #2

Activities/Labs:

- Investigative Lab #2: Hardy Weinberg (PTC)
- Investigative Lab #3: Analyzing Genes with BLAST
- Investigative Lab #8: Biotechnology: Bacterial Transformation (Amgen Biotechnology Experience, Lab 5)

UNIT VI: ECOLOGY

Readings in Biology in Focus 2e:

- Chapter 39.3-.6-Motor Mechanisms and Behavior
- Chapter 40-Population Ecology
- Chapter 41-Species Interactions
- Chapter 42-Ecosystems and Energy
- Chapter 43-Global Ecology and Conservation Biology

SEMESTER EXAM (cumulative for the year, taken before the AP Exam in May)
Activities/Labs:

- Investigative Lab #11: Transpiration
- Investigative Lab #12: Animal Behavior Lab with Isopods
- HHMI Trophic Cascades

**AP Biology Exam: May**

**UNIT VII: LABS, PROJECTS, AND PRESENTATIONS**
To be determined based on student interests
Course Title: AP Chemistry

Course #: 1563-1564

Course Description:
Students will participate in a rigorous study of topics in chemistry that include: solution chemistry, gas laws, thermochemistry, kinetics, equilibrium, solubility, electrochemistry and acid-base chemistry. Students read a college-level text, perform frequent laboratory experiments and keep a comprehensive lab notebook. Significant prerequisite knowledge application is expected for successful completion of the course. Students are strongly encouraged to take the AP Exam in May.

UC/CSU Approval: “d” approved

Grade Level: 10-12

Estimated Homework Per Week: Approximately 10 hrs, depending on student skill level, including all course preparation such as assigned work and individual studying

Prerequisite: Completion of Chemistry with a grade of a “B” both semesters. A grade of “B” or higher in Chemistry Honors is strongly recommended.

Recommended Prerequisite Skills:
Students should be intrinsically motivated to solve problems, seek help, and prepare in a comprehensive manner for the AP College Board Chemistry Exam. Calorimetry, enthalpy of reaction determination, Lewis structure writing, resonance, formal charges, bonding identification and diagramming, molecular shapes, bond angles, molecular polarity, intermolecular forces, ionic and covalent naming and formula writing, polyatomic ion identification and formula writing, equation writing and balancing, reaction identification, product prediction, limiting reactant determination, excess reactant determination, percent yield calculations, gas law calculations, gas law stoichiometry, solution preparation, molarity and molality calculations, oxidation and reduction reaction identification, oxidation and reduction reaction balancing.
Course Grade Scale:
- Homework: 20%
- Quizzes: 20%
- Laboratory: 15%
- Unit Exam: 30%
- Final Exam: 15%

Major Assessments/Units/Topics:
*Each unit is assessed with daily quizzes and a unit exam.

Unit 1: Chemical Reactions (Redox) and Thermochemistry
Students will review major chemical reaction types, equation balancing and product prediction. Enthalpy changes associated with reactions will be explored in significant detail.

Unit 2: Periodic Trends/Properties of Elements
Students will explain characteristic properties of elements and general trends found on the periodic table. In-depth analysis and explanation of the trends and properties observed will be facilitated in this unit.

Unit 3: Chemical Bonding/Molecular Geometry
Students will differentiate between different types of chemical bonding and relate said bonding to valence electron interactions. Additionally, students will correlate bonding of specific compounds to specific molecular shapes and 3D structures.

Unit 4: IMF’s/Gases/Solids
Students will correlate understanding of molecular behavior to intermolecular forces (IMFs) found in specific substances. Student will relate IMFs to specific characteristics seen in both solids and gases.

Unit 5: Solutions
Students will differentiate between different types of solutions and calculate concentrations based on solvent and solute quantities. Students will explain the relationship between enthalpy and entropy with respect to solution formation. Beer's law will be used to explore concentration of solutions.

Unit 6: Kinetics
Students will explore average and instantaneous rates, rate laws, integrated rate laws, activation energy and mechanisms of reactions.

Fall Final Exam - All Units
Unit 7: Equilibrium
Students will explore equilibrium relationships between reactants and products of chemical reactions. Le Chatlier's principle and reaction quotients will be used to analyze the relative shifts associated with product and reactant quantity modification.

Unit 8: Acid and Base Equilibrium
Students will explore strong and weak acid/base behaviors as they pertain to the structural characteristics and equilibrium.

Unit 9: Additional Aqueous Equilibrium
Students will explore acid base chemistry from the perspective of titration and common ion effect. Additionally, solubility will be covered in the context of equilibrium.

Unit 10: Chemical Thermodynamics
Students will correlate enthalpy, entropy, and Gibbs' free energy as it pertains to chemical reaction spontaneity and equilibrium position.

Unit 11: Electrochemistry
Students will explore the relationship between chemical and electrical energy as it pertains to oxidation and reduction processes.

Spring Final - FULL YEAR Comprehensive!
Course Title: AP Computer Science A

Course #: 3467-3468

Course Description:
AP Computer Science A is equivalent to a first-semester, college-level course in computer science. The course introduces students to computer science with fundamental topics that include problem solving, design strategies and methodologies, organization of data (data structures), approaches to processing data (algorithms), analysis of potential solutions, and the ethical and social implications of computing. The course emphasizes both object-oriented and imperative problem solving and design using Java language. These techniques represent proven approaches for developing solutions that can scale up from small, simple problems to large, complex problems. The AP Computer Science A course curriculum is compatible with many CS1 courses in colleges and universities. Students are strongly encouraged to take the AP Exam in May.

UC/CSU Approval: “g” approved

Grade Level: 11-12

Estimated Homework Per Week: 1hr/wk
This is a general guideline for planning and scheduling purposes. A student’s ability level may affect actual preparation time needed.

Prerequisite: Completion of Pre-Calculus or AP Computer Science Principles with a grade of “B” or higher

Recommended Prerequisite Skills: Logic, Problem Solving

Course Grade Categories:
• Assessments: 35%
• Final Assessment: 15%
• Homework/Classwork: 50%
Major Assessments/Units/Topics:
*Assessments per unit: 1-2 quizzes, 1 Unit Test, 3-4 Programming Projects

Unit 1: Introduction to Computing:
- Computer Processing
- Hardware Components
- Java Programming Language
- Object-Oriented Programming

Unit 2: Data & Expressions:
- Character Strings
- Variables and Primitive Data Types
- Expressions, Data Conversion
- Interactive Programs
- Graphics

Unit 3: Classes & Objects:
- Creating Objects
- Packages String
- Random
- Math Classes
- Formatting Output
- Enumerated Types
- Wrapper Classes
- Components & Containers
- Nested Panels
- Images
- Writing Classes & Objects
- Anatomy of a Class
- Encapsulation
- Anatomy of a Method
- Constructors
- Graphical Objects
- Graphical User Interfaces (GUI)
- Buttons & Text Fields

Unit 4: Conditionals & Loops:
- Simple Operations
  - Boolean Expressions and If-Statements
  - The While Statement and Iterators
  - The ArrayList Class
  - Event Sources
  - Check Boxes and Radio Buttons
• Complex Operations
  ○ The Conditional Operator,
  ○ Statements: do, for, switch
  ○ Drawing w/ Loops and Conditionals
  ○ Dialog Boxes

Unit 5: Object-Oriented Design:
• Software Development Activities
• Identifying Classes and Objects
• Class Relationships
• Interfaces
• Method Design and Overloading
• Testing
• GUI Design

Unit 6: Arrays:
• Array Elements
• Declaring and Using Arrays
• Arrays of Objects
• Variable Length Parameter Lists
• Two-Dimensional Arrays
• Polygons and Polylines
• Mouse and Key Events

Unit 7: Inheritance:
• Creating Subclasses
• Overriding Methods
• Class Hierarchies
• Designing for Inheritance
• Extending Adapter Classes
• Timer Class

Unit 8: Polymorphism
• Late Binding via Inheritance and Interfaces
• Sorting and Searching
• Event Processing
• File and Color Choosers
Unit 9: Exceptions
- Exception Handling
- Uncaught Exceptions
- The try-catch Statement
- Exception Propagation
- I/O Exceptions
- Tool Tips and Mnemonics
- Combo Boxes
- Scroll Panes and Split Panes

Unit 10: Recursion
- Recursive Thinking & Programming
- Using Recursion
- Recursion in Graphics

Unit 11: Collections
- Collections and Data Structures
- Dynamic Representations
- Linear Data Structures
- Non-Linear Data Structures
- Java Collections API

Unit 12: AP Prep Labs
- Magpie Lab
  - Strings and AI
- Elevens Lab
  - Classes and Objects
- Picture Lab
  - Arrays, Interfaces, Inheritance
Course Title: AP Computer Science Principles

Course #: 3758-3759

Course Description:
The AP Computer Science Principles course is designed to be equivalent to a first-semester introductory college computing course. The course introduces students to the foundational concepts of computer science and challenges them to explore how computing and technology can impact the world. With a unique focus on creative problem solving and real-world applications, AP Computer Science Principles prepares students for college and career. Students are strongly encouraged to take the AP Exam in May.

UC/CSU Approval: “g” approved

Grade Level: 10-12

Estimated Homework Per Week: 1 hour per week
This is a general guideline for planning and scheduling purposes. A student’s ability level may affect actual preparation time needed.

Prerequisite: Completion of Algebra 2 with a grade of “C” or higher OR Concurrent enrollment in Algebra 2 and completion of Intro to Computer Programming with a grade of “B” or higher

Recommended Prerequisite Skills: Logic, Problem Solving

Course Grade Scale:
- Assessments: 35%
- Final Assessment: 15%
- Homework & Classwork: 50%
Major Assessments/Units/Topics:
*Assessments per unit: 1-2 Quizzes, 1 Unit Test, In-class Activities

Unit 1: The Internet
Representing and Transmitting Information
- Bits and Binary Messages
- Abstract Number Systems
- Encoding Numbers and Text
Inventing the Internet
- IP Addresses, Packets, and Redundancy
- Routing, DNS, Protocols, and Abstraction

Unit 2: Digital Information
Encoding and Compressing Complex Information
- Encoding Images
- Lossless and Lossy Compression
Manipulating and Visualizing Data
- Visualizations, Trends, and Assumptions
- Cleaning and Summarizing Data

Unit 3: Algorithms & Programming
Algorithms
- The Need for Algorithms
- Designing Algorithms
Programming
- Programming Languages
- Procedural Abstraction & Top-Down Design
- Loops and Iteration

Unit 4: Big Data & Security
Implications of Big Data
- Big Data in the Real World
- Identifying People and the Cost of “free”
Encryption & Security
- Foundations of Encryption
- One-Way Functions
- Asymmetric and Public Key Encryption
Unit 5: Building Applications
   Event-Driving Programming
      ● Designing Event-Driving Applications
      ● User Input and Variables
      ● Boolean Logic and Conditionals
   Programming with Data Structures
      ● While Loops
      ● Simulations
      ● Arrays Functions with Return Values
      ● Processing Array

Unit 6: Performance Tasks
   Create Performance Task
      ● 12-hr AP Create Performance Task
   Explore Performance Task
      ● 8-hr AP Explore Performance Task
Course Title: AP Environmental Science

Course #: 1565-1566

Course Description:
AP Environmental Science (Course #1565-1566 / Grade 10-12) is an introductory college-level course. Students will identify and analyze environmental problems, both natural and man-made, and evaluate the relative risks associated with these problems. This course has been aligned to College Board Guidelines for Advanced Placement Environmental Science. Topics of study include the essentials of ecology and biodiversity, population issues, climate disruption, soil and water pollution, along with economics and politics of sustainability. Students are strongly encouraged to take the AP Exam in May.

UC/CSU Approval: “d” approved

Grade Level: 10-12

Estimated Homework Per Week: 3-4 hours/week

Prerequisite:
Grade 10: Completion of Chemistry or Chemistry H with a grade of “C” or higher both semesters
Grade 11 and 12: Completion of Chemistry or Chemistry H with a grade of “C” or higher both semesters above or currently enrolled in Chemistry

Recommended Prerequisite Skills: None

Course Grade Scale:
- Tests/quizzes: 45%
- Final exam: 15%
- Homework: 10%
- Lab/Projects: 30%

Major Assessments/Units/Topics:
I. Earth Systems and Resources
II. The Living World
III. Population
IV. Land and Water Use
V. Energy Resources and Consumption  
VI. Pollution  
VII. Global Change

**Course Schedule**

Assignments will include reading notes from the text, labs, projects and field trip studies. Exams are scheduled at the end of each unit.

<table>
<thead>
<tr>
<th>Units</th>
<th>Topics/Assignments</th>
</tr>
</thead>
</table>
| Unit 1 | Chapter 1: Studying the State of our Earth  
Salinization lab report  
Chapter 20: Sustainability, Economics and Equity –Introduce UN project |
| Unit 2 | Chapter 2: Environmental Systems  
Chapter 3: Ecosystem Ecology: Understanding the Movement of Matter |
| Unit 3 | Chapter 4: Global Climates and Biomes  
Chapter 5: Evolution of Biodiversity  
Chapter 18: Sustaining Biodiversity  
Guest speaker: Park Ranger from Cabrillo National Monument |
| Unit 4 | Chapter 6: Population and Community Ecology  
Chapter 7: Human Population |
| Unit 5 | Chapter 8: Earth Systems and Resources: Mining research/Cookie mining lab, Lab – Physical and Chemical Properties of Soil  
Chapter 9: Water Resources Research on California Water Issues |
| Semester 2:  
Unit 6 | Chapter 14: Water Pollution  
-Water Quality Testing Lab lab report  
-Field trip to the San Dieguito Lagoon/EIS (Environmental Impact Statement recommendations presentation) |
| Unit 7 | Chapter 10: Land, Public and Private – reading  
Chapter 11: Feeding the World – GMO Jigsaw |
| Unit 8 | Chapter 12: Nonrenewable Energy Resources  
Chapter 13: Achieving Energy Sustainability  
Video series: *Switch* with activity |
| Unit 9        | Chapter 15: Air Pollution  
|              | Chapter 19: Global Change  
|              | Field Trip: San Diego Zoo Safari Park |
| Unit 10      | Chapter 16: Waste Generation and Waste Disposal  
|              | Chapter 17: Human Health and Environmental Risk  
|              | Benchmark (two weeks before the college board exam- counts as your spring final exam) |
Course Title: AP Physics 1

Course #: 1569-1570

Course Description:
AP Physics 1 is an algebra-based, introductory college-level physics course. Students cultivate their understanding of Physics through inquiry-based investigations as they explore these topics: kinematics; dynamics; circular motion and gravitation; energy; momentum; simple harmonic motion; torque and rotational motion; electric charge and electric force; DC circuits; and mechanical waves and sound. Students will:

- Develop a deep understanding of foundational principles of physics in classical mechanics and modern physics by applying these principles to complex physical situations that combine multiple aspects of physics rather than present concepts in isolation
- Discuss, confer, and debate with classmates to explain a physical phenomenon investigated in class
- Design and conduct inquiry-based laboratory investigations to solve problems through first-hand observations, data collection, analysis and interpretation

Students are strongly encouraged to take the AP Exam in May.

UC/CSU Approval: “d” approved

Grade Level: 10-12

Estimated Homework Per Week: 5 hrs/week

Prerequisite: Completion of Pre-Calc with a grade of “B” or higher both semesters Or completion of Pre-Calc H with a grade of “C” or higher both semesters
- Recommended: Concurrent enrollment in Calculus AB or Calculus BC

Recommended Prerequisite Skills:
- Graphing skills and ability to analyzing graphs.
- Good ability to solve word problem

Course Grade Scale:
- Homework: 10%
- Labs: 20%
- Quizzes: 15%
Major Assessments/Units/Topics:

1. **Math Review**: Review significant Figures, Scientific Notation, metric System, and Vectors and Scalars

2. **Mechanics**
   a. **Kinematics**: Defining Motion, Graphing Motion, Kinematic Equations, Free Fall, and Projectile Motion (Horizontal and angled)
      - Quiz, Test, and laboratory experiment using Motion Sensors
   b. **Dynamics**: Newton’s Laws of motion, Free Body Diagrams, Friction, Air Resistance, Elevators, Ramps and Inclines, and Atwood Machines
      - Quiz, Test, and laboratory experiment: Atwood Machine
      - Quiz, Test, and laboratory experiment Conservation of Energy: Stopping Distance
   d. **Momentum**: Momentum and Impulse, Conservation of Momentum, Collision in Multiple Dimensions
      - Quiz, Test, and laboratory experiment: Collision and Simulation
   e. **Circular Motion and Rotation**: Centripetal Acceleration, Circular Speed, Centripetal Force, Frequency and period, vertical Circular Motion, Rotational Kinematics, Torque, Rotational Dynamics, Angular Momentum, and Rotational Kinetic Energy
      - Quiz, Test, and laboratory experiment find centripetal force using flying airplane
   f. **Gravity**: Universal Gravitation, Gravitational Fields, and Kepler’s laws
      - Quiz, Test, and laboratory experiment: Simulation
   g. **Oscillations**: Simple Harmonic Motion, Spring-Block Oscillators, Spring Combinations
      - Quiz, Test, and laboratory experiment: Calculating Period of Oscillation

3. **Mechanical Waves**: Wave Basics and Characteristics, Sound Waves, Resonance, Wave Interference, Beats, Standing Waves, and Doppler Effect
   - Quiz, Test, and laboratory experiment: Standing wave

4. **Electrostatics**: Electric Charge, Conduction and Induction, Coulomb’s Law, Electric Field
   - Quiz, Test, and laboratory experiment: Investigating Charge

5. **Current Electricity**: Electric current, Resistance, Ohm’s Law, Electrical Circuits (Parallel and Series), and Energy and Power
   - Quiz, Test, and laboratory experiment: Investigating Circuits
Cathedral Catholic High School
Course Catalog

Course Title: AP Physics C

Course #: 1549-1550

Course Description:
The Physics C: Mechanics course is equivalent to a one-semester, calculus-based, college-level physics course. It is especially appropriate for students planning to specialize or major in physical science or engineering. The course explores topics such as kinematics; Newton's laws of motion; work, energy and power; systems of particles and linear momentum; circular motion and rotation; and oscillations and gravitation. Introductory differential and integral calculus is used throughout the course.

Laboratory experience must be part of the education of AP Physics C students and should be included in all AP Physics courses. Colleges may require students to present their laboratory materials from AP science courses before granting college credit for laboratory, so students are encouraged to retain their laboratory notebooks, reports, and other materials. Students are strongly encouraged to take the AP Exam in May.

UC/CSU Approval: “d” approved

Grade Level: 10-12

Estimated Homework Per Week: 5 hrs per week

Prerequisite: Concurrent enrollment in AP Calculus AB or higher

Recommended Prerequisite Skills:
Graphing skills and ability to analyzing graphs.
Good ability to solve word problem
Mastery in Differentials and Integration

Course Grade Scale:
- Homework: 10%
- Labs: 20%
- Quizzes: 15%
- Tests: 35%
- Final: 20%
Major Assessments/Units/Topics: This course applies both differential and integral calculus and provides instruction in each of the following six content areas:

1. **Kinematics**: Vectors, Vector Algebra, Vector Components, Coordinate Systems, Displacements, velocities, and Accelerations
   - Motion in one dimension
   - Motion in two dimensions; including projectile motion
   *Quiz, Test, and One dimensional motion Experiment using Motion sensor and Projectile Motion Experiment

2. **Newton’s laws of motion**:
   - Static Equilibrium; First Law
   - Dynamics of a single particle; second law
   - System of two or more objects; third law
   *Quiz, Test, Friction lab

3. **Work, energy and power**:
   - Work and Work-Energy theorem
   - Forces and Potential Energy
   - Conservation of Energy
   - Power
   *Quiz, Test, Work by Variable force Lab

4. **Systems of particles and linear momentum**:
   - Center of mass
   - Impulse and Momentum
   - Conservation of Momentum, Collisions
   *Quiz, Test, Momentum-Impulse lab, Elastic and Inelastic Collision

5. **Circular motion and rotation**:
   - Uniform Circular Motion
   - Torque and Rotational Statics
   - Rotational Kinematics and Dynamics
   - Angular Momentum and its Conservation
   *Quiz, Test, Circular Motion of Flying pig Lab, Rotational Dynamics Lab

6. **Oscillations and gravitation**:
   - Simple harmonic Motion: Dynamics and Energy relationships
   - Mass on a Spring
   - Pendulum and other Oscillations
   - Newton’s Law of Gravity
• Orbits of Planets and Satellites
  * Quiz, Test, Energy in SHM and Pendulum lab
Course Title: Biology

Course #: 1511-1512

Course Description:
In this required, college-prep laboratory science course, students explore the fundamental properties of life. Topics of study include the fundamentals of ecology and nutrient cycles; macromolecules, which make up living things; cell structure and function; cellular energy; introduction to genetics; and evolution. Students engage in class discussions, laboratory investigations, research, and the construction of models.

UC/CSU Approval: “d” approved

Grade Level: 9

Estimated Homework Per Week: 1.5 hrs
This is a general guideline for planning and scheduling purposes. A student’s ability level may affect actual preparation time needed.

Prerequisite: Dependent on reading comprehension scores on English in the HSPT.

Recommended Prerequisite Skills: none

Course Grade Scale:
- Homework/Classwork: 10%
- Labs: 25%
- Quizzes and Tests: 50%
- Final Exam: 15%

Major Assessments/Units/Topics:
Assessments per unit: 2-3 Quizzes, Unit Test, Formal Lab Write Up, Activity.

Unit 1 The Science of Biology
What is Science
- Scientific method - observation, inference, hypothesis, controlled experiment, independent and dependent variable, control group, data, sources of error, conclusion (Apply through an inquiry based lab)

Studying Life
- Characteristics of living things
Unit 2 Ecology
The Biosphere
- Ecology
- Levels of organization within the biosphere - an individual, to population, to community, to ecosystem, to biome, to biosphere.
- Biotic and abiotic factors

Energy, Producers, and Consumers
- Primary producers
- Sunlight is the main energy source for life on Earth; some organisms rely on stored inorganic chemical compounds.
- Consumers
- Energy flows from the sun or inorganic compounds to autotrophs then to heterotrophs.
- About 10% of the energy available in one trophic level is transferred to the next level.

Energy Flow in Ecosystems
- Food chains and food webs
- Food webs and disturbance
- Trophic levels and ecological pyramids

Cycles of Matter
- The water cycle
- Nutrient cycles (nitrogen and carbon)
- Nutrient limitations

Biodiversity
- Climate Change
- Anthropogenic effects on the environment: students choose an effect to study, and do a poster symposium to present their topic. Use the HIPPCO acronym as an overview.

Unit 3 The Chemistry of Life
Properties of Water
- Polarity
- Hydrogen bonding
- Cohesion and surface tension
- Adhesion and capillary action

Carbon Compounds
- Carbon and carbon structures
- Macromolecules, monomer, polymer
- Carbohydrates, structures, monosaccharide, polysaccharide
- Lipids, structure, glycerol and fatty acids, saturated, unsaturated
- Nucleic acids, structure, nucleotides
- Protein, structure, amino acids
- Structure and function

Chemical Reactions and Enzymes
- Chemical reaction, reaction, product
● Activation energy
● Enzyme-substrate complex, substrate
● Regulation, temperature, pH, regulatory molecules

Unit 4 Cell Structure and Function

Life is Cellular
● Prokaryotic and eukaryotic cells

Cell Structure
● Organelles (REVIEW ONLY), Figure 7-11 Making Proteins
● Cell membrane Fluid Mosaic Model, Figure 7-13, lipid bilayer, semipermeable
● Differences between plant and animal cells

Cell Transport
● Passive transport, diffusion
● Facilitated diffusion
● Osmosis, aquaporin, isotonic, hypotonic, hypertonic, osmotic pressure
● Active transport, molecular transport, protein pumps, bulk transport, endocytosis, exocytosis
● Cellular communication (7.4), receptor
● Gap junctions
● (Use examples from theme - diabetes, cystic fibrosis, immune cells)

Homeostasis
● Cell specialization
● Levels of organization
● Limits to Cell Size
● Surface area of cell membrane vs. cytoplasm volume
● Rate of cell transport to support necessary cell functions

Unit 5 Energy and Life

● ATP

Photosynthesis: An Overview
● Chlorophyll, pigments, thylakoid, stroma, electron carriers, equation
● Light dependent reactions
● Light-independent reactions

The Process of Photosynthesis
● Discussion is needed to come to a consensus on how in-depth we want to teach this section, overview using diagram
● Factors affecting photosynthesis

Cellular Respiration: an overview
● Calorie, equation,
● Stages of respiration, aerobic, anaerobic
● Comparing photosynthesis and cell respiration

The Process of Cellular Respiration
OVERVIEW using diagram, glycolysis, Krebs cycle (pyruvic acid --> citric acid, energy extracted, electron transport chain, the totals (use diagram)

Fermentation
- Fermentation, alcoholic fermentation, lactic acid fermentation
- Energy and exercise

Unit 6 DNA and Protein Synthesis, Cell Cycle
Identifying the Substance of Genes
- Bacterial transformation, Hershey-Chase, the role of DNA

The structure of DNA
- Nucleotides, bases, covalent bonds, Chargaff's rule
- Antiparallel strands, hydrogen bonding, base paring

DNA Replication
- Replication of the DNA molecule

RNA
- messenger RNA, ribosomal RNA, transfer RNA
- RNA synthesis, transcription, RNA polymerase, promoters, RNA editing, introns, exons.

Ribosomes and Protein Synthesis
- polypeptides, codon, codon chart, start and stop codons
- Translation, anticodon, tRNA, amino acids, peptide bond, gene expression

Mutations
- Mutations, point mutations, substitutions, insertions, deletions, frameshift mutations, use the example from the theme (diabetes, cystic fibrosis), sickle cell disease,
- Chromosomal mutations, examples such as Down's syndrome

Studying the Human Genome
- Manipulating DNA, cutting DNA, restriction enzyme, separating DNA, gel electrophoresis, Reading DNA

Cell Growth, Division, and Reproduction
- Limits to cell size, surface area to volume ratio.
- Cell division, asexual reproduction, sexual reproduction

The Process of Cell Division
- Chromosomes, chromatin
- Cell cycle, phases of the cell cycle
- Mitosis, cytokinesis, phases of mitosis and diagrams, cytokinesis

Regulating the Cell Cycle
- Controls on cell division, cyclin, internal regulatory proteins, external regulators, growth factors, apoptosis.
- Cancer, tumor, causes of cancer, treatments for cancer (TED talk)

Unit 7 Genetics and Heredity, Meiosis
The Work of Gregor Mendel
- genetics, trait, genes, alleles, dominance
- segregation, F1 cross, gametes
Applying Mendel's Principles
- Probability, heterozygous, homozygous, phenotype, genotype, Punnett square
- Independent assortment, dihybrid cross

Other Patterns of Inheritance
- Incomplete dominance, codominance, multiple alleles, polygenic traits
- Environmental influence, (Ted Talk Epigenetics)

Meiosis
- Chromosome number, homologous, diploid, haploid
- Phases of meiosis - main events (prophase I - tetrads and crossing over), diagrams, zygote
- Comparing meiosis and mitosis
- Gene linkage and gene maps

Human Chromosome
- Karyotype, genome, sex chromosomes, autosomes
- Human traits, codominant and multiple alleles, blood groups, sex-linked inheritance, sex-linked genes
- Human pedigrees

Human Genetic Disorders
- Sickle cell disease, cystic fibrosis, Huntington's disease
- Chromosomal disorders

Unit 8 Evolution

Darwin's Voyage of Discovery
- REVIEW, species vary globally, species vary locally, species vary over time.

Ideas That Shaped Darwin's Thinking
- Lyell's principles of geology, Lamarck's ideas, Malthus's view of population growth, artificial selection.

Darwin Presents His Case
- Evolution by natural selection, struggle for existence, variation and adaptation, survival of the fittest, common descent.

Evidence of Evolution
- Biogeography, fossils, comparing anatomy and embryology, vestigial structures, embryology, molecular biology.
- Grant's study - HHMI the beaks of a finch.

Genes and Variation
- Populations and gene pools, allele frequency.
- Mutations, genetic recombination in sexual reproduction.

Evolution as Genetic Change in Populations
- Directional selection, stabilizing selection, disruptive selection.
- Genetic drift, bottleneck effect, founders effect.
- The Hardy-Weinberg principle.
Course Title: Biology B

Course #: 1525-1526

Course Description: In this required, college-prep laboratory science course, students explore the fundamental properties of life. Topics of study include the fundamentals of ecology and nutrient cycles; macromolecules, which make up living things; cell structure and function; cellular energy; introduction to genetics; and evolution. Students engage in class discussions, laboratory investigations, research, and the construction of models.

UC/CSU Approval: "d" approved

Estimated Homework Per Week: 1.5 hrs/wk
This is a general guideline for planning and scheduling purposes. A student’s ability level may affect actual preparation time needed.

Prerequisite: Dependent on reading comprehension scores on English in the HSPT.

Recommended Prerequisite Skills: none

Course Grade Scale:
- Homework/Classwork: 10%
- Labs: 25%
- Quizzes and Tests: 50%
- Final Exam: 15%

Major Assessments/Units/Topics:
Assessments per unit: 2-3 Quizzes, Unit Test, Lab Write Up, Activity.

Unit 1 The Science of Biology
  - What is Science
    - Scientific method - observation, inference, hypothesis, controlled experiment, independent and dependent variable, control group, data, sources of error, conclusion (Apply through an inquiry based lab)
    - How is the metric system important in science
    - What are the tools of science and how are they used to collect data?
Studying Life

- Characteristics of living things (Apply through an inquiry based labs)
- What are the central themes of biology?
- How do different fields of biology differ in their approach to studying life?

Unit 2 The Chemistry of Life

- Properties of Water
  - Polarity
  - Hydrogen bonding

- Carbon Compounds
  - Carbon and carbon structures
  - Macromolecules, monomer, polymer
  - Carbohydrates, structures, monosaccharide, polysaccharide
  - Lipids, structure, glycerol and fatty acids, saturated, unsaturated
  - Nucleic acids, structure, nucleotides
  - Protein, structure, amino acids

- Chemical Reactions and Enzymes
  - Chemical reaction, reaction, product
  - Enzyme-substrate complex, substrate

Unit 3 Cell Structure and Function

- Life is Cellular
  - Prokaryotic and eukaryotic cells

- Cell Structure
  - Organelles
  - Cell membrane Fluid Mosaic Model, Figure 7-13, lipid bilayer, semipermeable
  - Differences between plant and animal cells

- Cell Transport
  - Passive transport, diffusion
  - Facilitated diffusion
  - Osmosis, aquaporin, isotonic, hypotonic, hypertonic, osmotic pressure
  - Active transport, molecular transport, protein pumps, bulk transport, endocytosis, exocytosis

- Homeostasis
  - Cell specialization
  - Levels of organization
  - Limits to Cell Size
  - Surface area of cell membrane vs. cytoplasm volume
  - Rate of cell transport to support necessary cell functions
- Unit 4 Energy and Life
  - ATP
  - Photosynthesis: An Overview
    - Chlorophyll, pigments, thylakoid, stroma, electron carriers, equation
    - Light dependent reactions
    - Light-independent reactions
  - The Process of Photosynthesis
    - In the process of photosynthesis, plants convert the energy of sunlight into chemical energy stored in the bonds of carbohydrates
    - Factors affecting photosynthesis
  - Cellular Respiration: an overview
    - Calorie, equation,
    - Stages of respiration, aerobic, anaerobic
    - Comparing photosynthesis and cell respiration
  - The Process of Cellular Respiration
    - OVERVIEW using diagram, glycolysis, Krebs cycle (pyruvic acid --> citric acid, energy extracted, electron transport chain, the totals (use diagram)
  - Fermentation
    - Fermentation, alcoholic fermentation, lactic acid fermentation
    - Energy and exercise

- Unit 5 DNA and Protein Synthesis, Cell Cycle
  - The structure of DNA
    - Nucleotides, bases, covalent bonds, Chargaff's rule
    - Antiparallel strands, hydrogen bonding, base paring
  - DNA Replication
    - Replication of the DNA molecule
  - RNA
    - messenger RNA, ribosomal RNA, transfer RNA
    - RNA synthesis, transcription, RNA polymerase, promoters, RNA editing, introns, exons.
  - Ribosomes and Protein Synthesis
    - polypeptides, codon, codon chart, start and stop codons
    - Translation, anticodon, tRNA, amino acids, peptide bond, gene expression
  - Mutations
    - Mutations, point mutations, substitutions, insertions, deletions, frameshift mutations, use the example from the theme (diabetes, cystic fibrosis), sickle cell disease,
    - Chromosomal mutations, examples such as Down's syndrome
  - Studying the Human Genome
- Manipulating DNA, cutting DNA, restriction enzyme, separating DNA, gel electrophoresis, Reading DNA
  - **Cell Growth, Division, and Reproduction**
    - Limits to cell size, surface area to volume ratio.
    - Cell division, asexual reproduction, sexual reproduction
  - **The Process of Cell Division**
    - Chromosomes, chromatin
    - Cell cycle, phases of the cell cycle
    - Mitosis, cytokinesis, phases of mitosis and diagrams, cytokinesis
  - **Regulating the Cell Cycle**
    - Controls on cell division, cyclin, internal regulatory proteins, external regulators, growth factors, apoptosis.
    - Cancer, tumor, causes of cancer, treatments for cancer (TED talk)

- **Unit 6 Genetics and Heredity, Meiosis**
  - The Work of Gregor Mendel
    - genetics, trait, genes, alleles, dominance
    - segregation, F1 cross, gametes
  - Applying Mendel's Principles
    - Probability, heterozygous, homozygous, phenotype, genotype, Punnett square
    - Independent assortment, dihybrid cross
  - Other Patterns of Inheritance
    - Incomplete dominance, codominance, multiple alleles, polygenic traits
    - Environmental influence, (Ted Talk Epigenetics)
  - Meiosis
    - Chromosome number, homologous, diploid, haploid
    - Phases of meiosis - main events (prophase I - tetrads and crossing over), diagrams, zygote
    - Comparing meiosis and mitosis
    - Gene linkage and gene maps
  - Human Chromosome
    - Karyotype, genome, sex chromosomes, autosomes
    - Human traits, codominant and multiple alleles, blood groups, sex-linked inheritance, sex-linked genes
    - Human pedigrees
  - Human Genetic Disorders
    - Sickle cell disease, cystic fibrosis, Huntington's disease
    - Chromosomal disorders

- **Unit 7 Evolution**
  - Darwin's Voyage of Discovery
    - REVIEW, species vary globally, species vary locally, species vary over time.
Darwin Presents His Case
- Evolution by natural selection, struggle for existence, variation and adaptation, survival of the fittest, common descent.

Evidence of Evolution
- Biogeography, fossils, comparing anatomy and embryology, vestigial structures, embryology, molecular biology.
- Grant’s study - HHMI the beaks of a finch.

Genes and Variation
- Populations and gene pools, allele frequency.
- Mutations, genetic recombination in sexual reproduction.

Evolution as Genetic Change in Populations
- Directional selection, stabilizing selection, disruptive selection.
- Genetic drift, bottleneck effect, founders effect.
- The Hardy-Weinberg principle.

Unit 8 Ecology
- The Biosphere
  - Ecology
  - Levels of organization within the biosphere - an individual, to population, to community, to ecosystem, to biome, to biosphere.
  - Biotic and abiotic factors
- Energy, Producers, and Consumers
  - Primary producers
  - Sunlight is the main energy source for life on Earth; some organisms rely on stored inorganic chemical compounds.
  - Consumers
  - Energy flows from the sun or inorganic compounds to autotrophs then to heterotrophs.
  - About 10% of the energy available in one trophic level is transferred to the next level.
- Energy Flow in Ecosystems
  - Food chains and food webs
  - Food webs and disturbance
  - Trophic levels and ecological pyramids
- Cycles of Matter
  - The water cycle
  - Nutrient cycles (nitrogen and carbon)
  - Nutrient limitations
- Biodiversity
  - Earth’s Unique Biomes and how they interrelate.
Course Title: Biology Honors

Course #: 1513-1514

Course Description: This course will prepare students for taking AP Biology. Approval from the Science Department Chair required. Honors Biology is a rigorous, accelerated laboratory science course, which focuses on investigating major biological concepts. Emphasis will be placed on developing critical thinking as applied to ecology, biomolecules and cell function, cellular energy, genetics, and evolution. The course is open to students who will continue with Advanced Placement sciences at Cathedral.

*Local Honors weight only, not UC/CSU approved as an Honors course.

UC/CSU Approval: “d” approved

Grade Level: 9

Estimated Homework Per Week: 2-3 hrs

Prerequisite: Dependent on reading comprehension scores on English in the HSPT and concurrent enrollment in Algebra I or higher math

Recommended Prerequisite Skills: Strong foundations in: critical reading at grade 10 level or above, note taking skills, basic knowledge of chemistry (periodic table, chemical reactions), measurements, the metric system, and applying the scientific method (formulating a hypothesis, conducting research, collecting data, and drawing conclusions from data).

Course Grade Categories:
- Homework/Classwork: 10%
- Labs and Projects: 25%
- Quizzes and Tests: 50%
- Final Exam: 15%
Major Assessments/Units/Topics:

Unit 1 - Biology - Exploring Life
- Order, reproduction, growth and development, energy processing, regulation, response to the environment, evolutionary adaptation.
- Qualitative and quantitative measurements
- Applying the scientific method
- Independent and dependent variable, control group, data, sources of error, conclusion
- Metric measurements and conversions

Unit 2 - Chemistry The Basis of Life
- Chemistry review, atoms, water, bonding, valence numbers.
- Basics of biochemistry, carbon, functional groups
- Macromolecules, polymers, monomers, dehydration reaction, hydrolysis
- Saccharides, lipids, proteins, nucleic acids
- Protein structure and function, primary structure, secondary structure, hydrogen bonds, tertiary structure, quaternary structure
- Enzymes, activation energy, substrate, active site, induced fit

Unit 3 - The Working Cell
- Cell theory, organelles and functions, surface to volume ratio
- The fluid mosaic model of the plasma membrane, selectively permeable
- Passive diffusion, concentration gradient, passive transport
- Solutions, tonicity, isotonic, hypertonic
- Facilitated diffusion, aquaporin
- Active transport, exocytosis, endocytosis, phagocytosis, receptor mediated endocytosis

Unit 4 - Cells Energy
- ATP, phosphorylation
- Photosynthesis, electromagnetic spectrum, photons
- Light reactions, Calvin cycle, carbon fixation
- Cellular respiration, glycolysis, citric acid cycle, oxidative phosphorylation
- Lactic acid fermentation, alcohol fermentation

Unit 5 - Cellular Reproduction
- Cell division, chromosomes
- Asexual and sexual reproduction, zygote
- Mitosis, meiosis
- Binary fission
- Anchorage dependence, density dependent inhibition, growth factor
- Tumor, benign tumor, malignant tumor, metastasis
Unit 6 - Molecular Biology of the Gene
- Historical experiments from Griffith, Hershey and Chase, Morgan
- Model building of Watson and Crick, sugar-phosphate backbone, nitrogenous bases and base pair rule
- DNA replication
- Gene expression, transcription, mRNA editing
- Translation, ribosome
- Protein editing
- Epigenetics

Unit 7 - Patterns of Inheritance
- Mendelian genetics, monohybrid cross, dihybrid cross
- Testcross, calculating probability, pedigree analysis
- Genetic disorders, incomplete dominance, multiple alleles, pleiotrophy, polygenic inheritance, sex-linked disorders

Unit 8 - How populations evolve
- Darwin's voyage, natural selection
- Evidence for evolution
- Evolutionary tree
- Populations, Hardy-Weinberg calculations
- Genetic drift
- Speciation, geographic isolation, reproductive barriers
- Lactose persistence

Unit 9 - Ecology
- Ecology, biotic factors, abiotic factors, organization of the biosphere
- Historical environmental problems and the modern environmental movement
- Trophic structure in food chains and energy pyramids
- Energy flow through ecosystems
- Chemical cycling in the biosphere
- Primary productivity and biomass in ecosystems
- Anthropogenic effects on the biosphere
Course Title: Chemistry

Course #: 1531-1532

Course Description:
Students are introduced to topics in chemistry that include atomic structure, chemical bonding, naming and determining formulas of chemical compounds, chemical reactions, gas laws, thermochemistry, solution chemistry, and acid/base chemistry. Students will engage in a variety of learning activities, including laboratory experiments, problem solving, and report writing. Although this course prepares students for college level chemistry, it is NOT recommended for those who plan to take AP Chemistry or AP Biology.

UC/CSU Approval: “d” approved

Grade Level: 10-12

Estimated Homework Per Week: 1-2 hrs

Prerequisite: Concurrent enrollment in Algebra 2 or higher-level math OR completion of Geometry with a grade of “C” or higher.

Recommended Prerequisite Skills: Ability to follow lab safety procedures, work collaboratively and/or independently, and grade-level reading and writing skills.

Course Grade Scale:
- Homework/Classwork: 15%
- Quizzes: 20%
- Laboratory Reports: 15%
- Chapter Tests/Unit Tests: 35%
- Semester Final: 15%

Major Assessments and Topics:
Each chapter/unit consists of lectures, skills practice, labs, quizzes, and tests. Students will have opportunities to work individually and collaboratively. Homework/classwork will be used to reinforce concepts and skills.
Major topics covered will be:

1. **Atomic Structure**: Students will learn about the structure of atoms and the various historical and current models of atoms. Students will focus on the locations, charges, and relative masses of protons, electrons, and neutrons. Calculating relative abundances of isotopes, mass numbers, and numbers of electrons, protons, and neutrons will also be introduced. A unit test will conclude the unit.

2. **Chemical Bonding**: Students will learn how to differentiate between ionic, covalent, metallic bonds, and network solids. Students will also learn how to write chemical formulas and Lewis Dot structures, identify molecular shapes, and name molecular and ionic compounds. Trends in atomic and ionic size, electronegativity, and ionization energy will be applied to investigate polarity and intermolecular bonds (London dispersion forces, dipole, and hydrogen bonds). A unit test will conclude the unit.

3. **Naming and Determining Chemical Compounds**: Students will learn how to name and write chemical formulas of binary and ternary ionic compounds, molecular compounds, and acids and bases.

4. **Chemical Reactions**: Students will learn about the mole unit and its relationship to mass, volume, and number of representative particles. Students will also learn about conservation of mass in chemical reactions, learn how to write and balance chemical equations, use mole ratios to find the limiting reactant, and calculate amounts of reactants needed and products produced. In addition, students will learn how to calculate percent yield and percent error. Students will be introduced to the five main types of reactions – synthesis, decomposition, single and double replacement, and combustion. Students will learn how to apply solubility rules for ionic compounds and activity series of metals to predict types of products formed. A unit test will conclude the unit.

5. **Gas Laws**: Students will learn about some of the properties of gases and practice solving gas equations. Some of the topics will include compressibility, gas pressure, relationships between pressure, temperature and volume of gases, vapor pressure, and ideal gases. A unit test will conclude the unit.

6. **Thermochemistry**: Students will learn how to differentiate between mixtures and pure substances in the context of colloids, suspensions, compounds, and elements. Students will become familiar with physical and chemical changes and identify their corresponding features in a laboratory setting. Students will explore the kinetic molecular theory in relation to the movements of particles in solids, liquids, gases, and plasma. In addition, students will learn how to differentiate between heat and temperature as well as relate heat flow to corresponding exothermic and endothermic processes. A unit test will conclude the unit.

7. **Solution Chemistry**: Students will learn about the unique properties of water, such as its vapor pressure, surface tension, and melting and boiling points. The unit will also include topics on homogeneous aqueous solutions, solvents, solutes, solvation, saturation, molarity, dilutions, heterogeneous solutions, and hydrates. A unit test will conclude the unit.
8. **Acid/Base Chemistry**: Students will learn about how acids and bases are defined. Students will focus on Brønsted and Lowry’s conjugate acid-base pairs, strengths of acids and bases, and acid-base neutralization reactions. In addition, students will experiment with color changing indicators in titrations and in solutions with various pH values. A unit test will conclude the unit.
Course Title: Chemistry Honors

Course #: 1533-1534

Course Description: Honors Chemistry is a rigorous, accelerated laboratory science course, which focuses on major principles and concepts of chemistry. Emphasis will be placed on developing critical thinking as applied to the study of physical chemistry, thermodynamics, equilibrium, stoichiometry, kinetics, atomic structure and chemical bonding, redox, and acid base reactions. The course is open to students who have demonstrated exceptional academic ability.

UC/CSU Approval: “d” approved

Grade Level: 10-11

Estimated Homework Per Week: 2-3 hours (approximately 1 hr per class meeting)

Prerequisite: A grade of “B” or higher in Biology or Biology Honors AND concurrent enrollment in Algebra 2. This course will prepare students for taking AP Chemistry and to succeed in university-level chemistry after graduation.

Recommended Prerequisite Skills:
Students should have an interest in physical science and a strong aptitude for math and science. Students are expected to read at a level at or above grade level and be motivated to learn at an accelerated pace. Students in this course must be able to work collaboratively and independently and to follow lab safety procedures.

Course Grading Categories:
- Quizzes: 20%
- Tests: 35%
- Homework and classwork: 15%
- Laboratory work, reports, and other projects or performance tasks: 15%
- Cumulative Exam: 15%
Major Assessments/Units/Topics:
The course introduces basic inorganic chemistry topics. Each unit will encompass short formative assessments, multiple hands-on laboratory activities and will culminate in a summative unit test. The semester final exams are cumulative; the spring semester exam includes concepts from the entire year. An approximation of content by unit is given below:

Unit 1: Measurement
Students will review the scientific method, lab safety, observations, measurements, conversions, dimensional analysis, graphing and density through a variety of activities, experiments and research. They will also learn about matter, quantitative and qualitative observations, separation techniques, homogeneous and heterogeneous mixtures, and physical and chemical properties.

Unit 2: Matter and Energy
Students will differentiate between mixtures and pure substances in the context of colloids, suspensions, compounds and elements. Students will become familiar with physical and chemical changes and identify their corresponding features in the laboratory setting. Students will explore kinetic molecular theory and relate this theory to the movements of particles in solids, liquids, gases and plasma. Additionally, students will differentiate between heat and temperature and relate heat flow to corresponding exo- and endothermic processes. Calorimetry will be used to determine heat changes in both physical and chemical processes.

Unit 3: Atomic Structure
Students will learn about the structure of atoms and the various historical and current models of atoms such as the Bohr and Quantum Mechanical model. The unit will include the locations, charges and relative masses of protons, electrons, neutrons. Calculations will include the relative abundances of isotopes, mass numbers, and numbers of electrons, protons or neutrons. Nuclear energy will include fission, fusion and radioactive decay.

Unit 4: Periodic Table
Students will learn to access specific information about individual elements based on their position on the periodic table. Atomic number, atomic mass, group, period, and the number of protons and electrons will all be established from the periodic table. Electron configurations will be written and discussed with respect to their position on the periodic table. Cation and anion formation and their respective oxidation numbers will be discussed in the context of stability and periodic trends. Lastly, orbital locations, size and shape will be explored and emission spectrum calculations related to frequency and wavelength will be practiced in the laboratory.

Unit 5: Bonding
Students will learn how to differentiate between ionic and covalent bonds, metallic bonds, and network solids. They will learn to write chemical formulas, Lewis Dot Structures, identify molecular shapes, and how to name molecular and ionic compounds. Trends in atomic and ionic size, electronegativity and ionization energy will be applied in investigating polarity and intermolecular bonds (London dispersion forces, dipole, hydrogen bonds).
Unit 6: Stoichiometry
Students will learn about the mole and its relationship with mass, volume and number of representative particles. Mass is conserved in chemical reactions and students will learn how to write and balance chemical equations and then use the mole ratio to find the limiting reactant and to calculate the amounts of reactants needed or the yield of products. They will then be able to calculate the percent yield and percent error in a lab analysis. The five main types of reactions, synthesis, decomposition, single and double replacement, and combustion reactions will be introduced in a series of demos and investigated further in the Types of Chemical Reactions Lab. Students will apply solubility rules for ionic compounds and the activity series of metals when predicting the types of products formed.

Unit 7: Gases
Students will learn about the properties of gases, such as compressibility and pressure, the relationship between pressure, temperature and volume, the Ideal Gas Law, mixtures of gases (partial pressures), vapor pressure, and ideal and real gases. The unit will start with a series of gas demos (collapsing can: Boyles Law; egg in the bottle, etc.)

Unit 8: Solutions
Students will first learn about the unique properties of water such as vapor pressure, surface tension, melting and boiling points, which are important as most reactions take place in an aqueous solution. Homogeneous aqueous solutions involve the concepts of solvents, solutes, solvation and saturation. Students will do calculations involving molarity, molality, dilutions, and percent by mass or volume. A demo involving a light bulb conductivity tester will show students which solutions contain strong or weak electrolytes or non-electrolytes. Heterogeneous solutions include suspensions and colloids and can be tested with the Tyndall Effect. Students will also experience working with a hydrate and finding the number of water molecules attached to the salt.

Unit 9: Acids and Bases
Students will learn how acids and bases are defined (Arrhenius, Brønsted/Lowry, and Lewis) and the focus will be on the Brønsted/Lowry conjugate acid base pairs. The strengths of acids and bases will be discussed and how to neutralize them. Titrations can be used to find out the molarity of acids of bases and indicators are used to show a change in pH by a color change. Calculations involving pH, pOH, [OH−], and [H+] will be performed.

Unit 10: Oxidation-Reduction
Students will be able to define oxidation and reduction in terms of losing or gaining electrons, assign oxidation numbers, identifying oxidation and reducing agents, making half reactions and finally balancing redox equations in both acidic and basic conditions.
Unit 11: Organic Chemistry

This unit teaches the properties, structures, and nomenclature of alkanes, alkenes, alkynes, isomers, hydrocarbon rings, and hydrocarbons with functional groups. A quick survey of carbohydrates, proteins, lipids and nucleic acids will conclude this course.
Course Title: Computer Science Tools and Web Integration

Course #: 1470-1471

Course Description:
Semester 1 - This course is designed to introduce the student to the principles of computer programming, with a focus on object-oriented design and implementation. Students will learn how to approach everyday problems and tasks from a programmer’s perspective. The class will focus on program design, implementation in JavaScript, algorithm analysis, standard data structures, and object-oriented programming design. Software development principles such as documentation, coding styles and testing principles are covered in this course.

Semester 2 - This course will focus on building functional websites using the WordPress platform. Students will take a hands-on, problem-solving approach to the basics of web design, self-hosting vs cloud hosting, graphics creation using Photoshop and online software, the purpose and use of specific pages in a menu, and basic digital marketing ideas.

UC/CSU Approval: “g” approved

Grade Level: 10-12

Estimated Homework Per Week: 1 hour per week
This is a general guideline for planning and scheduling purposes. A student’s ability level may affect actual preparation time needed.

Prerequisite: None

Recommended Prerequisite Skills: Problem solving skills, creativity, organization

Course Grade Scale:
Tests/Quizzes: 35%
Homework & Classwork: 50%
Final Assessment: 15%

Major Assessments/Units/Topics:
Assessments per unit: 1-2 Quizzes, 1 Unit Test, In class Activities, Programming Projects

Unit 1: Computers and The Internet
● The Internet
  ○ The Internet Protocol Suite
  ○ Domain Name System

● Encryption and Security
  ○ Simple Encryption
  ○ Encryption with Keys
  ○ Asymmetric Encryption

● Introduction to Computing
  ○ Computing Tasks
  ○ Selecting Hardware
  ○ Interfaces
  ○ Specialized Hardware

Unit 2: Spreadsheets & Data Processing
● Excel
  ○ Excel User Interface
  ○ Formatting Cells
  ○ Basic Math
  ○ Creating Charts and Graphs

Unit 3: JavaScript Programming
● The Basics of Programming
  ○ Definition of a Scripting Language
  ○ Syntax and Key Words
  ○ Data Types

● JavaScript
  ○ Variables and Constants
  ○ Functions
  ○ Arrays
  ○ Loops
  ○ Conditional Statements
  ○ Objects

● Web Games
  ○ JavaScript and Web Graphics
  ○ Developing with AppLab

Unit 4: HTML & CSS

Unit 5: Building Your Website
Course Title: Environmental Science

Course #: 1527-1528

Course Description:
Environmental Science is an interdisciplinary course that will build an understanding of the dynamic components of the earth’s environment. Topics of study include global climate change and the atmosphere, evidence for plate boundaries, principles of ecology, sustaining biodiversity, populations, land and water use, and energy. The class includes a field trip, classroom speakers, and home evaluation studies.

UC/CSU Approval: “d” approved

Grade Level: 10-12

Estimated Homework Per Week: 2-3 hours

Prerequisite: Completion of Biology

Recommended Prerequisite Skills: An interest in the environment and the world around you, measurements and data collecting, reading for detail, analyzing cause and effect relationships in environmental problems.

Course Grade Scale:
- Homework and Classwork: 20%
- Labs and Projects: 30%
- Quizzes and Tests: 35%
- Final Exam: 15%

Major Assessments/Units/Topics:
Major projects include building and sustaining an ecocolumns, a population study, watershed analysis, and a home energy use study.
Assessments per unit: 2 quizzes and 1 test per unit, 1 formal lab write up or project per unit.
FULL LIST OF TOPICS:

Global Climate Change and the Atmosphere
- Describe the composition of the Earth's atmosphere.
- Explain how the movement of air across the Earth's surface causes weather patterns and changes that may occur.
- Explain the role of ocean circulation on weather.
- What are the greenhouse gasses and how do they warm the atmosphere.
- Explain the cause and effects of global warming.

The Earth's Systems
- Describe the internal structure of the Earth with reference to the core, mantle and crust.
- Describe the theory of plate tectonics and the relationship between plate boundaries.
- Describe the rock cycle with reference to igneous, metamorphic and sedimentary rocks.
- Discuss the formation of soil and soil horizons.
- Explain what influences soil formation.
- Describe environmental problems associated with soil degradation.

Ecosystems
- Define the terms ecology, ecosystem, population, species, and environment. Describe the relationship of each of these to the biosphere.
- Recognize the impacts of biomass formation.
- Describe components of an organism's ecological niche, distinguishing between the fundamental and the realized niche.
- Explain how abiotic factors influence the distribution and abundance of organisms in a habitat.
- Use measurement techniques to obtain data from pH, light, temperature, dissolved oxygen, nitrogen and soil productivity from the field and ecocolumn.
- Explain how trophic levels are used to describe energy flow in an ecosystem. Explain how energy is transferred between these levels.
- Distinguish between producers, primary and secondary consumers, detritivores, and saprotrophs.

Biodiversity
- Explain what is meant by biodiversity and discuss the importance of preserving and managing it. Explain why the loss of biodiversity can have significant effects on the ecosystem as a whole.
- Identify regions of naturally occurring high biodiversity and describe the importance of these.
- Evaluate the stability of a species and relate anthropogenic causes for depletion.
Population Dynamics

- Distinguish between population density and population size.
- Use the terms uniform, random, and clumped to describe the distribution of individuals in a population. Describe factors governing these distributions.
- Use the terms density, distribution, natality, mortality, age structure, survivorship, and fecundity to describe a population.
- Explain how births, deaths, emigration and immigration affect population size.
- Explain carrying capacity, environmental resistance.
- Describe how carrying capacity, environmental resistance, and limiting factors affect population size. Distinguish between density dependent factors and density independence factors in population regulation.
- Describe the characteristics of exponential and sigmoidal growth curves. Identify phases of growth and describe factors regulating growth at each stage.
- Describe aspects of human population dynamics, including the effects of urbanization on demographics, environmental and economic impacts of an increasing human population.

Land Use

- Compare and contrast subsistence farming, intensive industrialized agriculture, and sustainable agriculture. Include organic and inorganic farming, pesticide use, energy inputs, amount of land used and long term sustainability.
- Compare and contrast chemical pest control and integrated pest management, including economic and environmental considerations.
- Describe soil degradation and erosion, and its effects on the environment. Describe soil conservation methods and explain how they can prevent soil degradation and loss.
- Describe different methods of forestry and their environmental impact. Comment on the sustainability of these methods in different situations.
- Describe the nature of rangelands and their utilization and management.
- Describe the role of reserve lands in preserving biodiversity.
- Discuss the issues surrounding urban development. Explain methods for sustainable urban and city development, including efficient city design and transport options.
- Evaluate the causes for deforestation world-wide.

Water Use

- Describe the availability of fresh water on Earth.
- Describe the nature and extent of the Earth's fresh water and salt water resources.
- Describe agricultural, industrial, and domestic use of fresh water by humans.
- Discuss local global issues associated with water use including pollution of groundwater, damming and flood control, and supply of potable water.
- Study a local watershed and household consumption of fresh water.
- Explain what is meant by maximum sustainable yield, including its calculation and its use in fisheries management.
- Discuss the ecological impacts of commercial fishing practices with reference to netting, trolling, lining, and trawling. Explain the significance of by-catch to marine ecosystems.
Discuss the impact of aquaculture as an alternative to fishing natural populations.

Explain what is meant by water pollution, distinguishing between point source pollution and non-point source pollution.

Describe the effect of organic effluent and fertilizer run off on aquatic ecosystems.

**Energy Resources**

Recall basic energy concepts, forms of energy, energy transformation and laws of thermodynamics. Recall that energy is lost from the system at each transformation.

Describe the different methods of non-renewable electricity generation.

Describe the methods of coal and oil extraction and the effects of these on the environment.

Discuss the advantages and disadvantages of using coal and oil as a source of energy. Include considerations of economic and environmental impacts, an efficiency with which usable forms of energy are produced.

Describe nuclear power generation. Discuss its advantages and disadvantages, including short and long term environmental effects.

Discuss the production of renewable energy sources.

Explain how hydroelectric power is generated and its effect on the environment.

Demonstrate passive solar design in constructing buildings.

Describe the production of electricity from solar energy, wind energy, wave and tidal energy, geothermal energy, biofuels, and hydrogen fuel cells.

Discuss the future use, advantages, and disadvantages of renewable energy sources.

Discuss measures for treating, preventing, and reducing pollutants such as oil spills.

Describe the causes and effects of major environmental disasters, including oil spills, nuclear disasters, and industrial accidents. Discuss their immediate and longer term effects. Describe clean up methods and explain the reasons for the use of specific methods in particular situations.

Discuss the role of legislation in reducing or preventing pollution.
Course Title: Forensic Science

Course #: 1547-1548

Course Description: Forensic science is a laboratory-based, introduction to the analysis of crime scenes by collecting and analyzing physical evidence. This course is designed to integrate the fundamental scientific disciplines while giving students both theory and hands-on experience with the skills and knowledge required of a forensic crime scene investigator.

UC/CSU Approval: “d” approved

Grade Level: 11-12

Estimated Homework Per Week: 3 hours per week

Prerequisite: Completion of Biology

Recommended Prerequisite Skills: Basic math, strong foundation in note taking, knowledge of the scientific method, data collection skills, conducting research, basic hands-on laboratory skills, problem solving, evidence collection, lab safety, technical reading, and logical thinking.

Course Grade Scale:
- Tests and Quizzes: 40%
- Homework and classwork: 15%
- Labs, Investigations and Projects: 30%
- Final exam: 15%

Major Assessments/Units/Topics:
For each unit, students will be assessed with a lab report and at least one case analysis. There are approximately 6 exams per semester in addition to the final exam.

Forensic analysis topics will include, but are not limited to:

**Unit 1: Observation Skills**
Students test their observation skills and relate them to how they play a role in forensic science. Students will learn about what changes occur in the brain during observing the world around them. Students will debate the reliability of eyewitness testimony in the court system.
Unit 2: Crime Scene Investigation and Evidence Collection
Students will learn the procedures of crime scene investigations. They will learn about who is involved in the CSI team and their individual tasks when arriving at a crime scene. Students will learn how to sketch a crime scene and accurately measure each object present at the time of the crime.

Unit 3: The Study of Hair
Students will learn the anatomy of hair and how to analyze hair from different individuals. Students will learn the differences between human and animal hair samples. Students will analyze their own hair through a microscope to examine the different features. They will be able to define mtDNA, its role in hair analysis and how it can be used to identify a person.

Unit 4: The Study of Fibers and Textiles
Students will learn about different fibers, how to collect fibers from a crime scene and the distinguishing characteristics of those fibers. Students will work with various types of fiber and perform a burn test, solvent test, stain test and microscopic examination to determine how the fibers compare with one another, based on results.

Unit 5: Fingerprints
Students will learn about the various fingerprint patterns and the frequencies of each in a given population. Students will learn how to lift and collect latent and patent fingerprints from a crime scene. They will also learn how to make latent prints visible using various forensic science techniques.

Unit 6: DNA Fingerprints
Students will be able to explain the importance of DNA in crime scene investigations. Students will learn how evidence is prepared in order to obtain DNA from the sample. They will be able to explain what a short tandem repeat is and its importance in DNA profiling.

Unit 7: Blood and Blood Spatter
Students will be able to describe the forensic importance of the different types of blood cells and how to determine blood types. They will be able to analyze blood-spatter evidence by calculating the angle of impact, area of convergence and area of origin. Students will learn how to compare and investigate the various types of blood-spatter patterns.

Unit 8: Drug Identification and Toxicology
Students will learn about different drugs, poisons and toxins. They will be able to describe how people are exposed to drugs and describe their effects on the body. Students will present the signs and symptoms of overdose with a specific substance or combination of substances.
Unit 9: Handwriting Analysis, Forgery, & Counterfeiting
Students will learn about the recent developments in handwriting analysis and the limitations within these technologies. They will compare and contrast older paper currencies with new currencies, including those on plastic stock. Students will be able to explain how a sample of handwriting evidence is compared by using both qualitative and quantitative analysis.

Unit 10: Death: Meaning, Manner, Mechanism, Cause and Time
Students will learn about how to determine the cause, manner and mechanism of death. They will be able to sequence and describe the chemical and physical changes during decomposition. Students will distinguish among the four manners of death, which include, natural, accidental, suicidal and homicidal. The role of coroners will be explored as well as the role of medical examiners.

Unit 11: Forensic Anthropology
Students will be able to interpret the information a forensic anthropologist acquires from skeletal remains to construct a biological profile. Bone growth will be analyzed in order to estimate the age of the deceased. Bone structure will be scrutinized to determine the sex of the deceased. Methodology will be used to inspect skeletal remains including, radiology, DNA, computer imaging and craniofacial reconstruction.

Unit 12: Casts and Impressions
Students will determine how impression evidence gives indication of who was at the crime scene, events that took place and a basic overview of the scene. Students will discuss how evidence, such as foot, shoe and dental impressions, is considered class evidence and not individual evidence. They will analyze the methodology used when creating an impression or cast.

Unit 13: Tool Marks
Students will analyze how crime scene investigators utilize evidence from tools and tool marks to help solve crimes. They will look for specific tool markings in order to help determine the type of tool that produced those markings. Examples will be provided of various materials found in different types of tools, which could be used to link a person to a crime scene.

Unit 14: Ballistics
Students will compare and contrast different types of firearms including handguns, rifles and shotguns. New technology will be assessed to show how it has improved the collection and analysis of firearm and ballistic evidence. Entrance and exit wounds are studied to help determine the type of firearm used in a crime.
Course Title: Introduction to STEAM

Course #: 1505-1506

Course Description:
Students will engage in interdisciplinary learning of Science, Technology, Engineering, Art, and Math through a hands-on project based approach. The core of the class will be learning problem solving as design process. In doing so students will receive introductory level exploratory instruction on topics including proper use of machinery tools, foundation in applied physics, basic concepts of mechanical and electrical engineering, writing computer programs, designing and creating models using a Computer-Aided Design (CAD), and real-world applications of classroom concepts. Acquiring of knowledge will be demonstrated through a series of projects, starting with research and initial design and culminating with the completion of build projects that are geared toward solving real-world problems.

UC/CSU Approval: “g” approved

Grade Level: 9-12

Estimated Homework Per Week: 0 - 1 hr

Prerequisite: Concurrent enrollment in Algebra I or higher-level math

Recommended Prerequisite Skills: Good analytical skills and attention to detail.

Course Grade Scale:
- Homework: 15%
- Tests/Quizzes: 15%
- Projects: 50%
- Final Project: 20%

Major Assessments/Units/Topics:
Intro to STEAM is very project based. Students will make many projects as well as document the design process for each project in an Engineering Design Notebook. There will also be 4 - 6 quizzes per semester.
Unit 1: Introduction to STEAM
This is a quick unit introducing STEAM and STEAM careers. Students will research, make a presentation, and present to the class a STEAM career. Students will learn from their own presentation as well as others.

Unit 2: The Engineering Design Process
In this unit, students learn about the engineering design process and how to properly document their engineering designs as engineers do in the real-world for documenting patented designs.

- 2.1 Brainstorming: Students will do several exploratory and research activities on how to best brainstorm. Students will then do a project where they use their brainstorming skills to create an innovative design to successfully move ‘toxic waste’ from Cathedral to an un-named location (the ‘toxic waste’ is represented by blocks and it is moved from one table to another using paper, straws, tape, and McGyver skills).

- 2.2 Research: Students learn how to do research to help generate ideas and also to aid in their design. Students utilize their researching skills to help design and build a popsicle stick bridge. The highlight of the project is the competition day where weights are put on their popsicle stick bridges to see determine the strength of their bridge.

- 2.3 Design: Students learn about how to make a detailed drawing to illustrate their design. Students also learn a 3D modeling program and how to design parts and assemblies in 3D. Finally, students are introduced to and learn about the tools in the shop. Most students initially think that this is an easy task, but are surprised to find out how difficult it can be.

- 2.4 Testing and Modification: Students will learn the importance of testing their projects and refining them to continually improve their designs. A quick paper airplane project will help them to practice this skill as they make different designs and modify their designs and track their results.

Semester 1 Final Project: Students will select a real-world problem and design a product to address the problem using the skills they have learned over the first semester. They will then make a commercial about their product. In this project, they will brainstorm, research, design, test, and modify their product.

Unit 3: Simple Machines and Newton’s Laws
Students will learn the 6 simple machines and Newton’s Laws. They will then apply this to make a car fueled by Newton’s Laws and taking advantage of simple machines. Students cars will compete to see which car travels the desired distances most accurately.

Unit 4: Electric Circuits
Students will learn what an electric circuit is and learn about the two types of circuits. Students will learn how to do calculations and how to make simple circuits. Students will utilize these skills by creating a scaled house or some other project which they will create a circuit to light up the project using Christmas lights.
Unit 5: Programming
Students will learn basic programming skills and demonstrate these skills with a project which varies from year to year.

Semester 2 Final Project: For the semester 2 final project, students will choose a project that demonstrates the skills they acquired during the year.
Course Title: Physics

Course #: 1541-1542

Course Description:
Students engage in exploration of the general concepts of physics. In this challenging course, the main emphasis is on the introductory conceptual aspects of physics in both the lecture and laboratory sections of the class. Critical thinking skills are learned through projects and investigative experience. Strong analytical skills are used to solve conceptual physics problems and projects. Physics is an introductory course in algebra-based high school physics designed to provide students a basic understanding of physics principles in the areas of mechanics, work and energy, electricity and magnetism, semiconductors, waves, optics, and modern physics.

UC/CSU Approval: “d” approved

Grade Level: 10-12

Estimated Homework Per Week: 2.5 hours

Prerequisite: Completion of Algebra II with a grade of “C” or higher both semesters
  - Recommended: concurrent enrollment in Pre-Calculus

Recommended Prerequisite Skills:
Good ability to solve word problems and apply knowledge of complicated concepts. Good understanding of algebra.

Course Grade Scale:
- Homework: 10%
- Labs: 20%
- Quizzes: 20%
- Tests: 30%
- Final: 20%

Major Assessments/Units/Topics:
For each unit, students learn through in-class lectures and demonstrations. Students apply their knowledge in the labs and hands on activities. Students also read the textbook to complement the in-class lectures and activities. Each unit typically has 1 - 3 quizzes, 1-2 labs, and a unit assessment which is often a test.
Unit 1: Kinematics: Motion of objects. Students will begin this unit reviewing math concepts required for the year of physics. Students will also learn about speed and acceleration and the how to solve real-world problems using kinematic equations. A lab will be done where students graph their motion showing the relationship between speed and acceleration.

Unit 2: Dynamics: In this unit, forces and how they interact with the motion of objects are explored. Students learn about Newton’s Laws through reading the textbook, through in class lectures, demonstrations, and discussions, and through student activities and labs. Dynamics is a fun topic which we explore with hands on activities as time allows. Possible labs in this unit are terminal velocity of a coffee filter or applying Newton's 2nd Law to see how the force of one rolling ball causes acceleration of a second ball.

Unit 3: Momentum and Energy: Students learn about momentum and energy and how they relate to one another. Students perform calculations demonstrating their knowledge of these concepts. This is a shorter unit and, if time permits, there may be an online lab on colliding carts. There are many fun demonstrations on how momentum can be transferred from one object to another.

Unit 4: Rotational Motion, Gravity, and Projectile Motion: Students will learn about rotational motion, projectile motion, and about space—the physics of planetary, satellite motion, and tides. Students will have a quiz on rotational motion. For planetary motion, tides, and gravitational fields, students will research one of the topics and present to the class their topic.

Semester 1 Final: The semester 1 final is an exam which covers all the topics from the first semester up through rotational motion.

Unit 4 Continued: Projectile Motion and Gravity: Students will continue to learn about projectile motion and gravity. Students will do a lab on projectile motion.

Unit 5: Properties of Matter, Heat, and Thermodynamics: Students will review the properties of matter but looking at it from a physics point of view. Students will see how the properties of matter result in a material being conductive or insulating. Students will also learn how the energy of heat can be transformed into energy of motion. Students will explore these concepts in a lab.

Unit 6: Waves: Students will learn about the properties of waves and how waves can carry energy. Students will explore these properties in a lab.

Unit 7: Electricity and Magnetism: Students will learn about static electricity, electric circuits, and magnetism. Students will learn some practical applications with simple circuits and magnets. Students will apply this knowledge in a lab.
Semester 2 Final Project: The semester 2 final project is a Rube Goldberg device. Each step of the Rube Goldberg device demonstrates a different physics concepts. Students build the device in groups.
Course Title: Sports Medicine 1 & 2

Course #: 1522-1523

Sports Medicine 1 - Foundations of Athletic Training (Fall Semester only)
This course is designed for students who have a genuine interest in the sports medicine field and would like to learn the basics of the profession of athletic training. Students will not only learn about the history of athletic training, but also what it takes to become an athletic trainer. The course provides the study and application of the following components: Mechanisms and characteristics of sport trauma; shoulder, knee, and ankle anatomy and injuries; taping and wrapping techniques; infection control in the athletic environment; wound care; and basic life-saving skills training in CPR, AED, and first aid through the American Red Cross. Students can earn a CPR/AED/first aid certification in the class. No textbook is required for this course.

Sports Medicine 2 - Exercise Physiology (Spring Semester only)
This course builds on the traditional disciplines of anatomy and physiology by focusing on alterations and adaptations in body systems during physical activity. Students will cover a range of topics including: The history of exercise physiology in the U.S.; reflexes; muscle physiology; cardiorespiratory response to exercise; thermoregulation; and nutrition for athletic performance. Students explore these topics through several projects, labs, and a semester-long investigation. Some labs will require physical activity. No textbook is required for this course.

UC/CSU Approval: “g” elective (not “d” science)

Grade Level: 10-12

Estimated Homework Per Week: Approximately 2 hours per week

Prerequisite: A grade of “C” or higher in Biology AND a “C” or higher in Anatomy & Physiology or concurrent enrollment in Anatomy & Physiology

Recommended Prerequisite Skills:
- Grade level reading comprehension
- A genuine interest in sports, exercise, and human anatomy
Course Grade Scale:
- Homework and Class assignments: 10%
- Labs and Projects: 20%
- Quizzes: 20%
- Tests: 30%
- Semester Exam: 20%

Sports Medicine 1– Major Assessments/Units/Topics:

Unit 1: Careers in Sports Medicine and the history of athletic training  
Students will learn about different careers that fall under the sports medicine umbrella through a research assignment. Students also will understand the history of the profession of athletic training through a timeline activity.  
Major Assessment: Unit test

Unit 2: Anatomy and Medical terminology  
Students get a refresher on anatomical terminology they learned in anatomy and physiology. This includes body landmarks and directional terminology. Students learn proper terminology for types of body movements and demonstrate their understanding through a group project.  
Major assessments: Quiz and Unit test

Unit 3: Mechanisms and characteristics of sport trauma  
Students define and use proper medical terminology pertaining to sports injuries. Students will be able to analyze the mechanical properties of tissue based on the stress-strain curve model. Students learn about the types of tissue loads that can produce stress and strain. Students evaluate different injuries to the musculotendinous unit, synovial joints, and bones. Students demonstrate the off-the-field injury evaluation scheme (HOPS) through a case study project.  
Major assessments: Quiz and Unit test

Unit 4: Musculoskeletal Conditions  
Students will be able to identify the major anatomical components of the foot/ankle, knee, and shoulder. Students will know the common injuries of the foot/ankle, knee, and shoulder. Students learn how to tape an ankle.  
Major assessments: Quiz and Unit test

Unit 5: Concussions  
Students know what a concussion is and what steps are taken to care for a concussion. Students learn the signs and symptoms of concussions. Students understand the proper protocol for returning back to sport after sustaining a concussion. Students recognize the seriousness of concussions and be aware of the length of time potentially needed for recovery. Students will be familiar with the standardized assessment of concussions.  
Major assessment: Unit Quiz
Unit 6: Infectious Diseases and wound care
In this unit, students learn about infectious diseases and the importance of following universal precautions in professional and athletic environments to protect themselves and others from harmful bloodborne pathogens. Students also learn about the different types of wounds and demonstrate proper care for them through the completion of a lab.
Major assessments: Unit Test

Unit 7: Emergency Care
Students learn the basic life-saving skills training in CPR, AED, and first aid through the American Red Cross curriculum. Students can earn a CPR/AED/first aid certification that is good for two years with a passing unit test score.
Major assessment: Unit Test

Sports Medicine 2– Major Assessments/Units/Topics:
Unit 1: History of Exercise Physiology
Students learn about the factors influencing physical fitness in the U.S. over the past century.
Major assessment: Unit Test

Unit 2: The nervous system and reflexes
Students learn the general nervous system structure and function, the components of a reflex arc, how to test for reflexes, and how exercise can enhance brain/nervous system health.
Major Assessments: Quiz and Unit Test

Unit 3: Muscle physiology
Students learn about the structure of muscles, all the way down to the microstructure. They will demonstrate the steps leading up to a muscular contraction. This unit also covers the different muscle actions, types of muscle fibers, muscle fatigue, and the changes in muscles due to exercise, inactivity, and aging.
Major Assessments: Quiz and Unit Test

Unit 4: The cardiorespiratory system and exercise
In this unit, students explore the topics of the heart’s response to exercise and the mechanics of breathing during exercise. They will be able to calculate cardiac output, estimated maximal heart rate, and their estimated VO2 max—which evaluates their overall cardiorespiratory fitness.
Major Assessments: Quizzes and a Unit Test

Unit 5: Temperature Regulation
Students learn the basics on how the body regulates temperature. They will understand how the body responds to exercise in hot and cold environments and the dangers associated with each.
Major Assessments: Unit Test
Unit 6: Nutrition for performance
Students receive a general overview of everyday nutrition by learning about necessary macro and micronutrients as well as how to read nutrition labels and calculate calories. Then they learn about the nutrition necessary for an athlete in training. Students will know how to calculate their BMI and create a one day meal plan tailored to their needs as a specific type of athlete. Major Assessments: Unit Test
Course Title: STEAM Capstone and Practicum

Course #: 1515-1516

Course Description:
The major skills and concepts learned in Intro to STEAM, Advanced STEAM, and Engineering Design converge in the Engineering Capstone and Practicum. In this course students will work as a team to develop a solution to a technical problem of their choice. Students identify an issue, problem, or need and, using the engineering design process, research, design, build, test, and present their solution to a panel of peers, faculty, and/or professionals. In addition, students will partake in a practicum where they will choose a career interest and related company to spend time gaining field experience over the course of the school year.

UC/CSU Approval: “d” approved

Grade Level: 12

Estimated Homework Per Week: 1-2 hours

Prerequisite: Successful completion of Introduction to STEAM and Advanced STEAM. Completion or concurrent enrollment in Engineering Design.

Recommended Prerequisite Skills: Basic desktop computer knowledge, programming languages, tool and machine use, spreadsheets, CAD.

Course Grade Scale:
- Homework: 20%
- Projects: 50%
- Final Project: 30%

Major Assessments/Units/Topics:
Pertaining to the following topics, students will learn concepts and skills that apply while utilizing them with hypothetical projects. Once students grasp the information they will then apply it to their capstone project. Assessments will consist of progress updates, deliverables, and presentations throughout the project’s life. The first semester final will include schematic design testing results. The second semester final will be solution presentations to peers and professionals.
1. Project Management  
   a. Scope  
   b. Schedule - Gantt charts  
   c. Resources  
   d. Budget - Spreadsheets  
   e. Time - Time management  
   f. Deliverables - Internal and External  
2. Research  
   a. Techniques  
   b. Feasibility  
   c. Demographics  
3. Design  
   a. Preliminary Design  
   b. Flow Charts  
   c. Schematics  
   d. Bill of Materials  
4. Prototyping  
   a. 3D Modeling  
   b. Scaled Models  
5. Testing - Students will  
   a. Beta Testing  
   b. Program Testing  
   c. Schematic Testing  
6. Analysis  
   a. Data Analysis  
   b. Modifications  
7. Resolutions  
8. Marketing  
   a. Advertising  
   b. Demographics  
   c. Graphic Design