Chino Valley Unified School District
High School Course Description

A. CONTACTS	
1. School/District Information:	School/District: Chino Valley Unified School District Street Address: 5130 Riverside Drive Phone: 909 628-1201 Web Site: www.chino.k12.ca.us
2. Course Contact:	Teacher Contact: Office of Secondary Curriculum Position/Title: Director of Secondary Curriculum Site: District Office Phone: (909)628-1201 X1630
B. COVER PAGE - COURSE ID	
1. Course Title:	Physics in the Universe
2. Transcript Title/Abbreviation:	Physics Uni
3. Transcript Course Code/Number:	5S05
4. Seeking Honors Distinction:	No
5. Subject Area/Category:	Meets the UC/CSU "d" Laboratory Science requirement
6. Grade Level(s):	9-12
7. Unit Value:	5 credits per semester/10 credits total
8. Course Previously Approved by UC:	No
9. Classified as a Career Technical Education Course:	No
10. Modeled after an UC-approved course:	Yes
11. Repeatable for Credit:	No
12. Date of Board Approval:	May 7, 2020 / March 3, 2022
13. Brief Course Description: This course is a laboratory science course designed for the college-bound student that emphasizes students' ability to demonstrate their knowledge of Physics within the context of the Science and Engineering Practices delineated in the Next Generation Science Standards (NGSS). This course specifically examines the role of Physics Laws and processes in driving the Earth system.	
14. Prerequisites:	Co-requisite: Integrated Math 2 or Higher
15. Context for Course: Physics in the Universe is one of three courses in California's three-course model for high schools implementing NGSS. To highlight the nature of Earth and Space Sciences (ESS) as an interdisciplinary pursuit with crucial importance in California, the course presents an integration of ESS and Physics.	
16. History of Course Development: The course was developed to meet the 2013 state adopted NGSS standards for the advanced learner. It is one course from a three-course model that combines all high school performance expectations into three courses.	
17. Textbooks:	Savvas Learning Company LLC. *Experience Physics.* Cochran, Moore, Sterlace, Wysession. Grades 9-12. 2022
18. Supplemental Instructional Materials:	Teacher-created materials, as needed
C. COURSE CONTENT	
1. Course Purpose: Physics in the Universe is a college prep lab science class aligned with the Next Generation Science Standards (NGSS). In this class, students will learn core Physics concepts as well as some Earth Science and Astronomy which require Physics to explain and understand. Students build off their prior knowledge through an inquiry-driven curriculum that emphasizes the three dimensions of the NGSS: content knowledge, science and engineering practices (such as asking questions, scientific modeling, and analyzing data), and cross-cutting concepts (such as energy, patterns, and systems). The course includes units	

where students will investigate forces and motion, forces at a distance, energy conservation and renewable energy, nuclear processes and Earth history, waves and electromagnetic radiation, and stars and the origin of the universe.

2. Course Outline:

Forces and Motion

Students make predictions using Newton's Laws, investigate collisions in Earth's crust and complete an engineering challenge. Students mathematically describe how changes in motion relate to forces. Students conduct investigations of collisions between objects to develop a mathematical understanding of Newton's Laws. Students will use their models of conservation of momentum and the relationship between force, mass, and acceleration to make predictions for how objects would move and interact together. Students will investigate how different materials will respond to collision forces and how that can apply to construction techniques.

Forces at a Distance

Students investigate gravitational and electromagnetic forces and describe them mathematically. They predict the motion of orbiting objects in the solar system. They link the macroscopic properties of materials to microscopic electromagnetic attractions.

Energy Conservation and Conversion

Students track energy transfer and conversion through different stages. They evaluate different energy generating technologies. They investigate electromagnetism to create models of how generators work and obtain and communicate information about how solar photovoltaic systems operate. They design and test their own energy conversion devices. These ideas comprise of the most unifying crosscutting concept from Physics and all other sciences, conservation of energy.

Nuclear Processes

Students develop a model of the internal structure of atoms and then extend it to include the processes of fission, fusion, and radioactive decay. They apply this model to understanding nuclear power and radiometric dating. They use evidence from rock ages to reconstruct the history of the Earth and processes that shape its surface.

Waves and Electromagnetic Radiation

Students make mathematical models of waves and apply them to seismic waves traveling through the Earth. They obtain and communicate information about other interactions between waves and matter with a particular focus on electromagnetic waves.

Stars and Origin of the Universe

Students apply their model of nuclear fusion to trace the flow of energy from the Sun's core to Earth. They use evidence from the spectra of stars and galaxies to determine the composition of stars and construct an explanation of the origin of the Universe.

3. Key Assignments:

Forces and Motion

Assignments:

Students will do research and collect data through experimentation to substantiate Newton's second law of motion. Students will produce a mathematical model to describe how the net force on an object will affect its, speed, direction and momentum. As an extension, students will use mathematical representations to support the claim that total momentum of the system is conserved with no net force on the system.

Lab Activities:

Using a low friction system such as air tracks and glider carts along with metersticks and timers, students will investigate the effect of linear force on the speed of the glider cart.

Students will investigate inelastic and elastic collisions on the velocity and direction of the carts. Students further develop concepts of momentum by engineering a structure to protect a delicate object, like an egg, from damage during a collision and analyze the results.

Forces at a Distance
Assignments:
Students will use research and hands on lab activities to understand that gravity is the force of attraction that causes objects to fall toward the center of the Earth and that air resistance can slow down the acceleration of a falling object.
Lab Activities:
Students will investigate, using various objects, the acceleration due to gravity at Earth's surface.
Students create charges on objects such as glass rods and balloons by rubbing and by induction. They determine what objects are positively charged and which are negatively charged.

Energy Conservation and Conversion
Assignments:
Through research and laboratory investigation students will understand the relationship between the different forms of energy and conversion from one form to another.
Lab Activities:
Students will design and build simple energy conversion devices with available resources which includes ramps, springs, rubber bands etc. Students will then analyze the results.

Nuclear Processes
Assignments:
Students will use research and lab activities to understand how the structure of the atom determines nuclear processes that effect the Earth. Also, how those same predictable processes can be used to determine the age of rocks and Earth's history.
Lab Activities:
They will use simulations to model the decay of radioactive isotopes. Students will simulate the transformation of a radioactive isotope over time, graph the data and relate it to radioactive decay and half-lives. After completing these activities students will be able to determine the age of an unknown sample.

Waves and Electromagnetic Radiation
Assignments:
Through research and lab activities students will understand the relationship between P and S seismic waves. Students will understand the relationship between energy within a wave and how that is measured. Students will obtain and communicate information about other interaction between waves and matter.
Lab Activities:
Students will use wave apparatus, including springs, strings, and ripple tanks to understand the difference between wavelength, speed and amplitude in different media. This is used to determine the epicenter of earthquakes using realistic data sets from historic earthquakes and determine their relative magnitudes.

Stars and Origin of the Universe
Assignments:
Through research and hands on inquiry students will discover how spectra created by energizing different elements can be used to identify the element. Students will be able to identify unknown substances via their emission spectra. Students will then apply this knowledge to the discovery of the composition of different stars.
Lab Activities:
Students in groups use a large balloon and partially blow it up to model the expanding universe. Students then make random dots on the balloon and label them. The first point represents the Milky Way galaxy while the other points represent distant galaxies. Students measure the distance from the Milky Way to the other points. They then blow up the balloon to several larger sizes and measure the distance from the Milky Way to the other points.

4. Instructional Methods and/or Strategies:

- Lab-based learning (skills-based labs as well as student designed and implemented labs)
- Cross Cutting Concepts (Patterns, Similarity and Diversity; Cause and Effect; Scale, Proportion and Quantity; Systems and Systems Models; Energy and Matter; Structure and Function; Stability and Change)

- Science and Engineering Practices (Asking Questions and Defining Problems; Developing and Using Models; Planning and Carrying out Investigations; Analyzing and Interpreting Data; Using Mathematics, Information and Computer Technology and Computational Thinking; Constructing Explanations and Designing Solutions; Engaging in Argument from Evidence; Obtaining, Evaluating and Communication Information)
- Data interpretation and predictions
- Jigsaw research projects (students or student groups research different aspects of a topic and report their learning back to the whole class, e.g. different types of invasive species or genetic disorders)
- Computer based research projects: individual students or groups research
- Evidence based data interpretation (Claim, Evidence and Reasoning writing from labs or research projects)
- Student centered and created activities (e.g. Evolution Island where students determine changes over time to organisms (e.g. rats) on islands with different ecosystems)
- Scientific article reading, annotation and/or class report/presentation
- Using CER (claims, evidence, and reasoning) graphic organizer
- Project Based Learning
- Argument Driven Instruction
- "5 E" Lessons (Engage, Explore, Explain, Elaborate and Evaluate)
- Phenomena

5. Assessment Including Methods and/or Tools:

The evaluation of student progress and evaluation will be based on the following criteria outlined in board policy:

- Assessments (tests, quizzes, labs, cumulative projects): 60-75% of the final grade
- Assignments and class discussions: 25-40% of the final grade