

Physics of the Universe Syllabus and Course Objectives

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Course Overview: This is a lab-based science course. We will explore many topics related to matter, motion, and the universe. Students are expected to develop 21st century skills, recognize the cross cutting themes, and practice the scientific habits of mind.

Classroom Expectations to create a positive learning environment: Students are expected to **be in their assigned seats**, and to begin silently following directions as the bell rings. The **first 4 minutes of class will always be silent** and directions will be on the board. Students (and teachers) are expected to treat every member of the learning community with **respect at all times**. This includes raising a hand and waiting to be called on before speaking, listening when others are speaking, and participating in all activities. The materials listed below should be brought to class every day and taken out before the bell rings.

Grading: Academic grades are intended to accurately reflect each student's demonstrated mastery of the content. The most straightforward way to demonstrate that mastery is by performing well on tests. However, all evidence of understanding will be taken into account when grades are determined. If you disagree with a grade you are encouraged to argue your case (outside of class). Be prepared to discuss the standard(s) in question, answer questions, and demonstrate your understanding of the topic.

Homework: Practice develops skills. A reasonable amount of homework will be assigned each week.

Final Exam: At the end of each semester there will be a cumulative Final Exam (the last assessment opportunity for each standard).

Materials to bring Every Day:

Notebook, Reader, and/or binder
Pens and Pencils
Scientific Calculator

21st Century Skills – Essential for Success

1. Creativity: The use of imagination or original ideas in the production of work
2. Communication: The exchanging of information through writing/reading and speaking/listening
3. Collaboration: The action of working with someone or a group to produce something
4. Critical Thinking: The objective analysis and evaluation of something in order to form a judgment
5. Cultural Competency: The ability to work effectively and appropriately with people of different cultures.

Cross Cutting Concepts – Themes Found Throughout All of Science (and Beyond)

1. Patterns
2. Cause and effect
3. Scale, proportion, and quantity
4. Systems and system models
5. Energy and matter
6. Structure and function
7. Stability and change

Scientific Practices

– The Scientific Habits of Mind

1. Asking questions and defining problems
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations for science and designing solutions for engineering
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Disciplinary Core Ideas/Standards

Unit 1 Forces and Motion

Conservation of Momentum
Velocity vs. Acceleration
Analyze data to support Newton's Laws
Design and Evaluate devices that minimize Forces during collisions
Project: Design and build a helmet or a bumper that minimizes the force on a dynamics cart during a collision.

Unit 2 Forces at a Distance

Electromagnetic Forces and Charge
Gravitational Forces and Mass
The Four Forces of the Universe
Orbital Motion
Project: Design a star system and compare it to our Solar System

Unit 3 Energy Conversion

Modeling Different Types of Energy
Conservation of Energy
Project: Design a Roller Coaster
Semester Break
Modeling how Forces cause Changes in Energy
Electromagnetic Induction
Electromagnetism
Engineer a Device that Converts one form of Energy into another

Evaluate different energy sources used by human society

Project: Design and build a functional model of an electric generator.

Unit 4 Waves and E&M Radiation

Apply the wave equation in various media
Evaluate the Wave-Particle Duality of EM
Evaluate the published claims about the effects of EM radiation
Communicate information about modern devices that use wave energy
Use a model of Earthquakes to validate the Earth's internal structure
Project: EM research and presentation

Unit 5 Nuclear Processes

Model Nuclear Processes
Evaluate the evidence for Plate Tectonics
Construct an account of Earth's Formation and Early History
Project: Create a Fossil Journal, use data to determine the age of a fossil.

Unit 6 Stars and Universe Origins

Model Stars' Life cycles
Construct an Explanation of the Universe's Origin based on Evidence
Communicate ideas about how elements are produced
Project: Draw a poster showing the life cycle of a star.