Earth Science A

Course Syllabus

Course Description

This one year course explores the foundations of Earth Science in the following related topics / fields: Earth's place in the universe, dynamic Earth processes, Energy in the Earth system, biochemical cycles, structure and composition of the atmosphere, and California geology. Students will have the opportunity for self assessment as well as for teacher guidance and assessment throughout the course including the preparation and finalization of two semester Problem Solving Projects, which focus on research, organization, and drafting strategies. The course covers scientific terminology, historical and cultural advances in science, vocabulary building, test taking strategies, and several simulated labs, hands-on labs, the essay, workplace documents, and science projects using the scientific method.

Course Objectives

Students will develop an understanding of:

- Earth's place in the universe
- Galaxies and stars
- Solar systems
- Planets and satellites
- Planet Earth
- Tectonic processes
- Oceans
- Atmosphere
- Energy in the Earth system
- Earth's energy budget: inflow and outflow
- Circulation in the oceans and atmosphere
- Climate variations in time and space
- Biochemical cycles
- Rock cycle
- Water, Carbon, and Nitrogen Cycles
- California Geology
- Tectonic evolution
- Major economic Earth resources
- Surface processes
- Natural hazards
- Geographic Mapping
- Investigation and experimentation
- Question formation
- Planning a scientific investigation
- Observation and data collection

- Data analysis / graphing
- Drawing conclusions and communicating explanations
- Nature of science
- Scientific inquiry
- Scientific ethics
- Historical perspectives
- Science and society
- Science literacy
- Diversity
- Science, technology, and society
- safety

Textbook(s) This course is not textbook dependent.

Unit	Topics	Assignments

1	Introduction to Earth Science Investigation and Experimentation	Lectures: A. Question Formation 1. Formulate and evaluate a viable hypothesis 2. Recognize the value and role of observation prior to question formulation 3. Recognize the iterative nature of questioning 4. Given an experimental design, identify possible hypotheses that it may test B. Planning a Scientific Investigation 1. Given a hypothesis, formulate an investigation or experimental design to test that hypothesis 2. Evaluate an experimental design for its suitability to test a given hypothesis 3. Distinguish between variable and controlled parameters C. Observation and Data Collection 1. Identify changes in natural phenomena over time without manipulating the phenomena (e.g., a tree limb, a grove of trees, a stream, a hill slope) 2. Analyze the locations, sequences, and time intervals that are characteristic of natural phenomena (e.g., locations of planets over time, succession of species in an ecosystem) 3. Select and use appropriate tools and technology (e.g., computer-linked probes, spreadsheets, graphing calculators) to perform tests, collect data, analyze relationships, and display data 4. Evaluate the precision, accuracy, and reproducibility of data

		5. Identify and analyze possible reasons for inconsistent results, such as sources of error or uncontrolled conditions 6. Identify and communicate sources of unavoidable experimental error 7. Recognize the issues of statistical variability and explain the need for controlled tests 8. Know and evaluate the safety issues when designing an experiment and implement appropriate solutions to safety problems 9. Appropriately employ a variety of print and electronic resources (e.g., the World Wide Web) to collect information and evidence as part of a research project 10. Assess the accuracy validity and reliability of information gathered from a variety of sources. D. Data Analysis / Graphing 1. Construct appropriate graphs from data and develop qualitative and quantitative statements about relationships between variables 2. Recognize the slope of the linear graph as the constant in the relationship y=kx and apply this principle in interpreting graphs constructed from data 3. Apply simple mathematical relationships to determine a missing quantity in an algebraic expression, given the two remaining terms (e.g., speed = distance/time, density = mass/volume, force = pressure x area, volume = area x height) 4. Determine whether a relationship on a given graph is linear or non-linear and determine the

		appropriateness of extrapolating the data 5. Solve scientific problems by using quadratic equations and simple trigonometric, exponential, and logarithmic functions. E. Drawing Conclusions and Communicating Explanations 1. Draw appropriate and logical conclusions from data 2. Communicate the logical connection among hypotheses, science concepts, tests conducted, data collected, and conclusions drawn from the scientific evidence 3. Communicate the steps and results of an investigation in written reports and oral presentations 4. Recognize whether evidence is consistent with a proposed explanation 5. Construct appropriate visual representations of scientific phenomenon and processes (e.g., motion of Earth's plates, cell structure) 6. Read topographic and geologic maps for evidence provided on the maps and construct and interpret a simple scale map. Assignments: Answer Questions Discussion Boards Major Writing Assignment

		Quiz Project Preparation Chat

2	Nature of Science	Lecture: I. Scientific Inquiry a. Distinguish among the terms hypothesis, theory, and prediction as used in scientific investigations b. Evaluate the usefulness, limitations, and interdisciplinary and cumulative nature of scientific evidence as it relates to the development of models and theories as representations of reality c. Recognize that when observations do not agree with an accepted scientific theory, either the observations are mistaken or fraudulent, or the accepted theory is erroneous or incorrect d. Understand that reproducibility of data is critical to the scientific endeavor e. Recognize that science is a self-correcting process that eventually identifies misconceptions and experimental biases h. Recognize that an inquiring mind is at the heart of the scientific method and that doing science involves thinking critically about the evidence presented, the usefulness of models, and the limitations of theories i. Recognize that theories are judged by how well they explain observations and predict results and that when they represent new ideas that are counter to mainstream ideas they often encounter vigorous criticism j. Recognize that when observations, data, or experimental results do not agree, the unexpected results are not necessarily mistakes; to discard the unusual in order to reach the expected is to guarantee that nothing but what is expected will ever be

		seen k. Know why curiosity, honesty, openness, and skepticism are so highly regarded in science and how they are incorporated into the way science is carried out II. Scientific Ethics a. Understand that honesty is at the core of scientific ethics; first and foremost is the honest and accurate reporting of procedures used and data collected b. Know that all scientists are obligated to evaluate the safety of an investigation and ensure the safety of those performing the experiment c. Know the procedures for respectful treatment of all living organisms in experimentation and other investigations a. Historical Perspectives a. Discuss the cumulative nature of scientific evidence as it relates to the development of models and theories b. Recognize that as knowledge in science evolves, when observations do not support an accepted scientific theory, the observations are reconsidered to determine if they are mistaken or fraudulent, or if the accepted theory is erroneous or incomplete (e.g., an erroneous theory is the Piltdown Man fossil; an incomplete theory is Newton's laws of gravity) c. Recognize and provide specific examples that scientific advances sometimes

		result in profound paradigm shifts in scientific theories d. Discuss the need for clear and understandable communication of scientific endeavors so that they may be reproduced and why reproduction of these endeavors is important Assignments: Answer Questions Discussion Boards Major Writing Assignment Quiz Project Preparation Chat
3	Science and Society	Lecture: I. Science Literacy a. Recognize that science attempts to make sense of how the natural and the designed world function b. Demonstrate the ability to apply critical and independent thinking to weigh alternative explanations of events c. Apply evidence, numbers, patterns, and logical arguments to solve problems d. Understand that, although much has been learned about the objects, events and phenomena

		in nature, there are many unanswered questions, i.e., science is a work in progress e. Know that the ability of science and technology to resolve societal problems depends on the scientific literacy of a society II. Diversity a. Identify examples of women and men of various social and ethnic backgrounds with diverse interests, talents, qualities and motivations who are, or who have been, engaged in activities of science and related fields I. Science, Technology, and Society a. Identify and evaluate the impact of scientific advances on society b. Recognize that scientific advances may challenge individuals to reevaluate their personal Beliefs II. Safety a. Choose appropriate safety equipment for a given activity (e.g., goggles, apron, vented hood) b. Discuss the safe use, storage, and disposal of commonly used chemicals and biological specimens c. Assess the safety conditions needed to maintain a science laboratory (e.g., eye wash, shower, fire extinguisher) d. Read and decode MSDS/OSHA (Material Safety Data Sheet/Occupational Safety and Health Administration) labels on laboratory supplies and equipment e. Discuss key issues in the disposal of hazardous materials in either the laboratory

		or the local community f. Be familiar with standard safety procedures such as those outlined in the Science Safety Handbook for California Schools (1999) Assignments: Answer Questions Discussion Boards Major Writing Assignment Quiz Project Preparation Chat
4	Earth's Place in the Universe	Lecture: I. Galaxies and Stars a. Identify and describe characteristics of galaxies b. Explain the evidence for the "big bang" model c. Know that the Sun is a typical star and is powered by nuclear reactions, primarily the fusion of hydrogen to form helium d. Describe the process of the nuclear synthesis of chemical elements and how accelerators simulate the conditions for nuclear synthesis (i.e., in stars and in the early universe) e. Compare the use of visual, radio, and X-ray telescopes to collect data that reveal that stars differ in their life cycles f. Describe, in terms of color and brightness, how the evolution of a star is

		determined by a balance between gravitational collapse and nuclear fusion II. Solar Systems a. Explain how the solar system was formed, including differences and similarities among the sun, terrestrial planets, and the gas planets, and cite the evidence from Earth and moonrocks that indicate that the solar system was formed approximately 4.6 billion years ago b. Know the current evidence for the existence of planets orbiting other stars c. Describe changes in the solar system over time Assignments: Answer Questions Discussion Boards Major Writing Assignment Quiz Project Preparation Chat
5	Earth's Place in the Universe	Lecture: III. Planets and Satellites a. Cite various forms of evidence that indicate the proximity of the planets in the solar system in relation to Earth and the stars

		b. Cite various forms of evidence that Earth and other planets change over time c. Describe the influence of collisional processes on early Earth and other planetary bodies in terms of shaping planetary surfaces and affecting life on Earth Assignments: Answer Questions Discussion Boards Major Writing Assignment Quiz Project Preparation Chat
6	Planet Earth	Lecture: I. Tectonic Processes a. Diagram the major divisions of the geologic time scale as a basis for understanding changes in the Earth's processes b. Describe how earthquake intensity, magnitude, epicenter, focal mechanism, and distance are determined from a seismogram c. Compare major types of volcanoes in terms of shape and chemical and rock composition d. Describe the location and characteristics of volcanoes that are due to hot spots and those due to subduction e. Relate geologic structures to tectonic settings and forces f. Describe the evidence for plate tectonics on the sea floor and on land Assignments:

		Answer Questions Discussion Boards Major Writing Assignment Quiz Project Preparation Chat
7	Planet Earth	Lecture: II. Oceans a. Describe the chemical and physical properties of sea water b. Describe the mechanisms that cause wave action and tides c. Explain the layered structure of the oceans, including the generation of horizontal and vertical ocean currents and the geographic distribution of marine organisms, and how properties of ocean water, such as temperature and salinity, are related to these phenomena I. Atmosphere a. Compare the layers of the atmosphere in terms of chemical composition and thermal structure b. Discuss the evolution of Earth's atmosphere over geologic time, including the effects of outgassing, the variations of carbon dioxide concentration, and the origin of atmospheric oxygen c. Know the location of the ozone layer in the upper atmosphere, explain its role in absorbing ultraviolet radiation, and explain the way in which this layer varies both naturally and in response to human activities d. Identify the bands at specific latitudes where rainforests and deserts are distributed and the causes of this pattern Assignments: Answer Questions Discussion Boards

		Major Writing Assignment Quiz Project Preparation Chat
8	Course Closing	Review for Final Exam Take Final Exam Participate in Discussion Boards Submit Final Project

Grading Policy

Grading Scale	
Letter Grade	Percentage Earned
A	90% - 100%
B	80% - 89%
C	70% - 79%
D	60% - 69%
F	59% and lower

- This is an inquiry-based course. Students will generate knowledge through online readings, synchronous chats, asynchronous discussions with students and their instructor, interactions with online tutorials, and online and hands-on simulations.
- A semester project developed by each student will be used to demonstrate knowledge and understanding of the material in the course.
- The instructor will act as a guide, a facilitator, an events planner, and a resource advisor. He/she will always be available through e-mail.
- The student must actively construct and acquire knowledge by being intrinsically motivated to succeed. To succeed, students must participate and complete all readings and activities. This course requires the student's active participation.
- Both formal and informal assessment methods will be used in the course. Informal assessment will include an evaluation of the quality and timeliness of participation in class activities. Formal assessment may include multiple-choice quizzes, tests, discussion board participation, and written assignments. A final exam will be given at the end of the course.

NUVHS Expected Schoolwide Learning Results (ESLRs):

It is anticipated that NUVHS students will be:

Engaged Learners

1. Demonstrate self-directed learning skills such as time management, and personal responsibility through the completion of course requirements
2. Develop an understanding of their own preferred learning styles to enhance their overall academic potential
3. Incorporate effective and relevant internet and multimedia resources in their learning process to broaden their knowledge base

Critical Thinkers

1. Effectively analyze and articulate sound opinions on a variety of complex concepts
2. Illustrate a variety of problem-solving strategies that strengthen college preparation and workforce readiness
3. Formulate a framework for applying a variety of technology and internet-based research to enhance information literacy and collaborative thinking

Effective Communicators

1. Demonstrate awareness and sensitivity to tone and voice in multiple forms of communication
2. Express concepts and ideas in a variety of forms.
3. Enhance communication skills through the use of media rich or other technology resources

Global Citizens

1. Appreciate the value of diversity
2. Understand the range of local and international issues facing today's global community
3. Demonstrate awareness of the importance of cultural sensitivity and social responsibility in the 21st century