A.S. in Geology

College Learning Outcomes Matrix: Rate each course from 1 to 5 with 5 being the most important.

A.S. in Geology	**Year of SLO Assessment**	**1. Written, Oral and Visual Communication:**	**2. Scientific and Quantitative Reasoning:**	**3. Critical Thinking 4. Problem Solving:**	**5. Information Literacy:**	**GE**	**DEGREE**
CHEM 131 General Chemistry I	**n/a**	3	5	5	2	X	X
CHEM 132 General Chemistry II	**n/a**	3	5	5	2	X	X
PHYS 108A General Physics I	**n/a**	3	5	5	2	X	X
PHYS 108B General Physics II	**n/a**	3	5	5	2	X	X
MATH 104 Plane Trigonometry	**n/a**	3	5	5	2	X	X
GEOL 120 Physical Geology	**2013**	5	5	3	2	X	X
GEOL 120L Physical Geology Lab	**2013**	5	5	3	2	X	X
GEOL 121 Historical Geology	**2013**	5	5	3	2	X	X
GEOL 103 Environmental Geology	**2013**	5	5	3	2	X	E
GEOL 109 Oceanography	**2013**	5	5	3	2	X	E
GEOL 114 California Geology	**2013**	5	5	3	2	X	E
GEOL 125 Field Geology I	**2013**	3	4	4	2		E
GEOL 126 Field Geology II	**2013**	3	4	4	2		E
GEOL 128 Field Studies of Marin West of San Andreas Fault	**2013**	3	4	4	2		E
GEOL 129 Field Studies of Marin East of San Andreas Fault	**2013**	3	4	4	2		E
GEOL 201 Elementary Mineralogy	**2013**	5	5	3	2	X	E

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GENERAL EDUCATION SLOS

WHAT ASSIGNMENTS DO YOU GIVE IN THESE CLASSES THAT ASSESS THE FOLLOWING GE SLOS- What assessment tools do you use- Assess only SLOs that you rated 4 or 5.

5	1. Written, Oral and Visual Communication:	2. Scientific and Quantitative Reasoning:	3. Critical Thinking 4. Problem Solving:	5. Information Literacy:	GE	DEGREE
GEOL 120 Physical Geology	Written exams, oral presentations, papers	Calculations (e.g., plate movement rates from offsets)			X	X
GEOL 120L Physical Geology Lab	Written exams, oral presentations, papers	Calculations (e.g., plate movement rates from offsets)			X	X
GEOL 121 Historical Geology	Written exams, oral presentations, papers	Calculations (e.g., plate movement rates from offsets)			X	X
GEOL 103 Environmental Geology	Written exams, oral presentations, papers	Calculations (e.g., plate movement rates from offsets)			X	E
GEOL 109 Oceanography	Written exams, oral presentations, papers	Determining phylogenetic relationships in marine organisms			X	E
GEOL 114 California Geology	Written exams, oral presentations, papers	Calculations (e.g., plate movement rates from offsets)			X	E
GEOL 125 Field Geology I		Calculations (offsets, distances)	Determining structural relationships in field			E
GEOL 126 Field Geology II		Calculations (offsets, distances)	Determining structural relationships in field			E
GEOL 128 Field Studies of Marin West of San Andreas Fault		Calculations (offsets, distances)	Determining structural relationships in field			E
GEOL 129 Field Studies of Marin East of San Andreas Fault		Calculations (offsets, distances)	Determining structural relationships in field			E
GEOL 201 Elementary Mineralogy	Written exams, oral presentations, papers	Practical mineral determinations (hardness, streaking)			X	E

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Required Fundamentals (23 units total)
CHEM 131 General Chemistry I (5)
CHEM 132 General Chemistry II (5)
PHYS 108A General Physics I (5)
PHYS 108B General Physics II (5)
MATH 104 Plane Trigonometry (3) (or higher math equivalent)

Required Geology (8 units total)
GEOL 120 Physical Geology (3)
GEOL 120L Physical Geology Lab (1)
GEOL 121 Historical Geology (4)

Elective Geology (11.5 units total)
GEOL 103 Environmental Geology (3)
Or
GEOL 109 Oceanography (3)
Or
GEOL 114 California Geology (3)
Or
GEOL 125 Field Geology I (2½)
Or
GEOL 126 Field Geology II (2)
Or
GEOL 128 Field Studies of Marin West of San Andreas Fault (2)
Or
GEOL 129 Field Studies of Marin East of San Andreas Fault (2)
Or
GEOL 201 Elementary Mineralogy (4)

STUDENT LEARNING OUTCOMES:

Upon completion of this degree, students shall be expected to:

1. Apply fundamental principles from physics and chemistry to scientific questions related to the earth
2. Organize and create scientific inquiries using primary data collected from the lab and/or the field, in accordance with appropriate scientific methodologies and practices
3. Assess geologic hazards for specific areas, including hazards from earthquakes and landslides
4. Evaluate and compare mitigation strategies for geologic hazards and environmental pollution issues
5. Judge appropriate techniques for collecting field data at specific sites

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PHYSICAL SCIENCES (CHEMISTRY AND PHYSICS) – ASSESSMENT METHODS FOR:

CHEM 131 General Chemistry I
CHEM 132 General Chemistry II
PHYS 108A General Physics I
PHYS 108B General Physics II

Communication
Write a coherent logical explanation in a paragraph.
Write a full lab report, a coherent description/explanation of a whole experiment (method/data/analysis/conclusion)
Clearly articulate reasoning and methodology during problem solving

Scientific Reasoning / Critical Thinking / Problem Solving
In most science classes, it is difficult to distinguish between these three categories. Problem solving in general is VERY important.

Information Literacy
Most courses require locating data in appropriate tables within one textbook or standard reference source
Some courses require additional research to obtain information from print or internet sources

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THESE DEGREE OUTCOMES EQUAL WHICH COURSE OUTCOMES FOR THESE COURSES?

A.S. in Geology	Apply fundamental principles from physics and chemistry to scientific questions related to the earth	Organize and create scientific inquiries using primary data collected from the lab and/or the field, in accordance with appropriate scientific methodologies and practices	Assess geologic hazards for specific areas, including hazards from earthquakes and landslides	Evaluate and compare mitigation strategies for geologic hazards and environmental pollution issues	Judge appropriate techniques for collecting field data at specific sites
GEOL 120 Physical Geology	1, 2, 4	1	1	3	2
GEOL 120L Physical Geology Lab	1, 2, 3	4	6	11	5
GEOL 121 Historical Geology	1	3, 6	4, 7	6	6, 7
GEOL 103 Environmental Geology	1	3	1	4	1
GEOL 109 Oceanography	6	1	6	9	9
GEOL 114 California Geology	13	6	5	5, 9	5
GEOL 125 Field Geology I	1	1	3	2	1
GEOL 126 Field Geology II	1, 3	1	3	1, 5	1, 5
GEOL 128 Field Studies of Marin West of San Andreas Fault	4, 7, 10	9	3, 7	8, 9	1, 2, 4
GEOL 129 Field Studies of Marin East of San Andreas Fault	4	4	1	1	2
GEOL 201 Elementary Mineralogy	2	3	4	3	1

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IN WHICH COURSES ARE THESE DEGREE SLOS ASSESSED- Use "I" for Intro, "P" for Practice and "M" for Mastery.

A.S. in Geology	Apply fundamental principles from physics and chemistry to scientific questions related to the earth	Organize and create scientific inquiries using primary data collected from the lab and/or the field, in accordance with appropriate scientific methodologies and practices	Assess geologic hazards for specific areas, including hazards from earthquakes and landslides	Evaluate and compare mitigation strategies for geologic hazards and environmental pollution issues	Judge appropriate techniques for collecting field data at specific sites
GEOL 120 Physical Geology	P	I	I	I	I
GEOL 120L Physical Geology Lab	P	I	I	I	I
GEOL 121 Historical Geology	P	I	I	I	I
GEOL 103 Environmental Geology	P	I	I	I	I
GEOL 109 Oceanography	P	I	I	I	I
GEOL 114 California Geology	P	I	I	I	I
GEOL 125 Field Geology I	I	I	P	P	P
GEOL 126 Field Geology II	I	I	P	P	P
GEOL 128 Field Studies of Marin West of San Andreas Fault	I	I	P	P	P
GEOL 129 Field Studies of Marin East of San Andreas Fault	I	I	P	P	P
GEOL 201 Elementary Mineralogy	P	I	P	P	I

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DEGREE SLOS

WHAT ASSIGNMENTS DO YOU GIVE IN THESE CLASSES THAT ASSESS THE FOLLOWING DEGREE SLOS- What assessment tools do you use- Assess only SLOs that you rated 4 or 5.

A.S. in Geology	Apply fundamental principles from physics and chemistry to scientific questions related to the earth	Organize and create scientific inquiries using primary data collected from the lab and/or the field, in accordance with appropriate scientific methodologies and practices	Assess geologic hazards for specific areas, including hazards from earthquakes and landslides	Evaluate and compare mitigation strategies for geologic hazards and environmental pollution issues	Judge appropriate techniques for collecting field data at specific sites
GEOL 120 Physical Geology	Exam questions using chemical principles	Exam questions related to nature of science	Determination of hazards from topographic maps	Exam questions regarding mitigation techniques	n/a
GEOL 120L Physical Geology Lab	Exercise questions using chemical principles	Formulation of process for pursuing scientific questions	Determination of hazards from topographic maps	Exercise questions regarding mitigation techniques	n/a
GEOL 121 Historical Geology	In-class exercises involving radiometric dating	Lab exercises involving radiometric dating	n/a	n/a	n/a
GEOL 103 Environmental Geology	Exam questions using chemical principles	Exam questions related to nature of science	Determination of hazards from topographic maps	Exam questions regarding mitigation techniques	n/a
GEOL 109 Oceanography	Exam questions using chemical principles	Exam questions related to nature of science	n/a	n/a	n/a
GEOL 114 California Geology	Exam questions using chemical principles	Exam questions related to nature of science	Determination of hazards from topographic maps	Exam questions regarding mitigation techniques	n/a

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A.S. in Geology	Apply fundamental principles from physics and chemistry to scientific questions related to the earth	Organize and create scientific inquiries using primary data collected from the lab and/or the field, in accordance with appropriate scientific methodologies and practices	Assess geologic hazards for specific areas, including hazards from earthquakes and landslides	Evaluate and compare mitigation strategies for geologic hazards and environmental pollution issues	Judge appropriate techniques for collecting field data at specific sites
GEOL 125 Field Geology I	n/a	Create plan for determining hazards in specific area	Determination of hazards from topographic maps	Exam questions regarding mitigation techniques	Projects using graded collection techniques
GEOL 126 Field Geology II	n/a	Create plan for determining hazards in specific area	Determination of hazards from topographic maps	Exam questions regarding mitigation techniques	Projects using graded collection techniques
GEOL 128 Field Studies of Marin West of San Andreas Fault	n/a	Create plan for determining hazards in specific area	Determination of hazards from topographic maps	Exam questions regarding mitigation techniques	Projects using graded collection techniques
GEOL 129 Field Studies of Marin East of San Andreas Fault	n/a	Create plan for determining hazards in specific area	Determination of hazards from topographic maps	Exam questions regarding mitigation techniques	Projects using graded collection techniques
GEOL 201 Elementary Mineralogy	Exam questions using chemical principles	Exam questions related to nature of science	n/a	n/a	n/a

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GEOL_120	Physical Geology	Revise Course
Expected Outcomes for Student:		
1. define endogenic and exogenic forces and processes that drive and resist the forces of change to the quasi equilibrium conditions of our Earth's lithospheric regime 2. recognize basic mineral and rock types, geologic structures. 3. recognize problematic concerns of our ever-shrinking natural resources 4. explain the significance of geologic time.		

GEOL_120L	Physical Geology Laboratory	Revise Course
Expected Outcomes for Student:		
At the conclusion of this course, the student should be able to: 1. Describe and discuss the principles of physical geology 2. Identify rock and mineral specimens common to earth 3. Describe and discuss the geology and fossils of each geologic period, and 4. Identify fossils representative of each geologic period. 5. Reconnoiter the earth with high precision using a topographic map, compass and protractor 6. Calculate stream discharge, read a flood frequency and hydrography and predict flood events based on the data provided 7. Make structural cross-sections from geologic maps and develop the geologic history of the area based on that cross-section 8. Demonstrate the ability to use a microscope 9. Exhibit the ability to record field observations of exposed rock. 10. Using a brunton compass, obtain the attitude of bedding plains, joints, and faults in the field 11. Identify the common forms of faults and folds expressed in exposed rock		

GEOL_121	Historical Geology	Revise Course
Expected Outcomes for Student:		
At the conclusion of this course, the student should be able to: 1. describe and discuss the principles of historical geology 2. describe the origin of the earth 3. describe and discuss the geology and fossils of each geologic period, and 4. identify fossils representative of each geologic period. 5. Read at the highest level topographic and geologic maps 6. Have the ability to generate a geologic map of a basic area 7. Have the ability to measure stratigraphic sections of rock and collect in a representative fashion samples that reflect the lithology and paleontology of that stratigraphic section 8. Read and analyze the geology of an area from aerial photographs 9. Use Index fossils to appropriately place a stratigraphic section into the proper time period or epoch 10. Exhibit a high level of skill with a transit or compass		

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GEOL_103	Environmental Geology	Revise Course
Expected Outcomes for Student:		
Upon completion of this course, students will be able to: 1. Evaluate geologic hazards, including potential earthquake damage, flooding, and volcanic eruptions. 2. Judge the most probably effects of anthropogenic climate change. 3. Appraise the risks in particular areas from landslides 4. Compare the effects on coastal erosion from human activities		

GEOL_109	General Oceanography	Revise Course
Expected Outcomes for Student:		
1. Describe the scientific method using examples such as the proof of Earth's spherical nature or its rotation; 2. Explain direct inverse relationships as illustrated using the factors related to the law of gravitation and the development of empirical laws; 3. Explain gravitation, the earth's rotation and revolution in the production of the tide producing forces and observed tide curve characteristics; 4. Discuss physical, chemical, and evolutionary models of: the Earth's internal zones (oceanic and continental crust, mantle and core as well as lithosphere/ asthenosphere models); the ocean's water, salts and gasses; the atmosphere; and the marine biosphere; 5. Distinguish the interactions between atmosphere and oceans which create wind waves as well as surface and thermohaline ocean currents 6. Explain the interactions between lithosphere and oceans in the production of seismic sea waves which contribute to the variety of shorelines; 7. Identify the interactions between oceans, land and organisms in marginal ocean environments which contribute to the variety of shorelines; 8. Define the interrelationships between physics, chemistry, crustal geology and the distribution of marine sediments; 9. Identify the physical, chemical, geological and biological characteristics of the San Francisco Bay estuary, ways in which man has altered the natural environment, and the implications of such alterations.		

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GEOL_114	Geology of California	Revise Course
Expected Outcomes for Student:		
- recognize and define the difference between a Resource and a Reserve and be able to report the prospectus of future hydrocarbon availability as defined by M. King Hubbert. - define the global locations where base and precious metal and energy Resources and Reserves are most likely to be found -discuss with a high level of geotechnical expertise the various types of mineral and energy extraction and beneficiation methods and the environmental impact produced or emitted from such methods -define the tectonic relationships between seismicity and volcanism and define the geo-tectonic processes that have formed the State of California -interpret Topographic and Geologic maps -sketch from a geologic map a structural cross-section illustrating the subsurface conditions and by applying the fundamental principles of Geology, define the chronological steps, geo-tectonic forces and lithospheric processes that have led to the formation of the terrain illustrated by the structural cross-section. -identify the dissolved, suspended, and bed load, i.e. the total mean daily load, of any stream system as well as the discharge of that stream system. -replicate the Eras, Periods, and epochs of the Geological Society of Americas Geologic Time Chart -locate the epicenter of a seismic event and discuss at a high level of geotechnical expertise the modified Richter Scale and have the ability to discuss the major strike slip faults of the San Andreas Transform boundary. - discuss in specific detail the various canals associated with the California Water Project and relate the problems of providing fresh potable water to the ever increasing population of our state. -recognize glacial, coastal, riverine and structural land forms. -discuss the problems associated with the Eel and Russian river watersheds. -identify representative samples of the most common igneous, sedimentary and metamorphic rocks -recognize common massive sulfide minerals and relate the mineral to the economic metal extracted from that mineral. -discuss the more common elements extracted from common minerals -with sufficient cartographic skills to define the Longitude and Latitude of a point on planet Earth, provide the Land Office Grid System Coordinates of any given area defined by any scale of Topographic or Geologic map presented and have the skills to read both Azimuth and Compass Quadrant compass systems.		

GEOL_125	Field Geology I	Revise Course
Expected Outcomes for Student:		
1. Evaluate a field site in regards to its rocks and prominent geologic structures 2. Assemble knowledge about Marin County through combining information from seminal peer-reviewed papers and first-hand field experience 3. Assess questions about Marin County hazards, such as susceptibility to landslides and liquefaction 4. Revise poorly-mapped areas with more detailed field observations, such as inclusion of previously-unmapped faults and rock outcropping		

GEOL_126	Field Geology II	Revise Course
Expected Outcomes for Student:		
It is important to note that the basis for permitting students to take this course up to four times is that if the trip is to a different area then the rock type and structures will vary. Although the principles of the science remain the same, the more rock the student sees the better the geologist they become. 1. Discuss the geography, the regional geologic setting, geologic history, landforms, erosional processes, natural resources and unique geological features observed during this trip. 2. Possess sufficient cartographic skills such that they will be able to locate their position within 15 feet to the exact position through the use of a compass, protractor and topographic map. 3. Define the geological history as exposed in a road cut or out crop by employing the principles of the science of geology. 4. Identify common igneous, sedimentary and metamorphic rock types. They will have the ability to identify common Paleozoic invertebrates such as Trilobites, Cephalopods, and Brachiopods. Using standard identify keys they will be able to define the relative time period these organisms lived and thus define the age of the rock these critters came from. 5. Recognize common geologic structures and relate the forces that formed these structures. 6. Explain the current model for Basin and Range extension.		

GEOL_128	Geographical Studies of Pt. Reyes and the San Andreas Fault	Revise Course
Expected Outcomes for Student:		
1. Identify, classify, and describe minerals and rocks observed in the field 2. Identify, classify and describe geologic structures observed 3. Apply geologic concepts with field observations including -recognition of the geological processes that produced and continue to produce the peninsula, association of the basic geological principles that allow an ordering of the geological history of the peninsula, and construction of a generalized geological stratigraphic column for the peninsula 4. Interpret various features and rock outcrops based on the application of basic geologic concepts 5. Use topographic, geologic maps and geologic cross sections to formulate interpretations based on spatial and stratigraphic positions of features and rocks 6. Recognize and evaluate geological hazards in the Pt. Reyes area 7. Recognize the geomorphic processes responsible for various features in the Pt. Reyes area, including waves, tides, streams, and estuarine processes acting in and around the Pt. Reyes area 8. Recognize the characteristic features created by the San Andreas Fault 9. Understand the role that the San Andreas Fault has played and continues to play in the development of the peninsula 10. Relate plate tectonic processes as they relate to the San Andreas Fault and features exposed on the Pt. Reyes peninsula		

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GEOL_129	Field Studies of Marin East of the San Andreas Fault	Revise Course
Expected Outcomes for Student:		
1. Demonstrate knowledge of the areal geology of eastern Marin County 2. Create an organized journal of field observations and complete a comprehensive field trip report from that journal 3. Locate, compile, analyze and present scientific data 4. Apply an appreciation for the value of the scientific method through: a. Identification of the major rock types found in eastern Marin County inculding: basalt, greenstone, radiolarian chert, greywacke, shale, andesite, volcanic tuff, cherts converted to jasper, metacherts and greywackes, serpentinite, glaucophane shist (and other high pressure, low temperature metamorphic rocks) b. explain the geological processes that produced each of the rock types including: their relationship to either divergent or convergent tectonic activities and their sedimentary, igneous and/or metamorphic origins c. apply current hypotheses attempt to explain the complex geological cross section of eastern Marin		

GEOL_201	Elementary Mineralogy	Revise Course
Expected Outcomes for Student:		
1. identify the major rock forming minerals and those minerals species exploration geologist seek in order to suffice the never ending elemental demands of the industrialized world. 2. discuss the elemental composition of these mineral species, the geo-tectonic processes involved in their formation and the chemical characteristics of these minerals species that make them so coveted in the modern industrial world. 3. discuss in specific terms exploration techniques and targets, the regions from which the various economic mineral species are recovered and the mining techniques employed in their recovery. 4. Explain beneficiation methodologies and the environmental consequences inherent in the use of the elements recovered will be well engrained in the students cerebral cortex.		

CHEM_131	General Chemistry I	Revise Course
Expected Outcomes for Student:		
1) Explain the macroscopic physical and chemical properties of a substance in terms of its atomic-level structure. 2) Develop solutions to complex chemistry problems using quantitative and qualitative techniques, and articulate your answers. 3) Obtain and record careful laboratory measurements and observations, carry out qualitative and quantitative analyses of these data, and present the results in a formal laboratory report.		
CHEM_132	General Chemistry II	Revise Course
Expected Outcomes for Student:		
1) Predict chemical reactivity based on your knowledge of chemical kinetics, thermodynamics and equilibrium. 2) Develop solutions to complex chemistry problems using quantitative and qualitative techniques, and articulate your answers. 3) Obtain and record careful laboratory measurements and observations, carry out qualitative and quantitative analyses of these data, and present the results in a formal laboratory report.		

PHYS_108A	General Physics 1	Revise Course
Expected Outcomes for Student:		
Upon completion of the course, the student will: 1.Communicate and utilize the physical laws of kinematics and thermodynamics via problem solving 2. Apply the physical laws of kinematics and thermodynamics to word problems in order to obtain clear solutions by mathematical analysis. 3.Conduct an experiment, collect and analyze data, including such tools as graphs, regressions and statistical analysis, and interpret results within the framework of the physical laws of kinematics and thermodynamics 4. Write a lab report explaining, both qualitatively and quantitatively, the scientific results of an experiment and the certainty of those results. 5.Use modern scientific practices relevant to the field of physics: including the formulation of a scientific theory based on and consistent with quantified observations. 6.Demonstrate critical thinking skills		

PHYS_108B	General Physics II	Revise Course
Expected Outcomes for Student:		
Upon completion of the course, the student will: 1.Communicate and utilize the physical laws of electricity and magnetism via problem solving 2.Apply the physical laws and techniques of electricity and magnetism to word problems and obtain clear solutions through mathematical analysis of these laws. 3.Conduct an experiment, collect and analyze data, including such tools as graphs, regressions and statistical analysis, and interpret results within the framework of the physical laws of electricity and magnetism 4.Write a lab report explaining, both qualitatively and quantitatively, scientific results of an experiment based in the field of electricity and magnetism and report the certainty of those results. 5.Use modern scientific practices relevant to the field of electricity and magnetism: including the formulation of a scientific theory based on and consistent with quantified observations. 6.Demonstrate critical thinking skills		

MATH_104	Plane Trigonometry	Revise Course
Expected Outcomes for Student:		
Math 104 Student Learning Outcomes 1. Find all solutions in the interval 0 le x < 2pi of a trigonometric equation. 2. Solve for the sides and or angles of a triangle using the Law of Sines and/or the Law of Cosines. 3. Draw the graph of a sine or cosine function, correctly determining the amplitude, period, and phase shift.		