

**CTY Course Syllabus
Dynamic Earth**

Day 1	Topic	Lab Activities	Skills Obtained	Notes
Morning	Done on Sunday: <ul style="list-style-type: none"> • Lab safety protocols • Academic Honesty Policy Pre-test Welcome, course expectations <ul style="list-style-type: none"> • Lunch orders for field trips Organizing your notebook and work How to be a good scientist Inference and observations Scientific Laws and theories	Lab – observations vs. inferences	Authentic assessment of student knowledge Scientific and experimental process, Nature of Science Group member familiarity Observation vs. Inference Making measurements, working with and recording data “What is science?” How is science enacted?	Start daily notes on students Observe interactions between students NEEDS: Copies of protocols and academic honesty, Pre-Assessment, Inference/observation images Post Essential Questions – see green planning sheet
Afternoon	Earth’s building blocks (pg 24-27) Mineral characteristics Using qualitative and quantitative observations for identification’s Mineral Identification Moh’s scale Hardness, Luster, scratch tests	<u>Activity:</u> Mineral Make up sheets Lab - Mineral descriptions based on qualitative properties Lab- Mineral ID Mayhem!	Properties of common minerals, structure, composition, earth’s make up, identification, dichotomous keys, Moh’s hardness scale, Periodic Table of elements and molecular calculations, Composition of specific minerals, reinforce mineral characteristics, scientific identification of minerals vs descriptive method	Start saving paper towel rolls for later this week- speak to custodian Score pre-tests and generate spreadsheet, submit to CTY site

Day 2	Topic	Lab Activities	Skills Obtained	Notes
Morning	<p>Mineral Identification, Continued</p> <p>Mineral Museum- mineral identification using chemical formulas</p> <p>Parts of the earth (pgs 20-21) Plate tectonics (pgs. 32-55)</p> <p>Articles: The Day the Earth Stood Still, Earth's Crust, Evolution of a continental Crust, Is the Pacific Splitting in Two? Hot Rocks, The Earth's Crust, Super Piles,</p>	<p><i>Field Trip/Lab:</i> Hunting for minerals using chemical names</p> <p>Activity: partnered small posters and presentations on plate article readings</p> <p>Demo: water tank and convection</p> <p>Demo: athenosphere and plate movement (syrup & plates)</p> <p>Demo: Student kenesthetic convection reinactment</p>	<p>Convergent, divergent, transform boundaries, subduction zones, how landform processes</p> <p>Tectonic theory, application of geomorphic clues to place formations and placement of plates over time, science as a human endeavor, critical thinking</p> <p>Meyer, Continental Drift , magnetic orientation of basaltic rocks, polar wondering, jigsaw reading techniques, scanning large technical writing for important information, group presentations, cooperative skills</p>	<p>Before students arrive- review comp books for mineral notes and lab</p> <p><i>Need:</i> poster paper and markers for presentations</p>
Afternoon	<p>History of plate tectonic theory: Pangaea, Gondwaland, evolution of crust formation, How did Meyer develop plate theory? Plate models and global positions</p>	<p>Lab - Plate puzzles (4 part plate assembling with increased geologic evidence.</p>	<p>Introduction of oceanic crustal contribution to overall plate formation, Plate tectonics vs. Continental Drift, asthenosphere convection with physical models, measurement of plates for examination of data to illustrate plate movement, mathematical modeling, relating to magnetic data of basaltic age, metric conversion, special and temporal scales</p>	<p>Compile daily notes w/TA</p> <p>Review day</p> <p>Identification of students who have potential coursework problems and ELL students</p>

Day 3	Topic	Lab Activities	Skills Obtained	Notes
Morning	<p>Go over plate puzzle questions</p> <p>Global landform process Folding & faulting of lithosphere Differences between continental crusts and oceanic crusts</p> <p>Integrated Ocean Drilling Program, Deep exploration of the earth's crust IODP poster # 309, ANDRILL core poster</p>	<p>Activity: Correlate plate edges with IODP program sites</p> <p>Lab- Mid Atlantic Ridge plate movement</p>	<p>Divergent, convergent, transform boundaries and landforms created: trench, volcanic arch, melting, mid-ocean rift, continental rift, subduction, hot-spot volcanism, Moho, density of ocean crust vs. continental crust, general location of volcanoes, remote sensing and paleomagnetism</p>	<p>NEEDS: Gladware tubs, beans for next day</p> <p>NEED marshmallows</p> <p>Put up IDOP posters for students to review</p>
Afternoon	<p>Detailed earth composition and plate study</p> <p>Oceanic vs. continental crust Original vs. secondary crust</p>	<p>Activity- Partnered readings and poster presentations (text and article resources)</p>	<p>Convey understanding of sequence of event, plate research and current hypothesis in plate research through literature review for specific facts and oral presentation</p>	<p>NEEDS: partner assignments (keep all records for name mastery and ensuring students work with varied partners, materials for presentations)</p>

Day 4	Topic	Lab Activities	Skills Obtained	Notes
Morning	<p>Earthquakes and volcanoes in relationship to the plates</p> <p>Seismic scales - Richter vs. Mercalli or how to calculate the Richter logarithm with beans</p>	<p>Lab - Richter scale tubs of science</p> <p>Lab – plotting earthquake size and frequency globally</p> <p>Lab- plotting number and severity of earthquakes in US</p> <p>Activity- correlating plate boundaries to earthquakes and volcanoes and scientific research (IODP)</p> <p>Group Activity: CA fault flipbooks– given to RA’s for weekend activity</p>	<p>Fault types, movement and wave generation, compression, tension, shearing, folding, fault, strike-slip, physical modeling in science</p> <p>Mercalli vs. Richter scales, scales of magnitude and intensity, scope of global plate movement, How global networks work together to monitor earthquakes</p> <p>Looking for patterns, plot US earthquake numbers on map, decide on probability and location in relation to major US plates, plot world volcanoes and earthquakes and label major plates</p>	<p>NEEDS: pre-assign quake reading</p>
Afternoon	<p>Note book catch up</p> <p><u>Field Trip 2</u></p>	<p>Activity- the “great broken nose hunt” & Stanford survives the 1906 event (locate scientist and read about Stanford in 1906), cracks in the chapel hunt (seismic stories of Stanford)</p> <p>Activity – students relate to field trip accounts from 1906 students and current news publication regarding possibility and current CA status from <u>Stanford Report (2006)</u></p>	<p>Local events of great magnitude, set up for fault viewing on Crystal Springs trip, Global earthquakes in relationship to plate location compare real-time data to paper global map and locate plates, Major historical quake of CA, How 1906 changed seismology forever</p>	<p>NEED: goggles, zippy bag, sharpie, and hammer for geodes</p> <p>Notes on Field trips to RA’s: Students should take comp book, pencil/eraser water bottle, hat, sun screen and wear shoes with toes covered.</p>

Day 5	Topic	Lab Activities	Skills Obtained	Notes
Morning	Volcanoes Locations, types and viscosity of lava's relationship to type of eruption	Demo- Volcanic products If needed, trip back to mineral exhibit to see Pele's hair <u>Activity</u> - test reading on various volcanic eruptions		NEED: Sugar cubes – diabetics? Stop watches, Glad containers with twist lids for next day
Afternoon	Sharing our plate learning with others Interdisciplinary Activity- Viking Raid Rock Types - Igneous: Extrusive vs. Intrusive Faults and forces	Activity- go over plate questions from Thursday Activity- ninja placement of plate posters near site director's door Demo- volcanoes, magma and fudge, how crystal structure of magma and lave lead to specific volcano products Lab – plate models and paper hats or tectonic couture	Specific orientation to unique characteristics of igneous rocks.	NEEDS: ID students who will need more attention next week. Licorice, pennies or corn and tubs with lines Review daily notes to identify usable comments for evaluations Set up evals with opening paragraph and initial comments Set up rock type tubs

Day 6	Topic	Lab Activities	Skills Obtained	Notes
Morning	Review plates Notebook catch up Igneous Rocks	Activity- Plate quiz Activity- Igneous reading Lab- Igneous Rocks <u>Lab/Quiz</u> – identifying wild rocks Igneous- Greenland 2,5 billion Met – Serpentine at fault Sed- fossil bone and iron concretions	Classification of rock types based on quantitative observations and use of dichotomous key, scaffolding knowledge of minerals as building blocks, Using previous knowledge of plates, minerals and volcanism to identify evidence of processes and formation	NEED: dino bone, and other bizarre rock samples NEED samples and chemicals for chem. Weathering lab for Wed
Afternoon	Sedimentary and Metamorphic Rocks Relating rock formation and mineral contribution to formation i to volcanic process	Lab – Metamorphic Rocks Activity- Metamorphic reading Lab – Sedimentary Rocks Activity – Sedimentary reading Activity – geode smashing Difference between geodes and thunder eggs	Using previous knowledge of plates and volcanism to identify evidence of processes Weathering (Chemical and physical) Gravitational separation of heavy minerals by centripetal forces, formation and characteristics of different rock types, pet rocks, relationship of component parts to whole rock	Which RA will come on trips? TA- tables and lab cleaning for colds

Day 7	Topic	Lab Activities	Skills Obtained	Notes
Morning	<p><u>Field Trip 3:</u> USGS Western Region Headquarters</p> <p>Forams and relative/absolute dating</p> <p>Lunch at USGS office</p>	<p>Lab- Sand exploration (looking for forams and sand characteristics in sand samples brought)</p> <p><u>Activity:</u> how a scientist uses foram samples and conducts research</p>	<p>Biostratigraphy, relate to well lab, relate to 1/2-life lab and dating techniques</p> <p>Real-world data collection and applications of geologic data for climate and biotic response to climatic change</p>	<p>RA - Get pics of students at lab for show!</p>
Afternoon	<p><u>Field Trip 4</u> San Andres fault zone & Crystal Springs Reservoir</p> <p>Remote sensing and learning about the parts of the earth</p> <p>Geologic sequences- learning about what happened by looking at a cross cut</p> <p>Law of superposition</p>	<p>Lab- San Andres Fault crumple zone – enacting the fault</p> <p><u>Demo:</u> Brittle rocks and breaking metamorphic</p> <p>Quiz (wild rock)- metamorphic rock sample at fault</p> <p>Quiz - rock breakers – why are these so easy to break?</p> <p>Activity – superposition worksheets</p>	<p>Mercalli vs. Richter scales, scales of magnitude and intensity, scope of global plate movement, How global networks work together to monitor earthquakes, Law of Superposition, unconformities, non-conformities, using strata to identify formation of rocks in the lithosphere</p>	<p>TA- call SLAC visitor center to confirm availability of fossil viewing, check with kitchen for corn starch and fossil making materials, Set up erosion activities for Wed</p>

Day 8	Topic	Lab Activities	Skills Obtained	Notes
Morning	<p>Understanding of the rock cycle is not a one-way process</p> <p>Weathering – chemical, biological, and physical processes that breakdown rocks and products</p> <p>Forces that make other types of rocks</p>	<p>Lab - mechanical weathering – Breaking down sugar cubes with force</p> <p>Lab – chemical weathering of rocks</p> <ol style="list-style-type: none"> 1. Identify rocks in sample 2. Perform drip tests with weak acids 	<p>Relative dating and landform formation, relationship of plate movement, erosion processes and rock hardness to changes on land formation</p>	<p>NEED: materials for fossil making</p> <p>Order glacier materials</p>
Afternoon	<p>Wrap up rock cycle and weathering</p>	<p>Activity- text reading on dating and radiometric decay</p> <p>Lab- Radiometric decay with licorice</p>		<p>TA- find 365 day calendar and list of events to place</p>

Day 9	Lesson/Lecture Topic	Lab Activities	Skills Obtained	Notes
Morning	Geologic time	Lab – geologic time calendar, calculating the age of the earth on 364 scale, Add rock samples and images of life at various dates		Photos for slideshow NEED paper towel tubes for afternoon, copies of Mavericks stories Order Kona water bottles
Afternoon	Geologic Time Understanding the scale and formation of Fossils Dating techniques Relative and absolute dating Radiometric decay Geologic Time and fossils Law of Superposition	Activity- relative dating of land forms Activity- Reading text on geologic time/ relative dating Lab- Radiometric decay with licorice Quiz- Law of Superposition Activity- finding Turtle’s favorite mineral in the museum’s collection	Dating techniques- absolute dating, relative dating, radioactive decay, isotopes, ½-life, how different isotopes demonstrate different ages and are used by geologists, major geologic time divisions: eon, period, epoch, era, convey understanding of time sequence of events, forms and types of fossils, time periods of geologic timeline, Law of cross-cutting relationships, Unconformities, Law of superposition and cross-cutting relationships, unconformities (angular, non)	Notes to RA’s of what to bring on trips TA copies! Assessment: student notebooks for completion and detailed notes

Day 10	Lesson/Lecture Topic	Lab Activities	Skills Obtained	Notes
Morning	Finish geologic time Tidy comp books and get organized	<u>Lab</u> – mold and cast fossils and perimineralization		NEED: confirm vans, lunches and t-shirts for field trip TA- Inventory?
Afternoon	Weathering and gravitational seperation Meteors and landforms Guest Speaker: Peter Backus from SETI	Lab – Panning for gold (students may keep pyrite) Activity- text reading on solar system Activity- random rock quiz (siltstone from Pescadero)	Panning for Gold- panning for gold – why some minerals sink and others float (mineral density introduction The earth’s place in the solar system, uniqueness of life on the planet, researchers with really big possibly unsolvable questions	Guest speaker photos for slideshow NEED: find bottle of Kona water for each student

Day 11	Topic	Lab Activities	Skills Obtained	Notes
Morning	Finish fossilization Notebook catch up Meteors and land formations	Lab: Burning the perimineralized “logs” <u>Activity:</u> where meteors come from – the re-enactment Lab - Meteor impact sculpting of land Lab - finding my meteor	Formation and location of meteors, terrestrial crater formation and why they are so hard to find	Assessment: student notebooks for completion and detailed notes
Afternoon	Wrap up earth processes Individual comp book meetings with instructor to finish and tidy composition books	Activity- individual posters of what is most important to you that you have learned so far? Lab- Tides and the water bulge – figuring out tide charts for specific latitudes	Surface ocean circulation, water mass identification and oceanic water strata, sampling techniques for recent research cruise, first intro of ocean water from area of field trip, rip tides, long shore current	

Day 12	Topic	Lab Activities	Skills Obtained	Notes
Morning	<p>Oceans Open Ocean wind generated surface gravity waves</p> <p>Surface currents</p> <p>Tides</p>	<p>Lab - Wave tubes of science</p> <p><u>Activity:</u> labeling wave parts</p> <p><u>Activity:</u> reading about Mavericks</p> <p>Demo- sonar map making of Mavericks</p> <p><u>Activity:</u> Stormsurf preview, tide preview</p>	<p>Formation and location of meteors, terrestrial crater formation and why they are so hard to find</p> <p>Understanding the myth between waves and tides as sources of ocean level change, wave parts, near real time data on waves, how tides are basin-wide waves with low frequency and long wavelength</p> <p>Experimental process, physical modeling, stream parts, gradient and meanders, labeling and recording landforms created</p> <p>Erosion, deposition, sediment creation of rock type</p>	<p>Assessment: student notebooks for completion and detailed notes</p> <p>Note- LONG LAB, needs time for repeats and for personality issues.</p>
Afternoon	<p>Oceanic continues</p> <p>Video: NOVA: “Killer Waves”</p>	<p>Lab - plotting surface currents</p> <p><u>Activity:</u> assemble water mass model of Pacific ocean using ocean water from Mary’s sampling in Monterey</p> <p>Demo- Deep water that you drink!</p> <p>Lab- Tides and the water bulge – figuring out tide charts for specific latitudes</p>	<p>Surface ocean circulation, water mass identification and oceanic water strata, sampling techniques for recent research cruise, first intro of ocean water from area of field trip, rip tides, long shore current</p>	<p>NEEDS: Make Gack for glaciers</p>

Day 13	Lesson/Lecture Topic	Lab Activities	Skills Obtained	Notes
Morning	<p><i>Field Trip: National Marine Sanctuaries and Mavericks</i></p> <p>Half Moon Bay discussion with National Marine Sanctuaries staff, Stormsurf staff and members of Mavericks</p>	<p>Lab – making the big wave</p> <p>Lab – Surfboards at Mavericks- what to ride and why</p> <p>Video: (KQED – PBS) What is Mavericks?</p> <p>Demo- How forecasters predict large surf in global sequences</p> <p>Demo- how big are the boards or a quick visit to Mavericks surf shop to see the boards</p>		
Afternoon	<p>Open-ocean wind-generated surface gravity waves on site at Mavericks</p>	<p>Lab- beach relay race or the effects of sand on tractions</p> <p>Activity- how big are those waves, really?</p> <p>Activity: hanging out with a surfer of the giant waves – land surfing instruction</p> <p><i>Quiz:</i> beach landform puzzle</p>		

Day 14	Topic	Lab Activities	Skills Obtained	Notes
Morning	Posters: What is important about Mavericks Wrap up beach trip	Activity- reading and questions regarding beach trip		
Afternoon	Atmosphere-volcano connections Post Test Survey	Lab- plotting ash clouds from Mt. Pinatubo Activity- student presentations- what is most important to me from this class (small posters and speaking)		Flash drives of images and projects Take all stuff to room

Day 15	Lesson/Lecture Topic	Lab Activities	Skills Obtained	Notes/Other
Morning	Room tidy Give tour of minerals to Science and Engineering			