

Please be sure to look over the study guides for the midterms, and your review questions and the keys for those (from the course webpages).

Vocabulary

A'a

Accretionary wedge

Active continental margin

Andesitic composition

Anticline

Atom

Atomic mass number

Atomic number

Basaltic composition

Basin

Batholith

Bowen's reaction series

Brittle failure

Caldera

Cinder cone

Cleavage

Coarse-grained texture

Columnar joint

Composite cone

Continental volcanic arc

Crater

Crystal

Crystal settling

Crystallization

Decompression melting

Deformation

Dike

Dip-slip fault

Dissolved gases

Dome

Ductile deformation

Electron

Element

Fault

Fault scarp

Fault-block mountains

Feldspar

Felsic

Fine-grained texture

Fissure

Fissure eruption

Flood basalt

Fold

Fracture

Geothermal gradient

Glassy texture

Graben

Hardness

Horst

Intermediate composition

Igneous rock

Intrusive

Ion

Island arc

Isostasy

Isostatic adjustment

Joint

Laccolith

Lahar

Lava

Luster

Mafic

Magma

Mantle plume

Mineral

Mohs hardness scale

Monocline

Neutron

Normal fault

Nucleus

Orogenesis	Silicon-oxygen tetrahedron
Orogeny	Sill
Partial melting	Specific gravity
Pahoehoe	Stratovolcano
Passive continental margin	Streak
Pluton	Strike-slip fault
Plutonic	Syncline
Porphyritic texture	Terrane
Proton	Texture
Pyroclastic flow	Thrust fault
Pyroclastic materials	Transform fault
Quartz	Ultramafic composition
Reverse fault	Vein deposit
Rock	Vent
Rock cycle	Viscosity
Rock forming minerals	Volatiles
Scoria	Volcanic island arc
Shield volcano	Volcanic neck
Silicate	Volcano

Minerals are naturally-occurring, inorganic crystalline solids with definite chemical formulas. Physical properties important for mineral identification include cleavage, crystal form, hardness, luster, and some special properties like magnetism or effervescing in weak acid. The largest group of minerals is the silicates. Quartz and feldspar are the most common silicate minerals. Other rock-forming silicate minerals are biotite, hornblende, pyroxene, and olivine. Common non-silicates include halite, calcite and gypsum.

Rocks are composed of minerals or mineral-like solids. There are three main classes of rocks: igneous, sedimentary, and metamorphic. Each can form from any of the others. Know how each forms.

Igneous rocks are divided on the basis of composition, and on grain size (texture). Know the implications of the texture of an igneous rock. Know the differences of granite, diorite, gabbro, rhyolite, andesite and basalt. Each compositional group occurs in a distinct tectonic environment.

Know that basalt is the most common volcanic rock, has predominantly passive eruptions, from hot-spots or diverging plates. Know that granite is the most common plutonic rock, and occurs chiefly within continental volcanic arcs at convergent margins.

Minerals are composed of elements: the smallest unit of matter that retains the properties of the material. Atoms are composed of protons, neutrons and electrons. The mass is contained in the nucleus: which has the protons and the neutrons.

Protons have positive charge, and determine which element the atom is. There are varying numbers of neutrons within the nuclei of the same element. The electrons have a negative charge, and are responsible for the atoms bonding to other atoms: if an atom loses an electron, it becomes positively charged, and is called a CATION; if an atom gains an electron, it becomes negatively charged, and is called an ANION.

Magma is generated by partial melting of the mantle, by pressure release or by addition of water as a flux. Know where (in terms of plate tectonics) each of these events occurs. Two distinct types of magma are formed: basaltic (mafic) and granitic (felsic); intermediate types occur by assimilation of continental material in basaltic magma. The two types of magma lead to different styles of volcanic eruptions. Know the difference, and where each is likely to occur.

What affects the viscosity of magma, and how do these variations affect the viscosity? Basalt is fluid, and commonly flows as pahoehoe. Felsic magma often is explosive, and commonly erupts violently with a large outpouring of pyroclastic material.

Shield volcanoes are the largest type of volcanic peak, composed of basalt, and usually have quiet eruptions. Composite cones (stratovolcanoes) are also large, have interbedded lava and pyroclastic deposits, and can have violent eruptions, including nuee ardente flows. Cinder cones are the smallest, short-lived, steep sided, and composed nearly completely of pyroclastic material. Most volcanoes are associated with plate boundaries, however remember hot-spots.

Magma chambers feed volcanoes via conduits or pipes, that may remain after the volcanoes erode away as volcanic necks. Intrusive features of plutonic rocks solidified below Earth's surface include dikes, sills, laccoliths, stocks and plutons. Know the differences of these.

Deformation can be ductile or brittle. Ductile deformation includes various styles of folding: know the names of the kinds of folds, and that folds form as a result of compressive forces. Domes and basins are regional features associated with crustal uplift or subsidence.

Brittle deformation can be faulting, where appreciable movement occurs on the break, or joints, without appreciable movement on the breakage plane.

Faults can be dip-slip or strike-slip. Dip-slip faults that have movement of the hanging wall down the fault plane are called 'normal'. Normal faulting is the result of tensional forces, often at diverging tectonic plates or as a consequence of regional uplift. If the hanging wall has moved up the fault plane, it is called 'reverse'. Reverse faults with a low angle fault plane ($<45^\circ$) are classed as thrust faults. Reverse faults are the result of compressional forces, often where tectonic plates are converging. Thrust faults can move crustal blocks tens or hundreds of kilometers.

Strike-slip faults have movement parallel to the trend of the fault plane. The best-known strike-slip fault is the San Andreas Fault, in California, where right-lateral movement between the Pacific Plate and the North American Plate has offset rocks for at least the past 29 million years. Many strike-slip faults link offsets in the mid ocean ridge, where their motion accommodates displacement of lithospheric plates.

Mountain belts are created along plate boundaries. Where plates converge, the generation of magma, and the deformation of the rocks will lead to folded mountain belts with plutonic cores. Aleutian type mountain belts are the result of convergence of two oceanic plates, where an oceanic volcanic arc is created. Andes type mountain belts occur where the convergence is between an oceanic plate and a continental plate. There is emplacement of felsic and andesitic magma, a continental volcanic arc, and deformation of the accretionary wedge of sediment deposited on the continental margin and in the oceanic trench. Himalayan type mountain belts occur where two continental plates collide. There is little magma generation in this type of mountain building event. Continents are built by successive mountain-building events, and by addition of accreted terrane: fragments of crust within ocean basins may be added to continents when the crustal fragment does not subduct, and becomes attached to the continent.

Lithospheric plates rise and fall on the mantle surface, depending upon their density and their thickness. Thickening by mountain building, or removal of material by erosion results in an 'isostatic adjustment' of the lithosphere.

Vocabulary

Aftershock	Moment magnitude
Asthenosphere	Normal polarity
Body wave	Oceanic trench
Continental drift	Oceanic volcanic arc
Continental rift	Outer core
Continental Volcanic arc	Paleomagnetism
Convergent plate boundary	Pangaea
Core	Plate tectonics
Crust	Polar wandering
Divergent plate boundary	Primary (P) wave
Earthquake	Reverse polarity
Elastic rebound	Richter scale
Epicenter	Ridge-push hypothesis
Fault	Rift valley
Fault creep	Seamount chain
Focus	Sea floor spreading
Foreshock	Secondary (S) wave
Hot spot	Seismic sea wave (tsunami)
Inner core	Seismogram
Intensity	Seismograph
Liquefaction	Seismology
Lithosphere	
Lower_mantle	
Magnitude	Shadow zone
Mantle	Spreading center
Mantle plume	Slab-pull hypothesis
Mercalli Intensity Scale	Subduction zone
Mid Oceanic ridge	Surface wave
Moho	Trench
Upper mantle	Transform fault boundary
	Volcanic island arc

Know the details of Wegener's hypothesis of continental drift, including what evidence he had, and how he proposed the continents drifted. Know how long ago Pangaea existed.

Be able to recognize on a diagram the various parts of Earth: inner core, outer core, mantle, lower mantle, asthenosphere, lithosphere,

crust (both oceanic and continental), and know the thicknesses of each of these. Know the composition of each.

Divergent plates move apart, and new crust/lithosphere is created: sima, oceanic crust (eventually), basaltic magma and shallow-focus earthquakes occur at divergent margins. Most divergent boundaries are in ocean basins, due to the nature of the type of crust created.

Convergent plates move together. When an oceanic plate is involved, there is subduction, a destruction of crust. There are earthquakes associated with the subducting plate, with a specific relationship to the subducting plate and oceanic trench. There is volcanism also related to the subduction, with a specific relationship to the subducting plate, creating volcanic arcs. Continental crust does not subduct, being composed of less dense sial. Continental convergence results in the suturing of continental plates.

Transform boundaries do not create or destroy crust. They do not have significant volcanism associated with them. Most earthquakes at transform boundaries are shallow. Many transform boundaries connect segments of the mid-oceanic ridge.

Know the evidence that supports the plate tectonics theory: paleomagnetism (both sea floor anomalies and pole location indication), paleoclimatic data, actual rates of spreading, ages of chains of seamounts, continental shelf fit, continuation of structural trends, correlation of fossil locations, distribution of earthquakes and volcanism, age of sea floor sediments. **KNOW BOTH WHAT SUPPORTS IT, AND WHY IT SUPPORTS IT.**

There are three models of mantle convection. What are they? What evidence supports each; what evidence, or lack of it, weakens each model?

Earthquakes are caused by subjecting rocks to stresses beyond their strength. Most earthquakes occur at plate boundaries. The focus of an earthquake is the point below ground where the fault releases energy. The epicenter is directly above the focus, and usually is not on the fault that allowed the movement.

Earthquakes generate both body waves and surface waves. Surface waves do not penetrate deeply into Earth, and are chiefly 's' type waves, in that the movement is at right angles to the direction of wave travel. Body waves generated are both "P" waves (primary) and "S"

waves. P waves move material in the same direction as wave travel, and can penetrate any type of material. S waves can only travel through solid material. P waves are fastest, body S waves next fastest, and surface waves are slowest. The distance to an earthquake can be determined if you know the difference in time from the arrival of the first P wave and the first body S wave.

Intensity and magnitude are different ways to describe the strength of an earthquake. Intensity relies upon how it affects people: how much damage, and what it felt like. Magnitude is calculated from seismic records, and can be used to estimate how much energy was released by an earthquake. Moment magnitude includes rock strength, area of extent, distance of ground rupture. Richter magnitude measures the displacement created by the ground shaking.

Earthquake damage is related to the proximity to populated areas, the local building standards, the intensity, magnitude and duration of earthquake, the type of bedrock it propagates through. Secondary damage includes tsunamis, landslides, liquefaction and subsidence, and fire.

Long-range forecasts for earthquakes rely upon statistical occurrences of past events. They are reasonably accurate, but not that useful, except for building design. Short-range forecasts rely on a variety of methods, and have poor reliability.

Earth's interior structure can be determined by the speed of seismic waves, and the location where they penetrate through Earth and the locations where they do not (shadow zones).

In addition, remember to study the review questions that were assigned.