**Geology 101 Objectives and Vocabulary**
*(Italicized objectives are not so important.)*

This is a general overview but man not contain everything.
Look over your study sheets, lecture notes, film reviews, and shorties.

## Chapter 2: Atoms to Minerals

### Objectives

- *Give the location, charge and mass of the 3 atomic particles.*
- *Define element.*
- Distinguish between ionic and covalent bonded minerals.
- List the four most common elements in Earth's crust.
- List the five characteristic of a mineral, and, given items, tell whether or not they are a mineral.
- Distinguish between a mineral and a rock.
- Put common minerals into the major families - carbonates, silicates, sulfates/sulfides.
- List 4 native minerals.
- Explain three ways minerals form.
- Identify some minerals by color.
- Explain the problem with using color as the only test.
- Distinguish between the streak of metals and nonmetals.
- Match several common minerals with their formulas.
- Sort minerals by their luster - metallic, glassy, waxy, dull, earthy, etc.
- Put minerals in the proper place on the Mohs scale… along with fingernail, penny, glass and nail.
- Explain the practical application of the Mohs scale.
- Relate crystal size to rate of formation.
- Describe the acid test and what is involved, what is given off.
- Identify cleavage/fracture in mineral samples.
- Match tests w/ minerals - taste, dissolution lines, double refraction, density, magnetism, etc.
- Explain 8 ways you use minerals in your daily life.
- Explain how your life would be impacted without mining.
- Explain problems that result from mining and why reduction and recycling are important.
- Using simple tests, identify 16 minerals by name.
- *Explain the importance of silicate minerals*
- *Draw atomic configurations of elements 1- 20 atoms on the periodic table.*
- *Given atomic number & mass, draw configurations for any element.*

### Vocabulary

| | | | |
|---|---|---|---|
| *anion* | atom | atomic mass | atomic number |
| *cation* | chain silicate | carbonate | cleavage |
| covalent bond | compound | crystal | density |
| earthy luster | electron | element | ferromagnesian |
| fracture | framework silicate | glassy luster | hardness |
| ion | ionic bond | isolated silicate structure | isotope |
| luster | metallic bonding | metallic luster | mineral |
| Mohs hardness scale | molecule | neutron | nonmetallic luster |
| nucleus | polymorph | rock-forming mineral | proton |
| sheet silicate | silica tetrahedron | silicates | specific gravity |
| streak | striations | sulfides | |

**Chapter 3: Igneous Rocks**

**Objectives**

- Draw and label the rock cycle.
- Use the rock cycle to understand relationships between igneous, sedimentary and igneous rocks.
- Classify the most common igneous rocks using their texture.
- Classify the most common igneous rocks using their chemical composition.
- Explain what all igneous rocks have in common.
- Describe two effects of water in magma.
- Identify the conditions under which rocks in Earth's interior melt to form magma
- Describe the magmatic processes that produce igneous rocks of different composition - Bowen's
- Given a drawing, identify sill, dike, laccolith, batholith, neck, country rock, xenolith, etc.
- Relate magmatic activity to plate tectonic theory.
- Compare and contrast the formation of intrusive and extrusive igneous rocks.
- Compare/contrast lava & magma, their chemical and mineralogical compositions and behavior.
- Relate cooling rate to crystal size.
- Explain the importance of water in magma formation and the relation to subduction zones.
- Identify 4 common intrusive igneous rocks.
- Explain the significance of pillow lava.
- Explain the formation of a porphyry.
- Explain the formation of tuff.
- Describe the importance of igneous rocks in daily life.
- Explain why obsidian is unusual.
- Describe the difference between high- and lower-silica rocks.

**Vocabulary**

| | | | |
|---|---|---|---|
| andesite | aphanitic (fine-grained) | basalt | batholith |
| Bowen's reaction series | chill zone | contact | country rock |
| crystalline rock | crystal setting (?) | decompression melting | diaper |
| differentiation | dike | diorite | extrusive rock |
| felsic (silicic) rock/magma | flux melting | fragmental rock | gabbro |
| geothermal gradient | glassy rock | granite | igneous rock |
| intermediate rock/magma | intrusion | intrusive rock | komatite |
| lava | mafic rock/magma | magma | mantle plume |
| obsidian | pegmatite | peridotite | phaneritic |
| phenocryst | pluton | plutonic rock | porphyry |
| pumice | pyroclasts/tephra | rhyolite | rock cycle |
| scoria | sill | stock | texture |
| tuff | ultramafic rock | vesicles | volcanic breccia |
| volcanic neck | xenolith | | |

**Chapter 4: Volcanism & Igneous Rocks**

**Objectives**

- Identify 4 common extrusive igneous rocks.
- Define magma, discuss its sources, and relate the effect of silica content to its behavior.
- List three gasses that result from eruptions
- Relate the amount and type of gas to different types of eruptions.
- Define lava and describe its behavior relative to silica and gas content
- Describe different types of tephra and relate the types to different eruptions in history.
- Describe rift eruptions and identify major rift eruption sites on a world map.
- Identify columnar jointing and explain the formation of columnar jointing.
- Discuss the nature and give examples of subduction zone eruptions.
- Describe the nature and give examples of hot spot eruptions.
- Connect three historical eruptions with the major volcanic types.
- List two beneficial results of volcanic eruptions.
- Locate major volcanoes on a world map
- Compare/contrast cinder cone, composite, and shield volcano
- Identify the ways humans are impacted by vulcanism.
- Describe the formation of dush/ash, cinders/lapillia, blocks and bombs.
- Characterize what happens in a pyroclastic flow.
- Explain the formation of columnar joints.
- Identify intrusive formations - dike, sill, batholith, laccolith, neck, caldera, pluton, plume, stock.
- Locate intrusive and extrusive rocks in the PVCC area.
- Given pictures, identify ‘a’a and pahoehoe.
- Explain why high-silica magmas are more viscous compared with mafic lavas.
- Compare/contrast $CO_2$ from vulcanism vs anthropogenic emissions.
- *Explain the cause of volcanism on Io.*

**Vocabulary**

| | | | |
|---|---|---|---|
| ‘a’a | active volcano | ash | block |
| bomb | caldera | cinder | cinder cone |
| circum-Pacific belt | columnar jointing | crater | composite/stratovolcano |
| dormant volcano | dust | effusive eruption | explo./pyroclastic eruption |
| extinct volcano | flank eruption | flood basalt/plateau | hot spot |
| lahar | lapilli | lava | lava dome |
| lava tube | Mediterranean belt | pahoehoe | pillow lava |
| pyroclast | pyroclastic flow | shield volcano | vent |
| viscosity | VEI | volcanism | volcano |

**Chapter 5: Weathering & Soil**

**Objectives**

- Distinguish between erosion and weathering.
- Describe several agents of erosion.
- Distinguish between chemical and mechanical weathering
- Explain the processes, products, and giving examples of chemical and mechanical weathering.
- List several mechanical weathering processes, how each occurs and describe the results of each process discuss the effects of weathering on a variety of minerals and rocks.
- Relate time to weathering.
- Describe the relationship of climate to weathering
- Explain the formation of soil.
- Distinguish between residual and transported soil, and identify examples.
- Identify two major factors that determine soil properties.
- Draw and label a mature soil profile.
- Explain how desert soils differ from mature soils.

**Vocabulary**

A-horizon
abrasion
acid rain
B horizon (zone of accumulation)
chemical weathering
clay mineral
differential weathering
E horizon (zone of leaching
erosion
exfoliation
exfoliation dome
frost action
frost heaving
frost wedging
hematite
hydrolysis
limonite
loam
mechanical weathering
O horizon
oxidation
parent material
pressure release
residual soil
salinization
sheet joints
soil
soil depletion
soil fertility
soil horizon
soil profile
subsoil
spheroidal weathering
splash erosion
sheet wash
talus
transportation
transported soil
topsoil
weathering

**Chapter 6: Sediments & Sedimentary Rocks**

**Objectives**

- describe the three main sources for materials that form sedimentary rock.
- identify where sediments are deposited.
- given sample rocks, identify the cement binding the clasts.
- explain why clay- and silt-based rocks don't need cement
- identify where various sediments will settle in a river, delta, and alluvial fan.
- describe the formation of the 3 major classes of sedimentary rocks.
- identify 4 clastic rocks and contrast their formation.
- identify 3 chemical rocks and contrast their formation.
- identify 3 organic rocks and contrast their formation.
- in images identify stratification, bedding planes, and cross bedding and explain how each is formed.
- explain how fossils form in sedimentary rocks and why they form only in sedimentary rock.
- explain the formation of mud cracks and ripple marks.
- explain the formation of geodes.
- identify major sedimentary rock features in Arizona

**Vocabulary**

| | | |
|---|---|---|
| alluvial fan | bedding | bedding plane |
| cement/cementation | chemical sed rock | chert |
| clastic/detrital sed rock | clay | coal |
| compaction | conglomerate | contact |
| cross-beds | crystalline texture | deposition |
| dolomite | env. of deposition | evaporite |
| formation | fossil | graded bed |
| gravel | limestone | lithification |
| matrix | mud crack | organic sed rock |
| original horizontality | pore space | recrystallization |
| ripple marks | rounding | sand |
| sandstone | sediment | sedimentary breccia |
| sedimentary rock | sed. structures | shale |
| silt | sorting | source area |
| transportation | turbidity current | |

**Chapter 7: Metamorphism and Metamorphic Rocks**

**Objectives**

- Explain the forces that cause metamorphism.
- Identify where dynamic metamorphism occurs & the events & rocks that result from it.
- Explain the formation of quartzite and marble.
- Identify places where regional metamorphism occurs & the events/rocks that result from it.
- Relate massive and foliated metamorphic rocks to their method of formation
- Given a set of metamorphic rocks, sort them into foliated and non-foliated.
- Explain the shale-slate-phyllite-schist-gneiss metamorphic sequence.
- Draw & label the rock cycle including all processes, tracing the path of 1 rock through all the steps.

**Vocabulary**

| | | |
|---|---|---|
| compressive stress | confining pressure | contact metamorphism |
| differential stress | ductile / plastic | foliation |
| gneiss | hornfels | hydrothermal metamorphism |
| isotherm | marble | metamorphic rock |
| metamorphism | metasomatism | migmatite |
| parent rock / protolith | phyllite | quartzite |
| regional metamorphism | schist | shearing |
| slate | stress | vein |

**Chapter 8: Time & Geology**

**Objectives**

- Explain the importance of James Hutton and how he change thought.
- Differentiate between relative and absolute age
- Given a stratigraphic cross-section, use the the 4 laws to construct a sequence
- Describe radioactive decay & how radioactive isotopes can be used to determine absolute age.
- Fill in a generalized geologic timeline of Earth - eras, periods, and life forms.

**Vocabulary**

absolute (numerical) age
actualism
angular unconformity
*Archean Eon*
*Cenozoic Era*
*contacts*
correlation
*disconformity*
*eon*
*epoch*
era
*faunal succession*
formations
Haden Eon
half-life
*Holocene / Recent Epoch*
inclusion
index fossil
isotopes
isotopic dating
*lateral continuity*
Mesozoic Era
*nonconformity*
Law of Cross-Cutting Relationships
Law of Included Fragments
Law of Orig. Horizontality
Law of Superposition
Paleozoic Era
periods
Phanerozoic Era
physical continuity
*Pleistocene Epoch*
Precambrian
*Proterozoic Era*
*Quaternary Period*
*radioactive decay*
relative time
standard geo. time scale
trilobite
unconformity
uniformitarianism

**Chapter 9: Mass Wasting**

**Objectives**

- Define mass wasting
- Describe three types of mass wasting and their speeds.
- Explain how to identify unstable slopes
- Describe how to reduce mass wasting.
- Identify gravity as the cause of mass wasting.
- Relate mass wasting to relief (angle of repose), soil vs rock, water content, etc.
- Explain what happens when the angle of repose is exceeded.

**Vocabulary**

| | | |
|---|---|---|
| creep | debris | debris avalanche |
| debris flow | earth flow | fall |
| flow | landslide | mass wasting |
| mudflow | permafrost | relief |
| rock avalanche | rockfall | rock slide |
| rotational (slump) slide | shear force | slide |
| slump | soil | solifluction |
| talus | translational slide | |

**Chapter 10: Streams & Floods**

**Objectives**

• Draw and label the water cycle using the correct terms.
• Explain how the sun is the source of energy for running water.
• Draw and label the parts of a river system.
• Describe three ways running water attacks bedrock.
• Explain four ways running water transports material.
• Identify 2 major drainages of Arizona, the US, and the world.
• Draw 4 types of drainage patters and recognize them on a map.
• Characterize river types by erosiveness, valley shape/width, discharge, bed, load, etc.
• Explain the cause and effects of headward erosion, relating to waterfalls & stream piracy and the effect on the length of a river.
• Calculate stream discharge.
• Explain what can cause the carrying power of a stream to vary.
• Explain the evolution of a v-shaped valley.
• Explain why canyons form instead of v-shaped valleys.
• Explain how rivers widen their valley.
• Explain how gullies form.
• Explain the formation and location of badlands.
• Identify two water gaps and two wind gaps
• Explain the development of potholes and plunge pools.
• Explain the historical recession of Niagara Falls & explain how waterfalls form.
• Explain the development of flood plains, meanders, cutoffs, oxbow lakes.
• Explain how an entrenched meander forms.
• List factors that cause a stream to drop its load and locations of each drop.
• Compare and contrast delta and alluvial fan.
• Explain the development of levees and back waters.
• Explain why flood plains are good farming areas.
• Explain the formation of a floods & flash flood and explain why they are limited to certain areas.
• Identify one example of reservoir dam failure & name three kinds of natural dams.
• List three methods used to prevent floods.
• Explain how the running water history of Phoenix has changed over the years.

**Vocabulary**

alluvial fan
bank
base level
bed load
braided streams
channel
condensation
delta
dendritic, trellis, radial, rectangular
deposition
divide
discharge
distributaries
drainage basin
entrenched meander
evaporation
foreset beds
flash flood
flood
flood plain
gradient
graded bed
groundwater
headward erosion
levee
load
meander
oxbow
oxbow lake
pothole
plunge pool
precipitation
river system
runoff
stream piracy
suspension
solution
saltation
slot canyon
terrace
transpiration
tributaries
water budget
water cycle
wind gap / water gap
young / mature / old

**Chapter 11: Groundwater**

**Objectives**

- Compare the amounts of salt & fresh water on Earth.
- Describe the distribution and quantify of fresh water.
- Describe water cycle using precipitation, groundwater, runoff, evapotranspiration, evaporation.
- Define water budget and describe the water budget for Arizona.
- Identify and describe the factors that determine how much rain becomes groundwater.
- List factors that determine the amount of pore space in a rock.
- Give examples of the difference between porosity and permeability.
- Draw a typical water table-zone of saturation, zone of aeration, capillary fringe, water table, aquifer.
- List factors that cause that affect the depth of the water table.
- Compare and contrast wells with springs.
- describe the structure of an artesian formation and springs.
- Identify factors that cause variation in the water table.
- Identify local examples of efforts to recharge the aquifer.
- Explain why groundwater is typically cool.
- Explain the operation of geysers and fumaroles.
- Identify three cause of high mineral content in ground water.
- List two minerals that make groundwater "hard".
- List ways a spring may acquire high mineral content.
- Draw the formation of sinkholes, caverns, natural bridges, and lost rivers.
- Name three cavern formations in the USA, one in Arizona.
- Describe how karst topography develops.
- Describe formation of stalactites, stalagmites, columns, travertine, geyserite, veins, & pet wood.
- Identify the role of groundwater in cementing rocks.

**Vocabulary**

| | | |
|---|---|---|
| aquifer | artesian well | cave |
| cavern | concretion | cone of depression |
| confined aquifer | drawdown | gaining stream |
| geode | geyser | groundwater |
| hot spring | karst topography | losing stream |
| perched water table | permeability | petrified wood |
| porosity | recharge | saturated zone |
| sinkhole | speleothem | spring |
| stalactite | stalagmite | unconfined aquifer |
| unsaturated zone | water table | well |
| zone of aeration | zone of saturation | |

*Updated September 15, 2016*