Study guide for Weston ESS 101 Final Exam. Earthquakes through Deformation Units will be included. Refer to powerpoints, activities, and lab documents online to review for this test.

<u>Learning goals for Earthquakes:</u> Be able to answer correctly these essential questions

- What is an earthquake? (What is occurring, what causes it?)
- What are the types of earthquake waves? (and how do they differ?)
- How is the epicenter of an earthquake determined? (Why does this work?)
- Where are the principal earthquake zones on Earth? (How do they correlate with plate boundaries and volcanoes? Do all earthquakes occur along plate boundaries?)
- How is earthquake strength expressed? (What does this scale mean/measure?)
- What are the main factors that affect the amount of destruction caused by seismic shaking? (How can these be used to infer earthquake risk?)
- What is a tsunami? (How do we predict them, and how do we prevent devastation from these events?)
- What are other major hazards, local and global, from earthquakes, and how can we mitigate (prevent or minimize the damage from) these?
- How often do earthquake events occur in this region? How accurately can we predict these events?
- Where are the major earthquake producing faults in our region?

Earthquakes Vocabulary

aftershock
body wave
earthquake
elastic limit
elastic rebound
epicenter
focus
foreshock
intensity
liquefaction
magnitude
main shock
moment magnitude
p-wave
seismic seawave/tsunami
seismic wave
seismograph
seismology
surface wave
s-wave

<u>Learning Goals for the Weathering, Mass Wasting, and Sedimentary Rocks</u>
Weathering Processes (sections 4.1-4.4 in text)

- Know what physical and chemical weathering are.
- Know how joints and surface area affects weathering processes.
- Understand how frost/ice wedging, freeze-thaw cycles, fire, water, and temperature, climate, and biology can affect weathering rates.
- Understand what spalling (sheeting, exfoliation) is.
- Know what happens to rocks with $CaCO_3$ in them during chemical weathering, and what the products are (i.e. what is produced when limestone, travertine, marble, or dolomite are chemically weathered?).
- Know what happens to silicate rocks during chemical weathering, and what the products are (i.e. what does the rock change into?).
- Know how acid affects various types of rocks.
- Understand how rills, sinkholes, cave, and karst topography are formed.
- Know which minerals are more resistant to weathering and which ones are more vulnerable.
- Understand how differential weathering can shape landscapes.
- Soil will **<u>not</u>** be on the test.

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Mass Wasting (sections 4.12-4.19 in Text)

- Understand what the angle of repose is.
- Understand how slope, water, vegetation, and earthquakes affect mass wasting.
- Understand the differences between rock falls, rock slides, and debris flows.
- Know what creep, slump, and solifluction are.

Sedimentary Rocks

- Know where sedimentary rocks are usually formed
- Know the three mains processes that converts sediments to sedimentary rock.
- Be able to use a chart to identify types of sedimentary rocks based on a description.
- Understand the differences between clastic, chemical, and biochemical rocks and how we classify them.
- Understand that clastic sedimentary rocks are classified primarily based on grain size. Know other factors such as degree of roundedness and "maturity."
- Know which minerals typically make up sedimentary rocks.
- Know the most common cementing agents, and how you could distinguish them in a rock.
- Understand how grain size indicates the energy of the environment in which sediments are deposited.
- Understand how chemical sedimentary rocks form, and which environments tend to form them.
- Know what the carbonate compensation depth (CCD) is and why it is important in the deposition of rocks containing $CaCO_3$ in the ocean.
- Understand how biochemical rocks are formed.
- Know what cross-bedding is, and how it forms. Be able to tell the direction of water flow from a picture of cross-beds.
- Know what dunes, mud cracks, and ripples are and how they form.
- Know what a turbidity current is, and the sequence of deposition of grain sizes in a turbidite.
- Know the types of graded bedding, and understand what types of settings will deposit he types of graded beds: fining up, coarsening up, and ungraded bedding.
- Know what types of environments usually preserve fossils. What should be true about the energy of the environment (rock type), and amount of oxygen trapped in the sedments?

Sedimentary Rocks Vocabulary

Acid rain
Angle of repose
Breccia
Calcite
Carbonate Compensation Depth (CCD)
Chalk
Chemical Weathering
Chert
Clastic
Clay
Coal
Conglomerate
Creep
Cross-bedding
Debris Flow
Differential Weathering
Dunes
Evaporites
Freeze-thaw cycles
Frost or ice wedging
Joints
Karst Topography
Limestone
Lithification
Mud Cracks
Permafrost
Physical Weathering
Ripples
Rock Fall
Rock Slide
Sandstone
Shale
Siltstone
Sinkholes
Slump
Solifluction
Spalling (exfoliation weathering, sheeting)
Stalactites
Stalagmites
Turbidity current

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Learning goals for Streams and Water

- Know where most of Earth's fresh water is found, along with most of Earth's water.
- Know how much water is in ice versus groundwater.
- Know the definition of a stream.
- Understand how streams change from headwaters to mouth, in terms of discharge, capacity, and gradient.
- Know how to calculate discharge.
- Know how stream valleys develop and mature over time. How do you identify a young stream versus a mature stream?
- Know how to calculate sinuosity, and what sinuosity means.
- Know how sediment is transported in streams: bed load versus suspended load.
- Understand the relationship between the energy, velocity and competence of a stream. Which had more velocity or energy, a stream that transports large particles or only small particles?
- Understand where the highest velocity region is in a stream (i.e., what is a thalweg?). Why does the bed of a stream slow down the water?
- Understand and be able to explain how waterfalls form.
- Be able to explain a stream profile.
- Understand why braided streams form, and where they form, as opposed to meandering streams. How does competence and capacity affect stream form?
- Understand where alluvial fans form.
- Understand why deposition occurs, and how deltas form.
- Know what a flood plain is, and what types of development in flood plains are appropriate, or inappropriate.
- Understand the difference between porosity and permeability.
- Understand and be able to describe at least three distinctly different threats to groundwater.

Stream and Water Vocabulary

Alluvial fan
Baseline
Bed load
Capacity
Competence
Cone of depression
Cutoff
Delta
Discharge
Distributary
Flood plain
Meander
Nick point
Ox bow
Permeability
Porosity
Saltation
Saltwater intrusion
Sinuosity
Stream
Stream maturity
Stream profile
Suspended load
Thalweg
Traction
Tributary
Trunk stream
Ultimatebaseline

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Learning goals for Glaciers

- Determine the factors that affect the motion of glaciers, and calculate the speed of glacier movement.
- Discover what a glacier buget means for the growth and destruction of a glacier, and describe the features it leaves behind.
- Be able to recognize or describe features in glaciated environments, particularly till, moraines, drumlins, erratics, striations, and outwash features.
- Know when the last continental glaciation reached its peak, and approximately when it ended in the Puget Sound area.
- Understand how snow turns into glacial ice.
- Understand how and why a glacier flows, and where brittle and ductile deformation occur in a glacier.
- Understand glacier formation, particularly the relationships between the following:
  a.Temperature and glacier size
  b. Snowfall amount and glacier size.
- Understand the effects of global climate change on the amount of glacial ice, and the trends over the last 150 years.
- Be able to recognize features that indicate whether a glacier is advancing or retreating (moraines), and features that indicate whether an area was previously glaciated (striations, erratics, moraines, kames, eskers).
- Understand how CO_2 in the atmosphere, and other greenhouse gases, affect global average temperatures, on Earth and other planets.
- Understand the effect of glacial (terrestrial) ice loss on sealevel, locally and globally.

Glaciers Vocabulary

Ablation zone
Ablation till
Accumulation zone
Alpine glacier
Arête
Cirque
Compacted till
Continental ice sheet
End moraine
Equilibrium line
Esker
Firn
Glacial drift
Glacier
Horn
Ice field
Kame
Loess
Moraine
Outwash plain
Piedmont glacier
Tarn
Till
U-shaped valley
Valley train

Learning goals and readings for metamorphic rocks and deformation: *Textbook sections Unit 1, E and Unit 3 E: pages 69-75 and 298-316*

Learning goals for Metamorphism

- Understand the textural and mineralogical changes that commonly occur during metamorphism, and that these change with pressure, temperature, and presence of fluids.
- Know the two major types or mechanisms of metamorphism.
- Understand the conditions over which metamorphism occurs (confining pressure, fluids, temperature, and depth in the Earth), and how pressure and temperature change with depth.

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- Be able to describe common metamorphic textures and how they occur: foliation and lineation in particular.
- Understand how protolith is related to the metamorphosed rock.
- Be able to recognize common metamorphic rocks and minerals.

Learning goals for Deformation and Mountain Building

- Know the factors that affect rock strength.
- Know the types of deformation associated with extensional, compressional and transform/shear forces.
- Know the differences among strike-slip, normal and reverse faults, in terms of type of stress (shear, extensional or compressional).
- Know what a hanging wall and footwall are, and how they move relative to each other in the three fault types.
- Know the difference between a fault and a joint.
- Understand the difference between stress and strain.
- Understand the differences among brittle, ductile and elastic deformation.
- Know and be able to draw the basic features and types of folding.
- Know and be able to draw the basic features and types of faults.
- Understand where, and under what conditions mountain building occurs.
- *Bonus:* Know that earthquakes can trigger landslides, and give at least two famous examples of where and when this has occurred. Can landslides trigger earthquakes? What *else* can trigger earthquakes along a fault?

Vocabulary for Metamorphism, Deformation and Mountain Building

Accretion
Anthracite
Anticline
Basin
Brittle deformation
Confining pressure
Dip-slip fault
Dome
Ductile deformation
Elastic deformation
Fault
Fault trace
Fold
Foliation
Footwall
Gneiss
Graben
Hanging wall
Horst
Hydraulic fracturing
Joint
Lineation
Marble
Normal fault
Orogenesis
Overturned
Protolith
Quartzite
Recrystallization
Schist
Slate
Strain
Stress
Strike-slip fault
Syncline
Terrane

<u>Learning goals for Geologic Time (Chapter 11):</u>

- Know the difference between relative dating and absolute dating.

Relative dating:

- Understand how geologists use stratigraphy and rock associations to determine relative ages of rocks and sedimentary deposits.

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- Be able to explain the *principles original horizontality, uniformitarianism, superposition, cross-cutting relations, and inclusion.*
- Be able to explain the principle of faunal succession (called "fossil" succession in your book).
- Know the differences among, and be able to draw and explain, the following:
  - Unconformity
  - Angular unconformity
  - Nonconformity
  - Disconformity
- Be able to apply the principles of relative dating to reconstruct a geologic history by stratigraphic information, indicator fossils, rock types, and cross-cutting relationships, as we will do in lab.
- Know what constitutes an indicator fossil.

Absolute (radiometric) dating:

- Know what an isotope is.
- Understand how isotopes decay, and what a half-life represents.
- Understand how radioactive materials are used to date geologic materials of various ages.
- Know which dating techniques are used for young rocks (less than 20,000 years) and older materials (20,000 to billions of years).
- Know the differences between alpha, beta and gamma decay in terms of daughter products.
- Know what the differences are among alpha, beta and gamma radiation in terms of energy.
- Be able to infer a date from changing amount of parent and daughter product, and half-life.

Geologic time scale (p. 351 in textbook):

- Know the relative distinctions among an Eon, Era, Period and Epoch in terms of longest to shortest.
- Understand that these time periods are designated by fossil evidence of evolution, abundance, or extinction of key species.
- Know the ages of these time periods, and what was important about them in terms of Earth history and the fossil record…

<u>Put these time periods in order by (oldest on the bottom, youngest on top):</u>

Archean eon
Cambrian period
Carboniferous period
Cenozoic era
Devonian period
Holocene epoch
Mesozoic era
Phanerozoic eon
Pleistocene epoch
Precambrian eon
Quaternary period

<u>Know the following important dates, ages, or time periods (names) in Earth history, and be able to put these in order. Be able to correlate them with the above time periods:</u>

Dinosaurs became extinct
Evolution of one-celled organisms
Extinction of trilobites
First fish evolved
First land plants evolved
First reptiles evolved
Homonids evolved
Invertebrates evolved
Mammals became dominant
Most coal deposits formed