**EES 2510: Review Questions for Exam 3**

**Exam 3: Thursday November 29 during regular class time (11 AM – 12:20 PM)**

**Chapter 15 Oceans and Currents**

1 What are some reasons to study the oceans and ocean floor?

2 Describe how the shape of the ocean floor has been mapped, starting with the earliest surveys and including the latest approaches using satellite measurements.

The ocean floor has been mapped in multiple ways:

1. Earliest form happened around 1872-1876
   1. Method was by lowering weighted lines overboard
2. More modern techniques:
   1. Sidescan Sonar
      1. Reflections from multiple points collected together
   2. Multibeam Sonar
      1. Similar method process of the Sidescan Sonar
      2. Good depth control

3 Explain the connection between the type of crust (continental, oceanic) and the average elevation of continents (above sea level) and depth of ocean (below sea level).

4 Describe the three major provinces of the ocean floor. What is an additional feature of the sea floor related to plate tectonic processes?

The three main provinces of the Ocean Floor:

1. Continental margins
   1. Continental shelf
   2. Continental slope
   3. Continental rise
   4. Submarine canyons
2. Deep-ocean basins
   1. Abyssal plain
   2. seamounts
3. Mid-ocean ridges

The additional feature:

- Trenches

5 Know the four layers that make up oceanic crust (from the top: sediments, pillow lavas, vertical intrusions = sheeted dikes, gabbro). How thick is typical oceanic crust?

Within the oceanic crust the four layers fro top to bottom:

* Sediment
* Pillow lavas
* Vertical intrusions (dikes)
* Gabbro

The oceanic crust is around 7 km thick

6 Describe the process of sea floor spreading.

New oceanic crust forms and spreads along the mid-ocean ridge, as it continues to spread, the older crust will move away from the ridge. The spreading creates stripes of oceanic crust that match on either side of the ridges.

7 How do mid-ocean ridges with a slow rate of spreading differ from ones with a fast rate of spreading?

With the difference in the rate of spreading this creates a difference in space for water to appear. The slower rate of spreading will grant a greater space for water to take up but a faster spread rate will have the opposite effect.

8 What is the connection between mid-ocean ridge spreading rate and sea level?

9 What is one example of sea level rise related to mid-ocean ridge spreading rate from the geologic past? Over what length of time did sea level rise?

10 What factors cause portions of ocean waters to have different densities?

11 Describe the three scales of ocean currents -- small, intermediate, global—including their approximate size/extent and what drives them.

12 Explain how the global ocean current is connected to climate.

13 Problems at coasts result when natural processes interfere with humans and our structures. Discuss the nature and severity of these problems: rising sea level, hurricanes/typhoons.

These terms are used in the text but are **not important** for our purposes: backwash, barrier island, beach erosion, beach nourishment, beach profile, fjord, longshore current, longshore drift, rogue wave, sand spit, sea stack, swash, tidal reach, tide, wave base, wave-cut bench, wave refraction

**Chapter 9 Geologic Structures and Mountain Building**

1 What are orogenic processes?

2 How does *stress* differ from *strain*?

Stress and Strain are related to cause and effect. Stress is a force (cause), Strain is a change in shape (effect).

3 What are the three types of *deformation* that alter rock layers?

The three types of deformation are compression, tension, shear

4 What are three types of stress that operate on rock layers?

5 How is *compression* similar to *convergence*?

6 How is *tension* similar to *divergence*?

7 How is *shear* similar to *transform*?

8 What are *geologic structures*? How do geologic structures give information about the ways that rock layers have been deformed?

9 What are the two types of *folds*?

10 What are the three types of *faults*? What type of stress causes each one? (For example, *reverse faults* are created by *compression*.)

11 What is an *orogeny*? What is formed during an orogeny?

12 Define these terms: continental shield, platform, craton.

13 Briefly explain how mountain belts are created at *convergent* plate boundaries with *oceanic* crust against *oceanic* crust.

14 Briefly explain how mountain belts are created at *convergent* plate boundaries with *oceanic* crust against *continental* crust.

15 Briefly explain how mountain belts are created at *convergent* plate boundaries with *continental* crust against *continental* crust.

16 Briefly explain how *fault-block mountains* are created within areas of *continental* crust subjected to *tension*.

17 Study the four stages (three named orogenies, plus Rifting) that created the Appalachian Mountain Belt.

These terms are used in the text but are **not important** for our purposes: bearing, crustal root, epeiorogeny, exhumation, isostasy, joint, monocline, oblique-slip fault, orogenic collapse, slickensides, vein

terms to know: elastic, ductile, brittle, dome, anticline, syncline, basin, normal fault, reverse fault, thrust fault, strike-slip fault, orogeny

Extended answer questions:

• A region is characterized by numerous anticlines and synclines. There are also several faults present that appear to have formed at the same time as the folding. Without looking at any details, what type of faults would you assume them to be? Why?

• Describe the characteristics of regions dominated by fault-block mountains such as the Basin and Range (describe what creates the basins and what creates the ranges). What is their relationship to plate tectonics and why don't they create large-scale mountain belts like subduction at continental margins or continental collisions?

**Chapter 14 Streams and Floods**

1 Why is Earth the only one of the inner planets (Mercury, Venus, Earth, Mars) to have abundant liquid water?

Earth is the only one of the inner planets to have abundant liquid water because of the water and atmosphere derived from mantle during early period of intense volcanic activity. The early atmosphere dominated by CO2, the liquid water and life allowed the CO2 to be removed and stored as calcium carbonate rock (CaCO3)

2 What is the *Global Water Cycle* (the *hydrosphere*)?

3 Explain the connection among these terms: *runoff, infiltration, recharge, sheetwash/overland flow, channel flow.*

4 What is a *drainage system*? What is a *drainage basin*?

5 What is the *gradient* of a river? Where is it steep? Where gentle?

6 What is the difference between *velocity* and *discharge*?

7 In what two ways do rivers *erode*?

8 What is the significance of large potholes in the valley wall in Glen Helen in Yellow Springs? (lecture only)

9 In what ways do rivers normally erode and deposit at different but nearby places?

10 How do *cut banks* indicate that most rivers both deposit and erode?

11 Which comes first: rivers or valleys? That is, do rivers occur because valleys exist and therefore collect the water that makes rivers flow or do rivers create and shape their valleys?

12 How quickly do most valleys change?

13 What is river stage? What is flood stage?

14 Explain what is meant by a “100 year flood.”

15 What is the general relationship between magnitude (river stage or discharge) and frequency (probability of occurrence or recurrence interval)?

16 What is a *floodplain*? Can all flooding of the floodplain be prevented with *levees*? Would you build a home on a floodplain?

These terms are used in the text but are **not important** for our purposes: alluvial fan, base level, competence, drainage reversal, ephemeral stream, flasah flood, floodway, headward erosion, oxbow lake, stream rejuvenation, stream piracy, stream terrace, waterfall.

Terms to know:

gradient, velocity, infiltration capacity, discharge, cut bank, point bar, artificial levees, floodplains, natural levees, abrasion, pothole, cut bank

Extended answer questions:

• List the hydrosphere's major reservoirs and describe the different paths that water takes through the hydrologic cycle.

• Describe the hierarchical nature of drainage basins.

• Outline the ways in which streams erode, transport, and deposit sediment.

• Distinguish between two types of river channels (meandering and braided).

• Describe the common approaches to flood control.

**Chapter 16 Groundwater**

1 How important is *groundwater* in the *hydrologic cycle*?

Groundwater is very important to the hydrologic

2 Know these important terms: *porosity, permeability, aquifer, aquitard, water table.*

4 Upon what does *permeability* depend?

5 What are *buried valley aquifers* and why are they important in the mid-continent of North America? (lecture only)

6 What controls the *direction of groundwater flow*? What is the typical *rate* at which groundwater flows

7 How are *springs* created?

8 What is a *cone of depression*? How can the cone of depression for one well affect adjacent wells?

9 Be sure you can write an equation showing Darcy’s Law.

10 What are the threats to the quality of groundwater from human activity?

11 How has the City of Dayton acted to help protect its groundwater resource? (lecture only)

These terms are used in the text but are **not important** for our purposes: artesian, capillary fringe, disappearing stream, geothermal, geyser, hot spring, karst, oasis, perched water table, spleothem, stalactite, stalagmite

Terms to know: water table, porosity, permeability, aquifer, aquitard, Darcy’s Law

Extended answer questions:

• Describe the importance of groundwater as a source of freshwater and discuss threats to this source.

• Discuss the factors that cause variations in the water table

• Sketch a simple groundwater flow system and explain it. =

• Discuss water wells and their relationship to the water table.

• List and discuss important environmental problems associated with groundwater.

**Chapter 18 Glaciers and Glaciation**

1 What evidence of continental glaciation can be seen in satellite photos of southwestern Ohio? (lecture only)

2 How is the distribution of highly productive water wells in Ohio explained by processes of continental glaciation (lecture only)

3 What are *glaciers?* Why are snowfields and icebergs excluded?

4 How important are glaciers in the *hydrologic cycle*? What proportion of all water do they represent? What proportion of freshwater?

5 How are glaciers an important indicator of past climate? Of present climate?

6 How do *valley glaciers* differ from *continental glaciers*? Which kind is more important to Ohio?

7 Describe how the position of the *margin* (end) of a glacier depends on the balance of *accumulation* (snowfall exceeding summer melt) and *wastage* (melt exceeding snowfall).

8 When a glacier margin retreats, does the body of the glacier also retreat or does it continue to flow forward?

9 Describe the two components of glacier movement: (1) *plastic flow*; (2) *basal slip*

10 What are *buried valley aquifers* and why are they important to the Dayton area? (lecture only)

11 What is the magnitude of sea level changes caused by ice sheets growing and melting?

12 What is the Pleistocene Ice Age? When was it? When were other ice ages?

13 What is the *Slow Carbon Cycle*? What is the ultimate source of carbon to Earth’s atmosphere? What process removes carbon from the ocean and atmosphere?

14 Know definitions for these important terms: proxy, flux, reservoir.

15 How have CO2 concentrations (estimated using proxies) changed over the past 500 million years? How high (compared to present levels) has the concentration risen?

16 What is meant by the terms *Hot house* and *Ice house* for states of Earth’s climate?

17 How have CO2 concentrations (estimated using proxies) changed over the past 500 thousand years? How high (compared to present levels) has the concentration risen?

18 What is known about CO2 concentrations in the atmosphere as measured from ice cores? How do these compare with estimations of temperature derived from oxygen isotope ratios?

19 What are the three components of orbital variations of Earth identified in the Milankovitch Theory? How do these compare with estimates of climate change over the past 800 thousand years?

20 What is the connection between orbital variations, CO2 changes, and glacial cycles?

These terms are used in the text but are **not important** for our purposes: arête, cirque, drumlin, erratic, fjord, firn, glacial striation, glacial subsidence, hanging valley, horn, kettle hole, patterned ground, pluvial, roche moutonnee, U-shaped valleys, tidewater glacier, varve.

Extended answer questions:

• Explain the role of glaciers in the hydrologic cycle.

• Describe the different types of glaciers, their characteristics, and their present-day distribution.

• Describe how glaciers move, the rates at which they move, and the significance of the glacial budget.

• Distinguish between the two basic types of glacial drift. List and describe the major depositional features associated with glacial landscapes.

• Briefly summarize current ideas on the causes of ice ages.