ERTH 350 Environmental Geology Lab Exercise (Due 3/10/05):

In the order listed, include the following lab and writing exercises in a neat organized package, :

(1) Freeman Structural Geology / Geologic Map Lab Exercise

(2) Introduction to Rock Properties Problem Set

Environmental Geology Midterm Exam Study Guide

Midterm will be in 2 parts, the lab skills portion will be open book. You will be able to use your notes, conversion charts, answer keys, etc. to work on lab-style problems. Make sure you go over the answer keys before the exam, if you are still uncertain how to solve the problems. The second part of the quiz will be closed book, and consist of long-answer essay questions, short-answer terminology, perhaps some true/false.

Recommended Study Techniques

1) go over lab questions / study them
2) review the "How to Study" sheet handed out at beginning of term
3) use the concepts below as a guide to help you focus on your notes
4) memorize terms and concepts; use key word list as a checklist of material covered
5) go back over the labs and make sure you can do the tricks / skills
6) review some of the important figures in your lab manual and text
7) go to the lab and look at the lab answer keys,
8) review the techniques for working with maps
9) Study until you pass out, get up and study some more
10) change your socks and drink plenty of water
11) clean your room....

Key Words

Introduction

Environmental Geology
- natural hazards
- environmental quality
  - water
  - soil
  - waste

management
- natural resources
  - water
  - energy
  - mineral

Geologic Hazards
fluvial
mass wasting
coastal
karst
seismic
volcanic
coastal
death / destruction
anthropogenic
urbanization
hazard vs. risk
contaminants
health effects
environmental fate
industrial waste
biological waste
pollution
Environmental Spheres
Lithosphere
Biosphere
Hydrosphere
mass
matter
energy
kinetic energy
potential energy
thermal energy
mechanical energy
law of energy conservation
heat transfer
convection
conduction
radiation
Age of the Earth
Ultimate Driving Forces
- Climate
- Gravity
- Tectonics

Crustal Composition
Core
Mantle
Crust
Oceanic Crust
Continental Crust
Asthenosphere

Lithosphere
"Plates"
Scientific Method
Hypothesis
Experimental Design

Math Review

Unit Algebra
Unit Conversion
Graphing
Equation of Line
Slope of Line
y=mx + B
map view
cross-section view
3-D view
metric / English units

Topographic Map Review

topographic maps
north arrow
magnetic declination
map scale
fractional scale
graphical scale
longitude latitude
township-range-section
equator
prime meridian
parallels
angular measurement
7.5 min quadrangle
contour interval
index contour
law of V's / streams
UTM

Rocks and Minerals Review

rock
mineral
element
compound
atom
nucleus
electron
proton
neutron
mineral properties
crystal form
luster
color
streak
hardness
cleavage
fracture
specific gravity
rock forming minerals
silicates
carbonates
oxides
sulfates
halides
rock cycle
igneous
metamorphic
sedimentary
magma / lava
fast-cooling lava
slow-cooling magma
two-phase cooling
extrusive / lava
intrusive / magma
weathering
Regolith
Bedrock
Earth
Debris
Rock
sediment
sediment transport
sediment burial
lithification
fossil
metamorphic
foliation
non-foliated
heat-pressure-chemical
granite
basalt
obsidean
sandstone
shale
limestone
siltstone
gneiss
slate
marble
quartz
feldspar
muscovite
biotite

Plate Tectonics Review

Mineral
Element
Rock
Rock Types
Igneous
e.g. basalt
e.g. granite
Sedimentary
e.g. sandstone
Metamorphic
Magma
Lava
Weathering
Sediment
Volcano
Earthquake
Seismology
Crust
Oceanic (basalt)
Continental (granite)
Lithosphere (Plate)
Crust
Upper Mantle
Asthenosphere
Silly Putty
Deep Mantle
Outer Core (solid)
Inner Core (liquid)
Plate Tectonics
Alfred Wegener
Continental Drift
Plate Boundaries
Convergent
Divergent
Transform
Convergent
Subduction
Trench
Volcanic Arc
(e.g. Cascades)

Plate Destruction
accretionary tectonics
Divergent
Seafloor Spreading
Mid-Oceanic Ridge
Plate Creation
Transform
Fault
e.g. San Andreas
e.g. Offset Mid-Ocean Ridge
Alfred Wegner
Continental Drift
Jig-Saw Fit of Continents
Pangaea
Match-up of Fossils
Match-up of Geology
Modern Evidence
Seismic Distribution
Volcanic Distribution
Trench Distribution
Hot Spots
Hot Spot Tracks
Hawaiian Islands

Emperor Seamount
Seamounts
Volcanic Islands
Plate Motion Rates
1-10 cm/yr
Plate Driving Mechanism
Internal Heat
Radioactive Source
Heat Exchange
Mantle Convection
Convection cells
rising hot rock
sinking cool rock

Oregon Natural Hazards
Overview

seismic / earthquake
subduction zone earthquake
intraplate earthquake
landslide
coastal erosion
volcanic activity
- ash zone
- lahar

tsunami
flood
stream bank erosion
quake-slide
quake-tsunami
flood-coastal erosion

Earthquake Overview

earthquake
focus
epicenter
faults
volcanic
normal fault
revers fault
strike-slip fault
fault trace
fault zone
fault segment
rock deformation
- ductile
- elastic
- brittle

stress vs. strain
stick-slip
aftershock
fault creep
intraplate quakes
plate bound quakes
earthquake intensity vs. earthquake magnitude
fault slip rate
fault displacement
earthquake recurrence
paleoseismology
seismicity
fault offset
Hazard Variables
- intensity
- duration
- building design
- foundation materials
- written record
- geologic records
- tsunami deposits

Earthquake Hazards Mapping
liquefaction potential
amplification potential
landslide potential

Oregon Seismic Hazards
intraplate quakes
crustal quakes
Cascadia subduction zone
Deep intraplate
shallow crustal
paleoseismic record
- oral history

plate locking
plate flexure-release cycle

Physics Concepts
mass
temperature
density
Potential energy
Kinetic energy
Force
Weight
Acceleration due to gravity
Newton
Joule
Pascal
Pressure
Stress
Shear strength
Shear stress
velocity
force
weight vs. mass
friction
heat energy
Newton's law of gravitational attraction
phases of matter
solid
liquid
gas
heat flow
pressure differential

Structural Geology / Geologic Map Principles

- Planar Orientation
  - Strike (azimuth vs. quadrant)
  - Dip (angle + direction)
- Planar Features
  - Faults
  - Beds
- Trig. Functions
  - Sin, cos, tan
  - Angles
    - Degrees, minutes, seconds, radians
  - Arctan (inv. Tan)
  - Rise / run
  - VD/HD
  - Pythagorean's theorem
  - Right triangles
- Compass Bearings
  - Azimuth vs. Quadrant
- Three Point Problem
- Rock deformation
  - Brittle, elastic, ductile
- Rock folding
  - Anticlines (oldest in center)
  - Synclines (youngest in center)
  - Strike, dip, plunge
  - Domes, basins
  - Plunging folds
  - Doubly plunging folds
  - Law of V's / rock patterns
- Faults
  - Normal fault (tensional)
  - Reverse fault (compressional)
  - Thrust fault (compressional)
  - Strike-slip faults
  - Dip-slip faults
  - Oblique-slip faults
- Fractures / joints
- Folded Mountains
- Fault-block mountains
- Horst / graben
- Aulocogen
- Hogback
- Unconformities
  - Angular
  - Nonconformity
  - Disconformity
- Law of Original Horizontality

Law of Superposition
Law of cross-cutting relations
Law of inclusions
Relative vs. Absolute dating
Radiometric dating
Half life
Radioactive isotopes
Resistant rock vs. nonresistant rock
Fault and fold topography
    Hogbacks
    Fault valleys
    Scarp slope
    Drainage disruption / offset stream segments
    Dip slope

Volcanic Hazards

magma
lava
extrusive
intrusive
plutonic
volcanic
subduction zone volcanism
Cascade volcanic arc
dormant/active/extinct
magma types
    felsic (high Si)
    mafic (low Si)
    intermediate
    rhyolite
    andesite
    basalt
controls on style of volc.
    viscosity
    silica content
    temp. of magma
    gas content
    phreatic state
eruptive products
    lavas
        aa
        pahoehoe
    pyroclastics
        ash
        lapilli
        blocks
        bombs
        cinders
        tuff

- gases
  - carbon monoxide
  - steam
  - hydrogen sulfide gas

Volcanic Types / Eruption Styles
- Hawaiian – shield
- Cinder cone
- Stratovolcano / composite
- Fissure eruptions – CRBs
- Ash Flows / Pyroclastic Flows
- Lahars
- Calderas

Volcanic Landforms
- Vent
- Crater
- Caldera
- Flanks
- Parasitic cone
- Domes

Intrusive bodies
- Dikes, sills, batholiths

Cascade Hazards
- tephra
- ballistics
- pyroclastic flow
- lahar
- lava flow
- volc. gases
- lateral blasts
- glacial outburst floods

Other Hazards / concepts
- Mt. St. Helens, Rainier, Hood – risk / probabilities
- Mt. Mazama / crater lake story
- Volcano occurrence
  - Subduction zones
  - Hot spots
  - Rifts / spreading centers
- Ring of Fire
- Magnitude vs. frequency
- Runout zone
- Hazard footprint
- Hazard maps
- Lahar / debris flow
- Explosive vs. quiescent eruptions

Water Budget / Hydrologic Cycle

hydrology
spatial scale
temporal scale

mass
energy
flux
mass transfer functions
    evaporation
    condensation
    precipitation
    runoff
    infiltration
    transpiration
deterministic vs. stochastic processes
hydrologic cycle (sketch it)
convection
advection
groundwater
surface water
global water storage
residence time
compartments
    oceans
    groundwater
    lakes
    glaciers
    ice caps
transpiration
evapotranspiration
runoff
infiltration
vegetative interception
ice sheets
oceans
springs
soil moisture
atmospheric moisture
fresh water storage

Possible essay questions and other concepts/lab skills

List and discuss the types of earthquakes associated with the Pacific Northwest

Discuss the regions of the U.S. associated with volcanic hazards and the tectonic conditions associated with the hazard.

Discuss volcanic hazards associated with PNW, the most dangerous volcanoes, the processes that are most hazardous.

Compare and contrast earthquake vs. volcanic hazards, discuss similarities and differences.

Discuss the concept of paleoseismology, it's application to hazards mitigation, and the types of records that

contribute to the paleoseismic data set for Oregon.

Discuss the types of hazards associated with seismic events in the PNW.

List and discuss anthropogenic vs. natural environmental geology problems.

List and discuss the types of environmental hazards (natural and manmade) in Oregon / PNW.

Draw, sketch, and label the hydrologic cycle

Homework / Exercise Skills

-Be able to apply basic physics and geology principles to quantitative-style problem solving.
-Be able to do unit conversions
-Be able to problem solve using your notes and calculator.
-Map reading, map scale problems,
-Mineral / rock identification problems
-Be able to use trig. Functions to solve for strike and dip
-Know how to solve a three-point problem using elevation data
-Know how to measure strike and dip
-can you read a seismogram and locate an epicenter of an earthquake on a map?
- Do you know how the magnitude of an earthquake is determined?