

STUDY GUIDE FOR LAB PRACTICAL/EXAM 1

EOSC105 _GEOSCIENCE FRIDAY DAY LAB _FALL 2023

WHAT TO REVIEW:

- Chapters in the online lab manuals (under course content BELOW both lab folders)
- Power point lectures in the Thurs. lab folder or any additional info. in the folder
- Rocks and minerals in the library ask for EOSC105 boxes (reserve desk, 2 hr. limit).
- There is helpful information at the **beginning of the lab exercises in the Reader.**
- **Plate Tectonic questions/velocity problems** you did in lab.
- Your **lecture notes** will help with understanding **subduction zones, magnetic anomalies, hot spot motion...**
- Your **mineral and rock charts**: use color, make neat and organized! **Extra copies on Bb in lab folders**

GEOTIMESCALE

- Know the names and temporal order of the eons, eras and periods.
- Know the numeric ages of the age of Earth, and the beginning of each of the three eras.

ROCK DENSITY

- Understand the objective of the **Rock Density exercise**. Review what you did in lab (same day as minerals).

MINERALS AND ROCKS IDENTIFICATION PORTION OF THE EXAM: There will be about a total of 20 samples to identify. The samples will be broken up into sets (3 to 4 samples); each set will be in a separate bin, You will need to determine the physical properties and identify each of the samples and give the classification by selecting from a **word bank**: intrusive or extrusive igneous; detrital or biochemical (organic)/chemical sedimentary; metamorphic (foliated vs nonfoliated); silicate mineral or nonsilicate mineral. Possibly answer a few more questions, see below under **ID portion**.

MINERALS:

Possible questions:

- All minerals are classified under 2 categories. What are they? Why are the silicates more important?
- What are the 2 most abundant silicate minerals in Earth's crust?
- What is the difference between dark and light silicate minerals: **1)** Iron (Fe) and magnesium (Mg) content? **2)** Amount of silicon and oxygen (SiO₂ amount)...right? How does it work?
- **Know the basic rock forming minerals.** Know the common **silicate minerals**: quartz, k-feldspar, muscovite mica, plagioclase feldspar, biotite mica, hornblende (amphibole), augite (pyroxene), olivine.
- Know which minerals from above are felsic vs mafic.
- **MAKE SURE YOUR MINERAL AND ROCK ID CHARTS ARE COMPLETE.**
- You can use the mineral/rock charts during the exam. **No pictures are allowed**
- See sample problems below.
- You will need to turn in the ID charts at the end of the exam.
- **Know the basic rock forming minerals.** Know the common **silicate minerals**: quartz, k-feldspar, muscovite mica, plagioclase feldspar, biotite mica, hornblende (amphibole), augite (pyroxene), olivine.
- Which minerals on your chart are nonsilicates? Indicate on your mineral chart
- Be able to identify the minerals **you looked at in lab *(on your charts)** by using physical tests (hardness, cleavage, fracture, color)

IGNEOUS ROCKS:

Possible questions:

- Be familiar with the following terms: intrusive, extrusive, felsic, mafic, crystallization.
- What controls igneous texture (or size of minerals)?

- Know the 3 intrusive igneous rocks identified in lab (Granite, Diorite, Gabbro) and their extrusive or volcanic equivalents.

ID portion of the exam:

- Be able to classify an igneous rock as intrusive or extrusive (word bank).
- Be able to identify textures: phaneritic, aphanitic, porphyritic, glassy, vesicular (word bank).
- Dominant mineral composition (2 minerals): you will be asked only with phaneritic texture rocks →

SEDIMENTARY ROCKS:

Possible questions:

- How are detrital sedimentary rocks classified?...*Hint: what is the difference between siltstone and sandstone*

For the ID portion of the exam:

- Know the sedimentary rocks identified in lab and their classification: Detrital or Biochemical (Organic)/Chemical.
- Know type of sediment (gravel/pebble rock fragments; sand; silt; clay) that makes up each detrital rock
- Know composition of chemical and biochemical (SiO_2 or quartz, CaCO_3 or calcite.)

METAMORPHIC ROCKS:

For the ID portion of the exam:

- Know the metamorphic rocks identified in lab and their classification: foliated or nonfoliated
- What are **parent rocks** for 1) gneiss 2) slate 3) schist 4) marble and 5) quartzite (**put this info on your charts**)

UNDERSTAND THE ROCK CYCLE: Be able to connect the **3 rock types** with the correct processes: Weathering and Erosion; Lithification (compaction); Heat and Pressure (metamorphism); Crystallization; Melting. See figures in ppt slides

*IMPORTANT TO COMPLETE THE 4 MINERAL AND ROCK ID CHARTS YOU WORKED ON IN LAB (MINERAL, IGNEOUS, SEDIMENTARY, AND METAMORPHIC). **STAPLE TOGETHER** (your name on top) **AND BRING TO EXAM**. IF YOU FORGET, YOU TAKE THE EXAM WITHOUT.*

Examples of Rock/Mineral ID Questions: There will be 3 sets of minerals (three to four minerals per set) and 5 sets of rocks (three to four rocks per set), all will have the classification selection.

Example of Mineral Set Questions

MINERAL SAMPLE SET 1

- 1) Which of these four minerals **LACKS** cleavage (has only fracture)?
a. Sample "1A"; b. Sample "1B" c. Sample "1C" d. Sample "1D" e. All four samples have cleavage
- 2) What is the general hardness of these minerals? **Note:** MOHS 5 and less is considered soft
a. all four are hard; b. all four are soft; c. one is hard; the other three soft d. two are soft; the other two are hard
- 3) Which of these four mineral samples is in the carbonate group?
a. Sample "1A"; b. Sample "1B" c. Sample "1C" d. Sample "1D" e. None of them
- 4) Name these four mineral samples (labeled "1A", "1B", "1C" and "1D"); not necessarily in respective order
a. calcite, quartz, potassium feldspar, and halite;
b. gypsum, calcite, quartz, and halite;
c. gypsum, plagioclase, halite, and muscovite;
d. plagioclase, olivine, calcite, and quartz;
e. calcite, quartz, potassium feldspar, and gypsum;
a + b. halite, gypsum, potassium feldspar & olivine;
c + d. gypsum, quartz, calcite, and biotite;

- 5) Which of these four mineral samples is abundant in a granitic rock?
 a. Sample "1A"; b. Sample "1B" c. Sample "1C" d. Sample "1D" e. None of them
- 6) Which of these four mineral samples is abundant in a limestone rock?
 a. Sample "1A"; b. Sample "1B" c. Sample "1C" d. Sample "1D" e. None of them

Examples of Rock Set Questions

ROCK SAMPLE SET 1

- 1) Select correct rock classification for samples "1A" and "1B"
 a. Intrusive Igneous; b. Extrusive Igneous; c. Foliated Metamorphic; d. Non-foliated Metamorphic
 e. Bio-Sedimentary; a + b. Chemical-Sedimentary; c + d. Silici-clastic/detrital Sedimentary
- 2) Cooling history of *magma* Samples "1A" and "1B" is inferred to be relatively _____, whereas the cooling history of *magma* Samples "1C" and "1D" is inferred to be relatively _____.
 a. fast (1st blank); slow (2nd blank); b. slow (1st blank); fast (2nd blank); c. all four slow; d. all four fast
- 3) Rock sample "1A" most likely formed at which one of the three major plate boundary settings?
 a. Divergent; b. Convergent; c. Transform
- 4) Name these four rock samples "1A", "1B", "1C" and "1D"; not necessarily in respective order.
 a. schist, gneiss, shale and granite
 b. granite, shale, rhyolite and slate
 c. basalt, obsidian, pumice and limestone;
 d. obsidian, siltstone, schist and tuff;
 e. granite, gabbro, rhyolite, and basalt
 a+b. limestone, obsidian, diorite and andesite

ROCK SAMPLE SET 2

- 1) Select the correct rock classification name for all three of these rock samples "2A", "2B" and "2C".
 a. Intrusive Igneous; b. Extrusive Igneous; c. Foliated Metamorphic; d. Non-foliated Metamorphic
 e. Bio-Sedimentary; a + b. Chemical-Sedimentary; c + d. Silici-clastic/detrital Sedimentary
- 2) Which type of metamorphic foliation has distinctive light- and dark-colored layering or banding?
 a. Slaty; b. Schistosity; c. Gneissic d. None do; e. All three types have it.
- 3) Select the most-likely "Parent" rock (protolith) for all three rock samples "2A", "2B", and "2C".
 a. Basalt; b. Limestone; c. Granite; d. Shale (mudstone); e. Quartz sandstone
- 4) Name these three rock samples (labeled "2A", "2B" and "2C"), not necessarily in respective order.
 a. slate, siltstone, and granite; e. gneiss, rhyolite and siltstone
 b. gabbro, quartzite and slate a + b. slate, obsidian, and limestone;
 c. limestone, slate and andesite b + c. slate, schist and gneiss;
 d. schist, gneiss, and sandstone c + d. gabbro; shale and sandstone

ROCK SAMPLE SET 3

- 1) Which of these four rock samples has the highest percentage of clay minerals?
 a. Sample "3A"; b. Sample "3B"; c. Sample "3C"; d. Sample "3D"; e. None have clay
- 2) Select the correct classification name for all four of these rock samples "3A", "3B", "3C" and "3D".

- a. Intrusive Igneous; b. Extrusive Igneous; c. Foliated Metamorphic; d. Non-foliated Metamorphic
 e. Bio-Sedimentary; a + b. Chemical-Sedimentary; c + d. Silici-clastic/detrital Sedimentary

3) Which rock sample most likely deposited in fastest-moving, turbulent waters (highest-energy environment)?

- a. Sample "3A"; b. Sample "3B"; c. Sample "3C"; d. Sample "3D"; e. None most likely

4) Name these rock samples (labeled "3A", "3B", "3C" and "3D"); not necessarily in respective order.

- a. obsidian, siltstone, schist and pumice;
 b. gabbro, conglomerate, quartzite and diorite
 c. conglomerate, sandstone, siltstone, and shale
 d. schist, gneiss, shale and sandstone
 e. conglomerate, sandstone, granite, and slate
 a + b. basalt, obsidian, schist and limestone;

EARTHQUAKES

- Understand the objective of the **Earthquake Simulation exercise**.
 - Stick-slip fault mechanics, that involves, tectonic stress, fault rock friction/strength, building elastic strain/energy, fault release/offset, and release of elastic energy to generate earthquake.
 - Stick-slip fault model with bricks, sandpaper and rubber bands,
 - Review questions in the Earthquake exercise section. You will see similar questions in a multiple choice format

PLATE TECTONIC PLATE BOUNDARIES

- Know the names of the major tectonic plates
- Know the location of the plate boundaries
- Know the type of plate boundary found at a certain location
- Know the major geographic features and key geologic/tectonic processes that occur at at specific plate boundary

Example Questions of Plate Tectonics Boundaries and Processes

Directions: Match the geographic location (Capital Letter on located on map) with its associated tectonic feature or setting (small case letter(s)) in answer key). Note: For answers with two letters, bubble in two letters as a single answer.

- | | |
|---|--|
| a. convergent plate boundary with
oceanic-oceanic subduction | e. divergent plate boundary with continental rifting |
| b. convergent plate boundary with
oceanic-continental subduction | a. + b. transform plate boundary |
| c. convergent plate boundary with
continent-continent collision | b. + c. hot spot volcanism |
| d. divergent plate boundary with
seafloor spreading | c. + d. passive margin |

Tectonic Plate Boundary Map

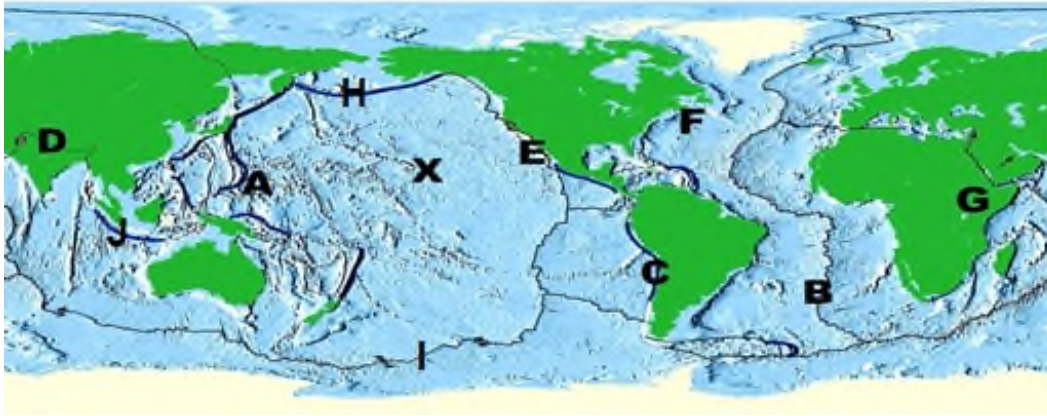


PLATE TECTONIC MAPS AND VELOCITY PROBLEMS

- Know **how to measure and calculate plate motion: Velocity (Rate) = Distance/Time (age of rock)**
- Be able **to calculate plate velocity and direction** (see your lab exercise) by using: **1)** Hot spot islands or hot spot volcanic rock on a continent, **2)** Transform PB (faults), and **3)** Magnetic anomalies on seafloor (*remember age of crust is older away from the MOR*)
- Understand how to read a bar scale on a map to measure “real world” distance →
- Remember compass direction: N, SE, NW, etc. Look for the North arrow on a map view image
 - Be able to infer direction of plate movement based on age of volcanic islands/volcanic rock on the continent.
- Understand type of relative motion along convergent, divergent, and transform plate boundaries.
- Understand **map view** verses **cross-section view**.
- Be able to locate significant plate tectonic features on a map: MOR, trench, magnetic anomalies, plate boundaries based on features, Ring of Fire.
- Where are most of the subduction plate boundaries? Where are the arc volcanoes and trenches located (relative to each other, in general) on a map view and cross-section view.
- Looking at a plate tectonic (PT) map,
 - **Be able to connect** the MOR to divergent PB and the youngest ocean crust. Are MORs plate boundaries?
 - **Be able to connect** trenches to subduction PB and oldest ocean crust. Are trenches plate boundaries?
 - What type of plate boundary do you associate **arcs** with?
 - Which Plate Boundaries have volcanic activity?
 - Which Plate Boundaries have shallow EQ? Deep EQ?
 - Remember seafloor spreading moves young crust away from MOR's
 - Be able to interpret the symbol for convergent subduction. (triangle/shark teeth!)
 - Understand why there are shallow and deep earthquakes at subduction zones and where they are located in relation to the arc and the trench. Be able to interpret a **map view and a cross section view** of this type of PB and place the following features: Arc, Trench, melting (*cross section view only*), deep EQ (*including epicenters*), shallow EQ (*including epicenters*)