

## Exam #2

***The first 10 questions come from the list we gave you. The last 8 questions are based on the posters. You can use the posters to help you answer any questions on this exam.***

***Supply your own paper and be neat and organized, please.***

### Mike and Dexy's Questions

1. Metamorphic rocks form over a wide range of temperatures and pressures. What are the highest and lowest temperatures associated with naturally occurring metamorphic rocks? What about pressure – what are the lowest and highest pressures under which naturally occurring metamorphic rocks may form? Discuss the limits – what controls them?
2. What is the difference between regional metamorphism and contact metamorphism? What is the source of the energy that causes metamorphism in each case?
3. What is a xenolith? What are the compositions of xenoliths that come from Earth's mantle? What is the difference between xenoliths that are found in basalts, and xenoliths associated with kimberlites?
4. What are peridotites and pyroxenites? Where are they found (there are several possibilities) and what minerals do they contain?
5. Contrast and compare the different sorts of metamorphic rocks, and their minerals, that would form when each of the following is metamorphosed:
  - ultramafic rock
  - mafic rock
  - shales (pelites)
  - limestones or dolostones = carbonates
  - sandstones
  - quartzo-feldspathic rocks
6. Some metamorphic rocks contain andalusite. Others, that have the same overall composition, contain kyanite. Why the difference?
7. If you have a limestone that is nearly 100% calcite and you metamorphose it, the result can be boring because no new metamorphic minerals are formed. However, if the limestone originally contained some quartz, and maybe feldspar, then you can get a whole bunch of very interesting metamorphic minerals. Why? Give examples of specific minerals and explain why they form.
8. What are metamorphic facies? Make a PT diagram and label the facies as they were

described by Eskola.

9. The table below gives thermodynamic properties for diaspore and boehmite. Both have composition  $\text{AlO}(\text{OH})$ .

mineral	molar volume at room temperature and pressure	molar entropy at room temperature and pressure	molar Gibbs energy at room temperature and pressure
diaspore	17.76 $\text{cm}^3/\text{mol}$	35.34 $\text{J}/\text{deg}\cdot\text{mol}$	-1009.345 $\text{KJ}/\text{mol}$
boehmite	19.53 $\text{cm}^3/\text{mol}$	48.45 $\text{J}/\text{deg}\cdot\text{mol}$	-987.45 $\text{Kj}/\text{mol}$

Which of these two minerals is stable at room temperature and pressure?

Which of these two minerals is most stable at high pressure?

Which of these two minerals is most stable at high temperature?

10. In Dutchess County the pelitic rocks near the Hudson River are barely metamorphosed. They still resemble the shales that they formed from. Moving east and a bit south, metamorphic grade increases. By the time you get to Connecticut, the rocks contain K-feldspar and sillimanite. Explain the variation in metamorphic grade in this region. How did the rocks form and why are higher grade rocks found where they are?

### **Poster Questions**

11. What is a MASH silicate?

12. Under what temperatures and pressures can an eclogite form?

13. Over half of the known carbonates are found on which continent?

14. What is the SIAMM classification system?

15. Can contact metamorphism occur at earth's surface?

16. What is phase layering?

17. What makes blueschists blue?

18. Which volcano in the Cascades has erupted the most in the last 4,000 years?