

Mid-Term Exam: Earth Materials and the Environment
March 10, 1998

Please read the questions carefully and answer **each** portion of the question. Neatness counts. Use the back of the test if necessary. Good Luck!

1. What are the characteristics of fibers? Why are the terms "fibers" and "asbestos" often considered synonymously? Is this appropriate?
2. Describe the two major silicate classes to which asbestos minerals belong. Make specific to the basic crystal structure and chemistry of chrysotile and crocidolite. Use diagrams as necessary (and the back of this sheet).

3. Would chrysotile and crocidolite be expected to react the same in biological fluids? Why or why not? Explain with respect to morphology, surface chemistry and surface area.

Short answer:

4. Define a mineral.
5. $1.0\text{ ml} =$ _____ *cc* air or fluid.
6. In what rock type is most chrysotile found? _____
7. What is wrong with this term "asbestos" ?
8. What is a polymorph? _____
9. Two types of chrysotile have very different surface areas, why?
10. Chalcedony is a fibrous form of quartz. Upon breaking or grinding, why is chalcedony not considered to be hazardous?

11. Following are important minerals:

Match the correct formula to the mineral name.

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| 1. Reibeckite | a. $(Mg, Fe)_7Si_8O_{22}(OH)_2$ |
| 2. Lizardite | b. $Ca_2(Fe, Mg)_5Si_8O_{22}(OH)_2$ |
| 3. Anthophyllite | c. $(Fe^{2+}, Mg)_7Si_8O_{22}(OH)_2$ |
| 4. Tremolite | d. $(Fe, Mg)_5Al_3Si_3O_{10}(OH)_8$ |
| 5. Chrysotile | e. $Na_2Mg_3Al_2Si_8O_{22}(OH)_2$ |
| 6. Grunerite | f. $Ca_2Mg_5Si_8O_{22}(OH)_2$ |
| 7. Antigorite | g. $Mg_3Si_2O_5(OH)_4$ |
| | h. $Mg_3Si_2O_5(OH)_4$ |
| | i. $Na_2Fe_2^{3+}(Fe, Mg)_3Si_8O_{22}(OH)_2$ |
| | j. $Mg_{3-x}Si_2O_5(OH)_{4+2x}$ |

12. Studies demonstrate that *occupational* exposures to asbestos may be detrimental to one's health. However, it has recently been questioned if *environmental* exposures to asbestos pose a serious health threat. What lines of evidence suggest that *environmental* exposures to asbestos are not such an important health issue?

13. Describe some of the flaws with the medical experiments that "demonstrate" asbestos is a health hazard.

14. Why is it difficult to unambiguously characterize reaction rates of "amphiboles"?
15. Why is the transformation from beta quartz important to the reactivity of α quartz? What occurs during this transition?
16. How does the structure of cristobalite differ from that of tridymite? Which would you think would be more toxic and why?
17. Why do samples of the same mineral from different localities often display very different reactivity and hence toxicity?
18. Label the fields with the respective SiO_2 polymorph. Label the arrows separating the fields which are reconstructive (**r**) and which are displacive (**d**) transformations.