

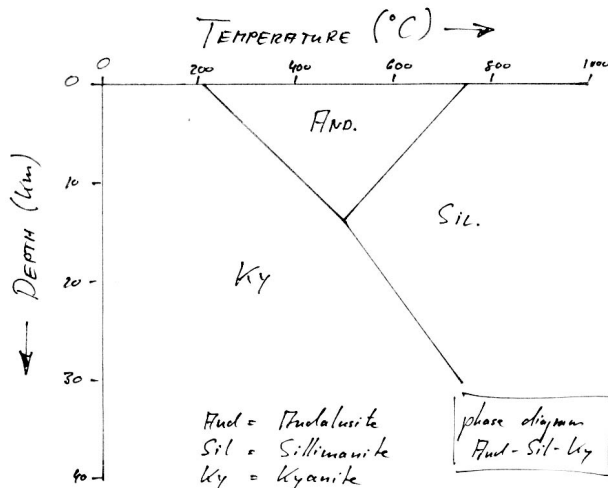
Name: _____

1. What is the definition of a mineral ? (4 points.)

naturally formed, inorganic, crystalline solid with distinct chemical composition

(should be 5 points)

2. The figure below shows the phase diagram for Andalusite (Al_2SiO_5) and its two polymorphs Kyanite and Sillimanite. (5 points)



a) What are polymorphs?

minerals that have same chem. composition but different crystal structures

b) Which of the three minerals is stable under high temperature conditions?

Sillimanite

c) What can you say about the temperature and pressure history of a rock that contains both Andalusite and Sillimanite, what about the history of a rock that contains all three minerals?

it had to be for some time at p-T conditions that fall right on the border between Andalusite and Sillimanite, if all 3 minerals are present the rock had to be at the triple point of all 3 phases.

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3. **Name five properties that can be used for mineral identification. (5 points)**

e.g., hardness, color, streak, luster, habit, taste, magnetic properties, cleavage...
any five will do



4. **Below is an image of Mt. Fuji, one of Japan's most famous volcanoes: (6 points)**

- a) **What type of volcano is it? How can you tell?**
stratovolcano (cone shape)

- b) **What type of magma is it likely to erupt.**
andesitic (and sometimes, according to the book basaltic) magma

- c) **What is the "Andesite Line", why does it circle almost the entire Pacific ocean?**
its tye line that separates andesitic volcanoes from basaltic volcanoes around the Pacific.
volcanoes inside the A.L. only erupt basaltic magma, while volcanoes outside the A.L. can erupt both andesite and basalt.

The A.L. is connected with subduction zones (Andesite = product of wet partial melting) and the Pacific is surrounded by many subduction zones.

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5. **Why do subducting slabs undergo partial melting, even though they are cooler than the surrounding mantle, which remains solid? (3 points)**

because they contain lots of water, which lowers the melting point, the surrounding mantle rocks have very little water in them and melt at higher temperatures

6. **What is the difference between rhyolite and basalt? How can you tell which is which? Which one is likely to contain more iron and magnesium? (3 points)**

Si content, based on color, rhyolite is lighter colored, both are aphanitic rocks, so mineral content can't really tell them apart without a good microscope

7. **How can you distinguish quartz from feldspar? (3 points)**

Feldspar has cleavage, quartz doesn't, so qtz surfaces tend to be irregular with conchoidal fractures, while fsp's show some cleavage planes. Also quartz clear, fsp. opaque

8. **Which lines of evidence did Alfred Wegener use to promote his theory of Continental Drift? (4 points)**

jigsaw puzzle fit, similar rock formations now separated by oceans, distribution of fossils, distribution of glacial sediments

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9. **How does the cooling history of a rock influence its crystal size? (5 points)**
slow cooling + release of latent heat inhibits formation of seed crystals from melt, therefore only few crystals compete for melt and space and we get a few large crystals
rapid cooling (latent heat release is insignificant): new crystals form easily from melt and we have many crystals competing for melt and space. Therefore we end up with many very small crystals
10. **What is a porphyry, and what can you say about its cooling history? (3 points)**
rock that has large crystals in microcrystalline matrix
2 stage cooling history, initial cooling occurs slowly \Rightarrow large x-tals form, then rapid cooling to form matrix
11. **Which weathering processes might be dominant in the Brooks range in Alaska? (2 points)**
physical weathering, esp. frost wedging
12. **Which transport processes produce well rounded grains? (2 points)**
eolian transport, beach processes
13. **Which (common) minerals are most stable on the surface of the Earth? (2 points)**
clays and quartz

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14. **Draw a (detailed) diagram of a subduction zone and label all the important parts. Which types of rocks would you expect to find (and where?) (10 points)**

look at any of the numerous images of subduction zones in the book

15. **Why can diamond be used to cut rocks, while graphite is commonly used as a lubricant? (4 points)**

Diamonds are C linked together by covalent bonds only, which are very strong. Graphite consists of sheets of C, which are connected by very weak van der Waals bonds, which cause the sheets to shear off easily

16. **Why does weathering produce rounded corners? (3 points)**

weathering is a surface process, edges and corners are areas where 2 (3) surfaces meet, so the effects of weathering are multiplied in these areas, leading to enhanced weathering at corners and edges. Therefore edges and corners are removed faster and the rock assumes a rounded shape.

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19. Identify the rock specimen. (8 points)

- a) **What is the major rock type, how did you arrive at your answer ?**
- b) **What are the major minerals present, how can you tell?**
- c) **What would you call this rock?**

- a) igneous (plutonic) fully crystalline, no holes, can see crystals
- b) quartz (clear, gray), feldspar (white, opaque) (see question 7), some black mineral, likely biotite or amphibole, due to the abundance of qtz in the sample (can't be pyroxenes)
- c) granite/granodiorite, depending on the actual mineral abundance