

Take Home Quiz 1 KEY

Take home quizzes are due at the beginning of the following lecture. They are worth 2 points of EXAM credit. Please attach this sheet to your answers if additional sheets are used.

1. Viscosity is an important property of magma. How does viscosity change with each of the following changes in the magma? **Explain why each change occurs**

- A. Increase in temperature of the magma
- B. Increase in silica content of the magma
- C. Increase in volatile content of the magma

A. As temperature increases, viscosity decreases. Bonding in liquids mimics the bonding seen in the minerals that are eventually produced from the melt. Within the liquid, atomic vibration increase as temperature increases. Stronger vibrations weaken bonding, and allow atoms to move more freely, thus decreasing viscosity.

B. As silica content increases, so does viscosity. Felsic magmas have a great deal of Si and Al, which tend to form chains like Si-O-Si-O or Si-O-Al-O. The bonds in which oxygen is between two Si ions or an Si and an Al ion are called bridging bonds. Bonds to cations like magnesium or iron are weaker, and are non-bridging. Bridging results in polymerization. The longer the polymerized chains, and the more chains that form, the higher the viscosity.

C. The presence of water and alkali elements (volatiles) reduces viscosity. This occurs because these substances substantially reduce the chain length in polymers

2. Explain why reporting the presence of volatiles on a weight percent basis is misleading, compared to a comparison on a molecular percent basis. Use water as an example of a volatile. .

Albite has a molecular weight of 262 g/mol, while water has a weight of 18 g/mol. If a sample has 1 wt. % water, it is one gram of water and 99 grams of albite - On a molecular basis, that is 0.056 moles of water, and 0.38 moles of albite, or 13.3 mol % water At 10 wt % water, the number increases to 62 mol % water, 38 mol. % albite.

