Name: ___________________________________Date: ______________________ Class: ___________________

Viscosity and Pressure in Volcanic Eruptions Worksheet
Answers

Part 1: Pressure Relief / Degassing

Instructions: Shake two sealed carbonated beverage cans for 10 seconds.
What happened when you opened the can quickly (in less than one second)? *Upon opening the soda can in a fraction of a second after agitation, the dissolved gases inside the liquid beverage suddenly experienced a decrease in pressure resulting in a rapid "explosion" of gas from the liquid contents of the can. This quickly created a mess!*
What happened when you opened the can slowly (taking 30 seconds)? *Upon opening the can slowly over a longer period of time, air slowly escaped from the pressurized environment of the can. This scenario was much less violent than the situation in which we quickly opened the can. The gas was given more time to escape from the agitated can, resulting in a less sudden decrease in pressure.*
How does this relate to how an agitated volcano with lots of dissolved gasses in its magma erupts? *The time that a volcano is able to degas is inversely related to the degree of explosivity of its eruption. The more time a volcano takes to release built up pressure, the less forceful the eruption will be. If given enough time, a volcano will slowly "fizzle" out instead of causing a massive explosion. A volcano that must degas in a very short period of time has a higher chance of a more violent release of gas.*

Part 2: Viscosity

Instructions: Use marbles to rank the viscosity of the fluids from lowest to highest:		
Lowest viscosity	1. A 2. B 3. C Example Answers	Highest viscosity
What do you notice about the higher viscosity fluid vs. the lower viscosity fluid when you stir/blow bubbles through them? *The higher viscosity fluid takes more force to stir.* *The higher the viscosity, the more force one has to exert on the straw to create a rising bubble in the fluid. The higher viscosity fluid also has bubbles that rise with more force and have more of an explosive effect upon reaching the surface.*		

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Viscosity (continued)

How might this relate to the strength of an eruption in a volcano with built up pressure?

The viscosity of a volcano's magma can contribute to the necessary conditions for an explosive eruption. In the case of extremely viscous magma, gases and bubbles must exist at very high pressures in order to escape from the magma; this requires a significant build-up of pressure and force in order to pierce through molten rock and can result in an explosive eruption.

In less viscous magma, bubbles easily rise through to the surface of the molten rock and have less of a violent "explosion" upon reaching air; this results in a more effusive eruption.

Concluding Questions

How do viscosity and time allowed for a volcano to degas effect the explosiveness an eruptions?

Overall, viscosity in a volcano's magma determines the amount of force required to fragment or break through magma. The more viscous a volcano's magma, the better conditions are for a violent eruption.

The time allowed for degassing also ties into the violent nature of many eruptions. Volcanoes cannot release the extreme pressures they experience underneath the Earth's surface in short amounts of time without a violent result. The less time allowed for a volcano's degassing, the more explosive an eruption.

How might understanding characteristics of explosive eruptions have human or engineering applications?

Understanding the main and more nuanced factors of what creates volcanic eruptions and affects the degree of explosivity in volcanic eruptiona are vital if we are to save lives and prevent the catastrophic effects associated with violent eruptions. The basic concepts of viscosity and degassing are critical in analyzing volcanoes. As we study these fascinating physical phenomena more and more, we can eventually dive into the chemistry of magma and the geology of volcano formation as it relates to the constant change of Earth's internal processes.

If we are to engineer solutions to mitigate or even eliminate the destruction associated with volcanoes, we must first understand the contributing factors in volcanic eruptions. This helps us to predict volcanic activity, including how violent an eruption might be, and plan accordingly.