

THE POROSITY OF PUMICE

Purpose

To determine the porosity of pumice. To determine how much the volcanic glass has been expanded by the exsolution of gas.

Instructions

Pumice is very porous but not permeable so indirect methods are needed to determine its porosity.

1. Measure the density of the obsidian.

Weigh the obsidian (g).

Place a beaker under the spout of the displacement can. Fill up the displacement can until it overflows. Empty the beaker and replace it.

Then lower the obsidian slowly into the displacement can.

When it has stopped overflowing use the measuring cylinder to find the volume of the water (ml) displaced. This is the volume of the obsidian. The density is weight in air in grams / volume in ml

2. Measure the density of the pumice using the same method. If it floats push it down with a thin piece of wire.
3. Calculate the volume occupied by one gram of obsidian. This is the reciprocal of the density.
4. Calculate the volume occupied by one gram of pumice.
5. The amount of expansion =
$$\frac{\text{volume of 1g of pumice}}{\text{volume of 1g of obsidian}}$$

Consider the volume occupied by one gram of pumice. This consists of volcanic glass and gas filled pore spaces. The volume occupied by the glass will be the same as the volume occupied by 1g of obsidian. Therefore the pore spaces will occupy the remainder. So the pore space in one gram of pumice is the volume of 1g of pumice - volume of 1g of obsidian. The porosity can now be calculated.

porosity of pumice =
$$\frac{\text{vol of 1g of pumice} - \text{vol of 1g of obsidian}}{\text{vol of 1g pumice}} \times 100$$

as a percentage

Draw a column 1cm wide on graph paper to illustrate the volume of 1g of obsidian and shade it. Beside it draw another column to illustrate the

volume of 1g of pumice, shade the volume occupied by the glass then the unshaded part is the volume of the gas

Teacher's Section

Requirements

Samples of pumice and obsidian, the larger the better, each with a nylon loop attached with a small amount of araldite.

Balance

Beaker

Displacement can

Measuring cylinder

15cm piece of stiff wire

Notes

Students find it difficult to understand the reasoning behind calculating the porosity. This experiment assumes that the obsidian and the glass in the pumice have the same density.

Time

15 minutes for the measurements