Democritus, Geometry, and Epistemology

Along with being an atomist physicist (or atomist natural philosopher), Democritus was a mathematician. In fact, he even said, "I'd rather discover a single geometric demonstration than become King of Persia!"

1. On the distinction between empiricism and rationalism, Democritus said, "There are two forms of knowledge: the genuine and the obscure. To the obscure belong our senses: sight, hearing, smell, taste, and feeling. Whenever the obscure way of knowing has reached its limit, the genuine way of knowing arises." Accordingly, is *empirical* knowledge his so-called "*genuine* knowledge" or his so-called "*obscure* knowledge"?

2. Based on your answer to the previous question, is *rational* knowledge his so-called "*genuine* knowledge" or his so-called "*obscure* knowledge"?

Along with being an atomist natural philosopher, Democritus was a mathematician. In fact, he even said, "I'd rather discover a single geometric demonstration than become King of Persia!" More than anything else in mathematics, he was particularly interested in geometry. Yet, his mathematical investigations were always in the service of making a philosophical point. In the case of the volume of a pyramid, Democritus sought to make a point about epistemology.
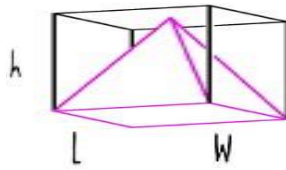

3. In order to explain the formula for the volume of any pyramid, Democritus had invited us to imagine how a *cube* is dividible into six congruent pyramids. Every cube is a rectangular prism, and so its volume is the product of its length, width, and height. Hence, if a cube can be divided into six congruent pyramids, then each pyramid's volume is a sixth of the cube's volume.
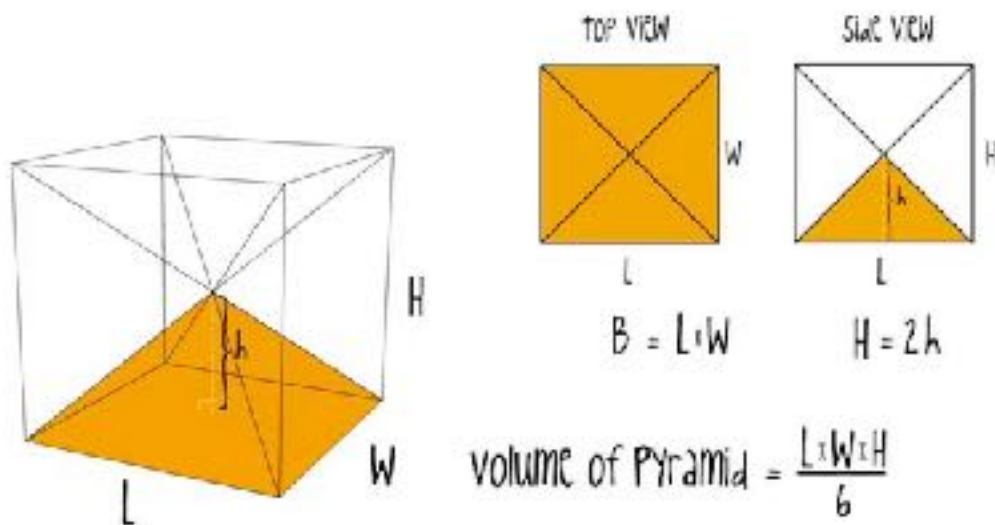
Moreover, each pyramid's height is half of the cube's height. Therefore, the pyramid's volume is a third of the product of the pyramid's height and the area of the pyramid's base.
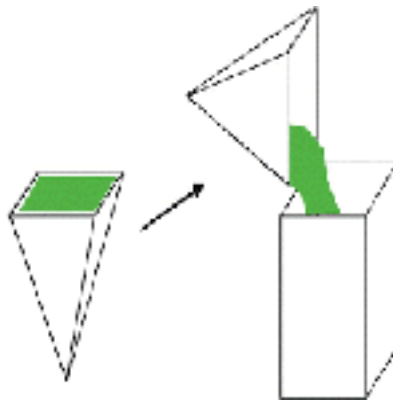
$$V_P = \frac{LWH}{6} = \frac{LW\,2h}{6} = \frac{LWh}{3}$$

In this way, Democritus discovered the formula for the volume of a pyramid. According to him, if a pyramid's *height* h units *tall*, and if its *base* is LW units-squared in *area*, then the pyramid's volume is $\dfrac{LWh}{3}$.

If this counts as knowledge (or justification for a true belief), what kind of epistemology is this? Is this skepticism, rationalism, or empiricism? **Explain.**

4. In order to explain the formula for the volume of a pyramid, Democritus provided a sensible demonstration. On the one hand, he had a wooden pyramid. On the other hand, he had a wooden rectangular prism. The wooden pyramid and the wooden rectangular prism were the same height (of h units *tall*), and their rectangular bases were congruent in area at LW units-squared. Democritus filled each wooden solid up with sand, and he soon found that the wooden rectangular prism held *three times as much* sand as the wooden pyramid could hold. Hence since the rectangular prism's volume is LWh units cubed, the pyramid's volume is $\dfrac{LWh}{3}$ units cubed.

In this way, Democritus discovered the formula for the volume of a pyramid. If this counts as *knowledge* (or *justification* for a *true belief*), then what *kind* of epistemology is this? Is this skepticism, rationalism, or empiricism? **Explain.**

5. With his paradoxical argument for how no cone whatsoever exists at all, Democritus sought to provide a demonstration in support of his opinion that nobody knows anything at all. Accordingly, what *kind* of epistemology was he endorsing? Was it skepticism, rationalism, or empiricism?

6. Despite his apparent skepticism, Democritus nonetheless believed that some things can be known. In particular, he believed that we can know the value of how sensible things feel to us. According to him, it is self-evident whether or not a certain sensation feels *good*, and it is self-evident whether or not a certain sensation feels *bad*. By definition, pleasure is any sensation that feels good, and pain is any sensation that feels bad. Hence according to Democritus, we can know for sure that pleasure is good, and we can know for sure that pain is bad. If this self-evidence counts as *knowledge* (or *justification* for a *true belief*), what *kind* of epistemology is this? Is this skepticism, rationalism, or empiricism? **Explain.**