

Worth its weight in gold?



There is a story told of the famous Greek mathematician, Archimedes:

The king of Syracuse commissioned a golden crown, providing a large quantity of gold for the purpose. When the crown was presented to him, it was weighed and found to be the same weight as the gold the king provided.

But, the goldsmith had cheated the king by keeping back some of the gold and replacing it with silver when he melted it down.

Archimedes was given the task of testing the crown to find out if it was pure gold, and the method he discovered made use of the different densities of gold and silver.



For this task you will need to know:

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

Mass is measured in grams (g), volume in cubic centimetres (cm³) and density in grams per cubic centimetre (g/cm³)

1. 1cm³ of gold costs £579 when the price is £30 per gram. Find the density of gold.
2. 1cm³ of silver costs £210 when the price is £20 per gram. Find the density of silver.
3. The king's goldsmith is provided with 4kg of gold. Calculate the volume, to 2 d.p. .
4. The goldsmith takes 1kg for himself, replacing it with a kilogram of silver. Calculate the volume of 1kg of silver, to 2 d.p. .
5. Calculate the volume of the 3kg gold, 1kg silver mixture used by the goldsmith.

Archimedes' famous 'Eureka' moment was the result of noticing that stepping into a bath increased the water level by the same amount as his volume, so immersing the crown in water would enable him to calculate its volume, and hence discover whether or not the king had been cheated.

Worth its weight in gold? – SOLUTIONS



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1. 1cm³ of gold costs £579 when the price is £30 per gram. Find the density of gold.
19.3 g/cm³
2. 1cm³ of silver costs £210 when the price is £20 per gram. Find the density of silver.
10.5 g/cm³
3. The king's goldsmith is provided with 4kg of gold. Calculate the volume, to 2 d.p. .
207.25cm³
4. The goldsmith takes 1kg for himself, replacing it with a kilogram of silver. Calculate the volume of 1kg of silver, to 2 d.p. .
95.24cm³
5. Calculate the volume of the 3kg gold, 1kg silver mixture used by the goldsmith.
250.68cm³

Archimedes' famous 'Eureka' moment was the result of noticing that stepping into a bath increased the water level by the same amount as his volume, so immersing the crown in water would enable him to calculate its volume, and hence discover whether or not the king had been cheated.