

## Pythagorean Beaker 1002904

### Operating instructions

11/22 HJB



#### 1. Safety instructions

- Handle the beaker carefully to avoid breakage.
- As the beaker is emptied almost fully during the demonstration, measures to collect the liquid must be taken beforehand.

#### 2. Description, technical data

The Pythagorean beaker allows an entertaining demonstration of the principle of a siphon.

Although Pythagoras is famous mainly for his  $a^2 + b^2 = c^2$  (theorem for right-angled triangles), this is just one of a series of accomplishments by the great thinker who also delved into areas such as religion, the nature of the soul and cosmic harmony. To demonstrate the virtues of moderation to his students, he designed a beaker named later after him. If the beaker is filled up to a certain level with wine or water, for example, it retains the liquid. However, adding any more liquid beyond this level causes the entire contents of the beaker to drain out via a hole at the bottom. The beaker is made of hand-blown glass, and the secret of its design is a siphon installed in the middle of the beaker.

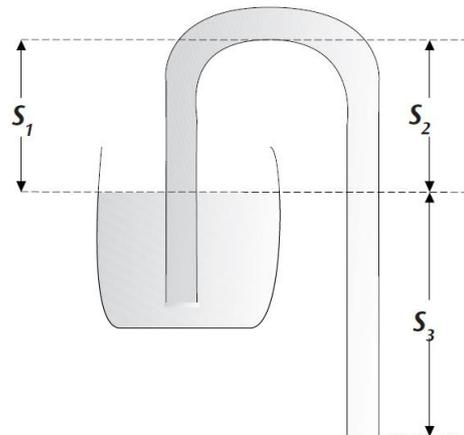
Height: 250 mm

Beaker diameter: 80 mm

#### 3. Principle

The siphon in the middle of the beaker consists of a bent glass tube with a short arm extending from just above the bottom of the beaker to the elbow, and a long arm extending from this elbow to the outlet at the foot of the beaker. The liquid

columns in both arms are governed by the laws of gravity, the long column pulling the short one after it once an overflow occurs. The liquid columns stay joined due to the external air pressure which prevents the formation of a vacuum. The water continues to flow out as long as the level of the liquid in the vessel is higher than the opening of the siphon's long arm.



**Figure 1: Principle of how a siphon works**

The flow of liquid is controlled by the water column  $S_3$  beneath the level of the liquid, column  $S_2$  being compensated by  $S_1$ .

#### 4. Procedure

- Fill the beaker with liquid to a point just short of the elbow.
- The beaker retains the liquid.
- Add more liquid until its level has risen beyond the elbow.
- The beaker is drained almost fully as a result.