Mass of gases

Level Elementary

Experiment 1
Air's mass

Concept

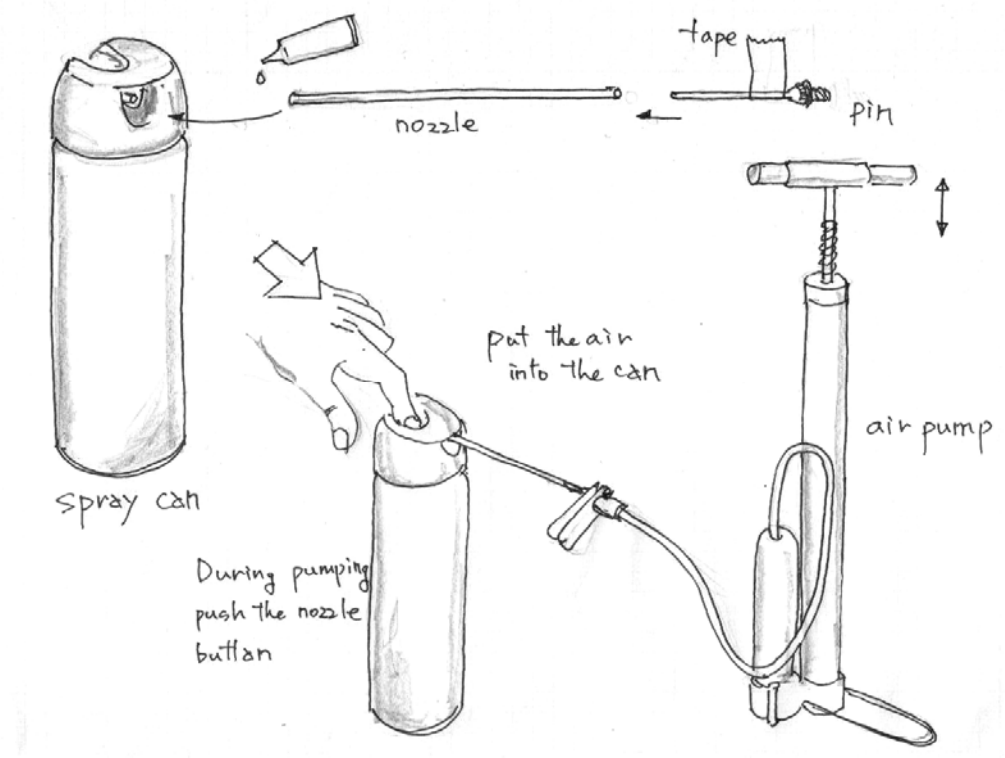
The air has mass. Let's measure the air's mass with a spray can and PET bottle.

Materials

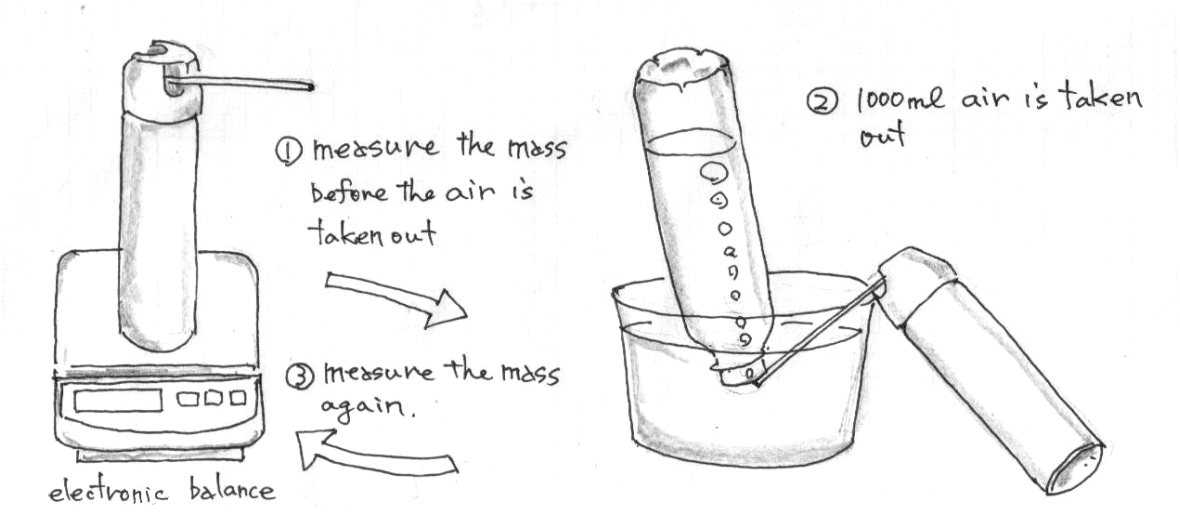
used spray can, PET bottle (500ml or 1000ml), and air pump, vinyl nozzle, adhesive tape, pin for the ball, electronic balance or balance, bond, and water tank

Procedure

(1)Confirm that there is no gas in the spray can.
(2)The nozzle is attached to the spray can by the bond.
The adhesive tape is rolled in the pin for the ball.
The pin is inserted to another side of nozzle tightly.
(3)The air is put into the spray can enough by the air pump. The spray button is pushed during pumping.



(4)Measure the mass of the spray can by the balance.
(5)Water is put in the water tank.
Water is put in the PET bottle, and it is set up inverted in the water tank.
(6)The air 1000ml is taken from the spray can by replacing the water of the PET bottle.
(7) Measure the mass of the spray can by the balance again.
(8)The mass of the air 1000ml is calculated.



Working

The following are one example of the measurement result.

The mass of the spray can with air: 117.6g
The mass of the can after taking out air1000ml : 116.4g
As a result, the mass of air 1000ml ($1dm^3$):1.2g

The mass of air $1dm^3$ in 0℃ 1atm is 1.293g.

Question

Let's calculate the mass of air in the classroom.
The mass of the air $1dm^3$ is assumed to be 1.2g, and the height, width, and length of the classroom are assumed to be 3.5m, 7m, 10m each.

The volume of the classroom=3.5 m ×7m× 10m=$245m^3$
$1m^3$=1000 dm^3
The mass of air in the classroom=1.2 g×1000×245=294000g =294kg

Addition

If you want to make sure that the air has mass without precious measurement. The next experiment is simple.

(1)Measure the mass of the ball with full of the air.

(2)Measure the mass of the ball after taking out the air from it.

Experiment 2

Hydrogen bubble

Concept

The hydrogen gas is lighter than the air. Let's experiment it by using soap bubbles.

Materials

PET bottle, straw, clay, zinc, diluted hydrochloric acid, glass, and the liquid detergent

Procedure

(1)The small hole is made in the cap of the PET bottle.
The straw is passed through the cap.
Surrounding of the hole is sealed with clay.
(2)The liquid detergent is thinned to 20 times by water and the soap bubble liquid is made.
(3)Zinc and diluted hydrochloric acid are put in the PET bottle and the cap is done.
(4)The straw end is put into the soap liquid.
Soap bubbles swell, and these rise in the air.