Mold mole molds

Make different shapes that hold a mole of gas.

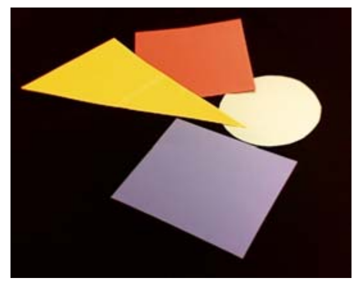
Materials & preparation

posterboard, cardboard, or other stiff paper
scissors
tape
ruler
calculator or mathematical mind

Teacher prep: For each group, construct a side or face to serve as the basis for their mole container. These can be rectangles, squares, circles, or triangles. The sides of a mole cube are 28.2 cm, so the shapes should be close to that size for easy-to-construct objects.

To do and notice

Use the materials available to construct a container that holds exactly one mole of air. You will be provided a face that must be used as one of the sides of your container.



To figure out how big to make the other sides of your container, here's some helpful information:

A mole of air in a regular room has a volume of about 22.4 L. Because you will be measuring two-dimensional panels, it is probably easier to convert this volume into cm^3. Since 1 ml=1 cm^3, then 1 L = 1000 cm^3. So a mole takes up about 22,400 cm^3.

Measure the dimensions of your starter face and calculate what the rest of the three-dimensional shape should look like.

What's going on?

The ideal gas law states that the properties of a gas can be related by the equation, pV=nRT, where p=pressure, V=volume, n=#moles of gas, R=gas constant (a fixed number), and T=temperature. At standard temperature and pressure, 0°C and 1 atm, respectively, the volume of 1 mole of gas is about 22.4 liters. The room you're in is probably warmer than 0°C, so the actual volume is slightly larger, but 22.4 L is still a good estimate.

With different starting faces, the mole containers will end up being a variety of boxes and cylinders, or even pyramids and cones. Their volumes, however, should all be 22,400 cm^3. These formulas may help with figuring out the dimensions for different shaped containers.

Box: V=length x width x height
Cylinder: $V=\pi$ x (radius of circular base)^2 x height
Cone: V = 1/3 x π x (radius of circular base)^2 x height
Pyramid: V=1/3 x area of the base x height of apex (not the triangular face…tricky)