VIRTUAL LAB: DENSITY OF AN UNKNOWN

PURPOSE
To measure mass and volume of various mineral samples in a virtual environment and calculate their densities. To use the property of density to identify unknown samples.

BACKGROUND
Scientists classify minerals according to physical properties, such as hardness, color, luster, streak, cleavage, crystal shape, and density. Density is the ratio of mass to volume of a sample and is an intensive property, meaning its value does not vary with the size of a mineral sample. Minerals containing heavy metals or elements with an atomic number greater than 26 (iron) and dark-colored minerals tend to be relatively dense. Minerals formed at high pressures and found deep within the earth's crust tend to be more dense than those minerals formed at low pressures and found at shallower depths. Because elements and minerals have characteristic densities, this property can be very useful in identifying unknown samples.

PROCEDURE
1. Launch your Internet browser and go to the following URL:
   http://academic.brooklyn.cuny.edu/geology/leveson/core/graphics/density/density_sim3.html

   Review the page that opens to become familiar with the sections of the Density Determination Table. Helpful information hints are provided in the center of the screen to assist throughout the virtual lab; see page 3 of this handout for a screen shot of the Table.

2. Select #12 from the Mineral choices on the left side of the Density Determination Table. A picture of the unknown mineral will appear at the top of the middle section of the Table. A virtual graduated cylinder of water appears immediately to the left of this picture. Read the volume of water in the virtual graduated cylinder and record measurement in the data table.
   NOTE: The screen directions state that the measurement should be made to the nearest 10 mL; however, measurements should be made to the nearest 1 mL due to the markings on the virtual graduated cylinder.

3. Click the IMMERSE THE MINERAL button. A virtual graduated cylinder of water with the mineral immersed appears to the right of the mineral picture. Read the volume of the water in the virtual graduated cylinder and record measurement in the data table.

4. Calculate the volume of the mineral using the formula: $V_{sample} = V_F - V_I$

5. Click the WEIGH THE MINERAL button. An image of a triple beam balance used to mass the mineral sample appears at the bottom of the Density Determination Table. Read the mass of the sample and record measurement in the data table.
   NOTE: The screen directions state that the measurement should be made to the nearest tenth gram. However, measurements should actually be made to the nearest hundredth gram (two decimal places) due to the markings on the virtual balance.

6. Calculate the density of the mineral sample, showing work for the calculation and recording result (with correct significant figures) in the data table.

7. Using the Density Chart on page 4 of this lab handout, identify the unknown mineral and record the mineral name in the data table.

8. Repeat Steps 2 through 7 for each unknown sample as indicated by Mineral Number in the data table.

DATA TABLE

Mineral Type	Initial Volume (V_I)	Final Volume (V_F)	Mineral Volume (V_{sample})	Mineral Mass	Calculated Density	Mineral Name
#12						
#6						
#9						
#21						
#13						
#24						
#19						
#113						
#112						

Show work for density calculations in the space below. The back side of page 3 of the lab handout can also be used if needed.

WELCOME TO THE VIRTUAL DENSITY TESTING LAB!

DENSITY DETERMINATION TABLE

Mineral
_____

- None ⦿
- # 12 ○
- # 6 ○
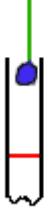- # 9 ○
- # 21 ○
- # 13 ○
- # 24 ○
- # 19 ○
- # 113 ○
- # 112 ○

Reset

In this space you will see:

Part of a graduated cylinder showing the initial water level before the mineral is immersed.

MINERAL WILL APPEAR HERE

~ INSTRUCTIONS ~

CHOOSE A MINERAL OTHER THAN 'NONE' FROM THE LIST ON THE LEFT

In this space you will see:

Part of a graduated cylinder showing the final water level after the mineral is immersed.

TRIPLE BEAM BALANCE WILL APPEAR HERE

DENSITY CHART

Density (g/cm^3)	Mineral
2.16	halite
2.32	gypsum
2.65	quartz
2.72	calcite
3.18	fluorite
3.4 to 3.6	topaz
4.1 to 4.3	chalcopyrite
4.58 to 4.65	pyrrhotite
5.02	pyrite