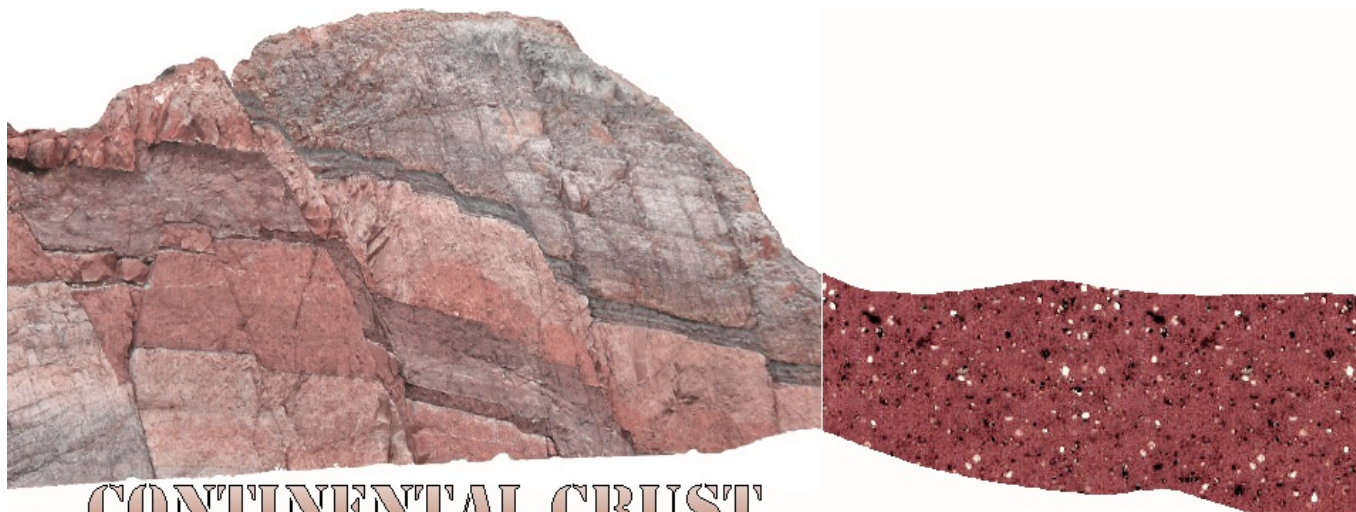LAB EXERCISE 6 - CRUSTAL DENSITIES

Name:	Course ID:

CONTINENTAL CRUST

OCEANIC CRUST

| Weighted Average Continental Crust Density: _____ $\frac{g}{cm^3}$ | Weighted Average Oceanic Crust Density: _____ $\frac{g}{cm^3}$ |

During this Lab exercise you will determine the average crustal densities of both the continental and the oceanic crust and report your findings by completing the figures. You will use your own density measurements of various rock types and the statistical computations of weighted averages to derive at your answers .

Materials Needed
•   Density measurement system (Hydrostatic Scale Method, in-class set)
•   Samples of crustal rocks from your Rock Mineral kit
•   Some background in computing weighted averages

Procedure
Measure and record the densities of...
          (a) Igneous Rocks: all mafics & ultramafics in your kit
          (b) Igneous Rocks: all acidics & intermediates in your kit.
          (c) Sedimentary Rocks: all sandstones, shales / claystones, and carbonates in your kit
          (d) Metamorphic Rocks: All Gneisses, schists and marbles in your kit

List your measurements:
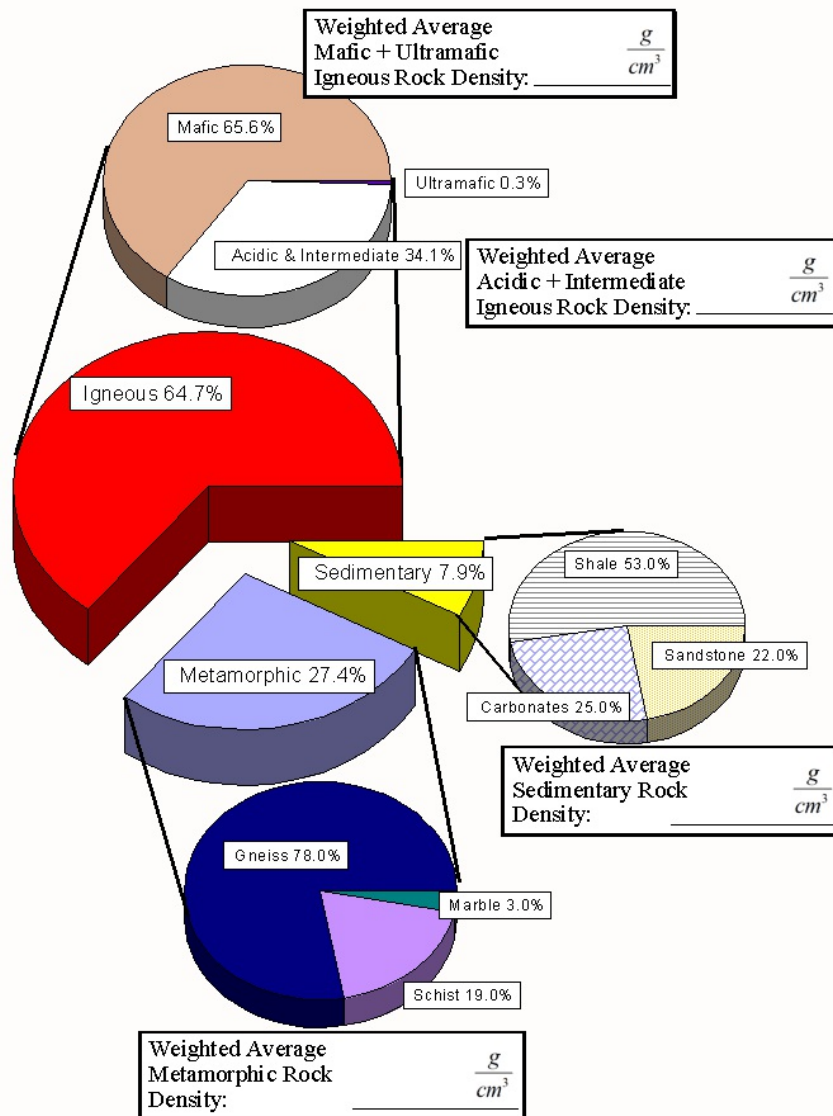
Complete the figure to the left by computing weighted averages for each category as indicated.

How to get started?
For the weighted average of <u>acidic + intermediate igneous rocks</u>, compute a straight forward average density of ALL your measured rock samples of the indicated type.

For the weighted average of mafic + ultramafic igneous rocks, compute a straight forward average of ALL your ultramafics first. Separately calculate a straight forward average of ALL your mafic measurements as indicated in the table below:

Ultramafic	Mafic
Peridotite (Olivine)	Basalt
	g/cm^3
	Gabbro
g/cm^3	
	g/cm^3
Avg:	Avg:
g/cm^3	g/cm^3

Figure (left side):

Weighted Average Mafic + Ultramafic Igneous Rock Density: _____ $\dfrac{g}{cm^3}$

Mafic 65.6%

Ultramafic 0.3%

Acidic & Intermediate 34.1%

Weighted Average Acidic + Intermediate Igneous Rock Density: _____ $\dfrac{g}{cm^3}$

Igneous 64.7%

Sedimentary 7.9%

Shale 53.0%

Sandstone 22.0%

Metamorphic 27.4%

Carbonates 25.0%

Weighted Average Sedimentary Rock Density: _____ $\dfrac{g}{cm^3}$

Gneiss 78.0%

Marble 3.0%

Schist 19.0%

Weighted Average Metamorphic Rock Density: _____ $\dfrac{g}{cm^3}$

In order to calculated the true average of mafic and ultramafic igneous rocks together we must use weighted averages instead of straight forward averages. Let's assume that the average of all mafic rock samples is 2.98g/cm³ and averages for the ultramafic rocks are determined to be 3.25g/cm³. Since mafics are present with 65.6% in the earth's crust, and ultramafics have an abundance of only 0.3%, the weighted average of the system is computed as follows:

$$avg_{weighted} = \frac{\sum(\rho \times \%)}{\sum(\%)} = \frac{(3.25\,g/_{cm3} \times 0.3\%) + (2.98\,g/_{cm3} \times 65.6\%)}{(0.3\% + 65.6\%)} = 2.98\,g/_{cm3}$$ where the Greek letter ρ(rho) denotes density.

Continue calculating the averages and weighted averages for subcategories. At the end you should have established four weighted averages: METAMORPHIC ROCK DENSITY, SEDIMENTARY ROCK DENSITY, ACID + INTERMEDIATE IGNEOUS ROCK DENSITY, and MAFIC + ULTRAMAFIC IGNEOUS ROCK DENSITY.

Since the Oceanic Crust is composed of mafic/ultramafic material, the average density of that crust would be your computed weighted average for mafic + ultramafic igneous rocks.

The other rocks comprise the continental crust, therefore its weighted average must be calculated from the remaining igneous, as well as sedimentary and metamorphic rocks.

How do your values compare to the accepted values printed in your textbook?