GG250 Lab 8
Simultaneous Linear Equations

This lab will have you set up and solve simultaneous linear equations (and then check your answers!). The main effort is in setting up the equations rather than solving them. To give you some idea of the variety of problems this method can be applied to, the selection of problems will be from stratigraphy, petrology, and geophysics. Turn in the assignments as Word documents attached to your e-mail. For each problem, include a copy of your Matlab work for solving the AX = B equations (the work should show the values of A, X and B), and a Word document that answers the questions underlined. You can submit the equations by typing them in Word or by using the Equation Editor that comes with Word.

Exercise 8a **(20 pts total)**
Samples from two drill holes into a sequence of sediments containing sand, silt, and clay. The total mass of the sand, silt, and clay is 10kg. The mass of sand plus twice the mass of clay is 8 kg. Twice the mass of sand plus five times the mass of silt, plus four times the mass of clay = 2 kg.

Set up the matrix equation (see Lab 8-20) **5 pts**

Matlab results **5 pts**

Solution for masses of sand, silt, and clay **5 pts**

Comments on the solution **5 pts**

Exercise 8b **(41 pts total)**
Balance the following petrologic reaction:

Fayalite +	Enstatite	=	Forsterite +	Ferrosilite
Fe_2SiO_4 +	$MgSiO_3$	=	Mg_2SiO_4	+	$FeSiO_3$

Which oxides are involved? (see Lab 8-22) **3 pts**
How many oxides are there? (see Lab 8-22) **1 pts**
What are the names of your unknowns? (see Lab 8-21) **3 pts**
How many unknowns are there? (see Lab 8-21) **1 pts**
What are the chemical formulas? (see Lab 8-21) **2 pts**

Fill in the following table (see Lab 8-23) **12 pts**

	Fayalite Fe_2SiO_4	Enstatite $MgSiO_3$	Forsterite Mg_2SiO_4	Ferrosilite $FeSiO_3$
FeO				
MgO				
SiO_2				

Initial matrix equation (see Lab 8-24) **5 pts**

Revised matrix equation (let the number of fayalites = 1) (see Lab 8-24) **5 pts**

Matlab results **5 pts**

Solution for balanced petrologic equation (see Lab 8-25) **4 pts**

Exercise 8c **(52 pts total)**
Balance the following petrologic reaction:
Diopside + Kyanite = Grossular + Pyrope + Quartz
$CaMgSi_2O_6$ + Al_2SiO_5 = $Ca_3Al_2Si_3O_{12}$ + $Mg_3Al_2Si_3O_{12}$ + SiO_2

Which oxides are involved? (see Lab 8-22) **4 pts**
How many oxides are there? (see Lab 8-22) **1 pts**
What are the names of your unknowns? (see Lab 8-21) **4 pts**
How many unknowns are there? (see Lab 8-21) **1 pts**
What are the chemical formulas? (see Lab 8-21) **2 pts**

Fill in the following table (see Lab 8-23) **20 pts**

	Diopside $CaMgSi_2O_6$	Kyanite Al_2SiO_5	Grossular $Ca_3Al_2Si_3O_{12}$	Pyrope $Mg_3Al_2Si_3O_{12}$	Quartz SiO_2
CaO					
Al_2O_3					
MgO					
SiO_2					

Initial matrix equation (see Lab 8-24) **5 pts**

Revised matrix equation (let the number of pyropes = 1) (see Lab 8-24) **5 pts**

Matlab results **5 pts**

Solution for balanced petrologic equation (see Lab 8-25) **5 pts**

Exercise 8d **(30 pts total)**
Suppose experimental evidence indicates that the period of a pendulum (T) is a function of the mass of the pendulum (M), its length (L), and gravitational acceleration (g), such that T= f (L,g,M). Find the function f.

Dimensioned starting equation (see Lab 8-28) **5 pts**

Dimensionless equation (see Lab 8-28) **5 pts**

Matrix equation (e.g., see Lab 8-29) **5 pts**

Matlab results **5 pts**

Form of the final dimensioned equation (see Lab 8-30) **5 pts**

Comments on the solution **5 pts**

Exercise 8e **(30 pts total)**
Suppose experimental evidence indicates the speed (c) of S-waves (shear waves) in the Earth depends on the rigidity of the rock (μ) and the density of the rock (ρ), where the dimensions of the terms are as follows:
μ = Force/area = $(ML/T^2)/L^2$
ρ = Mass/volume = (M/L^3)
Assuming that c = f (μ,ρ), find the form of the function f.

Dimensioned starting equation (see Lab 8-28) **5 pts**

Dimensionless equation (see Lab 8-28) **5 pts**

Matrix equation (e.g., see Lab 8-29) **5 pts**

Matlab results **5 pts**

Form of the final dimensioned equation (see Lab 8-30) **5 pts**

Comments on the solution **5 pts**