“Making Sense of Density,” as adapted from the *Prentice Hall Science Explorer: Chemical Building Blocks* textbook.

Presented by Kristin Coletti

http://isenseproject.org/projects/1398 Popsicle Stick
http://isenseproject.org/projects/1397 Clay
http://isenseproject.org/projects/1397 Crayon

Preparatory Activities

Introduction to mass and how mass is measured:

-definition, tool, units.

-In the lab:

Metric Measurement: Mass. (Prentice Hall)

Introduction to liquid volume and how volume is measured:

-definition, tool, units.

-In the lab:

Reading prepared graduated cylinders.

Demonstrating an ability to correctly measure a specified amount of water; and,

Prentice Hall “Rainbow Lab.”

Introduction to finding volume by water displacement.

Definitions

Accuracy: the ability of a measurement to match the actual value of the quantity being measured.

http://www.thefreedictionary.com/accuracy

Sensitivity of an instrument: the smallest amount it can measure.

http://www.answers.com/Q/What_is_the_sensitivity_of_an_instrument

Pre-Lab Conversation

-Review procedures for measuring mass and liquid volume, and introduce volume by water displacement.

-Review accuracy and the sensitivity of an instrument. (Stress the importance of being very particular with the measurements.)

-Review sixth grade concepts of ratio, rate, and unit rate, prior to introducing the concept of density.

The Day Before the Lab

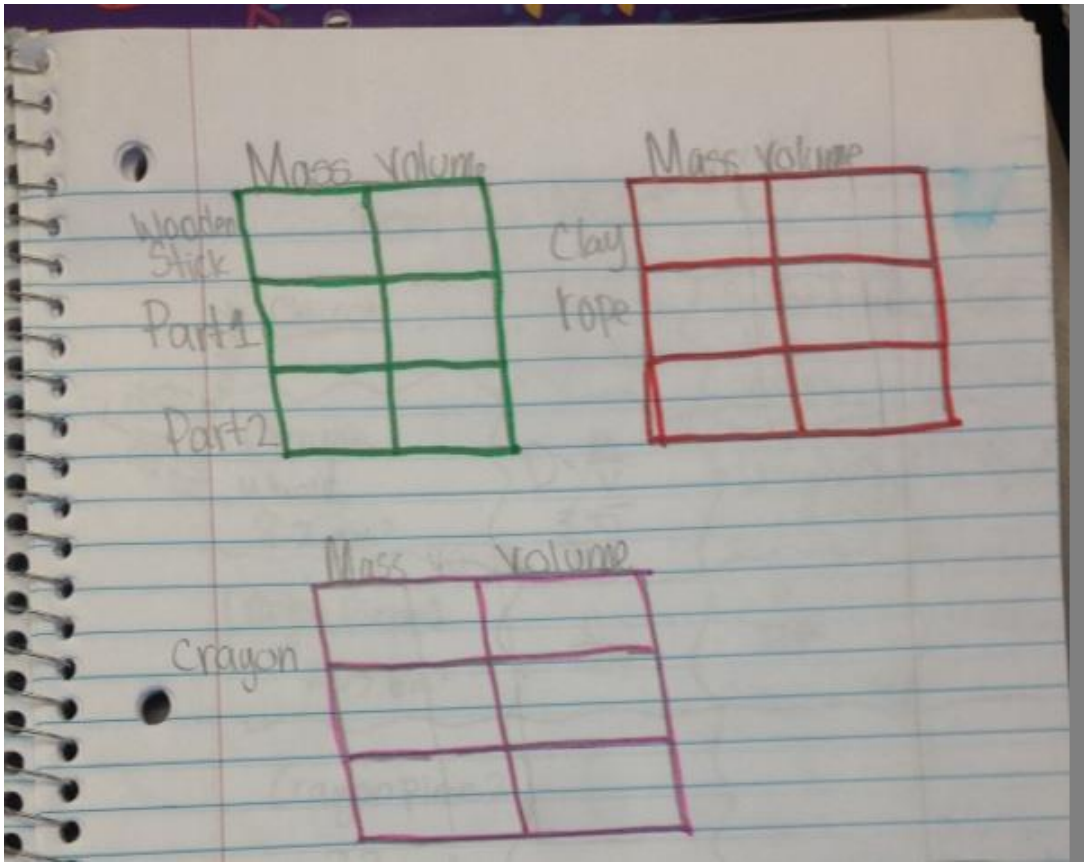
The teacher and the students read through the lab, together.

The teacher shows students the lab apparatus which will be at each group's station.

The teacher assigns the homework:

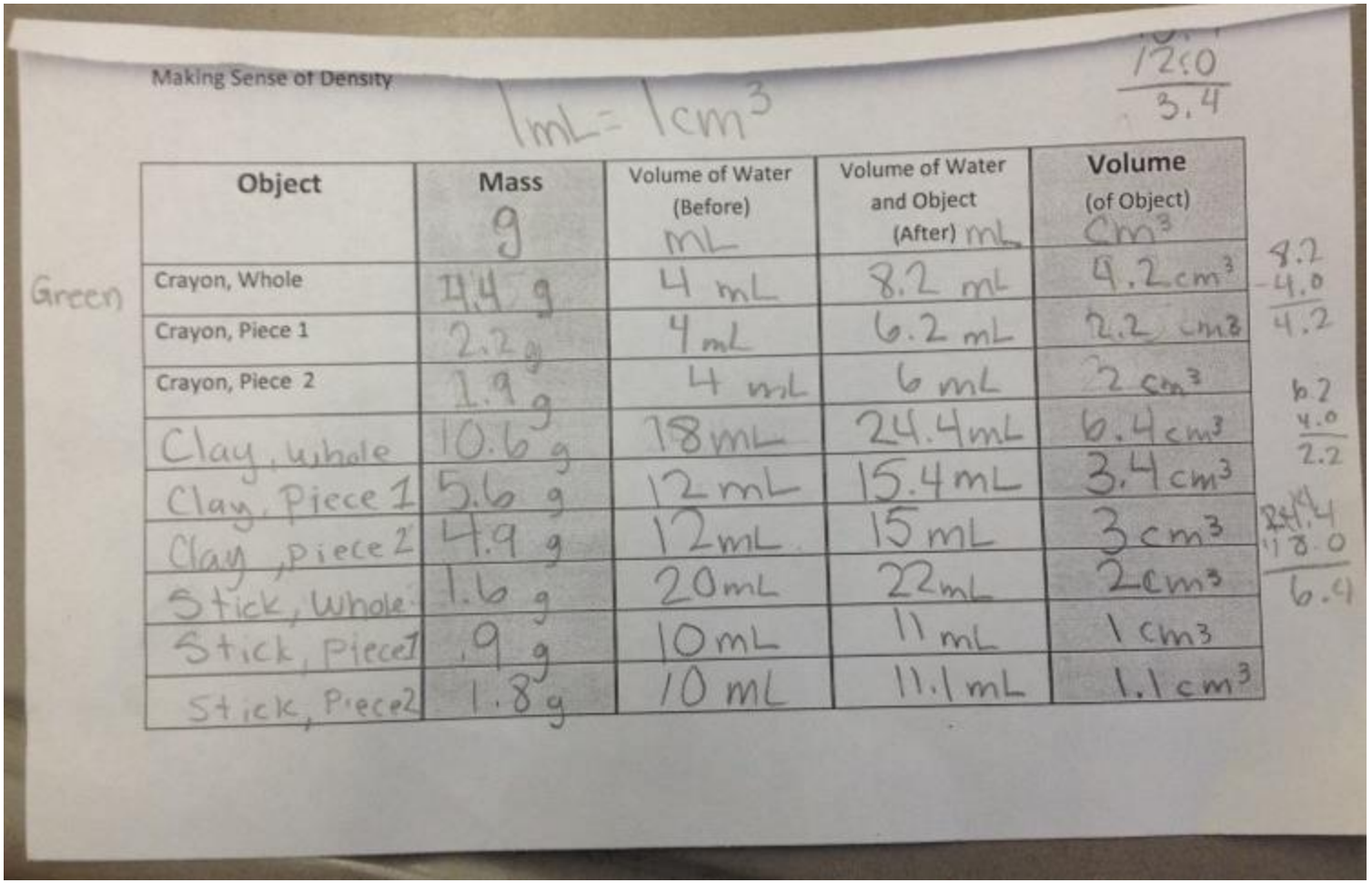
Re-read the lab, consider the data which will be collected, and create a data table in which to collect the data.

Student Sample of a Table



*The majority of students had a difficult time with this assignment.

Ms. Coletti's Table (Optional)



Making Sense of Density

1mL = 1cm³

Object	Mass (g)	Volume of Water (Before) (mL)	Volume of Water and Object (After) (mL)	Volume (of Object) (cm³)
Green Crayon, Whole	4.4 g	4 mL	8.2 mL	4.2 cm³
Crayon, Piece 1	2.2 g	4 mL	6.2 mL	2.2 cm³
Crayon, Piece 2	1.9 g	4 mL	6 mL	2 cm³
Clay, Whole	10.6 g	18 mL	24.4 mL	6.4 cm³
Clay, Piece 1	5.6 g	12 mL	15.4 mL	3.4 cm³
Clay, Piece 2	4.9 g	12 mL	15 mL	3 cm³
Stick, Whole	1.6 g	20 mL	22 mL	2 cm³
Stick, Piece 1	.9 g	10 mL	11 mL	1 cm³
Stick, Piece 2	1.8 g	10 mL	11.1 mL	1.1 cm³

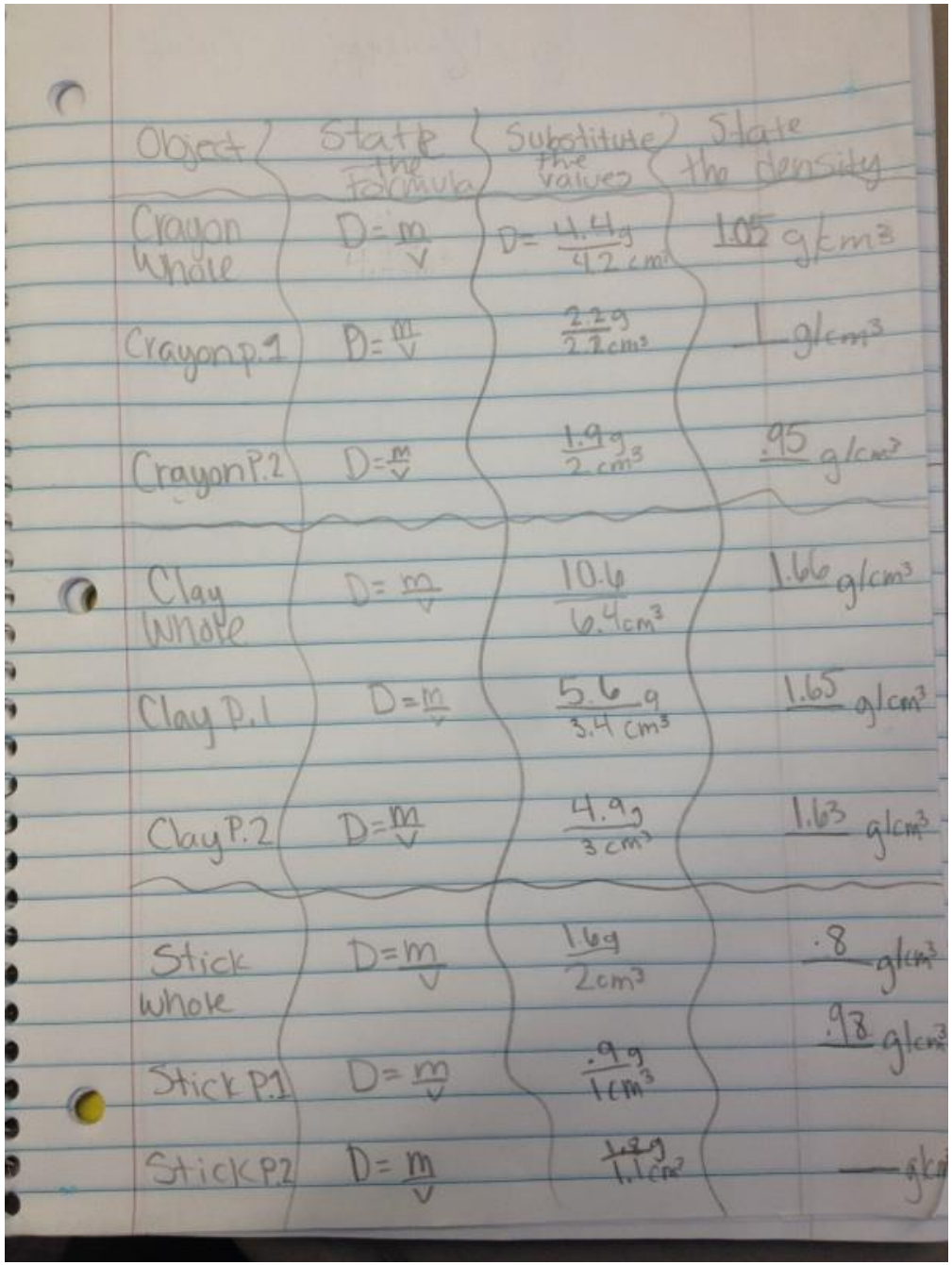
12.0 / 3.4

8.2 − 4.0 = 4.2

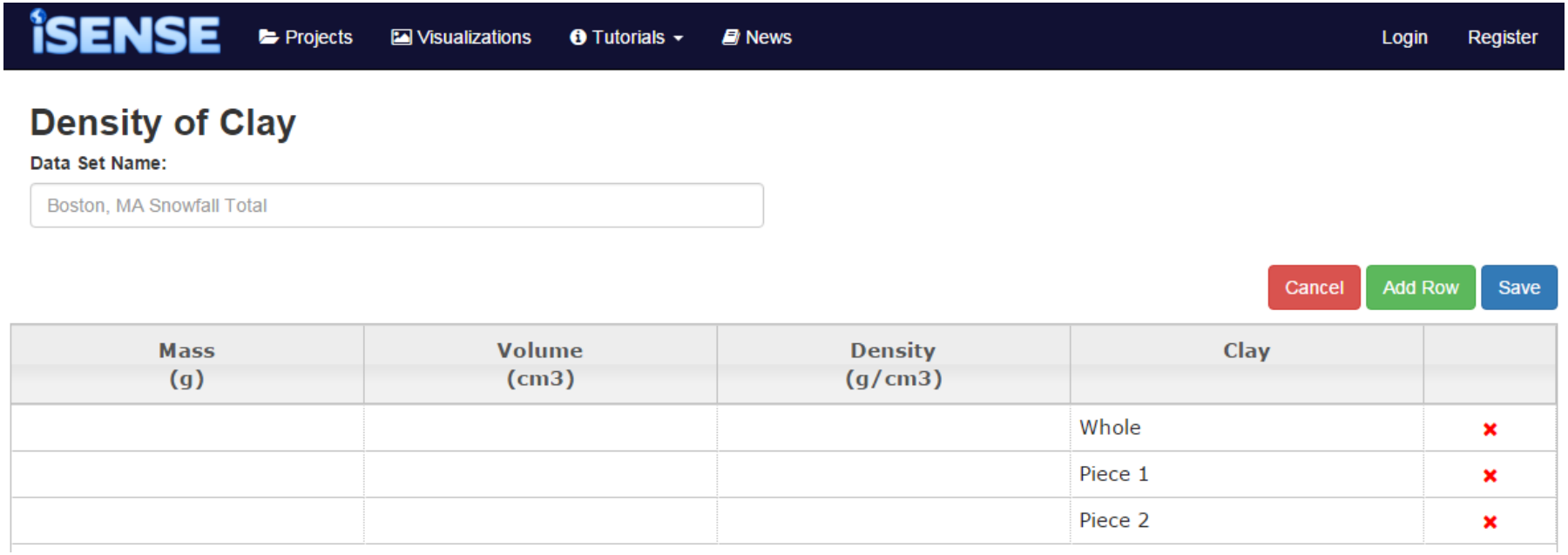
6.2 − 4.0 = 2.2

24.4 − 18.0 = 6.4

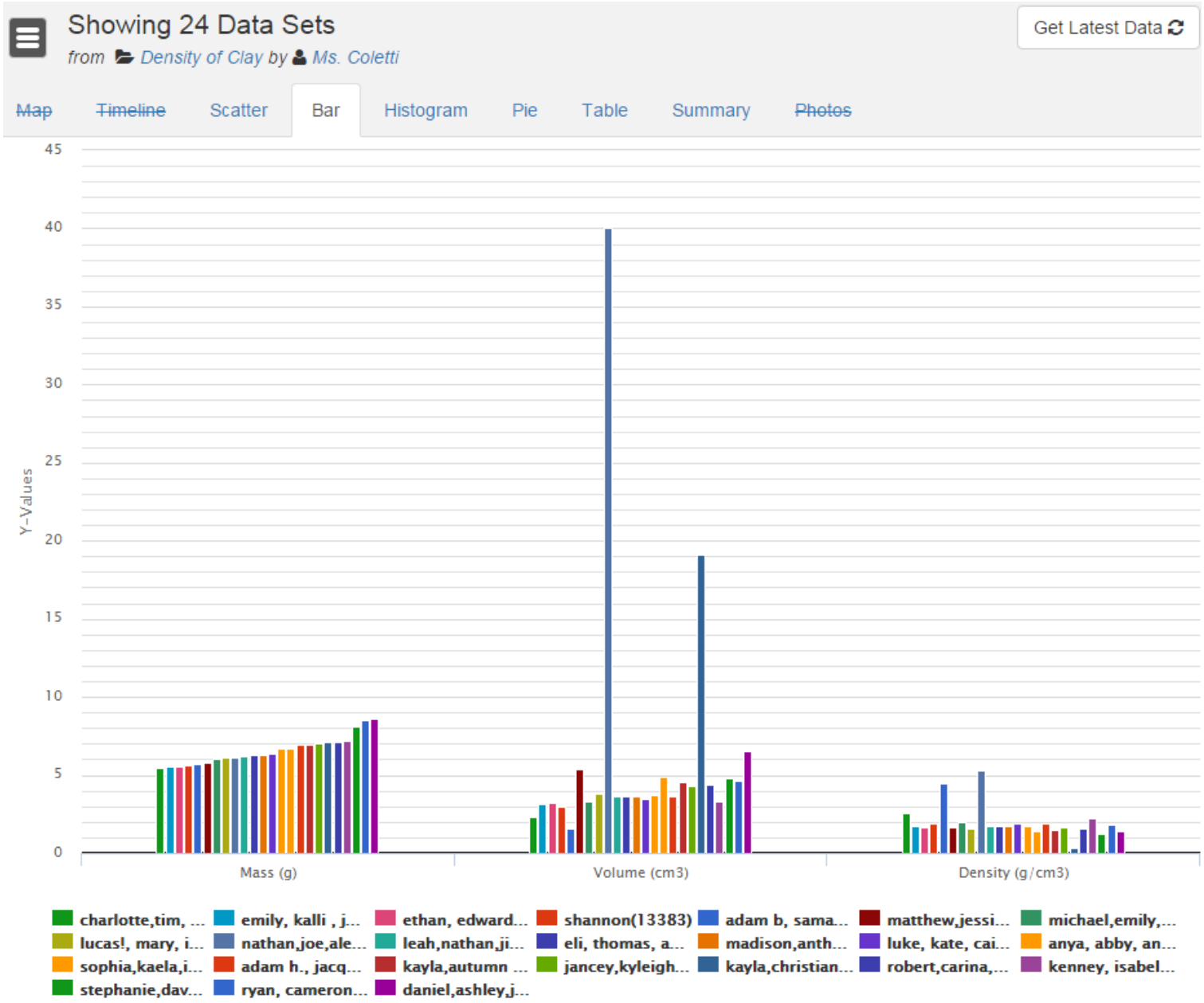
Calculating Density



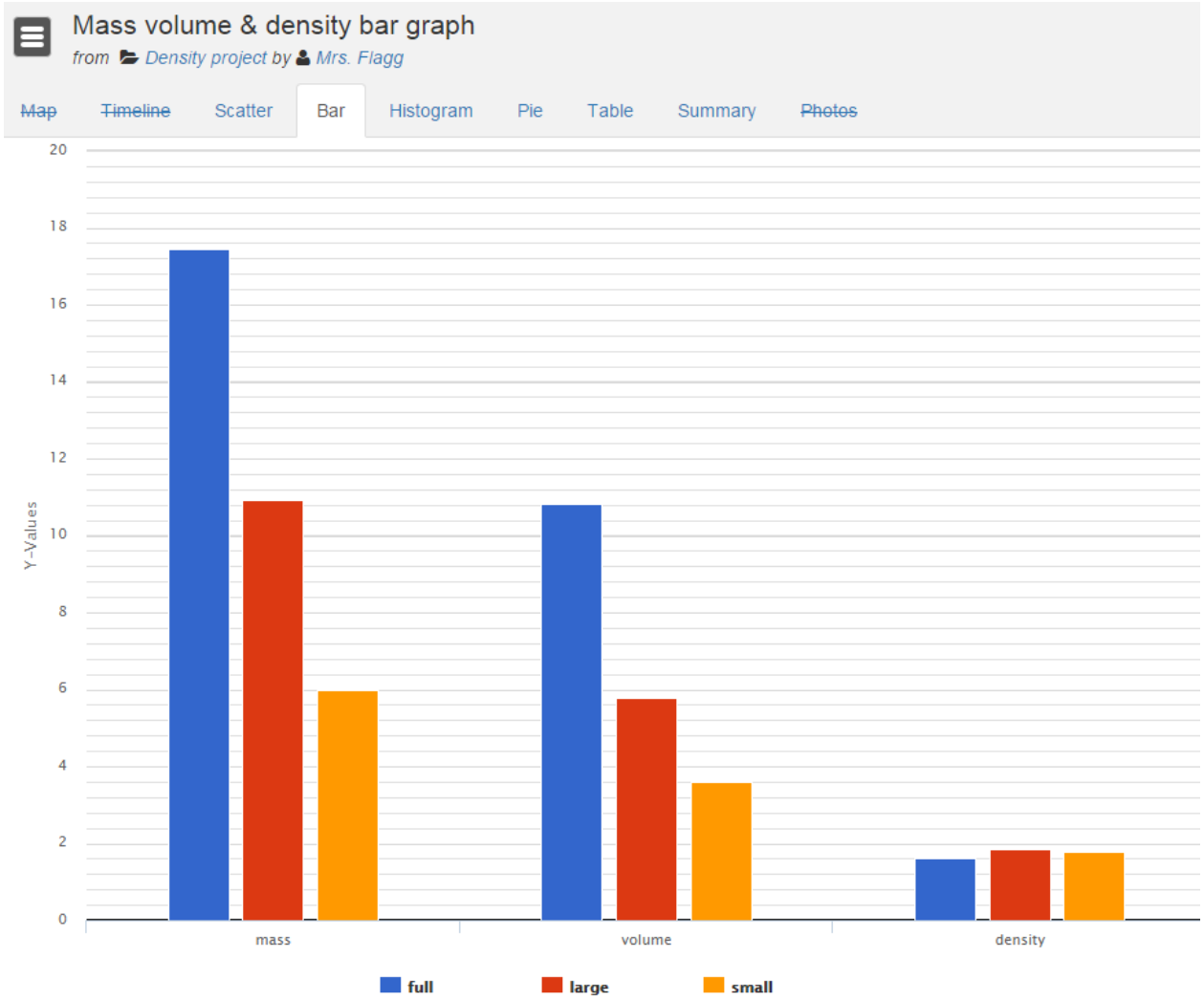
Entering Data: Student View



iSENSE Results Ugh



Thank you, Mrs. Flagg!



Rich Discussions

Why are the masses so close together, but the volumes are everywhere?
What caused the "high" measurements where the others are so much lower?
What were the people's mistakes?
Was it an error in measurement or was it the stick?
What if the higher measurements are the correct measurements?
Was the wood "submerged?
Was too much of the tool (used in submerging the stick) in the water?
Maybe the stick wasn't dried off?

How come they got such a big volume with such a little mass?
Did they use the bigger graduated cylinder?
How could their clay be less compact?
Did they split the clay up correctly?
How can their clay take up so much space?
Is their popsicle and crayon measurements similar?
Did they measure their data correctly?
Did they use the correct volume measurement?

Since they got 44 cm3 for the volume, it made the scale on the y-axis go up so it's not as accurate.
Why is the density so small with such a huge volume?
Did they forget the decimal point in the volume's data entry?
Did they use the wrong scale on the graduated cylinder?

* Why are those students so bad at science? (We revisited scientific questions.)

Follow-Up

Originally, the follow-up was going to be a worksheet which graphed the volume and mass of various sample sizes of the same mineral, then asking questions regarding the graph which represented density.

However, the follow-up will be a lab of calculating the density of water using several different sample sizes, and entering those results back into iSENSE.

“Issues”

-When saving the data, multiple students had issues with the data set name; the fix was to “cancel” and re-enter the data (even with the same name which was initially rejected).

-Students can’t fix their own entries.

-There’s still so much to get used to…

Just figure this out, at 9:09 PM on Friday night (Ugh):