Walker Middle School Science Pilot

Nutley Public Schools

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Where are we going in science education?

Next Generation Science Standards

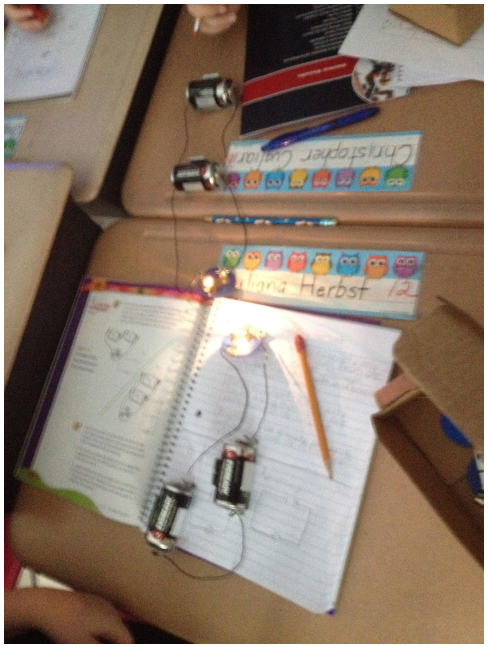
- **Twenty-six states, 41-member writing team to develop the standards**
- NJ Adoption Committee recommended to adopt last year (three members of Nutley faculty on committee), currently at state level
- **Dimension One: Scientific & Engineering Practices -** The practices describe behaviors that scientists engage in as they investigate and build models and theories about the natural world
- **Dimension Two: Crosscutting Concepts -** They are a way of linking the different domains in science
- **Dimension Three: Disciplinary Core Ideas/concepts -** Describes core ideas in the science disciplines and of the relationships among science, engineering and technology

2009 Core Curriculum Content Standards

5.1 Science Practices

A. Understand Scientific Explanations
B. Generate Scientific Evidence Through Active Investigations
C. Reflect on Scientific Knowledge
D. Participate Productively in Science
5.2 Physical Science
A. Properties of Matter
B. Changes in Matter
C. Forms of Energy
D. Energy Transfer and Conservation
E. Forces and Motion
5.3 Life Science
A. Organization and Development
B. Matter and Energy Transformations
C. Interdependence
D. Heredity and Reproduction
E. Evolution and Diversity
5.4 Earth Systems Science
A. Objects in the Universe
B. History of Earth
C. Properties of Earth Materials
D. Tectonics
E. Energy in Earth Systems
F. Climate and Weather
G. Biogeochemical Cycles

K - 5 Science



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FERA CYCLE

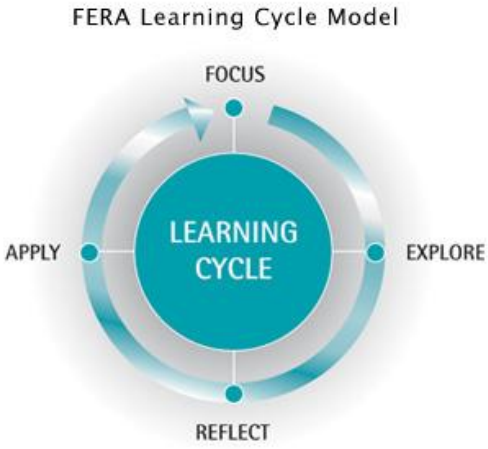
The STC Program embeds the FERA cycle for each lesson. This cycle has been developed by the National Science Resources Center (NSRC) and highlighted by the Center for Inquiry Science and Smithsonian Institute as a research proven method for inquiry science.

Focus Question - identify the problem/hypothesis, students record and discuss their prior knowledge.

•**Explore** – write/design a plan, materials, what and how to collect data, test ideas, do the hands-on inquiry

•**Reflect** –Analyze results. Make **claims**, use data, graphs, other visuals to support claims (**evidence**). Explain, teach, **defend findings** to someone else, then **write** a Conclusion.

•**Apply** – How is new knowledge applied in "**real world**"? Read to deepen content, new questions come up?



Click on graphic for more information

Science Pilot

7th Grade: 9 classes (2 Resource Pull out, 1 Inclusion)

-Plate Tectonics (Earth Science)

-Forces and Motion (Physical Science)

-Interdependence and Biodiversity (Life Science)

Science and Technology Concepts (STC) – developed by Smithsonian, published by Carolina Biological.

•Key Components of a "Research Based Approach" to Science Instruction:

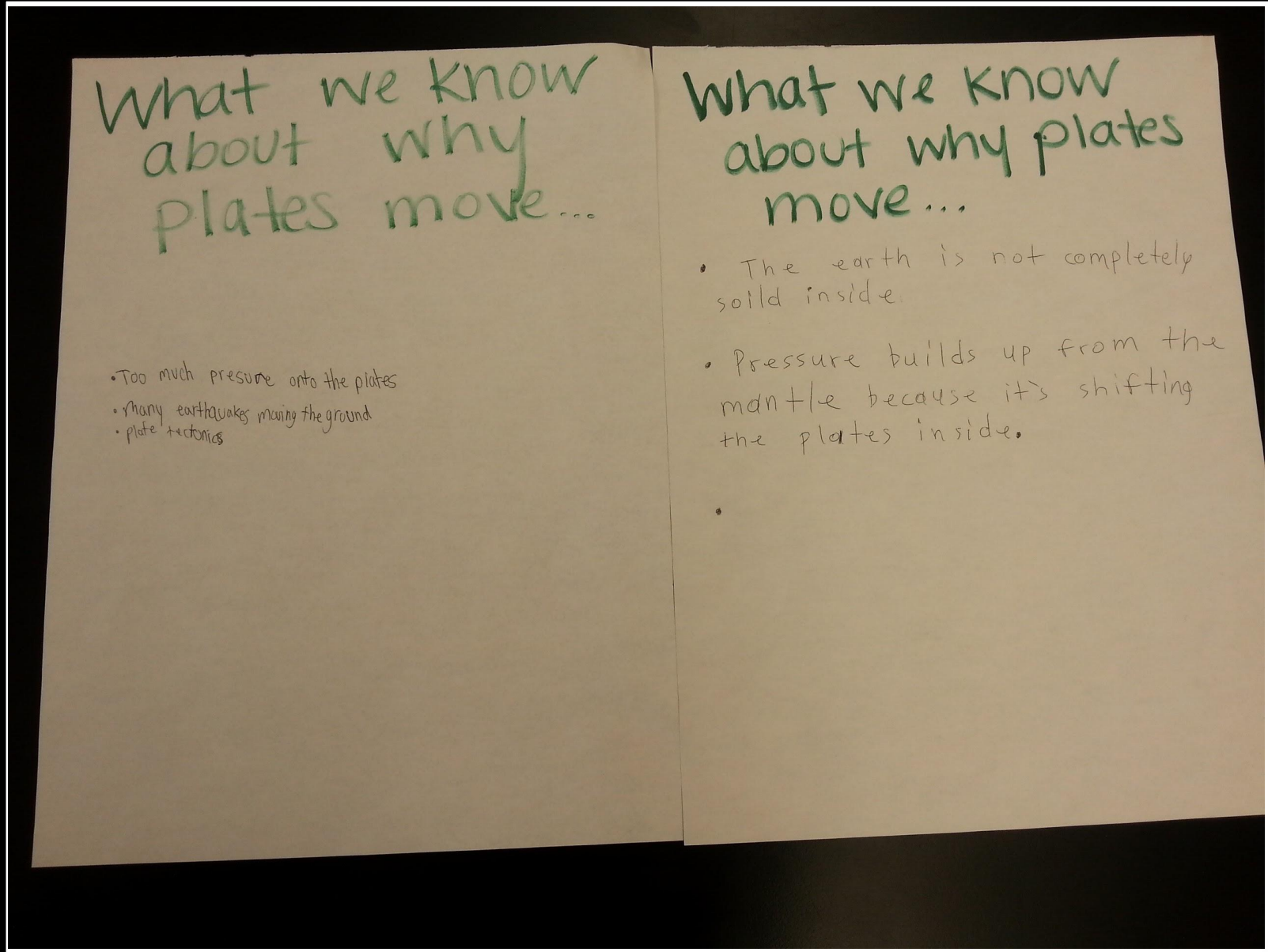
–Strong literacy component/Common Core ELA Standards

–STEM Based Learning (Science, Technology, Engineering, Math)

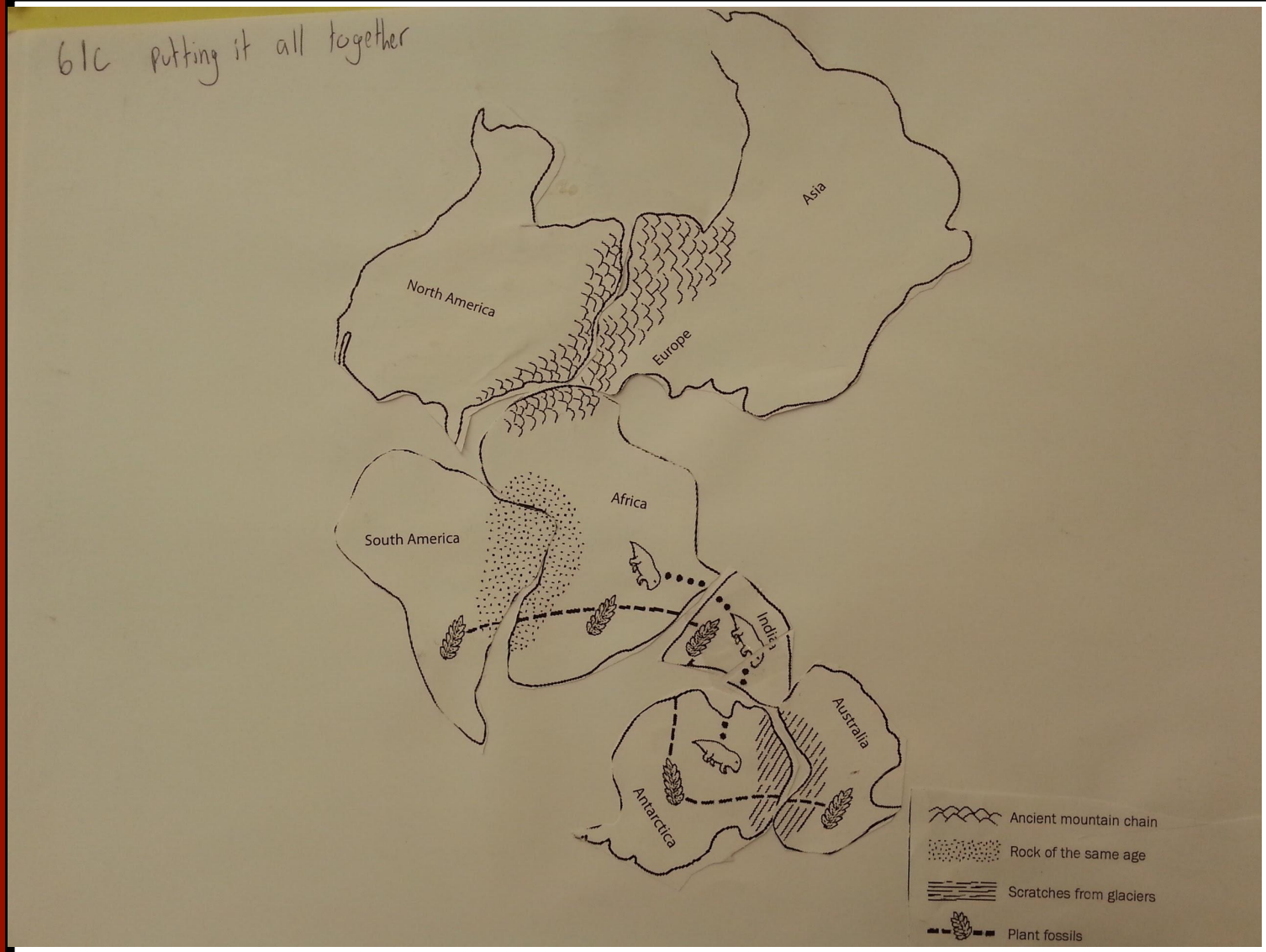
–Aligns with the Next Generation Science Framework (all 3 Dimensions) as well as 2009 NJ CCCS

PLATE TECTONICS

- At the beginning of the unit, students assessed their current understanding of plate tectonics through:
  - collaboration with the members of their lab groups
  - concept maps to organize their thoughts
- Throughout the unit, students gathered evidence for the theory of plate tectonics.
  - As new information was gained or refined, students added to & revised their concept maps
  - Students developed “working definitions” of terms
- This unit allowed students to deepen their understanding of earthquakes, volcanoes, and plate movement through the following experiences:
  - Analysis of seismic data (seismograms)
  - Study of maps (looking for patterns)
  - Hands-on activities
    - shapes of the continents
    - earthquake patterns
    - convection in the mantle
    - types of volcanoes, how they form, and how they impact land



Activating prior knowledge...



Evidence of Pangaea!

NAME _____ DATE _____ CLASS _____

7.1 INVESTIGATING FAULTS: RECORDING AND ANALYZING DATA

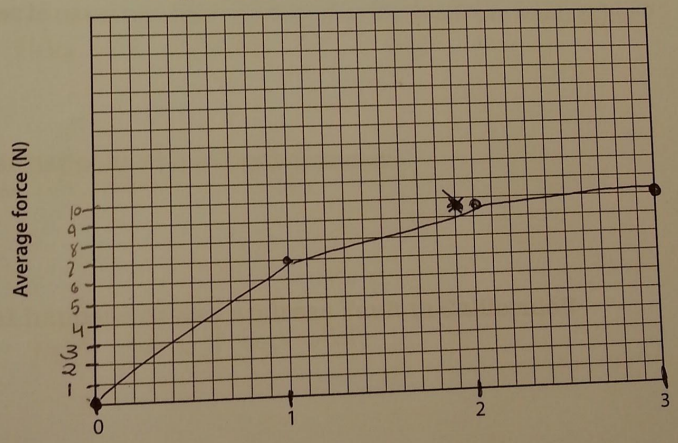
Directions Record the data from your fault experiment in Table 1. Conduct three trials for each test. Then, increase the friction between the blocks (by rotating the block and changing the number of Velcro® strips). Using the spring scale, measure the force in newtons (N) needed to move the blocks along the fault.

STUDENT SHEET

Table 1 Force to Move a Block Along the Fault

Frictional Resistance (number of Velcro® strips)	Force (N) Needed to Move the Block			
	Trial 1	Trial 2	Trial 3	Average
0	0	0	0	0
1	5	4	X	7
2	10	8	11	9.6
3	5	10	15	10

Average Force Required to Move a Block Along the Fault



Fault Lab:

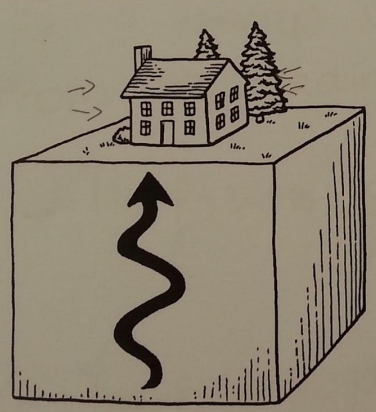
Data Table & Graph

Type of Earthquake Body Wave	Sketch of How Spring Moves	Time for Wave to Travel Back and Forth One Complete Trip (seconds)			
		Trial 1	Trial 2	Trial 3	Average
Push and Pull (P-wave), Step 6		2	1.5	1.1	1.53
Side to Side (S-wave), Step 7		.88	.32	.6	.6

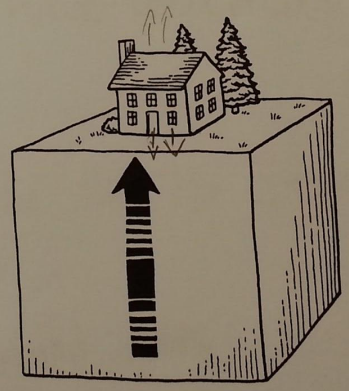
STUDENT SHEET

Rubrics/ Grades

1 Write P-wave or S-wave below each picture.



A. S-wave



B. P- wave

(continued)

Lesson 2

Modeling Earthquake Waves with Slinkys!

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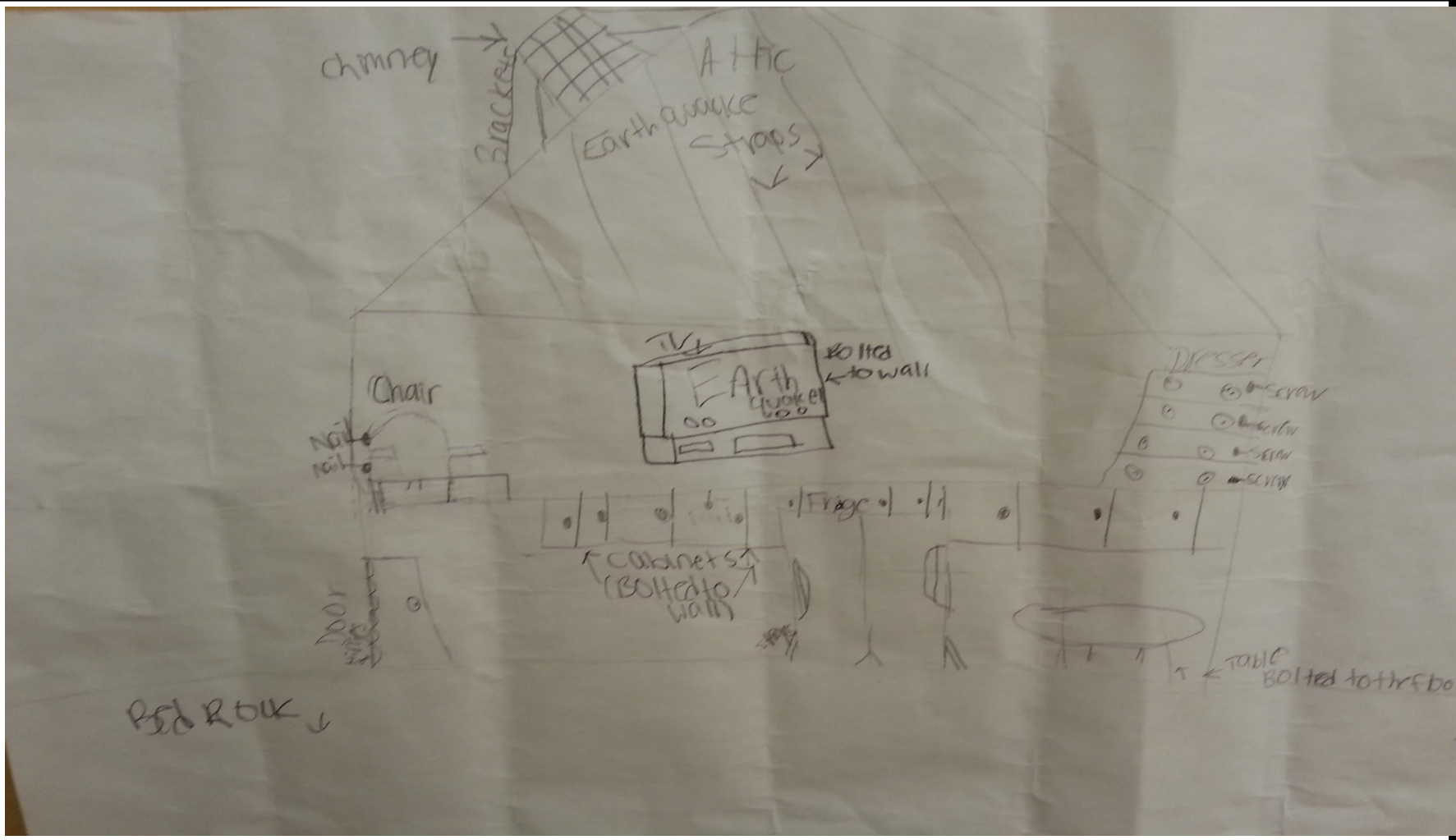
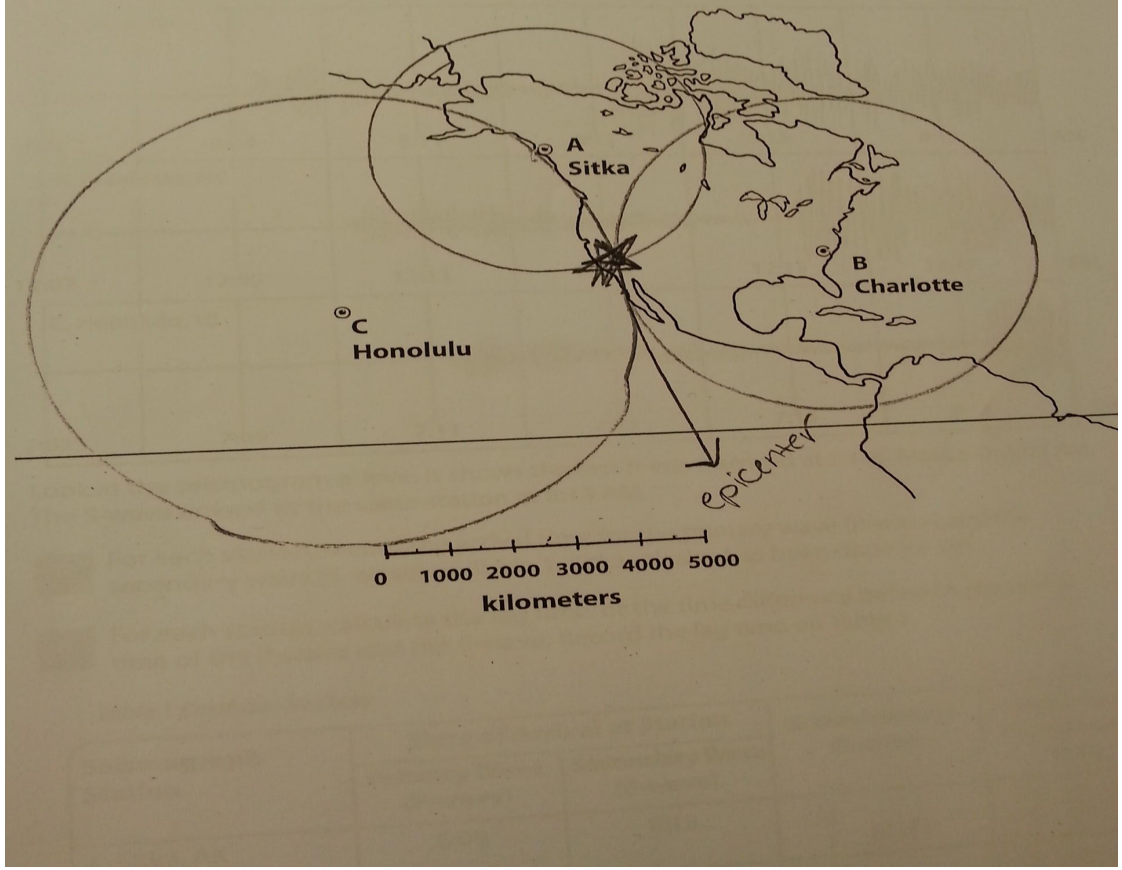


Student's Design of an Earthquake Resistant House

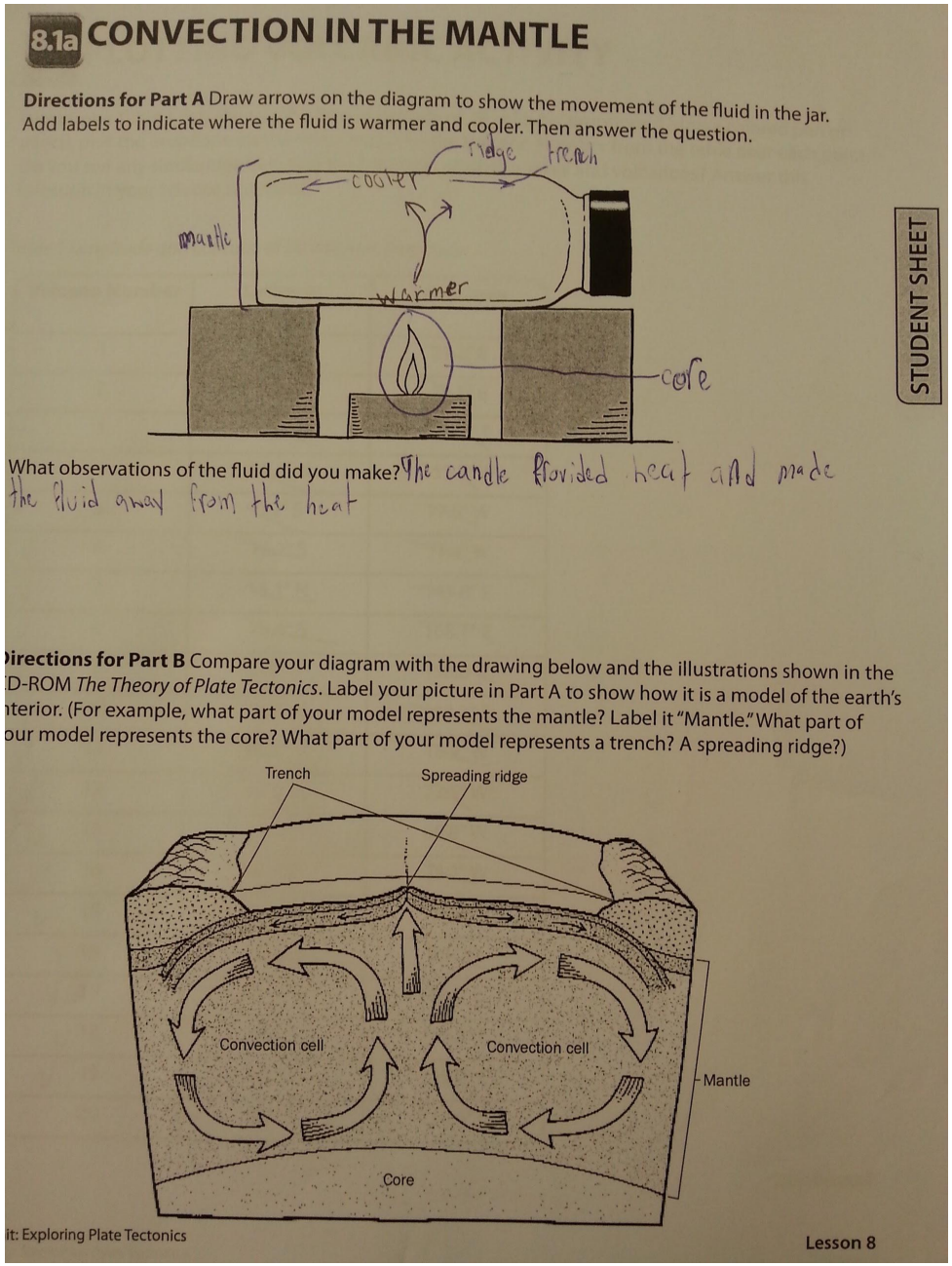
NAME _____ DATE _____ CLASS _____

3.3 LOCATING THE EPICENTER OF AN EARTHQUAKE (CONTINUED)

Directions Follow Procedure Step 10 of Inquiry 3.3 in the Student Guide and use the map below to locate and mark the earthquake's epicenter.



Using earthquake data to locate the epicenter!



8.1a CONVECTION IN THE MANTLE

Directions for Part A Draw arrows on the diagram to show the movement of the fluid in the jar. Add labels to indicate where the fluid is warmer and cooler. Then answer the question.

STUDENT SHEET

What observations of the fluid did you make? The candle provided heat and made the fluid away from the heat

Directions for Part B Compare your diagram with the drawing below and the illustrations shown in the CD-ROM *The Theory of Plate Tectonics*. Label your picture in Part A to show how it is a model of the earth's interior. (For example, what part of your model represents the mantle? Label it "Mantle." What part of your model represents the core? What part of your model represents a trench? A spreading ridge?)

it: Exploring Plate Tectonics Lesson 8

"Convection in the Mantle"

diagram & student's observation of the activity

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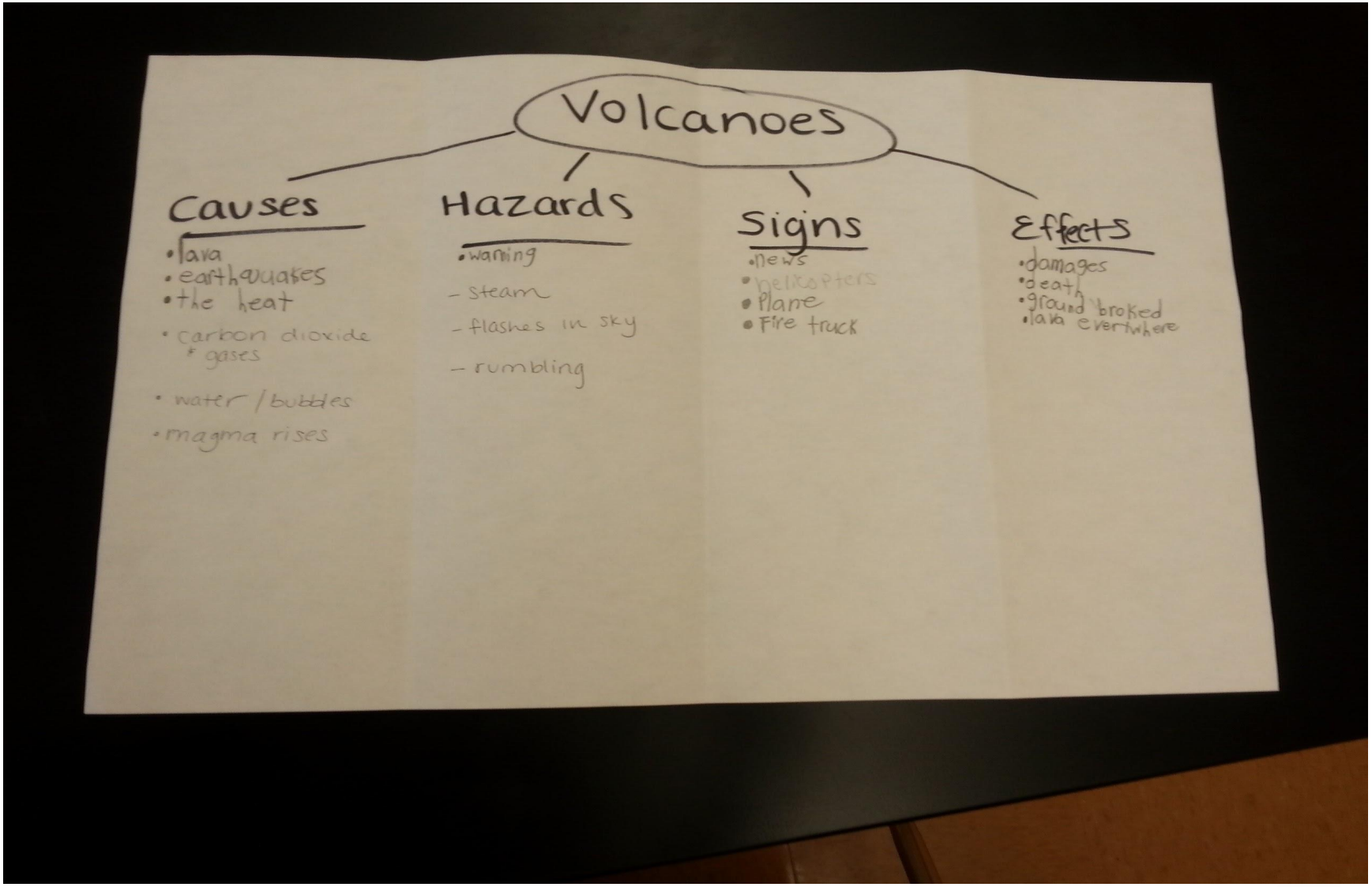
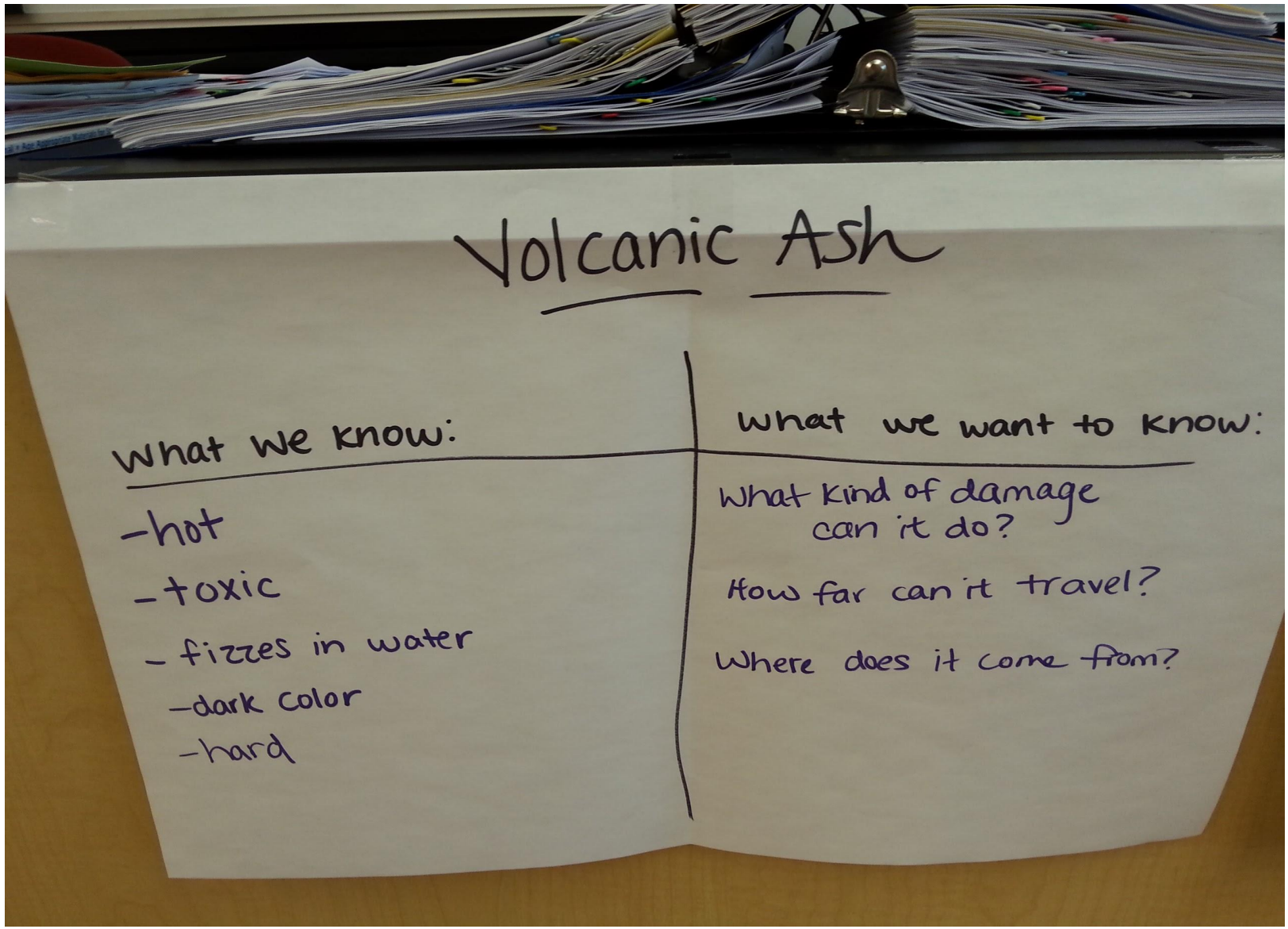


Student Concept Map



Additional Concept Map

Observing the Properties of Igneous Rock

Student Reflections on Plate Tectonics

"My favorite activity was looking at the volcanic rock through the loupe. It was fun to see the colors and minerals inside the rocks."

"The straw activity represented a volcano after it erupts and forms an ash cloud."

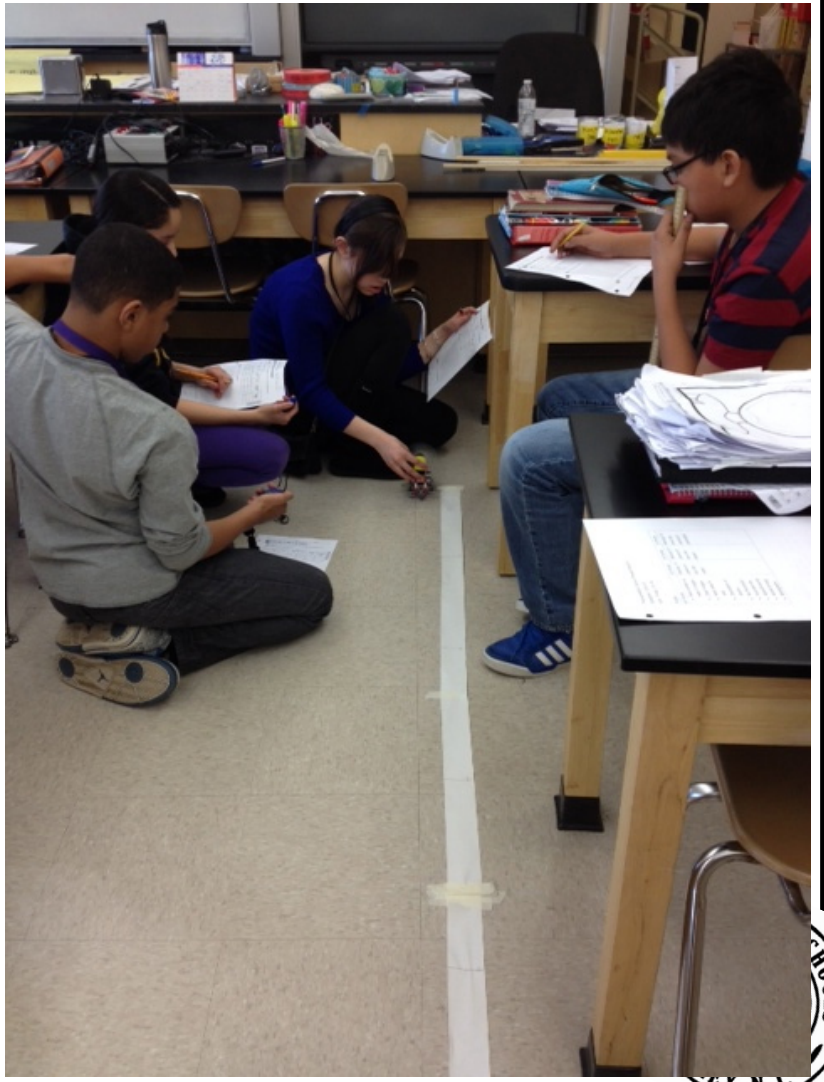
"I learned about plates. They are parts of the earth that move. I also learned more about the Earth. The inner core, outer core, mantle and crust are parts of earth."

"I learned how volcanoes erupt. A dark cloud appears. The lava flows like a stream and makes everything hot. It could wreck the land."

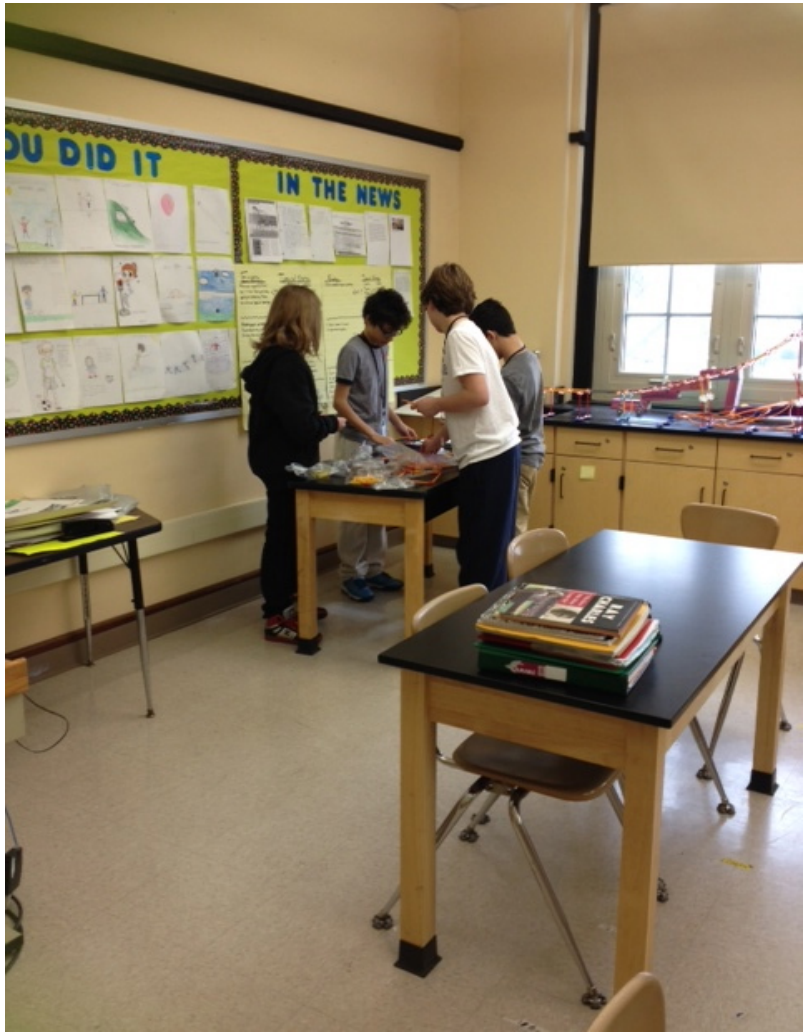
FORCES AND MOTION

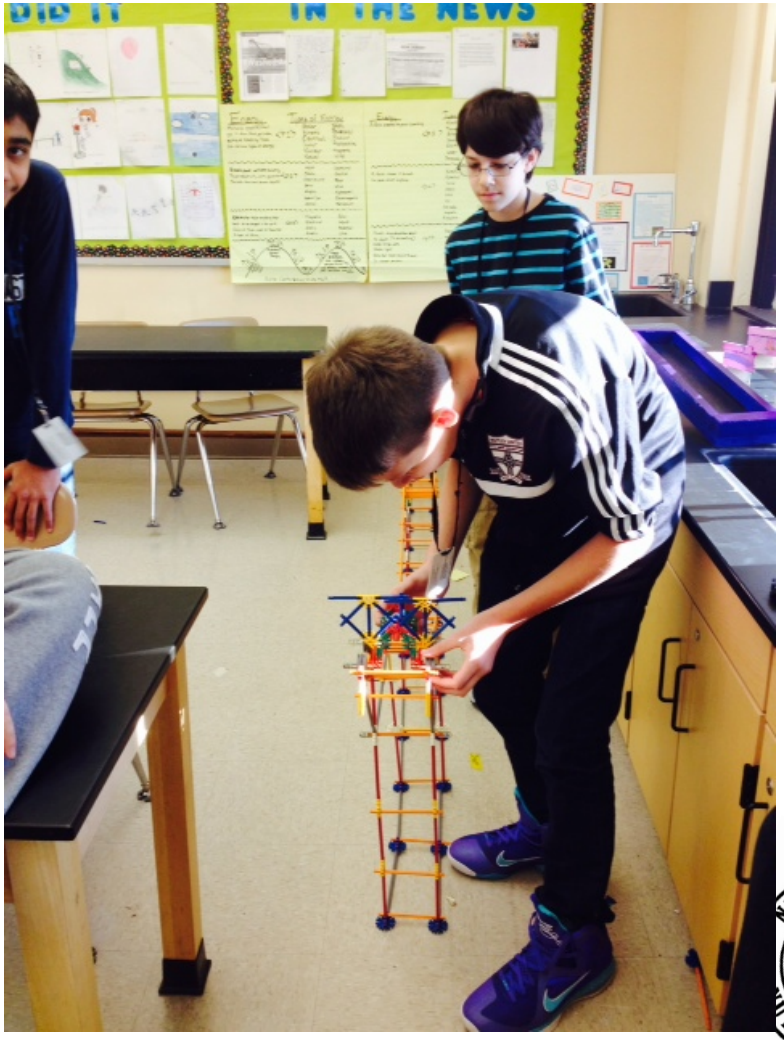
An in depth look at the variety of forces at work, motion, acceleration, velocity and energy an object possesses. Students manipulate these forces and motions by practical application in the classroom. Students were able to build Mousetrap cars, Fan Cars, and a Roller Coaster to help the explore Potential/Kinetic Energy, Velocity, Force, Work and Newton's Laws of Motion. The hands on experience and materials available greatly enhanced the ability to comprehend and evaluate some very complex terms and calculations in Forces and Motion.

Students at Work



Take a ride on our Roller Coaster





Student Reflections on Forces and Motion

"I learned lots of things throughout this marking period. We learned about motion, mass and weight. We also learned how to calculate the Kinetic Energy and Velocity. It was challenging at first, but I got the hang of it as we practiced more. My favorite lab would have to be the Fan Car! It was a lot of fun to build!"

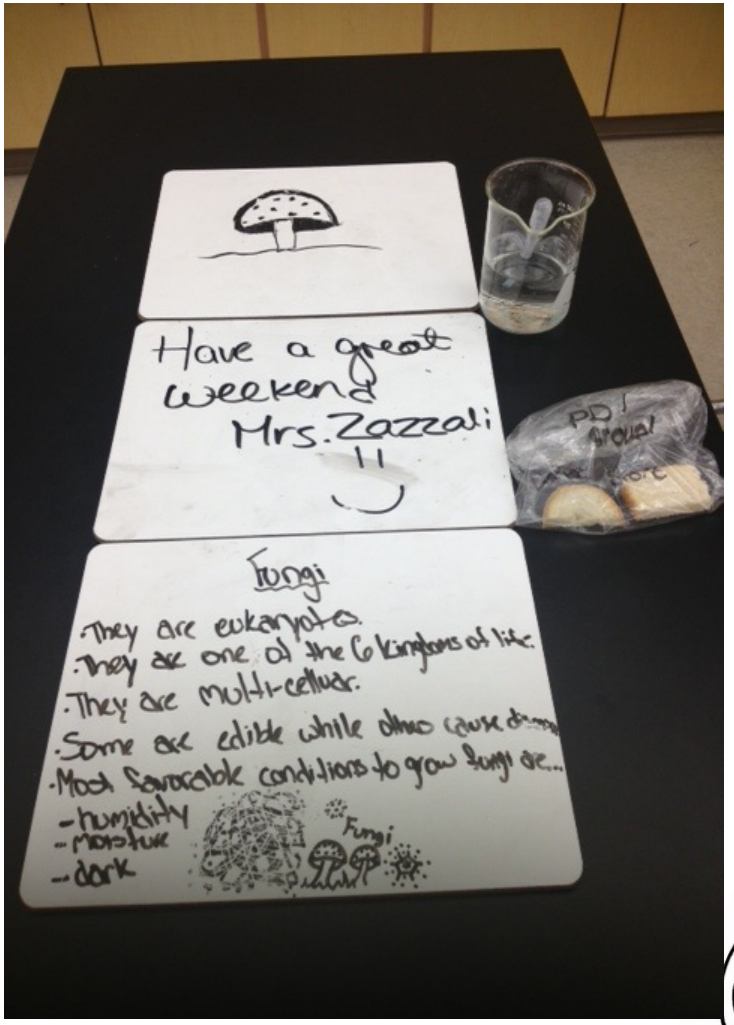
"Forces and Motion was very interesting this Marking Period. I learned a lot about calculating Velocity and Kinetic Energy and what those things were. I also learned about Kinetic and Potential Energy and how they apply to us. Overall, I had a great time with Forces and Motion."

Biodiversity and Inter-dependence

- The variety of organisms in an environment and how they mutually rely on each other.

- Students have the opportunity to explore Life Science by evaluating live organisms in common and microscopic view, manipulate their environment, and truly learn by doing.

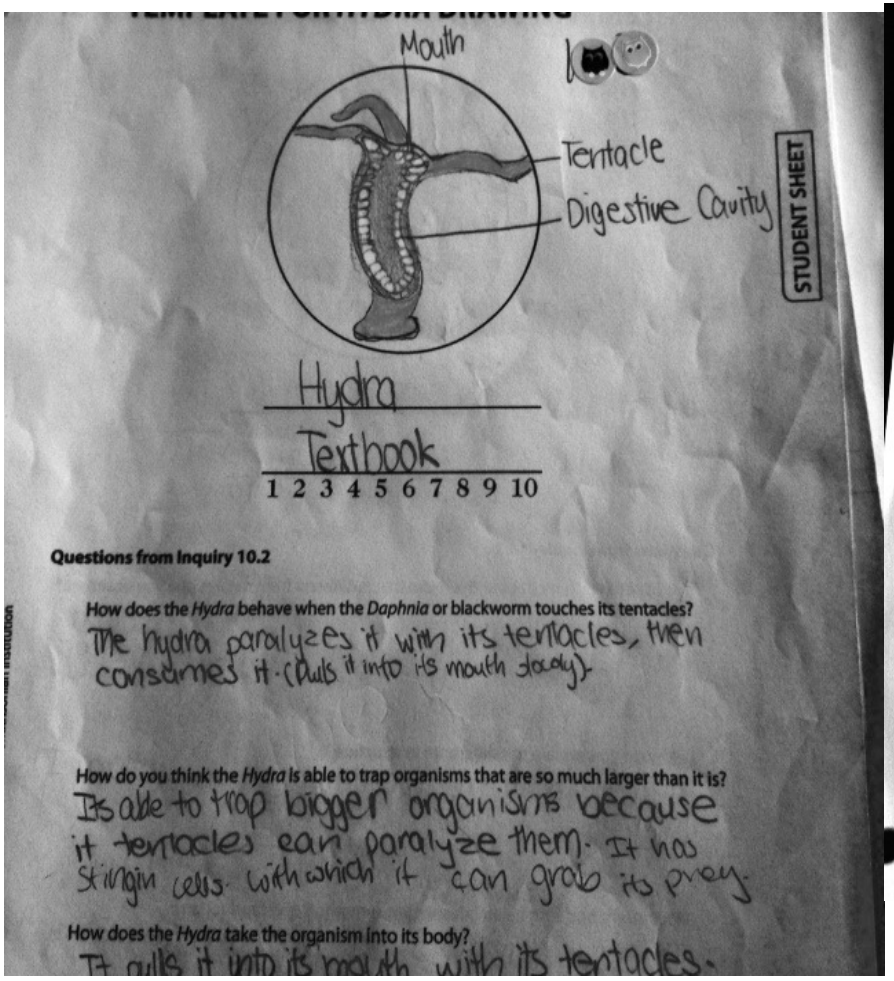
A look into the Fungi Kingdom

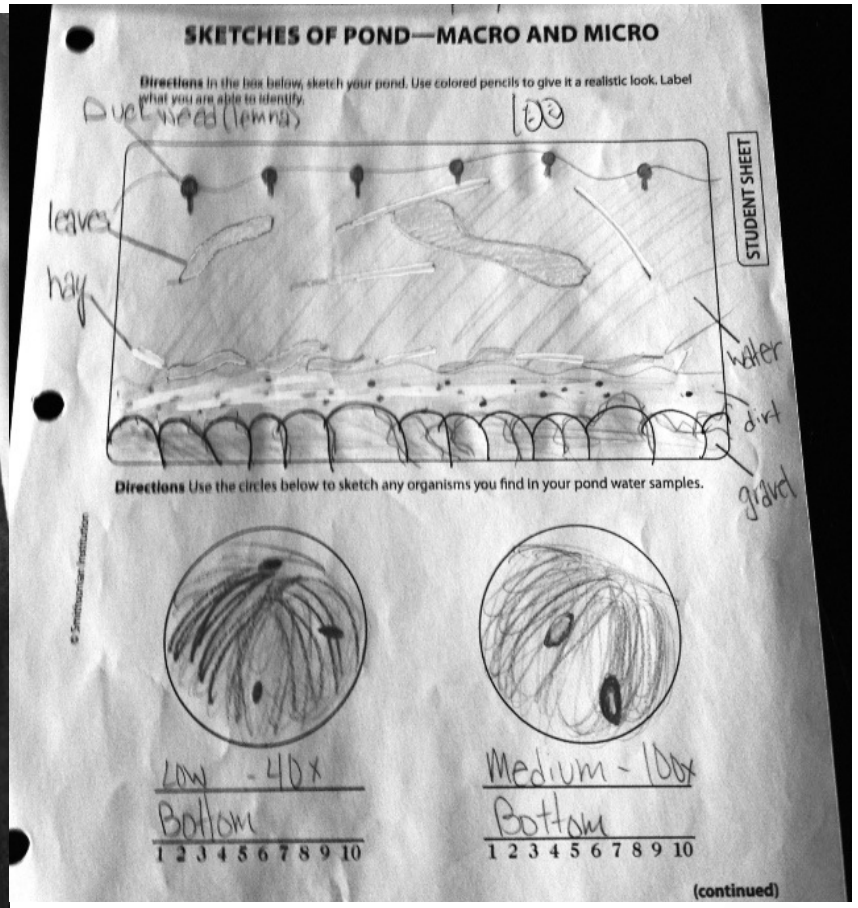


Student responses to What is a Habitat?

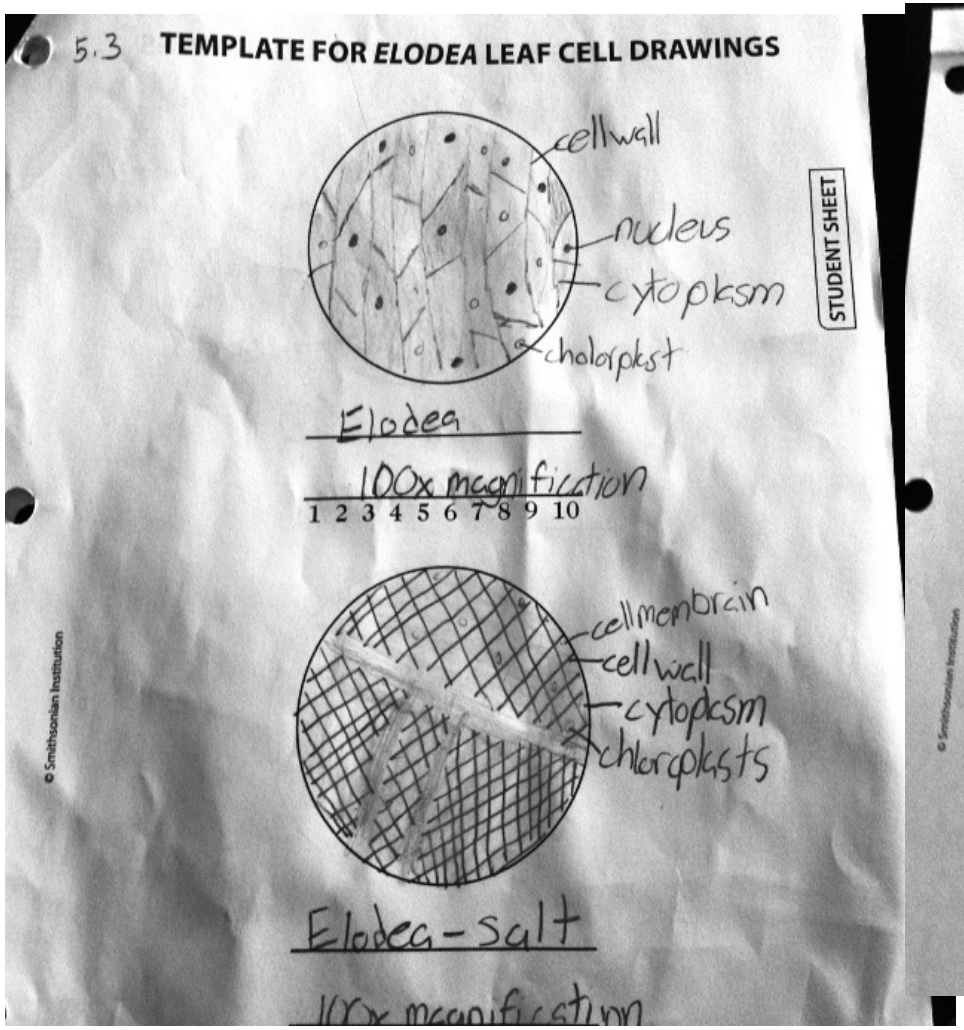
- All classes said…
- Place where an organism lives depending on the organism ex. Monkey lives in the jungle
- Where a species finds food
- Its' environment and where an organism reproduces, gets rid of waste
- Natural home or shelter of an animal
- Lives according to their needs
- Adapts and responds to environment
- And carries out life processes!

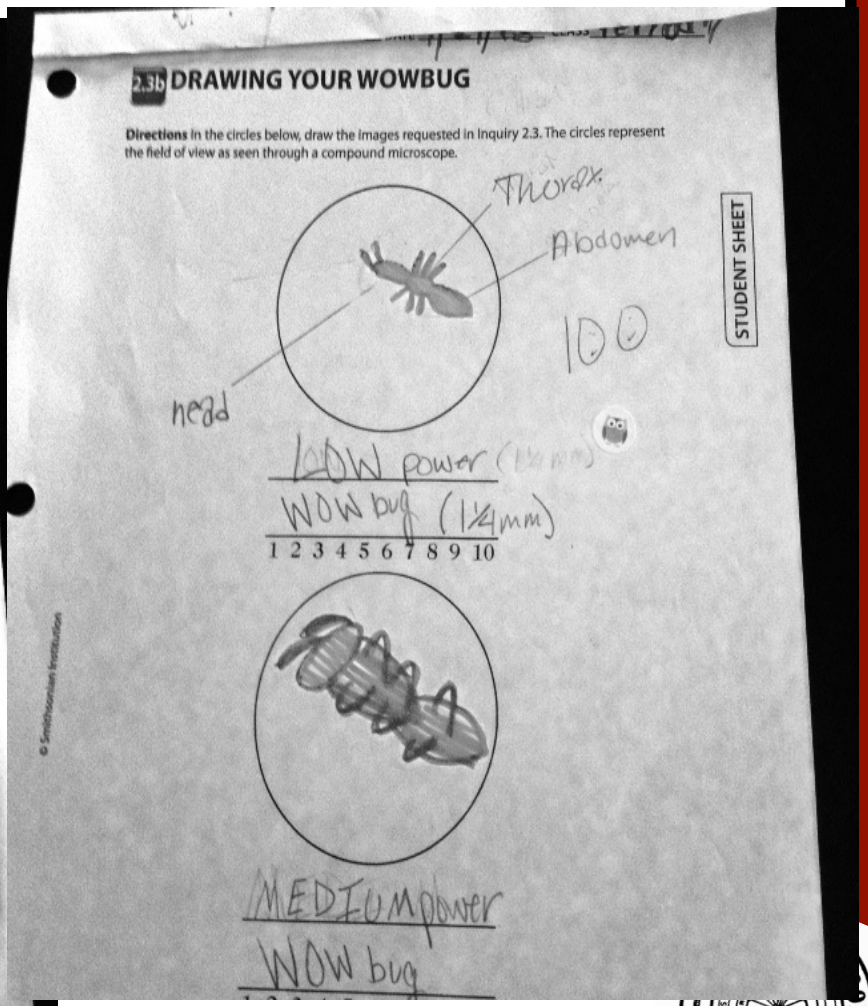
Some Sample Work





Look at all the Diversity





Feedback

"Somehow you found the way to teach our son and more importantly to make him enjoy science and actually want to learn!!! Thank you, thank you… We appreciate that you take your time and have patience with him!!!!"

- Parent e-mail

DATA: (Field tested summative assessments from STC program) per Performance Matters

Cycle 1

Biodiversity and Interdependence - RegEd/ICS - 89% (112 students)

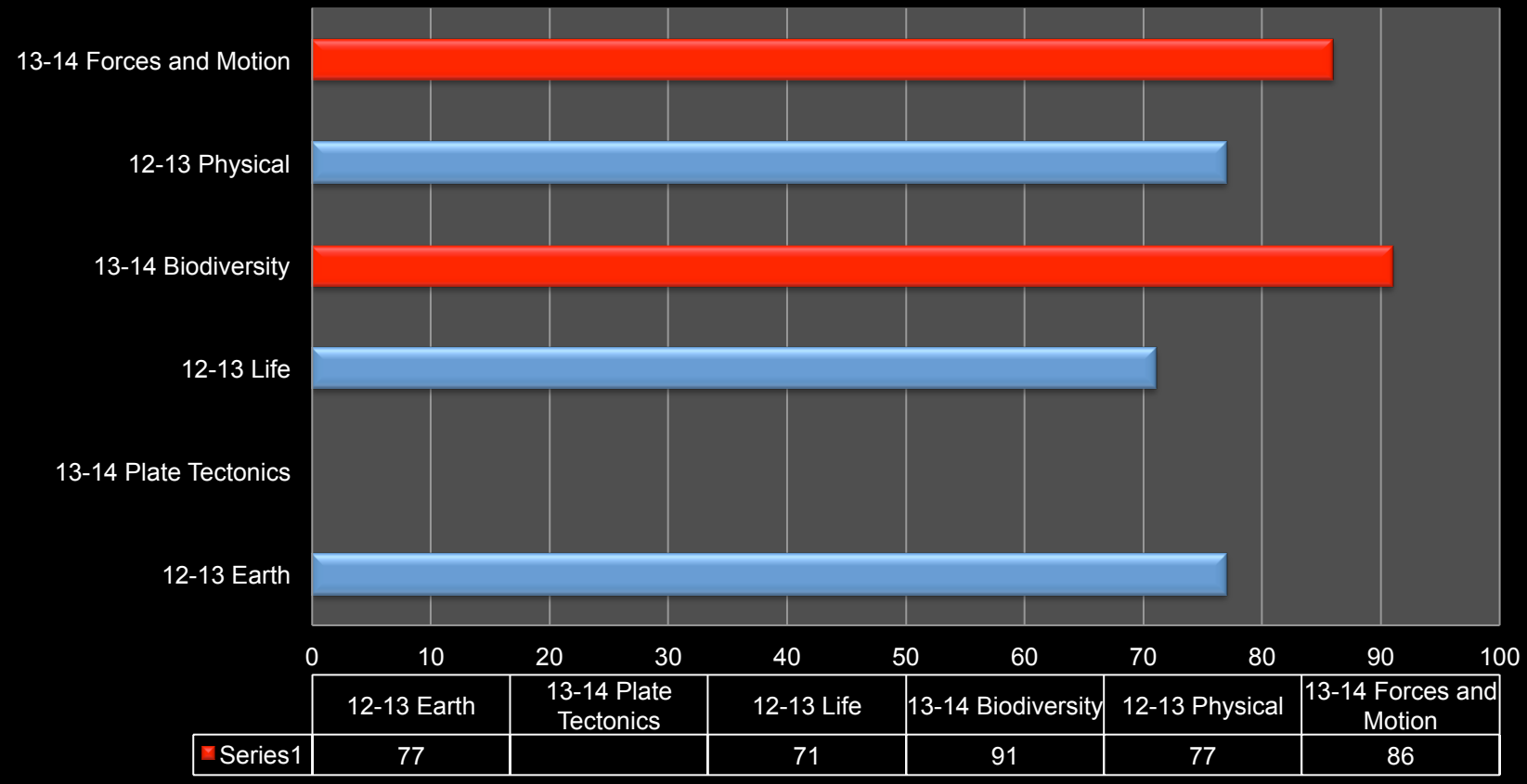
Forces and Motion - Resource Science - 74% (13 Students)

Cycle 2

Forces and Motion - RegEd/ICS - 87% (114 students)

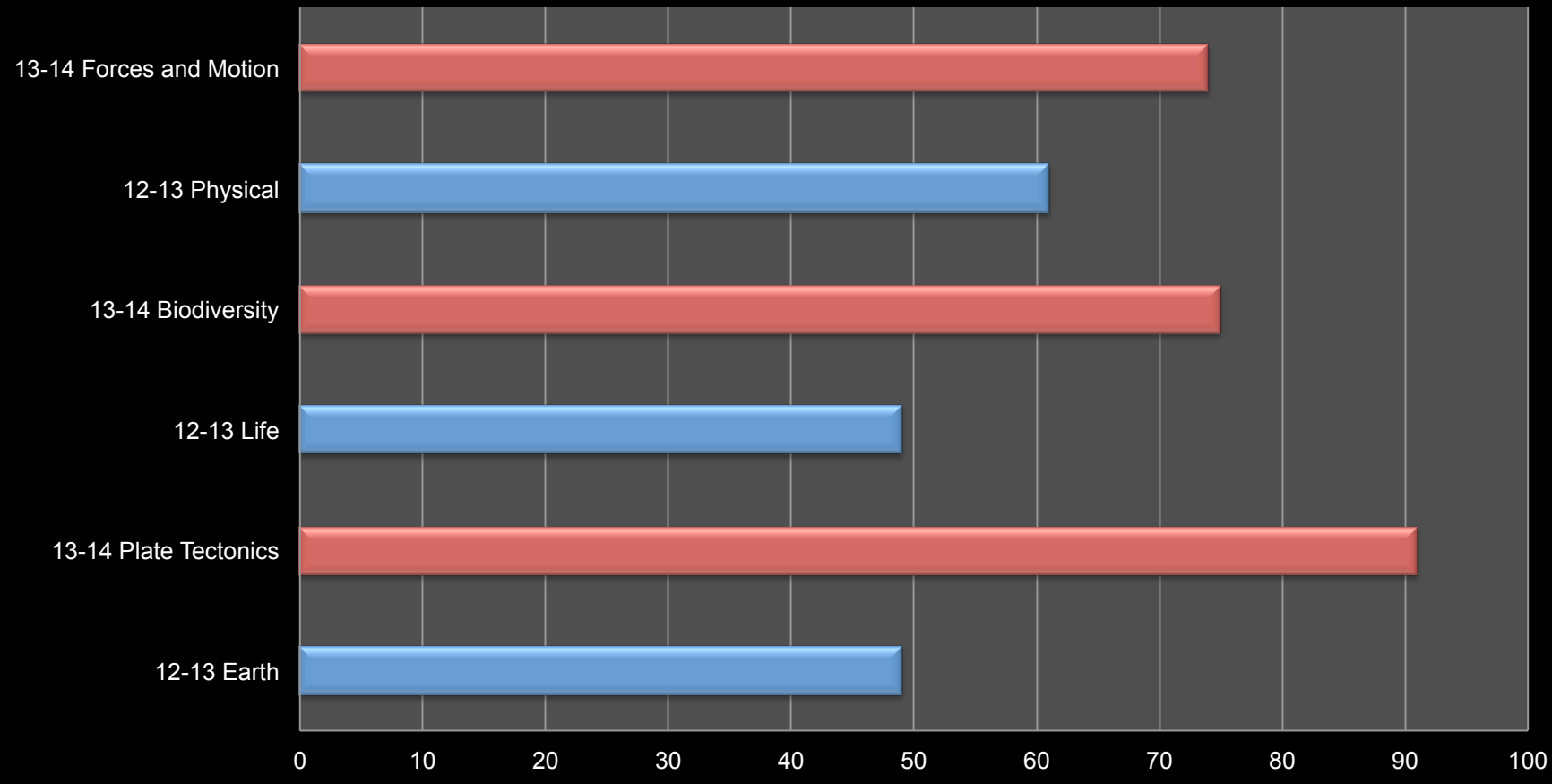
Plate Tectonics - Resource Science - 91% (13 students)

Common Assessments % (Regular ED)



	12-13 Earth	13-14 Plate Tectonics	12-13 Life	13-14 Biodiversity	12-13 Physical	13-14 Forces and Motion
Series1	77		71	91	77	86

Common Assessments % (SWD)



	12-13 Earth	13-14 Plate Tectonics	12-13 Life	13-14 Biodiversity	12-13 Physical	13-14 Forces and Motion
Series1	49	91	49	75	61	74

Moving Forward...

Grade	Life Science	Earth Science	Chemistry	Physical Science
6	Investigating Digestion and Motion	Understanding Weather and Climate	Mixtures, Compounds, and Elements	
7	Biodiversity and Interdependence	Exploring Plate Tectonics		Forces and Motion
8	Studying the Development and Reproduction of Organisms	Researching the Sun-Earth-Moon System		Exploring the nature of light