What's the Matter?

Major Topic and SOL Matter, Atoms

Science SOL PS.1a,d,f,j,l,n PS.2a,b,c,d,e,f PS.3a,b

Length of Unit 4 class periods (90 minutes each)

Major Understanding

Student will:

- be able to name the three basic states of matter and describe the particle arrangements of each state.
- be able to describe modern and historical models of atomic structure.
- be able to use inquiry-based strategies to develop theory.
- be able to identify liquids as acids or bases.

Essential Questions

- How could you describe the Particle Theory of Matter?
- How could you describe the way that particle arrangements differ within solids, liquids, and gases?
- How can qualitative and quantitative observations be used to develop theory?
- In what ways could you determine acidity or basicity?

Student Objectives

- The student will plan and conduct investigations.
- The student will be able to investigate and understand the basic nature of matter, atoms, and modern and historical models of atomic structure.
- Students will understand that matter differs according to both physical and chemical properties.
- Students will investigate and understand that atomic structure can be used to identify different substances.
- Students will understand the importance of using inquiry to develop theory

Bloom's Taxonomy Skills	**21st Century Learning Skills**
• Creating • Evaluating • Analyzing • Applying • Understanding • Remembering	• Critical Thinking • Problem Solving • Communication • Creativity & Innovation • Collaboration • Information & Media • Contextual Learning

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	• Research

Assessment Evidence

Performance Tasks

- Students will sketch illustrations to describe the particle arrangement within solids, liquids, and gases.
- Students will create models of atomic structure and complete reports about atomic discovery.
- Students will investigate the acidity and basicity of different solutions.

Other Evidence

- Pre-assessment and post-test (Teacher made---based on adopted textbooks and available resources)
- Illustrations (When giving teacher guided notes, students should be instructed to provide illustrations of early scientists' atom models and participate in class discussions about atomic theory)
- Presentation/Project & Writing assignment (Self-made models that are accompanied by research. This will be graded with the rubric, *Model of an Atom Rubric*).
- Class Participation
- Teacher Observations
- Notebooks
- Laboratory assignments/reports

Technology Computers, Internet connection, Projection system, pH Sensors and laptops, Logger Lite, Internet web browser

Internet Resources

- www.wordle.net
- www.polleverywhere.com
- www.teacherlink.org/mysteryshapes
- http://phet.colorado.edu/en/simulation/build-an-atom
- http://phet.colorado.edu/en/contributions/view/3306 (print the downloadable file for students)
- http://phet.colorado.edu/en/simulation/acid-base-solutions

Supplies/Materials

- Play-doh (and small household items to put inside)
- paperclips and skewers to use as probes
- liquid solutions

- pH Sensors
- beakers
- paper towels
- Styrofoam balls
- craft paint
- pipe cleaners
- candle stick holder
- string cheese
- blanched almond
- lighter/matches
- Experiment 28 Materials

Lesson 1: Probing at a *Mystery* (90 minutes)

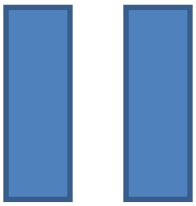
Engage:

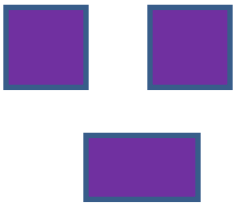
- Students will complete the *Mystery Shapes* activity with a partner. Discuss with students what they think are in the "atoms" (play-doh). Talk about the objects used to probe these mystery shapes.
  Note: Teacher will need to prepare for the *Mystery Shapes* activity previous to the lesson. Place common objects (i.e. thumbtack, coins) in the center of play-doh. Form into a ball so that the mystery object is in the center. Give each group a chopstick and a paperclip to probe the play-doe (atom) to try to guess the contents.
- Discuss with the students - What objects made it easier to feel the mystery object in the center of the play-doh?

Explore:

- Students will use the website: www.teacherlink.org/mysteryshapes to complete the interactive activity.
  Note: Students will have to choose three mystery shapes in a row correctly until they are prompted to solve the mystery shape with no choices. They will draw to the best of their knowledge what they think it is. They will have three shapes to draw. These are the answers to the three mystery shapes:

1. 

2. 

3. 

- Share the *guesses* with the class. Compare them to the correct answers.

Explain:

- Teacher will review the importance of using inquiry when making discoveries and developing theories in science.

Elaborate:

- Teacher will use guided notes (created by the teacher based on your classroom needs) and students will write notes and illustrate to discuss solids, liquids, and gases.

Evaluate:

- Students will be assessed on the objective, PS.2, orally. Students will review the characteristics of solids, liquids, and gases.

Lesson 2: Taking a Look (90 minutes)

Engage:

- Teacher will use the *candle simulation* discrepant event to encourage keen observation and explain its relationship to making scientific discoveries.

Directions for candle simulation –

1. Take a piece of string cheese and cut off an end so it has nice, sharp corners.
2. Take a blanched almond and stick it in the end of the cheese you just cut.
3. Place the other end of the string cheese in the candle stick holder.
4. Light the almond with a match or lighter (do the first four steps out of the view of the students). The almond sliver will stay lit for 1-2 minutes, due to the oil in the nut.
5. Ask the students to make observations about what they see (maybe even have a student take observation notes on the board).
6. Before the flame goes out, make sure you have saliva on your to your tongue to put out the flame, and eat the top of the string cheese and almond.
7. Review with the students what they really observed and which ones turned out to be inferences.

Explore:

- Students will use the website: http://phet.colorado.edu/en/simulation/build-an-atom to complete the interactive activity.

Explain:

- Teacher will review the importance of scientific theories that led to early atom models and the modern day model.

Elaborate:

- Teacher will use guided notes (created by the teacher based on your classroom needs) and students will write notes to discuss different atomic theories.

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Evaluate:

- Students will receive the rubric, *Model of an Atom*, for their on-going atom model projects. In addition, students will be assessed on the objective PS.3 through oral discussion to review basic atomic structure.
  Note: Teachers may want to collaborate with the language arts teacher on the correct writing format for the written portion of this project. The science teacher should provide sample student papers and models for viewing and review.

Lesson 3: Testing, Testing (90 minutes)

Engage:

- Teacher will test various solutions for acidity and basicity ---apple juice, milk, orange juice, shampoo, milk of magnesia, alka seltzer/water mixture, egg white, pine sol, bleach, HCl – these should be done as a demo and have the students guess the substances because bleach and HCl are harmful for the skin and clothing of the students.
  Note: In lesson 4 students will have the opportunity to test substances on their own-with pH paper, litmus paper, and a pH sensor in order to determine acidity and basicity.

Explore:

- Students will use the simulation on acids and basics: http://phet.colorado.edu/en/simulation/acid-base-solutions .
  Note: The downloadable activity handout can be found here: http://phet.colorado.edu/en/contributions/view/3306

Explain:

- Teacher will review the differences between acids, bases, and neutral substances.

Elaborate:

- Teacher will use guided notes (teachers should make their own notes dependent upon their available resources) to explain characteristics of acids, bases, neutral substances, and salts
  Note: For notes teachers could use available textbooks, search the topic online, or use Pete's PowerPoints as a resource. Alternatively, you could have students write their own notes from text material.

Evaluate:

- Students will be assessed through verbal assessment on their knowledge of acids and bases.
- In addition, students can sketch a pH scale and include drawings of items that can be classified as acids and bases.

- Students will use this review to understand the basic physical and chemical properties of acids and bases.

Lesson 4: Exploring Acids and Bases (90 minutes)

Engage:

- Students will complete a survey concerning matter, atoms, and inquiry at www.polleverywhere.com.
  Poll suggestion: What are 3 scientific atomic discoveries?

Explore:

- Teacher will use the website: www.wordle.net
  Copy and paste the survey answers (from Polleverywhere) to determine common themes from their survey answers (the more frequently used words with appear larger in the created graphic).

Explain:

- Teacher will review the poll results using Wordle and discuss the relevance of the answers received.

Elaborate:

- Teacher will review properties of acids and bases from Lesson 3.

Evaluate:

- Students will complete Lab Experiment 28: Household Acids and Bases from the Physical Science with Vernier Book.
- Closure: Students will review matter and atoms and all of their properties.

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Model of an Atom Rubric

Due Date: Name: _____

Directions: Review the model/discoveries of Dalton, Democritus, Thomson, Bohr, and Rutherford. In addition to your classroom resources, online research concerning the scientists must be performed. If the scientist did not have a particular model and just did research with atoms, the student model should replicate the "modern day atom".

Project Description: Make a model of an atom and base it on one of the following early scientist's ideas, research, and/or models: **John Dalton, William Crookes, J.J. Thomson, Niels Bohr, Henri Becquerel, Ernest Rutherford, Democritus, or James Chadwick**. Choose **one** of the scientists and do a one-page research paper about their **atom model (if they had one), research, educational background, beliefs, and/or experiments.**

*THIS RUBRIC MUST BE STAPLED TO THE FRONT OF THE RESEARCH PAPER OR YOU WILL RECEIVE A **5 POINT PENALTY**.

WRITTEN PORTION		
	POSSIBLE POINTS	POINTS RECEIVED
1 written page (**blue/black ink**) or one page typed (**double-spaced**)------→	**20**	
Must include a title----------→	**5**	
Must be: Neat----------→ Free of grammatical, spelling, and punctuation errors (-2 points/error)----------→	**10** **20**	
ORAL PORTION		
1-2 minute oral presentation about scientist and model---→	**10**	

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Good summary----------→	**10**	
Eye Contact----------→	**5**	
Model must be: Neat----------→ Creative----------→ Accurate----------→	 **10** **5** **5**	
HIGHEST POSSIBLE GRADE=	**100**	**GRADE RECEIVED=**