5E Inquiry Lesson Plan
Chemical Changes to Matter
5th Grade

Angela M. Morales
MSMC
Dr. Smirnova
ED 5534
Spring 2011
1. Overview
This lesson is devoted to the concept of chemical changes. This is one of a series of lessons on the content of chemical change. Students already have the basic knowledge introduced and automated which is why the inquiry method will be used to develop their critical thinking, process skills: observing, collecting data, inferring and concluding information on chemical changes.

2. Goals:
- Academic
  Students will understand the concept of chemical and physical changes, including changes in states of matter.
- Process
  The students will explore chemical changes using scientific inquiry to find a solution.

3. Select appropriate Standards:

**National standards**

<table>
<thead>
<tr>
<th>TABLE 6.1. SCIENCE AS INQUIRY STANDARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEVELS 5-8</td>
</tr>
<tr>
<td>Abilities necessary to do scientific inquiry</td>
</tr>
<tr>
<td>Understanding about scientific inquiry</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TABLE 6.2. PHYSICAL SCIENCE STANDARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEVELS 5-8</td>
</tr>
<tr>
<td>Properties and changes of properties in matter</td>
</tr>
<tr>
<td>Motions and forces</td>
</tr>
<tr>
<td>Transfer of energy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TABLE 6.5. SCIENCE AND TECHNOLOGY STANDARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEVELS 5-8</td>
</tr>
<tr>
<td>Abilities of technological design</td>
</tr>
<tr>
<td>Understanding about science and technology</td>
</tr>
</tbody>
</table>

**NY MST Standards**

**Standard 4:**
Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science.

**Key Ideas & Performance Indicators:**
Key Idea 3: Matter is made up of particles whose properties determine the observable characteristics of matter and its reactivity.

**Elementary --**
- observe and describe properties of materials using appropriate tools
- describe chemical and physical changes, including changes in states of matter

**Standard 1:**
Students will use mathematical analysis, scientific inquiry, and engineering design, as appropriate, to pose questions, seek answers, and develop solutions.

**Scientific Inquiry**
1. The central purpose of scientific inquiry is to develop explanations of natural phenomena in a continuing, creative process.

   **Students:**
   - ask “why” questions in attempts to seek greater understanding concerning objects and events they have observed and heard about.
   - question the explanations they hear from others and read about, seeking clarification and comparing them with their own observations and understandings.
   - develop relationships among observations to construct descriptions of objects and events and to form their own tentative explanations of what they have observed.

**Standard 5:**
Technology
Students will apply technological knowledge and skills to design, construct, use and evaluate products and systems to satisfy human and environmental needs.

**Objectives: CBC format**

Given a problem to solve: “Which of these two items will clean my pennies better: water or ketchup, and what type of change will occur?” (Along with materials) and a task to work in a group, the student will tell/report orally why their hypothesis was proved or disproved scoring at least 3/4 following criteria of the rubric.

Given the assignment of explaining what was learned in class today to his parents, the student will write a one page reflection on chemical changes in matter scoring 3/4 following criteria of the rubric.

**4. MATERIALS**
- Dull dirty Pennies (at least 30)
- Container of Ketchup (at least 3)
- Square Plastic containers (at least 6)
- Pitcher of water with dish soap mixed in (3 small ones)
- Paper towels (3 rolls)
- Wet wipes (1 package)
- Computer with Internet service (1)
- Projector (1)
- Inquiry Worksheet (at least 30)
- Pencils with erasers (at least 30)
- Marker/Chalk for board (at least 2)
- Folder for completed work (1)
- Homework assignment with rubric attached (at least 30)
- Copies of notes for lesson (at least 6)
- SMART board (one)
- The four pictures (for introduction) on a notebook file to be put on SMART board

Use of technology:

Group member role identities:

This is the site where I found NYS Science Standards:
http://accelerateu.org/standards/index.cfm?page=Explore&currentAreaID=1&currentStandardID=1&currentComponentID=3&currentLevelID=1&currentStrandID=111&currentGradeID=

This is another site where I found NYS Science Standards:

This is the site I used to obtain my National Science Standards:

This is where I got the rubric from:
http://rubistar.4teachers.org/index.php?screen=ShowRubric&rubric_id=1443575&

5. Introduction **Engage**

I will engage my students by starting off with a SMART board on with the following pictures on it:
Who can tell me what these pictures are about? Some responses may be “change” “Physical Change” “Cooking” “Chemical Change” “Eating”

What similarities do you recognize in the pictures? Some responses may be “Physical and Chemical Change” “water and cooking food”

What do we know about these types of changes? Some responses may be “changes in shape or size” “Change in color” “when it’s heated” “Physical can be changed back chemical can’t”

These are all great responses! Physical change are changes in size, shape and can be put back to it’s original state, where Chemical change is where is gas formed, or heat applied, and it creates new matter. Chemical changes cannot be put back to its original state; one indicator can be a color change.

Today you are all scientists in a lab, and you are trying to solve a problem. You see, I am an avid collector, and my favorite thing to collect is pennies. Do you like pennies? The thing is, all of my pennies just don’t shine like they used to so I need your help!! Are you ready for the problem?

**Problem:** Which of these two items will clean my pennies better: soapy water or ketchup, and what type of change will occur? Do not say it out loud... I want you to explore and prove your ideas like the scientists do....

Do you know how scientists discover things?
Can anyone tell me what the scientific method is, and the steps involved? I will then review:

**Process/Procedure**

The steps of your investigation (Inquiry):

1. Formulate the question
2. Define the hypothesis
3. Collect and analyze data
4. Test your hypothesis
5. Draw conclusions
6. Report to the class.

And now, you will explore….

**6. Development (Explore & Explain) Model, Strategy, Method**

Information Processing Model/Indirect Strategy/ Inquiry method/ Scientific method

This is a guided inquiry lesson where the student will use the scientific method to find the solution to the problem: Which of these two items will clean my pennies better: soapy water or ketchup, and what type of change will occur?

The scientific method is a way to ask and answer scientific questions by making observations and doing experiments. You will be broken up into three groups: two groups of five and one group of four. You will all have a role in your group. Now pay attention, this is very important. You are scientists and you need to collaborate with one another in order to solve this problem within our time that we have here today. The first role is the **Facilitator** (Task Oriented), makes sure everyone equally shares. This person is responsible for keeping everyone on task, on the agenda. If someone starts to fall off task, it is up to you to refocus them. Next is the group **Manager**, whose responsibility is that all group members have supplies and materials needed, and ensures the workspace is cleaned up at the end. Then we have the **Time Keeper**, who keeps track of the time allotted for the activity/discussion and informs the group of time limitations. Then we have the **Collector** who is responsible to gather all completed work and place it in the “Completed Work” folder. Then we have the **Checker**, who is responsible to check that all work is complete and that the reporter is prepared to cover all items that were on the checklist provided on the Inquiry Worksheet. (See attached) Last is the **Reporter**, this
7. **EXPLORE** (Guided practice)

Students will explore through collaborating with others. To keep students on task, I will provide a handout with the steps of the scientific method listed on it; it is on the Inquiry Worksheet that they will be using to record their answers on. (See attached)

I will then ask the Managers of the groups to distribute all supplies at work stations to each group member. All members should receive a worksheet, a pencil with an eraser, and at each station there will already be: some wet wipes (to clean up their hands at the end), paper towels (for cleaning pennies and drying hands and or tables with), one container of ketchup, one container of soapy water (both used as cleaning solutions for pennies), At least four dirty, dull pennies (to be cleaned), and two square plastic containers one for each solution to be worked with in (to clean pennies in).

Once all group members have the worksheets, I will read over the information and instructions to be sure everyone is clear on what is expected of them. Everyone understand? Show me a thumbs up or thumbs down. Then I will restate the problem:

**Which of these two items will clean my pennies better: soapy water or ketchup, and what type of change will occur?** Write this in the first box on your worksheets where it says “Question”. Ok, are we good? Thumbs up, thumbs down. Now, I want all of you scientists to think about this problem for a minute, and then I want you to formulate your hypothesis. Which do you think will work best to restore the shine to my pennies soapy water or ketchup?

I want you to think of WHY you think the outcome may be this way. You will have a maximum of 5 minutes to do this, so Time Keepers, be sure you watch the clock!

Once you have completed this step, then you will collect and analyze your data. What is change? What are two types of change you are learning about in science class? What are some clues that indicate a change occurred? What type of change do you think is going to take place, WHY? What does the penny look like? Can you describe all of the features? Do this for both pennies before you test your hypothesis. While testing your hypothesis, be sure to record as many visual details as possible. While testing the two ‘cleaners’ (the soapy water and ketchup) be sure to let each penny sit in them for one minute, ensuring the pennies are fully submerged under each cleaner. Again, time keepers watch the clock. What could be happening in that minute? Keep this in your mind, take notice to all details. When you remove your pennies from their cleaning containers, please wipe them dry with a paper towel and re evaluate any visual features that you see. Does it look the same as it did before you cleaned it? Does it look different? How? Was there a change? What kind of change do you think occurred? What gave you that idea? Cleaning will be given a maximum of 5 minutes to complete. Ok Time Watchers? What did you find out? Did your results support your hypothesis? Are your results reliable? Prove why? Explain-giving at least two reasons why.
I want students to be able to determine that the penny underwent a chemical change. I want them to relate that notion to the fact that the penny did change color, which in most cases (not all), implies a chemical change has occurred.

8. Accommodations
   - **Reading Problems**- I will provide written notes about the content of the lesson the day before so they can pre read the lesson and have them listen to the audio(from the pearsonsuccess.com website) of lesson one in chapter twelve of their books one day prior.
   - **Writing Problems**- I will provide written notes about the content of the lesson to be stapled in their notes.
   - **Behavior Problems**- I will assign them a job that will keep them busy in the group and if the issue continues I will give them a job to do to take them away from the situation but keeping them busy.
   - **High Achievement/EML**- At the end of the worksheet there will be a bonus section called “Another Look” (see attached)
   - **English Language Learning (ELL)**- I will provide written notes about the content of the lesson the day before so they can pre read the lesson and have them listen to the audio(from the pearsonsuccess.com website) of lesson one in chapter twelve of their books one day prior.

9. Closure (Evaluate)
I will close the lesson by inviting the groups to present the results of their investigations. Each group will have their reporter come in front of the class and briefly discuss their findings. Refer to the checklist in worksheet for what needs to be included in the presentation. I want to know your group number; I want you to restate the problem and your hypothesis. I then want you to share a few pieces of data collected. Then I want you to describe the process of testing your hypothesis-how did you come to your conclusions. Lastly, I want you to provide the answers to the initial questions. What did you find out? Did your results support your hypothesis? What type of change occurred? What told you it was that type of change? Are your results reliable? Prove why. All of this information is in your checklist use that as a guide to check your work before you present.

10. Independent Practice Elaborate
    Students will be asked to complete a homework assignment where they will have to explain the activity to their parents, providing them details of the scientific method they used and the two types of changes of matter involved. They need to discuss the activity from start to finish. Once
the discussion is over, the student is to write a reflection scoring 3/4 following the criteria of the rubric (see attached), to be handed in the next day.

11. Evaluation/ Assessment
- **Diagnostic**-Using scientific inquiry, I will assess prior knowledge but evaluating the answers to my diagnostic questions I asked after the video I played in my introduction.
- **Formative**-I will evaluate how well the student worked with their group during the guided practice, I will be walking around the room listening and watching what they are doing and saying. The quality of information (did they use their checklists and follow rubric attached) given during their presentations will also be taken into consideration for assessment.
- **Summative**-I will grade the assigned homework reflection assignment according to the rubric to align with my objective.

12. Reflection questions/ self-inquiry

1. **Engage**
   Was my video engaging enough to motivate students?
   Did it help to pre-assess their prior knowledge?
   Did I create interest with the video?

2. **Development (Explain & Explore)**
   Was I clear enough providing instructions?
   Did I encourage students to work together by assigning different roles?
   Did I ask enough probing questions to redirect student’s investigation?
   Did I create a need to know setting?
   Was my inquiry worksheet designed to make students critically think effectively?
   Was my problem designed for students to engage in using inquiry process skills?

3. **Elaborate**
   Did I encourage students to apply their concepts of changes in matter in new situations?
   Did I refer students to existing data and evidence by asking WHY do you think..?

4. **Evaluate**
   Did I observe students apply new concepts and skills?
   Did I look for evidence in their work, oral and written, that students have challenged their thinking?
   Did my checklist and rubric allow students to assess their own learning and group process skills?
   Did I ask enough open ended questions?
Independent/Group Investigation Work Sheet

Group # ______
Names:

Question
What do you want to find out?

Hypothesis
Which do you think will work best?

Process/Procedure
The steps of your investigation (inquiry):

1. Formulate the question
Data

Use this Checklist to record the selected data to answer the question & report to the class about the following topic:

Physical & Chemical Changes in matter:

Use this checklist as a guide to help you write your presentations
*Please place a ✔ in the boxes provided after you included it in your presentations

Did you write your group number and name on your worksheets?  ☐

Did you restate the problem and your hypothesis in your presentation?  ☐

Did you include something about the data you collected?  ☐
Conclusion/Analysis

Provide the answers to the initial questions. Which one works best? What type of change took place? How do you know? Did your results support your hypothesis? Are your results reliable? Prove why.
Finished early?? Still have some more time??

See if you can answer these two questions:

1. **What is the difference between a chemical change and a physical change?**
2. *Think of a time when you’ve caused a physical change, a chemical change, or both, explain below.*

**Notes for Activity on Chemical Changes in Matter:**

***Please listen to audio in chapter 12 for lesson one on pearsonsuccess.com prior to coming to this class***

- Matter changes all the time. Some changes are physical changes. Others are chemical changes.

- When a physical change happens, the material remains the same. Some physical changes are changes in position, size, shape, volume, and phase of matter. For example, falling raindrops can freeze to form sleet.

- A chemical change happens when one substance or kind of matter changes into another completely different kind of matter with different properties.

- For example, the ship's wheel in the picture was made of the element iron. After years of being in the ocean's water, the iron on the wheel’s surface changed into a new material called iron oxide. This compound is also called rust. The chemical and physical properties of rust are different from those of iron.
• When a chemical change occurs, atoms rearrange themselves to form different kinds of matter. It is not always easy to tell if a substance has changed chemically. Some signs that a chemical change happened are a change in color or that a gas or a solid formed.

• The scientific method is a way to ask and answer scientific questions by making observations and doing experiments.

• You will need to solve a problem: Which of these two items will clean my pennies better: soapy water or ketchup, and what type of change will occur?

• **Process/Procedure for Experiment:**

  The steps of your investigation (Inquiry):

  Formulate the question; Define the hypothesis; Collect and analyze data; Test your hypothesis; Draw conclusions; Report to the class

---

**Name:** _____________________________  **Date:** _____________________________

**HOMEWORK: Scientist for a day!** What will clean my penny the best—SOAPY WATER or KETCHUP??????? After discussing with your parents the process (scientific method) you used in science today to solve a problem and explain to them the concepts of chemical changes in matter, please write a brief reflection of the activity today. Please follow the criteria of the Rubric attached.
## Reflection & Oral Presentation Rubric

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Focus on Topic</strong></td>
<td>The introduction is inviting, states the main topic and previews the structure of the paper.</td>
<td>The introduction clearly states the main topic and previews the structure of the paper, but is not particularly inviting to the reader.</td>
<td>The introduction states the main topic, but does not adequately preview the structure of the paper nor is it particularly inviting to the reader.</td>
<td>The main idea is not clear. There is a seemingly random collection of information.</td>
</tr>
<tr>
<td><strong>Content</strong></td>
<td>There is one clear, well-focused topic. Main idea stands out and is supported by detailed information.</td>
<td>Main idea is clear but the supporting information is general.</td>
<td>Main idea is somewhat clear but there is a need for more supporting information.</td>
<td>The writer has not tried to transform the information in a personal way. The ideas and the way they are expressed seem to belong to someone else.</td>
</tr>
<tr>
<td><strong>Adding Personality</strong></td>
<td>The writer seems to be writing from knowledge or experience. The author has taken the ideas and made them &quot;his own.&quot;</td>
<td>The writer seems to be drawing on knowledge or experience, but there is some lack of ownership of the topic.</td>
<td>The writer relates some of his own knowledge or experience, but it adds nothing to the discussion of the topic.</td>
<td>The writer has not tried to transform the information in a personal way.</td>
</tr>
<tr>
<td><strong>Voice</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Introduction</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Organization</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Structure</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sequencing (Organization)</strong></td>
<td>Details are placed in a logical order and the way they are presented effectively keeps the interest of the reader.</td>
<td>Details are placed in a logical order, but the way in which they are presented/introduced sometimes makes the writing less interesting.</td>
<td>Some details are not in a logical or expected order, and this distracts the reader.</td>
<td>Many details are not in a logical or expected order. There is little sense that the writing is organized.</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>---------------------------------------------------------------</td>
<td>------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Conclusion (Organization)</strong></td>
<td>The conclusion is strong and leaves the reader with a feeling that they understand what the writer is &quot;getting at.&quot;</td>
<td>The conclusion is recognizable and ties up almost all the loose ends.</td>
<td>The conclusion is recognizable, but does not tie up several loose ends.</td>
<td>There is no clear conclusion, the paper just ends.</td>
</tr>
<tr>
<td><strong>Support for Topic (Content)</strong></td>
<td>Relevant, telling, quality details give the reader important information that goes beyond the obvious or predictable.</td>
<td>Supporting details and information are relevant, but one key issue or portion of the storyline is unsupported.</td>
<td>Supporting details and information are relevant, but several key issues or portions of the storyline are unsupported.</td>
<td>Supporting details and information are typically unclear or not related to the topic.</td>
</tr>
<tr>
<td><strong>Recognition of Reader (Voice)</strong></td>
<td>The reader's questions are anticipated and answered thoroughly and completely.</td>
<td>The reader's questions are anticipated and answered to some extent.</td>
<td>The reader is left with one or two questions. More information is needed to &quot;fill in the blanks&quot;.</td>
<td>The reader is left with several questions.</td>
</tr>
</tbody>
</table>