

Title: RUSTING & THE SCIENTIFIC METHOD

Problem to be studied: WHAT CAUSES RUST?

**use this before chemistry and after scientific method

Content Standard(s):

- 3.4.10.A. Describe concepts about the structure and properties of matter.
- 3.2.10.C. Identify and use the elements of scientific inquiry to solve problems

Process Standard(s):

- 3.2.10.D. Identify and apply the technological design process to solve problems.
- 3.2.10.B. Apply process knowledge and organize scientific and technological phenomena in varied ways.
- 3.2.10.A. Apply knowledge and understanding about the nature of scientific and technological knowledge.
- 3.7.10.B. Apply appropriate instruments and apparatus to examine a variety of objects and processes.

Assessment Strategies: (Evaluation)

Formative Evaluation:

- Quiz asking questions that pertain to controls, experimental design, and conclusions of scientific problems.
- Graded based on rubric which they will be given before the elaboration portion of the procedure.

Summative Evaluation:

- Reflective journals and data charts will be evaluated during the course of the laboratory investigation.
- Oral probing questions that will be asked during the course of the activity.

Procedures:

DAY 1

Engage:

- Show a clip of “The Wizard of Oz” (the oilcan scene with the tin man). Ask the question, “What can we learn about rust from this scene?”

Explore:

- Give the students 2 tubes and 2 nails. To one tube, add 1 salt packet to 2ml of distilled water and a small amount of iron filings. They can chose the other factors they want to explore using the other tube. Instead of using nails to start, they will experiment with iron filings. (ask how this will differ from the nails). They should answer the question, “Why did they choose those materials.” (*teacher probing*)
- Students will record their initial procedure including the question they want answered and the results they think they will observe (hypothesis), the materials and procedure they will

Suggested Grade Level:

8-9

Materials:

5 nails
5 test tubes
10 ml distilled water
small amt. Calcium Chloride
1 cotton ball
2 ml olive oil
Salt packet
1 piece Zinc (pellet)
1 piece Tin
1 piece Copper wire
1 rubber stopper
Small amount iron filings
Reflective journal

- use (procedure), and what they observe is actually happening (data). (testing and predicting hypotheses) *See reflective journal entry sheet. (*homework*)
- Go to one of the websites listed and research the process of rusting and record findings in your reflective journal.

DAY 2:

Explain:

- Students will share with the class what they are testing (variables). At this time, teacher will ask the question about controls? Did they include them? Is the procedure reproducible?
- What evidence do they expect to observe that will explain their hypothesis? What previous experience do they have with rusting?
 - How does that information they previously knew relate to what they observed? (*Using recorded observations to explain*)
- Where will they go from here?

Elaborate:

- Students will be given 5 tubes and 5 nails and be asked to make new predictions based on what they found out in the group setting. (*applying previous information in a new setting*)
- Students will use the 4 question strategy to design their new experiment. They should record their process in their reflective journals.
 - Q1-What materials are readily available for conducting experiments on rusting?
 - Q2-How does rusting act/happen?
 - Q3-How can I change the set of rusting materials to effect the action?
 - Q4-How can I measure or describe the response of rusting to the change?
- Student will have available to them all of the materials listed.
- Students will label and define controls and dependent and independent variables. They will restate a hypothesis that differs from the original.
- Students must create a data table that reflects their keen observations. This will take place over a few days.
 - ****Optional-Students that finish with the 5 nail set-up should use the design brief “Rust-proof paint” and work on the recipe and advertisement campaign.*

Evaluate:

- Students will be evaluated constantly during the activity via reflective journaling and teacher probing questions. (*demonstrating an understanding of knowledge*).
- A final quiz (see attached) will be given assessing the knowledge attained concerning scientific method.
 - ***Those students that designed the rust proof paint will present what they designed. Other students can critique the design based on their data and ask questions.
- Ask an expert to come in and give tips to the students that designed paint.

Related Web Sites:

- <http://www.pgo.pwp.blueyonder.co.uk/StBernards/science/year8/scheme.html> -actual lab activity
- <http://www.sln.org/guide/bond/sc1.html>-- a community water resource guide
- <http://www.kidwizard.com/spells/bottledHeat.asp> -fun games in science and rusting
- <http://madsci.wustl.edu/posts/archives/mar97/853477172.cb.r.html>-- bacteria and rusting
- <http://www.americanchelation.com/oxidative.html>-oxidation process and how it relates to rusting
- www.pde.state.pa.us ties the lesson to the standards in science and technology

Sources consulted in developing this lesson

Students and Research, Cothraon, Geise, Rezba
National Standards

Submitted by: Audra K. Case