Environmental Science Institute
THE UNIVERSITY OF TEXAS AT AUSTIN

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The Modern Epiphany: The Role of Chemicals in Our Lives

Lesson Plan for Grades 9-12
Length of Lesson: 1 hr 15 min

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Subject area/course: Chemistry/Life Sciences

Materials:
- 1 computer per pair of students (with internet capabilities and up-to-date software)
- work sheets, poster boards, scissors, glue/glue-sticks, construction/colored paper, printer access (optional)

TEKS/SEs:
§112.35: Chemistry
3(B) communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials;
3(C) draw inferences based on data related to promotional materials for products and services;
3(E) describe the connection between chemistry and future careers

Lesson objective(s): Students will be able to…
- Recognize that chemicals are everywhere and have a wide range of properties
- Identify common everyday products that are not usually recognized as chemicals
- Analyze product promotional materials and determine what is really being advertised
- Draw connections between chemistry and future careers

Differentiation strategies to meet diverse learner needs:
- Search YouTube for videos of different languages similar to the linked videos, for ESL students
- Incorporate kinesthetic activities for special needs students (go around the room and find chemicals)
- Offer particular students private study projects if they have trouble collaborating with peers
- Offer particular students more challenging assignments such as choosing items that consist of multiple chemicals, or to do additional research on the raw form of the chemical (i.e. what is $CaCO_3$ like, what are its characteristics and properties...)

ENGAGEMENT
- Breaking Bad – Chemistry Lesson (video, *see resources section*)
- chemicals are made from atoms: atoms are everywhere: thus, chemicals are everywhere (syllogism)
- Teachers should focus on clearing the misconception that chemicals are always hazardous and come in clearly marked bottles. There are indeed chemicals that people should handle with caution (strong acids and bases, flammables, corrosives, carcinogens, etc...) but items like coal (a chemical) poses no immediate threat to an individual.
- Teacher can use examples of students erasing pencil marks or students chewing gum as chemical reactions occurring. This is to emphasize that chemical reactions can be seemingly mundane but prevalent none the less.

EXPLORATION
- Students will be split into groups of 3-4

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- A representative from each group will go to a back table where there are 10 or so items on it. Teacher can choose 10-15 objects from the "common chemicals found in the home" web-page (*see resources section*).
- Once the group has selected their common object, they will conduct on-line research as a group to better understand it. Students will be asked to identify the object's common name, the name of the chemical or chemicals that it is composed of, the empirical formula for those chemicals (ex. CO_2 is carbon dioxide), some of the basic mechanisms for manufacturing/creating the product, and how much the product could cost (could be expressed as the cost for a box of chalk, or an ounce of bronze, or a bag of sand, etc...).

EXPLANATION

- Teacher can show "how it's made" videos for some of the common items on the table (available on youtube.com)
- Teacher will open the "What's in it? What's it in?" web page to help direct the class discussion. Teacher may ask students to choose one of the listed substances and talk about. Discussion should address the fact that these common objects, materials, and compounds can all be expressed formally as a chemical. Some of these chemicals are indeed more complicated and consist of more elements than others. Allow for students to notice the relationships.
- Students can discuss some of their findings with other groups or as a whole class. This point is great for assessing the progress and direction which the exploration activity took. Teacher should mention that just as they saw the items on the "What's in it? What's it in?" activity expressed as chemicals, their items can be too.

ELABORATION

- Students construct poster board visuals according to rubric (*see teacher pages below*)
- Group presentations

EVALUATION

- Formative assessment in the form of student posters and poster-presentations
- "Exit-slip" in the form of a 3 questions
    1. True or False: Chemicals should only be found in scientific laboratories.
    2. List 2 products that before today, you did not recognize as a chemical.
    3. List 2 careers (besides chemist or laboratory researcher) that frequently utilize chemicals and chemistry concepts.

SOURCES AND RESOURCES

- Dr. Laude's Hot Science – Cool Talks Lecture #__: http://www.esi.utexas.edu/hot-science-cool-talks/382-dr-laude-or-how-i-learned-to-stop-worrying-and-love-the-chemistry
- Breaking Bad – Chemistry Lesson (video): https://www.youtube.com/watch?v=-d23GS56HjQ
- "What's in it? What's it in?" activity web page: http://science.education.nih.gov/supplements/nih2/chemicals/activities/lesson1_everything.htm
- Common Chemicals Found in the Home: http://www.ivy-rose.co.uk/Chemistry/GCSE/Common-Chemicals-in-the-Home_Molecular-Formulae.php

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EXPLORATION ACTIVITY or ACTIVITIES

Purpose:
This activity is designed to help students understand the fundamentals of chemistry and why they are universally applicable. A small group research project on a common object/product that students had not previously thought of as a chemical is to be followed by the analysis and breakdown of the product (in terms of composition, manufacturing process, purpose, etc…). The second part of this activity (Elaboration section) is intended to allow students to share their research findings with the class and to better understand the careers that are associated with chemistry.

Materials
A sufficient number of computers
Work sheets
Poster boards
Scissors
Glue/glue-sticks
Construction/colored paper
Printer access (optional)

Safety Information
Computers have safety-search on/active
Students follow common safety materials protocol (i.e. scissor safety, etc…)

Procedure

(EXPLORATION):
1. Students will be split up into their groups of 3-4
2. The groups will each pick one of the available items on the back table
3. Each group will perform online research on their product to find out the product's commercial name, major chemicals involved/chemical composition, product purpose, general product manufacturing mechanism, product cost, and product target audience (who's intended to buy the product).

(ELABORATION):
1. Students will construct poster board visuals according to the rubric.
2. Each group will present their poster for 5 minutes
3. After each presentation the class will discuss possible careers associated with making, innovating, and using the products

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TEACHER PAGE(S)

EXPLORATION:

You and your group members must first pick 1 item from the available items selected by your instructor. Your next objective is to better understand the item. With the aid of your computers, perform some focused research on the fundamentals of the product such as the object's common name, the name of the chemical or chemicals that it is composed of, the empirical formula for those chemicals (ex. CO2 is carbon dioxide), some of the basic mechanisms for manufacturing/creating the product, and how much the product could cost (could be expressed as the cost for a box of chalk, or an ounce of bronze, or a bag of sand, etc...). Use the spaces below to record some of your notes and findings.

Ex: Chalkboard chalk

General info: (describe the object, what is it used for, what is commonly called, how abundant is it, where can it be found, etc..)

Chalkboard chalk is the common name, it is used to for writing or mark making on various surfaces (ex. chalkboard, for markings during construction and building processes, visual arts, etc…), and chalk is very abundant and can easily be obtained from most hardware and convenient stores, unprocessed forms of chalk can be found in many types of rock and from mining quarries

Chemicals: (list the primary chemicals used; list the name and empirical formula (ex: carbon dioxide, CO_2))

Chalk is composed primarily of Calcium Carbonate, the empirical formula is $CaCO_3$

How it's made: (describe some of the basic mechanisms or processes for making this product)

The first step to creating drawing/writing chalk is by mining calcium carbonate from rock quarries. Next, these rocks have to be pummeled and ground very finely. This powder is mixed with water and other solutions to create a form of paste. This paste is poured into the desired molds and dehydrated into the chalk that we use or see on a daily basis.

Sources: (list some of the websites you used, where you found your information)

How chalk is made: http://www.madehow.com/Volume-1/Chalk.html

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ELABORATION:

Topic	**Description**	**Points** (of 100 total)
General Info	Includes name of the product, what the product is commonly used for, what kind of people typically use this product (if any), how much the product typically costs (for a given quantity)	30pts
Chemicals	Students will research to find out what chemicals are used in this product, what elements make up those chemicals, where those elements are on the periodic table.	25ps
How It's Made	Describe some of the basic means by which this product is created, or synthesized, or manufactured (whichever is most applicable)	20pts
Visuals	Show images of your product your product (both in and out of packaging so people can better recognize it).	20pts
Sources	Briefly list some of the websites and other sources you used for images, information, etc…	5pts

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Name:_____ **Date**:__/____/_____
Name:_____ **Date**:__/____/_____

EXPLORATION:

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General info: (describe the object, what is it used for, what is commonly called, how abundant is it, where can it be found, etc..)

_____
_____
_____
_____
_____
_____

Chemicals: (list the primary chemicals used; list the name and empirical formula (ex: carbon dioxide, CO_2))

_____
_____
_____

How it's made: (describe some of the basic mechanisms or processes for making this product)

_____
_____
_____
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_____

Sources: (list some of the websites you used, where you found your information)

_____
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