Lesson Plan

Title

Application Day

Primary Subject Area:

Chemistry I

Grade Level:

10

Overview:

This unit is designed to show 10th grade chemistry students how the concepts they are learning in class are used in the "real world". The lesson will begin with a discussion of engineering and how an engineer attacks a problem. Students will then talk about how some of the concepts they have learned in class are applied to improve quality of life for people in the developing world.

This theme will run through the year, with monthly or bi-monthly "application days" where students will have to take what they have learned and apply it to a problem. The reasoning behind this is 2-fold. The first is relevance. Students often complain that they will never use chemistry again. These projects will show them how it is involved in much of their lives. The second is improving critical thinking/problem solving skills. Students need to be able to do more than just parrot back information to a teacher. This gives them a chance to work on skills that will help them in any field.

Approximate Duration

This lesson will occur over a single 75 minute class period. Future lessons will be conducted during the 55 minute class period.

MA Frameworks

Content Standards:

1.1 Identify and explain physical properties (e.g., density, melting point, boiling point, conductivity, malleability) and chemical properties (e.g., the ability to form new substances). Distinguish between chemical and physical changes.

1.2 Explain the difference between pure substances (elements and compounds) and mixtures.

Inquiry Standards:

SIS1. Make observations, raise questions, and formulate hypotheses.

SIS4. Communicate and apply the results of scientific investigations.

Interdisciplinary Connections

This unit connects to many different disciplines. The problem solving skills that they develop can be applied to any course that they will take. Our discussion on the development of technology will lead to human advancement and connections to their history classes. Finally, they will need to be able to use both written and verbal communication, which develops their ELA abilities.

Lesson Objectives

SWBAT show how science is applied to solve real world problems by developing solutions to purify drinking water in developing nations

Lesson Materials and Resources

1) Reading on drinking water (from globalwater.org)
2) Water bottles filled with dirty water
3) PPT on engineering
4) Individual whiteboards

Technology Tools and Materials

1) Projector

Background Information

Engineering (from Accreditation Board for Engineering and Technology):

ENGINEERING is the *profession* in which a *knowledge of the mathematical and natural sciences* gained by *study, experience, and practice* is applied with *judgment* to develop ways to utilize *economically* the *materials and forces of nature* for the *benefit of mankind*.

ENGINEERING TECHNOLOGY is the part of the technological field that requires the *application of scientific and engineering knowledge and methods* combined with *technical skills* in support of engineering activities; it lies in the *occupational spectrum between the craftsman and the engineer* at the end of the spectrum closest to the engineer.

Water purification (from globalwater.org):

the lack of safe drinking water is the primary cause of disease in the world today. Everyday, *tens of thousands of people die* from causes directly related to contaminated water. And for those who survive, without good health, there is little chance for a normal and productive life. A surprising statistic to many is that contaminated water causes 80% of the health problems throughout the world. Much of the reason is because in rural areas of developing countries, the only water source for people to wash with and drink from is often a badly polluted shallow well (less than 10 feet deep) or mud-hole used by both animals and humans. In those areas where there's actually a stream or river, they're often polluted as well, because animal and human wastes are emptied directly into it without proper treatment.

Useful Vocabulary

New Vocabulary Word	Meaning
Developing nation	A term generally used to describe a country with a low material level of well being
Purification	The act of cleaning by getting rid of impurities
Engineer	A person who designs, builds, or maintains engines, machines, or public works

Essential Questions to be answered; Grand Challenges

What does an engineer do?

How can we cheaply provide water to the developing world?

Misconceptions

1) Students may think an engineer and a scientist are the same
2) Students likely don't realize how important water is to the vast majority of the world.

Lesson Procedures

Engage/Elicit (10 minutes): Do-now: In your notebook, answer the following questions. "What do you think an engineer does? How are engineers different from scientists?" Then I will call on 3 students to answer.

Explain (15 minutes): I will give a short presentation on what an engineer is and introduce the problem solving method we will be using. The procedure is as follows: Define the problem, determine criteria for success, determine possible solutions, test solutions, look at data.

E**xplore (45 minutes):** Students will split into groups and be given a problem statement "Determine the best way to purify water in the developing world." Students will be given a few short readings and then talk ideas for how to best accomplish this task based on their knowledge of chemistry. Students will then share out their ideas at the end of class.

Evaluate (5 minutes): Students will reflect on the lesson in their notebooks.

Assessment Procedures

There will be constant assessments during this lesson. The do-now will help me recognize prior knowledge/ misconceptions. The short discussion will allow me to see how students solved the problem. The reflection at the end of the class will help me see what students have learned and what they have taken away from the class. I will also be going from group to group to check in on their thinking.

Accommodations/Modifications

Auditory/verbal learners: Classroom/group discussion
Kinesthetic learners: Students will have the water bottle to manipulate
Visual learners: Graphics from the presentation, materials
Other: Notes will be structured for ease of retention and then will be posted on-line.

There are no necessary modifications to learning outcomes.

Reproducible Materials

Each group will be given a single sheet of paper with the problem solving format expressly laid out. They will hand this in at the end of the class.

Explorations and Extensions

HW: Students will research currently available techniques for water purification and compare them to the solution that they came up with. The 3 main criteria they will judge are cost, usability, and effectiveness.

Lesson Development Resources

1) Globalwater.org
2) Project Based Learning handouts from RET workshop
3) Engineering textbook

Reflections

Contact Information

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