

Spectroscopy Webquest Lesson

Name: _____

Date: _____

'I thank God for the mind-boggling discoveries of science. It is as though a blind servant should keep bringing gorgeous jewels to the table.' -John Piper, 2005



www.diamonddestiny.proboards85.com/index.cgi

Description:

- Diamonds have long been symbol of wealth and prestige. Coming from the Greek word, *adamus*, meaning indestructible, diamonds have been discovered and used for thousands of years. Diamonds are a type of gemstone, but unlike other gemstones which contain many types of elements, diamonds only contain carbon. However, some trace elements can naturally be trapped in the carbon network. The most common impurity is nitrogen, but boron, hydrogen, and carbonates have also been found.

Diamond was discovered to be carbon in 1796. It took more than 150 years from that time until a method of diamond synthesis was invented. This process was difficult because at room temperature and pressure, graphite is the thermodynamically stable allotrope of carbon. In the 1950's diamonds were synthesized by Swedish and American researchers (2). "Pressures of over 55,000 atmospheres and 1400 degrees Celsius, plus molten iron to facilitate the change from graphite to diamonds were necessary" (2).

Since the 1950's developers of artificial diamonds have been keen to try to imitate natural diamonds, going so far as to mimic the natural impurities in diamonds. Some have even enhanced natural diamonds with laser drilling, application of sealants, and treatments to add/remove color.

Because of the expense of natural diamonds, current research has been focusing on how to most effectively create synthetic diamonds and use them in industry for financial gains. 100 metric tons are grown synthetically for industry each year (2).

The central issue facing buyers and sellers of diamonds is the proper identification of whether a diamond is real or synthetic.

The following [webpage](#) explains how spectroscopic means can characterize diamonds as real or synthetic, distinguish among natural diamonds, and identify natural defects in the diamonds.

Objectives:

- Students will be able to identify basic techniques scientists use to identify an unknown substance through a [webquest](#).
- Students will be able to determine how a natural and synthetic diamond can be differentiated using spectroscopic means through this website.

Intended Audience:

- Students in any high school science class will benefit from this webquest to determine how scientists use varying identification techniques.
- Chemistry students in particular will be able to relate to the carbon-carbon bonds and the impurities in the covalent network of diamonds.

Place in Curriculum:

- When studying the identification or classification of matter, students will be able to discover what techniques are used to identify a substance.
- When studying dichotomous keys in biology/chemistry, students can relate various identification methods.
- When studying the use of microscopes and their use in identification, students can see that there are limitations to what we can visibly see.

Required Time/Materials:

- The webquest should take approximately 40-60 minutes depending on the availability of computers and the academic ability of the students.
- Computers will be needed for this webquest. A projector also might be helpful for students to see the website(s) they will be on.

Nature of the Lesson:

- Webquest-Students will be completing this webquest.
- Website-Students will be using this website (click here for the homepage)

WEBQUEST Introduction / Instructions

Is this diamond real or fake?



www.diamonddestiny.proboards85.com/index.cgi

Identifying substances can be used in a variety of scientific fields. Chemists use a variety of methods available to them, some simpler than other. Your job is to identify the techniques used to identify an unknown substance through a webquest. After learning about various equipment and techniques to identify an unknown, you will be directed to a website that has more information on spectroscopes, a scientific instrument that studies elements and molecules and gives valuable information for known and unknown samples. A spectroscope uses infrared radiation to determine the difference between a natural and synthetic diamonds. Many fake diamonds on the market are disguised as real. Proceed through the webquest and answer the questions that follow each website.

How Do I Determine an Unknown?

Click on the website and answer the following questions below:

<http://misterguch.brinkster.net/identify.html>

1. When might you come into contact with unknown chemicals in the real world? (List a new example that is not listed on the website)
2. List 4 simple tests you can complete to identify an unknown substance **and** describe how they could be useful.
3. Which of the 4 tests are more useful? Why?
4. What is Chromatography? Describe one specific type of chromatography from the descriptions given.
5. What is spectroscopy?
6. List the 5 types of spectroscopy given and include a brief description.

7. What useful information can infrared spectroscopy give to scientists?
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How Do I Determine an Unknown in a Laboratory?

Click on the following website skim the lab and answer the following questions below:

<http://science.csustan.edu/nhuy/chem1002/unknown.htm>

8. After reading, what is the purpose of the lab?
9. List 2-3 scientific methods that are used to determine the identity of the unknown sample.
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How Do I Determine an Unknown Using Internet Databases?

Click on the website and answer the following questions below:

<http://www.chemistryguide.org/analytical-chemistry.html>

10. Define analytical chemistry.
11. Scroll down the page and click on one link on the webpage.
- Describe the following from the link you clicked on:
 - What is the main purpose of this website?
 - What information can be determined from the website?
 - How can this website be used to identify an unknown substance?
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What is one Practical Use of Determining an Unknown?

Spectroscopy is a technique used to determine the amount of given species. This method is used for the identification of substances through a spectrum that is emitted or absorbed by the substance. A spectroscope is the instrument used to measure the emission or absorption.

Substances can be identified using spectroscopy. One particular substance that can be identified as real or fake from spectroscopic methods are diamonds.

Click on the website and answer the following questions below:

<http://www.sas.upenn.edu/%7Ejustinpb/spectroscopylesson.html>)

Home page questions:

12. What is the purpose of this webpage?

History page questions:

13. Describe two important facts concerning the history of natural and synthetic diamonds.

Importance page questions:

14. Why is it necessary to identify a natural diamond from a synthetic diamond?

15. Describe how useful synthetic diamonds are for industry and everyday applications.

Highlights page questions:

16. What type(s) of information can spectroscopy spectra give a scientist? (See Figures 1-4)

Current research page questions:

17. List and describe **two** current research uses for synthetic diamonds.

Future research page questions:

18. List and describe **two** future research uses for synthetic diamonds.