(No name or picture)

Instructor: 2003 Science Teacher Workshop participant
School District: Diocese of Metuchen
Lesson Title: Nuclear Chemistry: Radiation
Grades: 9,10,11,12
Overview: students will work through a web document with embedded hyperlinks. Students will then click on various hyperlinks as per instructions. Web sites will offer text, graphics, graphs, animations, and virtual labs. Students will then answer follow up questions related to each web site visited.
Objectives: To reinforce concepts on radiation and to cultivate critical thinking skills.
Materials and Resources: Internet access and web document
This web lesson can be given as an in class assignment and/or homework assignment. It is intended to reinforce and extend what has already been learned; therefore it is advised that it be given after a thorough introduction to nuclear chemistry.
Evaluation: Based on a document of completed questions that is typed and turned in within a timely manner.

Nuclear Chemistry:Radiation

Nuclear chemistry is an exciting and continually emerging field. Lets begin our study by first building an atom!!! http://www.pbs.org/wgbh/aso/tryit/atom/. Be sure to read this page and the following ones completely or you'll get lost. Next, click on **The atom builder guide to elementary particles**. Read this completely. Return to the original page. Click on **The atom builder guide to building a stable atom.** Return to the original page and click on **Atom Builder activity**. Get to work and don't stop until you have successfully built a six proton, six neutron, six electron atom.

1) What does the sign read when you have successfully built a carbon atom?

Lets go a little further with this concept of radioactivity and learn about alpha, beta, and gamma radiation. Please point your browser toward http://www.physics.isu.edu/radinf/cover.htm and read pages 1, 3-5 (don't forget to click on the animations).
2) In what elements does α decay tend to occur?
3) Why do we call β particles beta particles and not electrons?
4) What is meant by an "excited state"?

Lets now look at what happens when radiation collides with an atom in our body. Please point your browser toward
http://www-rasanet.iaea.org/training/radiorweb/chap1/chap15.htm and look closely at the various animations. See if you can determine why this is so dangerous.

5) How does radiation damage cells?
6) List three possible outcomes of a damaged cell?

Now that we are somewhat familiar with the three types of radiation we can take a closer look at their characteristics. http://www.darvill.clara.net/nucrad/types.htm
Take the quiz at the end.
7) What was your score, including the two questions at the end?

Radiation has enormous benefits as well as enormous dangers associated with it. As a future taxpayer and voter it's important that we are familiar with radiation and can make informed decisions. To begin please click on http://nucleaire.edf.fr/English/fs_comment_marche.html. Read the information on fission and click on "see the animation".
8) What form of energy does fission predominately give off?
9) What is the name of the process occurring in the animation?

To get a different perspective on fission click on
http://lectureonline.cl.msu.edu/~mmp/applist/chain/chain.htm and play with the animation.
10) Why does the yellow graph on the right increase so quickly?

Lets now put fission to work for us in a nuclear reactor, click on http://www.nrc.gov/reading-rm/basic-ref/students/animated-pwr.html. See if you can figure out what is going on in this animation.
11) In a few sentences detail what is happening in the diagram?

Our next exploration will be to see how fusion can help us out of our current energy crunch. Click on http://ippex.pppl.gov/interactive/fusion/ and follow the hyperlinks to discover just how fusion works.
12) What happens to atomic movement when a gas gets hotter?
13) What is the relationship between energy, mass, and velocity?
14) How does the Coulomb force affect the two charged objects?
15) At what temperature in the animation does fusion occur?

It is difficult to imagine someone in this day and age not knowing what an x-ray is. Lets see how x-rays are produced. Click on http://www.physics.isu.edu/radinf/xray.htm and http://www.colorado.edu/physics/2000/xray/making_xrays.html. Make sure you read the text and do the animation.
16) Describe the process by which x-rays are produced?

Growing uses of radiation are in the fields of biology and pharmacy. In the following web site is a cell that has been injected with radioactive elements. These radioactive elements can be used to follow where medicines and molecules go in cells. Lets take a look. Go to
http://bio.winona.msus.edu/berg/ANIMTNS/autorad.htm
17) Where do the radioactive particles eventually end up on this cell?

Another interesting application of radiation is called carbon dating. Click on
http://www.ccr.jussieu.fr/radioactivite/english/indispensable.htm for further details.
18) How is carbon–14 formed in the atmosphere?

Read about carbon dating and then click on
http://lectureonline.cl.msu.edu/~mmp/applist/decay/decay.htm to get a better understanding as to what radioactive decay is.
19) What happens to the atomic nuclei decay rate if you increase the time?

There are so many uses for radioactivity and the list gets larger each day. Click on
http://www.darvill.clara.net/nucrad/uses.htm
for some further uses of radioactivity.
20) List and describe the various uses for radiation?

If you are interested in radiation and would like to check out some cool careers click on http://www.epa.gov/radiation/students/careers.html and go to “careers in science”.
21) List and describe the five careers mentioned?

***Extension:** If you would like to read about one of the great woman in science and a leader in the field of nuclear chemistry click on http://www.aip.org/history/curie/.
Write a two to three paragraph essay describing the major contributions made by Marie Curie.