Activity- Radioactive Dating Using Half-Life
An Activity about Forensic Anthropology

Introduction:
Scientists can use their knowledge of radioactive decay and half-lives to determine the age of many things, including skeletal remains. One method used to determine the age of bones is the Carbon-14 method. Carbon-14 is a radioactive isotope of carbon that is found in all living things. Carbon-14 is absorbed by living things when they are alive and although it does decay, it is constantly replaced. When an organism dies, the amount of C-14 begins to decay at a fixed rate determined by the half-life of the isotope. The half-life is the time it takes for ½ of a radioactive isotope to decay into a stable isotope. Scientists can measure the amount of C-14 remaining in a skeleton to determine how long ago an individual died.

Purpose:
- Simulate the process of radioactive decay of a fictitious element, “boneyum”, found in bones
- Use your data to solve a forensic mystery

Materials: Shoe box for each group, “radioactive atoms”, & data sheet

Part I: Determine the $\frac{1}{2}$ life of “boneyum”

Procedure:
1. Place each of your 100 squares in a shoe box. These squares represent radioactive atoms.
2. Shake the box with one big shake to mix your atoms. Each shake represents 10 years of time. Dump the atoms on the desk in front of you.
3. Sort out & count all the atoms (or squares) that land with their white/beige side up. These white atoms have decayed and turned into stable “daughter” atoms. Record this number in “# stable” section of your data table. Record the number of radioactive “red” atoms that remain on your table.
4. Put the remaining radioactive “red” atoms back in the box and leave the white ones off to the side.
5. Shake the box again and dump out the atoms on your desk. Sort out & count all the atoms (or squares) that land with their white/beige side up & add this # to the white ones you already have on our desk. These white atoms have decayed and turned into stable “daughter” atoms. Record this number in “# stable” section of your data table. Record the number of radioactive “red” atoms that remain.
6. Repeat steps until you don’t have any radioactive atoms remaining.

Data/ Observations: (record on your own paper!!!)

<table>
<thead>
<tr>
<th># radioactive “parent” atoms (red)</th>
<th>Start (time 0)</th>
<th>Shake 1 (10years)</th>
<th>Shake 2 (20years)</th>
<th>Shake 3 (30years)</th>
<th>Shake 4 (40years)</th>
<th>Shake 5 (50years)</th>
<th>Shake 6 (60years)</th>
</tr>
</thead>
<tbody>
<tr>
<td># stable “daughter” atoms that decayed (white)</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td>DO NOT WRITE ON THIS PAPER!!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% of radioactive atoms remaining in box (radioactive/ total x 100)</td>
<td>100 %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Graph your data on answer sheet & answer questions.
Part II- Determine the Missing Person

Real- Life Application:
The year was 1998. Some deer hunters stumbled across a suspicious-looking mound of dirt in a heavily wooded area in Stattonville, South Carolina. Crime scene investigators were called in to evaluate the scene. After determining that this might be a grave, the investigators ask for help from some forensic anthropologists. Working together, the site is carefully excavated. The skeletal remains of a human are found in the grave.

The forensic anthropologists determine that the remains belonged to a female, about age 13. She had been shot at close range through the back of the head. X-rays are taken. Police records turn up missing person reports of ten girls this age. Archaeologists decide to narrow down the range of possibilities by determining how long the young girl has been dead. To do this they must do radioactive dating of the fictitious element “boneyum”.

Purpose:
- Use the radioactive decay graph on “boneyum” from part I to solve the missing persons case.

The missing person report:

<table>
<thead>
<tr>
<th>Name of Girl</th>
<th>Hometown</th>
<th>Date first reported missing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sue Crayton</td>
<td>Rexty, SC</td>
<td>1964</td>
</tr>
<tr>
<td>Brenda Sills</td>
<td>Tebvro, GA</td>
<td>1985</td>
</tr>
<tr>
<td>Jane Killow</td>
<td>Loxton, AL</td>
<td>1945</td>
</tr>
<tr>
<td>Fay Johnson</td>
<td>Sunville, TN</td>
<td>1935</td>
</tr>
<tr>
<td>Mary Sparks</td>
<td>Mayfield, NC</td>
<td>1990</td>
</tr>
<tr>
<td>Linda Tims</td>
<td>Brownton, SC</td>
<td>1933</td>
</tr>
<tr>
<td>Andrea Brown</td>
<td>Troopville, GA</td>
<td>1985</td>
</tr>
<tr>
<td>Jay Sims</td>
<td>Glexton, SC</td>
<td>1900</td>
</tr>
<tr>
<td>Kay Thomas</td>
<td>Yexton, AL</td>
<td>1995</td>
</tr>
<tr>
<td>Leslie Andrews</td>
<td>Freeport, NC</td>
<td>1920</td>
</tr>
</tbody>
</table>

See Activity Sheet for questions to answer