

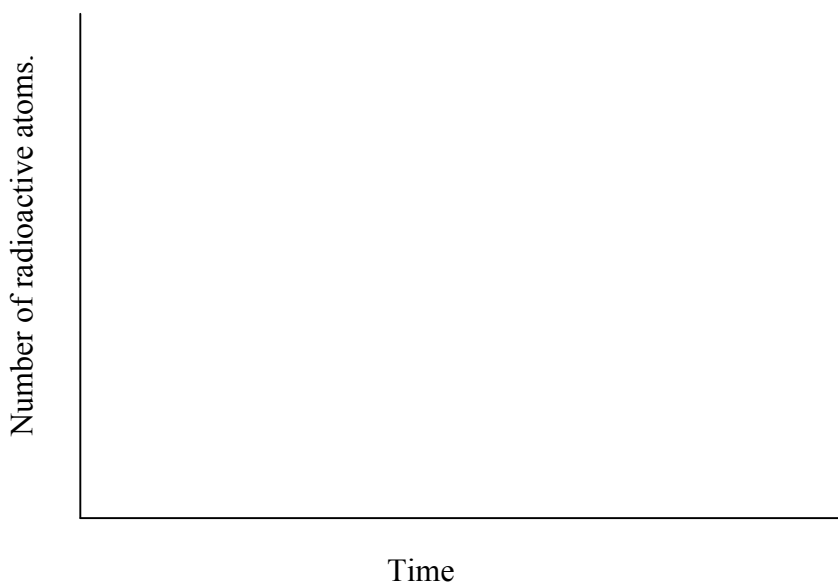
Understanding Half-life Activity

Name: _____

Required materials: Pennies, a cup, tray (shoe box lid).

At this point in the course you should be familiar with atoms and how they interact around us. Radioactive atoms are present in many parts of our daily lives from smoke detectors to radon gas present in some homes.

1. Radioactive atoms are naturally present in some types of rocks. What happens to the radioactive atoms in rocks?
2. Make a qualitative prediction of what a graph of how many radioactive atoms in a rock will remain as time progresses. Will there be more, less, or the same number of atoms as time progresses?



In this model experiment you will use pennies to represent radioactive atoms. The coins are placed in a cup, shaken and the poured out into a tray. Pennies with “heads” facing up have “decayed” and are removed from the tray and set aside. The remaining pennies are counted, recorded, and returned to the cup for the next shake.

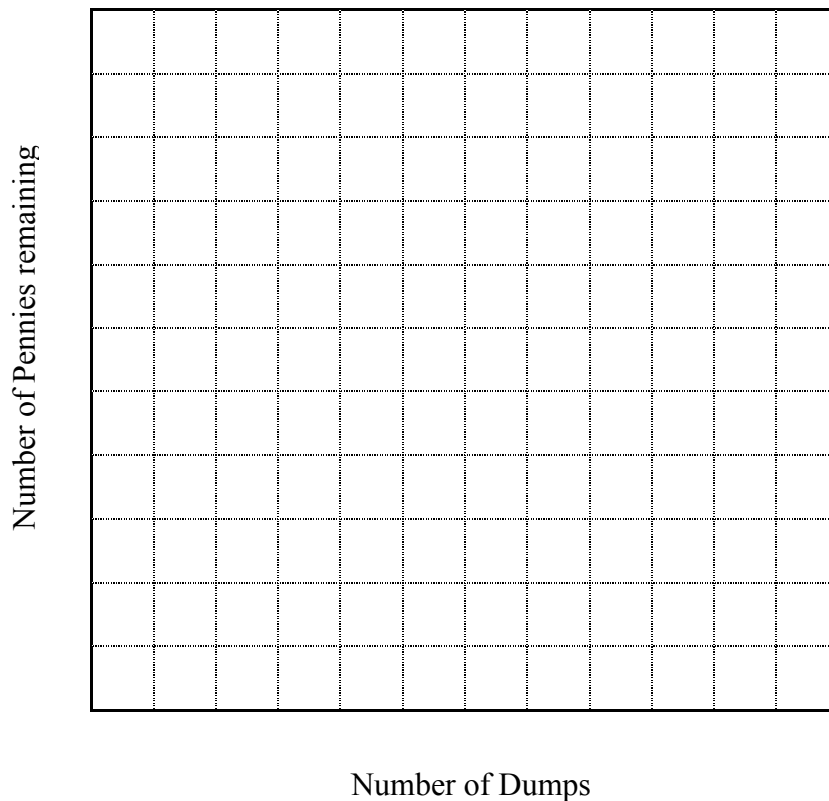
Experimental Procedure

- A. Place a known number (≥ 100) of coins in the cup.
- B. Record this number for the zero half-life (see example table).
- C. Shake and dump coins into tray.
- D. Remove all of the coins that have “heads” facing up and consider them as having decayed.
- E. Record the number of remaining coins as having “survived” for the first half-life. Put the surviving coins back in the cup. Every dump will count as one half-life.
- F. Repeat until all coins have decayed.

Example Table	
Half- life #	# Pennies
0	
1	
2	
3	
...	

Experimental Data	
Half-life #	# Pennies
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

3. Now, plot the experimental data of the number of Pennies vs. “Half-life”.



3. Describe any differences from your graph in step 2.

4. For each dump about how many pennies are taken away?
- a. _____ $\frac{3}{4}$
 - b. _____ $\frac{2}{3}$
 - c. _____ $\frac{1}{2}$
 - d. _____ $\frac{1}{3}$
 - e. _____ $\frac{1}{4}$
5. The half-life is the average amount of time for half of the radioactive atoms to decay. In this activity each dump represents one half-life. Pretend that the pennies are radioactive atoms. Suppose that you dumped the last decayed penny. Discuss with a partner whether or not a radioactive atom is guaranteed to decay after one half-life? Why?
6. Au^{185} undergoes an alpha decay with a half-life of roughly 7 minutes. Suppose that you have 16 grams of this radioactive isotope.
- a. How much is left after 14 minutes?
 - b. After 21 minutes?
 - c. **Extra Credit:** After 56 minutes?