# Science 10: Determining the Half Life of Pennies

1. **Purpose**: To determine the half-life of pennies being shaken.
2. **Materials**

100 pennies

graph paper

cup

1. **Procedure**
   * 1. Place 100 pennies into a cup.
     2. We are beginning with all of the parent element (all pennies heads up). Use Table A to record your results, complete the “O Shake” row.
        1. Parent Elements = heads (100)
        2. Daughter Element = tails (0)
     3. Place your hand over the lid of the cup and shake it vigorously five times.
     4. Dump all of the pennies onto your desk.
     5. Count and remove all pennies that are tails.
     6. Record the results of both parent and daughter elements in Table A.
     7. Repeat steps 3 to 6 until no pennies remain heads up.
     8. On the graph provided, label the horizontal axis as the “*Number of Shakes*” and number it from 0 - 15.
     9. On the same graph label the vertical axis as the “*Number of Parents and Daughters*” and number it from 0 to 100.
     10. Plot the data points of Parent Element (Heads) Left vs. Number of Shakes, and fit a curved line best joining the points together.
     11. After your graph is completed, use a different colored pen and label:
         1. 1st half-life (50 Parent Elements)
         2. 2nd half-life (25 Parent Elements)
         3. 3rd half-life (12.5 Parent Elements) etc...
     12. At each half-life match the number of shakes each one took by drawing a vertical line from each half-life point to the number of shakes.
     13. Plot the data points of the Daughter Element (tails) vs. the Number of shakes, and fit a curved line best joining the points together.
2. **Questions**
   1. What was the trend in the number of parent elements left after each shake?
   2. What was the trend in the number of daughter elements taken out after each shake?
   3. What type of line did you observe after all you points were plotted?
   4. Use your graph to answer the following questions:
      1. How old is the penny sample if there are:
         1. 75 heads in the sample:
         2. 66 heads in the sample:
         3. 45 heads in the sample:
         4. 20 heads in the sample:
         5. 15 heads in the sample:
         6. 4 heads in the sample:
         7. 32 tails in the sample:
         8. 89 tails in the sample:
         9. 90 tails in the sample:
         10. 99 tails in the sample:
   5. What sources of errors do you think came into this activity?
3. **Conclusion**
   1. How many shakes is the half-life of pennies?

*Table A:* Data of Parent Elements Left and Daughter Elements   
(They both have to add up to 100)

|  |  |  |
| --- | --- | --- |
| Number of Shakes | Parent Elements Left (Heads) | Daughter Elements (Tails) |
| 0 |  |  |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |
| 6 |  |  |
| 7 |  |  |
| 8 |  |  |
| 9 |  |  |
| 10 |  |  |
| 11 |  |  |
| 12 |  |  |
| 13 |  |  |
| 14 |  |  |
| 15 |  |  |

**Decay Graph**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| **Number of Parent and Daughters** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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**Number of Shakes**