Half Life Simulation Activity Worksheet

Introduction:

This worksheet is based on the Radioactive Half Life Activity available at https://www.ausetute.com.au/halflifemodel.html

Aim

To simulate the half life of a radioisotope using coins as a model of the radioisotope.

Procedure

1. Place 80 identical coins in a box. Use your fingers to sweep through them several times, or shake the box vigorously, to mix them up.
2. Wait 1 minute, then up-end the box, allowing the coins to fall on level ground.
3. Pick up the "tail-up" coins and pile them up, one on top of the other, to make a tower.
4. Count the number of "head-up" coins (atoms that have NOT decayed), and record this.
5. Place the coins that were "head-up" (undecayed) back into the box and mix with your fingers or shake the box.
6. Repeat steps 2 to 5, placing each new tower to the right of the one before. Stop the activity when just a few coins remain "head-up".

Results

Time (min)	**No. Heads-up** (No. undecayed radioisotopes remaining)	Make a sketch of the coin towers
0	80	
1		
2		
3		
4		

Conclusion

Every 1 minute, the number of undecayed radioisotopes remaining is _____. Therefore, the half life of this radioisotope is _____ minute. The radioactive decay of a radioisotope is an example of exponential decay.

Discussion Questions

1. Use the experimental data to draw a graph then use this graph to answer the following questions:
    - **a.** Determine the time taken for 60 coins to remain heads-up (undecayed radioisotopes).
    - **b.** Determine the number of heads-up coins (undecayed radioisotopes) when 2.5 minutes have elapsed.
2. Calculate the percentage of coins heads-up at each time interval in the results table and then complete the table below:

No. half lives	**% Heads-up** (% undecayed radioisotopes remaining)
0	
1	
2	
3	
4	

3. Use the table in question 2 to answer the following questions:
    a. What percentage of radioisotope atoms remain undecayed after 3 half lives?
    b. How many half lives must elapse for 25% of the radioisotopes to remain undecayed?
    c. If the half life of a radioisotope is 5 years, how much time must pass for 12.5% of the radioisotope to remain undecayed?
    d. If a sample of radioisotope has a mass of 60 grams, what mass of radioisotope remains undecayed when 4 half lives have passed?
4. On your graph from question 1, plot the points for a radioisotope that has a half life of 2 minutes and draw a line of best fit through them. Compare and contrast the two curves.
5. Calculate the percentage of coins tails-up at each time interval and complete the table below:

No. half lives	**% Tails-up** (% radioisotopes that have decayed)
0	
1	
2	
3	
4	

6. Graph the data in the table in question 5.
7. Compare and contrast the graphs produced in questions 1 and 6.