



## Half-Life Activity

The rate of decay for a *radioactive isotope* is measured in terms of its *half-life* - the time for one half of a radioactive substance to decay. Each radioactive isotope has its own characteristic half-life. In this activity you will simulate radioactive decay and determine three substances' half-lives. Each substance is represented by a given color, marked on one or more sides of a cube. Red is marked on one side of the cube, Yellow is on two sides and the remaining three sides are Green.

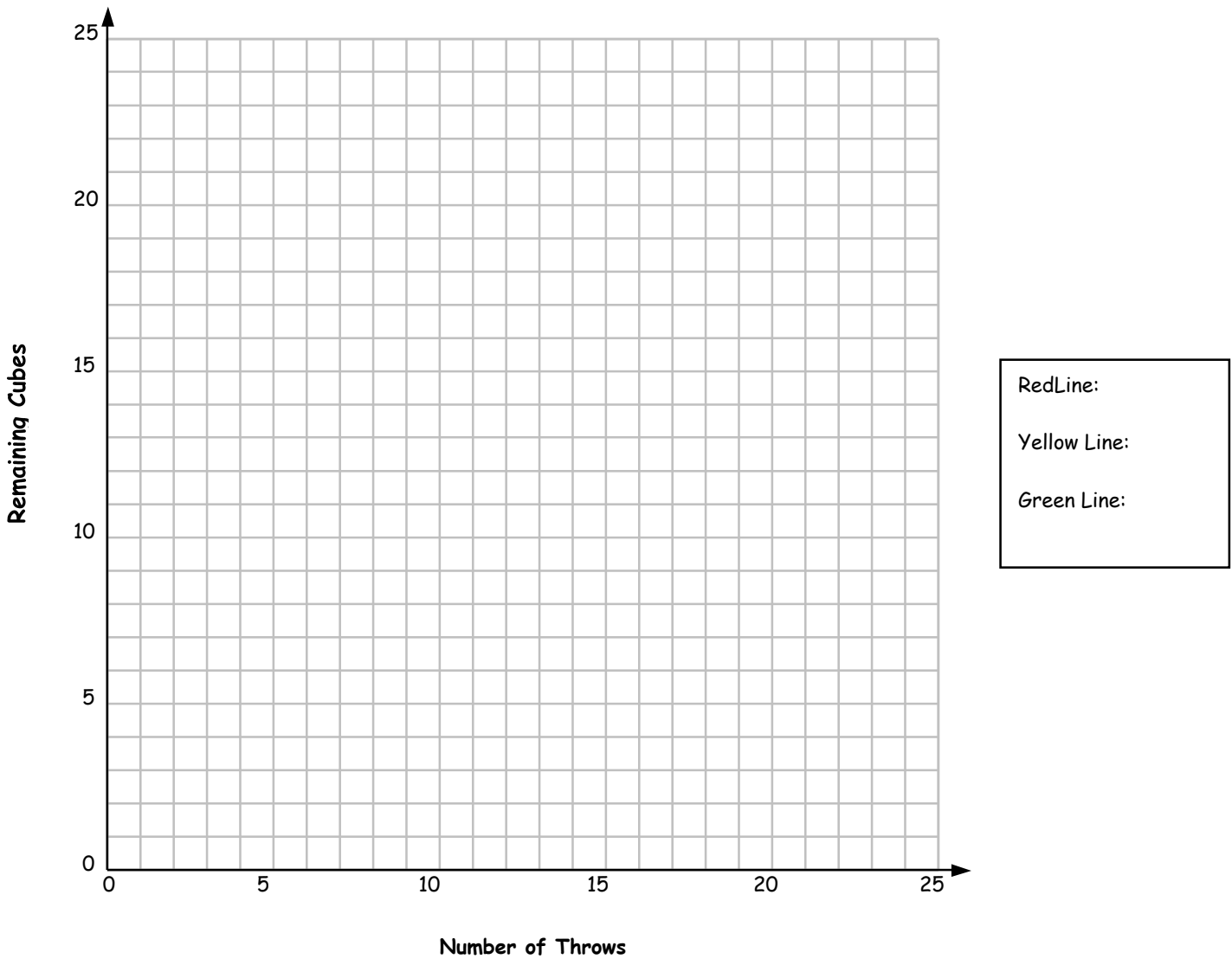
### Procedure:

- Shake the cubes in a container and roll them onto your lab table
- Count the number of Red sides that are face up and record this number in "Removed" in the data table
- Remove all of the dice that have Red sides facing up
- Roll the remaining cubes, count and remove any cubes that have Red sides up
- Repeat until all of the cubes have turned Red side up
  
- Repeat this procedure using the Blue sides and White sides of the cubes

| Throw | Red Substance |           | Yellow Substance |           | Green Substance |           |
|-------|---------------|-----------|------------------|-----------|-----------------|-----------|
|       | Removed       | Remaining | Removed          | Remaining | Removed         | Remaining |
| 1     |               |           |                  |           |                 |           |
| 2     |               |           |                  |           |                 |           |
| 3     |               |           |                  |           |                 |           |
| 4     |               |           |                  |           |                 |           |
| 5     |               |           |                  |           |                 |           |
| 6     |               |           |                  |           |                 |           |
| 7     |               |           |                  |           |                 |           |
| 8     |               |           |                  |           |                 |           |
| 9     |               |           |                  |           |                 |           |
| 10    |               |           |                  |           |                 |           |
| 11    |               |           |                  |           |                 |           |
| 12    |               |           |                  |           |                 |           |
| 13    |               |           |                  |           |                 |           |
| 14    |               |           |                  |           |                 |           |
| 15    |               |           |                  |           |                 |           |
| 16    |               |           |                  |           |                 |           |
| 17    |               |           |                  |           |                 |           |
| 18    |               |           |                  |           |                 |           |
| 19    |               |           |                  |           |                 |           |
| 20    |               |           |                  |           |                 |           |
| 21    |               |           |                  |           |                 |           |
| 22    |               |           |                  |           |                 |           |
| 23    |               |           |                  |           |                 |           |
| 24    |               |           |                  |           |                 |           |
| 25    |               |           |                  |           |                 |           |

Plot the number of cubes remaining versus the number of throws for each substance. Use a different color or line pattern for each substance. Do NOT connect the dots! Draw a smooth line or curve that approximately connects all of your points.

Remaining Cubes vs. Number of Throws



**Analysis Questions:**

- What was the half-life of each of your substances?  
 Red: \_\_\_\_\_  
 Yellow: \_\_\_\_\_  
 Green: \_\_\_\_\_
- In each case, how many rolls did it take to remove all of the cubes?  
 Red: \_\_\_\_\_  
 Yellow: \_\_\_\_\_  
 Green: \_\_\_\_\_
- Which of these hypothetical substances would be the most harmful? Explain.
- Is it possible to estimate the half-life of a substance in a single throw? How accurate would this be?
- Are your lines straight or do they curve? Do these lines correspond to a constant or non-constant rate of decay?

