

PHYSICS LABORATORY: The Half-Life of Beer Foam

BACKGROUND INFORMATION AND PURPOSE

Consider a fixed container containing a set number of atoms of a radioactive substance. You know that it is not possible to say when a specific nucleus in this container will decay, because this decay is a random phenomenon. However, we can *predict when* a particular nucleus will decay.

We can say with certainty that the rate of decay is proportional to the number of atoms not yet decayed (this is the 'Law of Radioactive Decay'). The 'half-life' is the amount of time taken for the number of nuclei to decrease by $\frac{1}{2}$. After each half-life, the number of nuclei not yet decayed has decreased by $\frac{1}{2}$ and number decayed has increased by $\frac{1}{2}$.

Radioactive decay is an exponential function. If N_0 is the initial population and the growth/decay rate (activity) is k then the population N at time t is:

$$N = N_0 e^{kt}$$

In this laboratory you will investigate the 'decay rate' of beer foam and determine its half-life. Specifically, you will determine the decay rate (k) and the half-life of beer foam.

Remember to make a hypothesis for this investigation before starting, and justify your hypotheses as appropriate.

DATA COLLECTION AND PROCESSING (DCP)

1. Pour beer into a measuring cylinder until the foam nearly reaches the top.
2. Quickly mark the initial beer liquid level and the foam-air level, and start the stopwatch.
3. Note the beer level and the foam-air level at a set time interval. Do this for as long as you can. When you no longer notice any change in these levels, continue waiting for another two to three minutes until as much foam turns into liquid as possible (some beer foam will remain on the inside of the measuring cylinder).
4. Record the maximum beer liquid height and the minimum foam-air height.
5. Repeat; three trials and a full error analysis with proper treatment of uncertainties is required.

Remember:

1. Refer to the 'Physics Lab Report Guide' before submitting your report.
2. Attach the 'Physics Lab Report Rubric' as a cover page to your paper copy.

You will be marked on Data Collection and Processing (DCP) and Conclusion and Evaluation (CE) for this lab.