Thank you for signing up to participate in this NSTA web seminar. To help you participate as fully as possible we are providing these suggestions and background.

We hope you will take part by engaging in two hands-on activities during the seminar. In order to do this, you will need to have available these materials when you join the seminar:

- one-quarter cup of water
- one-quarter cup of cooking oil
- one teaspoon of liquid dishwashing or laundry soap/detergent
- a container with a lid that will hold at least one-half cup of liquid (preferably a tall-form cylindrical container like an olive or jelly jar)

The results from these activities will be used as input for parts of the seminar.

The content of the seminar will involve some work with combinations, permutations, and probabilities. As a reminder, recall that the probability of a combination of events is the product of the probability of each event. For example, if we toss a coin, the probability that it will land with heads up is \( \frac{1}{2} \). If we toss two coins simultaneously, each has a probability of \( \frac{1}{2} \) that it will come up heads and the probability that the combination will be two heads is \( \frac{1}{2} \times \frac{1}{2} = \frac{1}{4} \).

Permutations often involve factorials. Recall that N-factorial is denoted as N! and is equal to:

\[ N! = N \cdot (N-1) \cdot (N-2) \cdot \ldots \cdot 3 \cdot 2 \cdot 1 \]

A factorial can be written in different ways to facilitate mathematical manipulation. For example:

6! = 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1, which can also be written as 6 \cdot 5 \cdot 4 \cdot (3!)

The expressions for permutations usually are ratios of factorials that have to be solved to obtain the number of permutations. An example is:

\[ \frac{9!}{3!6!} = \frac{9 \cdot 8 \cdot 7 \cdot (6!)}{3!3!6!} = \frac{9 \cdot 8 \cdot 7}{3 \cdot 2 \cdot 1} = \frac{3 \cdot 4 \cdot 7}{1} = 3 \cdot 4 \cdot 7 = 84 \]

Many calculators have a factorial key, but, for many problems, simple cancellations like these are faster than using a calculator. For larger numbers, the calculator is actually useless, because most calculators are unable to calculate anything beyond 69!. Try it on your calculator.

The content of this web seminar is based in part on the entropy model introduced in Chapter 8 in the textbook, *Chemistry: A Project of the American Chemical Society* (W.H. Freeman, New York, 2005), ISBN 0-7167-3126-6. An electronic version, pdf files, is also available, ISBN 0-71676-239-0. If you think this resource could be valuable to you, contact the publisher or the representative in your area. A further interactive online resource, the *Web Companion*, that supports this textbook is available at bcs.whfreeman.com/acsgenchem/.