

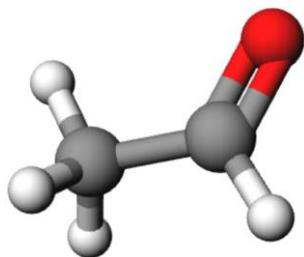
## Exam II

Administered: Monday, October 16, 2023  
24 points

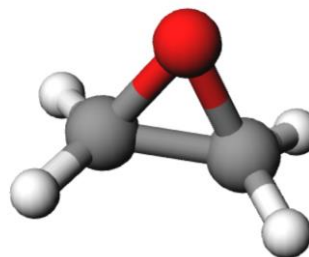
For each problem part: 0 points if not attempted or no work shown,  
1 point for partial credit, if work is shown,  
2 points for correct numerical value of solution

**Problem 1. (16 points)** Consider the following data for the critical temperature for two biochemicals.

Acetaldehyde  
 $C_2H_4O$



Ethylene Oxide  
 $C_2H_4O$



taken from the NIST Chemistry Webbook, <http://webbook.nist.gov/chemistry/>.

#### Critical Temperature of Acetaldehyde

Temperature (K)	Reference
466	<a href="#">Teja and Anselme, 1990</a>
461	<a href="#">Hollmann, 1903</a>
454.7	<a href="#">Van der Waals, 1881</a>

#### Critical Temperature of Ethylene Oxide

Temperature (K)	Reference
468.9	<a href="#">Walters and Smith, 1952</a>
469	<a href="#">Hess and Tilton, 1950</a>
465.2	<a href="#">Maass and Boomer, 1922</a>

Perform the following tasks.

- Determine the sample mean of the critical temperature of acetaldehyde.
- Determine the sample mean of the critical temperature of ethylene oxide.
- Determine the sample variance of the critical temperature of acetaldehyde.
- Determine the sample variance of the critical temperature of ethylene oxide.
- Identify the appropriate distribution to describe the difference of means in this case?
- Determine the lower limit of a 80% confidence interval on the difference of means of the critical temperature.
- Determine the upper limit of a 80% confidence interval on the difference of means of the critical temperature.
- Explain your findings in language a non-statistician can understand.

(exam continued on next page)

**Problem 2. (8 points)**

Consider a 6-cylinder automobile engine with six spark plugs, each with a lifetime that follows the normal distribution with a mean lifetime of 50,000 miles and a standard deviation of 2,000 miles.

- (a) What is the probability that a sparkplug lasts at least 45,000 miles?
- (b) What is the probability that all six sparkplugs last at least 45,000 miles?
- (c) What is the probability that a sparkplug dies before 45,000 miles?
- (d) What is the probability that no more than half the sparkplugs have died by 45,000 miles?