

Exam II

Administered: Monday, October 10, 2025

26 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 with work

Problem 1. (20 points)

Consider the following data is provided for the enthalpy of fusion of octane, taken from the NIST Chemistry Webbook, <http://webbook.nist.gov/chemistry/>.

Enthalpy of fusion of Octane (C₈H₁₈)

$\Delta_{\text{fus}}H$ (kJ/mol)	Temperature (K)	Reference
20.740	216.38	Finke, Gross, et al., 1954
21.8	216.6	Mondieig, Rajabalee, et al., 2004
20.74	216.4	Domalski and Hearing, 1996
20.652	215.8	Huffman, Parks, et al., 1931
20.092	215.6	Parks, Huffman, et al., 1930

Perform the following tasks.

- Determine the sample mean of the enthalpy of fusion of octane.
- Determine the sample variance of the enthalpy of fusion of octane.
- Determine the sample standard deviation of the enthalpy of fusion of octane.
- Identify the appropriate distribution to describe the mean of the enthalpy of fusion of octane in this case.
- Determine the lower limit of a 98% confidence interval on the mean of the enthalpy of fusion of octane.
- Determine the upper limit of a 98% confidence interval on the mean of the enthalpy of fusion of octane.
- Identify the appropriate distribution to describe the variance of the enthalpy of fusion of octane in this case.
- Determine the lower limit of a 98% confidence interval on the variance of the enthalpy of fusion of octane.
- Determine the upper limit of a 98% confidence interval on the variance of the enthalpy of fusion of octane.
- Explain your findings in parts (a) through (i) in language a non-statistician can understand.

Problem 2. (6 points)

The mechanical properties of four dogbone samples are characterized in four independent devices. A constant tensile stress is applied over an extended period of time. At a given temperature, the time to failure of an individual dogbone is known to follow the normal distribution with a mean lifetime of 30 minutes and a standard deviation of 3 minutes.

- What is the probability that an individual dogbone sample hasn't failed before 25 minutes?
- What PDF would describe the probability that x of the 4 dogbones haven't failed before 25 minutes?
- What is the probability that at least two dogbones haven't yielded before 25 minutes?