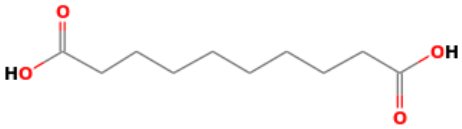
Exam II
Administered: Monday, October 9, 2026
24 points

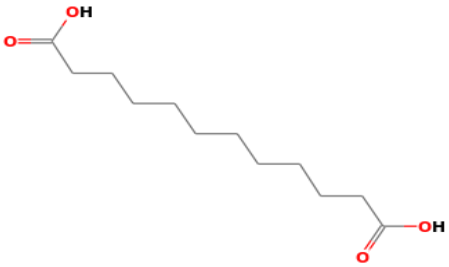
For each problem part: 0 points if not attempted or no work shown,
1 point for partial credit, if work is shown,
2 points for correct numerical value of solution

Problem 1. (16 points)
Consider the following data for the enthalpy of fusion for two alkanes of different lengths with a carboxylic acid group on each end.

decanedioic acid
$C_{10}H_{18}O_4$



dodecanedioic acid
$C_{12}H_{22}O_4$



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

Enthalpy of fusion of decanedioic acid

$\Delta_{fus}H$ (kJ/mol)	Temperature (K)	Method	Reference
40.807	404.0	N/A	Cingolani and Berchiesi, 1974
46.9	405.7	N/A	Ventolà, Bayés, et al., 2008
45.3	405.6	DSC	Xia, Zhang, et al., 2008
46.6	403.9	N/A	Roux, Temprado, et al., 2005
40.8	404.	N/A	Domalski and Hearing, 1996

Enthalpy of fusion of dodecanedioic acid

$\Delta_{fus}H$ (kJ/mol)	Temperature (K)	Method	Reference
50.564	402.5	N/A	Cingolani and Berchiesi, 1974
52.5	401.6	N/A	Ventolà, Bayés, et al., 2008
49.8	400.3	DSC	Roux, Temprado, et al., 2005
50.57	402.5	N/A	Domalski and Hearing, 1996

Perform the following tasks.
(a) Determine the sample mean of the enthalpy of fusion of decanedioic acid.
(b) Determine the sample mean of the enthalpy of fusion of dodecanedioic acid.
(c) Determine the sample variance of the enthalpy of fusion of decanedioic acid.
(d) Determine the sample variance of the enthalpy of fusion of dodecanedioic acid.
(e) Identify the appropriate distribution to describe the difference of means in this case?
(f) Determine the lower limit of a 95% confidence interval on the difference of means of the enthalpy of fusion.
(g) Determine the upper limit of a 95% confidence interval on the difference of means of the enthalpy of fusion.
(h) Explain your findings in language a non-statistician can understand.

Problem 2. (8 points)

Consider a battery with a lifetime described by the normal distribution with a population mean of 5.0 years and a population standard deviation of 0.5 years.

(a) What is the probability that a battery lasts at least 6.0 years?

(b) What PDF would describe the probability that x batteries haven't failed before 6.0 years?

(c) What is the probability that a device with a redundant power system running on three batteries has no batteries working in 6.0 years?

(d) What is the probability that a device with a redundant power system running on three batteries has at least one battery working in 6.0 years?