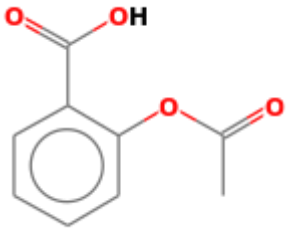
Exam II
Administered: Monday, October 17, 2022
22 points

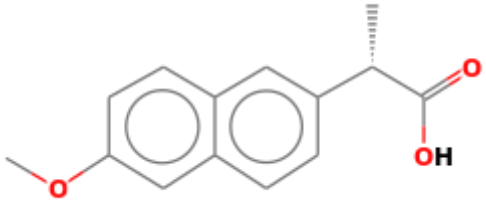
For each problem part: 0 points if not attempted or no work shown,
1 point for partial credit, if work is shown,
2 points for correct numerical value of solution

Problem 1. (16 points) Consider the following data for the enthalpy of fusion for two biochemicals.

acetylsalicylic acid (aspirin)
$C_9H_8O_4$



naproxen (Aleve)
$C_{14}H_{14}O_3$



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

Enthalpy of fusion of aspirin

$\Delta_{fus}H$ (kJ/mol)	Temperature (K)	Method	Reference
29.17	409.2	DSC	Xu, Sun, et al., 2004
31.01	412.7	DSC	Perlovich and Bauer-Brandl, 2001
29.8	414.	N/A	Kirklin, 2000

Enthalpy of fusion of naproxen

$\Delta_{fus}H$ (kJ/mol)	Temperature (K)	Method	Reference
34.2	428.8	DSC	Wassvik, Holmén, et al., 2006
31.5	428.5	N/A	Neau, Bhandarkar, et al., 1997
29.41	439.2	N/A	Claramonte, Vialard, et al., 1993

Perform the following tasks.
(a) Determine the sample mean of the enthalpy of fusion of aspirin.
(b) Determine the sample mean of the enthalpy of fusion of naproxen.
(c) Determine the sample variance of the enthalpy of fusion of aspirin.
(d) Determine the sample variance of the enthalpy of fusion of naproxen.
(e) Identify the appropriate distribution to describe the difference of means in this case?
(f) Determine the lower limit of a 90% confidence interval on the difference of means of the enthalpy of fusion.
(g) Determine the upper limit of a 90% 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. (6 points)
Consider a battery with a lifetime that follows the normal distribution with a mean lifetime of 18 months and a standard deviation of 2 months.
(a) What is the probability that a battery lasts at least 15 months?
(b) If you want to be 99.9% sure that the battery doesn't die, when should you replace the battery?
(c) If you have a system with a back-up battery, what is the probability that at least 1 battery continues to work in the time period determined in part (b)?