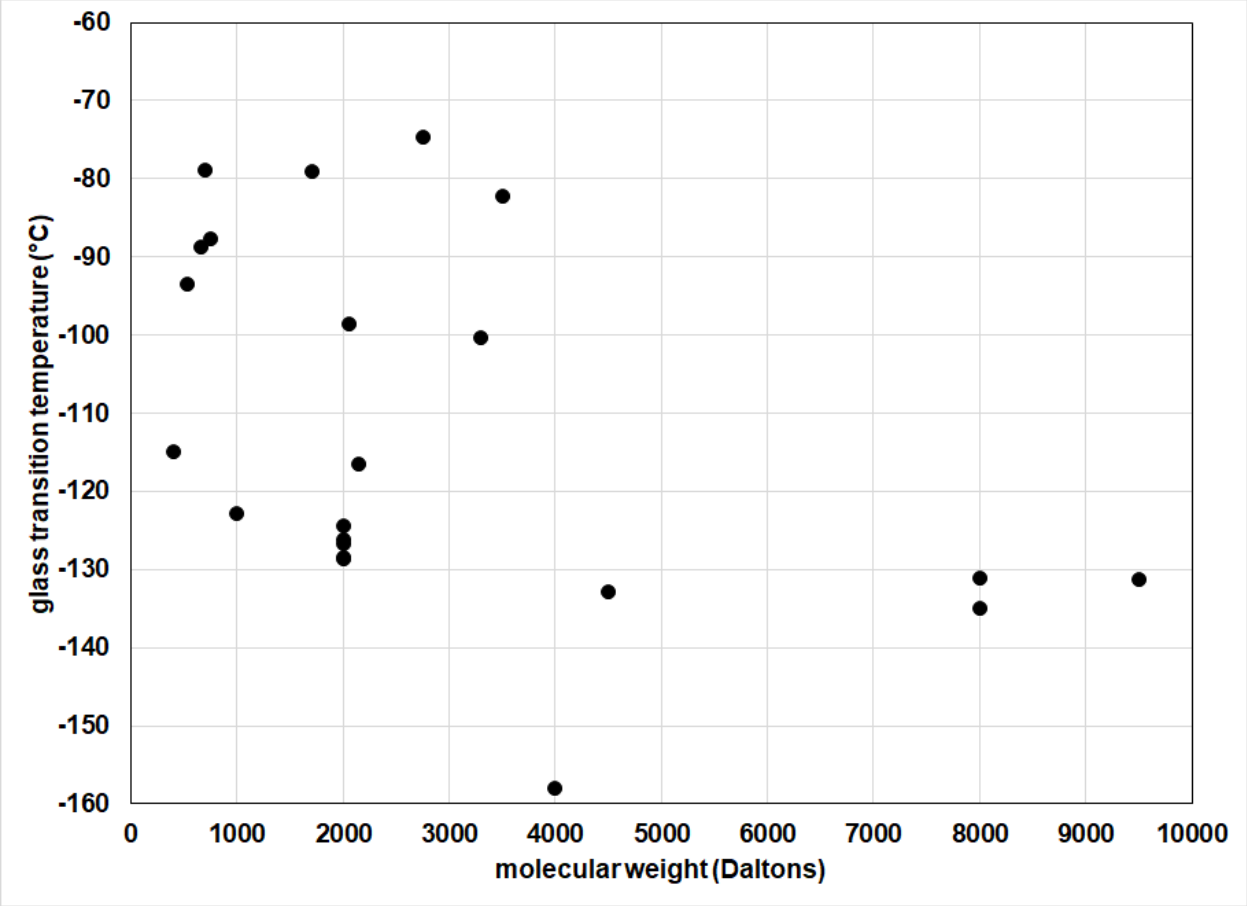
Exam I
Administered: Monday, September 14, 2026
24 points

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. (12 points)

Consider the relationship between molecular weight and glass transition temperature for the following **22** polymers plotted below. The data in this plot is available electronically on the course website in a spreadsheet file.



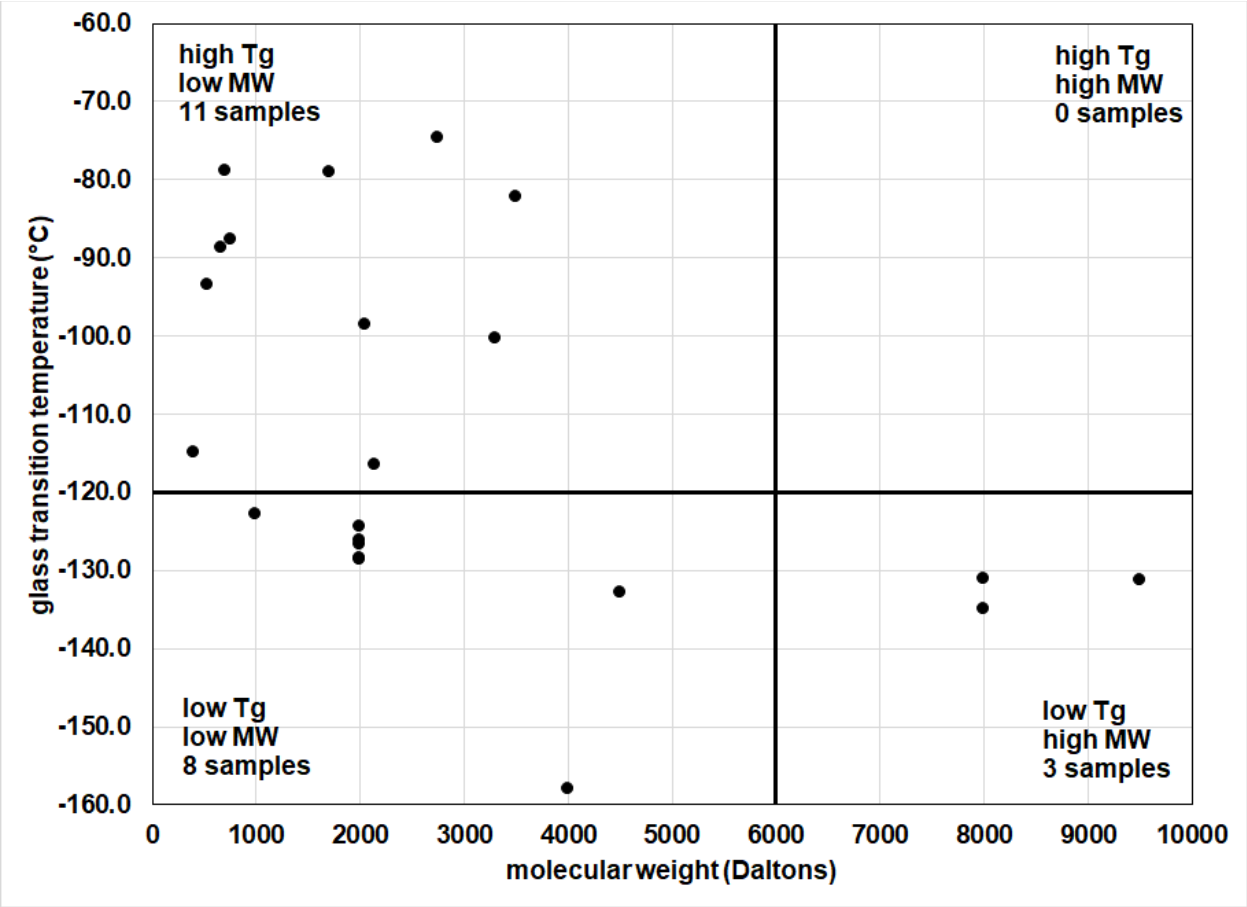
Answer the following questions for the materials in this table.

(a) Determine the mean molecular weight.
(b) Determine the mean glass transition temperature.
(c) Determine the standard deviation of the molecular weight.
(d) Determine the standard deviation of the glass transition temperature.
(e) Determine the correlation coefficient between the glass transition temperature and the molecular weight.
(f) What is the physical significance of your answer to part (e)?

Data taken from Katritzky, A.R. et al, "Prediction of Polymer Glass Transition Temperatures Using a General Quantitative Structure-Property Relationship Treatment", *J. Chem. Inf. Comput. Sci*. **36** 1996 pp. 879-884.

Problem 2. (12 points)

Consider the **22** materials in the plot below. We are evaluating these materials in terms of glass transition temperature and molecular weight. We have created a definition of low and high glass transition temperature and low and high molecular weight as indicated by the horizontal and vertical lines in the plot.



Using this information, answer the following questions.

(a) Draw a Venn Diagram of the sample space for this data.
(b) What is the probability that a material has low molecular weight and low glass transition temperature?
(c) What is the probability that a material has low glass transition temperature?
(d) What is the probability that a material has low molecular weight given that it has low glass transition temperature.
(e) What is the probability that a material has high glass transition temperature given that it has low molecular weight?
(f) Given this classification, prove that glass transition temperature and molecular weight are not independent of each other.