

Exam I

Administered: Monday, September 16, 2024
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 data for the following **12** polymers given below. This data is available electronically on the course website in a spreadsheet file.

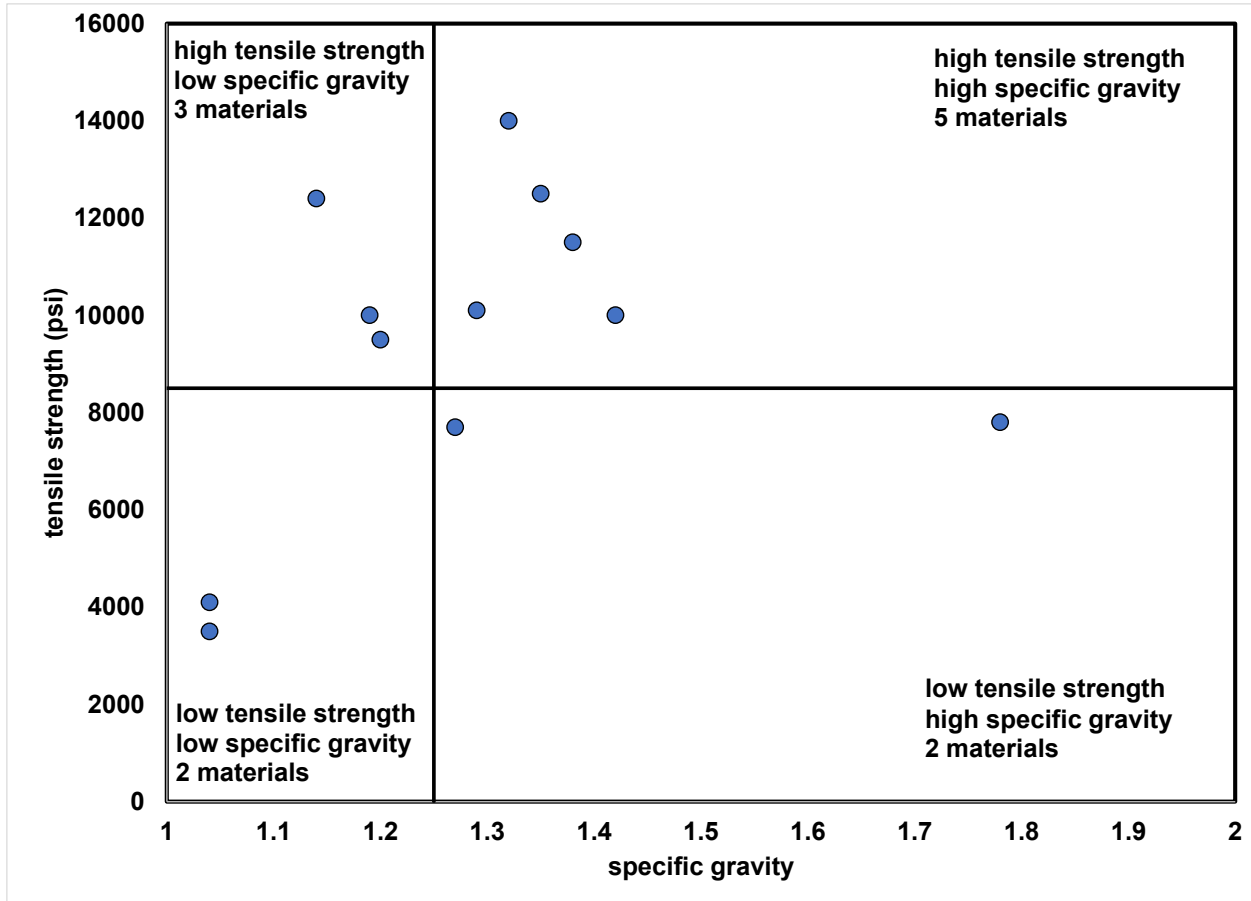
| | specific gravity | tensile strength (psi) | tensile modulus of elasticity (psi) | tensile elongation (%) | coefficient of thermal expansion (in/in/°F x 10 ⁻⁵) |
|------------------------|---------------------|------------------------------|---|------------------------------|---|
| ABS | 1.04 | 4100 | 294000 | 32 | 5.6 |
| Acetal | 1.42 | 10000 | 450000 | 75 | 6.8 |
| Acrylic High Impact | 1.19 | 10000 | 400000 | 4.5 | 4 |
| Polystyrene | 1.04 | 3500 | 270000 | 52 | 4.5 |
| Nylon | 1.14 | 12400 | 470000 | 90 | 4.5 |
| PEEK | 1.32 | 14000 | 490000 | 60 | 2.6 |
| PET | 1.38 | 11500 | 400000 | 70 | 3.9 |
| PETG | 1.27 | 7700 | 320000 | 210 | 3.8 |
| PPS | 1.35 | 12500 | 480000 | 4 | 4 |
| PPSU | 1.29 | 10100 | 340000 | 90 | 3.1 |
| PVDF | 1.78 | 7800 | 350000 | 35 | 7.1 |
| Polycarbonate | 1.2 | 9500 | 345000 | 135 | 3.8 |

Answer the following questions for the materials in this table.

- Determine the mean specific gravity.
- Determine the mean tensile strength.
- Determine the standard deviation of the specific gravity.
- Determine the standard deviation of the tensile strength.
- Determine the correlation coefficient between the specific gravity and tensile strength.
- What is the physical significance of your answer to part (e)?

Problem 2. (12 points)

Consider the 12 polymeric materials in the table in Problem 1. We are evaluating these materials in terms of low or high specific gravity and low or high tensile strength. A plot of the tensile strength vs the specific gravity is shown below.



Using this information, answer the following questions.

- Draw a Venn Diagram of the sample space for this data.
- What is the probability that a material has low tensile strength and high specific gravity?
- What is the probability that a material has high specific gravity?
- What is the probability that a material has low tensile strength given that it has high specific gravity?
- What is the probability that a material has high specific gravity given that it has low tensile strength?
- Given this classification, prove that tensile strength and specific gravity are not independent of each other.