Note: These questions will be discussed in the tutorial sessions on November 21.

Question 1:

The following table lists molecular weight data for a polytetrafluoroethylene. Compute:

(a) The number-average molecular weight,

(b) The weight-average molecular weight, and

(c) The degree of polymerization.

Molecular Weight Range (g/mol)	x_i	w_i
10,000–20,000	0.03	0.01
20,000–30,000	0.09	0.04
30,000–40,000	0.15	0.11
40,000–50,000	0.25	0.23
50,000–60,000	0.22	0.24
60,000–70,000	0.14	0.18
70,000–80,000	0.08	0.12
80,000–90,000	0.04	0.07

Question 2:

The density and associated percent crystallinity for two poly(tetrafluoroethylene) materials are as follows:

ρ (g/cm^3)	crystallinity (%)
2.144	51.3
2.215	74.2

(a) Compute the densities of totally crystalline and totally amorphous poly(tetrafluoroethylene).

(b) Determine the percent crystallinity of a specimen having a density of 2.26 g/cm^3.

Question 3:

The tensile strength and number-average molecular weight for two polyethylene materials are as follows:

Tensile Strength (MPa)	**Number-Average Molecular Weight (g/mol)**
85	12,700
150	28,500

Estimate the number-average molecular weight that is required to give a tensile strength of 195 MPa.

Question 4:

A cylindrical metal wire 2 mm in diameter is required to carry a current of 10 A with a minimum of 0.03 V drop per 300 mm of wire. Which of the metals and alloys listed in Table 18.1 are possible candidates?

Question 5:

Germanium to which 5×10^{22} m^{-3} Sb atoms have been added is an extrinsic semiconductor at room temperature, and virtually all the Sb atoms may be thought of as being ionized (i.e., one charge carrier exists for each Sb atom). (a) Is this material n-type or p-type? (b) Calculate the electrical conductivity of this material, assuming electron and hole mobilities of 0.1 and 0.05 m^2/V-s, respectively.

Question 6:

For each of the following pairs of materials, decide which has the larger thermal conductivity. Justify your choices.

(a) Pure copper; aluminum bronze (95 wt% Cu-5 wt% Al).

(b) Fused silica; quartz.

(c) Linear polyethylene; branched polyethylene.

(d) Random poly(styrene-butadiene) copolymer; alternating poly(styrene-butadiene) copolymer.

Question 7:

To what temperature must a cylindrical rod of tungsten 10.000 mm in diameter and a plate of 316 stainless steel having a circular hole 9.988 mm in diameter have to be heated for the rod to just fit into the hole? Assume that the initial temperature is 25°C.