Week 10

Amorphous structures I: Polymers

Exercise 1
Answer these questions by true or false:

1. Only cross-linked polymers exhibit elasticity, and thus a rubber plateau
   True/false

2. Thermoplastics which are in glass state are usually transparent
   True/false

3. The lower melt temperature of polymers compared to metals is due to the covalent bonds in polymers which are weaker compared to metallic bonds
   True/false

4. A unit cell of a polymer crystal is a big as the polymer chain
   True/false

Exercise 2:
Select the correct answer(s) (more than one answer can be correct)

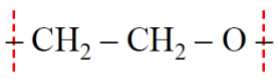
1. Thermoplastic materials
   a. Can easier be recycled than a thermoset material
   b. Are very common packaging materials
   c. Are always purely amorphous
   d. Have permanent cross-links between the polymer chain

2. Polymers are…
   a. Chain-like molecules where repeating units are covalently bound
   b. Always synthetic materials
   c. Often fully crystalline
   d. Mostly organic molecules

3. The radius of a polymer coil is…
   a. Larger in a poor solvent then in a good solvent
   b. Larger in polymer melt than in a good solvent
   c. Much smaller than the length of the polymer
   d. Has a higher entropy than the stretched chain

Exercise 3: Molecular weight and polydispersity

a) What is the polydispersity of poly(ehtyleneoxide)



With the following distribution:
10% of the molecules have N= 98
20% of the molecules have N= 99
40% of the molecules have N=100
20% of the molecules have N= 101

10% of the molecules have N= 102

b) Is this considered polydisperse for a polymer?

Exercise 4: In water, poly(ethylene oxide) has a Kuhn length of 0.72 nm and a monomer length of 0.28nm.
What is the expected end to end distance of 20 kg/mol coil in a random walk configuration?

Exercise 5:
Make an educated (well-motivated) guess about which polymer will give which material properties at room temperature: (1) hard and brittle, (2) elastic (at least a little bit) and (3) viscoelastic.