Name_____

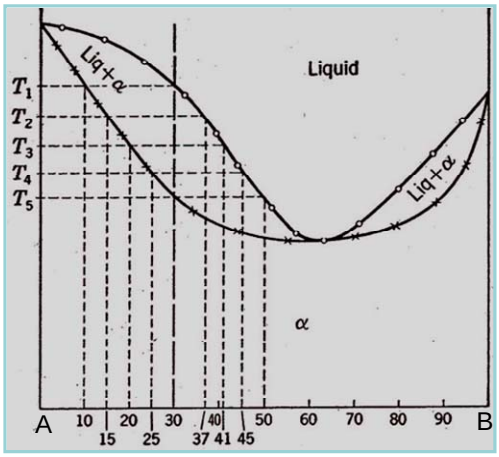
MSE 2001 Quiz 19 July 2011

1. What is the number average degree of polymerization for a polyethylene [-(CH_2CH_2)$_n$-] with number average molecular weight of 100 kg/mol?

2. What is the weight average molecular weight for a polymer sample composed of 5 moles of 10 kg/mol, 5 moles of 15 kg/mol, and 5 moles of 20 kg/mol chains?

3. What is the mole fraction of carbon in iron for a steel that contains 0.4 wt% carbon?

4. At the temperature marked T4 in the phase diagram below, what are the components and their compositions for an alloy composition of 30% B?



5. At the temperature marked T4 in the phase diagram, what are the components and their fractions for an alloy composition of 30% B?

Bonus:

6. Compute Young's modulus for a material that yields at an applied stress of 207 MPa and an elastic strain of 0.1%.

7. A metal tensile bar, 10-mm in diameter and 5-cm long, exhibits a yield strength of 400 MPa, an elastic modulus of 70 GPa, and an ultimate tensile strength of 500 MPa. What is the maximum load that this sample withstands during this test?

$\sigma(t) = \sigma_o exp(-t/\tau)$, $\sigma = F/A_0$, $\varepsilon = (l - l_o)/l_o$, $E = \sigma/\varepsilon$, $N_{Av} = 6.02 \times 10^{23}$, C = 12 g/mol, Fe = 55.8 g/mol, $M_n = \sum N_i M_i / \sum N_i$, $M_w = \sum N_i M_i^2 / \sum N_i M_i$, PDI = M_w/M_n, $DP_n = M_n/M_{RU}$
$f_L = (X_S - X_0)/(X_S - X_L)$, $f_S = (X_0 - X_L)/(X_S - X_L)$

Name_____

1. 3571
2. 16,111 g/mol
3. 0.018 or 1.8%
4. solid α is 0.25 B, liquid is 0.45 B
5. 75% solid α, 25% liquid
6. 207 GPa
7. 39,000 N