Assignment-1

Heat treatment and Surface hardening – II

NPTEL-Mooc-1st week

1) During homogeneous solidification of a pure metal from its molten state, very low nucleation rate and very high growth rate will result into the microstructure consisting of
   a) very coarse grains
   b) very fine grains
   c) mixture of fine and coarse grains
   d) different for different metal

2) If the interfacial energy increases by 15%, the homogeneous nucleation barrier for spherical particle increases by______________.
   a) 26%
   b) 33%
   c) 52%
   d) 72%

3) If the nucleation barrier at 5°C of undercooling is $10^{-18}$ J, the nucleation barrier at 10°C of undercooling is______________.
   a) $2 \times 10^{-18}$ J
   b) $4 \times 10^{-18}$ J
   c) $2.5 \times 10^{-19}$ J
   d) $5 \times 10^{-19}$ J

4) Recrystallization kinetics for metal A at a constant temperature is such that time required for 20% and 40% recrystallization are 50 min and 63 min, respectively. The constant ‘n’ in the Avrami equation $x = 1 - \exp (-k(t^n))$ is __________.
   a) 1.2
   b) 2.1
   c) 3.6
   d) 5.6

5) In question no. 4, the constant ‘k’ in the Avrami equation is__________ $\times 10^7$.
   a) 1.7
   b) 0.4
   c) 2.8
   d) 4.3
6) In question no. 4, time required for 70% recrystallization will be __________ minutes.
   a) 70
   b) 80
   c) 100
   d) 120

7) As compared to the growth-rate maximum, the nucleation rate maximum is at
   a) a lower temperature
   b) a higher temperature
   c) the same temperature
   d) the temperature of maximum transformation rate

8) A metal nucleates as sphere in a melt. If $\gamma_{sl} = 110 \text{ mJ/m}^2$ and $\Delta G_v = -10^8 \text{ J/m}^3$, the ratio of critical radius of spherical and critical edge length of cubed shape nucleus is ______________.
   A) 0.25
   B) 0.5
   C) 0.75
   D) 1.0

9) During homogeneous nucleation of a pure metal, with decrease in transformation temperature the volume of critical nucleus
   a) first increases then decreases
   b) first decreases then increases
   c) decreases
   d) increases

10) During the homogeneous nucleation of a pure metal, if the nucleation rate is below the critical nucleation rate
    a) solidification takes place rapidly
    b) solidification depends on the crystal structure of the metal
    c) liquid remain as supercooled liquid
    d) None of these