Assignment 6

EE24Btech11024 - G. Abhimanyu Koushik

1) The Miller indices of the first three Bragg peaks in the X-ray diffraction pattern obtained from a polycrystalline iron sample at room temperature are

(XE 2017)

a) (111), (200), (220) b) (100), (110), (111) c) (100), (110), (200) d) (110), (200), (220)

2) The number of close packed planes in the lattice of an FCC metal is

(XE 2017)

a) 2 b) 4 c) 6 d) 12

3) Which of the following treatment(s) can increase the electrical conductivity of silicon?

(i) Heating
(ii) Doping with arsenic
(iii) Doping with aluminum
(iv) Exposure to light

(XE 2017)

a) Only (i)
b) Only (i) and (ii)
c) Only (i), (ii) and (iv)
d) All (i), (ii), (iii) and (iv)

4) The unit cell volume of polyethylene (PE) is 0.0933 nm^3. Assuming two ethylene repeat units are contained within each unit cell, the density of a totally crystalline PE will be _____ g/cm^3. (Take the atomic weights for carbon and hydrogen as 12.01 g/mol and 1.008 g/mol, respectively and Avagadro's number as 6.023×10^{23} repeat units/mol)

(XE 2017)

5) A continuous and aligned carbon fibre (CF) reinforced polymer composite with 30% of CF and rest resin was designed for a specific application. The modulus of elasticity of CF is 170 GPa and that of resin is 3.0 GPa. The modulus of elasticity for this composite in the direction of fibre alignment is _____ GPa.

(XE 2017)

6) Match the composites in Column I with the most suitable application in Column II

Column I	**Column II**
P. Exfoliated silicates filled butyl rubber	1. Automobile pistons
Q. Fibre reinforced aluminium alloy	2. Contact lenses
R. Silicon carbide whiskers reinforced alumina	3. Ski boards
S. Carbon particles reinforced plastic composites	4. Tennis balls
	5. Cutting tool inserts for machining

(XE 2017)

a) P-4, Q-1, R-5, S-3
b) P-2, Q-3, R-4, S-5
c) P-3, Q-5, R-5, S-3
d) P-2, Q-1, R-3, S-5

7) Match the processes in Column *I* with products in Column *II*

Column I	**Column II**
P. Slip casting	1. Metal powders
Q. Zone refining	2. Thin films
R. Sputtering	3. Ceramic parts
S. Atomization	4. Single crystal
	5. Metal sheets

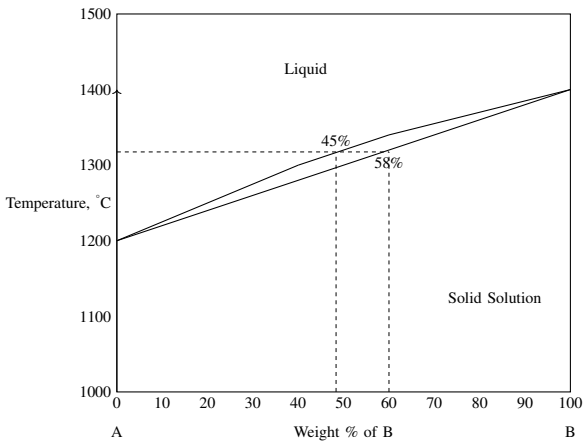
(XE 2017)

a) P-3, Q-4, R-2, S-1
b) P-2, Q-1, R-2, S-1
c) P-3, Q-4, R-5, S-1
d) P-3, Q-4, R-1, S-5

8) The value of diffusivity (D) for the diffusion of carbon (C) in $\gamma-$iron at $1300°C$ is _____$\times 10^{-13}\ m^2/s$. $\left(\text{Given } D_0 = 2 \times 10^{-5}\ m^2/s;\ \text{activation energy } Q = 142\ kJ/mol;\ R = 8.314\ J/mol \cdot K\right)$

(XE 2017)

9) Refer to the figure below:



If the alloy contains 47 wt. % of A and 53 wt. % of B at $1300°C$, the wt. % of liquid present in the alloy at this temperature will be _____

(XE 2017)

10) Which of the following statement(s) is/are true

(i) All piezoelectric materials are necessarily ferroelectric
(ii) All ferroelectric materials are necessarily piezoelectric
(iii) All pyroelectric materials are necessarily piezoelectric
(iv) All pyroelectric materials are necessarily ferroelectric

(XE 2017)

a) (i) and (ii)
b) (ii) and (iii)
c) (i) and (iv)
d) (ii) and (iv)

11) If the energy of formation of vacancies in pure copper is 0.9 eV, the fraction of vacancies in pure copper at $27°C$ will be _____$\times 10^{-16}$. $\left(\text{Boltzmann's constant is } 8.62 \times 10^{-5}\ eV/K\right)$

(XE 2017)

12) A ceramic material with a critical flaw size of 30 μm has fracture stress of 300 MPa. For the same material the fracture stress for a critical flaw size of 90 μm will be _____ MPa.

(XE 2017)

13) An inorganic material that is transparent under solar light appears coloured when doped with transition metal ions. The possible reason(s) for the colour is/are

(i) The electronic energy levels of the host material changes significantly by doping
(ii) The doped element selectively absorbs certain wavelength of light other than the perceived colour
(iii) The doped element emits radiation of specific wavelength

(XE 2017)

a) Only (i) b) Both (i) and (ii) c) Both (i) and (iii) d) Both (ii) and (iii)