2007-CE-69-85

EE24BTECH11050 - Pothuri Rahul

Q. 10 - Q. 22 carry two marks each

10) Match the properties in Column I with the appropriate units in Column II

Column I	Column II
P. Thermal diffusivity	1. Hm^{-1}
Q. Fracture toughness	2. m^2s^{-1}
R. Surface energy	3. Fm^{-1}
S. Magnetic permeability	4. $Nm^{-\frac{3}{2}}$
	Jm^{-2}

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

11) Match the characterization techniques in Column I with Column II

Column I	Column II
P. Scanning tunneling microscopy	1. No vacuum required
Q. Scanning electron microscopy	2. Backscattered electrons
R. Transmission electro microscopy	3. Photoelectrons
S. Atomic force microscopy	4. Atomically sharp tip
	5. Sub-Angstrom resolution

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

12) Match the materials in Column I with the applications in Column II

Column I	Column II
P. Titanium diboride	1. Photocatalyst
Q. Molybdenum disilicide	2. Furnace heating element
R. Hydroxyapatite	3. Ultra high temperature material
S. Nanocrystalline titanium oxide	4. Tough ceramic
	5. Artificial bone implant

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

13) Match the properties in column I with the options in Column II

Column I	Column II
P. Toughness	1. Resistance to plastic deformation
Q. Resilience	2. Time dependent permanent deformation under constant load
R. Creep	3. Total elongation at failure
S. Hardness	4. Area under Stress-strain graph
	5. Area under the elastic part of the stress-strain curve

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

14) Determine the mole fraction of vinyl chloride in a copolymer of vinyl chloride (CH_2CHCl) and vinyl acetate ($CH_2 - CH - OCOCH_3$) having molecular weight of $10520 g/mol$ and degree of polymerization of 160.

a) 0.14 b) 0.30 c) 0.70 d) 0.86

15) The electron concentration in an n-type semiconductor is $5 \times 10^{18}/m^3$. If the drift velocity of electrons is $100 m/s$ in an electric fieldof $500 V/m$, calculate the conductivity of the semiconductor.

a) $0.16 \times 10^{-1} S/m$ b) $1.6 \times 10^{-1} S/m$ c) $2.50 \times 10^{-1} S/m$ d) $30.05 \times 10^{-1} S/m$

16) Calculate tehe saturation magnetization (M_{sat}) for bcc iron of lattice parameter 2.866Å.

a) $0.76 \times 10^6 A/m$ b) $1.5 \times 10^6 A/m$ c) $3.15 \times 10^6 A/m$ d) $4.73 \times 10^6 A/m$

Common Data Questions Common data questions for 17 and 18 :
A plain $0.45 wt.\%$ carbon steel is cooled slowly from $900°C$ to just below the eutetoid temperature ($723°C$) so that the following reaction occurs:

$$\gamma\,(0.8 wt.\%c) \leftrightarrow \alpha\,(0.02 wt.\%c) + Fe_3C\,(6.67 wt.\%c)$$

17) During cooling from $900°C$ to $700°C$, the proeutectoid α forms from γ. Find the volume % of proeutectoid α just below $723°C$ for the steel.

a) 44.9% b) 66.1% c) 55.1% d) 34.9%

18) Find the volume % of pearlite for the steel just below $723°C$ for 0.45% carbon steel.

a) 44.9% b) 55.1% c) 40.9% d) 59.1%

Common data questions for 19 and 20 :
A $20 kN$ tensile load is applied axially to a steel bar of cross-section area $8 cm^2$ and $1 m$ length. The Young's modulus of steel (E_{steel}) is $200 GPa$, and of aluminium (E_{Al}) is $70 GPa$. The Poisson's ratio (v) can be taken as 0.3.

19) When the same load is applied to an aluminium bar, it is found to give same elastic strain as the steel. Calculate the cross-section area of the aluminium bar.

a) $11.43 cm^2$ b) $14.93 cm^2$ c) $18.26 cm^2$ d) $22.86 cm^2$

20) Calculate the final area of the steel bar after the deformation under the applied load of $20 kN$.

a) $7.9cm^2$ b) $9.7cm^2$ c) $7.0cm^2$ d) $8.1cm^2$

Linked Answer Questions

Statement for Linked answer questions 21 and 22 :

Chromium has the bcc structure with atomic diameter of 2.494Å

21) Calculate the lattice parameter of chromium assuming tight atomic bonding.

a) 1.442Å b) 2.880Å c) 4.323Å d) 5.764Å

22) Find the first diffraction peak position (2θ) for Cu $K\alpha$ radiation with a wavelength of 1.54Å

a) 21.76° b) 33.05° c) 44.43° d) 66.10°