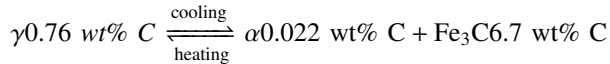


2011-XE-'53-65'

EE24BTECH11057 - SHIVAM SHILVANT*

- 10) A plain carbon steel was annealed just above the eutectoid temperature. Microstructural analysis revealed that the proeutectoid ferrite content was 30 wt % .The eutectoid reaction in the iron-iron carbide phase diagram is given below :



The carbon content of the steel in wt% is 4

- a) 0.24
b) 0.34
c) 0.44
d) 0.54
- 11) Match the materials in **Column-I** with the descriptions in **Column-II**. 2

Column-I	Column-II
P. Zirconia	1. Ultra-hard material
Q. Cubic boron nitride	2. High temperature superconductor
R. Hafnium carbide	3. Transformation toughening
S. Yttrium aluminium garnet	4. Ultra-high temperature material
	5. Host material for laser
	6. Micro-crack toughening

- a) P-3, Q-4, R-1, S-2
b) P-6, Q-1, R-4, S-2
c) P-3, Q-1, R-4, S-5
d) P-4, Q-6, R-1, S-5
- 12) Match the materials in **Column-I** with the descriptions in **Column-II**. 2

Column-I	Column-II
P. Polyacrylonitrile	1. Hard and brittle material
Q. Nylon-6,6	2. Very high temperature resistant polymer
R. Polytetrafluoroethylene (PTFE)	3. H-bonding
S. Ebonite	4. Acrylic fibre
	5. Rubber
	6. Polyester fibre

- a) P-6, Q-3, R-2, S-1
b) P-2, Q-6, R-4, S-5
c) P-4, Q-2, R-6, S-5
d) P-4, Q-6, R-1, S-5
- 13) Match the materials in **Column-I** with the descriptions in **Column-II**. 2
- a) P-6, Q-5, R-2, S-1
b) P-4, Q-5, R-2, S-1

Column-I	Column-II
P. Differential scanning calorimetry	1. Residual stress measurement
Q. Atomic force microscopy	2. Surface morphology of a material
R. Scanning electron microscopy	3. Incident beam passes through a thin sample
S. X-ray diffraction	4. Thermal expansion measurement
	5. Resolution less than 1 nm is possible
	6. Measurement of enthalpy change

c) P-4, Q-1, R-3, S-2

d) P-6, Q-1, R-5, S-3

14) Match the materials in **Column-I** with the descriptions in **Column-II**. 2

Column-I	Column-II
P. Thermal conductivity	1. H m^{-1}
Q. Dielectric strength	2. Wb m^{-2}
R. Magnetic permeability	3. $\text{W m}^{-1}\text{K}^{-1}$
S. Capacitance	4. V m^{-1}
	5. C V^{-1}
	6. $\text{J mol}^{-1}\text{K}^{-1}$

a) P-6, Q-4, R-2, S-5

b) P-3, Q-5, R-1, S-4

c) P-3, Q-4, R-1, S-5

d) P-6, Q-5, R-1, S-4

15) It takes 4 h for carburising a steel at 900°C . If the same carburising is to be accomplished in 2 h, what should be the temperature? The activation energy of diffusion of carbon in the steel is 151 kJ mol^{-1} . 4

a) 850°C

b) 955°C

c) 1015°C

d) 1228°C

16) A steel specimen 12mm diameter and 60mm length undergoes elastic deformation under tension. The deformed specimen experiences a longitudinal strain of 0.001. If the Poisson's ratio is 0.3, the diameter of the deformed specimen in mm is 4

a) 12.0120

b) 11.9964

c) 11.9964

d) 11.9880

Common Data Questions

Common Data for Questions 17 and 18:

The first peak in the powder X-ray diffraction pattern of an FCC metal appears at a Bragg angle of 19.2° . The wavelength of Cu-K_α radiation used is 0.154 nm.

17) The lattice parameter of the metal in nm is

40.4505 0.4055 0.3505 0.3055

- 18) The full width at half maximum FWHM of the first peak is 0.35° . Ignoring micro-strain and instrumental broadening, the crystallite size of the sample in nm is
420 24 200 240

Common Data for Questions 19 and 20:

For an intrinsic semiconductor, the mobilities of free electrons and holes are $0.14 \text{ m}^2\text{V}^{-1}\text{s}^{-1}$ and $0.038 \text{ m}^2\text{V}^{-1}\text{s}^{-1}$, respectively. Its bandgap is 1.107 eV and electrical conductivity at 300 K is $3.99 \times 10^{-4} \Omega^{-1}\text{m}^{-1}$.

- 19) The free electron concentration in m^{-3} at 300 K is
 413.99×10^{15} 27.98×10^{15} 13.99×10^{17} 27.98×10^{17}

20) What is the temperature at which the conductivity of the semiconductor is $0.399 \Omega^{-1}\text{m}^{-1}$? 4

- 1) 343 K
- 2) 443 K
- 3) 493 K
- 4) 543 K

Linked Answer Questions

Statement for Linked Answers Questions 21 and 22:

A continuous and aligned glass fibre reinforced composite has a modulus of elasticity of 150 GPa in the longitudinal direction. The matrix is a polyester resin with a modulus of 4.5 GPa . The glass fibre has a modulus of 340 GPa .

The volume fraction of the glass fibres is 4

- 1) 0.398
- 2) 0.434
- 3) 0.497
- 4) 0.566

If the cross-sectional area of the composite is 300 mm^2 , and a stress of 100 MPa is applied in the longitudinal direction, what will be the total load in kN carried by the glass fibres?

2

- 1) 0.5
- 2) 5
- 3) 20.5
- 4) 29.5