

**POSTAL**  
**Book Package**

**2023**

**GATE • PSUs**

**PRODUCTION AND  
INDUSTRIAL ENGINEERING**

**Objective Practice Sets**

**General Engineering : Volume I**

**Engineering Materials**



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Publications

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# Engineering Materials

- Q.1** In metals subjected to cold working, strain hardening effect is due to
- slip mechanism
  - twining mechanism
  - dislocation mechanism
  - fracture mechanism

- Q.2.** Which of the following properties of a solid are dependent on crystal imperfections?
- Yield stress
  - Melting point
  - Semiconductivity
  - Ductility
- Select the correct answer using the codes given below:
- 1 and 3
  - 1, 3 and 4
  - 2, 3 and 4
  - 2 and 4

- Q.3** Match **List-I** (Material) with **List-II** (Structure) and select the correct answer using the codes given below the lists:

List-I	List-II
A. Charcoal	1. F.C.C.
B. Graphite	2. H.C.P.
C. Chromium	3. Amorphous
D. Copper	4. B.C.C.

**Codes:**

	A	B	C	D
(a)	3	2	1	4
(b)	3	2	4	1
(c)	2	3	4	1
(d)	2	3	1	4

- Q.4** A sample containing 3.1% carbon is cooled slowly from liquid phase to a temperature just above the eutectic temperature. The ratio of austenite to liquid phase amount for the sample at the same temperature is \_\_\_\_\_.

- Q.5** Match **List-I** (Crystal structure) with **List-II** (Atomic packing factor) and select the correct answer using the codes given below the lists:

List-I	List-II
A. Simple cubic	1. 74%
B. Body-Centred cubic	2. 74%

- Face-Centred cubic
- 52%
- Hexagonal close packed
- 68%

**Codes:**

	A	B	C	D
(a)	3	4	2	1
(b)	4	3	2	1
(c)	3	4	1	2
(d)	4	3	1	2

- Q.6** Gibb's phase rule is given by ( $F$  = number of degree of freedom  
 $C$  = number of components  
 $P$  = number of phases)
- $F = C + P$
  - $F = C + P - 2$
  - $F = C - P - 2$
  - $F = C - P + 2$

- Q.7** Atomic packing factor (APF) in the case of copper crystal is

- 0.52
- 0.68
- 0.74
- 1.633

- Q.8** Match **List-I** (Name of the Element) with **List-II** (Crystal Structure) and select the correct answer using the codes given below the lists:

**List-I**

- Fluorspar
- Alpha-Iron
- Silver
- Zinc

**List-II**

- Body-centred cubic
- Hexagonal close packed
- Simple cubic
- Face-centred cubic

**Codes:**

	A	B	C	D
(a)	3	2	4	1
(b)	4	1	3	2
(c)	4	2	3	1
(d)	3	1	4	2

Answers		Engineering Materials						
1. (c)	2. (b)	3. (b)	4. (1.154)	5. (a & c)	6. (d)	7. (c)	8. (d)	9. (c)
10. (b)	11. (b)	12. (c)	13. (a)	14. (b)	15. (b)	16. (c)	17. (c)	18. (b)
19. (c)	20. (c)	21. (d)	22. (b)	23. (a)	24. (d)	25. (b)	26. (b)	27. (a)
28. (b)	29. (d)	30. (a)	31. (c)	32. (b)	33. (c)	34. (d)	35. (d)	36. (a)
37. (d)	38. (c)	39. (b)	40. (c)	41. (b)	42. (a)	43. (b)	44. (b)	45. (a)
46. (d)	47. (c)	48. (d)	49. (d)	50. (b)	51. (c)	52. (c)	53. (d)	54. (c)
55. (c)	56. (d)	57. (d)	58. (a)	59. (d)	60. (b)	61. (c)	62. (c)	63. (d)
64. (d)	65. (c)	66. (a)	67. (a)	68. (c)	69. (b)	70. (c)	71. (a)	72. (b)
73. (b)	74. (a)	75. (d)	76. (c)	77. (c)	78. (a)	79. (b)	80. (d)	81. (d)
82. (c)	83. (b)	84. (a)	85. (c)	86. (c)	87. (d)	88. (c)	89. (b)	90. (c)
91. (a)	92. (b)	93. (a)	94. (b)	95. (d)	96. (d)	97. (b)	98. (a)	99. (d)
100. (b)	101. (c)	102. (b)	103. (c)	104. (d)	105. (b)	106. (b)	107. (b)	108. (a)
109. (b)	110. (a)	111. (d)	112. (c)	113. (c)	114. (b)	115. (a)	116. (1.221)	117. (d)
118. (a)	119. (a)	120. (c)	121. (c)	122. (3.5)	123. (160)	124. (d)	125. (b)	126. (c)
127. (d)	128. (d)	129. (c)	130. (c)	131. (a)	132. (d)	133. (b)	134. (b)	135. (a)
136. (d)	137. (d)	138. (b)	139. (c)	140. (b)	141. (c)	142. (a)	143. (c)	144. (1.246)
145. (4)	146. (c)	147. (d)	148. (d)	149. (32)				

**Explanations Engineering Materials**

1. (c)

Dislocation mechanism is responsible for strain hardening.

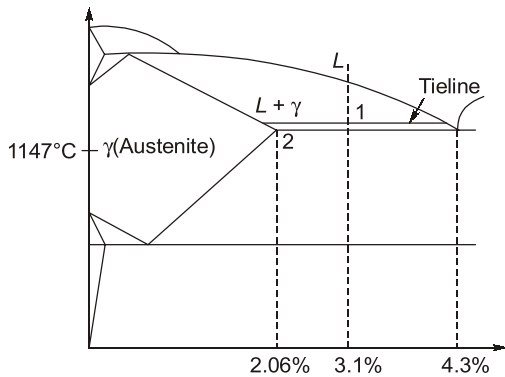
2. (b)

Melting point is not affected by crystal imperfection semiconductivity is affected by point defect.

3. (b)

BCC : Li, Na, K, Rb, Cs, Fr, Cr, Fe ( $\alpha$  iron and  $\delta$  iron), Mo, Ta, W, V, Zr, Ti  
 FCC : Ac, Al, Ca, Ce, Cu, Au, Ir, Pb, Ni, Pd, Pt, Fe ( $\gamma$  iron), Rn, Rh, Ag, Sr, Th, Yb  
 HCP : Be, Cd, Co, Mg, Os, Re, Ti, Zn, Zr and He  
 Amorphous : Glass, Charcoal

4. (1.154)



Applying lever rule at (1)

$$C_{\gamma} = \frac{C_{\text{Eutectic}} - C_1}{C_{\text{Eutectic}} - C_2}$$

and 
$$C_L = \frac{C_1 - C_2}{C_{\text{Eutectic}} - C_2}$$

So, 
$$\frac{C_{\gamma}}{C_L} = \frac{C_{\text{Eutectic}} - C_1}{C_1 - C_2}$$

$$\frac{C_{\gamma}}{C_L} = \frac{4.3 - 3.1}{3.1 - 2.06} = 1.154$$

$$\text{Sum} = 8 + 12 + 12 = 32$$

5. (a & c)

Both (a) & (c) are correct.

Crystal structure : APF

Simple cubic : 0.52

BCC : 0.68  
 FCC : 0.74  
 HCP : 0.74

6. (d)

$P + F = C + 2$  Gibb's phase rule

7. (c)

Copper is an example of FCC structure for which APF is 0.74

8. (d)

BCC : Li, Na, K, Rb, Cs, Fr, Cr, Fe ( $\alpha$  iron and  $\delta$  iron), Mo, Ta, W, V, Zr, Ti  
 FCC : Ac, Al, Ca, Ce, Cu, Au, Ir, Pb, Ni, Pd, Pt, Fe ( $\gamma$  iron), Rn, Rh, Ag, Sr, Th, Yb  
 HCP : Be, Cd, Co, Mg, Os, Re, Ti, Zn, Zr and He  
 Amorphous : Glass, Charcoal

9. (c)

Crystal Structure	Coordination No.
Simple cubic	6
BCC	8
FCC, HCP	12

10. (b)

11. (b)

Grain boundary is planar defect.  
 Point defect : Vacancy, interstitial impurity, substitutional impurity, self substitution, self interstitial. Frenkel  
 Line defect : Edge and screw dislocation  
 Planar defect : Grain boundary, twin boundary stacking fault. Low angle boundary

12. (c)

The correct option is (c) i.e., all the three statements are correct.

- As the metallic bond is non-directional, many metals tend to form highly symmetrical close-packed structures, which result in their relatively high densities. The most common and important are face centered cubic (FCC) and hexagonal close packet (HCP) structures.