1

General Metallurgy

1. Metal hardness determines its resistance to
(*a*) scratching, wear & penetration.
(*b*) machinability.
(*c*) cutting ability
(*d*) all (*a*), (*b*) & (*c*).

2. Brinell & Vickers hardness values are almost identical upto a hardness of
(*a*) 60 (*b*) 130
(*c*) 235 (*d*) 300.

3. In which of the hardness tests, the height of first rebound of a hammer being dropped freely is taken as the index of hardness ?
(*a*) Rockwell & Brinell tests
(*b*) Vickers test
(*c*) Shore test
(*d*) None of these.

4. Duplex process of steel making is practised in the steel plant located at
(*a*) Bokaro (*b*) Bhilai
(*c*) Tata (*d*) Rourkela

5. In general, metals at low temperatures (sub-zero), have more..... strength.
(*a*) tensile (*b*) yield
(*c*) both (*a*) & (*b*) (*d*) neither (*a*) nor (*b*).

6. If molten metal is poured into a mould and allowed to solidify, then it shrinks
(*a*) in the liquid state
(*b*) due to solidification
(*c*) in the solid state
(*d*) all (*a*), (*b*) & (*c*).

7. Which Indian steel plant does not use only L. D. converters for steel making?
(*a*) Rourkela steel plant
(*b*) Bhilai steel plant
(*c*) Bokaro steel plant
(*d*) Vizag steel plant

8. Which of the following defects is not produced in steel ingots & casting due to solidification shrinkage ?
(*a*) Piping (*b*) Gas holes
(*c*) Both (*a*) & (*b*) (*d*) Neither (*a*) nor (*b*).

9. Which Indian steel plant has stamped coal charging facility in some of its coke ovens batteries ?
(*a*) Rourkela (*b*) Durgapur
(*c*) Tata (*d*) Bokaro

10. Which is not a requisite of moulding sand ?
(*a*) High temperature resistance.
(*b*) Satisfactory bond strength.
(*c*) Permeability to gases.
(*d*) None of these.

11. Wrought iron
(*a*) can accommodate sudden & excessive shocks without permanent injury.
(*b*) is used for chains, anchors, railway coupling & crane hooks.
(*c*) can be annealed to avoid sudden failure.
(*d*) all (*a*), (*b*) & (*c*).

12. Which is not a deoxidiser of steel ?
(*a*) Nickel (*b*) Ferro-manganese
(*c*) Ferro-silicon (*d*) Aluminium.

13. Height of most of the coke ovens in Indian steel plants (except Vizag steel plant) is about ..... metres.
(*a*) 5. (*b*) 7.
(*c*) 3. (*d*) 9.

14. 7 metres tall coke ovens are located at (apart from one battery at Bhilai).....steel plant.
(*a*) Vizag (*b*) Rourkela
(*c*) Bokaro (*d*) Salem.

15. Which of the following steel making processes employs air blowing?
(*a*) L.D. process.
(*b*) IRSID/CAFL process.
(*c*) Kaldo rotary furnace.
(*d*) Bessemer converter.

16. Pressure of oxygen blown in L.D. converter is about..... kgf/cm^2.
(*a*) 1-5 (*b*) 15-20
(*c*) 45-50 (*d*) 90-100.

17. The maximum speed of Kaldo rotary furnace is about.....rpm.
(*a*) 1 (*b*) 30
(*c*) 100 (*d*) 500.

18. Cementite is
(*a*) a compound of iron & carbon (6.67%).
(*b*) hard (Brinell hardness 600+) & brittle.
(*c*) chemically Fe_3C
(*d*) all (*a*), (*b*) & (*c*).

19. 0.87 percent carbon steel contains.....percent pearlite.
(*a*) 20 (*b*) 50
(*c*) 80 (*d*) 100.

20. Presence of free cementite in plain carbon steel
(*a*) increases its hardness.
(*b*) reduces its strength.
(*c*) both (*a*) & (*b*).
(*d*) neither (*a*) nor (*b*).

21. Which allotropic form of iron has a face centred cubic (fcc) structure?
(*a*) α–iron (*b*) β–iron
(*c*) γ–iron (*d*) δ– iron.

22. Which Indian steel plant has the largest installed steel production capacity ?
(*a*) Rourkela steel plant.
(*b*) Vizag steel plant.
(*c*) Bhilai steel plant.
(*d*) Durgapur steel plant.

23. Razors are made of ..... steel.
(*a*) mild (*b*) low carbon
(*c*) medium carbon (*d*) high carbon.

24. In high carbon steels, hardness is obtained at the expense of
(*a*) ductility (*b*) toughness
(*c*) both (*a*) & (*b*) (*d*) neither (*a*) nor (*b*).

25. Annealing can not
(*a*) soften the steel and improve machinability.
(*b*) relieve internal stresses induced by rolling, forging or uneven cooling.
(*c*) remove coarseness of grain.
(*d*) none of these.

26. Specific energy consumption in Indian steel plants is about ..... G Cal/ton crude steel.
(*a*) 7.0 – 9.5 (*b*) 4 – 5
(*c*) 12 – 13 (*d*) 9 – 11.
(1 G Cal = 10^9 Calories)

27. Hadfield's manganese steel
(*a*) contains 12-14% Mn and 1% C.
(*b*) has great resistance to wear.
(*c*) is used for rock drills & stone crushers.
(*d*) all (*a*), (*b*) & (*c*).

28. High speed steel is softened by
(*a*) tempering at 400°C followed by quenching.
(*b*) normalizing at 1250°C.
(c) annealing at 850°C (for 4 hours) followed by slow cooling.
(*d*) all (*a*), (*b*) & (*c*).

29. Which is the chief alloying element in stainless steel which inhibits corrosion ?
(*a*) Chromium (*b*) Silicon
(*c*) Nickel (*d*) Carbon.

30. Which is not an integrated steel plant ?
(*a*) Rourkela steel plant.
(*b*) Bhilai steel plant.
(*c*) Durgapur steel plant.
(*d*) Salem steel plant.

31. Stainless steel sheets (by cold rolling) are produced in ..... steel plant.
(*a*) Bokaro (*b*) Bhilai
(*c*) Durgapur (*d*) Salem

32. Melting temperature of cast iron is.....^oC.
(*a*) 900 – 950 (*b*) 1140 – 1200
(*c*) 1350 – 1400 (*d*) 1400 – 1500.

33. Which property of the material is the most important in its rolling or forging ?
(*a*) Ductility (*b*) Malleability
(*c*) Hardness (*d*) Creep.

34. Wrought iron is never shaped by
(*a*) hammering (*b*) pressing
(*c*) casting (*d*) forging

35. Which one contains the least percentage of carbon ?
(*a*) Pig iron
(*b*) Wrought iron
(*c*) High speed steel
(*d*) Cast iron.

36. Puddling process is used for the production of
(*a*) pig iron (*b*) mild steel
(*c*) wrought iron (*d*) high alloy steel.

37. Which is not a copper based alloy ?
(*a*) Gun metal (*b*) Brass
(*c*) Bronze (*d*) Monel.

38. Alloy steel plant is located at
(*a*) Rourkela (*b*) Durgapur
(*c*) Bhilai (*d*) Burnpur.

39. Which is not a tin based alloy ?
(*a*) Soft solder (*b*) Babbit metal
(*c*) Nichrome (*d*) Monel.

40. Annealing can not
(*a*) relieve internal stress.
(*b*) improve wear resistance.
(*c*) improve machinability.
(*d*) refine grain structure.

41. Case hardening of low carbon steel can not be done by
(*a*) cyaniding
(*b*) nitriding
(*c*) electroplating
(*d*) induction hardening.

42. Phosphatic iron produces..... steel.
(*a*) tough (*b*) malleable
(*c*) ductile (*d*) brittle.

43. Ferrite is a solid solution of carbide in
(*a*) pearlite (*b*) cementite
(*c*) gamma iron (*d*) alpha iron.

44. Which of the following processes is most economical for achieving reasonable strength without developing internal stresses ?
(*a*) Hardening.
(*b*) Hardening followed by tempering.
(*c*) Normalising.
(*d*) Annealing.

45. Which alloying element does not impart hardness to steel ?
(*a*) Silicon (*b*) Copper
(*c*) Nickel (*d*) Aluminium.

46. Hardness (BHN) of ferrite is about
(*a*) 10 (*b*) 50
(*c*) 100 (*d*) 150.

47. Manganese content in carbon steel is limited to a maximum of .....percent.
(*a*) 1 (*b*) 1.65
(*c*) 2.2 (*d*) 2.6.

48. Nodular iron does not have
(*a*) poor machinability
(*b*) high tensile strength
(*c*) good fluidity
(*d*) low melting point.

49. Which alloying element can not impart high strength to steel at elevated temperature ?
(*a*) Nickel (*b*) Silicon
(*c*) Magnesium (*d*) Manganese.

50. Gamma iron occurs in the temperature range of.....°C.
(*a*) 0 – 770 (*b*) 770 – 910
(*c*) 910 – 1400 (*d*) 1400 – 1639.

51. Which is the most suitable process for improving mechanical properties of steel casting ?
(*a*) Hardening
(*b*) Phase annealing
(*c*) Tempering
(*d*) Recrystallisation annealing.

52. Eutectoid steel has a structure of
(*a*) pearlite (*b*) martensite
(*c*) sorbite (*d*) none of these.

53. Annealing temperature used for relieving internal stresses in welding structure is about.....°C .

(*a*) 300 – 350 (*b*) 500 – 600
(*c*) 800 – 900 (*d*) 1000 – 1100.

54. Which of the following salts is never used in cyaniding process ?
(*a*) Sodium cyanide.
(*b*) Sodium chloride.
(*c*) Sodium hydroxide.
(*d*) Sodium carbonate.

55. Which is not a deoxidiser used for producing 'killed steel' ?
(*a*) Copper.
(*b*) Ferro-silicon.
(*c*) Ferro-manganese.
(*d*) None of these.

56. Ferro magnetic alpha iron occurs in the temperature range of.....°C.
(*a*) 0 – 770 (*b*) 770 – 910
(*c*) 0 – 723 (*d*) 1400 – 1539.

57. Presence of sulphur in pig iron makes it
(*a*) soft (*b*) ductile
(*c*) brittle (*d*) hard

58. Carbon content in commercially available cold rolled steel is about .....percent.
(*a*) 0.1 (*b*) 0.35
(*c*) 0.5 (*d*) 0.8.

59. Hardness (BHN) of cementite is about
(*a*) 300 (*b*) 600
(*c*) 1000 (*d*) 1400.

60. Hypo eutectoid steel has a structure of
(*a*) pearlite & ferrite.
(*b*) pearlite & cementite.
(*c*) cementite & ferrite.
(*d*) none of these.

61. Which alloying element does not improve the machinability of steel?
(*a*) Lead (*b*) Sulphur
(*c*) Silicon (*d*) Phosphorous.

62. Depth of hard case obtained by cyaniding process of surface hardening (using sodium cyanide bath at 850°C for 3 hours) is about.....mm.
(*a*) 0.4 (*b*) 1
(*c*) 1.5 (*d*) 2.2.

63. Creep is predominant even at room temperature in
(*a*) gun metal bearings
(*b*) white metal bearings
(*c*) copper
(*d*) aluminium.

64. Surface hardness (VPN) of the order of ..... is obtained by nitriding operation.
(*a*) 100 (*b*) 500
(*c*) 1000 (*d*) 2000.

65. Which of the following elements of steel reduces its brittleness by combining with sulphur ?
(*a*) Manganese (*b*) Silicon
(*c*) Magnesium (*d*) Vanadium.

66. Austenite is not
(*a*) soft (*b*) ductile
(*c*) malleable (*d*) magnetic

67. Presence of manganese in steel increases its
(*a*) fluidity (*b*) tensile strength
(*c*) ductility (*d*) malleability.

68. Wear resistance property of alloy steel is improved by the addition of
(*a*) nickel (*b*) chromium
(*c*) vanadium (*d*) molybdenum.

69. Minimum percentage of chromium or nickel in austenitic stainless steel is
(*a*) 4 (*b*) 8
(*c*) 18 (*d*) 24.

70. Working of low carbon steel at a high strain rate results in
(*a*) increase in softness.
(*b*) decrease in toughness.
(*c*) increase in ultimate tensile strength.
(*d*) none of these.

71. Eutectoid steel has..... percent carbon.
(*a*) 0.025 (*b*) 0.1
(*c*) 0.8 (*d*) 1.5.

72. Gamma iron has..... cubic crystal structure.
(*a*) body centred (*b*) face centred
(*c*) simple (*d*) none of these.

73. Pig iron is a product of the
(*a*) cupola
(*b*) open hearth furnace

(*c*) electric arc furnace
(*d*) none of these.

74. Blow holes in steel casting is not minimised by the addition of
(*a*) magnesium (*b*) silicon
(*c*) aluminium (*d*) titanium.

75. Which is the most practised method of steel making ?
(*a*) L.D. process.
(*b*) Open hearth furnace.
(*c*) Duplex process.
(*d*) Bessemer process.

76. Out of the following, which is the most common process of steel making ?
(*a*) Basic Bessemer process.
(*b*) Acid Bessemer process.
(*c*) Duplex process.
(*d*) Open hearth furnace.

77. Carbon percentage in the steel used for boiler tube manufacture is about
(*a*) 0.5 (*b*) 0.15
(*c*) 0.65 (*d*) 0.35

78. Ductility of low carbon steel falls very rapidly at ..... °C.
(*a*) – 40 (*b*) – 80
(*c*) – 130 (*d*) 0

79. Austenite can be present even at sub-zero temperatures in an alloy steel due to the presence of high percentage of
(*a*) C (*b*) Ni
(*c*) Cr (*d*) Co

80. Structure obtained after austempering of steel (done to improve mechanical properties) is
(*a*) martensite
(*b*) bainite
(*c*) lameller carbide
(*d*) none of these.

81. Carbon content in carbon steel used for making heavy duty leaf and coil spring is about.....percent.
(*a*) 0.1 (*b*) 0.5
(*c*) 1 (*d*) 1.8.

82. The optimum hardening temperature of hyper eutectoid steel is 30 to 50°C ..... critical temperature.
(*a*) above upper (*b*) above lower
(*c*) below lower (*d*) none of these.

83. Normalising (a preliminary treatment before hardening to develop a more desirable grain structure) temperature is in the range of.....°C.
(*a*) 450—500 (*b*) 750—800
(*c*) 1050—1100 (*d*) 200—250.

84. Hyper eutectoid steel parts is subjected to incomplete hardening process due to the reason that
(*a*) cementite is harder than martensite.
(*b*) cementite is harder than pearlite.
(*c*) martensite is harder than cementite.
(*d*) martensite is harder than pearlite.

85. Steel castings subjected to normalising (to improve mechanical properties) is cooled in
(*a*) water (*b*) oil
(*c*) air (*d*) none of these

86. The grain structure obtained after isothermal hardening is
(*a*) pearlite
(*b*) martensite
(*c*) acicular troostite
(*d*) sorbite.

87. Residual austenite in steel (which reduces the lifting power of steel magnet) can be removed (by transforming it into martensite) by cooling it to.....°C.
(*a*) 0 (*b*) – 50 to – 100
(*c*) – 200 to 250 (*d*) 8

88. With decrease of temperature to –150°C from 0°C for most of the metals, the ultimate tensile & yield strength
(*a*) decreases
(*b*) increases
(*c*) remains same
(*d*) may increase or decrease.

89. Admirality brass (used for steam condenser tubes) comprises of
(*a*) 70% Cu + 30% Zn
(*b*) 30% Cu + 70% Zn
(*c*) 70% Cu + 30% Sn
(*d*) 30% Sn + 70% Zn.

90. Nodular iron is formed due to the formation of spheroids by the addition of ..... to molten grey cast iron.
(*a*) manganese (*b*) magnesium
(*c*) silicon (*d*) none of these

91. Bath temperature of steel in L.D. process is measured by a/an
(*a*) resistance thermometer.
(*b*) optical pyrometer.
(*c*) immersion thermo couple.
(*d*) bimetallic thermometer.

92. A solder
(*a*) wets the base metal and is drawn into the joints by capillary action.
(*b*) flows freely over the surfaces *i.e.* spreads and makes contact with the joint opening.
(*c*) solidifies as a sound, firmly adhering film and has an adequate mechanical strength.
(*d*) all (*a*), (*b*) & (*c*).

93. Strain hardening of metal/alloy reduces its
(*a*) strength
(*b*) hardness
(*c*) ductility & plasticity
(*d*) none of these.

94. Hot working of metals
(*a*) introduces residual stress in it.
(*b*) is carried out above its recrystallisation temperature.
(*c*) does not produce strain hardening.
(*d*) is done to obtain very thin sheets.

95. Hardening treatment to steel imparts it
(*a*) no internal strain.
(*b*) no hardness.
(*c*) minimum ductility or maximum brittleness.
(*d*) none of these.

96. With increase of carbon content, the hardening capacity of steels
(*a*) increases
(*b*) decreases
(*c*) remains same
(*d*) may increase or decrease.

97. Sensible heat of hot coke in coke ovens is recovered by
(*a*) dry quenching.
(*b*) preheating the coal charge.
(*c*) wet quenching of coke.
(*d*) none of these.

98. Phosphorous in steel
(*a*) occurs as Fe_3P, which induces cold shortness.
(*b*) is less dangerous in low carbon steels than in high carbon-steel.
(*c*) upto 0.1% is sometimes deliberately added to prevent sticking during the rolling of packs of sheets and in free cutting steels.
(*d*) all (*a*), (*b*) & (*c*).

99. Sulphur in steel
(*a*) occurs as FeS or MnS and induces hot shortness.
(*b*) generally should be < 0.05%.
(*c*) is sometimes deliberately added when used for screw stock and other free cutting steels.
(*d*) all (*a*), (*b*) & (*c*).

100. Alloying elements addition in steels can not improve their
(*a*) magnetic properties.
(*b*) depth of hardening.
(*c*) strength at elevated temperature.
(*d*) none of these.

101. Exposure to very high concentration of..... does not cause pitting corrosion in the immersed steel.
(*a*) H_2SO_4 (*b*) HNO_3
(*c*) O_2 (*d*) FeO

102. The grain structure obtained after austempering of steel (done to improve its mechanical properties) is
(*a*) martensite (*b*) bainite
(*c*) troostite (*d*) carbide.

103. During cooling of steel (C=0.8%) from 1000°C, the pearlite formation occurs at..... °C.
(*a*) 423 (*b*) 723
(*c*) 870 (*d*) 925

104. Pick out the wrong statement.
(*a*) Normalising is a pretreatment process done before hardening to develop a more desirable grain structure.

(*b*) Globular pearlite is obtained by a special annealing process called 'Pendulum Annealing'.
(*c*) Flame hardening comprises of heating the surface of steel parts below the critical temperature by an oxy-acetylene torch followed by sudden cooling.
(*d*) Nitriding operation improves the wear resistance properties of steel spindles.

105. Presence of manganese in steel is desirable upto a certain limit, as it increases its
(*a*) ductility (*b*) fluidity
(*c*) tensile strength (*d*) malleability

106. Nodular iron has a very high tensile strength of the order of..... kgf/cm^2.
(*a*) 1000 (*b*) 2000
(*c*) 4000 (*d*) 8000

107. Minimum percentage of carbon in cast iron is
(*a*) 0.05 (*b*) 0.5
(*c*) 1 (*d*) 2

108. The annealing temperature for relieving the internal stresses in welded structures to prevent distortion is about.....°C.
(*a*) 350 – 450 (*b*) 500 – 600
(*c*) 750 – 850 (*d*) 1000 – 1100

109. The property which makes wrought iron unsuitable for pipe manufacture is its
(*a*) hardness
(*b*) weldability
(*c*) thread cutting ability
(*d*) corrosion resistance

110. Which of the following alloying elements can not impart high strength at elevated temperature to steel ?
(*a*) Silicon (*b*) Manganese
(*c*) Nickel (*d*) Magnesium

111. Maximum percentage of carbon in ferrite is
(*a*) 0.025 (*b*) 0.25
(*c*) 0.05 (*d*) 0.5

112. Maximum percentage of carbon in austenite is
(*a*) 0.025 (*b*) 0.50
(*c*) 1.7 (*d*) 2.3

113. Bath temperature maintained during isothermal annealing of chromium steel by the transformation of supercooled austenite is about.....°C.
(*a*) 350 – 450 (*b*) 600 – 750
(*c*) 800 – 950 (*d*) 1000 – 1150.

114. Carbon percentage in cold rolled steel sheet may be about
(*a*) 0.1 (*b*) 0.4
(*c*) 0.6 (*d*) 0.8

115. Addition of ..... to steel improves its corrosion resistance property.
(*a*) cobalt (*b*) chromium
(*c*) copper (*d*) none of these.

116. Which of the following is used as 'etchant' in metallography of carbon steel ?
(*a*) 2% HNO_3 in water.
(*b*) 2% HNO_3 in C_2H_5OH.
(*c*) 2% HCl in water.
(*d*) none of these.

117. Normalising operation can not improve the ..... of the metal.
(*a*) ductility
(*b*) mechanical properties
(*c*) yield strength (*d*) all 'a', 'b' & 'c'.

118. Presence of ..... in steel does not improve its machinability.
(*a*) sulphur (*b*) phosphorous
(*c*) silicon (*d*) lead

119. In an alloy steel, austenite can be present even at subzero temperatures because of the presence of high percentage of
(*a*) carbon (*b*) aluminium
(*c*) chromium (*d*) cobalt.

120. Pick out the correct statement.
(*a*) Copper is used as a deoxidiser to produce 'killed steel'.
(*b*) Fatigue is the cause of failure of a material under repeated applied fluctuating stresses.
(*c*) Normalising improves the ductility of a metal.
(*d*) Case carburising is the most widely used method of case hardening of steel parts with very high carbon content.

121. Pick out the wrong statement.
(*a*) Ferrite is a solid solution of carbon in the solvent of α–iron.
(*b*) Wear resistance property of alloy steel is improved by nickel.
(*c*) Addition of silicon does not impart hardness to steel.
(*d*) Admirability brass is used for making steam condenser tubes.

122. ..... is essentially added to steel in order to inhibit grain growth in austenite during its heat treatment.
(*a*) Aluminium (*b*) Copper
(*c*) Tin (*d*) none of these.

123. Which of the following is a criteria for determination of hardness of steel ?
(*a*) Percentage of its alloying elements.
(*b*) Percentage of its carbon content.
(*c*) The distribution & shape of carbides in iron.
(*d*) None of these.

124. On severe deformation in a particular direction (as in rolling), a metal becomes
(*a*) anisotropic (*b*) isotropic
(*c*) homogeneous (*d*) ductile

125. For eutectoid steel, the optimum hardening temperature is
(*a*) $T_1 + 30$ to 50^oC (*b*) $T_2 + 30$ to 50^oC
(*c*) $(T_1 - 30)°C$ (*d*) $(T_2 + 30)°C$.
where, T_1 = lower critical temperature, °C
T_2 = upper critical temperature, °C

126. The minimum percentage of nickel or chromium in austenitic stainless steel is
(*a*) 3 (*b*) 6
(*c*) 8 (*d*) 12

127. Constantan is an alloy of nickel and
(*a*) chromium (*b*) iron
(*c*) copper (*d*) tin

128. Pick out the wrong statement.
(*a*) Babbit metal is used as bearing lining.
(*b*) 'Elinvar' (having nickel as the main alloying element) is used for making hair springs for watches and other precision instruments.
(*c*) 'Perminvar' (an alloy of iron, copper & nickel) is widely used in electrical industry due to its exceptional magnetic properties of constant permeability.
(*d*) Ferrite is a solid solution of carbide in gamma iron.

129. Pick out the correct statement.
(*a*) Austenite is a solid solution of carbon in gamma iron.
(*b*) Bell metal is not used for making bells.
(*c*) Constantan is not used for making thermocouples.
(*d*) Tempering of steel castings improves its mechanical properties.

130. In a case carburising process requiring hardening to be done for a thickness of 2 mm ; for a soaking temperature of 930°C, the holding time of heating is about.....hours.
(*a*) 5 – 11 (*b*) 9 – 16
(*c*) 19 – 24 (*d*) 26 – 35.

131. Percentage of copper in 'Perminvar' is about
(*a*) 10 (*b*) 25
(*c*) 40 (*d*) 60

132. Babbit metal is an alloy of tin, copper,
(*a*) and zinc.
(*b*) antimony and bismuth.
(*c*) and antimony.
(*d*) nickel and chromium.

133. Ratio of copper to zinc in utensil grade brass is about
(*a*) 1 : 1 (*b*) 2 : 1
(*c*) 3 : 1 (*d*) 4 : 1

134. Statue grade bronze is composed of
(*a*) 10% Cu + 90% Sn.
(*b*) 10% Sn + 90% Cu.
(*c*) 50% Cu + 50% Sn.
(*d*) 50% Cu + 50% Zn.

135. In flame hardening process, the amount of oxygen consumed is proportional to
(*a*) t (*b*) $1/t$
(*c*) $\sqrt{t}$ (*d*) $1/\sqrt{t}$
where, t = thickness of the hardened layer.

136. In spite of the fact that nitriding process is expensive & complex, it is still used for surface hardening of steel machine parts due to the fact that
(*a*) quenching is not needed.
(*b*) high production rate can be achieved.
(*c*) the hardened part is not distorted.
(*d*) only 800°C furnace temperature is needed.

137. Rubber exhibits
(*a*) plastic properties.
(*b*) linear elastic stress-strain relationship.
(*c*) non linear plastic stress-strain relationship.
(*d*) none of these.

138. During nitriding process ..... gets diffused in the surface layer of steel part.
(*a*) monoatomic nitrogen
(*b*) molecular nitrogen
(*c*) ammonia
(*d*) none of these.

139. Percentage of nickel in 'Elinvar' is about
(*a*) 16 (*b*) 32
(*c*) 48 (*d*) 60.

140. Admiralty brass is composed of
(*a*) 70% Cu + 30% Zn.
(*b*) 30% Cu + 70% Zn.
(*c*) 50% Cu + 50% Zn.
(*d*) 25% Cu + 75% Zn.

141. Those portions of the machine part which do not require surface hardening during nitriding operation, are protected from nitrogen by a layer of
(*a*) asbestos (*b*) copper
(*c*) tin (*d*) none of these

142. 'Alnico' used for making permanent magnets is an alloy comprising of
(*a*) 50% Fe + 20% Al + 20% Ni + 10% Co
(*b*) 50% Fe + 25% Ni + 25% Cr
(*c*) 50% Fe + 25% Al + 25% Cr
(*d*) none of these.

143. Solder is an alloy comprising of tin and
(*a*) lead (*b*) antimony
(*c*) copper (*d*) nickel

144. Bell metal is an alloy comprising of copper and
(*a*) lead (*b*) tin
(*c*) zinc (*d*) nickel

145. The ductility of copper and aluminium ..... when its temperature falls from 0 to – 150°C.
(*a*) increases
(*b*) decreases
(*c*) remains unchanged
(*d*) may increase or decrease ; depends on other factors.

146. The grain structure obtained after isothermal hardening is
(*a*) sorbite (*b*) pearlite
(*c*) acicular troostite
(*d*) martensite

147. ..... of steel castings results in improved mechanical properties.
(*a*) Phase annealing
(*b*) Hardening
(*c*) Recrystallisation annealing
(*d*) Tempering.

148. Out of the following heat treatment processes, which one is the most economical for the attainment of reasonably good strength without developing internal stresses ?
(*a*) Hardening
(*b*) Hardening followed by tempering
(*c*) Normalising
(*d*) Annealing.

149. What will be the result of working of low carbon steel at a high strain rate ?
(*a*) Increase in softness.
(*b*) Increase in ultimate tensile strength (UTS).
(*c*) Decrease in toughness.
(*d*) None of these.

150. Percentages of vanadium, chromium & tungsten are respectively ..... in high speed steel.
(*a*) 1, 4 & 18 (*b*) 4, 8 & 18
(*c*) 4, 14 & 18 (*d*) 4, 8 & 14.

151. The maximum temperature to which a steel part is heated in pendulum annealing is.....°C.
(*a*) 450 (*b*) 750
(*c*) 1050 (*d*) 1250

152. Which of the following can not prevent internal/external quenching cracks during heat treatment ?
(*a*) Austempering (*b*) Martempering
(*c*) Stress relieving through annealing
(*d*) Making the steel part smooth having no projections

153. The cast alloy of 'Hayness Satellite' is an alloy composed of tungsten,
(*a*) chromium & cobalt
(*b*) chromium & vanadium
(*c*) chromium & molybdenum
(*d*) molybednum & vanadium.

154. Pick out the wrong statement.
(*a*) Hayness satellite is superior to the high speed steel.
(*b*) Cyaniding process involves keeping low carbon steel in a cyanide bath maintained at 800°C.
(*c*) Cemented carbide tools (produced by powder metallurgy techniques) are used to cut non-ferrous metals.
(*d*) In bright hardening, the steel part is heated in a salt bath followed by cooling in fused alkaline bath maintained at 100°C above upper critical temperature.

155. Cemented carbide tool is an alloy comprising of tungsten, cobalt and
(*a*) molybdenum (*b*) carbon
(*c*) vanadium (*d*) chromium

156. Which of the following is characterised as a 'noble metal'?
(*a*) Lead (*b*) Silver
(*c*) Barium (*d*) Polonium

157. Amount of energy that a material can absorb before its fracture is a measure of its
(*a*) resilience (*b*) toughness
(*c*) malleability (*d*) ductility

158. High speed steel is commonly designated as
(*a*) 18 : 4 : 1 (*b*) 18 : 8 : 1
(*c*) 18 : 4 : 4 (*d*) 18 : 8 : 4

159. Pick out the wrong statement.
(*a*) Silicon content in silicon transformer steel is about 4-5%.
(*b*) Rail steel is a medium carbon steel.
(*c*) Nichrome wire used for electrical heating elements comes under the category of nimonic alloys.
(*d*) The hardening capacity of steel decreases with increasing carbon content.

160. High resistance electrical heating elements/wires are not made of
(*a*) Kanthal wire (*b*) nichrome
(*c*) nimonic alloys (*d*) marageing steel

161. An alloy used as thermocouple material comprises of 40% nickel and 60% copper. It is called
(*a*) German silver (*b*) chromel
(*c*) constantan (*d*) Kanthal

162. Which of the following is not an ore dressing operation?
(*a*) Classification (*b*) Smelting
(*c*) Roasting (*d*) Both (*b*) & (*c*)

163. Continuous casting of steel is not practised at ..... steel plant.
(*a*) Durgapur (*b*) Rourkela
(*c*) Salem (*d*) Bokaro

164. A surface hardening process does not employ ..... heating.
(*a*) furnace (*b*) electrolytic
(*c*) resistance (*d*) induction

165. Which of the following is characterised as 'rare earth' metal?
(*a*) Cessium (*b*) Molybdenum
(*c*) Nickel (*d*) Aluminium

166. The capacity of a material to absorb/store energy is called its
(*a*) brittleness (*b*) resilience
(*c*) malleability (*d*) none of these

167. Which of the following metals can be extracted from its sulphide ore using both the hydrometallurgical as well as pyrometallurgical method of metal extraction?
(*a*) Iron (*b*) Copper
(*c*) Aluminium (*d*) Lead

168. Which of the following is not a deoxidiser of steel?
(*a*) Manganese (*b*) Silicon
(*c*) Aluminium (*d*) None of these

169. A ..... operation is termed as liquation.
(*a*) roasting (*b*) smelting
(*c*) refinning (*d*) classification

170. Which of the following is never used as an alloying element in steel?
(*a*) Molybdenum (*b*) Tungsten
(*c*) Lead (*d*) Silicon

171. Austenite of steel is transformed to ..... after quenching operation.
(*a*) martensite (*b*) bainite
(*c*) pearlite (*d*) none of these

172. Potable/drinking water storage tanks and pipelines are never made of ..... because of the reason that human body can not discharge it out in any form, if corroded/eroded particles of it is entrained with the drinking water and consumed by the human beings.
(*a*) polythene (*b*) polyvinyl chloride
(*c*) lead (*d*) cast iron

173. Pick out the correct statement.
(*a*) Tata iron and steel company (TISCO) is the largest producer of the steel in India.
(*b*) Fire refining process is a metal purification process used for aluminium.
(*c*) All oxide ores are not soluble in water.
(*d*) 'Patenting' is a process for refinning of aluminium.

174. In iron-carbon equilibrium diagram, the carbon content of cast iron is assumed between ..... per cent.
(*a*) 1.5 and 4 (*b*) 2.0 and 4
(*c*) 2 and 4.3. (*d*) 1.5 and 4.3

175. A coarse crystalline structure of steel induces
(*a*) strength (*b*) brittleness
(*c*) ductility (*d*) none of these

176. ..... is the hardest, strongest and least ductile of all the constituents of steel.
(*a*) Austenite (*b*) Pearlite
(*c*) Martensite (*d*) Bainite

177. The amount of pearlite in hyper eutectoid steel is generally ..... per cent.
(*a*) 25 (*b*) < 50
(*c*) 65 (*d*) > 90

178. Cold working of steels increases its
(*a*) yield point (*b*) tensile strength
(*c*) brittleness (*d*) none of these

179. Spheroidise annealing of medium/high carbon tool steel raises its
(*a*) tensile strength
(*b*) hardness
(*c*) elongation percentage
(*d*) none of these

180. In 'normalising' of the object as compared to 'annealing',
(*a*) time required is less.
(*b*) cooling is done in water.
(*c*) grain refinement is not achieved.
(*d*) internal stresses are not relieved.

181. Which of the following heat treatment processes are designed for increasing the hardness of steel with minimum loss of ductility ?
(*a*) Isothermal annealing
(*b*) Tempering
(*c*) Normalising
(*d*) Spheroidise annealing

182. Steel hardening processes are classified according to the quenching procedure applied. Martempering is also known as the ..... quenching.
(*a*) stepped (*b*) interrupted
(*c*) isothermal (*d*) double media

183. Austempering is also known as the ..... quenching.
(*a*) double media (*b*) interrupted
(*c*) isothermal (*d*) stepped

184. During hardening of steel objects, sudden quenching in a single medium
(*a*) gives rise to internal stresses.
(*b*) promotes its tendency of cracking & warping.
(*c*) promotes transformation of austenite into martensite.
(*d*) all *'a'*, *'b'* & *'c'*.

185. With increase in tempering temperature of the hardened steel object, its ..... reduces.
(*a*) toughness (*b*) hardness
(*c*) rigidity (*d*) both (*b*) & (*c*)

186. Which of the following is not a microconstituent of cast iron?
(*a*) Cementite (*b*) Austenite
(*c*) Bainite (*d*) Pearlite

187. One of the microconstituents of cast iron has a Brinell hardness number of about 80. It may be
(*a*) pearlite (*b*) austenite
(*c*) ferrite (*d*) none of these

188. Pure iron can dissolve about ..... per cent carbon at a temperature little above its melting point.
(*a*) 3.5 (*b*) 4
(*c*) 4.5 (*d*) 5

189. Pick out the wrong statement.
(*a*) When cast iron is in the molten state, most of the carbon is in solution as Fe_3C.
(*b*) Slow cooling of molten cast iron favours the precipitation of graphite due to the decomposition of Fe_3C into Fe and graphite.
(*c*) Rapid cooling of molten cast iron allows the carbon to remain as Fe_3C.
(*d*) During cooling of molten cast iron, presence of high silicon resists the decomposition of Fe_3C while that of sulphur accelerates its decomposition.

190. Bell less top (BLT) charging system is the most modern method of raw material charging in a
(*a*) blast furnace
(*b*) L.D. converter
(*c*) coke oven
(*d*) sintering machine

191. Which of the following Indian steel plants is not an 'integrated steel plant'?
(*a*) Visakhapatnam steel plant.
(*b*) Salem steel plant.
(*c*) Durgapur steel plant.
(*d*) Rourkela steel plant.

192. Heterogeneous mixture obtained by smelting of arsenical ores resulting in the formation of aresnides of two more metals is called **'speiss'**. Speiss is
(*a*) malleable (*b*) ductile
(*c*) brittle (*d*) slag

193. One of the micro constituents of cast iron has a Brinell hardness of about 200. It could be
(*a*) ferrite (*b*) cementite
(*c*) pearlite (*d*) either (*b*) or (*c*)

194. Shot blasting process is meant for the
(*a*) surface cleaning of castings.
(*b*) 'salamander' tapping from blast furnace.
(*c*) defect location in steel ingots.
(*d*) dismantling of furnace refractory lining.

195. Electrical transformer steel uses ..... as an alloying element.
(*a*) silicon (*b*) lead
(*c*) nickel (*d*) molybdenum

196. Nodular cast iron is also called ..... cast iron.
(*a*) mottled
(*b*) spheroidal graphitic
(*c*) ductile (*d*) both *b* & *c*

197. .....has high damping capacity.
(*a*) Cast iron (*b*) Steel
(*c*) Brass (*d*) Bronze

198. 'NIMONICS' are ..... based alloys.
(*a*) chromium (*b*) nickel
(*c*) lead (*d*) vanadium

199. Bismuth, lead & silver are ..... soluble in pure iron.
(*a*) partially (*b*) completely
(*c*) not (*d*) highly

200. 'Active metals' like sodium, potassium, calcium, magnesium, aluminium etc. are extracted from their ores by
(*a*) carbo-thermic reduction.
(*b*) flash roasting.
(*c*) electrolytic reduction.
(*d*) froth floatation.

201. Which of the following metals is not found in 'native' form (free state) on earth?

(*a*) Gold (*b*) Platinum
(*c*) Maganesium (*d*) None of these

202. Carnallite is the chloride ore of
(*a*) copper (*b*) magnesium
(*c*) silver (*d*) zinc

203. Pyrolusite is the oxide ore of
(*a*) manganese (*b*) zinc
(*c*) calcium (*d*) mercury

204. Anglesite is the sulphate ore of
(*a*) calcium (*b*) copper
(*c*) magnesium (*d*) lead

205. Rocks formed in the crust of the earth by chemical changes such as hydrolysis, precipitation and oxidation & reduction are called ..... rocks.
(*a*) igneous (*b*) volcanic
(*c*) metamorphic (*d*) sedimentary

206. Which of the following elements is not recovered commercially from sea water?
(*a*) Sodium (*b*) Calcium
(*c*) Bromine (*d*) None of these

207. When sulphide ores are roasted, the gas produced is
(*a*) CO_2 (*b*) H_2S
(*c*) SO_2 (*d*) SO_3

208. The co-ordination number of an atom in a crystal is indicated by the number of
(*a*) its valance electrons.
(*b*) its nucleons.
(*c*) nearest atoms that it possesses.
(*d*) possible slip planes in the crystal.

209. Which of the following alloys does not contain copper?
(*a*) Bronze (*b*) Bell metal
(*c*) Brass (*d*) Solder

210. Which of the following metals is not present in German Silver?
(*a*) Copper (*b*) Zinc
(*c*) Nickel (*d*) Silver

211. Landing gears of aircrafts are made of
(*a*) high speed steel
(*b*) babbit metals
(*c*) precipitation hardened marageing steel
(*d*) none of these

212. Which of the following is a cobalt base high temperature super alloy?
(*a*) Nimonics (*b*) Ford 406
(*c*) Satellites (*d*) none of these

213. Which of the following methods can not be used for control of engineering properties of materials ?
(*a*) Nuclear radiation
(*b*) Grain size control
(*c*) Alloying
(*d*) None of these

214. Alloying of a metal can not improve upon its
(*a*) strength
(*b*) toughness
(*c*) corrosion resistance
(*d*) none of these

215. Stress causing a deformation of ..... percent is called the yield strength of the material.
(*a*) 0.2 (*b*) 0.5
(*c*) 1 (*d*) 1.2

216. Pearlite contains about 0.8% carbon. Its hardness is about ..... on BHN scale.
(*a*) 100 (*b*) 170
(*c*) 250 (*d*) 350

217. The limit of ..... percent carbon is recognised as the dividing line between steel and cast iron.
(*a*) 1.2 (*b*) 1.5
(*c*) 1.8 (*d*) 2

218. Which of the following is characterised as a 'light metal'?
(*a*) Sodium (*b*) Zinc
(*c*) Gold (*d*) Copper

219. Which of the following metals is extracted from its ore by electrometallurgical process?
(*a*) Copper (*b*) Aluminium
(*c*) Zinc (*d*) Nickel

220. Corrosion of metals can not be obviated by its
(*a*) aluminising

(*b*) chromising/galvanising
(*c*) alloying
(*d*) tempering

221. Which of the following does not come under the category of heat treatment process?
(*a*) Pack carburising
(*b*) Nitriding and cyaniding
(*c*) Galvanising
(*d*) Spheroidising

222. Which is not a solid state semi-conductor?
(*a*) Tellurium (*b*) Cobalt
(*c*) Selenium (*d*) Germanium

223. Pick out the wrong statement.
(*a*) Styrene butadiene rubber (SBR) is a polymerisation product having very low modulus of elasticity.
(*b*) Phenol formaldehyde (also called bakelite) comes under the category of elastomer.
(*c*) Duralumin is a thermocouple making material.
(*d*) Corrosion rate of materials generally increases at higher temperature.

224. Percentage of silver in German silver is
(*a*) 0 (*b*) 20
(*c*) 40 (*d*) 60

225. Mirageing steels which have high yield & tensile strength are
(*a*) almost free from carbon ($C = < 0.003\%$).
(*b*) martensitic.
(*c*) age hardening.
(*d*) all *'a'*, *'b'* & *'c'*.

226. Pick out the correct statement.
(*a*) Carbon content in high carbon steel may be upto 2%.
(*b*) Lead is the main alloying element which imparts heat resistant properties to steel.
(*c*) High carbon steel is used for making heavy duty springs as for locomotive wagons and heavy vechicles.
(*d*) none of these.

227. Which of the following is characterised as a heavy metal?
(*a*) Nickel (*b*) Platinum
(*c*) Magnesium (*d*) Lithium

228. A popular high speed steel is designated as 18:4:1. 18, 4 and 1 respectively represent the percentages of ..... in steel.
(*a*) tungsten, chromium & vanadium
(*b*) nickel, chromium & molybdenum
(*c*) nickel, chromium & vanadium
(*d*) nickel, chromium & tungsten

229. Phosphor bronze is used for making
(*a*) cutting tools (*b*) utensils
(*c*) thermo couples (*d*) bearings

230. Which of the following is not a cutting tool material?
(*a*) Hadfield manganese steel
(*b*) Tungsten carbide
(*c*) Satellite alloy (*d*) Both *'b'* & *'c'*

231. ..... are generally subjected to 'calcination'.
(*a*) Sulphides (*b*) Carbonates
(*c*) Oxides (*d*) Peroxides

232. An alloy of copper and aluminium is called
(*a*) hindalium (*b*) duralumin
(*c*) German silver (*d*) monel metal

233. Percentage of copper in German silver is about
(*a*) 0 (*b*) 20
(*c*) 50 (*d*) 80

234. Mirageing steels have high notch toughness and good ductility. Main alloying elements in mirageing steels are
(*a*) nickel, chromium & vanadium.
(*b*) nickel, cobalt & molybdenum.
(*c*) vanadium, molybdenum & chromium.
(*d*) none of these.

235. An alloy of aluminium and ..... is called Hindalium.
(*a*) magnesium (*b*) silver
(*c*) manganese (*d*) nickel

236. Which of the following is characterised as a 'refractory metal'?
(*a*) Zirconium (*b*) Thorium
(*c*) Strontium (*d*) Tin

237. Pick out the wrong statement.
(*a*) Residual or applied stresses accelerate the corrosion of materials.

(*b*) One gram equivalent of metal is liberated on application of one faraday of electricity.
(*c*) Decomposition voltage (which is the minimum voltage required for continuous electrolysis) of molten salts increases linearly with rise in temperature.
(*d*) none of these.

238. Coating of ..... is done in galvanising process.
(*a*) tin (*b*) lead
(*c*) zinc (*d*) aluminium

239. Corks are made of
(*a*) bark of a special oak tree
(*b*) teak wood
(*c*) synthetic polymers
(*d*) none of these

240. The latest integrated steel plant of India is located at
(*a*) Durgapur (*b*) Bokaro
(*c*) Visakhaptnam (*d*) Jamshedpur

241. ..... flux is used for the extraction of metal from its self fluxing ores.
(*a*) Neutral (*b*) Acid
(*c*) Basic (*d*) No

242. ..... of a metal is termed as 'dross'.
(*a*) Oxide (*b*) Carbonate
(*c*) Sulphide (*d*) Nitrate

243. Bearings are lined using ..... metal.
(*a*) gun (*b*) babbit
(*c*) silver (*d*) lead

244. Aluminium ..... is a refractory material.
(*a*) sulphide (*b*) sulphate
(*c*) chloride (*d*) none of these

245. Malleablising of ..... cast iron produces malleable iron.
(*a*) nodular (*b*) white
(*c*) grey (*d*) all (*a*), (*b*) & (*c*)

246. Carbon is present as..... in white cast iron.
(*a*) graphite flakes (*b*) cementite
(*c*) epsilon carbide (*d*) spheroidal graphite

247. ..... in a crystal is a vacancy defect.
(*a*) Stacking fault (*b*) Twin defect
(*c*) Dislocation (*d*) Point defect

248. Which of the following heat treatment processes is applied to steel castings?
(*a*) Quenching
(*b*) Full annealing
(*c*) Normalising
(*d*) Sub-critical annealing

249. An age hardening alloy is exemplified by
(*a*) babbit metal (*b*) duralumin
(*c*) brass (*d*) bronze

250. ..... is not a constituent of iron and steel.
(*a*) Pearlite (*b*) Cementite
(*c*) Silumin (*d*) Bainite

251. Bell-less top (BLT) material charging system is employed in the
(*a*) sintering machine
(*b*) blast furnace
(*c*) L.D. converter
(*d*) cupola

252. An iron ore mine is not located at
(*a*) Purnapani (Orissa)
(*b*) Barsua (Orissa)
(*c*) Bailadila (Chattisgarh)
(*d*) Gua (Jharkhand)

253. Desulphurisation in blast furnace is promoted by high
(*a*) hearth temperature
(*b*) slag volume
(*c*) slag basicity
(*d*) all (*a*), (*b*) and (*c*)

254. High slag rate (about 350-450 Kg/ton pig iron) in Indian blast furnace is mainly due to the
(*a*) high ash content in coke.
(*b*) high percentage (about 70%) of sinter in the B.F. charge burden.
(*c*) use of quartz for viscosity reduction of slag.
(*d*) use of low hot blast temperature.

255. Pouring of molten liquid steel in the ingot moulds is termed as the

(*a*) casting (*b*) teeming
(*c*) lancing (*d*) none of these

256. Hot top is used in
(*a*) pig iron ladles (*b*) steel ladles
(*c*) ingot moulds (*d*) torpedo ladles

257. Which of the following is not a non-ferrous alloy?
(*a*) Magnalium (*b*) Meehanite
(*c*) Gun metal (*d*) Muntz metal

258. ..... ores are subjected to flash smelting technique for metal extraction.
(*a*) Aluminium (*b*) Copper
(*c*) Zinc (*d*) both *'b'* & *'c'*

259. An alloy of nickel and copper is called
(*a*) gun metal (*b*) German silver
(*c*) monel (*d*) muntz metal

260. Which of the following is an electro-refinning process?
(*a*) Aluminising (*b*) Galvanising
(*c*) Chromising (*d*) None of these

261. Silicon content in 'Silicon transformer steel' is about.....percent.
(*a*) 1-1.5 (*b*) 4.5-5
(*c*) 14.5-15 (*d*) 18.5-19

262. Silicon present in transformer steel
(*a*) increases its electrical resistance.
(*b*) decreases its hysterisis loss.
(*c*) increases its hysterisis loss.
(*d*) decreases its magnetic permeability.

263. 'Inconel' is used for insulating blanket in jet engines, and it has excellent resistance for high temperature corrosion, oxidation & creep properties. Its main alloying elements are
(*a*) tungsten, vanadium & molybdenum.
(*b*) chromium, vanadium & tungsten.
(*c*) nickel, chromium & iron.
(*d*) vanadium, molybdenum & nickel.

264. Which of the following is the elemental form of carbon present in cast iron?
(*a*) Cementite
(*b*) Graphite flakes
(*c*) Graphite nodules
(*d*) Both (*b*) & (*c*)

265. One of the most commonly used stainless steel is designated as 18:8 steel. 18 and 8 **respectively** represent the percentages of ..... in the stainless steel.
(*a*) nickel & chromium
(*b*) chromium & tungsten
(*c*) chromium & nickel
(*d*) chromium & vanadium

266. Babbit metal used for making bearing is mainly ..... based alloy.
(*a*) lead (*b*) tin
(*c*) copper (*d*) antimony

267. 'Hastealloy' has excellent high temperature properties besides having high corrosion oxidation and creep properties. Its main alloying elements are
(*a*) nickel, molybdenum & iron.
(*b*) nickel, chromium & tungsten.
(*c*) molybednum, chromium & tungsten.
(*d*) iron, chromium & vanadium.

268. Pick out the wrong statement.
(*a*) Titanium is a radioactive material.
(*b*) Atomic weight of a radio active metal varies with the lapse of time, but its atomic number remains constant.
(*c*) Main gas evolved in the calcination reaction is carbon dioxide.
(*d*) Slag is essentially formed in all the smelting operations.

269. Which among, the following materials of construction has the highest resistance to atmospheric air corrosion?
(*a*) Cast iron (*b*) Low carbon steel
(*c*) Copper (*d*) Aluminium

270. Which of the following is not a metal refinning process?
(*a*) Liquation (*b*) Fire refinning
(*c*) Distillation (*d*) None of these

271. Leaching solvent used in Baeyer's process for bauxite purification is
(*a*) NaOH (*b*) NH_4OH
(*c*) NaCl (*d*) dilute H_2SO_4

272. In a crystal, the atoms are located at the position of minimum potential energy. The main reason, why most crystals show good clevage is because their atoms/molecules/ions are

(*a*) arranged in random disordered pattern.
(*b*) strongly bonded together.
(*c*) arranged in planes.
(*d*) spherically symmetrical.

273. Pick out the wrong statement.
(*a*) Constituent parties (*i.e.* atoms/molecules/ions) in a solid are arranged in definite geometrical configuration.
(*b*) Cubic close packing arrangement is also known as body centred cubic.
(*c*) The existence of a substance in more than one solid modifications is known as polymorphism.
(*d*) In a crystal lattice, the number of nearest neighbours to each atom is called the co-ordination number.

274. Extraction of.....employs thermal reduction process.
(*a*) aluminium (*b*) copper
(*c*) magnesium (*d*) none of these

275. .....can not be extracted by carbon reduction process.
(*a*) Aluminium (*b*) Lead
(*c*) Zinc (*d*) none of these

276. The main purpose of smelting an ore is to
(*a*) oxidise it.
(*b*) separate out the volatile impurities.
(*c*) reduce it.
(*d*) obtain an alloy of the desired metal.

277. Carnallite is an ore of
(*a*) magnesium (*b*) zinc
(*c*) copper (*d*) aluminium

278. Which of the following is an ore of zinc ?
(*a*) Diaspore (*b*) Calamine
(*c*) Malachite (*d*) None of these

279. Heating of pyrite ores in presence of air to remove sulphur is termed as its
(*a*) smelting (*b*) roasting
(*c*) calcination (*d*) fluxing

280. Leaching of ore with dilute cyanide solution is done for the extraction of
(*a*) zinc (*b*) titanium
(*c*) silver (*d*) copper

281. Which of the following is not a characteristic of alkali metals ?
(*a*) High thermal conductivity.
(*b*) High melting point.
(*c*) High electrical conductivity.
(*d*) None of these.

282. Sodium metal can not be stored under
(*a*) alcohol (*b*) kerosene
(*c*) benzene (*d*) toluene

283. The metal that can be extracted from sea water is
(*a*) beryllium (*b*) calcium
(*c*) magnesium (*d*) lithium

284. .....does not contain aluminium.
(*a*) Feldspar (*b*) Cryolite
(*c*) Fluorspar (*d*) Bauxite

285. Pick out the correct statement.
(*a*) All the ores are mineral, but all the minerals are not ores.
(*b*) Rocky impurities present in a mineral are called 'mattee'.
(*c*) Electrolytic reduction method is used in the extraction of transition metals.
(*d*) In froth floatation process of concentration of sulphide ores, the ore particles float because they are insoluble.

286. Aluminium metal is refined by the.....process.
(*a*) Baeyer's (*b*) Hoop's
(*c*) Hall's (*d*) Solvay's

287. Blister copper is a/an.....of copper.
(*a*) pure form (*b*) ore
(*c*) alloy (*d*) impure form

288. With increase in temperature, the electrical conductivity of semiconductors
(*a*) increases
(*b*) decreases
(*c*) remains constant
(*d*) either *'a'* or *'b'*

289. Superconductors are those substances, which

(*a*) conduct electricity at low temperatures.
(*b*) offer no resistance to current flow.
(*c*) conduct electricity at high temperatures.
(*d*) offer high resistance to current flow.

290. Closeness of packing is maximum is case of the.....crystal lattice.
(*a*) face centred (*b*) simple cubic
(*c*) body centred (*d*) none of these

291. .....iron is not an allotropic form of iron.
(*a*) Alpha (*b*) Beta
(*c*) Gamma (*d*) Delta

292. Chilled cast iron contains.....graphite.
(*a*) very large precentage of
(*b*) very low precentage of
(*c*) no
(*d*) 10 per cent

293. In order to be called 'steel', an alloy should have iron percentage ≥
(*a*) 40 (*b*) 50
(*c*) 70 (*d*) 80

294. Carbon content in drills, dies & commonly employed taps should be about.....per cent.
(*a*) 0.35 (*b*) 0.5
(*c*) 0.8 (*d*) > 1

295. Silicon steel is most widely used in
(*a*) making leaf springs.
(*b*) electrical industry.
(*c*) making cutting tools.
(*d*) none of these.

296. .....process is used for coating steel with a thin layer of phosphate.
(*a*) Parkerising (*b*) Sheradising
(*c*) Phosphorising (*d*) Anodising

297. Chilling, heat treatment and alloy addition to cast iron generally reduces its
(*a*) wear resistance (*b*) machinability
(*c*) both '*a*' & '*b*' (*d*) neither '*a*' nor '*b*'

298. Cast irons are generally specified by their
(*a*) iron percentage (*b*) carbon percentage
(*c*) hardness (*d*) tensile strength

299. The range of Mho's scale of hardness is from
(*a*) 1 to 8 (*b*) 1 to 10
(*c*) 1 to 15 (*d*) 1 – 20

300. Production of articles having soft ductile interior and a very hard surface is done by
(*a*) case hardening.
(*b*) tempering and hardening.
(*c*) annealing and hardening.
(*d*) hardening.

301. Nitriding is a/an.....process.
(*a*) case hardening (*b*) spheridising
(*c*) annealing (*d*) normalising

302. Conversion of metallic powder into articles of different forms is done by a technique called
(*a*) carbiding
(*b*) precipitation
(*c*) powder metallurgy
(*d*) high pressure casting

303. The process of heating the cold pressed metal powder in powder metallurgy technique is termed as the
(*a*) precipitation (*b*) deposition
(*c*) sintering (*d*) incineration

304. Pick the odd man out from the following metallurgical processes.
(*a*) Cyaniding (*b*) Nitriding
(*c*) Galvanising (*d*) Pack carburising

305. In amorphous materials, there is no definite atomic structure and atoms exist in a random pattern just as in a liquid. Which of the following is an amorphous material ?
(*a*) Brass (*b*) Glass
(*c*) Lead (*d*) Zinc

306. Steel pipes are generally manufactured by the.....process.
(*a*) electroforming (*b*) forging
(*c*) extrusion (*d*) cold working

307. The phenomenon of weld decay is found in
(*a*) cast iron (*b*) stainless steel
(*c*) brass (*d*) bronze

308. Galvanising is generally done on
(*a*) non-ferrous metals.

(*b*) low carbon steel.
(*c*) stainless steel. (*d*) cast iron.

309. The alloying element whose percentage is maximum in high speed steel is
(*a*) chromium (*b*) tungsten
(*c*) molybdenum (*d*) vanadium

310. Cemented carbide tools are not suitable for cutting
(*a*) aluminium (*b*) brass
(*c*) steel (*d*) cast iron

311. Tensile strength of steel can be safely increased by adding carbon upto.....per cent.
(*a*) 0.35 (*b*) 0.66
(*c*) 0.83 (*d*) 1.2

312. Wrought iron does not have the
(*a*) ability to hold protective coating.
(*b*) uniform strength in all directions.
(*c*) ductility property.
(*d*) high resistance to crushing & corrosion.

313. The primary factor which determines the hardness of steel is the
(*a*) carbon percentage in it.
(*b*) percentage of alloying elements in it.
(*c*) type of heat treatment employed.
(*d*) shape and distribution of carbides in iron.

314. As the impurities are oxidised, the melting point of iron
(*a*) decreases (*b*) increases
(*c*) remains unchanged
(*d*) unpredictable

315. Which of the following products are produced by powder metallurgy techniques?
(*a*) Cemented carbides.
(*b*) Bearings and porous metallic parts.
(*c*) Tungsten and molybdenum.
(*d*) All (*a*), (*b*) & (*c*).

316. Machinability of a metal does not depend upon its
(*a*) tensile strength
(*b*) toughness (*c*) hardness
(*d*) none of these

317. The imperfection in the crystal structure of metal is called
(*a*) slip (*b*) impurity
(*c*) clevage (*d*) dislocation

318. Iron has got.....isotopes.
(*a*) two (*b*) three
(*c*) four (*d*) no

319. .....wire is expected to be the strongest in tension.
(*a*) Stainless steel (*b*) Piano
(*c*) Mild steel (*d*) Brass

320. Line imperfection in a crystal is called the
(*a*) Schottky defect
(*b*) edge dislocation
(*c*) Frenkel defect
(*d*) none of these

321. The material for wire drawing should have high
(*a*) stiffness (*b*) toughness
(*c*) ductility (*d*) hardness

322. .....is used for making imitation jewellery.
(*a*) Gun metal (*b*) Aluminium bronze
(*c*) Silicon bronze (*d*) Phosphorous bronze

323. .....is a mesomorphous material.
(*a*) Mica (*b*) Glass
(*c*) Rubber (*d*) Silver

324. The highest percentage of carbon that an iron-carbon alloy can have is.....per cent.
(*a*) 2.4 (*b*) 3.6
(*c*) 4.8 (*d*) 6.6

325. Cold worked steel parts are normally subjected to
(*a*) annealing (*b*) shot peening
(*c*) tempering (*d*) sheradising

326. Formation of thorium by radioactive decay of uranium is represented by the following reaction.

$$_{92}U^{238} \rightarrow {}_{90}Th^{234} + Z$$

Z in the above equation stands for a/an
(*a*) electron (*b*) neutron
(*c*) proton (*d*) alpha particle

327. Average number of neutrons released per fission in nuclear fission reaction is about
(*a*) 1.5 (*b*) 2
(*c*) 2.5 (*d*) 3.5

328. About..... of energy is released in nuclear fission.
(*a*) 200 eV (*b*) 200 MeV
(*c*) 100 MeV (*d*) 100 eV

329. The ratio of the atoms to the lattice parameters for fcc unit cell is
(*a*) 1 : 2 (*b*) 2 : 1
(*c*) $1 : 2\sqrt{2}$ (*d*) 1 : 4

330. Silicon is doped with.....in a *p*-type semi-conductor.
(*a*) phosphorous (*b*) aluminium
(*c*) arsenic (*d*) none of these

331. .....cubic lattice structure has the maximum co-ordination number.
(*a*) Face centred (*b*) Body centred
(*c*) Simple (*d*) none of these

332. Silicon is doped with.....in a *n*-type semi-conductor.
(*a*) phosphorous (*b*) carbon
(*c*) boron (*d*) none of these

333. .....cubic lattice structure has the greatest atomic packing factor.
(*a*) Face centred (*b*) Simple
(*c*) Body centred (*d*) none of these

334. A crystal lattice is a/an
(*a*) random arrangement of molecules but an orderly arrangement of atoms.
(*b*) random arrangement of atoms in a crystal.
(*c*) orderly arrangement of atoms inside a crystal.
(*d*) piece of crystal.

335. Match the typical product yield percentage in an integrated steel plant in India.
List I
(*a*) Yield of gross coke from dry coal.
(*b*) Yield of blast furnace grade (*i.e.* 25 – 80 mm size) coke from dry coal carbonised.
(*c*) Yield of continuous cast slab from steel.
(*d*) Yield of tar from dry coal carbonised.
List II
I. 67 II. 96
III. 3 IV. 87

336. Match the temperature (°C) maintained in various processes/furnaces in an integrated steel plant.
List I
(*a*) Zinc bath used for galvanising steel.
(*b*) Cold rolled steel batch annealing furnace.
(*c*) Soaking pit for heating steel ingot.
(*d*) Sulphuric acid pickling bath for steel coil.
List II
I. 100 II. 1300
III. 700 IV. 450

337. Match the temperature (°C) encountered in various metallurgical processes.
List I
(*a*) Tempering oil bath temperature.
(*b*) L.D. steel tapping temperature.
(*c*) Glass tank furnace temperature.
(*d*) Oxy-acetylene flame temperature.
List II
I. 1650 II. 400
III. 2400 IV. 1400

338. Match the relevant terminologies in both the lists.
List I
(*a*) Occupies top position in electromotive series of metals.
(*b*) Metals whose oxides decompose by heat alone.
(*c*) Activators and depressors.
(*d*) Lowermost in the electromotive series of metals.
List II
I. Ag, Pt, Au
II. Froth floatation
III. Ag and Hg
IV. Alkali and alkaline earth metals

339. Match the mine locations where various metallic ores are found.
List I
(*a*) Copper ore mine
(*b*) Iron ore mine
(*c*) Uranium ore mine
(*d*) Gold ore mine
List II
I. Jadugoda (Jharkhand)

II. Khetri (Rajasthan)
III. Kiriburu (Jharkhand)
IV. Kolar (Karnataka)

340. Match the main alloying elements present in various alloys.

List I
(*a*) Transformer steel
(*b*) Inconel
(*c*) Gun metal
(*d*) Pewter type metal

List II
I. Nickel II. Silicon
III. Tin IV. Copper

341. Match the effects of various alloying elements added in steel.

List I
(*a*) Silicon (*b*) Nickel
(*c*) Vanadium (*d*) Tungsten

List II
I. Increases toughness of steel.
II. Confers red hardness to steel.
III. Increases hardenability of steel.
IV. Alloying element for electrical and magnetic steel.

342. Match the specific gravity of various alloying elements of steel.

List I	*List II*
(*a*) Molybdenum	I. 19.35
(*b*) Carbon	II. 10.2
(*c*) Tungsten	III. 7.2
(*d*) Manganese/chromium	IV. 2.3

343. Match the melting point ($^{\circ}$C) of various alloying elements of steel.

List I	*List II*
(*a*) Nickel	I. 3410
(*b*) Vanadium	II. 1453
(*c*) Molybdenum	III. 1890
(*d*) Tungsten	IV. 2617

344. Match the temperature ($^{\circ}$C) during heating of cast iron with its various allotropic forms existing.

List I	*List II*
(*a*) α- iron	I. 1400-1539
(*b*) β-iron	II. 910-1400
(*c*) γ- iron	III. 768-910
(*d*) δ-iron	IV. < 768

345. Match the effect of various alloying elements added in steel.

List I
(*a*) Manganese (*b*) Aluminium
(*c*) Chromium (*d*) Cobalt

List II
I. Adds to red hardness by hardening ferrite.
II. Counteracts brittleness from sulphur.
III. Acts as deoxidiser.
IV. Adds to depth hardenability with improved resistance to wear & abrasion.

346. Match the effects of various alloying elements added in cast iron.

List I
(*a*) chromium (0.15-1.0%).
(*b*) Vanadium (0.15-0.50%).
(*c*) Manganese (0.3-1.25%).
(*d*) Molybdenum (0.3-1.0%).

List II
I. Increases hardenability and freedom from cracking & distortion.
II. Decreases machinability.
III. Improves tensile strength, transverse strength, hardness, & resistance to wear sheat.
IV. Increases fluidity & density in castings.

347. Which of the following is not found on iron-carbon equilibrium diagram ?
(*a*) Curie point (*b*) Peritectic point
(*c*) Eutectic point (*d*) Eutectoid point

348. The temperature at which the magnetic property of iron disappears (*i.e.*, it becomes non-magnetic) and its electrical conductivity & specific heat also changes is called the Curie point, which is ..... °C.
(*a*) 768 (*b*) 908
(*c*) 1400 (*d*) 1539

349. Which of the following micro-constituents of steel is not a ferrite-cementite mixture having lamellar structure ?
(*a*) Pearlite (*b*) Sorbite
(*c*) Troostite (*d*) Ledeburite

350. Time-temperature-transformation (TTT) diagram is not the same as the
(*a*) Ellingham diagram.
(*b*) Isothermal transformation diagram.

(*c*) Bain's curve.
(*d*) C-curve or S-curve.

351. Maximum carbon content in cast iron is ..... percent.
(*a*) 3.8 (*b*) 4
(*c*) 4.3 (*d*) 4.6

352. Cast iron compared to steel is better in
(*a*) ductility.
(*b*) strength.
(*c*) malleability.
(*d*) fluidity & castability.

353. Phosphorous exists in iron & steel as
(*a*) P (*b*) P_2O_5
(*c*) Fe_3P (*d*) P_2O_3

354. Cryolite is
(*a*) a double flouride of sodium & aluminium (AlF_3. 3NaF).
(*b*) used as a flux in melting practices.
(*c*) used as an electrolyte in aluminium reduction cell.
(*d*) all (*a*), (*b*), & (*c*).

355. Carbon content in blast furnace flue dust is about.....percent.
(*a*) 1 - 5 (*b*) 20 - 25
(*c*) 45 - 50 (*d*) 75 - 80

356. Carbon is present in the uncombined (graphitic) form in case of
(*a*) cast iron (*b*) steel
(*c*) ferroalloy (*d*) none of these

357. Carbon is present in the combined form (carbide) in case of
(*a*) pig iron (*b*) steel
(*c*) ferroalloys (*d*) all (*a*), (*b*), & (*c*)

358. High speed cutting tool steels contain about.....percent of tungsten.
(*a*) 6 - 8 (*b*) 18 - 20
(*c*) 30 - 35 (*d*) 50 - 55

359. Which of the following finds the least commercial use ?
(*a*) Pure iron (*b*) High silicon iron
(*c*) Low carbon steel
(*d*) High carbon steel

360. Materials having .....lattice structure are usually most ductile.
(*a*) f.c.c. (*b*) b.c.c.
(*c*) h.c.p. (*d*) cubic

361. The crystal structure of most of the common metals is
(*a*) orthorhombic (*b*) cubic
(*c*) hexagonal (*d*) none of these

362. Which of the following is the hardest ?
(*a*) Cementite (*b*) Pearlite
(*c*) Austenite (*d*) Ferrite

363. Addition of.....in steel is helpful in increasing the depth of hardness.
(*a*) chromium (*b*) sulphur
(*c*) vanadium (*d*) tungsten

364. ..... possesses viscoelastic properties.
(*a*) Cork (*b*) Glass
(*c*) Graphite (*d*) Rubber

365. Plasticisers are added to polymers to improve their
(*a*) tensile strength
(*b*) softness & flexibility
(*c*) acid resistance (*d*) alkali resistance

366. Which of the following is a non-magnetic material ?
(*a*) Cobalt (*b*) Zinc
(*c*) Nickel (*d*) None of these

367. A magnetic material becomes..... above the Curie temperature.
(*a*) ferromagnetic (*b*) diamagnetic
(*c*) paramagnetic (*d*) none of these

368. Nickel is a ..... material.
(*a*) ferromagnetic (*b*) diamagnetic
(*c*) paramagnetic (*d*) none of these

369. Approximate value of the modulus of elasticity for steel is about ..... $\times 10^6$ Kg/cm^2.
(*a*) 0.5 (*b*) 2
(*c*) 40 (*d*) 75

370. Which of the following has the highest density and the lowest melting point ?
(*a*) Stainless steel (*b*) Titanium
(*c*) Lead (*d*) Aluminium

371. Which of the following undergoes granular fracture?
(*a*) Wrought iron (*b*) Steel

(*c*) Cast iron (*d*) None of these

372. ..... is used for making standard electrical resistance.
(*a*) Invar (*b*) Aluminium
(*c*) Constantan (*d*) Phosphor bronze

373. White cast iron is not
(*a*) malleable (*b*) whitish in color
(*c*) brittle (*d*) strong & hard

374. Which of the following is the easiest to bend?
(*a*) Steel (*b*) Stainless steel
(*c*) Cast iron (*d*) Wrought iron

375. Silicon percentage in acid resistant cast iron is about
(*a*) 4 (*b*) 8
(*c*) 14 (*d*) 20

376. Which of the following will have the highest melting point?
(*a*) Pig iron (*b*) Mild steel
(*c*) Wrought iron (*d*) High carbon steel.

377. ..... welding process is normally used in the fabrication of car bodies.
(*a*) Resistance (*b*) Thermit
(*c*) Arc (*d*) Brazing/soldering

378. Constituents of stellite are
(*a*) zinc, copper & nickel
(*b*) cobalt, chromium & tungsten
(*c*) zinc, aluminium & nickel
(*d*) nickel, cobalt & vanadium.

379. Which of the following has the highest compressive strength?
(*a*) Wrought iron (*b*) Cast iron
(*c*) Mild steel (*d*) High carbon steel

380. Brinell Hardness number (BHN) for talc is approximately in the range of
(*a*) 1 - 5 (*b*) 20 - 30
(*c*) 100 - 150 (*d*) 200 - 250

381. Which of the following is the softest material ?
(*a*) Quartz (*b*) Calcite
(*c*) Corrundum (*d*) Flourite

382. Vicker's hardness number for diamond is about
(*a*) 4000 (*b*) 8000
(*c*) 12000 (*d*) 16000

383. Which of the following is the hardest material ?
(*a*) Topaz (*b*) Quartz
(*c*) Corrundum (*d*) Flourite

384. Slow plastic deformation of metals under a constant stress is termed as the ..... failure.
(*a*) fatigue (*b*) endurance
(*c*) creep (*d*) none of these

385. Hammers and railway rails are normally made of
(*a*) mild steel (*b*) dead mild steel
(*c*) medium carbon steel
(*d*) high carbon steel

386. Mild steel is used for making
(*a*) fish plates (*b*) die block
(*c*) channels (*d*) drop forging

387. Dead mild steel, which contains 0.10 to 0.15 percent carbon, is used for making
(*a*) shafts (*b*) flanges
(*c*) gears (*d*) shear blades

388. Cold work parts are normally subjected to
(*a*) normalising (*b*) hardening
(*c*) annealing (*d*) shot peening

389. To improve the machinability of steel by its softening, it is subjected to
(*a*) cold working (*b*) annealing
(*c*) shot blasting (*d*) heating

390. The maximum percentage of chromium that can be added to steel is about
(*a*) 12 (*b*) 18
(*c*) 24 (*d*) 30

391. Which of the following heat treatment processes is usually applied to castings ?
(*a*) Tempering (*b*) Annealing
(*c*) Normalising (*d*) Carburising

392. With increase in temperature, the electrical conductivity of a .....decreases.
(*a*) semi-conductor (*b*) metal or alloy
(*c*) dielectric (*d*) none of these

393. X-rays do not exhibit the property of
(*a*) reflection (*b*) scattering
(*c*) diffraction (*d*) dispersion

394. Globular form of cementite is formed during the ..... process.
(*a*) spherodising (*b*) hardening
(*c*) annealing (*d*) normalising

395. Cupola produces ..... iron.
(*a*) pig (*b*) cast
(*c*) wrought (*d*) carbon free

396. Puddling process is used for converting pig iron into
(*a*) cast iron (*b*) wrought iron
(*c*) mild steel (*d*) semi-steel

397. Maximum consumption of limestone is in the ..... industry.
(*a*) iron & steel (*b*) cement
(*c*) glass (*d*) fertiliser

398. The softest and the least strong constituent of steel is
(*a*) austenite (*b*) cementite
(*c*) ferrite (*d*) pearlite

399. The highest percentage of carbon that an iron-carbon alloy can have is ..... which gives the whitest and the hardest cast iron, which is wholly cementite.
(*a*) 4.30 (*b*) 4.80
(*c*) 5.50 (*d*) 6.66

400. Which of the following comprises of hydrocarbons?
(*a*) Mica flakes (*b*) Glass
(*c*) Rubber (*d*) None of these

401. Maximum permissible sulphur content in steel is ..... percent.
(*a*) 0.01 (*b*) 0.055
(*c*) 0.50 (*d*) 0.80

402. Which of the following is a light alloy ?
(*a*) Monel metal (*b*) Dow metal
(*c*) German silver (*d*) Babbit metal

403. ..... of austenite decreases the hardenability in steel.
(*a*) Fine grains
(*b*) Coarse grains
(*c*) Homogeneity
(*d*) Dissolved elements (except cobalt)

404. The specific gravity of coal depends mainly on its ..... content.
(*a*) carbon (*b*) volatile matter
(*c*) ash (*d*) moisture

405. Hot working of lead is carried out at
(*a*) 75°C (*b*) 373°K
(*c*) 150°C (*d*) room temperature

406. Drossing is a ..... operation.
(*a*) smelting (*b*) deslagging
(*c*) roasting (*d*) dressing

407. Fire refining process is employed in case of
(*a*) tin (*b*) copper
(*c*) zinc (*d*) aluminium

408. Gas produced in calcination operation is
(*a*) oxygen (*b*) chlorine
(*c*) carbon dioxide (*d*) hydrogen sulphide

409. The leaching solvent used in Baeyer's process for the purification of bauxite is
(*a*) ammonium hydroxide
(*b*) sodium carbonate
(*c*) sodium hydroxide
(*d*) ammonium carbonate

410. The malleability of a material is the property by virtue of which, it can be rolled or hammered into thin sheets. Which of the following materials has the maximum malleability ?
(*a*) Lead (*b*) Copper
(*c*) Aluminium (*d*) Wrought iron

411. The iron ore mostly used for the production of pig iron in our country (containing 65 - 66% Fe) is
(*a*) magnetite (*b*) hematite
(*c*) limonite (*d*) siderite

412. Presence of free carbon in iron makes it ..... grained crystalline structure.
(*a*) soft and imparts a coarse
(*b*) hard and imparts a coarse
(*c*) soft and imparts a fine
(*d*) hard and imparts a fine

413. Cast iron is
(*a*) used for making shock resisting parts.
(*b*) manufactured in cupola and is brittle.
(*c*) having compressive strength more than its tensile strength.
(*d*) all (*a*), (*b*), and (*c*).

414. Carbon content in plain carbon steel is ..... percent.
(*a*) 0.10 – 0.15 (*b*) 0.35 – 0.45
(*c*) 0.65 – 0.80 (*d*) 0.85 – 1.2

415. ..... is added in low carbon steel to raise its yield point.
(*a*) Sulphur (*b*) Phosphorous
(*c*) Silicon (*d*) Manganese

416. A steel alloy containing 36% nickel is called ....., which has a zero co-efficient of expansion.
(*a*) austenitic stainless steel
(*b*) heat resisting steel
(*c*) invar
(*d*) high speed steel

417. ..... can replace tungsten in high speed steel.
(*a*) Chromium (*b*) Vanadium
(*c*) Cobalt (*d*) Molybdenum

418. Shock resisting steels should possess high
(*a*) hardness (*b*) toughness
(*c*) tensile strength
(*d*) wear resistance

419. Which of the following alloying elements reduces the formation of iron sulphide in steel ?
(*a*) Cobalt (*b*) Nickel
(*c*) Manganese (*d*) Vanadium

420. A material in which the atoms are arranged regularly in some directions but not in others is termed as 'mesomorphous material'; an example of which is
(*a*) lead (*b*) glass
(*c*) mica (*d*) silver

421. Examination of crystal structure of a material is normally done by
(*a*) metallurgical microscope.
(*b*) X-ray technique.
(*c*) spectroscope techniques.
(*d*) optical microscope.

422. Pick out the wrong statement.
(*a*) A coarse grained steel has low toughness and a greater tendency to distort during heat treatment.
(*b*) The lower critical temperature is the same for all steels, which is 723°C.
(*c*) A fine grained steel is more ductile and has a less tendency to distort during heat treatment.
(*d*) The upper critical temperature of steels does not very with their carbon contents.

423. Which of the following processes improves the machinability of steel but decreases its hardness & tensile strength ?
(*a*) Spheroidising (*b*) Normalising
(*c*) Full annealing (*d*) None of these

424. When the steel is subjected to normalising, its..... decreases.
(*a*) yield point
(*b*) ductility
(*c*) ultimate tensile strength
(*d*) none of these

425. Softening of hardened steel is done by its
(*a*) normalising (*b*) tempering
(*c*) annealing (*d*) carburising

426. ..... is not a case hardening process.
(*a*) Carburising (*b*) Nitriding
(*c*) Cyaniding (*d*) Annealing

427. Castability of aluminium is increased by the addition of ..... in it.
(*a*) silicon (*b*) manganese
(*c*) bismuth (*d*) lead

428. A steel containing pearlite and cementite is
(*a*) hard (*b*) soft
(*c*) tough (*d*) both (*b*) & (*c*)

429. A steel containing ferrite & pearlite is
(*a*) soft (*b*) hard
(*c*) tough (*d*) both (*b*) and (*c*)

430. A hardened steel essentially contains
(*a*) sorbite (*b*) troostite
(*c*) martensite (*d*) none of these

431. ..... steel is widely used for the manufacture of motor car crankshafts.
(*a*) Silicon (*b*) Nickel
(*c*) Chrome (*d*) High speed

432. The temperature at which new grains are formed in the metal is called the ..... temperature.
(*a*) eutectic (*b*) recrystallisation
(*c*) upper critical (*d*) lower critical

433. The increase in hardness of metal due to its cold working is termed as the ..... hardening.
(*a*) work (*b*) age
(*c*) induction (*d*) flame

434. Cast iron and steel pipes are produced by the ..... casting.
(*a*) die (*b*) investment
(*c*) slush (*d*) true centrifugal

435. High speed steel tools retain their hardness upto a temperature of ..... °C.
(*a*) 500 (*b*) 750
(*c*) 900 (*d*) 1100

436. Addition of..... in steel can help in increasing the depth of hardness.
(*a*) nickel (*b*) chromium
(*c*) vanadium (*d*) tungsten

437. Case hardening of a material is
(*a*) followed by tempering or carburising.
(*b*) preceded by its tempering.
(*c*) done to get a soft ductile interior with a very hard surface.
(*d*) carried out to get extreme hardness in its core.

438. The process by which steel is coated with a thin layer of phosphate to act as a base or primer for paints & enamels is called
(*a*) phosphorising (*b*) sheardising
(*c*) parkerising (*d*) spheroidising

439. Steel castings
(*a*) have poor endurance limit.
(*b*) can not withstand impact.
(*c*) are not weldable.
(*d*) are weldable.

440. During hardening of steel parts, higher ratio of surface to mass produces
(*a*) greater depth of hardening.
(*b*) non-uniformity in surface hardness.
(*c*) surface defects.
(*d*) smaller depth of hardening.

441. Range of Mho's scale of hardness is
(*a*) 1 - 5 (*b*) 5 - 10
(*c*) 1 - 10 (*d*) 1 - 15

442. Very high sulphur in pig iron makes
(*a*) its casting unsound.
(*b*) it hard and machinable.
(*c*) it brittle and malleable.
(*d*) all (*a*), (*b*), & (*c*).

443. Dies for wire drawing are generally made of
(*a*) mild steel (*b*) stainless steel
(*c*) carbides (*d*) high carbon steel

444. Surface hardness achieved by nitriding is of the order of ..... VPN.
(*a*) 150 - 200 (*b*) 500 - 650
(*c*) 750 - 850 (*d*) 1000 - 1100

445. Which of the following alloying elements is present in maximum percentage in high speed steel ?
(*a*) Molybdenum (*b*) Chromium
(*c*) Tungsten (*d*) Vanadium

446. The ability of tool steel to resist softening at high temperatures is termed as the ..... hardness.
(*a*) red (*b*) extended
(*c*) super (*d*) extreme

447. Coarse grained steels have
(*a*) low toughness.
(*b*) no tendency to distort.
(*c*) high density.
(*d*) very high toughness.

448. Fine grained steels have
(*a*) high brittleness.
(*b*) higher tendency to distort.
(*c*) high ductility.
(*d*) none of these.

449. Maximum hardenability of steel depends upon its
(*a*) chemical composition.
(*b*) carbon content.
(*c*) grain size.
(*d*) alloying elements content.

450. The phenomenon of weld decay is found in case of
(*a*) gun metal (*b*) brass
(*c*) stainless steel (*d*) cast iron

451. Young's modulus of elasticity of a material is the slope of the initial linear portion of the stress-strain curve. It decreases appreciably by
(*a*) alloying additions
(*b*) heat treatment
(*c*) cold work
(*d*) increasing temperature

452. Pick out the wrong statement.
(*a*) Both annealing and normalising release the internal stresses of the material besides improving the mechanical properties.
(*b*) Low carbon steel does not respond to the heat treatment for hardening of the material, hence it is subjected to case hardening or surface hardening processes like cyaniding, carburising nitriding etc, which produces high carbon outer layers resulting in increase of surface hardness.
(*c*) Induction hardening and flame hardening techniques are also used for surface hardening.
(*d*) Martempering of a material is a hardening process.

453. Spheroidising of a material is a/an ..... process.
(*a*) normalising (*b*) annealing
(*c*) tempering (*d*) hardening

454. Hardenability of a material
(*a*) determines its toughness.
(*b*) indicates its hardness.
(*c*) determines the depth of hardness.
(*d*) none of these.

455. Hydrogen embrittlement of metal results from the
(*a*) corrosion fatigue.
(*b*) stress corrosion.
(*c*) pitting corrosion.
(*d*) none of these.

456. Ceramic materials are
(*a*) organic in nature.
(*b*) stronger in compression than in tension.
(*c*) always amorphous in nature.
(*d*) always bad heat conductors.

457. Common house hold glass *i.e. soda-lime glass* is a/an..... material.
(*a*) full crystalline (*b*) partly crystalline
(*c*) amorphous (*d*) none of these

458. China clay is a major raw material for the production of
(*a*) glass
(*b*) fireclay refractory bricks
(*c*) porcelain
(*d*) none of these

459. Cermets are..... materials.
(*a*) refractory (*b*) reinforced
(*c*) abrasive (*d*) fully metallic

460. Pick out the correct statement.
(*a*) Plastics are good conductors of heat & electricity.
(*b*) All the polymers are highly crystalline in nature.
(*c*) Polymers can be vaporised by heating to a very high temperature.
(*d*) The liquid polymer becomes greasy, then waxy and finally solid on increasing the degree of polymerisation.

461. Polystyrene is a ..... plastic at room temperature.
(*a*) ductile (*b*) brittle
(*c*) malleable (*d*) none of these

462. Buna-s is a .....polymeric material.
(*a*) fibrous (*b*) plastic
(*c*) resinous (*d*) rubbery

463. Polymerisation of poly functional monomers produces polymers having
(*a*) good mechanical strength
(*b*) low viscosity
(*c*) low melting point
(*d*) none of these

464. Unbreakable crockeries are made from ..... polymers.
(*a*) polystyrene (*b*) melamine
(*c*) polyester (*d*) polyurathane

465. Crystallisation of polymers is an undesirable property. Crystallisation of celluloid is prevented by adding
(*a*) glycerol (*b*) nitro cellulose
(*c*) camphor (*d*) none of these

466. Pick out the wrong statement.
(*a*) A ferromagnetic material becomes paramagnetic above the 'Curie temperature'.
(*b*) Permanent magnets are made of hard materials, whereas electromagnets require soft magnetic materials.
(*c*) Soft magnetic materials (*e.g.*, pure iron) have higher permeability and low hysterisis loss & coercive forces.
(*d*) Tungsten steel and alnico are not hard magnetic materials.

467. Dielectrics are electrical insulating materials having
(*a*) very narrow energy gap in its band structure.
(*b*) very large number of charge carriers.
(*c*) positive temperature co-efficient of resistance.
(*d*) great influence of temperature and frequency on its permittivity.

468. Which of the following is not a dielectric material?
(*a*) Cotton, silk, & paper
(*b*) Asbestos, glass, porcelain, & mica
(*c*) Rubber & polymeric resins.
(*d*) All refractory materials.

469. Thermistors are used in the ..... devices.
(*a*) voltage measuring
(*b*) temperature measuring
(*c*) temperature compensating
(*d*) both (*b*) & (*c*)

470. Pick out the wrong statement.
(*a*) Electrical conductivities of semi-conductors is of the order of 10^{-15} $(\text{ohm} \cdot \text{cm})^{-1}$.
(*b*) Semiconduction is also possible in ceramic & organic materials.
(*c*) The conductivity of an extrinsic semi conductor decreases with the rise in temperature.
(*d*) The operation of a p-n junction, which is a rectifier, is affected by temperature.

471. Pick out the correct statement.
(*a*) Materials exhibiting high elasticity obey Hooke's law.
(*b*) The elastic behaviour of rubber under compression is the same as its behaviour under tension.
(*c*) The damping capacity of a material is due to its plastic deformation.
(*d*) The stress required to cause plastic flow in polycrystalline material is higher as compared to monocrystalline materials due to the presence of grains of different orientations.

472. In cold working of metal as compared to its hot working
(*a*) cracks & blow holes are eliminated.
(*b*) ductility & impact strength improves.
(*c*) appreciable strain hardening is produced.
(*d*) yield stress, hardness & fatigue strength is not at all affected.

473. With decrease in the grain size of a material, its creep resistance
(*a*) increases (*b*) decreases
(*c*) remains constant
(*d*) either (*a*) or (*b*); depends on the material

474. Pick out the wrong statement.
(*a*) Ductile fracture of a stressed material, which exhibits a large plastic deformation, is commonly caused by the formation and coalescence of voids in the necked region.
(*b*) Brittle fracture is caused by the propagation of pre existing cracks in the material and involves minimum plastic deformation.
(*c*) Fatigue fracture of a material is always brittle in nature and takes place due to the existence of line imperfections.
(*d*) Brittle materials are generally tested in tension.

475. The stress at which a metal fails by fatigue lies

(*a*) near the fracture point of the stress-strain curve.
(*b*) in the plastic range.
(*c*) in the elastic range.
(*d*) none of these.

476. Which of the following metals is malleable but not ductile?
(*a*) Silver (*b*) Lead
(*c*) Copper (*d*) None of these

477. The elastic strain in a material is
(*a*) inversely proportional to the stress
(*b*) time dependent
(*c*) reversible
(*d*) irreversible

478. Reduction in the grain size reduces the ..... of the material.
(*a*) fatigue resistance
(*b*) tensile strength
(*c*) creep resistance
(*d*) all (*a*), (*b*), & (*c*)

479. The formation of oxide film on a metal due to atmospheric exposure reduces its
(*a*) toughness (*b*) stiffness
(*c*) creep limit (*d*) all (*a*), (*b*), & (*c*)

480. Pick out the wrong statement.
(*a*) The X-rays can not be deflected by electric field unlike cathode rays.
(*b*) The intensity of X-rays can be measured by ionisation current produced due to the ionisation of gas by X-rays.
(*c*) The quality of X-rays can be controlled by varying the anode-cathode voltage.
(*d*) Crystal structure of a material can be studied by an electron microscope.

481. Most of the common metals have the ..... crystal lattice structure.
(*a*) cubic (*b*) hexagonal
(*c*) orthorhombic (*d*) none of these.

482. Pick out the wrong statement.
(*a*) Every crystal system has certain important planes and directions which are described by means of three numbers called Miller indices.
(*b*) The co-ordination number of a given crystal is an indication of the closeness of the packing of atoms.
(*c*) The Miller indices of all planes parallel to one another are not identical.
(*d*) The Miller indices of a plane are proportional to the reciprocal of numerical parameters of the intercepts.

483. In a cubic structure the [100] direction and [100] plane are not parallel. The [110] direction in a cubic cell is parallel to the
(*a*) body diagonal of the cube.
(*b*) diagonal of one face of the cell.
(*c*) one edge of the cube.
(*d*) none of these.

484. The interplaner distance, in a cubic crystal, is equal to the cube edge length. The Miller indices for that particular planes are
(*a*) [100] (*b*) [110]
(*c*) [111] (*d*) none of these.

485. The most important material handling system in an integrated steel plant is the
(*a*) belt conveyor
(*b*) diesel locomotive
(*c*) truck
(*d*) overhead cranes & hoists

486. Rockwell number represents the ..... of a substance
(*a*) hardness
(*b*) hardenability
(*c*) surface hardness
(*d*) depth of hardness

487. The generic chemical name for the class of polymers, which are commercially known as 'nylons' is
(*a*) polyolefins (*b*) polyamide
(*c*) polyacrylate (*d*) polyurathane

488. Sudden immersion/dipping of red hot steel bar in water makes it
(*a*) malleable & tough.
(*b*) ductile & soft.
(*c*) brittle & hard.
(*d*) none of these.

489. Diamond does not conduct electricity, because
(*a*) its structure is very compact.
(*b*) no free electrons are present.

(*c*) it is of crystalline nature.
(*d*) there are only carbon atoms present.

490. Graphite is a good
(*a*) thermal & electric insulator
(*b*) conductor of heat
(*c*) conductor of electricity
(*d*) both 'b' & 'c'

491. Production of one ton of steel plate in an integrated steel plant in India consumes about ..... KWh of electricity.
(*a*) 100-150 (*b*) 200-250
(*c*) 400-450 (*d*) 700-750

492. Out of the following, ... waves have the largest wavelength.
(*a*) radio (*b*) light
(*c*) x-ray (*d*) gamma-ray

493. The ability of a substance to assume two or more crystalline structure is called the
(*a*) isomorphism (*b*) polymorphism
(*c*) amorphomism (*d*) isomerism

494. The temperature at which ferromagnetic alpha iron transforms to paramagnetic alpha iron is
(*a*) 910°C
(*b*) above the recrystallisation temperature
(*c*) 770°C
(*d*) below the recrystallisation temperature

495. A process used for making thin phosphate coating on steel to act as a base or primer for enamels & paints is called
(*a*) sheardising (*b*) parkerising
(*c*) dipping (*d*) none of these

496. Heating of an ore below its melting point in presence of excess of air is called
(*a*) calcination (*b*) smelting
(*c*) roasting (*d*) sublimation

497. Pick out the wrong statement.
(*a*) Alloys are harder than their component elements.
(*b*) Presence of silicon in steel decreases its electrical resistance.
(*c*) Karbate is an acid resistant material of construction.
(*d*) Nichrome, a steel alloyed with 10% Ni & 20% Cr can be used upto a temperature of 1100°C.

498. Polyurathanes can not be used for making
(*a*) foam & mattresses.
(*b*) coating material.
(*c*) adhesives.
(*d*) bottles.

499. Alkyd resins can not be used for making
(*a*) plasticisers.
(*b*) paint & varnishes.
(*c*) fibres.
(*d*) film forming materials.

500. Which of the following polymers shows the highest anti-tacking properties ?
(*a*) Melamine formaldehyde resin
(*b*) Phenolic resin
(*c*) Epoxy resin
(*d*) Alkyd resin

501. Trade name of ..... is neoprene.
(*a*) polychloroprene
(*b*) polyisoprene
(*c*) polytetra flouroethylene
(*d*) poly vinyl acetate

502. Wavelength of X-rays is about 1 angstrom however it can not pass through a sheet of
(*a*) paper (*b*) cloth
(*c*) lead (*d*) aluminium

503. Number of electrons in the outermost shell of a semi-conductor material is
(*a*) 2 (*b*) 4
(*c*) 6 (*d*) 8

504. Which of the following has the least value of ultimate tensile strength (UTS) ?
(*a*) Medium carbon steel
(*b*) High carbon steel
(*c*) Cast iron
(*d*) Wrought iron

505. Cast irons are generally specified by their
(*a*) carbon content (*b*) tensile strength
(*c*) hardness
(*d*) manufacturing process

506. Generally, ... are subjected to galvanising (*i.e.*, Zinc coating).
(*a*) non-ferrous metals

(*b*) non-metals
(*c*) low carbon steels
(*d*) stainless steel

507. Pipes for bi-cycle frames are made of ..... steel
(*a*) hot rolled (*b*) chrome carbon
(*c*) cold rolled (*d*) stainless

508. Steel pipes are normally manufactured by the ..... process.
(*a*) extrusion (*b*) cold working
(*c*) forging (*d*) electroforming

509. Post weld treatment is done by
(*a*) normalising (*b*) stress relieving
(*c*) tempering (*d*) solution annealing

510. Quantity of limestone added as a flux in a cupola is about --- kg per ton of iron.
(*a*) 5 (*b*) 30
(*c*) 100 (*d*) 250

511. Addition of 2% nickel in steel makes it suitable for making
(*a*) electronic valves
(*b*) boiler plates, rivets etc.
(*c*) turbine blades
(*d*) connecting rods

512. The element responsible for the presence of free graphite in cast iron is
(*a*) sulphur (*b*) phosphorous
(*c*) silicon (*d*) manganese

513. Plastic articles are normally produced by the ..... moulding.
(*a*) green sand (*b*) injection
(*c*) shell (*d*) dry sand

514. Collapsible tubes for toothpaste are produced by .....extrusion.
(*a*) direct (*b*) indirect
(*c*) impact (*d*) none of these

515. Which of the following mechanical properties of a material is most structure insensitive ?
(*a*) Modulus of elasticity (Young's modulus)
(*b*) Toughness
(*c*) Percentage reduction of area
(*d*) Tensile strength

516. Arrange copper, silver, gold and aluminium from lower to higher conductor of heat.
(*a*) Aluminium, gold, copper, silver
(*b*) Copper, gold, silver, aluminium
(*c*) Copper, gold, aluminium, silver
(*d*) Gold, copper, aluminium, silver

517. Styrene butadiene rubber is commercially manufactured by ..... polymerisation
(*a*) bulk (*b*) suspension
(*c*) solution (*d*) emulsion

518. The variation of thermal conductivity of a metal with temperature is often correlated using an expression of the form, $k = k_o + \alpha T$.
Where, k is the thermal conductivity and T is the temperature in $^{\circ}K$. The unit of α in S.I. system will be
(*a*) $W/m^2.^{\circ}$ K
(*b*) W/m
(*c*) $W/m.\ ^{\circ}K$
(*d*) none ; α is just a number.

519. Metal extrusion process is generally used for producing ..... sections.
(*a*) uniform hollow & solid
(*b*) varying hollow & solid
(*c*) uniform hollow
(*d*) uniform solid

520. In powder metallurgy, the operation carried out to improve the bearing property of a bush is termed as the
(*a*) plating (*b*) heat treatment
(*c*) impregnation (*d*) infiltration

521. Carbide tipped cutting tools are manufactured by powder metallurgy techniques and have a composition of
(*a*) 90% tungsten carbide & 10% cobalt.
(*b*) 70% aluminium oxide & 30% silica.
(*c*) 30% nickel, 15% chromium & 55% tungsten.
(*d*) 65% tungsten & 35% zirconium.

522. An orthotropic material is a special class of anisotropic material, which is described by their properties in three perpendicular directions. An example of orthotropic material is

(*a*) stainless steel (*b*) cast iron
(*c*) wood (*d*) teflon

523. The temperature at which ferromagnetic material can no longer be magnetised by the outside forces is termed as the
(*a*) critical point.
(*b*) Curie temperature.
(*c*) inversion temperature.
(*d*) eutectic temperature.

524. A polymer is termed as an 'elastomer', if its percentage elongation is more than 100%. An elastomer is termed as 'rubber', if its percentage elongation is more than ..... percent.
(*a*) 150 (*b*) 200
(*c*) 300 (*d*) 400

525. The maximum value, which the residual stress in a material can reach is the ..... of the material.
(*a*) elastic limit (*b*) plastic limit
(*c*) yield stress (*d*) breaking stress

526. The maximum stress below which a material can withstand an infinite number of cycle of stress is termed as the
(*a*) fatigue strength
(*b*) creep strength
(*c*) resilience
(*d*) endurance limit

527. Glycerene is used as a coolant in cooling of some engines instead of water, because
(*a*) its higher boiling point (290°C) increases its heat carrying capacity.
(*b*) comparatively less weight of coolant is required.
(*c*) smaller radiator can be used.
(*d*) all *a*, *b* & *c*.

528. Wrought iron is never shaped by
(*a*) casting (*b*) cold working
(*c*) forging (*d*) welding

529. Grey cast iron (used for making underground water pipes & manhole covers) as compared to steel has higher
(*a*) ductility (*b*) impact strength
(*c*) machinability (*d*) melting point

530. Mho's scale of hardness, which consists of 10 standard minerals is used for the measurement of ..... hardness.
(*a*) scratch (*b*) indentation
(*c*) dynamic (*d*) rebound

531. Which of the following hardness tests does not measure the indentation hardness of metals & alloys ?
(*a*) Vicker's hardness test.
(*b*) Shore sceleroscope test.
(*c*) Brinell hardness test.
(*d*) Rockwell hardness test.

532. Which of the following hardness tests uses the depth of penetration caused by the indentor as the parameter for arriving at the hardness value of a material ?
(*a*) Shore sceleroscope test.
(*b*) Vicker's hardness test.
(*c*) Brinell hardness test.
(*d*) Rockwell hardness test.

533. Which of the following non destructive tests for detection of flaws in metallic components can detect both surface as well as internal defects ?
(*a*) Magnetic particle inspection tests.
(*b*) Liquid penetration inspection test.
(*c*) Radiographic & ultrasonic inspection test.
(*d*) none of these.

534. Match the following forming/fabricating methods for polymeric materials with their characteristics.
List I
(*a*) A fabrication method in which a heated piston is forced into the shape of a mould cavity by internal pressure.
(*b*) A forming method for articles by fusing a plastic material in a chamber, and then forcing the mass into a hot mould, where it solidifies.
(*c*) A method of moulding a material in a confined cavity by applying pressure and usually heat.
(*d*) A method of forming a material by forcing it in a fluid state under pressure through a runner system into the cavity of a closed mould.
List II
I. Transfer moulding

II. Blow moulding
III. Injection moulding
IV. Compression moulding

535. Match the average percentage of metal in their ores.

List I	*List II*
(*a*) Gold ore	I. 50
(*b*) Lead ore	II. 30
(*c*) Aluminium ore	III. 5
(*d*) Iron ore	IV. 0.001

536. Match the crystal lattice structure of various materials.

List I	*List II*
(*a*) Zinc	I. Body centred cubic (bcc)
(*b*) Fluorspar	II. Face centred cubic (fcc)
(*c*) Silver	III. Simple cubic
(*d*) α–iron	IV. Hexagonal close packed (hcp)

537. Match the manufacturing techniques used for producing various products.

List I
(*a*) Aluminium can for soft drink
(*b*) Aluminium brake shoe
(*c*) Stainless steel cups
(*d*) Crankshaft
List II
I. Sand casting
II. Pressure die casting
III. Deep drawing
IV. Impact extrusion

538. The lines of force of a magnetising field pass through a ferromagnetic solid. The lines of forces per unit area are called the magnetic
(*a*) flux density (*b*) moment
(*c*) field intensity (*d*) none of these

539. Silicon addition in plain carbon steel
(*a*) reduces its electrical resistance
(*b*) increases its magnetic permeability
(*c*) increases magnetostriction
(*d*) none of these

540. Tackiness is an adhesive property which means that the adhesive is changing from fluid to highly viscous phase. For good bond to develop, the ..... of the adhesive used and the joining materials should be closely equal.
(*a*) impact strength
(*b*) co-efficient of expansion
(*c*) hardness
(*d*) tensile strength

541. Increasing the percentage of 3 CaO . SiO_2 in portland cement results in the
(*a*) delayed curing.
(*b*) release of more heat during setting.
(*c*) attainment of high strength in shorter time.
(*d*) enhanced water requirement for hardening.

542. The purpose of adding glass network modifiers to glass is to
(*a*) enhance its strength.
(*b*) decrease its viscosity in semi-liquid state.
(*c*) increase its toughness.
(*d*) increase its transparency.

543. Curing of slaked lime mortar is by
(*a*) hydration with water.
(*b*) water loss to atmosphere.
(*c*) reaction with CO_2 of the atmosphere.
(*d*) reaction with oxygen of the atmosphere.

544. Pick out the wrong statement.
(*a*) Curie temperature is required to be higher than the highest operating temperature, if the magnet is not to loose magnetism during operation.
(*b*) The hard magnetic materials used in the medical devices is 'alnico', which is an alloy of aluminium, iron & nickel.
(*c*) Metallic glasses are good ferromagnetic material because of its high permeability & non-crystalline structure.
(*d*) Curie temperature of a ferromagnetic material like nickel increases with the addition of iron & cobalt, but deareases with the addition of silicon & gold.

545. Pick out the wrong statement.
(*a*) In an electrical insulator, the energy gap between valance band and conduction band can not be overcome by thermal agitation or application of electrical field.
(*b*) An electrical insulator has no valance band while on electrical conductor has no conduction band and hence a semiconductor does not conduct electricity.
(*c*) In a semi-conductor, the valance band is full and the energy gap between valance band and conduction band is small.
(*d*) In an electrical conductor, the valance band is not full and some electrons can be energised to conduct electricity.

546. Succeptibility in a magnetisation curve (*B Vs H*) of a ferromagnetic material is
(*a*) maximum at the end of the magnetisation.
(*b*) constant throughout.
(*c*) the highest in the beginning and reduces to zero near full magnetisation.
(*d*) low in the beginning, assumes a maximum value in the middle & becomes almost zero near full magnetisation.

547. Absorption of water in concrete during service will result in
(*a*) its shrinkage.
(*b*) increase in volume.
(*c*) corrosion of steel reinforcements.
(*d*) reinitiation of hydration.

548. A good ferromagnetic material must have low
(*a*) magnetic permeability.
(*b*) electrical resistivity.
(*c*) magnetostriction.
(*d*) none of these.

549. Use of glass fibres as fillers in plastics decreases its
(*a*) strength.
(*b*) thermal expansivity.
(*c*) both '*a*' & '*b*' .
(*d*) neither '*a*' nor '*b*'.

550. Pick out the wrong statement.
(*a*) Doping of alumina with magnesia reduces its thermal conductivity, because its structure becomes free of pores.
(*b*) With increase in temperature, the thermal conductivity of silica increases bacause of its predominantly glassy structure.
(*c*) With increase in temperature, the thermal conductivity of magnesia decreases because of its predominantly crystalline structure.
(*d*) Pure metals and single crystals have lower thermal conductivity than metals with impurities.

551. Which of the following alloying element added in aluminium increases its fluidity & strength ?
(*a*) Copper (*b*) Zinc
(*c*) Tin (*d*) Silicon

552. Hydrogen embrittlement occurs in electrolytic tough pitch (ETP) copper due to Cu_2O reacting with H_2 at 400°C, which can be avoided by
(*a*) keeping its surface temperature always < 400°C.
(*b*) keeping its surface always clean.
(*c*) adding phosphorous to ETP copper to form P_2O_5.
(*d*) continuous washing of its surface.

553. Which of the following alloys of copper can be used against wear, fatigue & corrosion that is known for its golden color & strength ?
(*a*) Cartridge brass.
(*b*) Aluminium bronze.
(*c*) Beryllium bronze.
(*d*) Phosphor bronze.

554. An alloy of cobalt, chromium, tungsten & carbon used for cutting metals at high speed & temperature is
(*a*) stellite (*b*) cemented carbide
(*c*) cermet (*d*) alnico

555. .....forbids the use of high melting point metals like tungsten & molybdenum against creep.
(*a*) Low tensile strength

(*b*) Easy oxidisability at elevated temperature
(*c*) Formation of weak unstable structure at elevated temperature
(*d*) Brittleness at room temperature

556. Creep resistance can be improved by allowing the
(*a*) uniformly dispersed coarse particles precipitation in the metal matrix.
(*b*) directional solidification of alloys.
(*c*) grains to grow coarse.
(*d*) hard particles to precipitate along grain boundaries.

557. The complete transformation of austenite takes place during cooling from liquid state ..... 723°C.
(*a*) at (*b*) just below
(*c*) just above (*d*) much above

558. Pick out the wrong statment.
(*a*) Low melting point metals have high co-efficient of thermal expansion.
(*b*) Thermal co-efficient of expansion of metals is not related to its melting point.
(*c*) With increase in temperature, the linear thermal expansivity of all refractory oxides decreases steadily except for zirconia & silica.
(*d*) Compressive thermal stresses in metals cause cracks inclined at 45° to the surface.

559. Residual stresses in the welded joint are not reduced, if the welded structure is
(*a*) heated & cooled rapidly.
(*b*) shot penned on the weld & heat affected zone (HAZ).
(*c*) beaten by a hammer along the weld.
(*d*) plastically deformed and then load released.

560. Curing of adhesive made by low molecular weight thermosetting plastic takes place
(*a*) by vulcanising.
(*b*) on addition of a catalyst.
(*c*) after heating.
(*d*) under pressure & heat.

561. Use of light weight aggregate in concrete
(*a*) increases its rate of drying.
(*b*) causes greater shrinkage.
(*c*) makes the structure better conductor of heat.
(*d*) none of these.

562. Shell moulding employs a pattern made of
(*a*) plaster of paris
(*b*) wood
(*c*) metal
(*d*) wax

563. 'Transition temperature' of metals is concerned with its ..... properties
(*a*) creep (*b*) fatigue
(*c*) impact (*d*) tensile

564. Metals are good conductors, because their valance band is
(*a*) partially filled.
(*b*) completely filled.
(*c*) completely empty.
(*d*) either '*b*' or '*c*'.

565. .....failure comprises most of the service failures in engineering materials
(*a*) Fatigue
(*b*) Ductile to brittle transition
(*c*) Creep
(*d*) Impact

566. Tungsten filaments are produced by ..... technique.
(*a*) die casting.
(*b*) powder metallurgy.
(*c*) electrodeposition.
(*d*) forging.

567. Match the general processes of welding with the specific process.

List I	*List II*
(*a*) Explosion welding	I. Friction welding
(*b*) Resistance welding	II. Stud welding
(*c*) Arc welding	III. Projection welding
(*d*) Solid state welding	IV. Cladding

568. Match the following.

List I	*List II*
(*a*) Pilling bedworth ratio	I. Cyclic stress
(*b*) Griffith criterion	II. Recovery
(*c*) Bauschinger effect	III. Oxidation
(*d*) polygonisation	IV. Brittle Fracture

569. Powder metallurgy processing can be used for making
(*a*) dispersion strengthened copper rod
(*b*) self lubricating bearing
(*c*) connecting rod
(*d*) cemented carbide. [GATE 91]

570. For preparation of porous bearing by powder metallurgy, preferred particle shape is
(*a*) spherical (*b*) nodular
(*c*) irregular (*d*) no preferred shape. [GATE 92]

571. Match the commonly used manufacturing process for the following products.
A. Thoriated nickel wire
B. Aircraft turbine blade made form a nickel based super alloy
C. Automobile crank shaft made for ductile iron
D. Silicon wafers used in the electronic industry
1. Single crystal growing
2. Sand casting
3. Powder metallurgy
4. Investment casting
(*a*) A-1, B-4, C-2, D-3
(*b*) A-4, B-3, C-2, D-1
(*c*) A-1, B-4, C-3, D-2
(*d*) A-2, B-4, C-3, D-1 [GATE 94]

572. Match the following features in tensile stress-strain curves.
A. Yield drop
B. Serrations
C. Increase in flow stress with plastic deformation
D. 1000% uniform strain
1. Strain ageing
2. Superplasticity
3. Dislocation pinning
4. Dislocation multiplication
(*a*) A-3, B-1, C-2, D-4
(*b*) A-3, B-1, C-4, D-2
(*c*) A-3, B-2, C-4, D-1
(*d*) A-4, B-3, C-2, D-1 [GATE 95]

573. The steady state temperature profile of a rectangular sheet of metal inside a furnace can be obtained by solving the following partial differential equation;

$$\frac{\delta^2 T}{\delta x^2}+\frac{\delta^2 T}{\delta y^2}=0$$

The number of boundary conditions needed to solve this equation are:
(*a*) one in x-direction, one in y-direction
(*b*) two in x-direction, two in y-direction
(*c*) two in any of the two directions
(*d*) four in any of the two directions. [GATE 96]

574. Increasing the mean stress influences the S-N curve as follows : (S represents alternating stress)
(*a*) shifts upwards
(*b*) keeps unaltered
(*c*) shifts downwards [GATE 96]

575. Match the following materials with the method most commonly used for making their powders.
A. Nickel
B. Tungsten
C. Silicon carbide
D. Super alloys
1. Carbothermic reduction
2. Inert gas atomisation
3. Oxide reduction
4. Carbonyl process
(*a*) A-2, B-3, C-4, D-1
(*b*) A-1, B-3, C-4, D-2
(*c*) A-2, B-3, C-1, D-4
(*d*) A-4, B-3, C-2, D-1 [GATE 96]

576. Powder metallurgy is used to produce
(*a*) high precision components with complex cavities and sharp features
(*b*) components of large size
(*c*) porosity free components
(*d*) components of such alloys whose constituents do not form alloys readily [GATE 98]

577. $\begin{bmatrix} 21 & 0 & 0 \\ 0 & 9 & 0 \\ 0 & 0 & 6 \end{bmatrix}$ MPa

The maximum shear stress available for the above stress tensor is ----- MPa.
(*a*) 9 (*b*) 6
(*c*) 1.5 (*d*) 7.5 [GATE 98]

578. The minimum energy required to impose a plastic strain of ε to a metal having unit volume and a constant flow stress = σ , is
(*a*) $\sigma\in$ (*a*) $2\sigma\in$
(*a*) $\sigma\in/2$ (*a*) $3\ \sigma\in/4$ [GATE 98]

579. A high cycle fatigue failure is identified by the presence of
(*a*) dimples
(*b*) beach marks or striations
(*c*) slip lines
(*d*) mirror like fractures. [GATE 99]

580. Two samples *A* and *B* of a brittle material have crack lengths in the ratio 3:1. The ratio of the tensile strengths (measured normal to the cracks) of *A* and *B* will be in the ratio
(*a*) 1 : 3 (*b*) $\sqrt{3}$: 1
(*c*) 1 : $\sqrt{3}$ (*d*) 1 : 9 [GATE 99]

581. During solid state sintering of powders, the following mechanisms can be active.
(*a*) Evaporation and condensation
(*b*) Solid state diffusion process
(*c*) Liquid formation in grain boundaries
(*d*) Creation of more dislocations. [GATE 99]

582. One of the methods of purification of leach liquor is ion exchange which involves exchange between
(*a*) two liquid phases
(*b*) a gaseous phase and a liquid phase
(*c*) a liquid phase and an organic resin phase
(*d*) a solid phase and a gas phase.
[GATE 2000]

583. The Larson-Miller parameter '*P*' connecting the temperature '*T*' and the rupture time 't_r' is given as
(*a*) $P = T(\log t_r + c)$ (*b*) $P = \log t_r - c/T$
(*c*) $P = (c-T)/t_r$ (*d*) $P = T\log t_r$
[GATE 2000]

584. Alloy powders manufactured by the following process have spherical shapes:
(*a*) Electro-chemical deposition
(*b*) Gaseous reduction
(*c*) Atomisation
(*d*) Mechanical attrition. [GATE 2001]

585. Fick's second law of diffusion is stated as:
(*a*) $\frac{\partial C}{\partial T} = D.\frac{\partial^2 C}{\partial x^2}$
(*b*) $\frac{\partial C}{\partial x} = D.\frac{\partial^2 C}{\partial t^2}$
(*c*) $\frac{\partial C}{\partial t} = \frac{\partial}{\partial x}\left(D.\frac{\partial C}{\partial t}\right)$
(*d*) $\frac{\partial C}{\partial t} = \frac{\partial}{\partial t}\left(D.\frac{\partial C}{\partial x}\right)$ [GATE 2001]

586. The percentage of ferrite and pearlite in annealed 0.5% carbon steel is approximately
(*a*) 7.3% ferrite and 92.7% pearlite
(*b*) 92.7% ferrite and 7.3% pearlite
(*c*) 37.5% ferrite and 62. 5% pearlite
(*d*) 63.5% pearlite and 37.5% ferrite.
[GATE 2002]

587. Coating of zinc over steel is known as
(*a*) cladding (*b*) galvanising
(*c*) anodising (*d*) passivation
[GATE 2003]

588. Match the following
Group 1
P. Grain refinement of aluminium
Q. Improvement of fluidity of cast iron
R. Refinement of graphite flakes in cast iron
S. Removal of dissolved hydrogen from molten aluminium
Group 2
1. Magnesium
2. Titanium
3. Phosphorous
4. Ferro-silicon
5. Chlorine
(*a*) P-2, Q-3, R-4, S-5
(*b*) P-4, Q-3, R-1, S-2
(*c*) P-2, Q-4, R-1, S-5
(*d*) P-3, Q-5, R-4, S-2 [GATE 2003]

589. An Fe/graphite diffusion couple is annealed at 1273 K. The carbon content (in mass%) on the Fe side of the Fe/graphite diffusion couple will be close to
(*a*) 0.5 (*b*) 1
(*c*) 1.6 (*d*) 6.7 [GATE 2004]

590. Cemented carbide cutting tools are
P. made by casting
Q. made of mainly WC and cobalt
R. made of Fe_3C and cobalt
S. made by liquid phase sintering
(*a*) P, Q
(*b*) Q, R

(*c*) P, R
(*d*) Q, S [GATE 2004]

591. Identify the correct statements from the following:
P. 0.2% yield strength of a material implies 0.2% of the yeild strength.
Q. Von-Misses yield criterion implies that yielding occurs when the distortion energy reaches a critical value.
R. Radius of the cylinderical Von-Misses yield surface increases as the grain size of a single phase material decreases.
S. Tresca's yield criterion gives a circular cylinderical surface in the space of the three principal stresses.
(*a*) *P, Q* (*b*) *Q, R*
(*c*) *R, S* (*d*) *P, S*
[GATE 2004]

592. For sintering of green powder compacts of copper, choose the correct statement:
P. Sintering should be done in an inert or reducing atmosphere.
Q. At a given sintering temperature, the rate of shrinkage will be higher for finer powder size.
R. Full density parts can be produced in a finite time by solid-state sintering.
S. Sintered compacts will have a higher strength than those made by metal working.
(*a*) *P, Q* (*b*) *Q, R*
(*c*) *P, R* (*d*) *Q, S*
[GATE 2004]

593. Match the following:
Group 1
P. Dulong formula
Q. Carbon
R. Dwight-Lloyd machine
S. Radiation
Group 2
1. Ultimate analysis
2. Gray body
3. Sintering
4. Refractory
(*a*) P-1, Q-2, R-3, S-4
(*b*) P-2, Q-4, R-3, S-1
(*c*) P-1, Q-4, R-3, S-2
(*d*) P-3, Q-1, R-4, S-2 [GATE 2004]

594. Match the following:
Group 1
P. Hall Petch relation
Q. Orowan mechanism
R. Nabarro-Herring creep
S. Griffith criterion
Group 2
1. Bulk diffusion between grain boundaries
2. Fracture of brittle materials
3. Grain boundary strengthening
4. Dispersion strengthening
(*a*) P-1, Q-2, R-3, S-4
(*b*) P-2, Q-3, R-4, S-1
(*c*) P-4, Q-1, R-2, S-3
(*d*) P-3, Q-4, R-1, S-2 [GATE 2004]

595. The driving force sintering of a powder compact is
(*a*) strain energy
(*b*) surface energy
(*c*) volume energy
(*d*) stacking fault energy. [GATE 2003]

596. In powder compacting of a monolithic component, it is generally advised to keep the ratio of thickness to width below a limit (say 2.0). This is essentially due to
(*a*) difficulty in ejection of compact leading to breakage.
(*b*) sidewall friction leading to non-uniform density.
(*c*) difficulty in sintering.
(*d*) difficulty in burn off. [GATE 2005]

597. The engineering stress-strain curve for a ceramic material is
(*a*) parabolic (*b*) exponential
(*c*) logarithmic (*d*) linear
[GATE 2010]

598. In heterogenous nucleation, the radius of the critical nucleus does not depends upon
(*a*) contact angle
(*b*) undercooling
(*c*) the surface energy of the interface between the product and parent phases.
(*d*) enthalpy change per unit volume of the product phase. [GATE 2010]

599. Which of the following are not commercially manufactured by powder metallurgy?
(*a*) Aircraft brake pads
(*b*) Self-lubricating bearings

(*c*) Tungsten carbide based cutting tools
(*d*) Turbine blades
[GATE 2010]

600. In the powder metallurgy processing, the objective of pressing before sintering is to
(*a*) squeeze out the moisture around the powder particles
(*b*) further refine the grain size
(*c*) break up the oxides around the particles
(*d*) compacting the powder particles into mechanical and atomic closeness.
[GATE 2006]

601. Identify the combination of mechanisms which best describes sintering of pure metals in powder metallurgy.
P. Grain boundary melting
Q. Liquid metal freezing
R. Interparticle melting
S. Recrystallisation
T. Grain growth
U. Oxidation
V. Reduction
(*a*) *S* and *I* (*b*) *P* and *Q*
(*c*) *R* and *Q* (*d*) *U* and *V*
[GATE 2006]

602. Transport mechanisms that do not contribute to densification during sintering are:
P. Surface diffusion
Q. Bulk diffusion
R. Bulk diffusion
S. Evaporation-condensation
T. Viscous flow
(*a*) *P, Q* (*b*) *Q, S*
(*c*) *Q, T* (*d*) *P, S*
[GATE 2008]

603. Match the particle morphologies in group 1 with the powder production methods in group 2.
Group 1
P. Superalloy powder with rounded morphology
Q. Monosized spherical *Ta* powder
R. *Fe* powder with onion peel structure
S. Irregularly shaped *W* powder
Group 2
1. Carbonyl process
2. Gas atomisation
3. Oxide reduction
4. Rotating electrode process
(*a*) P-2, Q-1, R-4, S-3
(*b*) P-1, Q-4, R-3, S-2
(*c*) P-2, Q-4, R-1, S-3
(*d*) P-4, Q-1, R-2, S-3 [GATE 2008]

604. Oil impregnated bronze bearings are manufacture using
(*a*) pressure die casting
(*b*) centrifugal casting
(*c*) solid-state sintering
(*d*) liquid phase sintering [GATE 2008]

605. Which one of the following expands upon solidification?
(*a*) Low carbon steel
(*b*) High carbon steel
(*c*) White cast iron
(*d*)Gray cast iron [GATE 2011]

606. When load is applied to a material, 'instantaneous' strain develops with
(*a*) the speed of light
(*b*) half the speed of light
(*c*) the speed of sound
(*d*)infinite speed [GATE 2011]

607. When a zinc metal rod is immersed in dilute hydrochloric acid, it results in
(*a*) Evolution of hydrogen
(*b*) Evolution of chlorine
(*c*) Evolution of oxygen
(*d*) No evolution of any gas [GATE 2012]

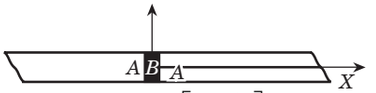
608. Copper can be reduced from acidic copper sulphate solution by
(*a*) Silver (*b*) Iron
(*c*) Carbon (*d*) Lead
[GATE 2012]

609. Which one is NOT an agglomeration process?
(*a*) Nodulizing (*b*) Briquetting
(*c*) Roasting (*d*) Pelletizing
[GATE 2012]

610. The temperature field of a slab is given by $T = 400 - 50z \exp(-t - x^2 - y^2)$. The temperature gradient in y -direction is

(*a*) 100yz exp (-t - x^2 - y^2).
(*b*) -100yz exp(-t - x^2 - y^2).
(*c*) 100xz exp (-t - x^2 - y^2).
(*d*) -100 xz exp (-t - x^2 - y^2).
[GATE 2012]

611. Thin layer of material B (of total amount m) is plated on the end faces of two long rods of material A. These are then joined together on the plated side (see the figure below) and heated to a high temperature. Assuming the diffusion coefficient of B in A is D, the composition profile c_B along the rod axis x after a time t is described by



(*a*) $c_B = \frac{m}{2\sqrt{\pi Dt}} \exp\left[-\frac{x^2}{4Dt}\right]$
(*b*) $c_B = \frac{m}{2\sqrt{\pi Dt}} \text{erf}\left[-\frac{x^2}{4Dt}\right]$
(*c*) $c_B = \frac{m}{2\sqrt{\pi Dt}}\left[1 - \text{erf}\left(-\frac{x^2}{4Dt}\right)\right]$
(*d*) $c_B = \frac{m}{2\sqrt{\pi Dt}}$ t [GATE 2012]

612. A polymer matrix composite is reinforced with long continuous ceramic fibers aligned in one direction. The Young's moduli of the matrix and fibers are E_m and E_r respectively , and the volume fraction of the fibers is f. Assuming iso-stress condition, Young's modulus of the composite E_c in a direction perpendicular to the length of fibers, is given by the expression

(*a*) $E_c = (1-f)\,E_m + f\,E_f$
(*b*) $E_c = f\,E_m + (1-f)\,E_r$
(*c*) $\frac{1}{E_C} = \frac{(1-f)}{E_m} + \frac{f}{E_f}$
(*d*) $\frac{1}{E_C} = \frac{f}{E_m} + \frac{(1-f)}{E_f}$ [GATE 2012]

613. Match the processes in *Group I* with the objectives in *Group II*.

Group I
P. Vacuum Arc Degassing (VAD)
Q. LD
R. COREX
S. Blast Furnace

Group II
1. Primary iron making
2. Secondary steel making
3. Direct smelting
4. Primary steel making

(*a*) P-3, Q-4, R-2, S-1
(*b*) P-4, Q-3, R-1, S-2
(*c*) P-3, Q-2, R-1, S-4
(*d*) P-2, Q-4, R-3, S-1 [GATE 2012]

614. The sulphide capacity (C_s) of liquid slag of composition 55 wt% CaO, 20 wt% SiO_2, 15 wt% Al_2O_3 and 10 wt% MgO is given by the following equation

$\log C_s = 3.44\,(X_{CaO} + 0.1\,X_{MgO} - 0.8\,X_{Al_2O_3} - X_{SiO}) - (9894/T) + 2.05$

where, X is mole fraction of the respective components. Atomic weights of Ca, Mg, Si, Al and O are 40, 24, 28, 27, and 16 respectively.

The value of C_s at 1900 K is
(*a*) 0.0009 (*b*) 0.009
(*c*) 0.09 (*d*) 0.9 [GATE 2012]

615. Fracture stress for a brittle material having a crack length of 1 μm is 200 MPa. Fracture stress for the same material having a crack length of 4 μm is
(*a*) 200 MPa (*b*) 150 MPa
(*c*) 100 MPa (*d*) 50 MPa
[GATE 2012]

616. Which one of the following can give information about the corrosion rate?
(*a*) Pourbaix diagram
(*b*) Polarization technique
(*c*) EMF series
(*d*) Galvanic series [GATE 2013]

617. The total number of possible heat transfer mode(s) is
(*a*) 1 (*b*) 2
(*c*) 3 (*d*) 4 [GATE 2013]

618. If σ and ε are true stress and true strain, respectively, the maximum true uniform strain that can be imparted to a material obeying, $\sigma = 1050\,\varepsilon^{0.25}$ is
(*a*) 0.15 (*b*) 0.25
(*c*) 0.35 (*d*) 0.45 [GATE 2013]

619. The yield strength of a polycrystalline metal increases from 100 MPa to 145 MPa on decreasing the grain size from 64 μm to 25 μm. The yield strength of this metal (in MPa) having a grain size of 36 μm is

(*a*) 110 (*b*) 125
(*c*) 140 (*d*) 165 [GATE 2013]

620. In a brittle material, the maximum internal crack is 8 μm. If Young's modulus is 400 GPa and surface energy is 3.14 J/m^2, the estimated theoretical fracture strength (in MPa) is

(*a*) 375 (*b*) 412
(*c*) 327 (*d*) 447 [GATE 2013]

621. Match the powder production technique given in *Group I* with the corresponding shape listed in *Group II*.

Group I

P. Reduction Q. Gas Atomization
R. Milling S. Electrolysis

Group II

1. Flaky 2. Spongy
3. Dendritic 4. Spherical

(*a*) P-2, Q-4, R-1, S-3
(*b*) P-1, Q-3, R-2, S-4
(*c*) P-2, Q-3, R-4, S-1
(*d*) P-3, Q-2, R-1, S-4 [GATE 2013]

622. For the following electrochemical reaction $Sn + 2\ H^+ = Sn^{2+} + H_2$, if the solution has Sn^{2+} concentration 10^{-2} M and pH 5 at 298 K, which of the following is true?

Given : standard reduction potential for $S_n^{2+} + 2e^- \rightarrow Sn$ is – 0.136 V versus SHE; $pH_2 = 1$ atm

(*a*) Sn undergoes oxidation
(*b*) H^+ undergoes reduction
(*c*) Sn^{2+} undergoes reduction
(*d*) No net reaction [GATE 2013]

623. The Pilling-Bedworth ratio is defined as

(*a*) the molar weight of an oxide divided by the molar weight of the metal consumed in oxide formation.
(*b*) the volume of the oxide divided by the volume of the metal consumed in oxide formation.
(*c*) the density of the oxide divided by the density of the metal consumed in oxide formation.
(*d*) the molar Gibbs energy of the oxide divided by the Gibbs energy of the metal consumed in oxide formation.

[GATE 2014]

624. What is the theoretical requirement of air (in m^3 at STP) for the complete combustion of 100 m^3 (at STP) of a fuel consisting of pure CH_4 ? Assume that air contain 21 vol.% of oxygen.

(*a*) 386 (*b*) 488
(*c*) 805 (*d*) 952 [GATE 2014]

625. An electrolytic refining cell for copper consists of an alloy with activity of copper $a_{Cu} = 0.8$ as the anode, and pure copper as the cathode. What is the absolute value of the cell potential (in millivolts) at 25°C , given that copper is divalent? Faraday constant is 96500 C/mol and the universal gas constant is 8.314 J/(mol.K).

(*a*) 2.9 (*b*) 4.6
(*c*) 6.8 (*d*) 8.9 [GATE 2014]

626. A rod of a metal with Young's modulus of 200 GPa is pulled in tension to a stress of 400 MPa. What is the elastic strain (in %) that is recovered, when the rod is completely unloaded?

(*a*) 0.1 (*b*) 0.2
(*c*) 0.3 (*d*) 0.4 [GATE 2014]

627. Match the operations listed in *Group I* with the type of processes listed in *Group II*.

Group I :

P. Blast Furnace Iron making
Q. BOF Steel making
R. Hall-Heroult Process
S. Bayer Process

Group II :

1. Refining
2. Electrolysis
3. Smelting
4. Leaching

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

[GATE 2014]

628. The driving force for sintering a compact consisting of spherical particles of radius R_1 is ΔG_1. If the particle size is reduced to $R_2 = 0.1\ R_1$, the corresponding driving force $\Delta G_2 = \alpha \Delta G_1$, where α is

(*a*) 2 (*b*) 5
(*c*) 10 (*d*) 15

[GATE 2015]

Answers

1. (*d*)	2. (*d*)	3. (*c*)	4. (*c*)	5. (*c*)	6. (*d*)	7. (*b*)	8. (*d*)
9. (*c*)	10. (*d*)	11.(*d*)	12. (*a*)	13. (*a*)	14. (*a*)	15. (*d*)	16. (*b*)
17. (*b*)	18. (*d*)	19. (*d*)	20. (*c*)	21. (*c*)	22. (*c*)	23. (*d*)	24. (*c*)
25. (*d*)	26. (*a*)	27. (*d*)	28. (*c*)	29. (*a*)	30. (*d*)	31. (*d*)	32. (*b*)
33. (*b*)	34. (*c*)	35. (*b*)	36. (*c*)	37. (*d*)	38. (*b*)	39. (*c*)	40. (*b*)
41. (*c*)	42. (*d*)	43. (*d*)	44. (*c*)	45. (*b*)	46. (*b*)	47. (*b*)	48. (*a*)
49. (*c*)	50. (*c*)	51. (*b*)	52. (*a*)	53. (*b*)	54. (*c*)	55. (*a*)	56. (*c*)
57. (*d*)	58. (*a*)	59. (*d*)	60. (*a*)	61. (*c*)	62. (*a*)	63. (*b*)	64. (*c*)
65. (*a*)	66. (*d*)	67. (*b*)	68. (*a*)	69. (*b*)	70. (*c*)	71. (*c*)	72. (*b*)
73. (*d*)	74. (*a*)	75. (*a*)	76. (*d*)	77. (*b*)	78. (*c*)	79. (*c*)	80. (*b*)
81. (*c*)	82. (*a*)	83. (*b*)	84. (*a*)	85. (*c*)	86. (*c*)	87. (*b*)	88. (*b*)
89. (*a*)	90. (*b*)	91. (*c*)	92. (*d*)	93. (*c*)	94. (*b*)	95. (*c*)	96. (*a*)
97. (*a*)	98. (*d*)	99. (*d*)	100. (*d*)	101. (*b*)	102. (*a*)	103. (*b*)	104. (*c*)
105. (*c*)	106. (*c*)	107. (*d*)	108. (*b*)	109. (*a*)	110. (*d*)	111. (*a*)	112. (*c*)
113. (*b*)	114. (*a*)	115. (*b*)	116. (*b*)	117. (*a*)	118. (*c*)	119. (*c*)	120. (*b*)
121. (*c*)	122. (*a*)	123. (*c*)	124. (*a*)	125. (*b*)	126. (*c*)	127. (*c*)	128. (*d*)
129. (*a*)	130. (*c*)	131. (*b*)	132. (*b*)	133. (*b*)	134. (*b*)	135. (*c*)	136. (*a*)
137. (*c*)	138. (*a*)	139. (*b*)	140. (*a*)	141. (*c*)	142. (*a*)	143. (*a*)	144. (*b*)
145. (*c*)	146. (*c*)	147. (*a*)	148. (*c*)	149. (*b*)	150. (*a*)	151. (*b*)	152. (*d*)
153. (*a*)	154. (*d*)	155. (*b*)	156. (*b*)	157. (*b*)	158. (*a*)	159. (*d*)	160. (*d*)
161. (*c*)	162. (*d*)	163. (*c*)	164. (*a*)	165. (*a*)	166. (*b*)	167. (*b*)	168. (*b*)
169. (*c*)	170. (*c*)	171. (*a*)	172. (*c*)	173. (*c*)	174. (*c*)	175. (*b*)	176. (*c*)
177. (*d*)	178. (*c*)	179. (*c*)	180. (*a*)	181. (*b*)	182. (*b*)	183. (*c*)	184. (*d*)
185. (*d*)	186. (*c*)	187. (*c*)	188. (*d*)	189. (*d*)	190. (*a*)	191. (*b*)	192. (*c*)
193. (*d*)	194. (*a*)	195. (*a*)	196. (*d*)	197. (*a*)	198. (*b*)	199. (*c*)	200. (*c*)
201. (*c*)	202. (*b*)	203. (*a*)	204. (*d*)	205. (*d*)	206. (*a*)	207. (*c*)	208. (*c*)
209. (*d*)	210. (*d*)	211. (*c*)	212. (*c*)	213. (*d*)	214. (*d*)	215. (*a*)	216. (*b*)
217. (*d*)	218. (*a*)	219. (*b*)	220. (*d*)	221. (*c*)	222. (*b*)	223. (*c*)	224. (*a*)
225. (*d*)	226. (*c*)	227. (*a*)	228. (*a*)	229. (*d*)	230. (*a*)	231. (*b*)	232. (*b*)
233. (*c*)	234. (*b*)	235. (*a*)	236. (*a*)	237. (*c*)	238. (*c*)	239. (*a*)	240. (*c*)
241. (*d*)	242. (*a*)	243. (*b*)	244. (*d*)	245. (*b*)	246. (*b*)	247. (*d*)	248. (*b*)
249. (*b*)	250. (*c*)	251. (*b*)	252. (*a*)	253. (*d*)	254. (*a*)	255. (*b*)	256. (*c*)
257. (*b*)	258. (*b*)	259. (*c*)	260. (*d*)	261. (*b*)	262. (*a*)	263. (*c*)	264. (*d*)
265. (*c*)	266. (*b*)	267. (*a*)	268. (*a*)	269. (*c*)	270. (*d*)	271. (*a*)	272. (*c*)
273. (*b*)	274. (*d*)	275. (*a*)	276. (*c*)	277. (*a*)	278. (*b*)	279. (*b*)	280. (*c*)
281. (*b*)	282. (*a*)	283. (*c*)	284. (*c*)	285. (*a*)	286. (*b*)	287. (*d*)	288. (*a*)
289. (*b*)	290. (*a*)	291. (*b*)	292. (*c*)	293. (*d*)	294. (*d*)	295. (*b*)	296. (*a*)
297. (*b*)	298. (*d*)	299. (*b*)	300. (*a*)	301. (*a*)	302. (*c*)	303. (*c*)	304. (*c*)
305. (*b*)	306. (*c*)	307. (*b*)	308. (*b*)	309. (*b*)	310. (*c*)	311. (*b*)	312. (*b*)
313. (*d*)	314. (*b*)	315. (*d*)	316. (*b*)	317. (*d*)	318. (*c*)	319. (*b*)	320. (*b*)
321. (*c*)	322. (*b*)	323. (*a*)	324. (*d*)	325. (*a*)	326. (*d*)	327. (*c*)	328. (*b*)
329. (*c*)	330. (*b*)	331. (*a*)	332. (*a*)	333. (*a*)	334. (*c*)		

335.	336.	337.	338.	339.
(*a*)-IV	(*a*)-IV	(*a*)-II	(*a*)-IV	(*a*)-II
(*b*)-I	(*b*)-III	(*b*)-I	(*b*)-III	(*b*)-III
(*c*)-II	(*c*)-II	(*c*)-IV	(*c*)-II	(*c*)-I
(*d*)-III	(*d*)-I	(*d*)-III	(*d*)-I	(*d*)-IV

340.	341.	342.	343.	344.	345.	346.
(*a*)-II	(*a*)-IV	(*a*)-II	(*a*)-II	(*a*)-IV	(*a*)-II	(*a*)-II
(*b*)-I	(*b*)-I	(*b*)-IV	(*b*)-III	(*b*)-III	(*b*)-III	(*b*)-III
(*c*)-IV	(*c*)-III	(*c*)-I	(*c*)-IV	(*c*)-II	(*c*)-IV	(*c*)-IV
(*d*)-III	(*d*)-II	(*d*)-III	(*d*)-I	(*d*)-I	(*d*)-I	(*d*)-I

347. (*a*)	348. (*a*)	349. (*d*)	350. (*a*)	351. (*c*)	352. (*d*)	353. (*c*)	354. (*d*)

355. (*b*) 356. (*a*) 357. (*d*) 358. (*b*) 359. (*a*) 360. (*a*) 361. (*b*) 362. (*c*)
363. (*a*) 364. (*d*) 365. (*b*) 366. (*b*) 367. (*c*) 368. (*a*) 369. (*b*) 370. (*c*)
371. (*b*) 372. (*c*) 373. (*a*) 374. (*d*) 375. (*c*) 376. (*c*) 377. (*a*) 378. (*b*)
379. (*d*) 380. (*b*) 381. (*b*) 382. (*b*) 383. (*c*) 384. (*c*) 385. (*d*) 386. (*c*)
387. (*b*) 388. (*c*) 389. (*b*) 390. (*b*) 391. (*c*) 392. (*b*) 393. (*d*) 394. (*a*)
395. (*b*) 396. (*b*) 397. (*b*) 398. (*c*) 399. (*d*) 400. (*c*) 401. (*b*) 402. (*b*)
403. (*a*) 404. (*c*) 405. (*d*) 406. (*d*) 407. (*b*) 408. (*c*) 409. (*b*) 410. (*a*)
411. (*b*) 412. (*a*) 413. (*d*) 414. (*b*) 415. (*b*) 416. (*c*) 417. (*d*) 418. (*b*)
419. (*c*) 420. (*c*) 421. (*b*) 422. (*d*) 423. (*a*) 424. (*b*) 425. (*b*) 426. (*d*)
427. (*a*) 428. (*a*) 429. (*a*) 430. (*c*) 431. (*c*) 432. (*b*) 433. (*a*) 434. (*d*)
435. (*c*) 436. (*d*) 437. (*c*) 438. (*c*) 439. (*d*) 440. (*a*) 441. (*c*) 442. (*a*)
443. (*c*) 444. (*d*) 445. (*c*) 446. (*a*) 447. (*a*) 448. (*c*) 449. (*b*) 450. (*c*)
451. (*d*) 452. (*a*) 453. (*b*) 454. (*c*) 455. (*b*) 456. (*b*) 457. (*b*) 458. (*b*)
459. (*a*) 460. (*d*) 461. (*b*) 462. (*d*) 463. (*a*) 464. (*b*) 465. (*c*) 466. (*d*)
467. (*d*) 468. (*d*) 469. (*d*) 470. (*c*) 471. (*d*) 472. (*c*) 473. (*b*) 474. (*d*)
475. (*c*) 476. (*b*) 477. (*c*) 478. (*c*) 479. (*c*) 480. (*d*) 481. (*a*) 482. (*c*)
483. (*b*) 484. (*a*) 485. (*b*) 486. (*a*) 487. (*b*) 488. (*c*) 489. (*b*) 490. (*d*)
491. (*c*) 492. (*a*) 493. (*b*) 494. (*c*) 495. (*b*) 496. (*c*) 497. (*b*) 498. (*d*)
499. (*c*) 500. (*a*) 501. (*a*) 502. (*a*) 503. (*d*) 504. (*c*) 505. (*b*) 506. (*c*)
507. (*c*) 508. (*a*) 509. (*b*) 510. (*b*) 511. (*b*) 512. (*c*) 513. (*b*) 514. (*a*)
515. (*a*) 516. (*a*) 517. (*b*) 518. (*c*) 519. (*b*) 520. (*d*) 521. (*a*) 522. (*c*)
523. (*b*) 524. (*b*) 525. (*a*) 526. (*d*) 527. (*d*) 528. (*a*) 529. (*c*) 530. (*a*)
531. (*b*) 532. (*d*) 533. (*c*)

534.
a-II
b-I
c-IV
d-III

535.
a-IV
b-III
c-II
d-I

536.
a-IV
b-III
c-II
d-I

537.
a-III
b-I
c-IV
d-II

538. (*a*) 539. (*b*) 540. (*b*) 541. (*c*) 542. (*b*) 543. (*c*) 544. (*b*) 545. (*b*)
546. (*c*) 547. (*d*) 548. (*c*) 549. (*b*) 550. (*d*) 551. (*d*) 552. (*c*) 553. (*b*)
554. (*a*) 555. (*b*) 556. (*b*) 557. (*b*) 558. (*b*) 559. (*a*) 560. (*b*) 561. (*b*)
562. (*c*) 563. (*c*) 564. (*a*) 565. (*a*) 566. (*b*)

567.
a-IV
b-III
c-II
d-I

568.
a-III
b-IV
c-I
d-II.

569. (*b* & *d*) 570. (*d*) 571. (*a*) 572. (*b*)
573. (*b*) 574. (*c*) 575. (*c*) 576. (*c*) 577. (*a*) 578. (*c*) 579. (*b*) 580. (*b*)
581. (*b*) 582. (*c*) 583. (*a*) 584. (*c*) 585. (*a*) 586. (*d*) 587. (*b*) 588. (*a*)
589. (*d*) 590. (*d*) 591. (*b*) 592. (*a*) 593. (*c*) 594. (*d*) 595. (*b*) 596. (*a*)
597. (*d*) 598. (*a*) 599. (*d*) 600. (*d*) 601. (*d*) 602. (*b*) 603. (*b*) 604. (*c*)
605. (*d*) 606. (*c*) 607. (*a*) 608. (*b*) 609. (*c*) 610. (*a*) 611. (*a*) 612. (*c*)
613. (*b*) 614. (*b*) 615. (*c*) 616. (*b*) 617. (*c*) 618. (*b*) 619. (*b*) 620. (*d*)
621. (*a*) 622. (*c*) 623. (*b*) 624. (*d*) 625. (*a*) 626. (*b*) 627. (*b*) 628. (*c*)