🧪 Unit 1 – Iron–Carbon Equilibrium Phase Diagram (100 MCQs)

1. The iron–carbon diagram is an example of a _____.
a) Time–Temperature diagram
b) Phase diagram
c) Cooling curve
d) Hardness chart
✅ Answer: b

2. The term “equilibrium” in the diagram indicates _____.
a) Fast cooling
b) Rapid transformation
c) Slow rate of temperature change
d) Instant heating
✅ Answer: c

3. Ferrite is also known as _____.
a) α-iron
b) γ-iron
c) δ-iron
d) β-iron
✅ Answer: a

4. Ferrite has which type of crystal structure?
a) FCC
b) BCC
c) HCP
d) Orthorhombic
✅ Answer: b

5. The carbon solubility in ferrite is approximately _____.
a) 0.02%
b) 0.8%
c) 2.14%
d) 6.67%
✅ Answer: a

6. Cementite is a compound of _____.
a) Fe_2O_3
b) Fe_3C
c) FeO
d) FeC
✅ Answer: b

7. Cementite contains approximately _____ carbon.
a) 0.8%
b) 2.14%
c) 4.3%
d) 6.67%
✅ Answer: d

8. Cementite is known for being _____.
a) Soft and ductile
b) Hard and brittle
c) Magnetic
d) Elastic
✅ Answer: b

9. Austenite has a _____ crystal structure.
a) BCC
b) FCC
c) BCT
d) Orthorhombic
✅ Answer: b

10. Austenite is stable at _____.
a) Room temperature
b) High temperature
c) Low temperature
d) Sub-zero temperature
✅ Answer: b

11. Pearlite is a mixture of _____.
a) Ferrite and austenite
b) Ferrite and cementite
c) Austenite and martensite
d) Cementite and graphite
✅ Answer: b

12. Pearlite is formed at a carbon content of approximately _____.
a) 0.02%
b) 0.8%
c) 2.14%
d) 4.3%
✅ Answer: b

13. The eutectoid point in the Fe–C diagram is at _____.
a) 0.18% C
b) 0.8% C

c) 2.14% C
d) 4.3% C
✅ Answer: b

14. The eutectic point corresponds to a carbon content of _____.
a) 0.8%
b) 2.14%
c) 4.3%
d) 6.67%
✅ Answer: c

15. The peritectic reaction occurs at _____.
a) 0.8% C
b) 0.18% C
c) 2.14% C
d) 4.3% C
✅ Answer: b

16. The lowest melting point in the Fe–C system occurs at _____.
a) 0.8% C
b) 2.14% C
c) 4.3% C
d) 6.67% C
✅ Answer: c

17. Martensite has a _____ crystal structure.
a) FCC
b) BCC
c) BCT
d) Orthorhombic
✅ Answer: c

18. Which phase is stable at room temperature in pure iron?
a) Austenite
b) Ferrite
c) Cementite
d) Martensite
✅ Answer: b

19. The eutectoid reaction occurs at a temperature of approximately _____.
a) 1147°C
b) 1493°C
c) 727°C
d) 911°C
✅ Answer: c

20. The eutectic reaction occurs at a temperature of about _____.
a) 1147°C
b) 727°C
c) 911°C
d) 1493°C
✅ Answer: a

21. The eutectic mixture in the Fe–C diagram is known as _____.
a) Pearlite
b) Ledeburite
c) Bainite
d) Martensite
✅ Answer: b

22. Austenite transforms to pearlite at _____.
a) Above 911°C
b) Around 727°C
c) Below 400°C
d) 1493°C
✅ Answer: b

23. Martensite is formed by _____.
a) Slow cooling
b) Rapid quenching
c) Annealing
d) Tempering
✅ Answer: b

24. The line separating ferrite and austenite regions in the Fe–C diagram is called _____.
a) A_1 line
b) A_3 line
c) A_4 line
d) Solvus line
✅ Answer: b

25. The solubility of carbon in austenite is up to _____.
a) 0.02%
b) 0.8%
c) 2.14%
d) 4.3%
✅ Answer: c

26. The structure of cast iron mainly depends on _____.
a) Cooling rate
b) Carbon content

c) Both a and b
d) None
✅ Answer: c

27. Which of the following is a metastable phase?
a) Ferrite
b) Pearlite
c) Cementite
d) Martensite
✅ Answer: d

28. The hard and brittle phase in steel is _____.
a) Ferrite
b) Pearlite
c) Cementite
d) Martensite
✅ Answer: c

29. The stable form of iron below 910°C is _____.
a) α-iron
b) β-iron
c) γ-iron
d) δ-iron
✅ Answer: a

30. The Fe–C phase diagram is valid up to _____ carbon content.
a) 2.14%
b) 4.3%
c) 6.67%
d) 10%
✅ Answer: c

31. The eutectoid mixture in the Fe–C system is called _____.
a) Martensite
b) Pearlite
c) Ledeburite
d) Bainite
✅ **Answer:** b

32. Eutectoid reaction in steel occurs when _____.
a) Austenite → Ferrite + Cementite
b) Ferrite → Austenite
c) Cementite → Austenite
d) Austenite → Martensite
✅ **Answer:** a

33. The carbon content in eutectoid steel is _____.
a) 0.02%
b) 0.8%
c) 2.14%
d) 4.3%
✅ **Answer:** b

34. The eutectic reaction in iron–carbon system is _____.
a) $L \rightarrow \gamma + Fe_3C$
b) $L \rightarrow \alpha + Fe_3C$
c) $\gamma \rightarrow \alpha + Fe_3C$
d) $L + Fe_3C \rightarrow \gamma$
✅ **Answer:** a

35. The phase present in hypoeutectoid steel just above 727°C is _____.
a) Ferrite
b) Austenite
c) Pearlite
d) Cementite
✅ **Answer:** b

36. The phase present below 727°C in eutectoid steel is _____.
a) Pearlite
b) Ferrite
c) Cementite
d) Martensite
✅ **Answer:** a

37. Hypoeutectoid steels contain _____.
a) Less than 0.8% carbon
b) Exactly 0.8% carbon
c) More than 0.8% carbon
d) More than 4.3% carbon
✅ **Answer:** a

38. Hypereutectoid steels contain _____.
a) Less than 0.8% carbon
b) Exactly 0.8% carbon
c) More than 0.8% carbon but less than 2.14%
d) More than 4.3% carbon
✅ **Answer:** c

39. Cast irons contain carbon more than _____.
a) 0.8%
b) 2.14%

c) 4.3%
d) 6.67%
✅ **Answer:** b

40. At 4.3% carbon, the alloy becomes _____.
a) Steel
b) Cast iron
c) Wrought iron
d) Ferritic iron
✅ **Answer:** b

41. The eutectic mixture of austenite and cementite is called _____.
a) Pearlite
b) Ledeburite
c) Bainite
d) Martensite
✅ **Answer:** b

42. Ferrite is _____ magnetic at room temperature.
a) Strongly
b) Weakly
c) Non
d) Paramagnetic
✅ **Answer:** a

43. Austenite is _____ magnetic at room temperature.
a) Strongly
b) Non
c) Weakly
d) Ferromagnetic
✅ **Answer:** b

44. Cementite is _____.
a) Soft and ductile
b) Very hard and brittle
c) Very soft and tough
d) Elastic
✅ **Answer:** b

45. Martensite is formed by _____ transformation.
a) Diffusional
b) Non-diffusional
c) Partial diffusion
d) Slow diffusion
✅ **Answer:** b

46. Martensitic transformation occurs during _____.
a) Heating
b) Cooling
c) Isothermal holding
d) Annealing
✅ **Answer:** b

47. The temperature at which austenite begins to form on heating is called _____.
a) A_1
b) A_3
c) A_4
d) Acm
✅ **Answer:** b

48. The eutectoid temperature is also called the _____.
a) A_1 line
b) A_3 line
c) A_4 line
d) Solvus line
✅ **Answer:** a

49. The structure of hypoeutectoid steel below 727°C is _____.
a) Ferrite + Pearlite
b) Pearlite + Cementite
c) Ferrite + Cementite
d) Austenite + Cementite
✅ **Answer:** a

50. The structure of hypereutectoid steel below 727°C is _____.
a) Ferrite + Pearlite
b) Pearlite + Cementite
c) Ferrite + Cementite
d) Pearlite only
✅ **Answer:** b

51. The carbon content of pure iron is _____.
a) 0%
b) 0.02%
c) 0.8%
d) 2.14%
✅ **Answer:** a

52. Austenite can dissolve up to _____ carbon at 1147°C.
a) 0.02%
b) 0.8%

c) 2.14%
d) 4.3%
✅ **Answer:** c

53. Cementite appears as _____ in microstructure.
a) Dark plates
b) Bright plates
c) Light network
d) None
✅ **Answer:** b

54. The main constituent of white cast iron is _____.
a) Graphite
b) Cementite
c) Ferrite
d) Austenite
✅ **Answer:** b

55. The eutectic reaction in Fe–C occurs at _____°C.
a) 727
b) 911
c) 1147
d) 1493
✅ **Answer:** c

56. δ-ferrite is stable between _____.
a) Room temp – 912°C
b) 912°C – 1394°C
c) 1394°C – 1538°C
d) Above 1538°C
✅ **Answer:** c

57. The crystal structure of δ-ferrite is _____.
a) BCC
b) FCC
c) BCT
d) Orthorhombic
✅ **Answer:** a

58. The phase existing just below 912°C in pure iron is _____.
a) δ-ferrite
b) γ-austenite
c) α-ferrite
d) Cementite
✅ **Answer:** b

59. The carbon content at eutectic point is _____.
a) 0.02%
b) 0.8%
c) 2.14%
d) 4.3%
✅ **Answer:** d

60. Iron changes from BCC to FCC at about _____.
a) 727°C
b) 911°C
c) 1147°C
d) 1493°C
✅ **Answer:** b

61. The compound Fe_3C is called _____.
a) Austenite
b) Ferrite
c) Cementite
d) Martensite
✅ **Answer:** c

62. The term “pearlite” is derived due to its _____ appearance.
a) Black
b) Bright
c) Pearl-like
d) Dull
✅ **Answer:** c

63. The eutectic composition corresponds to _____.
a) 0.8% C
b) 2.14% C
c) 4.3% C
d) 6.67% C
✅ **Answer:** c

64. The eutectoid transformation occurs in _____.
a) Steels
b) Cast irons
c) Wrought irons
d) Pig iron
✅ **Answer:** a

65. Hypoeutectoid steels are softer due to the presence of _____.
a) Ferrite
b) Cementite

c) Pearlite
d) Martensite
✅ **Answer:** a

66. The melting point of pure iron is approximately _____.
a) 1147°C
b) 1394°C
c) 1538°C
d) 1600°C
✅ **Answer:** c

67. The transformation temperature of eutectoid steel is _____.
a) 1147°C
b) 727°C
c) 911°C
d) 1493°C
✅ **Answer:** b

68. The mechanical property of pearlite is _____.
a) Soft and ductile
b) Hard and strong
c) Brittle
d) Magnetic
✅ **Answer:** b

69. In the Fe–C system, Fe_3C is a _____ compound.
a) Solid solution
b) Intermediate compound
c) Intermetallic compound
d) Alloy
✅ **Answer:** b

70. The eutectic mixture is a combination of _____.
a) Ferrite + Pearlite
b) Austenite + Cementite
c) Ferrite + Cementite
d) Austenite + Graphite
✅ **Answer:** b

71. The solidification of cast iron begins at _____.
a) 1147°C
b) 1493°C
c) 727°C
d) 911°C
✅ **Answer:** a

72. In the Fe–C diagram, line PSK represents _____.
a) Eutectoid reaction
b) Eutectic reaction
c) Peritectic reaction
d) Solidus line
✅ **Answer:** a

73. In eutectoid steel, structure at room temperature is _____.
a) Pearlite
b) Ferrite
c) Cementite
d) Martensite
✅ **Answer:** a

74. The hard and brittle constituent in cast iron is _____.
a) Ferrite
b) Graphite
c) Cementite
d) Pearlite
✅ **Answer:** c

75. The region below 727°C in the Fe–C diagram mainly contains _____.
a) α + Fe_3C
b) γ + Fe_3C
c) α + γ
d) L + γ
✅ **Answer:** a

76. The eutectic mixture “ledeburite” transforms into _____ upon cooling.
a) Pearlite + Cementite
b) Ferrite + Pearlite
c) Cementite + Graphite
d) Austenite + Ferrite
✅ **Answer:** a

77. The peritectic reaction in Fe–C system occurs at about _____.
a) 727°C
b) 911°C
c) 1493°C
d) 1147°C
✅ **Answer:** c

78. The phase diagram helps determine _____.
a) Hardness
b) Corrosion rate

c) Phases present at given conditions
d) Grain size
✅ **Answer:** c

79. The percentage of carbon in cast iron lies between _____.
a) 0.02–0.8%
b) 0.8–2.14%
c) 2.14–6.67%
d) 6.67–10%
✅ **Answer:** c

80. Which of the following is *not* a phase in Fe–C system?
a) Ferrite
b) Pearlite
c) Cementite
d) Graphite
✅ **Answer:** d

81. Carbon exists in Fe–C system as _____.
a) Solute element
b) Solvent
c) Compound Fe_3C
d) Free graphite
✅ **Answer:** c

82. The solid solution of carbon in α-iron is called _____.
a) Austenite
b) Ferrite
c) Cementite
d) Martensite
✅ **Answer:** b

83. The microstructure formed at 0.2% carbon after cooling is _____.
a) Ferrite + Pearlite
b) Pearlite only
c) Pearlite + Cementite
d) Ferrite + Cementite
✅ **Answer:** a

84. The Fe–C diagram is drawn up to _____ carbon percentage.
a) 2%
b) 4.3%
c) 6.67%
d) 10%
✅ **Answer:** c

85. The Fe–C diagram is useful for _____.
a) Predicting hardness
b) Predicting phase transformations
c) Measuring strength
d) Determining density
✅ **Answer:** b

86. The eutectic composition gives _____ melting point.
a) Maximum
b) Minimum
c) Average
d) Variable
✅ **Answer:** b

87. At 0.8% carbon and 727°C, the phase present is _____.
a) Austenite
b) Pearlite
c) Ferrite
d) Cementite
✅ **Answer:** b

88. In the Fe–C diagram, the horizontal line at 727°C is known as _____.
a) Eutectic line
b) Eutectoid line
c) Peritectic line
d) Liquidus line
✅ **Answer:** b

89. Steel having 0.8% carbon is called _____.
a) Hypoeutectoid
b) Eutectoid
c) Hypereutectoid
d) None
✅ **Answer:** b

90. When austenite cools rapidly, it forms _____.
a) Pearlite
b) Bainite
c) Martensite
d) Ferrite
✅ **Answer:** c

91. The iron–carbon diagram is plotted up to _____°C.
a) 1147
b) 1394

c) 1538
d) 1600
✅ **Answer:** c

92. The eutectoid mixture contains _____.
a) Ferrite + Cementite
b) Austenite + Cementite
c) Ferrite + Graphite
d) Cementite only
✅ **Answer:** a

93. The Fe–C diagram is also called the _____ diagram.
a) Binary equilibrium
b) Ternary
c) Pseudobinary
d) None
✅ **Answer:** a

94. The hypoeutectoid steel contains _____ ferrite than pearlite.
a) More
b) Less
c) Equal
d) No
✅ **Answer:** a

95. Cementite is also known as _____.
a) Iron carbide
b) Iron oxide
c) Iron sulphide
d) Iron nitride
✅ **Answer:** a

96. Which phase has the highest hardness?
a) Ferrite
b) Pearlite
c) Cementite
d) Martensite
✅ **Answer:** d

97. Which phase has maximum ductility?
a) Ferrite
b) Pearlite
c) Cementite
d) Martensite
✅ **Answer:** a

98. The Fe–C diagram is used to design _____.
a) Heat treatment processes
b) Alloy addition
c) Surface coating
d) Welding joints
✅ **Answer:** a

99. Austenite exists between _____°C range in steel.
a) 400–700°C
b) 727–1147°C
c) 911–1394°C
d) 1394–1538°C
✅ **Answer:** c

100. The Fe–C diagram helps to predict _____.
a) Microstructure
b) Grain size
c) Hardness directly
d) Corrosion rate
✅ **Answer:** a

🔥 Unit 2 – Heat Treatment (100 MCQs)

1. Heat treatment is defined as _____.
a) Heating metals above melting point
b) Heating and cooling metals in solid state to get desired properties
c) Cooling metals in liquid state
d) Coating metals with oxide layer
✅ **Answer:** b

2. The main purpose of heat treatment is to _____.
a) Improve color of metal
b) Obtain desired mechanical properties
c) Reduce cost
d) Change shape
✅ **Answer:** b

3. The equilibrium structure of alloys can be predicted using _____.
a) TTT diagram
b) Equilibrium diagram
c) Cooling curve

d) Hardness chart
✅ **Answer:** b

4. Which of the following is not a purpose of heat treatment?
a) Improve mechanical properties
b) Relieve stresses
c) Change dimensions permanently
d) Refine microstructure
✅ **Answer:** c

5. Hardness of cutting tools can be increased by _____.
a) Annealing
b) Hardening
c) Normalizing
d) Stress relieving
✅ **Answer:** b

6. Heat treatment improves fatigue strength in parts like _____.
a) Bolts
b) Crankshafts
c) Nuts
d) Rivets
✅ **Answer:** b

7. Annealing makes steel _____.
a) Harder
b) Softer and more machinable
c) Brittle
d) Unusable
✅ **Answer:** b

8. Stress relief heat treatment removes stresses caused by _____.
a) Welding
b) Machining
c) Forging
d) All of these
✅ **Answer:** d

9. Wear resistance can be increased by _____.
a) Normalizing
b) Case hardening
c) Annealing
d) Stress relieving
✅ **Answer:** b

10. The success of heat treatment depends on controlling _____.
a) Heating rate
b) Soaking time
c) Cooling rate
d) All of these
✅ **Answer:** d

11. During soaking, the part is _____.
a) Rapidly cooled
b) Held at constant temperature
c) Hammered
d) Tempered
✅ **Answer:** b

12. The unit of soaking time is _____.
a) Minutes
b) Hours
c) Seconds
d) Both a and b
✅ **Answer:** d

13. The cooling rate decides the _____ of the material.
a) Color
b) Microstructure
c) Weight
d) Composition
✅ **Answer:** b

14. The atmosphere in the furnace is controlled to avoid _____.
a) Oxidation
b) Decarburization
c) Both a and b
d) None
✅ **Answer:** c

15. Hardening and tempering is also known as _____.
a) Case hardening
b) Through hardening
c) Nitriding
d) Carbonitriding
✅ **Answer:** b

16. Hardening involves _____.
a) Heating and slow cooling
b) Heating and rapid cooling

c) No heating
d) Heating above melting point
✅ **Answer:** b

17. The medium used for quenching can be _____.
a) Water
b) Oil
c) Salt bath
d) All of these
✅ **Answer:** d

18. The key factors affecting hardening are _____.
a) Composition of steel
b) Size and shape of part
c) Cooling rate
d) All of these
✅ **Answer:** d

19. Hardening process is generally used for _____.
a) Medium carbon steels
b) Low carbon steels
c) Stainless steels
d) Cast irons
✅ **Answer:** a

20. The process of adding carbon to the surface of steel is called _____.
a) Nitriding
b) Carburizing
c) Tempering
d) Annealing
✅ **Answer:** b

21. Carburizing increases _____.
a) Surface hardness
b) Core toughness
c) Both a and b
d) None
✅ **Answer:** c

22. Carburizing is suitable for _____.
a) Low carbon steels
b) Medium carbon steels
c) High carbon steels
d) Cast irons
✅ **Answer:** a

23. The diffusion of carbon occurs during _____.
a) Carburizing
b) Tempering
c) Annealing
d) Normalizing
✅ **Answer:** a

24. Gas carburizing is carried out in a _____.
a) Solid medium
b) Gas medium
c) Liquid medium
d) None
✅ **Answer:** b

25. In pack carburizing, the medium used is _____.
a) Ammonia
b) Charcoal
c) Salt bath
d) Oil
✅ **Answer:** b

26. Liquid carburizing uses _____.
a) Molten cyanide salts
b) Molten copper
c) Oil
d) Water
✅ **Answer:** a

27. Carburized steel has _____ surface and _____ core.
a) Soft, hard
b) Hard, tough
c) Brittle, soft
d) Ductile, brittle
✅ **Answer:** b

28. Carbonitriding introduces _____ into steel.
a) Carbon
b) Nitrogen
c) Both carbon and nitrogen
d) Hydrogen
✅ **Answer:** c

29. Temperature range for carbonitriding is _____.
a) 500–600°C
b) 700–800°C

c) 850–880°C
d) 950–1050°C
✅ **Answer:** c

30. Carbonitriding is best suited for _____.
a) Low carbon steels
b) High carbon steels
c) Cast iron
d) Stainless steel
✅ **Answer:** a

31. The main advantage of carbonitriding is _____.
a) High cost
b) Shallow case depth
c) Low cost and good surface hardness
d) No diffusion
✅ **Answer:** c

32. Case depth achieved in carbonitriding is about _____.
a) 0.1 mm
b) 0.3–0.75 mm
c) 1.5 mm
d) 3 mm
✅ **Answer:** b

33. Surface hardness after carbonitriding is around _____.
a) 20 HRC
b) 30 HRC
c) 52–56 HRC
d) 65 HRC
✅ **Answer:** c

34. Nitriding involves diffusion of _____.
a) Nitrogen
b) Carbon
c) Both
d) Hydrogen
✅ **Answer:** a

35. The temperature range for nitriding is _____.
a) 400–450°C
b) 540–570°C
c) 700–800°C
d) 900–1000°C
✅ **Answer:** b

36. Nitriding is carried out in presence of _____.
a) Ammonia gas
b) Oxygen
c) Steam
d) Methane
✅ **Answer:** a

37. Nitriding does not require _____.
a) Quenching
b) Heating
c) Furnace
d) Nitrogen
✅ **Answer:** a

38. Nitriding gives very high _____.
a) Surface hardness
b) Core hardness
c) Ductility
d) Elongation
✅ **Answer:** a

39. Nitriding case depth ranges between _____.
a) 0.1–0.5 mm
b) 1–2 mm
c) 2–4 mm
d) 4–6 mm
✅ **Answer:** a

40. White layer in nitriding is also called _____.
a) Compound zone
b) Diffusion zone
c) Austenite layer
d) Tempered layer
✅ **Answer:** a

41. Diffusion zone in nitriding lies below _____.
a) White layer
b) Austenite zone
c) Case depth
d) None
✅ **Answer:** a

42. Gas nitriding compound layer thickness is _____.
a) 10 μm
b) 20–50 μm

c) 100 μm
d) 1 mm
✅ **Answer:** b

43. Nitriding steels usually contain _____.
a) Cr, Mo, V, Al
b) Ni, Cu, Zn
c) Mn, Si, Ti
d) Pb, Sn, Cd
✅ **Answer:** a

44. Nitriding improves _____.
a) Wear resistance
b) Fatigue life
c) Corrosion resistance
d) All of these
✅ **Answer:** d

45. Induction hardening uses _____.
a) Flame
b) Induced current
c) Chemical bath
d) Salt bath
✅ **Answer:** b

46. In induction hardening, heat is generated due to _____.
a) Radiation
b) Conduction
c) Eddy currents
d) Convection
✅ **Answer:** c

47. Induction heating frequency affects _____.
a) Case depth
b) Color
c) Grain size
d) Hardness only
✅ **Answer:** a

48. Medium frequency induction machine operates at _____.
a) 1–10 kHz
b) 50–60 Hz
c) 100–200 Hz
d) 200–500 kHz
✅ **Answer:** a

49. High frequency induction machines work at _____.
a) 250–425 kHz
b) 1–10 kHz
c) 20–50 Hz
d) 10–100 Hz
✅ **Answer:** a

50. The heat produced in induction hardening depends on _____.
a) Frequency and current
b) Temperature only
c) Time only
d) Magnetic field only
✅ **Answer:** a

51. Tempering is done after _____.
a) Annealing
b) Hardening
c) Normalizing
d) Nitriding
✅ **Answer:** b

52. The main purpose of tempering is to _____.
a) Increase brittleness
b) Reduce brittleness and improve toughness
c) Increase hardness
d) Remove corrosion
✅ **Answer:** b

53. Tempering temperature range for carburized steels is _____.
a) 100–150°C
b) 160–180°C
c) 200–250°C
d) 300–400°C
✅ **Answer:** b

54. Direct hardening steels are tempered at _____.
a) 160–180°C
b) 200–450°C
c) 500–600°C
d) 650°C
✅ **Answer:** b

55. Induction hardened parts are tempered at _____.
a) 150°C
b) 180–250°C

c) 300°C
d) 400°C
✅ **Answer:** b

56. Normalizing is done to _____.
a) Refine grain size
b) Relieve stresses
c) Both a and b
d) None
✅ **Answer:** c

57. The cooling medium in normalizing is _____.
a) Water
b) Oil
c) Air
d) Salt bath
✅ **Answer:** c

58. Stress relieving is done at temperatures between _____.
a) 100–200°C
b) 180–650°C
c) 700–900°C
d) 900–1100°C
✅ **Answer:** b

59. Stress relieving is mainly used for _____.
a) Forged components
b) Welded components
c) Castings
d) All of these
✅ **Answer:** d

60. Overheating during heat treatment causes _____.
a) Coarse grains
b) Finer grains
c) Bright color
d) High toughness
✅ **Answer:** a

61. Burning occurs when metal is heated _____.
a) Below critical temperature
b) Near melting point for long time
c) Slowly cooled
d) None
✅ **Answer:** b

62. Decarburization means _____.
a) Increase of carbon content
b) Loss of carbon from surface
c) Increase of nitrogen
d) None
✅ **Answer:** b

63. Cracks in hardened parts increase with _____.
a) Higher carbon content
b) Higher hardening temperature
c) Faster cooling
d) All of these
✅ **Answer:** d

64. Distortion or warpage occurs due to _____.
a) Uneven heating
b) Improper quenching
c) Improper fixturing
d) All of these
✅ **Answer:** d

65. Normalizing temperature range is in _____.
a) Austenitic region
b) Ferritic region
c) Martensitic region
d) None
✅ **Answer:** a

66. The purpose of annealing is to _____.
a) Soften metal
b) Increase hardness
c) Induce stresses
d) Reduce ductility
✅ **Answer:** a

67. Slow cooling during annealing is done _____.
a) In air
b) In furnace
c) In oil
d) In water
✅ **Answer:** b

68. Rapid quenching produces _____.
a) Pearlite
b) Martensite

c) Bainite
d) Ferrite
✅ **Answer:** b

69. Martensite is characterized by _____.
a) High hardness
b) Low toughness
c) Both a and b
d) None
✅ **Answer:** c

70. Normalizing results in _____.
a) Fine grain structure
b) Coarse grains
c) Soft metal
d) None
✅ **Answer:** a

71. Hardening temperature is selected to achieve _____.
a) Full austenite formation
b) Partial ferrite
c) Cementite phase
d) None
✅ **Answer:** a

72. The medium used for tempering is usually _____.
a) Oil
b) Air
c) Furnace atmosphere
d) Any of these
✅ **Answer:** d

73. Quenching media must be preheated to avoid _____.
a) Boiling
b) Cracks
c) Explosion
d) All
✅ **Answer:** d

74. Fire extinguishers near furnaces should be of _____ type.
a) Water
b) CO_2 or dry powder
c) Foam
d) Sand
✅ **Answer:** b

75. PPE in heat treatment includes _____.
a) Gloves
b) Goggles
c) Apron
d) All of these
✅ **Answer:** d

76. Oil quenching gives _____ cooling than water.
a) Slower
b) Faster
c) Equal
d) None
✅ **Answer:** a

77. Quenching medium affects _____.
a) Case depth
b) Cooling rate
c) Hardness
d) Both b and c
✅ **Answer:** d

78. Normalizing is applied to _____.
a) Forged parts
b) Castings
c) Rolled parts
d) All
✅ **Answer:** d

79. In tempering, hardness _____.
a) Increases
b) Decreases
c) Remains same
d) None
✅ **Answer:** b

80. Tempering relieves _____.
a) Internal stresses
b) External stresses
c) Mechanical pressure
d) All
✅ **Answer:** a

81. Case hardening includes _____.
a) Carburizing
b) Nitriding

c) Carbonitriding
d) All
✅ **Answer:** d

82. Carburizing temperature is usually around _____.
a) 600°C
b) 800°C
c) 900–950°C
d) 1000–1100°C
✅ **Answer:** c

83. Carbon potential in carburizing is _____.
a) 0.2%
b) 0.4%
c) 0.75%
d) 1%
✅ **Answer:** c

84. The microstructure of hardened steel consists of _____.
a) Ferrite
b) Martensite
c) Pearlite
d) Bainite
✅ **Answer:** b

85. After carburizing, parts are usually _____.
a) Quenched
b) Air cooled
c) Oil cooled
d) Both a and c
✅ **Answer:** d

86. Normalizing helps in obtaining _____.
a) Uniform microstructure
b) Variable hardness
c) High brittleness
d) Non-uniform grains
✅ **Answer:** a

87. Decarburization can be avoided by _____.
a) Controlled atmosphere
b) Rapid cooling
c) Heating above melting
d) Using oil
✅ **Answer:** a

88. Nitriding improves corrosion resistance due to _____.
a) Nitrogen layer
b) Carbon layer
c) Chromium
d) None
✅ **Answer:** a

89. The maximum hardness in nitriding exceeds _____.
a) 100 Hv
b) 500 Hv
c) 1000 Hv
d) 1500 Hv
✅ **Answer:** c

90. The distortion in parts during heat treatment can be minimized by _____.
a) Slow heating and cooling
b) Rapid quenching
c) Random heating
d) Overheating
✅ **Answer:** a

91. The compound zone in nitriding is sometimes called _____.
a) White layer
b) Black layer
c) Diffusion layer
d) Surface oxide
✅ **Answer:** a

92. Medium carbon steel examples include _____.
a) EN8, C40, C45
b) EN19, EN24
c) EN31
d) All of these
✅ **Answer:** d

93. Cracking tendency increases with _____.
a) High carbon and fast cooling
b) Low carbon and slow cooling
c) Both
d) None
✅ **Answer:** a

94. The main purpose of stress relieving is to _____.
a) Increase strength
b) Relieve internal stress

c) Refine grains
d) None
✅ **Answer:** b

95. In induction hardening, surface heating is achieved by _____.
a) Induced current
b) Radiation
c) Convection
d) Conduction
✅ **Answer:** a

96. In annealing, the structure becomes _____.
a) Coarse pearlite
b) Fine pearlite
c) Martensite
d) Bainite
✅ **Answer:** a

97. In normalizing, the structure becomes _____.
a) Fine pearlite
b) Coarse pearlite
c) Martensite
d) Austenite
✅ **Answer:** a

98. TTT diagram is used to study _____.
a) Transformation of austenite
b) Melting point
c) Crystal defects
d) Hardness
✅ **Answer:** a

99. TTT diagram helps to design _____.
a) Heat treatment cycles
b) Tool shape
c) Casting molds
d) Welding electrodes
✅ **Answer:** a

100. Heat treatment mainly aims at _____.
a) Controlling microstructure
b) Increasing mass
c) Removing surface
d) Changing composition
✅ **Answer:** a