HEAT TREATMENT QUESTIONS

1. What is the effect of heat treatment on a metal?

a) Improvement in availability

b) Improved physical properties

c) Decreased color

d) Decreased availability

2. 2. Quenching involves submerging a heated metal in a liquid to speed up its cooling process.

a) True

b) False

3. Carburizing is ideally carried out on steels that have less than _____ carbon content.

a) 90%

b) 50%

c) 10%

d) 25%

4. Annealing a metal _____ its internal strains.

a) doesn't affect

b) removes

c) increases

d) doubles

5. Casehardening refers to _____ the material, after which necessary heat treatment is done to it.

a) annealing

b) critical range

c) carburizing

d) hardening

6. In the process of hardening of steel, the metal has to be heated to a temperature _____ the critical range.

a) below

b) half

c) above

d) around

7. Normalizing is a heat treatment carried out on all metals.

a) True

b) False

8. In the process of the hardening of aluminum alloys, what is the temperature above which it should be heated?

a) 1200°F

b) 600°F

c) 2400°F

d) 900°F

9. Which heat treatment method is also called as “drawing”?

a) Tempering

b) Casehardening

c) Annealing

d) Normalizing

10. The critical range of steel is between _____

a) 1300°F and 1600°F

b) 2400°F and 2600°F

c) 900°F and 2800°F

d) 900°F and 2400°F

11. The purpose of normalizing steel is to

a) remove induced stresses

b) improve machinability

c) soften the steel

d) increase the toughness and reduce Brittleness

12. Heat treatment of steel is done mainly to change its

A. Mechanical properties

B. Physical properties

C. Chemical composition

D. All of the above

13. Steel will respond to hardening by heat treatment processes, only when the minimum carbon content in it is _____ percent.

A. 0.02

B. 0.2

C. 0.35

D. 0.5

14. The heat treatment process used for softening hardened steel is

A. Carburising

B. Normalizing

C. Annealing

D. Tempering

15. During cooling of steel containing 0.8% carbon from 1000°C, pearlite occurs at _____ °C.

1. 480
2. 723
3. 768
4. 910

16. Which of the following elements is essentially added to steel during heat treatment to inhibit grain growth in austenite?

a) Tin
b) Aluminium
c) Copper
d) Brass

17. What is the criterion used for the determination of hardness of steel?

a) Content of alloying elements
b) Carbon content
c) Method of steel production
d) Shape and distribution of carbide in iron

18. Which is the softest structure that appears on iron-carbon equilibrium diagram?

a) Cementite
b) Ferrite
c) Pearlite
d) Austenite

19. Cementite has

a) An orthorhombic crystal structure
b) High tensile strength
c) Low compressive strength
d) Both (b) & ©

20. Bainite

a) Consists of ferrite and carbide (a decomposition product of austenite)
b) Is the constitution produced in steel when austenite transforms at a temperature below that at which pearlite is produced and above that at which martensite is formed
c) Is produced by austempering
d) All of the above

21. Martensite has a _____ crystal lattice structure.

a) Body centered tetragonal
b) Body centered cubic
c) Face centered cubic
d) Closed packed hexagonal

22. Troosite is a mixture of

a) Ferrite & austenite
b) Austenite & martensite
c) Ferrite & cementite
d) None of the above

23. Hypereutectoid steels have the structure of

a) Pearlite alone
b) Phases of ferrite & pearlite
c) Phases of cementite & pearlite
d) None of these

24. Which of the following is not a mixture of ferrite & cementite?

a) Pearlite
b) Sorbite
c) Troostite
d) None of these

25. Prolonged annealing of steel causes

a) Decrease in ductility
b) Increase in strength

c) Grain growth
d) All of the above

26. Heat treatment of steel involves the change of

a) Ferrite to austenite
b) Austenite to ferrite
c) A body centered cubic iron lattice to a face centered cubic iron lattice
d) None of the above

27. Hardenability of steel is a measure of

a) Its carbon content
b) Its cementite content
c) The depth to which the steel will harden on quenching
d) None of these

28. TTT (time- temperature- transformation) diagram is also known as

a) S- curve or C- curve
b) Bain's curve
c) Isothermal transformation diagram
d) All of the above

29. TTT diagram is used more particularly for

a) The assessment of decomposition of austenite in heat treatable steel
b) Knowing the extent of austenite decomposition under equilibrium condition
c) Knowing the phases and resulting microstructure corresponding to equilibrium condition
d) None of these

30. Which of the following is not a metal heat treatment process?

a) Maraging
b) Austempering
c) Quench hardening
d) Calorising

31. Heat treatment processes of metal can not improve its

a) Ductility, toughness, corrosion resistance, hardness & strength
b) Grain size,
c) Electrical & mechanical properties
d) None of these

32. Spheroids annealing of steel compared to normal annealing produces steel with lower

a) Hardness & strength
b) Relative elongation
c) Reduction of area
d) None of these

33. In case of full annealing, the austentizing temperature for hypoeutectoid steel is in the range of —- °C.

a) 723-910
b) 910-1130
c) 467-723
d) 668-800

34. The austenitizing temperature of hyper-eutectoid steels in case of full annealing is in the range of____ °C.

a) 723-910
b) 723-1130
c) 910-1130
d) 467-723

35. Full annealing of steel does not improve its

a) Formability
b) Machinability
c) Hardness
d) None of these

36. Normalising

a) Produces harder & stronger steel than full annealing
b) Eliminates the carbide network at the grain boundaries of hypereutectoid steels

c) Produces enough strength & ductility in a steel that is too soft & ductile for machining
d) all of the above

37. The purpose of tempering is to reduce

a) Residual stresses & %elongation
b) Ductility & toughness
c) Hardness
d) None of these

38. Martempering of steel

a) Employs two stage quenching (first rapid cooling in salt bath and then slower air cooling).
b) Produces martensitic structure with a high stress and distortion
c) Decrease ductility
d) Is suitable for very large section

39. The structure produced by austempering of steel is

a) Bainite
b) Martensite
c) Troostite
d) Austenite

40. Austempering of steel

a) Employs interrupted quenching
b) Is a hardening treatment
c) Can be done for very large sections
d) None of these

41. Case hardening of a steel part (which requires a hard wear resistant surface called the case a and a relatively soft, tough & shock resistant core) can be done by

a) Carburizing or nitriding
b) Cyaniding or carbonitriding
c) Flame hardening or induction hardening
d) All of the above

42. Carburising (also called cementation) of low carbon steel part

a) Increases the carbon content at the surface by absorption & diffusion
b) Is done at 870- 925°C
c) Is a case hardening process
d) All of the above

43. Cyaniding “and “Nitriding” are two methods of

a) Hardening
b) Case hardening
c) Tempering
d) Normalising

44. After heating upto required hardening temperature, why must tool steels be quenched?

a) To induce internal stresses
b) To build up hardening structure
c) To fall off the scale
d) To return it to its original structure

45. The external surface of the part made of mild steel can be hardened by

a) Tempering
b) Normalising
c) Case hardening
d) Hardening

46. In nitriding process the NH3 gas is introduced at

a) 500°C to 560°C
b) 575°C to 600°C
c) 600°C to 650°C

d) 650°C to 700°C

47. Which one of the following processes is used for hardening the surface of tool steel?

a) Carburizing
b) Cyaniding
c) Induction hardening
d) Hardening

48. Lower critical temperature of high carbon steel while hardening is

a) 960°C
b) 900°C
c) 723°C
d) 560°C

49. In a case hardening process, ammonia gas is introduced on steel; the process is known as

a) Cyaniding
b) Nitriding
c) Carburizing
d) Ammonising

50. The toughness in a steel is increased and brittleness is decreased by a heat treatment operation called as

a) Annealing

b) Normalizing

c) Tempering

d) Case hardening

51. Case hardening is a method of producing hard skin on the surface of steel are

a) High-carbon steel parts

b) Cast iron (heavy parts)

c) Low-carbon steel parts

d) Alloy steel parts

52. A carbon steel piece is heated just above 730°C, maintained at that temperature for a few hours and then slowly cooled. What heat treatment process is carried out?

a) Normalizing

b) Casehardening

c) Hardening

d) Annealing

53. H.S.S. is tempered at

a) 220°C to 230°C

b) 230°C to 270°C

c) 280°C to 400°C

d) 550°C to 600°C

54. Which one of the following is the solid carburizing material?

a) Charcoal
b) Petrol
c) Ammonia
d) Kerosene

55. While hardening, after heating the steel to the required temperature, it is held at that temperature as soaking time for normally

a) 5 minutes for 10 mm thickness
b) 10 minutes for 5 mm thickness
c) 2 minutes for 20 mm thickness
d) 20 minutes for 2 mm thickness

56. Which one of the following quenching media is used for hardening H.S.S. tool?

a) Water
b) Brine solution
c) Oil
d) Soda water

57. The process of increasing carbon percentage on the surface of tow-carbon steel is known as

a) Hardening
b) Nitriding
c) Carburizing
d) Tempering

58. Which one of the following heat treatment processes produces a scale-free surface on the component?

a) Flame hardening
b) Case hardening
c) Nitriding
d) Induction hardening

59. After hardening process, the metal becomes more hardened and also will become more

a) Brittle
b) Ductile
c) Malleable
d) Tough

60. For case hardening the first stage is carburising. By carburising it s meant…

a) Increasing the percentage of carbon of the steel piece
b) Increasing the percentage of carbon of the core of the piece
c) Increasing the percentage of carbon on the surface
d) Decreasing the percentage of carbon of the steel piece

61. For annealing hypoeutectoid steel according to the carbon content, it should be heated to

a) 30°C to 50°C above the lower critical point
b) 30°C to 50°C above the upper critical point

c) 600°C to 630°C

d) 1000°C to 1030°C

62. Liquid carburising is done in a heated salt bath. Which one of the following is not a carburising salt?

a) Sodium carbonate

b) Sodium sulphate

c) Sodium cyanide

d) Barium chloride