



Theoretical questions: mechanical engineering technician (part 1)

Right answer in bold.

1. A phase diagram is
 - a. a graph of compositions
 - b. a graph of transition temperatures
 - c. a plot of reaction times
 - d. a graph of temperature, solubility, and composition**
2. Which of the following is not a mechanical property?
 - a. Poisson's ratio
 - b. shear modulus
 - c. hardness
 - d. endurance limit
 - e. crystal limits**
 - f. bending stress
3. A traditional tensile tester can perform all of the following mechanical property tests except
 - a. hardness**
 - b. shear strength
 - c. impact strength
 - d. bending modulus
 - e. yield strength
 - f. compressive yield strength
4. A true stress, true strain test does one of the following:
 - a. uses instantaneous areas
 - b. indicates plasticity**
 - c. requires an extensometer
5. A tensile test uses all but
 - a. grips
 - b. micrometer
 - c. durometer**
 - d. a gage length
 - e. a gage section
 - f. controlled loading
6. Which is the hardest?
 - a. 40 GPA
 - b. 70 HRC**
 - c. 450 HB
 - d. 95 HRB
 - e. 300 kg/mm²
 - f. 3125 MPa
7. Which of the following is likely to scratch glass?
 - a. a file
 - b. a gold ring
 - c. a screwdriver
 - d. a ski pole

e. marble

f. hexagonal carbon

8. Which of the following hardness designations conforms to consensus standards?

a. 315 HB

b. 315 Brinell Hardness

c. 31 Rockwell C

d. 315 Knoop Hardness

9. Toughness can be measured by all but which one of the following?

a. tensile testing

b. Charpy vee

c. K\C

d. shear testing

e. impact testing

f. crack propagation studies

10. What is an atom?

a. an element

b. neutrons and protons

c. the smallest part of a substance

d. a form of energy

11. What is an element?

a. a state of matter

b. types of metals

c. groups of molecules

d. a unique substance

12. A substance is

a. a chemical

b. a solid

c. a solid, liquid, or gas

d. atoms of different elements

13. An alloy is

a. a diatom

b. amphoteric

c. composed of two or more elements

d. molecules composed of elements

14. Which of the following is a mixture?

a. steel

b. concrete

c. aluminum oxide

d. polystyrene

15. Which of the following is a physical property?

a. color

b. hardness

c. microstructure

d. valence

e. electronegativity

f. composition

16. Which of the following is not a dimensional concern in the use of engineering materials?

a. available sizes

b. surface texture

c. flatness

d. camber

e. centerline

f. thickness available

17. Which of the following is not a chemical property?

a. corrosivity

b. chemical reactivity

c. composition

d. solubility

e. moisture absorption

f. specific gravity

18. Which of the following is not a visible microstructural component?

a. lamellae

b. phases

c. electrons

d. inclusions

e. voids

f. grains

19. Which of the following is the best heat insulator?

a. Fe

b. Ni

c. Ag

d. Ti

e. W

f. Mo

20. Which of the following is the best electrical conductor?

a. Cu

b. Ag

c. Pt

d. Hg

e. Ni

f. Au

21. The first plastic was

a. polyphenol formaldehyde.

b. polyamide.

c. polystyrene.

d. cellulose nitrate.

e. Rayon.

f. Bakelite.

22. A mer is

a. an atom.

b. a group of like atoms.

c. the smallest part of a substance.

d. a substance.

23. Which of the following plastics is thermosetting?

a. nylon

b. acetate

c. Rayon

d. Bakelite

e. celluloid

f. Vectra

24. Which of the following is a linear thermoplast?

a. PEEK

b. phenolic

c. polyethylene

d. polystyrene

e. neoprene

f. cellulose acetate

25. Which of the following is not a polymer-strengthening mechanism?

a. polymerization

b. copolymerization

c. alloying

d. blending

e. reinforcement

f. cross-linking

26. Which of the following is not a ceramic?

a. silica glass

b. aluminum oxide

c. yttria

d. magnesia

e. silicon carbide

f. cemented carbide

27. Which of the following is a ceramic?

a. granite

b. Waterford crystal

c. soapstone

d. marble

e. agate

f. alumina

28. Which of the following is not a type of glass?

a. Vycor

b. silica glass

c. soda lime glass

d. crystal

e. Pyrex

f. Plexiglas

29. Which of the following is used as a binder for cemented carbides?

a. steel

b. cobalt

c. chromium

d. silver

e. copper

f. glass

30. Which of the following is a cermet?

a. WC/Co

b. TiC/steel

c. WC/10CoCr

d. carbon/graphite

31. Ceramics can be all but

a. glasses

b. oxides

c. intermetallics

d. nitrides

e. carbides

32. Which of the following is not a step in refining iron ore to make steel?

a. mining

b. pelletizing

- c. roasting
 - d. flotation
 - e. crushing
 - f. sintering**
33. Pig iron is
- a. steel in ingot form
 - b. iron plus coke**
 - c. high-carbon iron
 - d. steel plus silicates
34. Inclusions are
- a. voids in steel.
 - b. separate phases.
 - c. steel contaminants (intentional or not).**
 - d. cracks.
 - e. silicones.
 - f. hydroxides.
35. Which of the following are saleable steel shapes?
- a. ingots
 - b. bars
 - c. semi's
 - d. plate**
 - e. slabs
 - f. pigs
36. What is a phase in steel?
- a. a grain
 - b. a dendrite
 - c. multiple inclusions
 - d. a homogeneous component**
 - e. transition to solid
 - f. melting
37. Recrystallization
- a. means formation of dendrites.
 - b. occurs on quenching.**
 - c. is the generation of new grains.
 - d. occurs spontaneously in hot rolling.
38. Cementite is
- a. Fe_2O_3
 - b. FeC
 - c. FeO
 - d. FeSO_4
 - e. Fe_3C**
 - f. Fe_3O_4
39. What carbon content is required to make a carbon steel quench hardenable to 100% martensite?
- a. 0.3%
 - b. 1.0%
 - c. 0.6%**
 - d. 1.5%
40. Which of the following are used to through harden steels?
- a. laser glazing
 - b. austenitize and quench**
 - c. electron beam
 - d. carburize

- e. nitride
 - f. martemper
41. Which heat treatment produces recrystallization?
- a. tempering
 - b. austenitizing
 - c. quenching**
 - d. normalizing
42. The fastest quenching medium is
- a. oil
 - b. air
 - d. salt (molten)
 - c. cryogenic
 - e. water**
 - f. brine
43. Alloy steels include all but
- a. high strength low alloy.
 - b. microalloyed steels.**
 - c. high-speed steels.
 - d. tool steels.
 - e. manganese steels.
 - f. hammer steels.
44. Which of the following are types of solid solutions?
- a. FCC
 - b. ordered
 - c. BCT
 - d. substitutional
 - e. intergranular**
 - f. internal
45. The weldability of steel is improved by
- a. annealing.
 - b. carburizing.
 - c. sulfur in the steel**
 - d. hot rolling.
 - e. cold rolling.
 - f. quenching.
46. Which of the following is a typical yield strength for a high-strength low-alloy steel?
- a. 50,000 psi
 - b. 90,000 psi
 - c. 8 GPa
 - d. 900 MPa**
4. Which of the following are not added to increase hardenability?
- a. Mo
 - b. Ni
 - c. Cr
 - d. Mn
 - e. N
 - f. Se**
47. Which of the following improve the machinability of tool steels?
- a. Al
 - b. Cu**
 - c. Si
 - d. S

e. Ar

f. W

48. Which of the following is not a requirement of cast iron?

a. Fe

b. Si

c. Cu

d. Mn

e. C

49. Which of the following is not a type of cast iron?

a. malleable

b. gray

c. white

d. ADI

e. ductile

f. pot metal

50. What is the hardest that gray cast iron can be?

a. 100 HB

b. 250 HB

c. 40 HRC

d. 60 HRC

e. 500 HB

f. 95 HRB

51. Which of the following is not a requirement for precipitation hardening?

a. aging

b. quenching

c. solution treating

d. annealing

52. A brass is an alloy of copper and

a. Pb

b. Zn

c. Ca

d. Zr

e. Te

f. Ni

53. A bronze is an alloy of copper and

a. C

b. Ni

c. Mo

d. N

e. Sn

f. Cr

54. Copper/nickel/zinc alloys

a. are ferromagnetic

b. have the density of steel

c. can match silver appearance

d. have high hardness

55. Which of the following are aluminum's neighbors in the periodic table?

a. Mg

b. Zn

c. Cu

d. Fe

e. N

- f. Ar
56. Aluminum's ore is
- magnetite
 - cryolite.
 - alum
 - ammonium aluminite
 - bauxite**
 - magnesite
57. The density of aluminum is
- about the same as that of magnesium**
 - one third that of nickel
 - one third that of titanium
 - twice that of beryllium
58. The wrought alloy designation suffix that designates annealing is
- H18
 - T7
 - T10
 - T510**
 - T611
59. The primary purpose of solution treating is to
- soften
 - homogenize
 - stress relieve
 - dissolve alloy atoms
 - normalize
 - recrystallize**
60. An age hardened wrought alloy can usually be stress relieved at about
- 400°C**
 - 600°C
 - 100°C
 - 200°C
 - 600°F
 - 250°F
61. The property that makes aluminum suitable for food contact is that
- it is a biocide
 - it heats quickly
 - it is a moisture barrier
 - it is nontoxic**
62. The stiffness of nickel is the same as that of
- copper**
 - titanium
 - steel
 - stainless steel
63. Which of the following is the biggest use of nickel?
- plating
 - coinage
 - stainless steel**
 - heating elements
64. Titanium is
- lighter than aluminum
 - lighter than magnesium
 - lighter than beryllium

d. lighter than steel

65. Which of the following are refractory metals?

- a. Al
- b. Fe
- c. Ni
- d. Cu
- e. Mo**
- f. Co

66. Magnesium is heavier than

- a. Zn
- b. Ti
- c. Be**
- d. Al

67. The heaviest (highest density) of the following metals is

- a. Ta
- b. Pb
- c. W**
- d. Zr
- e. U
- f. Mo

68. Cobalt is essential for all but which one of the following?

- a. zinc alloys
- b. ultra-high-strength steels
- c. cemented carbides**
- d. Stellite-type alloys

69. You want high impact strength on a product. Which of the following properties might you list as selection factors?

- a. hardness
- b. stress rupture
- c. CharpyVee**
- d. tensile strength
- e. elongation

70. Which of the following properties correlates with long-term dimensional stability?

- a. thermal conductivity
- b. coefficient of thermal expansion**
- c. moisture absorption in 24 h
- d. hardness
- e. elasticity modulus
- f. Poisson's ratio

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