ISRO VSSC TA 2016

Q1. The pair of physical quantities having the same unit is
(a) Thrust and weight
(b) Thrust and pressure
(c) Force and pressure
(d) Weight and pressure

Q2. A wheel of diameter 10 cm describes 600 revolutions per minute. The angular velocity of the wheel is:
(a) 20π rad/s
(b) 40π rad/s
(c) 2π rad/s
(d) 10π rad/s

Q3. The designation of sheet of size 594×841 is
(a) A1
(b) A4
(c) A3
(d) A2

Q4. Which of the following is the lightest pencil?
(a) 2B
(b) 1B
(c) HB
(d) H

Q5. The neutral axis of the cross-section of a beam is that axis at which the bending stress is
(a) zero
(b) minimum
(c) maximum
(d) infinity

Q6. A steel bar of 6mm is heated from 25℃ and 60℃ and it is free to expand. The bar will induce
(a) No stress
(b) shear stress
(c) tensile stress
(d) compressive stress

Q7. The stress strain relationship of a Newtonian fluid is
(a) linear
(b) parabolic
(c) Hyperbolic
(d) bilinear

Q8. Francis turbine is best suited for
(a) medium head application from 24 to 180m
(b) low head installation up to 30m
(c) high head installation above 180m
(d) all types of heads

Q9. Match the following

A. Annealing	**1. Refines grain structure**
B. Nitriding	**2. Improves hardness of the whole mass**
C. Normalizing	**3. Improves ductility**
D. Martempering	**4. Increases surface hardness**

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

Q10. Tempering of quenched martensite steel is necessary to improve.
(a) Hardness
(b) Corrosion resistance
(c) Ductility
(d) Strength

Q11. Which of the following welding techniques require a vacuum environment:
(a) Ultrasonic welding
(b) Laser beam

(c) Plasma arc
(d) Electron Beam

Q12. Positive displacement flow meters are……flow meters.
(a) Variable area flow
(b) Differential pressure flow
(c) Quantity flow
(d) None of these

Q13. Reciprocation of the cutting tool in shaping machines is accomplished by:
(a) Rack pinion mechanism
(b) Crank and connecting rod mechanism
(c) Cam and cam follower mechanism
(d) Oscillating lever mechanism

Q14. Allowance provided to vertical walls of patterns for easy withdrawal is called:
(a) Shrinkage allowance
(b) Draft allowance
(c) Distortion Camber allowance
(d) Rapping allowance

Q15. In a milling machine, cutting tool is held in position by:
(a) Chuck
(b) Spindle
(c) Arbor
(d) Tail stock

Q16. The fit on a hole shaft system is specified as G7g6. The type of fit is:
(a) Interference
(b) Transition
(c) Clearance
(d) Cannot be determined as basic size is not given

Q17. In an interchangeable assembly, Shaft of sizes $30^{+0.030/-0.010}$ are mated with holes of size $30^{+0.020/+0.030}$. Maximum interference and max clearance respectively is:
(a) 10 microns, 40 microns
(b) 50 microns, 40 microns
(c) 40 microns, 10 microns
(d) 50 microns, 20 microns

Q18. A composite shaft consisting of two stepped portions having spring constants k1 and k2 is held between two rigid supports at the ends. Its equivalent spring constant is
(a) $\frac{K_1+K_2}{2}$
(b) $\frac{K_1+K_2}{K_1K_2}$
(c) $\frac{K_1K_2}{K_1+K_2}$
(d) $K_1 + K_2$

Q19. Lame's theory is associated with
(a) thin cylindrical shells
(b) thick cylindrical shells
(c) direct and bending stresses
(d) none of the above

Q20. The Mach number of the supersonic flow is between
(a) 0.8 and 12
(b) 1.2 and 5
(c) 5 and 10
(d) none of the above

Q21. Which one of the following is trapezoidal thread?
(a) Acme
(b) Square
(c) Buttress
(d) all of the above

Q22. Rolling friction is
(a) lesser than sliding friction
(b) more than sliding friction
(c) equal to sliding friction
(d) equal to kinetic friction

Q23. Match welding defects with causes
A. Spatter **1.Damp electrodes**

B. Lack of penetration	**2.Less welding current**
C. Slag inclusion	**3. Arc blow**
D. Porosity	**4.Improper cleaning in multi-pass welding**

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

Q24. Match the following

A. Two wire method	**1.Interference**
B. Optical flat	**2. Straightness**
C. Auto collimator	**3. Screw threads**
D. Clinometers	**4. Angle w.r.t gravity**

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

Q25. Which of the following statements are true:
1. Stress and pressure are measured in units of Load/Area.
2. Intensity of pressure at a point is same in all directions whereas stress depends on load and direction.
3. Pressure and Stress are scalar.
(a) 1 and 3 only
(b) 1,2,3
(c) 1 and 2 only
(d) 2 and 3 only

Q26. Poisson's ratio of which of the following materials is nearly zero.
(a) Rubber
(b) Aluminium
(c) Cork
(d) Steel

Q27. The stress developed in a thin spherical shell (thickness t and Diameter D) subjected to an internal pressure P is:
(a) PD/4t
(b) PD/2t
(c) PD/t
(d) PD/8t

Q28. Endurance limit depends on
1. Material
2. Size
3. Surface Finish
4. Type of loading
(a) 1, 2, 3, 4
(b) 1, 3, 4
(c) 1 and 4 only
(d) 1, 2, 3

Q29. Shot peening increases the fatigue life of springs because it results in
(a) Alteration of stiffness of spring
(b) Residual compression at surface
(c) Changes in surface composition
(d) Abrasion in surface leads to smooth surface

Q30. The force exerted on the jet by a moving flat vertical plate, in the direction of plate, is given by the equation:
(a) $\rho a(VU)^2$
(b) $-\rho a(V-U)^2$
(c) $\rho a(V-U)$
(d) None of the above

Q31. If a number of forces are acting at a point, their resultant will be inclined at an angle θ with the horizontal, such that
(a) $\tan\theta = \frac{\sum H}{\sum V}$
(b) $\tan\theta = \frac{\sum V}{\sum H}$
(c) $\tan\theta = \sum V \times \sum H$
(d) $\tan\theta = \sqrt{\sum V + \sum H}$

Q32. Which of the following is applied to brittle materials
(a) maximum principal stress theory
(b) maximum principal strain theory

(c) maximum strain energy theory
(d) maximum shear stress theory

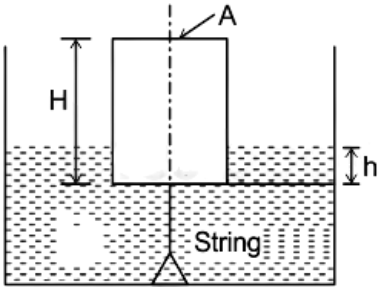
Q33. Which of the following constituents of steel is softest
(a) Ferrite
(b) Ledeburite
(c) Pearlite
(d) Austenite

Q34. Which bond gives the softest bond?
(a) silicate bond
(b) shellac bond
(c) vitrified bond
(d) all of equal strength

Q35. Ratio of inertia force to surface tension is known as
(a) Weber's number
(b) Mach number
(c) Froude number
(d) Euler number

Q36. When a venturimeter is used in an inclined position, its reading will show variation with
(a) Fluid velocity
(b) Fluid density
(c) Remains same
(d) Decreases

Q37. A cylindrical body of cross section area 'A', height 'H' and the density 'ρ_s' is immersed to a depth of 'h' in a liquid of density 'ρ' and tied to the bottom with a string. The tension in the string is



(a) ρgha
(b) $(P_S-\rho)gha$
(c) $(\rho-P_S)gha$
(d) $(\rho h-P_S H)ga$

Q38. If dry steam is heated above saturation temperature, then it is called
(a) sensible heat
(b) superheating
(c) super saturated steam
(d) entropy

Q39. The cycle generally used for gas turbine is
(a) Otto cycle
(b) Dual cycle
(c) Diesel cycle
(d) Brayton cycle

Q40 The critical pressure of a liquid is
(a) The pressure above which a liquid will explode
(b) The pressure above which a liquid will always convert into a vapour.
(c) The pressure above which a liquid will remain a liquid.
(d) The pressure below which a liquid will always be a vapour form.

Q41. For refrigerating system work done per Kg of air is 30Kcal and heat extracted per Kg air is 45Kcal. Amount of refrigerant used is 10 Kg. The coefficient of performance of system is
(a) 6.52
(b) 1.50
(c) 10.56
(d) 0.67

Q42. Cold worked component are generally subjected to
(a) Normalising
(b) Tempering
(c) Hardening

(d) Annealing

Q43. The concept of just in Time focuses on
(a) eliminating waste
(b) reduce machining time
(c) reduce labour expenses
(d) man power development

Q44. The stress concentration factor is
(a) It is the ratio of maximum stress to the nominal stress
(b) It is the ratio of nominal stress to the maximum stress
(c) It is the ratio of maximum stress to the endurance limit
(d) It is the ratio of nominal stress to the endurance limit

Q45. Arrange the following in steps followed in powder metallurgy:
1. Metal powdering
2. Blending
3. Compacting
4. Sintering
(a) 1.2.3.4
(b) 1,2,4,3
(c) 1,4,2,3
(d) 1,3,2,4

Q46. Consider the following statements:

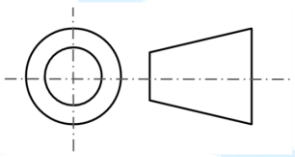


Fig 1

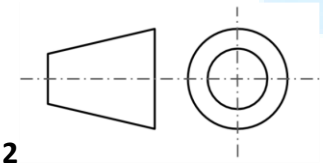


Fig 2

Figure 1 represents First angle projection
Figure 2 represents First angle projection
The object assumed to be positioned in between the projection planes and the observer in First angle projection
The object in the third quadrant puts the projection planes between the viewer and the object.
(a) 1,3 and 4
(b) 2,3 and 4
(c) 1 and 3 only
(d) 2 and 4 only

Q47. If a room is to be maintained at 200K while surroundings are at 300K by a refrigeration system using reversed Carnot cycle, Coefficient of Performance (COP) will be:
(a) 2
(b) 3
(c) 0.5
(d) 5

Q48. A differential manometer connected at two points shows a difference in mercury level as 10cm. The difference of pressure at the two points are: (Assume pipe is horizontal, Specific gravity of mercury is 13.6 and fluid in pipe is 0.9, g =10m/s^2)
(a) 127 N/m^2
(b) 12700 N/m^2
(c) 12700 N/mm^2
(d) None of the above

Q49. A steel rod of 1m length has to transmit a force of 15kN without stretching more than 1mm. E of steel is 200GPa. Minimum cross sectional area required is
(a) 150 mm^2
(b) 75 m^2
(c) 150 m^2
(d) 75 mm^2

Q50. A thin cylindrical shell of diameter (d), length (l), and thickness (t) is subjected to

an internal pressure (P). The ratio of the longitudinal strain to loop strain is
(a) m -2/2m-1
(b) 2m-1/m-2
(c) m-2/2m+1
(d) m+2/2m+2

Q51. Rankine's constant for a mild steel column with both ends hinged is
(a) 1/750
(b) 1/1600
(c) 1/7500
(d) None of the above

Q52. The materials used in the manufacture of thermistors are
(a) Oxides of manganese and cobalt
(b) Oxides of iron and zinc
(c) Carbides of silicon and germanium
(d) All of these

Q53. The maximum value of reduction in rolling process is
(a) $\Delta t = D/2(1-\sin\alpha)$
(b) $\Delta t = D(1-\sin\alpha)$
(c) $\Delta t = D/2(1-\cos\alpha)$
(d) $\Delta t = D/2(1-\cos\alpha/2)$

Q54. A metal strip to be rolled from initial wrought thickness of 3.5 mm to a final rolled thickness of 2.5mm in a single pass rolling mill having rolls of 250mm diameter. The strip is 450mm wide. The average co-efficient of friction in the roll gap is 0.08. Assuming plane-strain flow stress of 140MPa for the metal and assuming negligible spreading. The roll separating force F is
(a) 320KN
(b) 420KN
(c) 820.6 KN
(d) 165 KN

Q55. Find the melting efficiency for an arc welding process which has a potential of 15 volts and current rating of 250 amperes. Weld has travel speed of 6mm/s for a cross sectional area of 18mm^2. Heat transfer efficiency is 0.80 and heat required to melt the base metal is 12J/mm^3.
(a) 45.0%
(b) 43.2%
(c) 47.2%
(d) 44.5%c

Q56. The loss of head at the entrance to the pipe due to sudden contraction is expressed by
(a) $\frac{0.5V_2^2}{2g}$
(b) $\frac{(V_1-V_2)^2}{2g}$
(c) $\frac{(V_1-V_2)^3}{G}$
(d) $\frac{V_2^2-V_1^2}{4g}$

Q57. During expansion in steam turbine, entropy
(a) Increase exponentially
(b) decrease exponentially
(c) Increase linearly
(d) None of these

Q58. The effort (P) required to lift the load (W) in a screw jack (where α is the helix angle and $\emptyset$ is the angle of friction), is given by
(a) $P = W\cos(\alpha+\emptyset)$
(b) $P = W\sin(\alpha+\emptyset)$
(c) $P = W\tan(\alpha-\emptyset)$
(d) $P = W\tan(\alpha+\emptyset)$

Q59. Volumetric strain for a bar subjected to normal stress on all its surfaces is
(a) $(\Sigma_X+\Sigma_Y+\Sigma_Z)\frac{(1-v)}{2E}$
(b) $(\Sigma_X+\Sigma_Y+\Sigma_Z)\frac{2v}{E}$

(c) $(\Sigma_X + \Sigma_Y + \Sigma_Z)\frac{(1+2v)}{E}$

(d) $(\Sigma_X + \Sigma_Y + \Sigma_Z)\frac{(1-2v)}{E}$

Q60. If the strain energy absorbed in a cantilever beam in bending under its own weight is 'K' times greater than the strain energy absorbed in an identical simply supported beam in bending under its own weight, then the magnitude of 'K' is

(a) 2

(b) 4

(c) 6

(d) 8

Q61. In a 5KW cooling capacity refrigeration system operating on a simple vapour compression cycle, the refrigerant enters the evaporator with an enthalpy of 75KJ/Kg and leaves with an enthalpy of 183 KJ/Kg. The enthalpy of the refrigerant after compression is 210 KJ/Kg. The COP and the Power input to compressor is

(a) 4, 1.24 KW

(b) 4.5, 1.50 KW

(c) 4.5, 1.40 KW

(d) 4, 1.40 KW

Q62. A centrifugal pump running at 500rpm and at its maximum efficiency is delivering a head of 30m at a flow rate of 60 litres/min. If the rpm is changed to 1000, then the head H in meters and flow rate Q in litres/min at maximum efficiency are estimated to be

(a) H = 60, Q = 120

(b) H = 120, Q =120

(c) H = 60, Q = 480

(d) H = 120, Q = 30

Q63. For IT01 grade, tolerance is expressed as

(a) 0.3 + 0.02D

(b) 0.5 + 0.12D

(c) 0.3 + 0.008D

(d) 0.8 + 0.02D

Q64. The index of performance for a machining operation is a function of

(a) $\frac{MRR}{TWR}$

(b) $\frac{TWR}{MRR}$

(c) $\frac{MRR-TWR}{MRR}$

(d) $\frac{TER-MRR}{TWR}$

Q65. Degree of freedom for a robot is

(a) 10

(b) 6

(c) 3

(d) 5

Q66. Shaving of metals is done in order to

(a) Remove burr and improve accuracy

(b) Remove excess metal

(c) Remove scrap

(d) All of the above

Q67. When holes are required to be machined on several faces in small work piece, the jig used is

(a) box jig

(b) latch jig

(c) pot jig

(d) post jig

Q68. Major drawback of EDM process is that

(a) it has very high capital cost

(b) power consumption is very high

(c) Wear takes place at electrode at each spark

(d) material removal rate is less

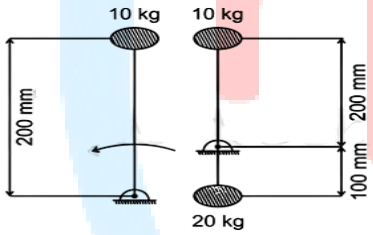
Q69. Routing assists engineers in deciding in advance

(a) the flow of material in the plant

(b) the method of proper utilization of man power
(c) the methods of proper utilization of machines
(d) the layout of factory facilities

Q70. In a 2D CAD software, clockwise circular arc of radius 5, specified from P1(15,10) to P2(10, 15) will have its centre at
(a) (10, 10)
(b) (15, 10)
(c) (15, 15)
(d) (10, 15)

Q71. A rigid body shown in the first figure has a mass of 10 kg. It rotates with a uniform angular velocity 'ω'. A balancing mass of 20kg is attached as shown in second figure. The percentage increase in mass moment of inertia as result of this addition is



(a) 25%
(b) 50%
(c) 100%
(d) 200%

Q72. Match the following:

A. Conduction	**1. Stefan Boltzmann law**
B. Convection	**2. Fourier law**
C. Radiation	**3. Kirchhoff's law**
	4. Newton's law of cooling

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

Q73. "Equal volumes of all gases at the same temperature and pressure have the same number of molecules" is :
(a) Boyles law
(b) Charles law
(c) Avogadro's law
(d) Daltons law

Q74. Which of the following statements are true w.r.t Hydrostatic forces on surfaces.
1. Total pressure is the force exerted by a static fluid on a surface either plane or curved. This force always acts normal to the surface.
2. In a vertical plane surface submerged in a liquid, the centre of pressure lies below the centre of gravity.
3. The distance of the centre of pressure from the free surface is independent of density of the liquid.
(a) 1,2and 3
(b) 1 only
(c) 1 & 3 only
(d) 1 & 2 only

Q75. First derivative of cot(x)tan(x) is
(a) $\cot^2(x)$
(b) $\tan^2(x)$
(c) 1
(d) 0

Q76. A bag contains 5 red, 4 blue and 3 green balls. Find the probability of randomly drawing a red ball?
(a) 1/3
(b) 2/3
(c) 7/12
(d) 5/12

Q77. The value of $20C_{18}$ is?
(a) 200
(b) 190
(c) 180

(d) 210

Q78. The value of $\lim_{\theta \to 0} \frac{\sin 3\theta}{\sin 4\theta}$ Is?

(a) -3/4
(b) 4/3
(c) 3/4
(d) 1

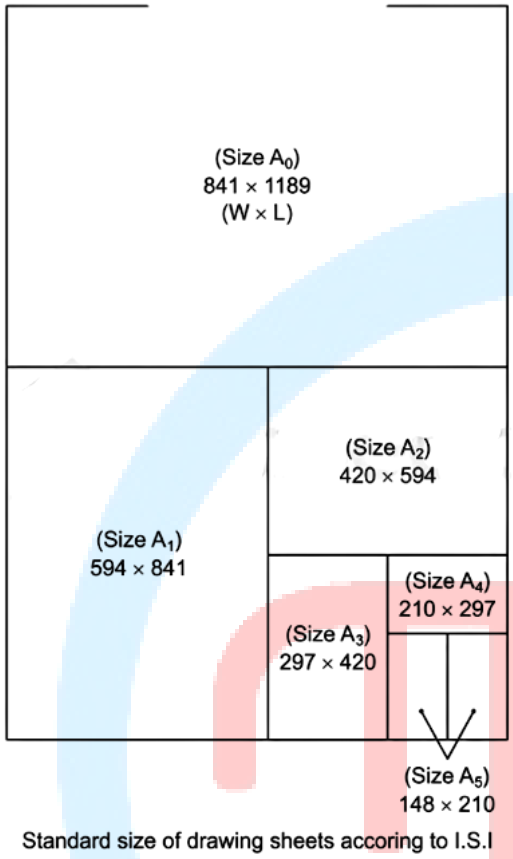
Q79. If x = a(θ - sinθ), y = a(1-cosθ), then
dy/dx is?
(a) Cot(θ/2)
(b) tan(θ/2)
(c) sin(θ/2)
(d) Cos(θ/2)

Q80. The length of the major axis and minor axis of the ellipse $\frac{x^2}{144} + \frac{y^2}{121} = 1$ are?

(a) 26, 12
(b) 12, 11
(c) 24, 11
(d) 24, 22

VSSC TA 2016 SOLUTION

Ans1. a
Solution:



Standard size of drawing sheets accoring to I.S.I

Ans2. a
Solution:

$$\Omega = \frac{Angle\ rotated}{Time\ required}$$

$$\Omega = \frac{2\pi N}{60} = 20\pi \text{ rad/s}$$

Ans3. a
Solution:

Ans4. d
Solution:

Ans5. a
Solution:

Ans6. a
Solution:

Ans7. a
Solution:

Ans8. a
Solution:

Ans9. b
Solution:

Ans10. c
Solution:
Tempering is a heat treatment process in which the hardness of a hardened alloy is reduced by the appropriate heat treatment process; for example, steel hardened by the formation of martensite formation can be tempered.

Ans11. d
Solution:

Ans12. c
Solution:

Ans11. d
Solution:
Electron Beam Welding is a fusion welding in which coalescence is produced by heating the work piece due to impingement of the concentrated electron beam of high kinetic energy on the work piece. As the electron beam impinges the work piece, the kinetic energy of the electron beam converts into thermal energy resulting in melting and even evaporation of the work material.

Ans13. d
Solution:
This is generally accomplished by means of a quick return mechanism. One typical

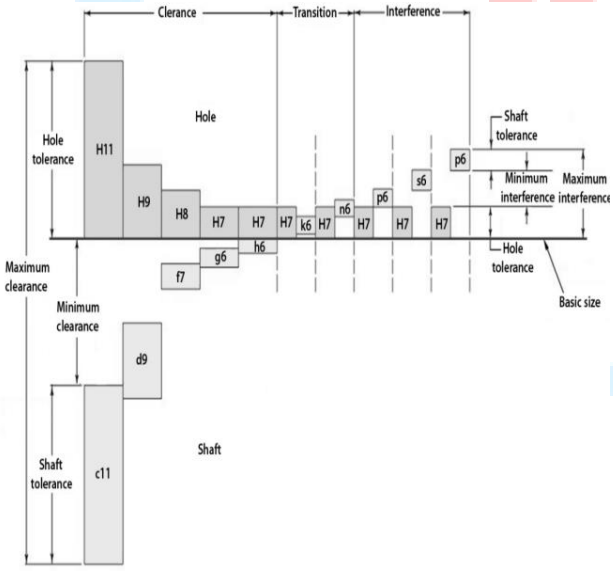
mechanism used in shapers is the quick return mechanism (Oscillating lever mechanism).

Ans14. b
Solution:
Pattern draft is the taper placed on the pattern surfaces that are parallel to the direction in which the pattern is withdrawn from the mould (that is perpendicular to the parting plane), to allow removal of the pattern without damaging the mould cavity.

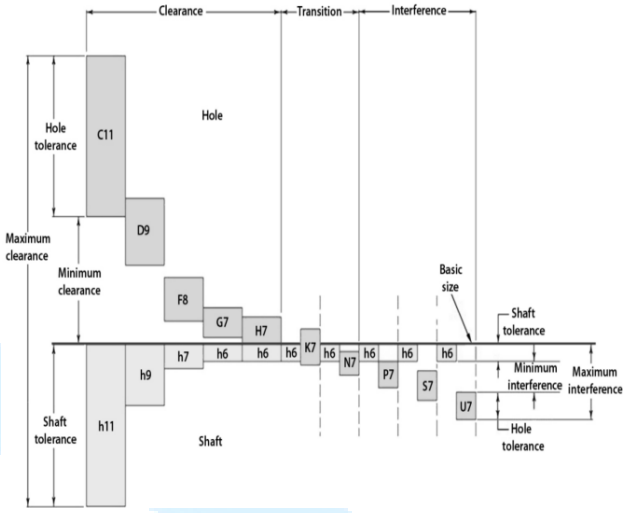
Ans15. c
Solution:

Ans16. c
Solution:
The fundamental deviation of tolerance zone from the basic size is designated by capital letters A, B, C...Z is provided for holes and small letters a, b, c....z is provided for shafts.
Hole diameter is always bigger than the shaft diameter so the fit will be a clearance fit

For hole basis system



For shaft basis system



Ans17. a
Solution:
Maximum interference = The maximum limit for shaft - The minimum limit for the hole
= (25 + 0.04) - (25 + 0.02) = 0.02mm = 20microns

Ans18. d
Solution:

Ans19. b
Solution: Lame's equation is based on the maximum principal stress theory of failure, as this theory is more suitable for brittle materials, Lame's equation is also applicable to brittle materials like Cast iron or Cast Steel.

Ans20. b
Solution:

Ans21. a
Solution:
Trapezoidal thread forms are screw thread profiles with trapezoidal outlines. They are the most common forms used for lead screws (power screws). They offer high strength and ease of manufacture. They are typically found where large loads are required, as in a vise or the lead screw of a lathe

Ans22. a
Solution:

Ans23. a
Solution:

Ans24. b
Solution:

Ans25. c
Solution:

Ans26. c
Solution:

Ans27. a
Solution:

Ans28. a
Solution:

Ans29. b
Solution:
Shot Peening is a surface enhancement process used to impart compressive residual stresses into fatigue-prone metals. This process increases fatigue strength by delaying the initiation of cracking.

Ans30. b
Solution:

Ans31. b
Solution:

Ans32. a
Solution:
All other theories(ST. Venant's theory, Guest and Tresca's Theory, Haigh's Theory, Mises - Henky theory) are for ductile material except **Rankine's theory** i.e. Maximum principal stress theory, which is for **brittle material**.

Ans33. a
Solution:

Ans34. a
Solution:
Silicate bond (S): This bonding material is used when the heat generated by grinding must be kept to a minimum. Silicate bonding material releases the abrasive grains more readily than other types of bonding agents. This is the softest bond in grinding wheel.

Ans35. a
Solution:

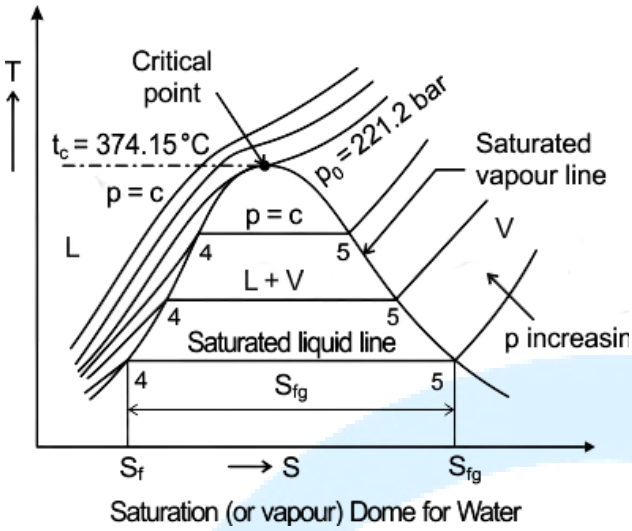
Ans36. c
Solution:

Ans37. d
Solution:
For Vertical equilibrium
Weight of the body + Tension in the string = Buoyant Force
$mg + T =$ Specific weight of water $\times$ volume of the submerged body
$P_s gha + T = \rho gah$
$T = (\rho h - \rho_s h)ga$

Ans38. b
Solution:

Ans39. d
Solution:

Ans40. c
Solution:



Saturation (or vapour) Dome for Water

Ans41. b
Solution:
COP = $\frac{45}{30} = \frac{4.5}{3} = 1.5$

Ans42. d
Solution:

Ans43. a
Solution:
IT is an inventory management method whereby labour, material and goods (to be used in manufacturing) are re-filled or scheduled to arrive exactly when needed in the manufacturing process.
The main objective of this method is to reduce inventory holding costs and increase inventory turnover.

Ans44. a
Solution:

Ans45. a
Solution:

Ans46. b
Solution:

Ans47. a
Solution:

COP = $\frac{Q_1}{Q_1 - Q_2} = \frac{200}{100} = 2$

Ans48. b
Solution:
$P_A + [900 \times g \times (Y + 0.1)] = P_B + (900 \times g \times Y) + [0.1 \times g \times 13600]$
$P_A - P_B = 13600 \times g \times 0.1 - 900 \times g \times 0.1$
$= 0.1g \times 12700 = 12700\ N/m^2$

Ans49. d
Solution:
Using $\delta l = \frac{Pl}{AE}$
$10^{-3} = \frac{15 \times 1000}{A \times 200 \times 10^9}$
$A = 0.000075 m^2$
$A = \frac{0.000075}{10^6} = 75 mm^2$

Ans50. a
Solution:
$\frac{E_L}{E_H} = \frac{Pd/2te(1/2-\mu)}{Pd/4te(2-\mu)}$
$= \frac{1-2\mu}{2-\mu}$
$= \frac{1-2/m}{2-1/m}$
$= \frac{M-2/m}{2m-1/m}$
= m -2/2m-1

Ans51. c
Solution:

Ans52. a
Solution:

Ans53. c
Solution:

Ans54. c
Solution:
Δt = 1mm
R = 125 mm
σ = 140 MPa
M = 0.08
Length of contact = $\sqrt{ROH}$

$= \sqrt{125 \times 1}$ = 11.2mm

Roll separating force = $\frac{2}{\sqrt{3}}\Sigma(Bl)\left[1 + \frac{Ml}{4H}\right]$ = 875.9 kN

Ans55. b
Solution:
V = 15 volts
I = 250 A
v = 6 mm/s
A = 18 mm^2
H_m = Heat required to melt the metal
H_i = Heat input

$\eta_m = \frac{H_M}{H_I} = \frac{12}{\frac{V}{A}\times\frac{I}{V}\times\eta} = \frac{12}{\frac{15}{18}\times\frac{250}{6}\times 0.8} = \frac{1296}{3000} = 0.432$

= 43.2%

Ans56. a
Solution:

Ans57. d
Solution:

Ans58. d
Solution:

Ans59. d
Solution:

Ans60. c
Solution:

For simply supported beam strain energy,

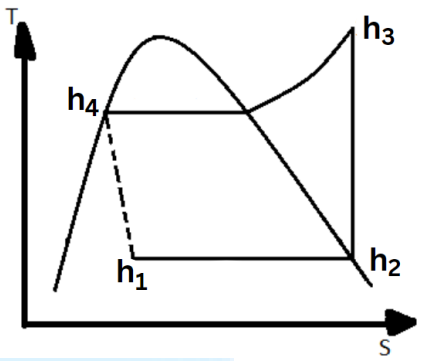
$E_1 = \frac{W^2L^3}{240EI}$

For cantilever beam strain energy,

$E_2 = \frac{W^2L^3}{40EI}$

Therefore, $\frac{E_2}{E_1}$ = 6

Ans61. a
Solution:
Given: h_1 = 75 KJ/Kg
H_2 = 183 KJ/Kg
H_3 = 210 KJ/Kg



$Q = \dot{M}(h_2-h_1)$

$\dot{M} = \frac{5}{108}$ = 0.04629

$COP = \frac{\text{Refrigerating Effect}}{\text{Compressor work}} = \frac{H_2-H_1}{H_3-H_2} = \frac{108}{27} = 4$

$P = \dot{M}(H_3 - H_2) = 0.04629 \times 27 = 1.25kW$

Ans62. b
Solution:
$Q \propto N$

$\frac{Q_1}{Q_2} = \frac{N_1}{N_2}$

Q_2 = 120

$H \propto N^2$

$\frac{H_1}{H_2} = \frac{N_1^2}{N_2^2}$

$\frac{30}{H} = \frac{(500)^2}{(1000)^2}$

H_2 = 120

Ans63. c
Solution:
Formula for standard tolerances in grades for basic sizes up to and including 500mm

Standard Tolerance Grade	Formula for calculation where D is the geometric mean of the basic size in millimeters
IT01	0,3 + 0,008D
IT0	0,5 + 0,012D
IT1	0,8 + 0,020D

Ans64. a
Solution:

Ans65. b
Solution:

Ans66. d
Solution:
Shaving of metals is done in order to remove burr, excess or scrap metal and improve accuracy.

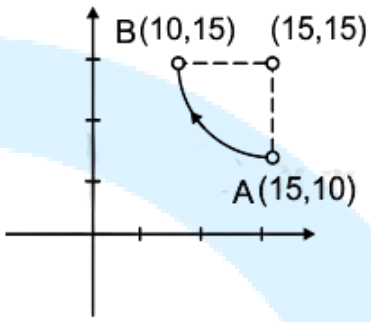
Ans67. a
Solution:
Closed jigs (Box jig) are used when the operations are to be done on more than one side of the piece. Jigs are identified according to the way they are built. The most commonly used jigs are:
Pot jig
Template jig
Plate jig
Table jig
Sandwich jig
Angle plate jig
Modified angle plate jig
Box jig
Channel jig
Leaf jig
Indexing jig
Solid jig
Post jig
Trunnion jig

Ans68. c
Solution:
The slow rate of material removal.
The additional time and cost used for creating electrodes for Ram/Sink edm.
Reproducing sharp corners on the work piece is difficult due to electrode wear.

Ans69. c

Solution: Routing may be defined as the "selection of proper follow which each part of the product will follow, while being transferred from raw material to finished products.

Ans70. c
Solution:



Ans71. b
Solution:
$I_1 = mk^2$
$= 10\times 0.2^2$
$= 0.4\ Kgm^2$
$I_2 = m_1k_1^2 + m_2k_2^2$
$= 0.4 + 0.2 = 0.6Kgm^2$
%age increase in MOI $= \frac{0.6-0.4}{0.4} = \frac{0.2}{0.4} = \frac{1}{2} = 50\%$

Ans72. b
Solution:

Ans73. c
Solution:

Ans74. a
Solution:

Ans75. d
Solution:
By trigonometric identities: cot A = cos A/sin A = 1/tan A
Therefore, y = t(1/tanx)tanx = 1
So, d y/ d x of constant = 0

Ans76. d

Solution:

Total number of balls in the bag = 5 + 4 + 3 = 12

Number of red ball = 5

∴ The probability of getting a red ball = $\frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}} = \frac{5}{12}$

Ans77. b

Solution:

$^{20}C_{18}$

We know that, $^{n}c_r = \frac{n!}{r!(n-r)!}$

So,

$^{20}C_{18} = \frac{20!}{18!(20-18)!} = \frac{20 \times 19}{2!} = 190$

Ans78. c

Solution:

$\lim_{\Theta \to 0}\left[\frac{\text{Sin}3\theta}{\Theta} \times \frac{\Theta}{\text{Sin}4\theta}\right]$

$\lim_{\Theta \to 0}\left[\frac{\text{Sin}3\theta}{\Theta} \times \frac{1}{\text{Sin}4\theta/\theta}\right]$

Using product and reciprocal rule of limits

$\lim_{\Theta \to 0}\left[\frac{3\text{sin}3\theta}{3\theta}\right] \times \frac{1}{\lim_{\Theta \to 0}\left[\frac{4\text{Sin}4\theta}{4\theta}\right]}$

If $\theta \to 0$

Then3θ and 4θ approaches to 0 i.e. $3\theta \to 0$, $4\theta \to 0$

$3 \lim_{\Theta \to 0}\left[\frac{\text{Sin}3\theta}{3\theta}\right] \times \frac{1}{4 \lim_{\Theta \to 0}\left[\frac{\text{Sin}4\theta}{4\theta}\right]}$

$3 \times 1 \times \frac{1}{4 \times 1} = \frac{3}{4}$

Ans79. a

Solution:

Given: x = a(θ - sinθ), y = a(1-cosθ) Here, we have to find dy/dx

As we know that, if x = f(t), y = g(t), where t is a parameter, then

X = a(θ - sinθ)

⇒ dx/dθ = a(1 - cosθ)……(1)

Y = a(1− cosθ)

⇒ dy/dθ = a(0−(−sinθ)) = asinθ……(2)

Dividing (2) and (1)

$\frac{\text{Dy}}{\text{Dx}} = \frac{\text{Sin}\theta}{1-\cos\theta} = \frac{2\sin(\theta/2) \times \cos(\theta/2)}{1-1+2\sin^2\Theta/2} = \text{Cot}(\theta/2)$

Ans80. d

Solution:

Comparing $\frac{x^2}{144} + \frac{y^2}{121} = 1$ with $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, we find that a = 12, b = 11 and a < b.

∴ Length of Minor axis = 2a = 24.

The length of the Major axis = 2b =22.