1. **If thermal conductivity of a material of wall varies as $k_0(1-\alpha T)$, the temperature at the center of the wall will be (α is +ve)**

   (a) Depends on other factors
   (b) More than that in case of constant thermal conductivity
   (c) Less than that in case of constant thermal conductivity
   (d) None of the above

2. **The spectral emissive power E_{λ} for a diffusely emitting surface is $E_{\lambda}=0$ for $\lambda<3\mu m$; $E_{\lambda}=150\ W/m^2\ \mu m$ for $3<\lambda<12\mu m$; $E_{\lambda}=300 W/m^2\ \mu m$ for $12<\lambda<25\mu m$; $E_{\lambda}=0$ for $\lambda>25\mu m$. The total emissive power of the surface over the entire spectrum is**

   (a) 1250 W/m^2 **(b)** 2500 W/m^2 **(c)** 4000 W/m^2 **(d)** 5250 W/m^2

3. **A wire is plastically deformed bent by supplying a force of 40 N over a distance of 0.8 m. (The force moves in the direction in which the distance is measured). If the wire has a mass of 0.2 kg and a specific heat of 0.5 kJ/kg.^{0}C estimate the maximum increase in the average temperature of the wire**

   (a) 0.03^{0}C **(b)** 0.3^{0}C **(c)** 3^{0}C **(d)** 30^{0}C

4. **Two rods one of length L and the other of length 2L are made of the same material and have the same diameter. The two ends of the longer diameter. The two ends of the longer rod are maintained at 100^{0}C. One end of the shorter rod is maintained at 100^0 C while the other end is insulated. Both the rods are exposed to the same environment at 40^{0}C. The temperature at the insulated end of the shorter rod is measured to be 55 ^{0} C. The temperature at the midpoint of the longer rod would be**

   (a) 40^{0}C **(b)** 50^{0}C **(c)** 55^{0}C **(d)** 100^{0}C

5. **A sphere, a cube and a disc all of the same material, quality and volume are heated to 900 K and left in air. Which of these will have the lowest rate of cooling**

   (a) Cube **(b)** Disc **(c)** Sphere **(d)** All will have the same rate of cooling

6. **Air with initial condition of p1,v1 expands to final condition of p1/2, 3v$_1$. The process is**

   (a) Hyperbolic **(b)** Adiabatic **(c)** Polytropic with $n>1$ **(d)** Polytropic with $n<1$

7. **Sun's surface at 5800 K emits radiation at a wavelength of 0.5μ.A furnace at 300^0 C will emit through a small opening, radiation at a wavelength of**

   (a) 5μ. **(b)** 0.5μ. **(c)** 2.5μ. **(d)** 0.25μ.

8. **Polytropic index n is given by**

   (a) $\dfrac{\log\left(\frac{p_2}{p_1}\right)}{\log\left(\frac{v_1}{v_2}\right)}$ **(b)** $\dfrac{\log\left(\frac{p_1}{p_2}\right)}{\log\left(\frac{v_1}{v_2}\right)}$ **(c)** $\dfrac{\log\left(\frac{v_1}{v_2}\right)}{\log\left(\frac{p_2}{p_1}\right)}$ **(d)** $\dfrac{\log\left(\frac{v_2}{v_1}\right)}{\log\left(\frac{p_2}{p_1}\right)}$

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9. The heat flow rate through parallel walls of thickness L_1, L_2 and L_3 and having surface areas A_1,A_2 and A_3, thermal conductivities k_1, k_2, and k_3, respectively and first and last walls maintained at temperatures t_1 and t_2 will be

(a) $\dfrac{t_1 - t_2}{\dfrac{L_1}{A_1k_1} + \dfrac{L_2}{A_2k_2} + \dfrac{L_3}{A_3k_3}}$

(b) $\dfrac{t_1 - t_2}{\dfrac{k_1}{A_1L_1} + \dfrac{k_2}{A_2L_2} + \dfrac{k_3}{A_3L_3}}$

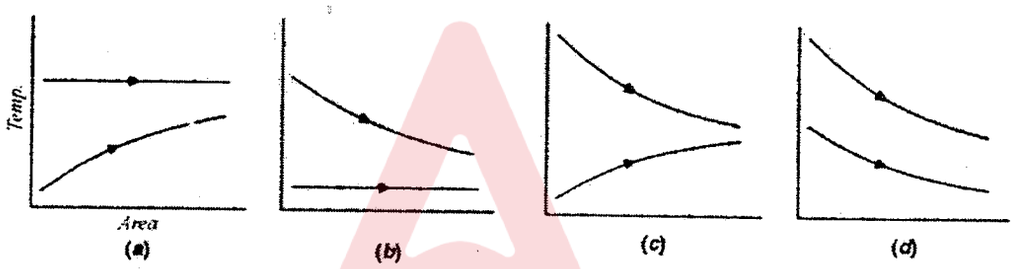
(c) $\dfrac{t_1 - t_2}{\dfrac{k_1A_1}{L_1} + \dfrac{k_2A_2}{L_2} + \dfrac{k_3A_3}{L_3}}$

(d) $\dfrac{t_1 - t_2}{\dfrac{L_1A_1}{k_1} + \dfrac{L_2}{k_3} + \dfrac{L_3}{k_3}}$

10. Which of the following property of air does not increase with rise in temperature?

(a) Specific gravity (b) Kinematic viscosity (c) Thermal conductivity (d) Thermal diffusivity

11. Choose the correct figure representing gas to gas heat transfer in parallel flow heat exchanger?



12. The value of Prandtl number for air is about

(a) 0.1 (b) 0.3 (c) 0.7 (d) 10.5

13. A body cools from 90^0C to 80^0C in 5 minutes. Under the same external conditions to cool from 80^0C to 70^0C the body will take

(a) 5 minutes (b) 4 minutes (c) 2.5 minutes (d) More than 5 minutes

14. When the temperature of a solid surface changes from 227^0C to 1227^0C, its total emissive power changes from E_1 to E_2. The ratio $\left(\dfrac{E_2}{E_1}\right)$ will be

(a) 3 (b) 9 (c) 81 (d) Cannot be determined on the basis of information provided

15. Characteristic gas constant of a gas is equal to

(a) C_p / C_v (b) C_v / C_p (c) $C_p - C_v$ (d) $C_p + C_v$

16. The matrix $A=\begin{bmatrix}-4 & -3 & -3\\ 1 & 0 & 1\\ 4 & 4 & x\end{bmatrix}$ is its own adjoint. The value of x will be

(a) 5 (b) 3 (c) -3 (d) -5

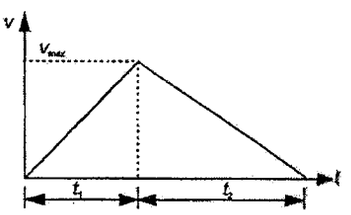
17. The temperature of sun can be measured using a

(a) Standard thermometer (b) Radiation pyrometer (c) Platinum resistance thermometer (d) Mercury thermometer

18. A car moving with uniform acceleration covers 450 m in a 5 second interval, and covers 700 m in the next 5 second interval. The acceleration of the car is

(a) 7 m/s^2 (b) 50 m/s^2 (c) 25 m/s^2 (d) 10 m/s^2

19. A particle starts from rest with a constant acceleration α m/sec^2 and after some time it decelerates at a uniform rate of β m/sec^2 till it comes to rest. If the total time taken between two rests positions is t, the maximum velocity acquired by the particle would be



(a) $\frac{\alpha+\beta}{2}t$ (b) $\frac{\alpha-\beta}{2}t$ (c) $\left(\frac{\alpha\beta}{\alpha+\beta}\right)t$ (d) $\left(\frac{\alpha+\beta}{\alpha-\beta}\right)t$

20. Two metallic blocks having masses in the ratio 2: 3 are made to slide down a friction less inclined plane starting initially from rest position. When these blocks reach the bottom of the inclined plane, they will have their kinetic energies in the ratio

(a) 2:3 (b) 3:5 (c) 3:2 (d) 7:4

21. A particle is projected at an angle θ to the horizontal and it attains a maximum height H. The time taken by the projectile to reach the highest point, of its path is

(a) $\frac{\sqrt{H}}{g}$ (b) $\sqrt{\frac{2H}{g}}$ (c) $\frac{\sqrt{2H\sin\theta}}{g}$ (d) $\frac{\sqrt{2H}}{\sin\theta}$

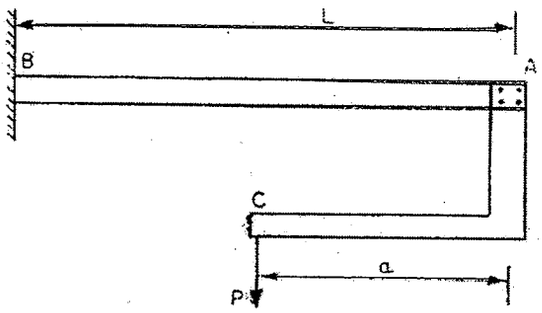
22. The tension in the cable supporting a lift moving upwards is twice the tension when the lift moves downwards. What is the acceleration of the lift?

(a) g/4 (b) g/3 (c) g/2 (d) g

23. For the apparent weight of a body at equator to become zero, the earth should rotate with an angular velocity of

(a) $\sqrt{\frac{2g}{r}}$ (b) $\sqrt{\frac{g}{r}}$ (c) $\sqrt{\frac{g}{2r}}$ (d) $\frac{g}{r}$

24. A cantilever beam AB of length L and uniform flexural rigidity EI has a bracket AC attached to its free end shown in Fig. Vertical load is applied to the free end C of the bracket. In order that the deflection of point A to be zero the ratio a/L should be



(a) $\frac{1}{2}$ (b) $\frac{1}{3}$ (c) $\frac{1}{4}$ (d) $\frac{2}{3}$

25. Given that
P_E = the crippling load given by Euler
P_C = the load at failure due to direct compression
P_R = the load in accordance with the Rankine's criterion of failure
Then P_R is given by

(a) $\frac{(P_E + P_C)}{2}$ (b) $\sqrt{P_E \times P_C}$ (c) $\frac{P_C . P_E}{P_C + P_E}$ (d) None of the above

26. Bending moment M and torque is applied on a solid circular shaft. If the maximum bending stress equals to maximum shear stress developed, them M is equal to

(a) $\frac{T}{2}$ (b) T (c) $2T$ (d) $4T$

27. For solid shaft subjected to a torque of 18000 Nm having a permissible shear stress of 60N/mm^2, the diameter of shaft is

(a) 115mm (b) 121mm (c) 149mm (d) 108mm

28. Shear force is

(a) Rate of change of loading (b) Sum of bending moments
(c) Rate of change of bending moment (d) None of the above

29. Maximum deflection in cantilever due to pure bending moment M at its end is

(a) Ml^2/2El (b) Ml^2/3El (c) Ml^2/4El (d) Ml^2/6EI

30. Maximum shear stress in Mohr's circle is equal to

(a) Radius of circle (b) Diameter of circle (c) Center of circle from y-axis (d) Chord of circle

31. Hardness of steel depends on

(a) Amount of carbon it contains
(b) The shape and distribution of the carbides in iron
(c) Method of fabrication
(d) Contents of alloying elements

32. The modulus of $1+\cos\alpha+i\sin\alpha$ is

(a) $2\sin\frac{\alpha}{2}$ (b) $2\cos\frac{\alpha}{2}$ (c) $\sin^2\frac{\alpha}{2}-1$ (d) $\cos^2\frac{\alpha}{2}-1$

33. Hardnes of martensite is about

(a) RC 65 (b) RC 48 (c) RC 57 (d) RC 80

34. Materials after cold working are subjected to following process to relieve stresses

(a) Hot working (b) Tempering (c) Normalizing (d) Annealing

35. In drop forging the forging is done by

(a) Dropping the workpiece at high velocity
(b) Dropping the hammer at high velocity
(c) Dropping the die with hammer at high velocity
(d) Dropping a weight on hammer to produce requisite impact

36. Which of the machine tools can be used for boring

1. **Lathe**
2. **Drilling machine**
3. **Vertical milling machine**
4. **Horizontal milling machine**

(a) 1,2,3 (b) 1,3,4 (c) 2 and 4 (d) 1 and 2

37. The vernier reading should not be taken at its face value before an actual check has been taken for

(a) Zero error (b) Its calibration (c) Flatness of measuring jaws (d) Temperature equalization

38. High carbon steel carries carbon percentage of

(a) 0.1 to 0.3% (b) 0.3 to 0.6% (c) 0.6 to 0.8% (d) 0.8 to 1.5%

39. In order to measure/detect materials by non-destructive testing the method generally used is

(a) Acoustic emission
(b) Infrared radiometer
(c) Liquid crystallography
(d) Thermochemic point

40. Shock resisting steels should have

(a) Low wear resistance
(b) High wear resistance
(c) Toughness
(d) Poor hardenability

41. A screw having coefficient of friction equal to or greater than the tangent of the load angle is known as

(a) Machine screw (b) Self locking screw (c) Set-screws (d) Ball-bearing type screws

42. A bolt is designed with a large factor of safety, on the basis of

(a) Direct tensile stress
(b) Direct compressive stress
(c) Direct bending stress
(d) Direct shear stress

43. For two springs having same stiffness (k) are in series, the equivalent stiffness would be

(a) $\frac{k}{4}$ (b) $\frac{k}{2}$ (c) k (d) $2k$

44. A material is classified as brittle, if the elongation in a gauge length of 59 *mm*, is less than

(a) 1% (b) 3% (c) 4% (d) 5%

45. In an extra humid atmosphere which one of the following motor would you select?

(a) Open type (b) Semi-protected (c) Drip proof (d) Totally enclosed fan cooled

46. In fillet weld throat is

(a) Perpendicular distance from the root to the hypotenuse
(b) The smaller side of triangle of the fillet
(c) The larger side of triangle of the fillet
(d) None of the above

47. Sensitiveness of a governor is

(a) The ratio of the difference between the maximum and minimum equilibrium speed to the mean equilibrium speed.
(b) The ratio of the maximum speed to minimum speed within the operating range
(c) The ratio of the difference between the maximum and mean speed to that of minimum to mean speed
(d) The range of variation of engine speed

48. The value of c which makes the angle 45^0 between $\bar{a} = i + cj$ and $\bar{b} = i + j$ is

(a) 1 (b) $\frac{1}{\sqrt{2}}$ (c) $\frac{-1}{\sqrt{2}}$ (d) 0

49. For traction applications, the type of motor best suited is

(a) Induction motor (b) Synchronous motor (c) DC shunt motor (d) DC series motor

50. In simple harmonic motion the acceleration is proportional to

(a) Displacement
(b) Linear velocity
(c) Angular velocity
(d) Rate of change of angular velocity

51. A vibro meter

(a) Indicates vibration aplitude
(b) Indicates vibration frequency
(c) Indicates mature of vibrations
(d) Only indicates second and above harmonics

52. At node of the shaft

(a) The vibrations are minimum
(b) The vibrations are maximum
(c) The vibrations are average
(d) The vibrations are zero

53. Match list I with list II and select the correct answer using the codes. given below the lists.

List I (Match property)
A. Malleabillity
B. Hardness
C. Resilience
D. Isotropy

List II (Related to)
1. Wire drawing
2. Impact loads
3. Cold rolling
4. Indentation
5. Direction

	A	B	C	D
(a)	4	2	1	3
(b)	3	4	2	5
(c)	5	4	2	3
(d)	3	2	1	5

54. The cutting speed of the tool in a mechanical shaper is

(a) Maximum at the beginning of the cutting stroke
(b) Maximum at the end of the cutting stroke
(c) Maximum at the middle of the cutting stroke
(d) Minimum at the middle of the cutting stroke

55. Which is not correct statement about the function of flux in brazing

(a) To avoid thermal distortion and cracking
(b) To dissolve surface oxide coatings which have formed prior to brazing
(c) To prevent oxides from forming during the brazing operation on both the base metal and the brazing material
(d) To facilitate the wetting process by reducing the viscosity of the melt

56. Investment casting is used for

(a) Shapes which are made by difficulty using complex patterns in sand casting
(b) Mass production
(c) Shapes which are very complex and intricate and can't be cast by any other method
(d) There is nothing like investment casting

57. Internal and external threads can be produced on tapered surfaces conveniently by

(a) Universal milling machine
(b) Plano miller
(c) Planetary milling machine
(d) lathe

58. Optical square is

(a) Engineer's square having stock and blade set at 90^0
(b) A constant deviation prism having the angle of deviation between the incident ray and reflected ray, equal to 90^0
(c) A constant deviation prism having the angle of deviation between the incident ray and reflected ray, equal to 45^0
(d) Used to produce interference fringes

59 A master gauge is

(a) A new gauge
(b) An international reference standard
(c) A standard gauge for checking accuracy of gauges used on shop floors
(d) A gauge used by experienced technicians

60. Dimension of the hole is $50^{+0.02}_{-0.00}$ **mm and shaft is** $50^{+0.02}_{+0.00}$ **mm. The minimum clearance is**

(a) 0.02 mm **(b)** 0.00 mm **(c)** -0.02 mm **(d)** 0.01 mm

61. Two cutters are mounted on the arbor so that two faces are machined simultaneously in

(a) Gang milling **(b)** Straddle milling **(c)** Pendulum milling **(d)** Profile milling

62. The main alloying elements in high speed steel in order of increasing proportion are

(a) Vanadium, chromium, tungsten **(b)** Tungsten, titanium, vanadium
(c) Chromium, titanium, vanadium **(d)** Tungsten, chromium, titanium

63. Surface roughness on a drawing is represented by

(a) Triangles **(b)** Circles **(c)** Squares **(d)** Rectangles

64. A husband and wife appear in an interview for two vacancies for same post. The probability of husband getting selected is $\frac{1}{5}$ **while the probability of wife getting selected is** $\frac{1}{7}$**. Then the probability that anyone of them getting selected is**

(a) $\frac{11}{35}$ **(b)** $\frac{12}{35}$ **(c)** $\frac{1}{35}$ **(d)** $\frac{34}{35}$

65. Cylindrical parts are held on planer by

(a) V-blocks and arrestors **(b)** Angle plates
(c) V-block, T-bolts and clamps **(d)** T-bolt and clamps

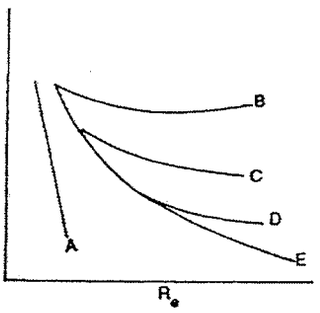
66. Expressing a dimension as $25.3^{\pm 0.05}$ **mm is the case of**

(a) Unilateral tolerance **(b)** Bilateral tolerance
(c) Limiting dimensions **(d)** All of the above

67. **In comparison to an open-loop system a closed loop system is**

(a) More stable **(b)** More accurate **(c)** More complex **(d)** All of the above

68. **The Moody diagram is shown in Fig. The friction factor for turbulent flow in a smooth pipe is given by curve**



(a) A **(b)** B

(c) E **(d)** C

69. **A piping system consists of three pipes arranged in series, the lengths of the pipes are 1200m, 750 m and 600 m and diameters 750 mm, 600 mm, 450 mm respectively. Transform the system to an equivalent 450 mm diameter pipe**

(a) 671.3m **(b)** 771.3m **(c)** 871.3m **(d)** 971.3m

70. **Friction drag is generally larger than the pressure drag in**

(a) Flow past a sphere **(b)** Flow past a thin sheet **(c)** Flow past an airfoil **(d)** Flow past a cylilnder

71. **If D is the diameter of impeller at inlet, w is the width of impeller at inlet and V_f is the velocity of flow at inlet, then discharge through a centrifugal pump is equal to**

(a) πDV_f **(b)** $DV_f w$ **(c)** $\pi DV_f w$ **(d)** πDw

72. **Cavitation parameter is defined by**

(a) $\frac{P_v - P}{\rho V^2/2}$ **(b)** $\frac{P_{atm} - P_v}{\rho V^2/2}$ **(c)** $\frac{P - P_{atm}}{\frac{\rho V^2}{2}}$ **(d)** $\frac{P - P_v}{\frac{\rho V^2}{2}}$

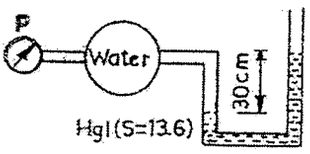
73. **The maximum thickness of boundary layer in a pipe of radius R is**

(a) 0.1 R **(b)** 0.22 R **(c)** 0.5 R **(d)** R

74. **At a point A in a pipe lilne carrying water, the diameter is 1 m, the pressure 98 KPa and the velocity $1 m/s$. At a point B, 2 m higher than A, the diameter is 0.5m and the pressure 20 KPa. The direction of flow would be**

(a) A to B **(b)** B to A **(c)** Cannot be ascertained from data **(d)** None of these

75. In the given figure pressure p ,in kPa , is



(a) 37 (b) 48.0 (c) 45.2 (d) 51.3

76. A small plastic boat loaded with pieces of steel rods is floating in a bathtub. If the cargo is dumped into the water allowing the boat to float empty, the water level in the tub will

(a) Rise (b) Fall (c) Not change (d) Rise then fall

77. Four cars, with a mass of 1500 kg each, are loaded on a 6 m wide, 12 m long small car ferry. How far, in cm will it sink in the water?

(a) 15.2 (b) 11.5 (c) 10.2 (d) 8.3

78. Water enters a turbine at 900kPa with negligible velocity. What maximum speed, in m/s, can it reach before it enters the turbine rotor?

(a) 42 (b) 47 (c) 45 (d) 52

79. Given that:
Specific gravity of mercury = 13.6;
Intensity of pressure = 40kPa
Express the intensity of pressure (gauge) in various units (S.I)

(a) 0.3 bar, 3.077 m of water, 0.15 m of mercury
(b) 0.4 bar, 4.077 m of water, 0.299 m of mercury
(c) 0.5 bar, 5.077 m of water, 0.339 m of mercury
(d) None of the above

80. The differential equation satisfying $y = Ae^{3x} + Be^{2x}$ is

(a) $\frac{d^2y}{dx^2} + 5\frac{dy}{dx} - 6y = 0$
(b) $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 0$
(c) $\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 6y = 0$
(d) $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} - 6y = 0$