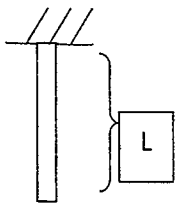
1. The resultant of two equal forces P making an angle θ, is given by:

   (a) 2P sin (θ/2) (b) 2P tan (θ/2) (c) 2P cot (θ/2) (d) 2Pcos(θ/2)

2. A body weighs 98N on a spring balance on the north pole. The same body is shifted to the equator, the weight of the body at the equator on the same scale is: (*Assume g=9.8 m/sec^2 and radius of the earth=6400 km*)

   (a) 97.45N (b) 98.66 N
   (c) 97.66 N (d) 98.22N

3. A uniform heavy rod of weight W, cross-sectional area A and length L and having Young's Modulus E is hanging vertically from a fixed support. Neglecting lateral contraction, the elongation of the rod is given by:



   (a) 5WL/3AE (b) 48WL/AE (c) WL/2AE (d) WL/(548AE)

4. Two barsB1 and B2 of different materials and the same size are subjected to the same tensile force. If the bars have unit elongation in the ratio of 3:7 respectively, then the ratio of modulus of elasticity of the two bars B1 and B2 will be:
   (a) 3:7 (b) 7:3 (c) 3:4 (d) 4:3

5. The pressure at a point 6 m below the free surface of water is:
   (a) 58.86 kPa (b) 58.86 Pa (c) 58.86 bar (d) 58.86 MPa

6. A uniform body of 4 m long, 1 m wide and 1 m deep floats in water. If the depth of immersion is 0.6 m, then the weight of the body is:

   (a) 20.54 kN (b) 23.54 kN (c) 35.54 kN (d) 45.54 kN

7. A jet of water discharging from a 6 cm diameter orifice has a diameter of 40 mm at its vena contracta. The coefficient of contraction is:

(a) 0.36 (b) 0.54 (c) 0.21 (d) 0.44

8. A Pelton wheel develops 2000 kW under a head of 100 metres while running at 200 r.p.m. and discharging 3000 litres of water per second. The unit discharge of the wheel is:

(a) 0.8 m^3/sec (b) 0.3 m^3/sec (c) 0.5 m^3/sec (d) 0.6 m^3/sec

9. What Drag force is exerted at sea level by a 3.5m braking Parachute when the speed is 20 m/s C_d =1.20 and this remains constant, ρ_{air} (sea level)=1.225 kg/m^3

(a) 2828.6 N (c) 282.86 N
(b) 28.28 N (d) 2.828 N

10. To convert volumetric analysis to gravimetric analysis, the relative volume of each constituent of the flue gases is:

(a) divided by its molecular weight (b) multiplied by its density
(c) multiplied by its specific weight (d) multiplied by its molecular weight

11. A perfect gas at 27^{0}C is heated at constant pressure till its volume is double. The final temperature is:

(a) 237^{0}C (b) 327^{0}C (c) 208^{0}C (d) 654^{0}C

12. 1 m^3 of air at a pressure of 10 kg/cm^2 is allowed to expand freely to a volume of 10 m^3. The work done will be:

(a) Zero (b) –ve (c) +ve (d) 10^5 kg m

13. One reversible heat engine operates between 1400 K and T_2K and another reversible heat engine operates between T_2K and 600 K. If both the engines have the same heat input and output, then temperature T_2 is equal to:

(a) 616.85 K (b) 1000.33 K (c) 916.52 K (d) 816.55 K

14. Carnot cycle consists of:

(a) two constant volume and two isentropic processes
(b) two constant pressure and two isentropic processes
(c) one constant volume, one constant pressure and two isentropic processes
(d) two isothermal and two isentropic process

15. The operating temperature of a cold storage is -4^0C. The heat leakage from the surrounding is 30kW for the ambient temperature of 35^0C. The actual C.O.P. of refrigeration plant used is one-fifth that of ideal plant working between the same temperatures. The power required to drive the plant is:

(a) 22.86 kW (b) 19.45 kW (c) 20.56 kW (d) 21.74 kW

16. The essential constituent of a hardened steel is:

(a) austenite (b) pearlite (c) martensite (d) troostite

17. In a vibrating system, if the actual damping coefficient is 50 N/m/s and critical damping coefficient is 500 N/m/s, then logarithmic decrement is equal to:

(a) 0.21 (b) 0.45 (c) 0.63 (d) 0.87

18. A block of mass 1.2 kg moving at a speed of 20 cm/s collides head on with a similar block kept at rest, the coefficient of restitution is 3/5, the loss of kinetic energy during the collision is:

(a) 6.7×10^{-3} joule (b) 7.7×10^{-3} joule (c) 8.7×10^{-3} joule (d) 17.7×10^{-3} joule

19. Stage efficiency of a turbine is equal to:

(a) $\frac{\text{Work done on blades}}{\text{Total energy supplied}}$ (b) $\frac{\text{Work done on blades}}{\text{Energy supplied per stage}}$

(c) $\frac{\text{Energy supplied per stage}}{\text{Work done on blades}}$ (d) $\frac{\text{Total energy supplied}}{\text{Work done on blades}}$

20. A pendulum bob has a speed of 3 m/s while passing through its lowest position, the speed of the bob when it makes an angle of 60^0 with the vertical is: (Assume g= 10 m/sec^2 and Length of pendulum is 0.5 m) :

(a) 1 m/s (b)1.5 m/s (c) 1.75 (d) 2.0 m/s

21. In a thin cylindrical shell subjected to an internal pressure p, the ratio of longitudinal stress to the hoop stress is:

(a) 1/2 (b) 4.0 (c) 1/4 (d) 2.0

22. A hot plate transfers heat with a heat flux of 8000 W/m^2 into the ambient air at 25^0C. if the surface of the hot plate is maintained at 125^0C, calculate the heat transfer coefficient for the convection between the plate and the air:

(a) 75 W/m^2- K
(b) 80 W/m^2- K
(c) 70 W/m^2- K
(d) 60 W/m^2- K

23. Water at 50^0C flows over a hot plate maintained at temperature 150^0C. The plate has a width of 50 cm and length of 100 cm. If the heat transfer coefficient between the water and the plate is 2100 W/m^2-K, the thermal resistance of convection is:

(a) 7.52×10^{-4} K/W
(b) 10.52×10^{-4} K/W
(c) 8.52×10^{-4} K/W
(d) 9.52×10^{-4} K/W

24. An Aluminum sphere dipped into water at 10 degree centigrade, if temperature is increased, the force of bouncy will:

(a) increase
(b) decrease
(c) remain constant
(d) increase or decrease depending on the radius of the sphere

25. According to Lami's theorem:
(a) the three forces must be equal.
(b) the three forces must be at 120^0 to each other.
(c) the three forces must be in equilibrium
(d) if the three forces acting at a point are in equilibrium, then each force is proportional to the ' sine 'of the angle between the other two.

26. When a body of mass moment of inertia I (about a given axis) is rotated about that axis with an angular velocity ω, then the kinetic energy of rotation is:

(a) $I\omega^2$ (b) $0.5\ I\omega$ (c) $0.5\ I\omega^2$ (d) $I\omega$

27. In a boiler, feed water supplied per hour is 225 kg while coal fired per hour is 25 kg. The net enthalpy rise per kg of water is 150 kJ. If the calorific value of the coal is 2050 kJ/kg, then the boiler efficiency will be

(a) 75% (b) 45% (c) 66% (d) 55%

28. The metacentric height of a ship is 0.5 m and the radius of gyration is 6 m. The time of rolling of a ship is:

(a) 30.01s (b) 17.01s (c) 15.01s (d) 16.01s

29. For an irrotational flow the equation $\frac{\partial^2 \Phi}{\partial x^2} + \frac{\partial^2 \Phi}{\partial y^2}$ is known as ,

(a) Bernoulli's equation
(b) Cauchy Riemann's equation
(c) Euler's equation
(d) Laplace equation

30. A Pelton Wheel develops 2500 kW under a head of 150 metres while running at 200 r.p.m. and discharging 200 litres of water per second. The unit power of the wheel is:

(a) 0.63 kW (b) 0.36 kW (c) 1.36 kW (d) 1.63 kW

31. An Iron rod and a Copper rod lies side by side, as the temperature is changed, the difference in the length of the rods remains constant value of 10 cm. The lengths of Iron and Copper rods at zero degree centigrade shall be ----------. (coefficient of Linear expansion of Iron= 1.1×10^{-5} per degree centigrade and coefficient of Linear expansion of Cu= 1.7×10^{-5} per degree centigrade)

(a) 18.3 cm and 8.3 cm (b) 28.3 cm and 18.3 cm
(c) 38.3cm and 28.3cm (d) 48.3 cm and 38.3 cm

32. The specific speed of a turbine is given by the equation:

(a) $\frac{N\sqrt{P}}{H^2}$ (b) $\frac{N\sqrt{P}}{H^{3/2}}$ (c) $\frac{N\sqrt{P}}{H^{5/4}}$ (d) $\frac{N\sqrt{P}}{H^3}$

33. A furnace is made of a red brick wall of thickness 0.6 m and conductivity 0.8 W/m K . For the same heat loss and temperature drop, this can be replaced by diatomite earth of conductivity 0.16 W/m K and thickness of --------

(a) 0.55m (b) 0.12m (c) 1.25m (d) 0.50m

34. An elevator weighing 500 kg is to be lifted up at a constant velocity of 0.20 m/s. The minimum horse power of the motor is: (assume g= 9.8 m/sec^2)

(a) 2.2hp (b) 2 hp (c) 1.5 hp (d) 1.3 hp

35. An electric cable of aluminium conductor (k=230W/mK) is to be insulated with rubber (k=0.18W/m K).The cable is to be located in air (h=6W/m^2).The critical thickness of insulation will be:

(a) 40 mm (b) 10 mm (c) 30 mm (d) 50 mm

36. A hot fluid enters the counter flow heat exchanger at 120°C and leaves at 80°C. A cold fluid enters the heat exchanger at 60 °C. The mean temperature difference between the two fluids is (Assume the values of fluid flow rates and specific heats in such a manner that the heat capacities of the two fluids are equal)

(a) 15° C (b) 35° C (c) 40° C (d) 20° C

37. In a psychrometric process, the sensible heat added is 40 kJ/s and the latent heat added is 30 kJ/s. The sensible heat factor for the process will be:

(a) 0.3 (b) 0.2 (c) 0.57 (d) 1.5

38. When two refrigerants are mixed in the proper proportions, the mixture forms a third refrigerant called:

(a) synthetic refrigerant (b)refrigerant mixture
(c) high pressure refrigerant (d) an azeotrope

39. A fixed gear having 300 teeth is in mesh with another gear having 60 teeth. The two gears are connected by an arm. The numbers of turns made by the smaller gear for one revolution of arm about the centre of bigger gear is:

(a) 2 (b) 6 (c) 4 (d) 5

40. Nusselt number is the ratio of

(a) Convective and Conductive resistances
(b) Conductive and Convective resistances
(c) Wall heat transfer rate to mass heat flow rate
(d) Kinetic viscosity to thermal diffusivity

57. When a liquid flows through a tube with subcooled or saturated boiling the process is known as

(a) Pool boiling (b) bulk boiling

(c) Convection boiling (d) forced convection boiling

58. For filmwise condensation, the heat transfer coefficient will be equal whether the tube is horizontal or vertical, when the ratio of length to diameter is

(a) 1.3 (b) 2.87 (c)0.77 (d) >10

59. Insulated tip temperature of a rectangular longitudinal fin will be equal to

(a) $\theta_o$tanh ml (b) θ_o /sinh ml (c) ($\theta_o$tanh ml)/ml (d) θ_o /cosh ml

60. The characteristic length computing Grashof number in the case of a horizontal cylinder is

(a) diameter of the cylinder (b) length of the cylinder

(c) radius of the cylinder (d) perimeter of the cylinder

61. In liquid metal heat transfer for a fluid flowing through a tube, Nusselt number is a function of

(a) Reynold Number (b) Prandtl Number

(c) Peclet Number (d) Reynolds and Peclet Number

62. Absorptivity of the grey body

(a) varies with temperature

(b) varies with wavelength of the incident ray

(c) varies with wavelength and temperature of the incident ray

(d) does not vary with wavelength and temperature of the incident ray

63. Gases have poor

(a) transmissivity (b) absorptivity (c) reflectivity (d) emissivity

64. Intensity of solar radiation in kW/sqm is about

(a) 1 (b) 3 (c) 5 (d) 2

65. Match the following:

A	Stanton Number	1	Surface Tension
B	Mach Number	2	Mass Transfer
C	Weber Number	3	Forced Convection
D	Schmidt Number	4	Compressiblity

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

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

66. In MLTθ system, the dimension of thermal conductivity is
(a) $ML^{-1}T^{-1}\theta^{-3}$ (b) $MLT^{-1}\theta^{-1}$ (c) $MLT^{-3}\theta^{-1}$ (d) $MLT^{-2}\theta^{-1}$

67. For infinite parallel planes with emissivities 0.4 and 0.2, the interchange view factor for a radiation from surface 1 to surface 2 is about
(a) 0.4 (b) 0.6 (c) 0.2 (d) 0.15

68. A chromel – alumel thermocouple of diameter 0.7mm is used to measure the temperature of a gas stream for which h= 600 W/sqm K. Acceptable reading of the temperature can be taken after (specific heat = 400 J/kg K, Density = 8600 kg/cum)
(a) 1 second (b) 4 seconds (c) 2 seconds (d) 3 seconds

69. On a hot summer day, surface of the concrete highway may reach 328 K. Suppose a stream of water is directed on the highway so that the surface is suddenly lowered to 308 K. Time taken in hours to cool the concrete to 318 K to a depth of 5 cm below the surface is: (Thermal diffusivity = 1.77E-03 m^2/h)
(a) 1.2 (b) 1.4 (c) 1.8 (d) 1.6

70. Hot surface at temperature 400 K having emissivity of 0.5 dissipates heat by radiation into a surrounding of 375 K. Its radiation heat transfer coefficient (W/sqm K) is
(a) 14.6 (b) 7.3 (c) 1.83 (d) 9.4

71. Hot steel sphere of diameter 40mm is immersed in oil. If the heat transfer coefficient between the sphere and oil is 300 W/sqm K , then Biot Number is:
Take k_{steel} = 50 W/m K and k_{oil} = 0.2 W/m K
(a) 0.04 (b) 0.12 (c) 10 (d) 0.24

72 A metallic surface is maintained at 1000 K, the wavelength at which maximum spectral intensity occurs
(a) 289.8 μm (b) 28.98 μm (c) 0.2898 μm (d) 0.002898 mm

73. Air at 293 K is flowing with velocity of 3m/s over a heated flat square plate. Plate is 0.3 m wide and is maintained at 330 K. Average heat loss from the plate due to convection is (Take ν= 16.768E-6 m^2/s, Pr =0.7, k=0.027 W/m K)
(a) 33 W (b) 37 W (c) 45 W (d) 41 W

74. Two fluids A and B exchange heat in counterflow heat exchanger. Fluid A enters at 700 K and fluid B enters at 300 K. Mass flow rate of A & B is 1 kg/s. Specific heat of fluid A and B is 1000 J/kg K and 4000 J/kg K. Net Effectiveness of heat exchange is 75 %. Exit temperature of Fluid B is
(a) 380 K (b) 385 K (c) 375 K (d) 370 K

75. If the following equations are consistent, then value of k is

$4x-3y+1=0$
$kx-8y+10=0$
$x+y-5=0$

(a) -6 (b) 7 (c) 6 (d) –7

76. If ω and ω^2 are cube roots of unity, then $(2-\omega+2\omega^2)(2+2\omega-\omega^2)$ is

(a) 0 (b) -9 (c) 8 (d) 9

77. Area of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$

(a) ab (b) a/b (c) πab (d) ab/π

78. find $\lim_{x\to 0}\frac{1-\cos x}{x^2}$

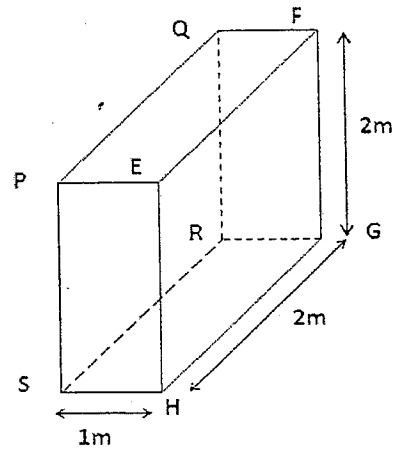
(a) 0 (b) 1/2 (c) –1/2 (d) 1

79. Equation of the plane parallel to the x axis and passes through the point (4,6,2) and (4, -5, 3)

(a) y+11z+28=0 (b) y-11z+28=0
(c) y+11z-28=0 (d) y-11z-28=0

80. $\vec{a}$ and $\vec{b}$ are unit vectors such that $2\vec{a}-4\vec{b}$ and $10\vec{a}+8\vec{b}$ are perpendicular to each other. Angle between the vectors $\vec{a}$ and $\vec{b}$ is

(a) 90° (b) 120° (c) 110° (d) 100°



(a) 10°C (b) 20°C (c) 30°C (d) 40°C

63. Two walls of thicknesses d_1 and d_2 and thermal conductivities k_1 and k_2 are in contact. In the steady state, if the temperatures at the outer surfaces are T_1 and T_2, the temperature at the common wall is

(a) $(k_1T_1d_2+k_2T_2d_1)/(k_1d_2+k_2d_1)$ (b) $(k_1T_1+k_2d_2)/(d_1+d_2)$
(c) $[(k_1d_1+k_2d_2)/(T_1+T_2)]*T_1T_2$ (d) $k_1d_1T_1+k_2d_2T_2/(k_1d_1+k_2d_2)$

64. A Carnot cycle refrigerator operates between 250 K and 300 K. Its coefficient of performance (C.O.P.) is:

(a) 6.0 (b) 5.0 (c) 1.2 (d) 0.8

65. . A 3 m^3 rigid tank contains nitrogen gas at 500 kPa and 300 K. Now heat is transferred to the nitrogen in the tank and the pressure of nitrogen rises to 800 kPa. The work done during this process is

(a) 500 kJ (b) 1500 kJ (c) 0 kJ (d) 900 kJ

66. A solid cylinder (surface 2) is located at the centre of a hollow sphere (surface 1). The diameter of the sphere is 1m, while the cylinder has a diameter and length of 0.5 m each. The radiation configuration factor F11 is

(a) 0.375 (b) 0.625 (c) 0.75 (d) 1.0

67. One kilogram of water at room temperature is brought into contact with a high temperature thermal reservoir. The entropy change of the universe is

(a) equal to entropy change of the reservoir (b) equal to entropy change of water
(c) equal to zero (d) always positive

68. For specified limits for the maximum and minimum temperatures, the ideal cycle with the lowest thermal efficiency is:

(a) Carnot (b) Stirling (c) Ericsson (d) Otto

69. A refrigerator removes heat from a refrigerated space at –5°C at a rate of 0.35 kJ/s and rejects it to an environment at 20°C. The minimum required power input is:

(a) 30 W (b) 33 W (c) 56 W (d) 124 W

70. A heat pump is absorbing heat from the cold outdoors at 5°C and supplying heat to a house at 22°C at a rate of 18,000 kJ/h. If the power consumed by the heat pump is 2.5 kW, the coefficient of performance (COP) of the heat pump is :

(a) 0.5 (b) 1.0 (c) 2.0 (d) 5.0

71. . If the inner and outer walls of a hollow sphere having surface areas of A1 and A2 and inner and outer radii r1 and r2 are maintained at temperatures t1 and t2, then rate of heat flow will be

(a) $\frac{k}{\sqrt{A_1 A_2}} \frac{t_1 - t_2}{r_1 - r_2}$ (b) $k\sqrt{A_1 A_2} \frac{t_1 - t_2}{r_2 - r_1}$

(c) $4\pi k \frac{t_1 - t_2}{\sqrt{A_1 A_2}}$ (d) $4\pi k r_1 r_2 \frac{t_1 - t_2}{\sqrt{A_1 A_2}}$

72. Water is boiled at 1 atm pressure in a coffee maker equipped with an immersion-type electric heating element. The coffee maker initially contains 1 kg of water. Once boiling started, it is observed that half of the water in the coffee maker evaporated in 18 minutes. If the heat loss from the coffee maker is negligible, the power rating of the heating element is

(a) 0.9kW (b) 1.52kW (c) 2.09kW (d) 1.05kW

73. Ductility of steel is reduced by

(a) Hot rolling (b) Cold working (c) Piercing (d) Annealing

74. Machining of cast iron material is mostly performed

(a) with flood coolant (b) with mist coolant
(c) Dry (d) with high pressure coolant

75. A sine bar is used for the accurate measurement of

(a) lengths (b) diameters (c) angles (d) depths

76. The process used to improve fatigue resistance of the metal by setting up compressive stresses in its surface, is known as

(a) hot piercing (b) extrusion (c) cold peening (d) cold heading

77. The instrument which has all the features of try-square, bevel protractor, rule and scriber is

(a) outside micrometer (b) inside micrometer
(c) depth gauge micrometer (d) combination set

78. Vector C is perpendicular to vectors A and B both, then:

(a) AxB=C (b) A.B=C (c) A. [AXC]=B (d) BxC=A

79. An unbiased dice is tossed twice. Find the Probability of getting 4,5 or 6 on the first toss and a 1,2,3 or 4 on the second toss

(a) 7/3 (b) 18/23 (c) 1/9 (d) 1/3

80. For the given characteristic matrix [A], determine the Eigen Values :-

$$[A]= \begin{bmatrix} 4 & 1 \\ 1 & 4 \end{bmatrix}$$

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