Units 6 to 10 - Paper 2

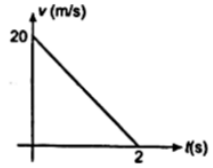
1. A force $3\hat{i}+4\hat{j}N$ acts on abody and displaces it by $3\hat{i}+4\hat{j}m$. The work done by the force is

(a) 10 J
(b) 12 J
(c) 16 J
(d) 25 J

Answer: d
Solution

$W = F \cdot S = (3\hat{i}+4\hat{j})\cdot(3\hat{i}+4\hat{j}) = 9+16 = 25\,J$

2. Velocity- time graph of a particle of mass 2 kg moving in a straight line is a shown in figure



. Work done by all the forces on the particle is

(a) 400 J
(b) -400 J
(c) -200 J
(d) 200 J

Answer: b
Solution

Work done by all forces = change in kinetic energy

$$=\frac{1}{2}m(v_f^2-v_i^2)$$

$$=\frac{1}{2}\times 2(0-400) = -400J$$

3. Three thin rods each of length L and mass M are placed along x; y and z axis such that one end of each rod is at origin. The moment of inertia of this system about z-axis is

(a) $\frac{2}{3}ML^2$
(b) $\frac{4ML^2}{3}$
(c) $\frac{5ML^2}{3}$
(d) $\frac{ML^2}{3}$

Answer: a
Solution

Moment of inertia of the rod lying along z-axis will be zero. Of the rods along x and *y*-axis will be $\frac{ML^2}{3}$ each. Hence, total moment of inertia is $\frac{2}{3}ML^2$.

4. A solid sphere; a hollow sphere and a disc; all having same mass and radius; are placed at the top of an inclined plane and released. The friction coefficients between the objects and the incline are same and not sufficient to allow pure rolling. Least time will be taken in reaching the bottom by

(a) the solid spere
(b) the hollow spere
(c) the disc
(d) all will take same time

Answer: d
Solution

For all bodies a = *g* sin *q* - *m g* cos *q* .
Hence all will take equal time.

5. The weights of an object in the coal mine; at sea level; and at top of mountains are $W_1 = W_2$ and W_3 respectively; then

(a) $W_1 < W_2 > W_3$
(b) $W_1 = W_2 = W_3$
(c) $W_1 < W_2 < W_3$
(d) $W_1 > W_2 > W_3$

Answer: a
Solution

In a coal mine and at the top of a mountain value of *g* is less, hence apparent weight is less.

6. The ratio of the radius of the earth to that of the moon is 10. The ratio of the acceleration due to gravity on the earth to that on the moon is 6. The ratio of the escape velocity from the earth's surface to that from the moon is

(a) 4
(b) 6
(c) 12
(d) None of these

Answer: d
Solution

$$v = \sqrt{2gR}$$

$$\therefore \quad \frac{v_e}{v_m} = \sqrt{\frac{g_e}{g_m}\times\frac{R_e}{R_m}}$$

$$= \sqrt{\frac{6}{1}\times\frac{10}{1}} = \sqrt{60}$$

7. The Young's modulus of a wire is numerically equal to the stress which will

(a) not change the length of the wire
(b) double the length of the wire
(c) increase the length by 50%
(d) change the radius of the wire to half

Answer: b
Solution

$Y = \frac{\text{Stress}}{\text{Strain}}$, Y = Stress for unit strain or $\Delta l = l$

8. A block of ice of mass M = 10kg is moved back and forth over the flat horizontal surface of a large block of ice. Both blocks are at 0^C and the force that produces the back-and- forth motion acts only horizontally. The coefficient of friction between the two surfaces is 0.060. If m = 15.2 g of water is produced; the total distance travelled by the upper block relative to the lower is ($L_{ice} = 3.34x10^5 J/kg$)

(a) 432 m
(b) 863 m
(c) 368 m
(d) 216 m

Answer: b
Solution

$\mu Mgd = mL$

$$\therefore d = \frac{mL}{\mu Mg} = \frac{(15.2\times10^{-3})(3.34\times10^5)}{0.06\times10\times9.8}$$

$= 863.4\ m$

9. If the equation for the displacement of a particle moving on a circular path is given by $q = 2t^3 + 0.5$; where q is in radian and t is in second; then the angular velocity of the particle after 2 s is

(a) 8 rad/s
(b) 12 rad/s
(c) 24 rad/s
(d) 36 rad/s

Answer: c
Solution

$$\omega = \frac{d\theta}{dt} = 6t^2,\ At\ t = 2s$$

$$\omega = 6(2)^2 = 24\ rad/s$$

10. The calories of heat develoepd in 200W heater in 7 min is estimated

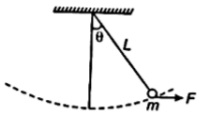
(a) 1500
(b) 100
(c) 1000
(d) 20000

Answer: d
Solution

$$H = \frac{200 \times 7 \times 60}{4.18} cal$$

$$= 20095.7 \approx 20{,}000 \text{cal}$$

11. An object of mass m is tied to a string of length L and a variable horizontal force is applied on it which starts at zero and gradually increases until the strong makes an angle θ with the vertical. Work done by the force F is.

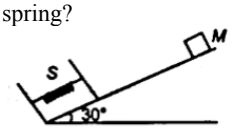


(a) $mgL(1 - \sin\theta)$
(b) mgL
(c) $mgL(1 - \cos\theta)$
(d) $mgL(1 + \cos\theta)$

Answer: c
Solution

W = change in potential energy = mgh
$= mgL(1\text{-}\cos\theta)$

12. An ideal massless spring s can be compressed 1 m by a force of 100 N in equilibrium . The same spring is placed at the bottom of a frictionless inclined plane inclined at 30^0 to the horizontal. A 10 kg block M is released from rest at the top ofthe incline and is brought to rest momentarily after compressing the spring by 2 m. If $g = 10m/s^2$; what is the speed of mass just before it touches the spring?



(a) $\sqrt{20}m/s$
(b) $\sqrt{30}m/s$
(c) $\sqrt{10}m/s$
(d) $\sqrt{40}m/s$

Answer: a
Solution

$F = kx$

$$\therefore\ k = \frac{F}{x} = \frac{100}{1} N/m = 100 N/m$$

Now from energy conservation, between natural length of spring and its maximum compression state.

$$\frac{1}{2}mv^2 + mgh = \frac{1}{2}kx_{\max}^2$$

$$v = \sqrt{\frac{kx_{\max}^2}{m} - 2gh}$$

$$= \sqrt{\frac{(100)(2)^2}{10} - (2)(10)\left(\frac{2}{2}\right)}$$

$$= \sqrt{20}\, m/s$$

13. Moment of inertia of a body depends upon

(a) axis of rotation
(b) torque
(c) angular momentum
(d) angular velocity

Answer: d

14. A ring and a disc of different masses are rotating with the same kinetic energy. If we apply a retarding torque γ on the ring; it stops after making n revolutions. After how many revolutions will the disc stop; if the retarding torque on it is also γ ?

(a) n/2
(b) n
(c) 2n
(d) Data insufficient

Answer: b

15. A thin bar of mass m and length l is free to rotate about a fixed horizontal axis through a point at its end. The bar is brought to a horizontal position ($q = 90^0$) and then released. The angular velocity when it reaches the lowest point is

(a) directly proportional to its length and inversely proportional to its mass
(b) independent of mass and inversely proportional to the square root of its length
(c) dependent only upon the acceleration due to gravity and the mass of the bar
(d) directly proportional to its length and; inversely proportional to the acceleration due to gravity

Answer: b

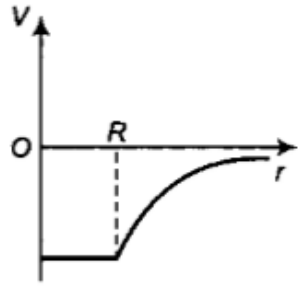
16. If V is the gravitational potential on the surface of the earth; then what is its value at the centre of the earth?

(a) 2 V
(b) 3V
(c) 3/2V
(d) 2/3V

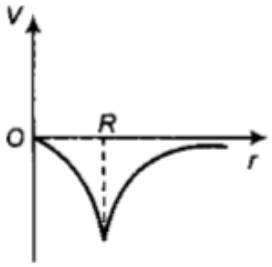
Answer: c

17. The diagram showing the variation of gravitational potential of earth with distance from the centre of earth Is

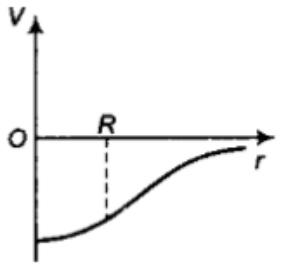
(a)



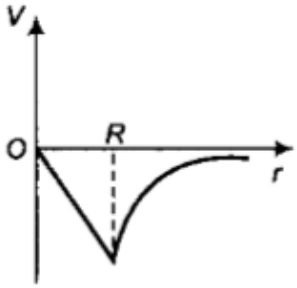
(b)



(c)



(d)



Answer: c

18. An elevator cable is to have a maximum stress of $7X10^7 m^2$ to allow for appropriate safety factors. Its maximum upward acceleration is $1.5m/s^2$. If the cable has to support the total weight of 2000 kg of a loaded elevator; the area of cross-section ofthe cable should be

(a) $3.22cm^2$
(b) $2.38cm^2$
(c) $0.32cm^2$
(d) $8.23cm^2$

Answer: a

19. A uniform steel bar of cross-sectional area A and length L is suspended so that it hangs vertically. The stress at the middle point of the bar is (ρ is the density of steel)

(a) $\frac{L}{2a}\rho g$
(b) $\frac{L\rho g}{2}$
(c) $\frac{LA}{\rho g}$
(d) $L\rho g$

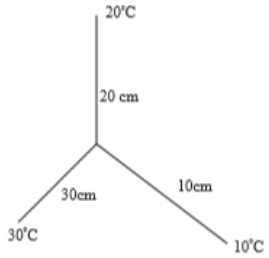
Answer: b

20. There is a black spot on a body. if the body is heated and carried in dark room then it glows more. This can be explained on the basis of

(a) Newton's law of cooling
(b) Wein's law
(c) Kirchhoff's law
(d) Stefan's law

Answer: c

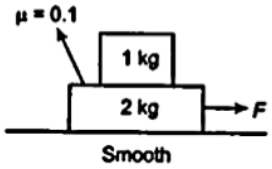
21. Three rods made of the same material and having same cross-sectional area but different length 10 cm; 20 cm and 30 cm are joined as shown. The temperature of the junction is



(a) 10.8^0c
(b) 14.6^0c
(c) 16.4^0c
(d) 18.2^0c

Answer: c

22. A force of F = 0.5 N is applied on lower block as shown in figure. The work done by lower block on upper block for a displacement of 3m of the upper block with respect to ground is [Take $g = 10m/s^2$]



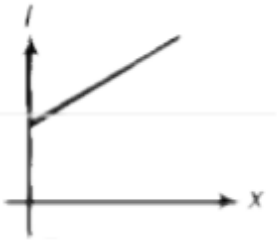
(a) -0.5J
(b) 0.5J
(c) 2J
(d) -2J

Answer: b

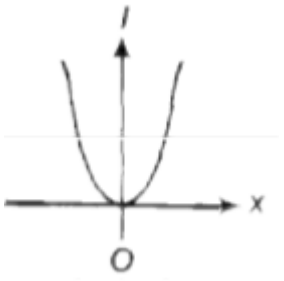
23. Figure represents the MI of the solid sphere about an axis parallel to the diameter of the solid sphere and at a distance xfrom it. Which one of the following represents the variations of l with x?

(a)

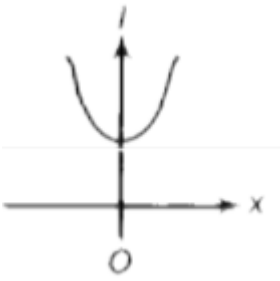
(b)



(c)

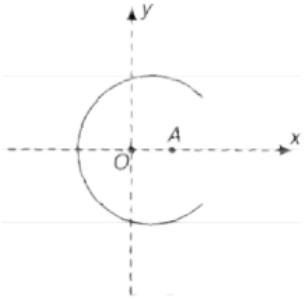


(d)



Answer: d

24. A portion of a ring of radius R has been removed as shown in figure. Mass of the remaining portion is m. Centre of the ring is at origin 0. Let I_A and I_O be the moment of inertias passing through points



A and O and perpendicular to the plane of the ring. Then;

(a) $I_O = mR^2$
(b) $I_O = I_A$
(c) $I_O > I_A$
(d) $I_A > I_O$

Answer:

25. Two satellites A and B in ratio of masses 3: 1 are in circular orbits of radii rand 4r. Then ratio of total mechanical energy of A and B is

(a) 1:03
(b) 3:01
(c) 3:04
(d) 12:01

Answer: d

26. The acceleration due to gravity g and mean density of earth rho are related by which of the following relations? (G = gravitational constant and R = radius of earth)

(a) $\rho = 4\pi gR^2/3G$
(b) $\rho = 4\pi gR^3/3G$
(c) $\rho = 4g/4\pi GR$
(d) $\rho = 3g/4\pi GR^3$

Answer: c

27. The temperature of a wire length 1 m and area of cross-section $1cm^2$ is increased from o^0c to 100^0c If the rod is not allowed to increase in length; the force required will be ($alpha = 10^{-5}/^0C$ and $/Y = 10^{11}N/m^2$)

(a) 10^3 N
(b) 10^4 N
(c) 10^5 N
(d) 10^9 N

Answer: b

28. A beaker contains 200 g of water. The heat capacity of the beaker is equal to that of 20 g of water. The initial temperature of water in the beaker 20^0 c If 440 g of hot water at 92^0c is poured in it; the final temperature (neglecting radiation loss) will be nearest to

(a) 58^0 C
(b) 68^0 C
(c) 73^0 C
(d) 78^0 C

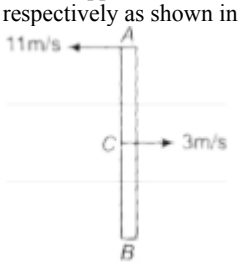
Answer: b

29. A small body of mass m slides without friction from the top ofa hemisphere of radius r. At what height will the body be detached from the center of the hemisphere

(a) h=r/2
(b) h=r/3
(c) h=2r/3
(d) h=r/4

Answer: c

30. A uniform rod AB of length 7m is undergoing combined rotational and translational motion such that at some instant of time; velocities of its end pointsA and centre C are both perpendicular to the rod and opposite in direction; having magnitudes 1 1 m/s and 3 m/s respectively as shown in the figure.



Velocity of centre C and angular velocity of the rod remain constant

(a) acceleration of point A is $56m/s^2$
(b) acceleration of point B is $56m/s^2$
(c) at the instant shown in the figure acceleration of point B is more than that of point A s
(d) angular velocity of the rod is 4 rad/s

Answer:

31. A body of mass 0.1 kg moving with a velocity of 10 m/s hits a spring (fixed at the other end) of force constant 1000 N/m and comes to rest after compressing the spring. The compression of the spring is

(a) 0.01 m
(b) 0.1 m
(c) 0.2m
(d) 0.5 m

Answer: b

32. A uniform solid sphere of mass m and radius r is surrounded symmetrically by a uniform thin spherical shell of radius 2 r and mass m.

(a) The gravitational field at a distance of 15 r from the centre is $2/9GM/r^2$
(b) The gravitational field at a distance 2.5 r from the centre is $8/25GM/r^2$
(c) The gravitational field at a distance of 1.5r from centre is zero
(d) The gravitational field between the sphere and spherical shell is uniform.

Answer: b

33. Four equal masses (each of mass M) are placed at the corners of a square of side a. The escape velocity of a body from the centre 0 of the square is

(a) $4\sqrt{2GM/a}$
(b) $\sqrt{8\sqrt{2}GM/a}$
(c) 4GM/a
(d) $\sqrt{4\sqrt{2}GM/a}$

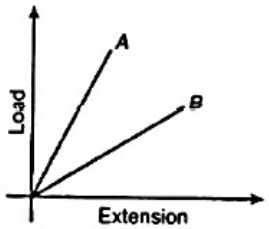
Answer: b

34. A liquid of mass m and specific heat c isheated to a temperature 2T. Another liquid of mass m/2 and specific heat 2c is heated to a temperature T. if these two liquids are mixed; the resulting temperature of the mixture is

(a) {2/3) T
(b) (8/5)T
(c) (3/5)T
(d) (3/2)T

Answer: d

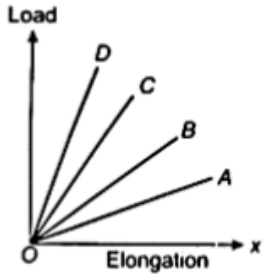
35. In the given figure; ifthe dimension ofthe wires are the same and materials are different; Young's modulus is more for



(a) A
(b) B
(c) Both
(d) None

Answer: a

36. The load versus elongation graph for four wires of the same material is shown in the figure. The thickest wire is represented by the line



(a) OD
(b) OC
(c) OB
(d) OA

Answer: d

37. A uniform chain of length L and mass M is lying on a smooth table and one third of its length is hanging vertically down over the edge of the table. If g is acceleration due to gravity; the work required to pull the hanging part on the table is

(a) MgL
(b) $\frac{MgL}{3}$
(c) $\frac{MgL}{9}$
(d) $\frac{MgL}{18}$

Answer: d

38. The potential energy between the atoms in a molecule is given by $U(x) = \frac{a}{x^{12}} - \frac{b}{x^6}$ where a and b positive constants and x is the distance between the atoms. The atom is in equilibrium when

(a) x=0
(b) $x = (\frac{a}{2b}^{1/6})$
(c) $x = (\frac{2a}{b}^{1/6})$
(d) $x = (\frac{11a}{5b}^{1/6})$

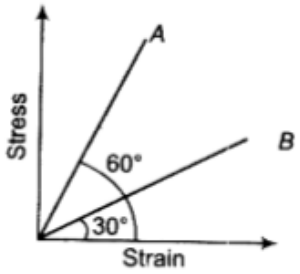
Answer: c

39. A ball rolls without slipping. The radius of gyration of the ball about an axis passing through its centre of mass is K. If radius of the ball be R; then the fraction of total energy associated with its rotational energy will be

(a) $\frac{K^2}{K^2+R^2}$
(b) $\frac{R^2}{K^2+R^2}$
(c) $\frac{K^2+R^2}{R^2}$
(d) $\frac{K^2}{R^2}$

Answer: a

40. The stress versus strain graphs for wires of two materials A and B are as shown in the figure. If Y_A and Y_B are the Youngs moduli of the materials; then



(a) $Y_B = 2Y_A$
(b) $Y_A = Y_B$
(c) $Y_B = 3Y_A$
(d) $Y_A = 3Y_B$

Answer: d

41. When a force is applied on a moving body, its motion is retarded. Then the work done is :

(a) positive
(b) negative
(c) zero
(d) positive and negative
(e) none of the above

Answer: b

42. A 10 kg object collides with stationary 5 kg object and after collision they stick together and move forward with velocity 4 ms^{-1} . What is the velocity with which the 10 kg object hit the second one ?

(a) 4 ms^{-1}
(b) 6 ms^{-1}
(c) 10 ms^{-1}
(d) 12 ms^{-1}
(e) 14 ms^{-1}

Answer: b

43. The recoil velocity of a 4.0 kg rifle that shoots a 0.050 kg bullet at speed of 280 ms^{-1} is :

(a) +3.5m/s
(b) -3.5m/s
(c) -√3.5m/s
(d) +√3.5m/s
(e) +7m/s

Answer: b

44. The momentum of a body is increased by 25%. The kinetic energy is increased by about :

(a) 25%
(b) 5%
(c) 56%
(d) 38%
(e) 65%

Answer: c

45. A running man has the same kinetic energy as that of a boy of half his mass. The man speeds up by 2m/s and the boy changes his speed by x m/s , so that the kinetic energies of the boy and the man are again equal. Then x in m/s is :

(a) (-2√2)
(b) 2√2
(c) √2
(d) 2
(e) 1/√2

Answer: b

46. Potential energy in a spring when stretched by 2 cm is U. Its potential energy, when stretched by 10 cm is :

(a) U/25
(b) U/5
(c) 25U
(d) 5U
(e) none of these

Answer: c

47. The velocity of a moving galaxy is 300km/s and the apparent change in the wavelength of a spectral line emitted from the galaxy is observed as 0.5 nm. Then, the actual wavelength of the spectral lline is

(a) 3000 Å
(b) 5000 Å
(c) 6000 Å
(d) 4500 Å
(e) 5500 Å

Answer: b

48. A force (4i+j-2k) N acting on a body maintains its velocity at (2i+2j+3k) ms^{-1}. The power exerted is

(a) 4 W
(b) 5 W
(c) 2 W
(d) 8 W
(e) 1 W

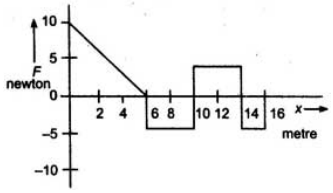
Answer: a

49. Identify the false statement from the following

(a) Work-energy theorem is not independent of Newton's second law
(b) Work-energy theorem holds in all inertial frames
(c) Work done by friction over a closed path is zero
(d) No potential energy can be associated with friction
(e) Work done is a scalar quantity

Answer: c

50. A particle is acted upon by a force F which varies with position x as shown in figure. If the particle at x = 0 has kinetic energy of 25 J, then the kinetic energy of the particle at x =16 m is



(a) 45J
(b) 30J
(c) 70J
(d) 135J
(e) 20J

Answer: a

51. A rod of mass m and length l is made to stand at an angle of 60° with the vertical. Potential energy of the rod in this position is

(a) mgl
(b) mgl/2
(c) mgl/3
(d) mgl/4
(e) mgl/√2

Answer: d

52. A stationary body of mass m explodes into three parts having masses in the ratio 1:3:3. The two fractions with equal masses move at right angles to each other with a velocity of 1.5m/s. Then the velocity of the third body is

(a) 4.5 √ 2 m/s
(b) 5 m/s
(c) 5√ 32 m/s
(d) 1.5m/s
(e) 1m/s

Answer: a

53. A ball is dropped from a height h. If the coeffecient of restitution is e then to what height will it rise after jumping twice form the ground:

(a) (eh)/2
(b) 2eh
(c) eh
(d) e^4h
(e) h^4

Answer: d

54. Total angular momentum of a rotating body remains constant if the net torque acting on the body is:

(a) zero
(b) maximum
(c) minimum
(d) unity
(e) equal to the total angular momentum about a parallel axis

Answer: a

55. A system consisting of two masses connected by a massless rod lies along the x-axis. A 0.4 kg mass is at a distance x=2m while a 0.6kg mass is at a distance x =7 m. The x-coordinate of the centre of mass is

(a) 5m
(b) 3.5m
(c) 4.5m
(d) 4m
(e) 3m

Answer: a

56. The velocity of an 800g object changes from

(a) v_0 = 3i =4j to v_f = (-6v_f+2k) m/s change in kinetic energy is
(b) 3J
(c) 6J
(d) 2J
(e) 1.2J

Answer: c

57. Four point masses P, Q, R and S with respective masses 1 kg, 1 kg, 2 kg and 2 kg from the corners of a square of side a. The centre of mass of the system will be farthest from

(a) P only
(b) R and S
(c) R only
(d) P and Q
(e) P and R

Answer: d

58. The moment of inertia of flywheel having kinetic energy 360 J and angular speed of 20 rad/s is

(a) 18 kg-m^2
(b) 1.8 kg-m^2
(c) 0.5 kg-m^2
(d) 9 kg-m^2
(e) 0.9 kg-m^2

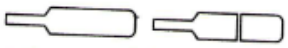
Answer: b

59. A quarter horse power motor runs at a speed of 600 rpm. Assuming 40% efficiency the work done by the motor in one rotation will be

(a) 7.46 J
(b) 7400 J
(c) 7.46 erg
(d) 74.6 J
(e) 746 J

Answer: a

60. A cricket bat is cut at the location of its centre of mass as shown. Then



(a) the two pieces will have the same mass
(b) the bottom piece will have larger mass
(c) the handle piece will have larger mass
(d) mass of handle piece is double the mass of bottom piece
(e) cannot say

Answer: b

61. If I is the moment of inertia and E is the kinetic energy of rotation of a body, then its angular momentum will be:

(a) √(EI)
(b) 2EI
(c) E/i
(d) √(2EI)
(e) IE

Answer: d

62. A solid disc of mass M is just held in air horizontally by throwing 40 stones per second vertically upwards to strike the disc with a velocity 6 m/s. If the mass of each stone is 0.05 kg, what is the mass of the disc? (g = 10 m/s^2)

(a) 1.2 kg
(b) 0.5 kg
(c) 20 kg
(d) 3 kg
(e) 4 kg

Answer: a

63. A circular this disc of mass 2 kg has a diameter 0.2 m. Calculate its moment of inertia about an axis passing through the edge and perpendicular to the plane of the disc (in kg-m^2)

(a) 0.01
(b) 0.03
(c) 0.02
(d) 3
(e) 2

Answer: b

64. The moment of inertia of a uniformly rotating body is suddenly reduced to half its value, its angular velocity :

(a) remains the same
(b) reduce to half
(c) doubles
(d) zero
(e) None of these

Answer: c

65. A fly wheel makes 300 rpm. The angular velocity of the fly wheel in rad/s is :

(a) 10π
(b) 20π
(c) 30π
(d) 40π
(e) None of these

Answer: a

66. When a ceiling fan is switched on, it makes 10 revolutions in the first 3 s. Assuming a uniform angular acceleration, how many rotations it will make in the next 3 s ?

(a) 10
(b) 20
(c) 30
(d) 40
(e) 60

Answer: c

67. A solid cylinder of mass 20 kg has length 1m and radius 0.2 m. Then its moment of inertia (in kg-m^2)about its geometrical axis:

(a) 0.8
(b) 0.4
(c) 0.2
(d) 20.2
(e) 20.4

Answer: b

68. A mass 3m, initially at rest at the origin, explodes into three fragments of equal mass. Twoof the fragments have speed v each and move perpendicular to each other. The third fragment will move with a speed :

(a) v/√2
(b) v/2
(c) v
(d) √(2v)
(e) 2v

Answer: d

69. The moment of inertia of a ring about of one its diameter is I. What will be its mioment of inertia about a tangent parallel to the diameter ?

(a) 4 I
(b) 2 I
(c) 3/2 I
(d) 3 I
(e) I

Answer: d

70. A thin disc is rotating with a constant angular velocity about its own axis. A is a point on the rim of the disc and B is a point half-way between the rim and the centre. The ratio of the velocity at A to that at B is :

(a) 1:04
(b) 1:02
(c) 1:01
(d) 2:01
(e) 4:01

Answer: d

71. A solid cylinder rolls down an inclined plane of height 3 m and reaches the bottom of plane with angular velocity, of 2 √2rad s. The

(a) 5cm
(b) 0.5cm
(c) √10cm
(d) √5m
(e) 10cm

Answer: d

72. Acceleration due to gravity is g on the surface of the earth. Then the value of the acceleration due to gravity at a height of 32 km above earth's surface is :(Assume radius of earth to be 6400 km)

(a) 0.99 g
(b) 0.8 g
(c) 1.01 g
(d) 0.9 g
(e) 9 g

Answer: a

73. Two planets have radii r_1 and r_2 and densities d_1 and d_2 respectively. Then the ratio of acceleration due to gravity on them will be :

(a) $r_1d_1:r_2d_2$
(b) $r_1d_2:r_2d_1$
(c) $r_1^2d_1:r_2^2d_2$
(d) $r_1:r_2$
(e) $r_1 / \sqrt{d_1}:r_2 / \sqrt{d_2}$

Answer: a

74. The mass of a planet is six times that of the earth. The radius of the planet is twice that of the earth. If the escape velocity from the earth is v, then the escape velocity from the planet is :

(a) $\sqrt{3}v$
(b) $\sqrt{2}v$
(c) v
(d) $\sqrt{5}v$
(e) $\sqrt{12}v$

Answer: a

75. LANDSAT series of satellites move in near polar orbits at an altitude of

(a) 3600 km
(b) 3000 km
(c) 918 km
(d) 512 km
(e) 9200 km

Answer: c

76. If the escape velocity of a planet is 3 times that of the earth and its radius is 4 times that of the earth, then the mass of the planet is (Mass of the earth = 6×10^{24} kg)

(a) 1.62×10^{22} kg
(b) $0.72 \times \times 10^{22}$ kg
(c) 2.16×10^{26} kg
(d) 1.22×10^{22} kg
(e) 3.6×10^{22} kg

Answer: c

77. If an earth satellite of mass m orbiting at a distance 2R from the centre of earth has to be transferred into the orbit of radius 3 R, the amount of energy required is (R = radius of earth)

(a) mgR
(b) mgR/3
(c) mgR/2
(d) mgR/12
(e) mgR/9

Answer: d

78. The compressibility of water is 6×10^{-10} N^{-1} m^2 . If one litre is subjected to a pressure of 4×10^7 Nm^{-2} , the decrease in volume is

(a) 2.4 cc
(b) 10 cc
(c) 24 cc
(d) 15 cc
(e) 12 cc

Answer: c

79. The ratio of radii of earth to another planet is 2/3 and the ratio of their mean densities is 4/5. If an astronaut can jump to a maximum height of 1.5 m on the earth, with the same effort, the maximum height he can jump on the planet is

(a) 1m
(b) 0.8m
(c) 0.5m
(d) 1.25m
(e) 2m

Answer: c

80. If an object of mass m is taken from the surface of earth (radius R) to a height 2R, then the work done is

(a) 2mgR
(b) mgR
(c) (2/3)mgR
(d) (3/2)mgR
(e) (1/3)mgR

Answer: c

81. A wire of length L and area of cross section A is stretched through a distance x metre by applying a force F along length, then the work done in this process is (Y is the Young's modulus of the material):

(a) ½ (AL)(YL)(x/L)
(b) (AL)(YL)(x/L)
(c) 2 (AL)(YL)(x/L)
(d) 3 (AL)(YL)(x/L)
(e) 4 (AL)(YL)(x/L)

Answer: a

82. A piece of ice is floating in a jar of ice containing water. When the ice melts the level of water .....

(a) rises
(b) falls
(c) remains unchanged
(d) rises or falls
(e) cannot say

Answer: c

83. A uniform plane of Young's modulus Y is moved over a smooth horizontal surface by a force F. The area of cross section of the plank is A. The compressive strain on the plank in the direction of the force is

(a) F/(AY)
(b) (2F)/(AY)
(c) F/(2AY)
(d) (3F)/(AY)
(e) F/(3AY)

Answer: c

84. When the temperature is raised, the viscosity of liquid decreases, this is because:

(a) decreased volume of the solution
(b) increase in temperature increases the average kinetic energy of molecules which overcomes the attractive force between them
(c) decreased covalent and hydrogen bond force
(d) increased attraction between molecules
(e) none of the above

Answer: b

85. The excess of pressure inside the first soap bubble is three times that inside the second bubble. The ratio of volume of the first to that of the second bubble is

(a) 1:03
(b) 1:09
(c) 1:27
(d) 9:01
(e) 27:01:00

Answer: c

86. Bernoulli's principle is based on the law of conservation of

(a) mass
(b) momentum
(c) pressure
(d) energy
(e) volume

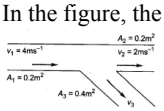
Answer: d

87. Which one of the following statements is wrong?

(a) Young's modulus for a perfectly rigid body is zero
(b) Bulk modulus is relevant for solids, liquids and gases
(c) Rubber is less elastic than steel
(d) Young's modulus and shear modulus are relevant for solids
(e) The stretching of a coil spring is determined by its shear modulus

Answer: a

88. In the figure, the velocity v_3 will be



(a) zero
(b) 4m/s
(c) 1m/s
(d) 3m/s
(e) 2m/s

Answer: c

89. Water rises up to the heigh h in a capillary tube of certain diameter. This capillary tube is replaced by similar tube of half the diameter. Now, the water will rise to the height of:

(a) 4h
(b) 3h
(c) 2h
(d) h
(e) (1/2) h

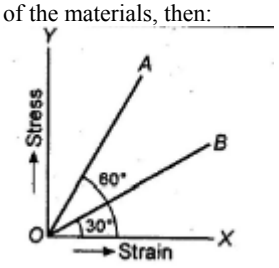
Answer: c

90. Construction of submarines is based on:

(a) Archimedes' principle
(b) Bernoulli's theorem
(c) pascal's law
(d) Newton's laws
(e) Boyle's laws

Answer: a

91. The stress versus strain graphs for wires of two materials A and B are as shown in the figure. If Y_A and Y_B are the Young's modulus of the materials, then:



(a) $Y_B=2Y_A$
(b) $Y_B=Y_A$
(c) $Y_B=3Y_A$
(d) $Y_A=3Y_B$
(e) $Y_B=1/2Y_A$

Answer: d

92. 27 identical drops of water are falling down vertically in air each with a terminal velocity 0.15 m/s. If they combine to forma single bigger drop, what will be its terminal velocity?

(a) 0.3 m/s
(b) 1.5 m/s
(c) 0.45 m/s
(d) zero
(e) 0.95 m/s

Answer: b

93. The force required to take away a flat circular plate of radius 4 cm from the surface of water is (surface tension of water is 70 dyne cm^{-1}) :

(a) 560π dyne
(b) 280π dyne
(c) 140π dyne
(d) 1120π dyne
(e) None of these

Answer: d

94. Surface tension of water is $0.072Nm^{-1}$. If water is carried in a space ship to the moon and its surface tension is determined then its value will be

(a) $0.072Nm^{-1}$
(b) $0.121\ Nm^{-1}$
(c) $0.438\ Nm^{-1}$
(d) zero
(e) None of these

Answer: d

95. Viscosity in liquids is due to :

(a) gravitational force
(b) intermolecules force
(c) frictional force between molecules
(d) repulsive force between molecules
(e) None of these

Answer: b

96. The coefficient of viscosity for hot air is :

(a) same as the coefficient of viscosity for cold air
(b) smaller than the coefficient of viscosity for cold air
(c) greater than the coefficient of viscosity for cold air
(d) zero
(e) None of these

Answer: c

97. The force on a sphere of radius r moving uniformly in a viscous medium of coefficient of viscosity y depends on :

(a) yr
(b) yr^{-1}
(c) $\sqrt{(yr)}$
(d) yr^4
(e) None of these

Answer: a

98. A spring of force constant k is cut into two pieces, such that one piece is double the length of the other. Then, the longer piece will have a force constant of :

(a) (2/3) k
(b) (3/2) k
(c) 3 k
(d) 6 k
(e) None of these

Answer: b

99. A 4 m long coper wire of cross-sectional area 1.2 cm^2 is stretched by a force of 4.8×10^3 N. Young's modulus for copper ($Y = 1.2 \times 10^{11} N/m^2$) the increase in length of wire is :

(a) 1.32 mm
(b) 0.8 mm
(c) 0.48 mm
(d) 5.36 mm
(e) 2.45 mm

Answer: a

100. Given that the surface tension of water is 75 dyne/cm, its density 1 g/cc and angle of contact zero, the height to which water rises in a capillary tube of 1 mm diameter is : (take g = 10 m/s^2)

(a) 9.0 cm
(b) 7.5 cm
(c) 6.0 cm
(d) 3.0 cm
(e) 1.5 cm

Answer: d