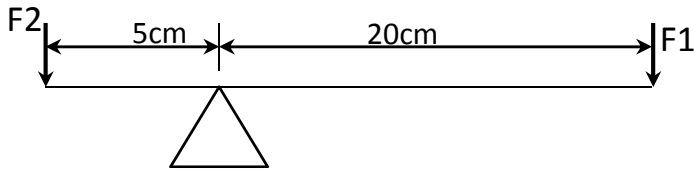
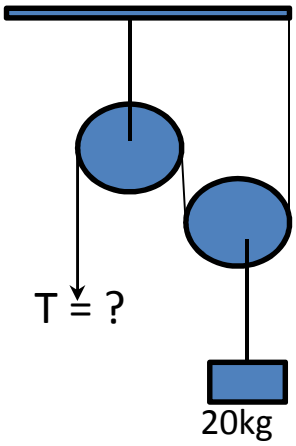
1. What would be the value of F1 to balance the system if F2=20N?



(a) 3 N
(b) 5 N
(c) 4N
(d) None of the above

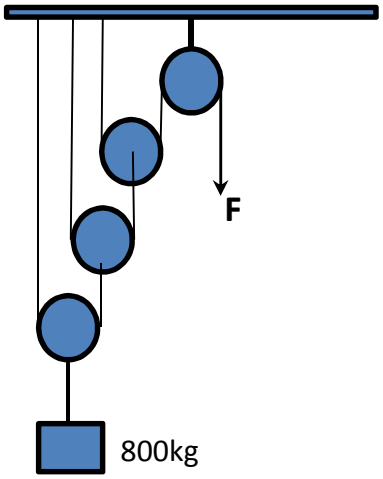
2. The stress in a wire of diameter 2 mm, if a load of 100 gram is applied to the wire is
(a) 3.1×10^5 N/m^2
(b) 6.2×10^5 N/m^2
(c) 1.5×10^5 N/m^2
(d) 12.4×10^5 N/m^2

3. In the pulley system, shown here what should be the tension T in order to lift the weight of 20kg?



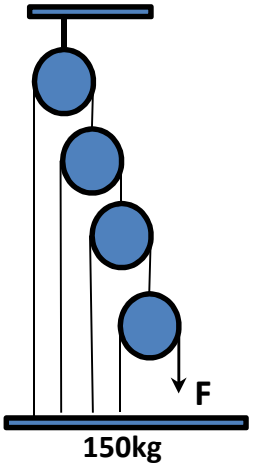
(a) 40kg
(b) 30kg
(c) 20kg
(d) 10kg

4. Figure here shows a pulley system. What would be the value of F to lift up the load



(a) 100kg
(b) 200kg
(c) 800/3 kg
(d) 400kg

5. What would be the value of F to lift up the load as shown in figure.



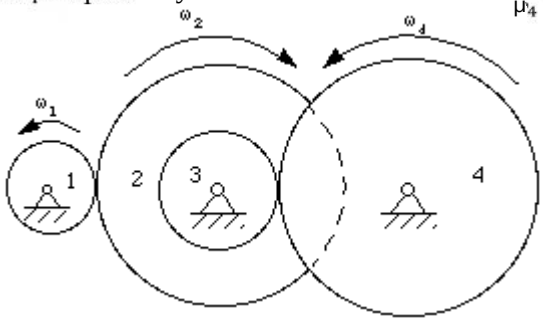
(a) 30kg
(b) 10kg
(c) 15kg
(d) 20kg

6. The diameter of a screw is 5mm add the lead of the screw thread (pitch) is 1mm. What is the mechanical advantage of the screw?
(a) 3.141
(b) 9.42
(c) 12.56
(d) 15.71

7. Two shafts are neither parallel nor intersecting. If we intend to transmit power between the two then which type of gear is mostly preferred?
(a) Straight bevel
(b) Worm and worm
(c) Double helical herringbone
(d) Crossed helical

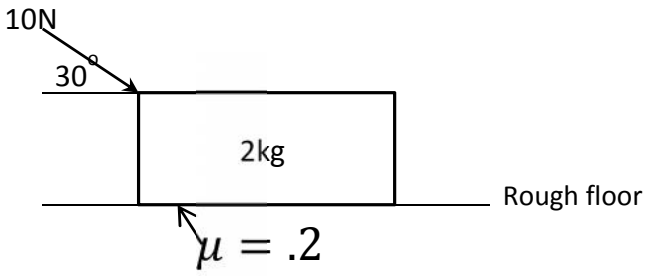
8. Two spur gears have pitch circle diameters of 10cm and 2cm. The larger gear has a rotational speed of 100RPM. Then what is the rotational speed of the smaller one?
(a) 200RPM
(b) 500RPM
(c) 1000RPM
(d) 400RPM

9. Figure shows a compound gear train, where the number of teeth in gears 1, 2, 3 and 4 are $N1, N_2, N_3 and\ N_4$ respectively. What would be the ration $\frac{\mu_1}{\mu_4}$ in terms of the teeth?



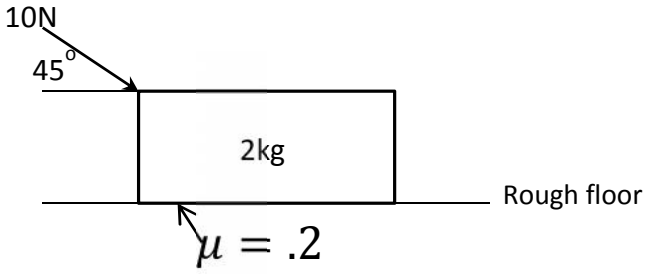
(a) $\frac{N_1}{N_4}$
(b) $\frac{N_1 N_4}{N_3 N_2}$
(c) $\frac{N_2 N_4}{N_1 N_3}$
(d) $\frac{N_1 N_3}{N_2 N_4}$

10. Two wires A and B have same dimensions (area and length same) and are stretched by the same amount of force. Young's modulus of A is twice that of B. The relation $\frac{\Delta l_2}{\Delta l_1}$ would be equal to :
    (a) 1
    (b) ½
    (c) 2
    (d) ¼
11. Practical value of Poisson's ratio for a steel wire subjected to a longitudinal force can be within:
    (a) 0 to .5
    (b) -.5 to 0
    (c) -1 to .5
    (d) -.5 to .5
12. Figure here shows a weight of 2kg resting on a rough floor which is acted upon by a force of 10N as shown. If the coefficient of friction between the floor and the mass is 0.2 then would system start to move? Assume g=10m/s^2.



    (a) Yes
    (b) No
    (c) Information insufficient
    (d) Problem cannot be solved

13. In the figure shown a weight of 2kg resting on a rough floor which is acted upon by a force of 10N as shown. The coefficient of friction between the floor and the mass is 0.2. Assume g=10m/s^2.



If the force applied is at an angle of 45^0 then what would be the acceleration of the mass?

(a) 1.657 m/s^2
(b) .828 m/s^2
(c) 3.51 m/s^2
(d) None of the above

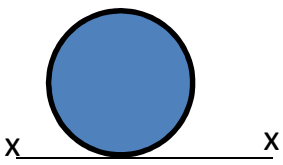
14. A uniform cube of side *a* and mass *m* rests on a rough horizontal plane surface. A horizontal force *F* is applied normal to one face at a point that is directly above the center of the face at a height of *a/4* above the center. The minimum value of F for which the cube begins to topple about an edge without slipping is:

(a) mg/4
(b) 2mg
(c) 2mg/3
(d) Mg/2

15. Three rods of mass *m* and length *l* are joined together to form an equilateral triangle. What would be the moment of inertia of the system about an axis passing through its center of mass and perpendicular to the plane of the triangle?

(a) $\frac{ml^2}{2}$
(b) $\frac{ml^2}{6}$
(c) $\frac{ml^2}{12}$
(d) $\frac{ml^2}{2}$

16. What is the moment of inertia of a solid sphere of mass M and radius R about an axis XX as shown in the Figure?



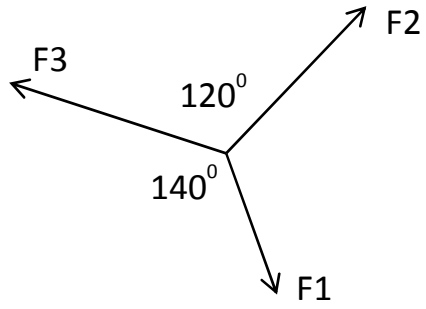
(a) $\frac{2}{5}MR^2$
(b) $\frac{9}{10}MR^2$
(c) $\frac{7}{5}MR^2$
(d) $\frac{8}{5}MR^2$

17. A uniform rod has mass *m* and length *2l*. Two particles of mass *m* each are placed at its two ends. What is the moment of inertia of the system about the center of mass of the system?
    (a) $\frac{25ml^2}{12}$
    (b) $\frac{4ml^2}{3}$
    (c) $\frac{5ml^2}{3}$
    (d) $\frac{7ml^2}{3}$
18. Two circular disks of the same weight and thickness are made from metals having different densities ρ1 and ρ2 such that ρ2 > ρ1. The moment of inertia of the disks about their central axis can be written as:
    (a) $I_1 > I_2$
    (b) $I_2 > I_1$
    (c) $I_1 = I_2$
    (d) It cannot be told
19. If I_1 is the moment of inertia of a thin rod about an axis perpendicular to its length and passing through the center of mass and I_2 the moment of inertia of the ring formed by the same rod about an axis passing through the center of the mass of the ring and perpendicular to the plane of the ring. Then the ratio I_1/I_2 is:
    (a) $\pi^2/12$
    (b) $\pi^2/6$
    (c) $2\pi^2/3$
    (d) $\pi^2/3$
20. A non-uniform rod AB has a mass *M* and length $2l$. The left end of the rod is designated as A and the right end as B. The mass per unit length of the rod is *mx* at a point of the rod distant *x* from A. The moment of inertia of this rod about an axis perpendicular to the rod through A would be:
    (a) Ml^2
    (b) $2Ml^2$
    (c) $Ml^2/3$
    (d) $Ml^2/12$
21. A non-uniform rod AB has a mass *M* and length $2l$. The left end of the rod is designated as A and the right end as B. The mass per unit length of the rod is *mx* at a point of the rod distant *x* from A. what would be the moment of inertia of the rod about the mid-point of AB?
    (a) $2Ml^2/3$
    (b) $4Ml^2/3$
    (c) $Ml^2/3$
    (d) $Ml^2/12$
22. A uniform circular disk has a moment of inertia of 1.2 $kg.m^2$ about its central axis which is perpendicular to the plane of the disk. If a segment of 60^0 is cut out from the disk then the moment of the inertia of the remaining disk about the same old axis is:

(a) 0.6 *kg* m^2

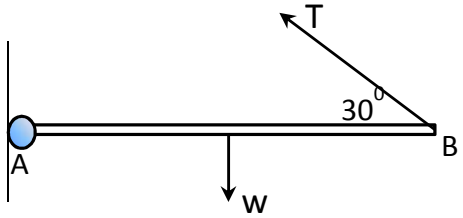
(b) 1.2 kg m^2
(c) 1.0 kg m^2
(d) 0.5 kg m^2

23. Three co-planner forces F1, F2 and F3 are in equilibrium. If F1=20N then how much is F2?



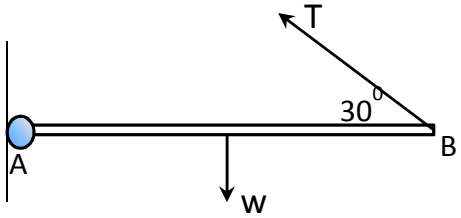
(a) 10.23N
(b) 26.94 N
(c) 18.14N
(d) 14.84N

24. A uniform rod AB of weight W is hinged to a fixed point at A. It is held in horizontal position by a string, one end of which is attached to B as shown. The tension in the string in terms of W is:



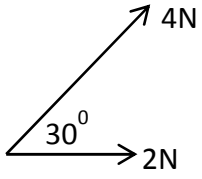
(a) T = W
(b) T =2W
(c) T=3W/2
(d) None of the above

25. A uniform rod AB of weight W is hinged at a fixed point A. It is held in horizontal position by a string, one end of which is attached to B as shown. Reaction at A can be R_x and R_y which can be written in terms of W. The expression for R_y in terms of W is:



(a) $R_y = \sqrt{3}W/2$
(b) $R_y = W$
(c) $R_y = W/4$
(d) $R_y = W/2$

26. The Figure shows two concurrent forces acting at a point. The magnitude of the resultant force is?



(a) 4.472N
(b) 5.818N
(c) 5.73N
(d) None of the above

27. Two blocks of mass 4kg and 2kg are placed side by side on a smooth floor. A horizontal force of 30N is acting on the 4kg block. The normal reaction between the two blocks is:

(a) 30N
(b) 20N
(c) 10N
(d) 12N

28. The center of mass of a uniform semi-circular disk of radius *R* lies on the axis of symmetry at a distance of *h* from the center. The expression for *h* is:
(a) $h = R/2$
(b) $h = 3R/\pi$
(c) $h = 3R/2\pi$
(d) $h = 4R/3\pi$

29. The center of mass of a solid hemisphere of radius *R* lies at a distance of *h* from its center on the axis of symmetry. The expression for *h* is:
(a) $h = 3R/8$
(b) $h = 2R/5$
(c) $h = 4R/13$
(d) $h = 3R/4$

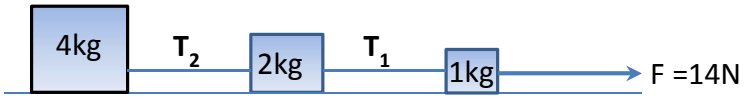
30. Two particles of mass 1kg and 2kg are placed at *x=0* and *x=3m* on the *x*-axis. The center of mass of the two particles is located at:
(a) x=1m
(b) x=2m
(c) x=2.5m
(d) x=1.5m

31. The position of a particle executing SHM can be described by $x = 10\sin\left(\pi t + \frac{\pi}{6}\right)$ in SI units. The time period of the particle is:
(a) 4s
(b) 1s
(c) 2s
(d) 3.141s

32. The position of a particle executing SHM can be described by $x = 10\sin\left(\pi t + \frac{\pi}{6}\right)$ in SI units. The maximum velocity of the particle is:

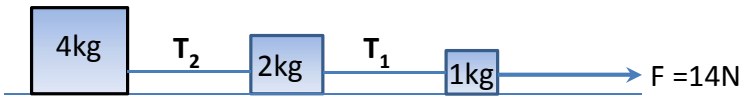
(a) $5\pi\ m/s$
(b) $4\pi\ m/s$
(c) $2\pi\ m/s$
(d) $10\pi\ m/s$

33. The figure shows three blocks connected by two light and inextensible strings placed on a smooth horizontal surface acted upon by a force of 14N. The tension T_2 in the string is:



(a) 6N
(b) 4N
(c) 8N
(d) 14N

34. The figure shows three blocks connected by two light and inextensible strings placed on a smooth horizontal surface acted upon by a force of 14N. The tension T_1 in the string is:



(a) 8N
(b) 12N
(c) 1N
(d) 2N

35. A stone is thrown at an angle of 45^0 to the horizontal with kinetic energy K. The kinetic energy at the highest point is:
(a) $K/2$
(b) $K/\sqrt{2}$
(c) K
(d) Zero

36. A ball is thrown vertically upward with a velocity of 10 m/s. It returns to the ground with a velocity of 9 m/s. If g =9.8m/s^2 , then the maximum height attained by the ball is nearly: (Assume air resistance to be uniform)
(a) 5.1m
(b) 4.1m
(c) 4.61m
(d) 5.0m

37. A spring-mass system oscillates such that the mass moves on a rough surface having coefficient of friction μ. It is compressed by a distance *a*, from its normal length and, on being released, it moves to a distance *b* from its equilibrium position. The decrease in amplitude for one-half cycle (-a to b) is:
(a) $\mu mg/K$
(b) $2\mu mg/K$
(c) $\mu g/K$
(d) $\mu mg/2K$

38. A particle of mass 0.01kg travels along a space curve with velocity 4i+16k m/s. After some time its velocity becomes 8i+20j m/s due to the action of a conservative force. The work done on the particle during this interval of time is:
    (a) 0.32J
    (b) 6.9J
    (c) 9.6J
    (d) 0.96J
39. A body is attached to the lower end of a vertical spring and it is gradually lowered to its equilibrium position. This stretches the spring by a length *d*. If the same body attached to the same spring is allowed to fall suddenly, what would be the maximum stretching in this case?
    (a) d
    (b) 2d
    (c) 3d
    (d) d/2
40. What is the fractional decrease in kinetic energy of a particle of mass m_1 when it makes a head on elastic collision with a particle of mass m_2 kept at rest.
    (a) $4m_1m_2/(m_1+m_2)^2$
    (b) $2m_1m_2/(m_1+m_2)^2$
    (c) $(m_1-m_2)^2/(m_1+m_2)^2$
    (d) $m_1m_2/(m_1+m_2)^2$

Answers to Mechanics problem from 1-40

1. B
2. A
3. D
4. A
5. B
6. D
7. D
8. B
9. C
10. C
11. A
12. A
13. B
14. C
15. A
16. C
17. D
18. B
19. D
20. B
21. C
22. C
23. D
24. A
25. D
26. B
27. C
28. D
29. A
30. B
31. C
32. D
33. C
34. B
35. A
36. C
37. B
38. D
39. B
40. A