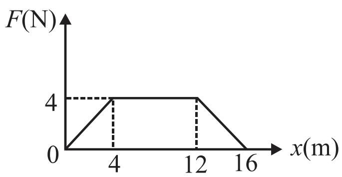
NEET UG (2024)
Physics
Quiz-18

SECTION-A

1. A body constrained to move in the y-direction is subjected to a force $F = (2\hat{i} + 15\hat{j} + 6\hat{k})$N. The work done by this force, in moving the body through a distance of 10 m along y-axis is:

(1) 100 J (2) 150 J
(3) 120 J (4) 200 J

2. The figure given below shows the force F versus displacement x graph. The net work done by the force when an object is displaced from x = 0 to x = 16 m is



(1) 84 J (2) 24 J
(3) 48 J (4) 100 J

3. A man pulls a bucket of water from a well of depth H. If the mass of the rope and that of the bucket full of water are m and M respectively, then the work done by the man is:

(1) $(m+M)gh$ (2) $\left(\frac{m}{2}+M\right)gh$
(3) $\left(\frac{m+M}{2}\right)gh$ (4) $\left(m+\frac{M}{2}\right)gh$

4. A body of mass 1 kg is moving with velocity of $(3\hat{i} + 4\hat{j})$ m/s. The kinetic energy possessed by it will be

(1) 125 J (2) 25 J
(3) 10.8 J (4) 12.5 J

5. The power required by engine of car of mass 1000 kg to accelerate it from rest to a speed of 72 km/h in 20 s is

(1) 10 kW (2) 1 kW
(3) 100 kW (4) 1000 kW

6. When a ball is thrown up vertically with velocity v_0 it reaches a maximum height of h. If one wishes to tiple the maximum height then the ball should be thrown with velocity:

(1) $\sqrt{3}v_0$ (2) $3v_0$
(3) $9v_0$ (4) $3/2\ v_0$

7. A string of mass 'm' and length 'l' rests over a friction less table with 1/4th of its length hanging from aside. The work done in bringing the hanging part back on the table is:

(1) mgl l/4 (2) $mgl/32$
(3) $mgl/16$ (4) none of these

8. A cord is used to lower vertically a block of mass M by a distance d with constant downward acceleration $g/4$. Work done by the cord on the block is

(1) $Mg\frac{d}{4}$ (2) $3Mg\frac{d}{4}$
(3) $-3Mg\frac{d}{4}$ (4) Mgd

9. The potential energy of a certain spring when stretched through a distance 'S' is 10 joule. The amount of work (in joule) that must be done on this spring to stretch it through an additional distance 'S' will be

(1) 30 (2) 40
(3) 10 (4) 20

10. The force constant of a wire is k and that of another wire is $2k$ When both the wires are stretched through same distance, then the work done

(1) $W_2 = 2W_1^2$ (2) $W_2 = 2W_1$
(3) $W_2 = W_1$ (4) $W_2 = 0.5W_1$

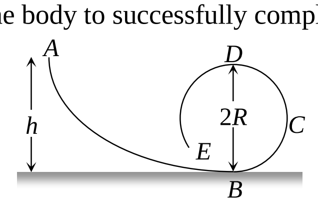
11. If the linear momentum is increased by 50%, the kinetic energy will increase by

(1) 50% (2) 100%
(3) 125% (4) 25%

12. In which case does the potential energy decrease

(1) On compressing a spring
(2) On stretching a spring
(3) On moving a body against gravitational force
(4) In free fall of body

13. A frictionless track $ABCDE$ ends in a circular loop of radius R. A body slides down the track from point A which is at a height h = 5 cm. Maximum value of R for the body to successfully complete the loop is



(1) 5 cm (2) $\frac{15}{4}$ cm
(3) $\frac{10}{3}$ cm (4) 2 cm

14. A 4 kg mass and a 1 kg mass are moving with equal kinetic energies. The ratio of the magnitudes of their linear momenta is

(1) 1 : 2 (2) 1 : 1
(3) 2 : 1 (4) 4 : 1

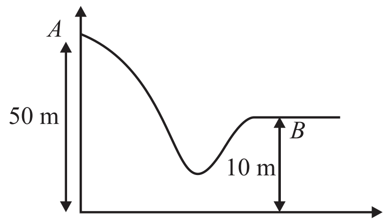
15. If the momentum of a body increases by 0.01%, its kinetic energy will increase by

(1) 0.01% (2) 0.02%
(3) 0.04% (4) 0.08%

16. A weight lifter lifts 300 kg from the ground to a height of 2 meter in 3 second. The average power generated by him is

(1) 5880 watt
(2) 4410 watt
(3) 2205 watt
(4) 1960 watt

17. A body is released from position A as shown in figure. The speed of body at position B is

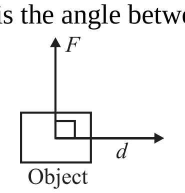


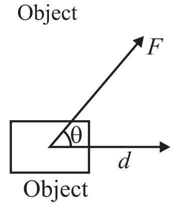
(1) 10 m/s (2) $10\sqrt{2}$ m/s
(3) 20 m/s (4) $20\sqrt{2}$ m/s

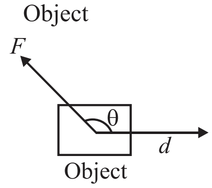
18. What average horsepower is developed by an 80 kg man while climbing in 10 s a flight of stairs that rises 6 m vertically

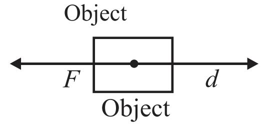
(1) 0.63 HP (2) 1.26 HP
(3) 1.8 HP (4) 2.1 HP

19. In which of the following figures the work done by force F in displacing an object through distance d is positive?
(θ is the angle between F and d)

(1) 

(2) 

(3) 

(4) 

20. A force of $2\hat{i}+3\hat{j}+4\hat{k}$ N acts on a body for 4 second, produces a displacement of $(3\hat{i}+4\hat{j}+5\hat{k})$m. The power used is-

(1) 9.5 W (2) 7.5 W
(3) 6.5 W (4) 4.5 W

21. An engine pump is used to pump a liquid of density ρ continuously through a pipe of cross-sectional area A. If the speed of flow of the liquid in the pipe is v, then the rate at which kinetic energy is being imparted to the liquid is

(1) $\frac{1}{2}A\rho v^3$ (2) $\frac{1}{2}A\rho v^2$
(3) $\frac{1}{2}A\rho v$ (4) $A\rho v$

22. If the magnitude of two vectors are 8 unit and 5 unit and their scalar product is zero, the angle between the two vectors is

(1) Zero (2) 30°
(3) 60° (4) 90°

23. Mass is non-uniformly distributed over the rod of length 'ℓ'. Its linear mass density varies linearly with length as $\lambda = kx$. The position of centre of mass is given by-

(1) $\frac{2\ell}{5}$ (2) $\frac{\ell}{2}$
(3) $\frac{3\ell}{4}$ (4) $\frac{2\ell}{3}$

24. Two bodies of masses 2 kg and 4 kg are moving with velocities 2 m/s and 10 m/s respectively along same direction. Then the velocity of their centre of mass will be

(1) 8.1 m/s (2) 7.3 m/s
(3) 6.4 m/s (4) 5.3 m/s

25. The centre of mass of a body

(1) Lies always outside the body
(2) May lie within, outside on the surface of the body
(3) Lies always inside the body
(4) Lies always on the surface of the body

26. The velocities of three particles of masses 20 gm, 30 gm and 50 gm are $10\hat{i}$, $10\hat{j}$ and $10\hat{k}$ (in m/s) respectively. The velocity (in m/s) of the centre of mass of the three particles is

(1) $2\hat{i}+3\hat{j}+5\hat{k}$
(2) $10(\hat{i}+\hat{j}+\hat{k})$
(3) $20\hat{i}+30\hat{j}+5\hat{k}$
(4) $2\hat{i}+30\hat{j}+50\hat{k}$

27. When a body is placed on a rough plane inclined at an angle θ to the horizontal, its acceleration is

(1) $g(\sin\theta - \cos\theta)$
(2) $g(\sin\theta - \mu\cos\theta)$
(3) $g(\sin\theta - \cos\theta)$
(4) $g\mu(\sin\theta - \cos\theta)$

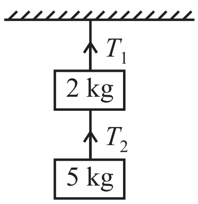
28. A spring gun of spring constant 90 N/cm is compressed 12 cm by a ball of mass 16 g. If the trigger is pulled, the velocity of the ball is:

(1) 90 ms^{-1} (2) 9 ms^{-1}
(3) 40 ms^{-1} (4) 60 ms^{-1}

29. A body is initially at rest. It undergoes one-dimensional motion with constant acceleration. The power delivered to it at time t is propartional to:

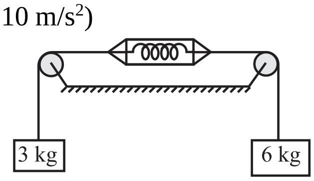
(1) $t^{1/2}$ (2) t
(3) $t^{3/2}$ (4) t^2

30. The ratio of tension T_1 and T_2 is (strings are massless)



(1) 7 : 2 (2) 7 : 5
(3) 5 : 2 (4) 2 : 7

31. In the given diagram, reading of spring balance will be (g = 10 m/s^2)



(1) 30 N (2) 40 N
(3) 60 N (4) 80 N

32. A car is moving round a curve of radius 20 m without slipping on a banked road with θ = 45°. Assuming the coefficient of friction between the road and tyres to be 0.2. What is the maximum speed with which the car can move? (Take g = 10 m/s^2)

(1) 10 m/s (2) 5 m/s
(3) 15 m/s (4) $10\sqrt{3}$ m/s

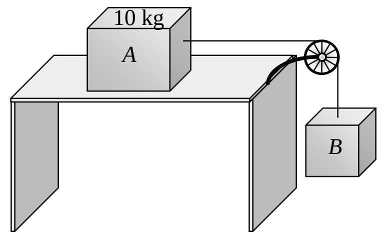
33. The coefficient of friction μ and the angle of friction λ are related as-

(1) $\sin\lambda = \mu$ (2) $\sin\lambda = \mu$
(3) $\tan\lambda = \mu$ (4) $\tan\lambda = \frac{\mu}{2}$

34. A force $F(t) = 12 - 3t$(N) varying with time acts on a particle moving along x-axis. Starting from v = 0 particle is taken along x-axis. Find the momentum of particle at t = 10 s.

(1) $-30\hat{i}$ kg m/s
(2) $-20\hat{i}$ kg m/s
(3) $30\hat{i}$ kg m/s
(4) $20\hat{i}$ kg m/s

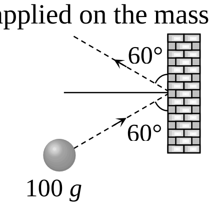
35. If mass of A = 10 kg, coefficient of static friction = 0.2, coefficient of kinetic friction = 0.2. Then mass of B to start motion is-



(1) 2 kg
(2) 2.2 gm
(3) 4.8 gm
(4) 200 gm

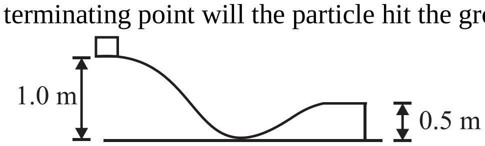
SECTION-B

36. A mass of 100 g strikes the wall with speed 5 m/s at an angle as shown in figure and it rebounds with the same speed. If the contact time is 2×10^{-3} sec, what is the force applied on the mass by the wall



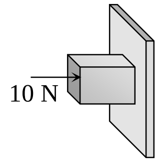
(1) $250\sqrt{3}$ N to right
(2) 250 N to right
(3) $250\sqrt{3}$ N to left
(4) 250 N to left

37. Figure shows a particle sliding on a frictionless track which terminates in a straight horizontal section. If the particle starts slipping from the point A, how far away on the horizontal track from the terminating point will the particle hit the ground?



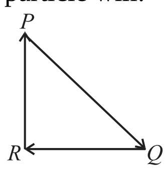
(1) 1 m from the end of the track
(2) 2 m from the end of the track
(3) 3 m from the end of the track
(4) Insufficient information

38. A horizontal force of 10 N is just necessary to just hold a block stationary against a wall. The coefficient of friction between the block and the wall is 0.2. The weight of the block is



(1) 2 N (2) 20 N
(3) 50 N (4) 100 N

39. A particle moving with velocity $\vec{V}$ is acted by three forces shown by the vector triangle *PQR*. The velocity of the particle will:



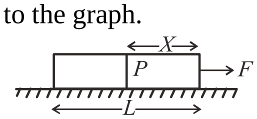
(1) Increase (2) Decrease
(3) Remain constant (4) Remain not constant

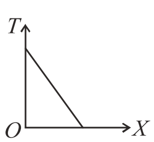
40. A uniform rope of length l lies on a table. If the coefficient of friction is μ, then the maximum length l_1 of the part of this rope which can overhang from the edge of the table without sliding down is-

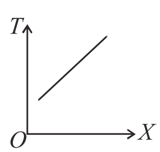
(1) $\frac{l}{\mu}$ (2) $\frac{l}{\mu+l}$

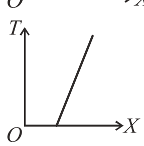
(3) $\frac{\mu l}{1+\mu}$ (4) $\frac{\mu l}{\mu-1}$

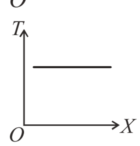
41. A uniform rod of mass *M* pulled by force *F* on smooth surface. The value of tension *T* in the rod varies with the distance *X* from the force end is according to the graph.



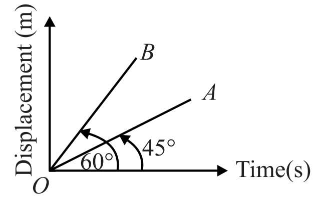
(1) 

(2) 

(3) 

(4) 

42. The displacement-time graphs for two bodies moving in a straight line are shown. What is the relative velocity of *B* with respect to *A*?



(1) $(\sqrt{3}-1)$m/s (2) $(\sqrt{3}+1)$m/s

(3) $(\sqrt{3})$m/s (4) 1 m/s

43. A projectile is thrown at an angle 37° from the vertical. The angle of elevation of the highest point of the projectile from point of projection is:

(1) $\tan^{-1}\left(\frac{3}{2}\right)$ (2) $\tan^{-1}\left(\frac{2}{3}\right)$

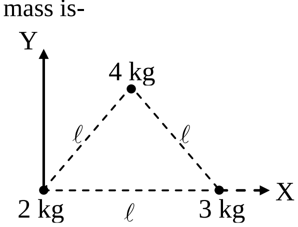
(3) $\tan^{-1}\left(\frac{3}{8}\right)$ (4) $\tan^{-1}\left(\frac{8}{3}\right)$

44. A particle is projected from horizontal plane (*x*–*z*) (where *y*-axis is along vertical) such that its velocity at time *t* is $\vec{v} = \alpha\hat{i} + (\beta - \gamma t)\hat{j}$. The horizontal range of the particle is:

(1) $\frac{\alpha\beta}{\gamma}$ (2) $\frac{2\alpha\beta}{\gamma}$

(3) $\frac{\alpha\beta}{2\gamma}$ (4) $\frac{3\alpha\beta}{2\gamma}$

45. Three masses 2 kg, 3 kg and 4 kg are lying at the corners of an equilateral triangle of side ℓ. The (X) coordinate of center of mass is-



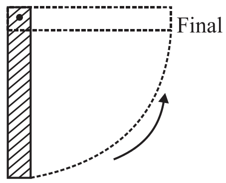
(1) $\frac{7}{12}\ell$ (2) $\frac{5}{9}\ell$

(3) $\frac{7\sqrt{2}}{9}\ell$ (4) $\frac{\sqrt{5}}{9}\ell$

46. An engine pumps up 100 kg of water through a height of 10 m in 5 s. Given that the efficiency of the engine is 60%. If $g = 10\ \text{ms}^{-2}$, the power of the engine is

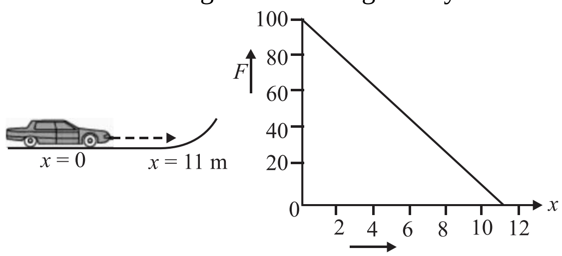
(1) 3.3 kW
(2) 0.33 kW
(3) 0.033 kW
(4) 33 kW

47. A uniform metal rod of 2 kg and 1 m length is hinged at one end and is rotated by 90° anticlockwise as shown find the work done by the gravity in this process:
(take g = 10 m/s^2)



(1) –5 J (2) –10 J
(3) –20 J (4) –15 J

48. A toy car of mass 5 kg moves up a ramp under the influence of force F plotted against displacement x. The maximum height attained is given by:



(1) h_{max} = 20 m (2) h_{max} = 15 m
(3) h_{max} = 11 m (4) h_{max} = 5 m

49. The potential energy of a particle varies with position x according to the relation $U(x) = 2x^4 - 27x$ the point $x = 3/2$ is point of:
(1) unstable equilibrium
(2) neutral equilibrium
(3) stable equilibrium
(4) none of these

50. A truck of mass 30,000 kg moves up an inclined plane of slope 1 in 100 at a speed of 30 kmph. The power of the truck is (given $g = 10\ \text{ms}^{-1}$)
(1) 25 kW (2) 10 kW
(3) 5 kW (4) 2.5 kW

Solution

1. (2)

$W = \vec{F} \cdot d\vec{r}$

$= (2\hat{i} + 15\hat{j} + 6\hat{k}).(10\hat{j})$

= 150 Joule

2. (3)

$W = \frac{1}{2}(16+8) \times 4 = 48$ J

3. (2)

$W = \vec{F} \cdot \vec{d}$

$= mg\frac{h}{2} + Mgh$

$= \left(\frac{m}{2} + M\right)gh$

4. (4)

$|\vec{v}| = \sqrt{9+16} = 5$ m/s

$\text{KE} = \frac{1}{2} \times 1 \times 25 = 12.5$ J

5. (1)

$72 \text{ km/h} = 72 \times \frac{5}{18} = 20$ m/s

$P = \frac{1}{2} \times \frac{1000 \times 20 \times 20}{20} = 10$ kW

6. (1)

$h = \frac{v_0^2}{2g}$

$3h = \frac{v^2}{2g}$

$3 \times \frac{v_0^2}{2g} = \frac{v^2}{2g}$

$\boxed{V = v_0\sqrt{3}}$

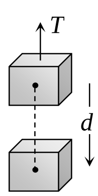
7. (2)

$W = Mgh$

$\because\ h = \left(\frac{l}{4}\right) \times \frac{1}{2}$ and $M = \frac{m}{4}$

$\boxed{W = \frac{mg}{4}\frac{l}{8}} = \frac{mgl}{32}$

8. (3)



When the block moves vertically downward with acceleration $\frac{g}{4}$ then tension in the cord

$T = M\left(g - \frac{g}{4}\right) = \frac{3}{4}Mg$

Work done by the cord = $\vec{F}.\vec{s} = Fs\cos\theta$

$= Td\cos(180°) = -\left(\frac{3Mg}{4}\right) \times d = -\frac{3}{4}Mgd$

9. (1)

$\frac{1}{2}kS^2 = 10$ J (given in the problem)

$\frac{1}{2}k\left[(2S)^2 - (S)^2\right] = 3 \times \frac{1}{2}kS^2 = 3 \times 10 = 30$ J

10. (2)

$W = \frac{1}{2}kx^2$

If both wires are stretched through same distance then $W \propto k$. As $k_2 = 2k_1$ so $W_2 = 2W_1$

11. (3)

Let $P_1 = P$, $P_2 = P_1 + 50\%$ of $P_1 = P_1 + \frac{P_1}{2} = \frac{3P_1}{2}$

$E \propto P^2 \Rightarrow \frac{E_2}{E_1} = \left(\frac{P_2}{P_1}\right)^2 = \left(\frac{3P_1/2}{P_1}\right)^2 = \frac{9}{4}$

$\Rightarrow E_2 = 2.25E_1 = E_1 + 1.25E_1$

$\therefore E_2 = E_1 + 125\%$ of E_1

12. (4)

In compression or extension of a spring work is done against restoring force.

In moving a body against gravity work is done against gravitational force of attraction.

It means in all three cases potential energy of the system increases.

13. (4)

Condition for vertical looping $h = \frac{5}{2}r = 5$ cm

$\therefore r = 2$ cm

14. (3)

$P = \sqrt{2mE}$. If E are const.

then $\frac{P_1}{P_2} = \sqrt{\frac{m_1}{m_2}} = \sqrt{\frac{4}{1}} = 2$

15. (2)

$E \propto P^2$ (if m = constant)

Percentage increase in E = 2 (Percentage increase in P)

= 2 × 0.01% = 0.02%

6. **(4)**

$$P = \frac{\text{Workdone}}{\text{Time}} = \frac{mgh}{t}$$

$$= \frac{300 \times 9.8 \times 2}{3} = 1960\,\text{W}$$

17. **(4)**

$$\frac{1}{2}mv^2 = m \times g\left(50 - 10\right)$$

$$v = 20\sqrt{2}\ \text{m/s}$$

18. **(1)**

$$p = \frac{mgh}{t} = \frac{80 \times 9.8 \times 6}{10}\,\text{W} = \frac{470}{746}\,\text{HP} = 0.63\,\text{HP}$$

19. **(2)**

20. **(1)**

$$P = \frac{\vec{F}.\vec{s}}{t} = \frac{(2\hat{i} + 3\hat{j} + 4\hat{k}).(3\hat{i} + 4\hat{j} + 5\hat{k})}{4}$$

$$= \frac{38}{4} = 9.5\,\text{W}$$

21. **(1)**

Energy supplied to liquid per second by the pump

$$= \frac{1}{2}\frac{mv^2}{t} = \frac{1}{2}\frac{V\rho v^2}{t} = \frac{1}{2}A \times \left(\frac{l}{t}\right) \times \rho \times v^2 \quad \left[\frac{l}{t} = v\right]$$

$$= \frac{1}{2}A \times v \times \rho \times v^2 = \frac{1}{2}A\rho v^3$$

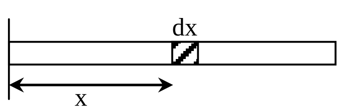
22. **(4)**

$$\vec{A} \cdot \vec{B} = AB\cos\theta = 0$$

$$= 8 \times 4\cos\theta = 0$$

$$\theta = 90^\circ$$

23. **(4)**



$$\lambda = kx$$

Let the cross section = A

mass of element dx at distance x

$dm = (kx)\,Adx$

$$X_{cm} = \frac{\int_0^{\ell} x(kx)\,Adx}{\int_0^{\ell} (kx)\,Adx} = \frac{\int_0^{\ell} x^2 dx}{\int_0^{\ell} xdx} = \frac{\left[\frac{x^3}{3}\right]_0^{\ell}}{\left(\frac{x^2}{2}\right)_0^{\ell}}$$

$$= \frac{2\ell}{3}$$

24. **(2)**

$$\vec{v}_{cm} = \frac{m_1\vec{v}_1 + m_2\vec{v}_2}{m_1 + m_2} = \frac{2 \times 2 + 4 \times 10}{2 + 4} = 7.3\,\text{m/s}$$

25. **(2)**

26. **(1)**

$$V_{cm} = \frac{0.02 \times 10\hat{i} + 0.03 \times 10\hat{j} + 0.05 \times 10\hat{k}}{0.1}$$

27. **(2)**

28. **(1)**

$$\frac{1}{2}kx^2 = \frac{1}{2}mv^2$$

$$\frac{1}{2} \times 90 \times 10^2 \times (12 \times 10^{-2})^2 = \frac{1}{2} \times 16 \times 10^{-3} \times v^2$$

$$v = 90\ \text{m/s}$$

29. **(2)**

$$V = u + at$$

$$v = 0 + at$$

$$P = Fv$$

$$= ma \cdot at$$

$$P = ma^2 t$$

$$\boxed{P \propto t}$$

30. **(2)**

$T_1 = 7\text{g}$

$T_2 = 5\text{g}$

$T_1 : T_2 = 7 : 5$

31. **(2)**

$$T = \frac{2m_1 m_2 g}{m_1 + m_2} = \frac{2 \times 3 \times 6 \times 10}{(3 + 6)} = 40\ \text{N}$$

32. **(4)**

$$v_{max} = \sqrt{Rg\left(\frac{\tan\theta + \mu}{1 - \mu\tan\theta}\right)}$$

$$= \sqrt{20 \times 10 \times \frac{(1 + 0.2)}{(1 - 0.2)}}$$

$$= \sqrt{200 \times \frac{12}{8}} = 10\sqrt{3}\ \text{m/s}$$

33. **(3)**

34. **(1)**

$$P_2 - P_1 = \int_0^{10} F\ dt$$

35. **(1)**

$$\mu_s = \frac{m_B}{m_A} \Rightarrow 0.2 = \frac{m_B}{10} \Rightarrow m_B = 2\text{ kg}$$

36. **(3)**

Force = Rate of change of momentum

Initial momentum $\vec{P}_1 = mv\sin\theta\,\hat{i} + mv\cos\theta\,\hat{j}$

Final momentum $\vec{P}_2 = -mv\sin\theta\,\hat{i} + mv\cos\theta\,\hat{j}$

$$\therefore\ \vec{F} = \frac{\Delta\vec{P}}{\Delta t} = \frac{-2mv\sin\theta\,\hat{i}}{2\times10^{-3}}$$

Substituting m = 0.1 kg, v = 5 m/s, θ = 60°

Force on the ball $\vec{F} = -250\sqrt{3}N\,\hat{i}$

Negative sign indicates direction of the force

37. **(1)**

$$mg(1-0.5) = \frac{1}{2}mv^2$$

$$\boxed{v=\sqrt{10}}$$

$$x = vt = v\sqrt{\frac{2h}{g}} = \sqrt{10}\times\sqrt{\frac{2\times0.5}{10}}$$

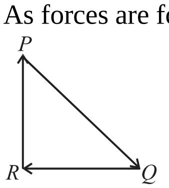
$$\boxed{x = 1\text{m}}$$

38. **(1)**

$$F = \frac{W}{\mu}\quad \therefore W = \mu F = 0.2\times10 = 2\text{N}$$

39. **(3)**

As forces are forming closed loop in same order



So, $\vec{F}_{net} = 0$

$$\Rightarrow m\frac{d\vec{v}}{dt} = 0 \quad\Rightarrow\quad \vec{v} = \text{ constant}$$

40. **(3)**

For given condition we can apply direct formula

$$l_1 = \left(\frac{\mu}{\mu+1}\right)l$$

41. **(1)**

$$T = \frac{F}{L}(L-x)$$

42. **(1)**

tan θ = V

V_A = tan 45° = 1

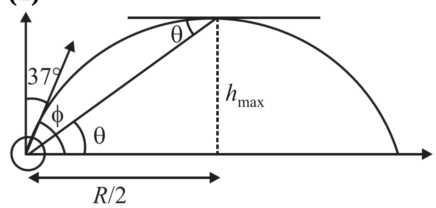
V_B = tan60° = $\sqrt{3}$

V_{AB} = $V_A - V_B = (1-\sqrt{3})$

OR

$V_{BA} = \sqrt{3}-1$

43. **(2)**



$$\tan\theta = \frac{h_{max}}{R/2}\ \ \tan\theta = \frac{\tan\phi}{2}$$

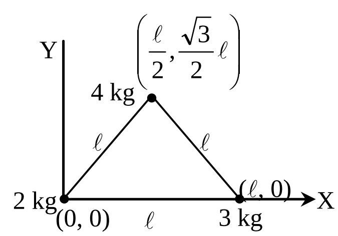
$$\tan\theta = \frac{\tan 53^\circ}{2},\ \tan\theta = \frac{4/3}{2} = \frac{2}{3}$$

$$\theta = \tan^{-1}\left(\frac{2}{3}\right)$$

44. **(2)**

$$R = \frac{2u_x u_y}{g} = \frac{2\alpha\beta}{\gamma}$$

45. **(2)**



$$X_{cm} = \frac{m_1x_1 + m_2x_2 + m_3x_3}{m_1+m_2+m_3} = \frac{2\times0 + 3\times\ell + 4\times\frac{\ell}{2}}{2+3+4} = \frac{5}{9}\ell$$

46. **(1)**

Work output of engine = mgh

= $100\times10\times10 = 10^4$ J

Efficiency (η) = $\frac{\text{output}}{\text{input}}$

$$\therefore \text{ Input energy} = \frac{\text{output}}{\eta} = \frac{10^4}{60}\times100 = \frac{10^5}{6}\text{J}$$

$$\therefore \text{ Power} = \frac{\text{input energy}}{\text{time}} = \frac{10^5/6}{5} = \frac{10^5}{30} = 3.3\text{ kW}$$

47. **(2)**

$$W = -mg\frac{h}{2}$$

$$= -2\times10\times\frac{1}{2} = -10 \text{ Joule}$$

48. **(3)**

$W = mgh$

$\frac{1}{2} \times 11 \times 100 = 5 \times 10 \times h$

$\boxed{h = 11 \text{ m}}$

49. **(3)**

$u = 2x^4 - 27x$

$\frac{du}{dx} = 8x^3 - 27 = 0$

$x = \frac{3}{2}$

$\frac{d^2u}{dx^2} = 24x^2$

$= 24 \times \left(\frac{3}{2}\right)^2$

$= 24 \times \frac{9}{4}$

$= 54 > 0$

Stable equilibrium

50. **(1)**

As truck is moving on an incline plane therefore only component of weight $(mg \sin\theta)$ will oppose the upward motion

Power = force × velocity = $mg \sin\theta \times v$

$= 30000 \times 10 \times \left(\frac{1}{100}\right) \times \frac{30 \times 5}{18} = 25 kW$