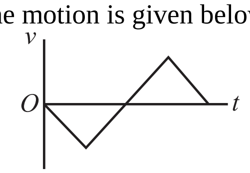
NEET UG (2024)
Physics
Quiz-14

SECTION-A

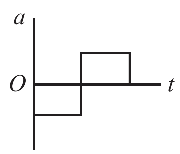
1. When a car is stopped by applying brakes, it stops after travelling a distance of 100 m. If speed of car is halved and same retarding acceleration is applied then it stops after travelling a distance of

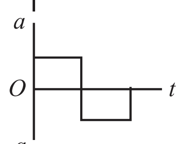
(1) 25 m (2) 50 m
(3) 75 m (4) 100 m

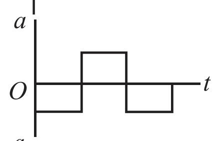
2. The velocity-time (v-t) graph for a particle in straight line motion is given below.

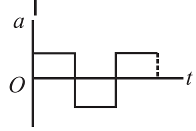


The corresponding acceleration-time (a–t) graph will be

(1) 

(2) 

(3) 

(4) 

3. A particle is thrown vertically up with initial velocity of 60 m/s. The distance covered by the particle in first two seconds of descent will be (take g = 10 m/s^2)

(1) 5 m (2) 15 m
(3) 20 m (4) 40 m

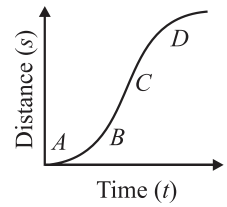
4. If the initial speed of a particle is u and its acceleration is given as $a = At^3$, where A is constant and t is time, then its final speed v will be given as

(1) $u + At^4$ (2) $u + \frac{At^4}{4}$
(3) $u + At^3$ (4) $u + \frac{At^3}{4}$

5. A stone falls freely under gravity. It covers distances h_1, h_2 and h_3 in the first 5 seconds, the next 5 seconds and the next 5 seconds respectively. The relation between h_1, h_2 and h_3 is (1) $h_1 = \frac{h_2}{3} = \frac{h_3}{5}$

(2) $h_2 = 3h_1$ and $h_3 = 3h_2$
(3) $h_1 = h_2 = h_3$
(4) $h_1 = 2h_2 = 3h_3$

6. A particle shows distance-time curve as given in this figure. The maximum instantaneous velocity of the particle is around the point



(1) A (2) B
(3) C (4) D

7. The displacement x of a particle varies with time t as $x = ae^{-\alpha t} + be^{\beta t}$, where a, b, and are positive constants. The velocity of the particle will

(1) Go on decreasing with time
(2) Be independent of α and β
(3) Drop to zero when $\alpha = \beta$
(4) Go on increasing with time

8. Two particles A and B are moving in uniform circular motion in concentric circles of radii r_A and r_B with speed v_A and v_B respectively. Their time period of rotation is the same. The ratio of angular speed of A to that of B will be :

(1) $r_A : r_B$ (2) $v_A : v_B$
(3) $r_B : r_A$ (4) 1 : 1

9. Motion of a particle is given by equation
$s = (3t^3 + 7t + 2 + 14t + 8)$ m
The value of acceleration of the particle at t = 1 s is

(1) 10 m/s^2
(2) 32 m/s^2
(3) 23 m/s^2
(4) 16 m/s^2

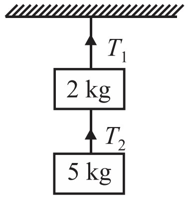
10. A ball is allowed to fall from top of a building. If t_1 is time taken to fall first 1/4th of its height and t_2 is time taken to fall last 1/4th of its height then, t_2/t_1 is

(1) $\frac{\sqrt{3-2}}{1}$ (2) $\frac{\sqrt{3}-\sqrt{2}}{1}$
(3) $\frac{\sqrt{2-3}}{1}$ (4) $\frac{2-\sqrt{3}}{1}$

11. A particle moves in a circle of radius 5 cm with constant speed and time period 0.2 πs. The acceleration of the particle is

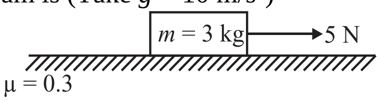
(1) 5 m/s^2 (2) 15 m/s^2
(3) 25 m/s^2 (4) 36 m/s^2

12. 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

13. The value of frictional force on block in the given diagram is (Take g = 10 m/s^2)



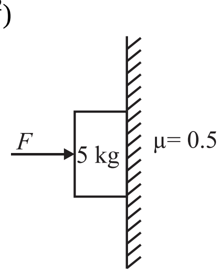
(1) 4 N (2) 5 N
(3) 6 N (4) 9 N

14. A particle is moving in xy-plane in a circular path with centre at origin. If at an instant the position of particle is given by $\frac{1}{\sqrt{2}}(\hat{i}+\hat{j})$, then velocity of particle is along

(1) $\frac{1}{\sqrt{2}}(\hat{i}-\hat{j})$ (2) $\frac{1}{\sqrt{2}}(\hat{j}-\hat{i})$
(3) $\frac{1}{\sqrt{2}}(\hat{i}+\hat{j})$ (4) Either (1) or (2)

15. In translatory equilibrium
(1) The net external force acting on particle is zero
(2) The net external force acting on particle is constant (non-zero)
(3) Particle is always at rest
(4) Velocity of particle changes linearly witht time

16. If the coefficient of friction between the block of mass 5 kg and wall is 0.5, then minimum force F required to hold the block with the wall is
(g = 10 m/s^2)



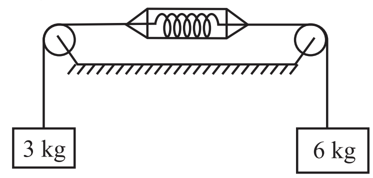
(1) 10 N (2) 100 N
(3) 40 N (4) 50 N

17. The maximum speed of car with which it can go around a level road of radius 10 m is (coefficient of friction between the road and tyre is 0.5)
(g = 9.8 m/s^2)

(1) $\sqrt{19}$ m/s (2) $\sqrt{29}$ m/s
(3) $\sqrt{39}$ m/s (4) $\sqrt{49}$ m/s

18. A person aiming to reach exactly opposite point on the bank of a stream is swimming with a speed of 0.5 m/s at an angle of 120° with the direction of flow of water. The speed of water in the stream is
(1) 0.25 m/s
(2) 0.5 m/s
(3) 1.0 m/s
(4) 0.433 m/s

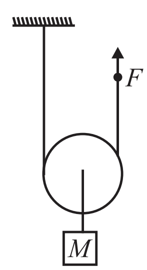
19. In the given diagram, reading of spring balance will be (g = 10 m/s^2)



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

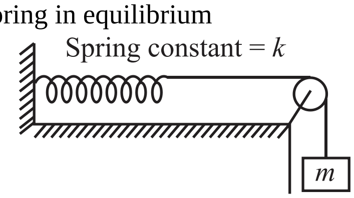
20. A car is moving in a circular horizontal track of radius 10 m with a constant speed of 10 m/s. A bob is suspended from the roof of the car by string of length 1 m. The angle made by the string with the vertical is
(1) Zero (2) 30°
(3) 45° (4) 60°

21. The force F needed to keep the block at equilibrium in given figure is (pulley and string are massless)



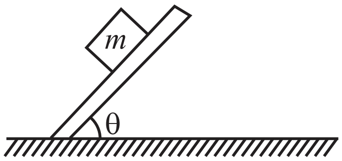
(1) $Mg/5$ (2) $Mg/4$
(3) $Mg/2$ (4) $Mg/3$

22. Initially the spring is relaxed. If the mass m is slowly released, then the elongation produced in the spring in equilibrium



(1) mg/k (2) $mg/2k$
(3) $2mg/k$ (4) $mg/4k$

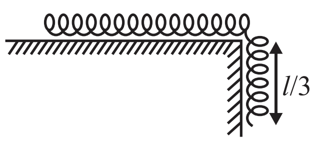
23. A block of mass m is kept on a plank. The coefficient of friction between the plank and the block is 1. The plank is slowly raised from one end so that it makes angle θ with horizontal. The force of friction acting on the plank when θ=30° is



(1) $\frac{Mg}{\sqrt{2}}$ (2) $\frac{Mg}{2}$

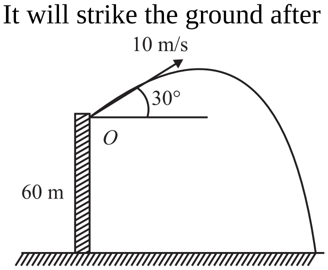
(3) $\frac{\sqrt{3}Mg}{2}$ (4) Mg

24. A uniform chain of mass m and length l is lying on a horizontal table with one third of its length hanging over the edge of the table. If the chain is in limiting equilibrium what is the coefficient of friction for the contact between the table and chain?



(1) 2/3 (2) 1/3
(3) 1/2 (4) 3/4

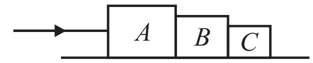
25. A ball is projected from a point O as shown in figure. It will strike the ground after (g = 10 m/s^2)



(1) 4 s (2) 3 s
(3) 2 s (4) 5 s

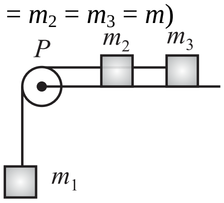
26. Which one of the following statements is incorrect?
(1) Rolling friction is smaller than sliding friction.
(2) Limiting value of static friction is directly proportional to normal reaction.
(3) Coefficient of sliding friction has dimensions of length.
(4) Frictional force opposes the relative motion.

27. Three blocks A, B and C of masses 4 kg, 2 kg and 1 kg respectively, are in contact on a frictionless surface, as shown. If a force of 14 N is applied on the 4 kg block, then the contact force between A and B is



(1) 18 N (2) 2 N
(3) 6 N (4) 8 N

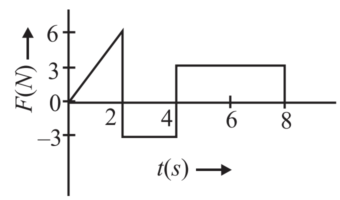
28. A system consists of three masses m_1, m_2 and m_3 connected by a string passing over a pulley P. The mass m_1 hangs freely and m_2 and m_3 are on a rough horizontal table (The coefficient of friction = μ). The pulley is frictionless and of negligible mass. The downward acceleration of mass m1 is: (Assume $m_1 = m_2 = m_3 = m$)



(1) $\frac{g(1-g\mu)}{9}$ (2) $\frac{2g\mu}{3}$

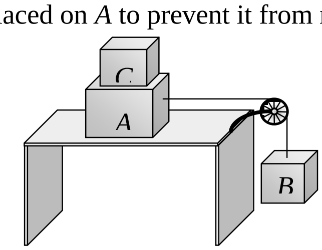
(3) $\frac{g(1-2\mu)}{3}$ (4) $\frac{g(1-2\mu)}{2}$

29. The force F acting on a particle of mass m is indicated by the force-time graph shown below. The change in momentum of the particle over the time interval from 0 s to 8 s is



(1) 24 N s (2) 20 N s
(3) 12 N s (4) 6 N s

30. Two masses A and B of 10 kg and 5 kg respectively are connected with a string passing over a frictionless pulley fixed at the corner of a table as shown. The coefficient of static friction of A with table is 0.2. The minimum mass of C that may be placed on A to prevent it from moving is



(1) 15 kg (2) 10 kg
(3) 5 kg (4) 12 kg

31. Sand is being dropped on a conveyor belt at the rate of M kg/s. The force necessary to keep the belt moving with a constant velocity of v m/s will be
(1) Zero (2) Mv newton
(3) 2 Mv newton (4) $\frac{Mv}{2}$ newton

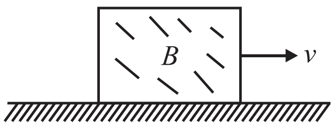
32. In a rocket, fuel burns at the rate of 1 kg/s. This fuel is ejected from the rocket with a velocity of 60 km/s. This exerts a force on the rocket equal to

(1) 6000 N (2) 60000 N
(3) 60 N (4) 600 N

33. A lift of mass 1000 kg is moving with acceleration of 1 m/s^2 in upward direction, then the tension developed in string which is connected to lift is

(1) 9800 N (2) 10,800 N
(3) 11,000 N (4) 10,000 N

34. A block *B* is pushed momentarily along a horizontal surface with an initial velocity *v*. If μ is the coefficient of sliding friction between *B* and the surface, block *B* will come to rest after a time



(1) $\frac{v^2}{g\mu}$ (2) $\frac{v}{\mu g}$
(3) $\frac{g\mu}{v}$ (4) $\frac{g}{v}$

35. A tube of length *L* is filled completely with an incompressible liquid of mass *M* and closed at both the ends. The tube is then rotated in a horizontal plane about one of its ends with a uniform angular velocity ω. The force exerted by the liquid at the other end is

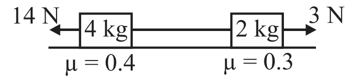
(1) $\frac{ML\omega^2}{2}$ (2) $ML\omega^2$
(3) $\frac{ML\omega^2}{4}$ (4) $\frac{ML^2\omega^2}{2}$

SECTION-B

36. A block of mass *m* is placed on a smooth wedge of inclination θ. The whole system is accelerated horizontally so that the block does not slip on the wedge. The force exerted by the wedge on the block (*g* is acceleration due to gravity) will be

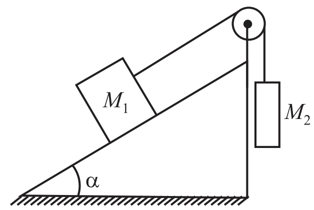
(1) $mg \cos \theta$
(2) $mg \sin \theta$
(3) mg
(4) $mg/\cos \theta$

37. Two blocks of masses 2 kg and 4 kg are connected by a massless string which is just taut. Now two forces 3 N and 14 N are applied on blocks. The tension in the string is



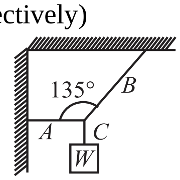
(1) 24.3 N (2) 20 N
(3) 6 N (4) Zero

38. Select the correct statement with respect to the given situation.



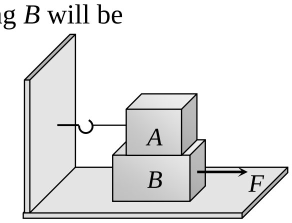
(1) If $M_1\sin\alpha > \mu M_1\cos\alpha + M_2$, block M_1 moves upward
(2) If $M_1\sin\alpha > \mu M_1\cos\alpha + M_2$, block M_1 moves downward
(3) If $M_1\sin\alpha > \mu M_1\cos\alpha - M_2$, block M_1 moves downward
(4) Both (1) & (3)

39. A block of weight *W* is supported by three strings as shown in figure. Which of the following relations is true for tension in the strings? (Here T_1, T_2 and T_3 are the tension in the strings *A*, *B* and *C* respectively)



(1) $T_1 = T_2$
(2) $T_1 = T_3$
(3) $T_2 = T_3$
(4) $T_1 = T_2 = T_3$

40. A block *A* with mass 100 kg is resting on another block *B* of mass 200 kg. As shown in figure a horizontal rope tied to a wall holds it. The coefficient of friction between *A* and *B* is 0.2 while coefficient of friction between *B* and the ground is 0.3. The minimum required force *F* to start moving *B* will be



(1) 900 *N*
(2) 100 *N*
(3) 1100 *N*
(4) 1200 *N*

41. A fireman of mass 60 kg slides down a pole. He is pressing the pole with a force of 600 *N*. The coefficient of friction between the hands and the pole is 0.5, with what acceleration will the fireman slide down (g = 10 m/s^2)

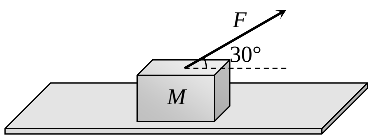
(1) 1 m/s^2

(2) 2.5 m/s^2

(3) 10 m/s^2

(4) 5 m/s^2

42. A block of mass $M = 5$kg is resting on a rough horizontal surface for which the coefficient of friction is 0.2. When a force $F = 40$ N is applied, the acceleration of the block will be $(g = 10 \text{ m/s}^2)$



(1) 5.73 m/sec^2 (2) 8.0 m/sec^2

(3) 3.17 m/sec^2 (4) 10.0 m/sec^2

43. In uniform circular motion

(1) Acceleration of the particle changes continuously

(2) Acceleration of the particle remain constant

(3) Velocity of the particle remain constant

(4) Speed of the particle changes continuously

44. If a body is moving in circular path of radius 14 m.

It complete one revolution in 7 s. Considering the speed to be uniform, the value of centripetal acceleration is

(1) $\frac{8}{7}\pi^2$ m/s^2 (2) π^2 m/s^2

(3) $\frac{7}{8}\pi^2$ m/s^2 (4) $\frac{3}{4}\pi^2$ m/s^2

45. A car accelerates from rest at a constant rate α for some time after which it decelerates at a constant rate β and comes to rest. If total time elapsed is t, then maximum velocity acquired by car will be

(1) $\frac{(\alpha^2 - \beta^2)t}{\alpha\beta}$ (2) $\frac{(\alpha^2 + \beta^2)t}{\alpha\beta}$

(3) $\frac{(\alpha + \beta)t}{\alpha\beta}$ (4) $\frac{\alpha\beta t}{\alpha + \beta}$

46. A cyclist paddling at a speed of 10 m/s on a level road takes a sharp circular turn of radius 10 m without reducing the speed. The angle made by cyclist with vertical is

(1) $\pi/4$ (2) $\pi/3$

(3) $\pi/6$ (4) $\pi/2$

47. A projectile is fired from the level ground at angle θ above the horizontal. Angle of elevation (ϕ)of highest point from point of projection is

(1) $\tan\phi = 2\tan\theta$

(2) $\tan\phi = \tan\theta$

(3) $\tan\phi = \frac{1}{2}\tan\theta$

(4) $\tan\phi = \frac{1}{4}\tan\theta$

48. Two weights w_1 and w_2 are connected by a light thread which passes over a light smooth pulley. If the pulley is raised with an acceleration equal to that due to gravity, then the tension in the thread will be

(1) $\frac{2w_1w_2}{w_1 + w_2}$ (2) $\frac{4w_1w_2}{w_1 + w_2}$

(3) $\frac{w_1w_2}{w_1 + w_2}$ (4) $\frac{(w_1 - w_2)^2}{w_1 + w_2}$

49. A projectile is thrown with speed 40 ms^{-1} at angle θ from horizontal. It is found that projectile is at same height at 1s and 3s. What is the angle of projection?

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

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

(3) $\tan^{-1}(\sqrt{3})$

(4) $\tan^{-1}(\sqrt{2})$

50. Pseudo force, also called fictitious force, such as centrifugal force, arises only in

(1) Inertial frames

(2) Non-inertial frames

(3) Both inertial and non-inertial frames

(4) Rigid frames

Solution

1. **(1)**

Stopping distance $= \dfrac{u^2}{2a}$

2. **(3)**

3. **(3)**

$h = \dfrac{1}{2}gt^2$

$h = \dfrac{1}{2} \times 10 \times 4 = 20 \text{ m}$

4. **(2)**

$\int_u^v dv = \int_0^t At^3 dt$

$\therefore \; v - u = \dfrac{At^4}{4}$

5. **(1)**

When a body starts from rest and under the effect of constant acceleration then the distance travelled by the body in final time intervals is in the ratio of odd number i.e., 1 : 3 : 5 : 7

So, $h_1 : h_2 : h_3 \Rightarrow 1 : 3 : 5$

$\dfrac{h_1}{h_2} = \dfrac{1}{3}, \dfrac{h_1}{h_3} = \dfrac{1}{5}$

$\Rightarrow \; h_1 = \dfrac{h_2}{3}, h_1 = \dfrac{h_3}{5}$

So, $h_1 = \dfrac{h_2}{3} = \dfrac{h_3}{5}$

6. **(3)**

Maximum instantaneous velocity will be at that point which has maximum slope.

As clear from the graph 'C' has maximum slope.

7. **(4)**

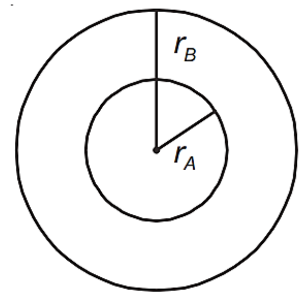
$x = ae^{-\alpha t} + be^{\beta t}$

$\dfrac{dx}{dt} = a(-\alpha)e^{-\alpha t} + b(\beta)e^{\beta t}$

$v = b\beta e^{\beta t} - a\alpha e^{-\alpha t}$

As we increase time $e^{\beta t}$ increases and $e^{-\alpha t}$ decreases. So, v keeps on increasing with time.

8. **(4)**



$T_A = T_B = T$

$\omega_A = \dfrac{2\pi}{T_A}$

$\omega_B = \dfrac{2\pi}{T_B}$

$\dfrac{\omega_A}{\omega_B} = \dfrac{T_B}{T_A} = \dfrac{T}{T} = 1$

9. **(2)**

$s = 3t^3 + 7t^2 + 14t + 8$

$v = \dfrac{ds}{dt} = 9t^2 + 14t + 14$

$a = \dfrac{d^2s}{dt^2} = 18t + 14$

$a|_{t=1\text{ s}} = 18 + 14$

$\boxed{a|_{t=1\text{ s}} = 32 \text{ ms}^{-2}}$

10. **(4)**

$t_1 = \sqrt{\dfrac{2}{g}\left(\dfrac{h}{4}\right)}$

$t_2 = \sqrt{\dfrac{2}{g}\left(4 \cdot \dfrac{h}{4}\right)} - \sqrt{\dfrac{2}{g}\left(3 \cdot \dfrac{h}{4}\right)}$

Now, $\dfrac{t_2}{t_1} = \dfrac{\left(2 - \sqrt{3}\right)\sqrt{\dfrac{2}{g}\dfrac{h}{4}}}{\sqrt{\dfrac{2}{g}\left(\dfrac{h}{4}\right)}} = \dfrac{t_2}{t_1} = \dfrac{2 - \sqrt{3}}{1}$

11. **(1)**

$r = 5 \text{ cm}, v = ?, \; T = 0.2\pi s$

$T = \dfrac{2\pi}{\omega} \Rightarrow \omega = \dfrac{20\pi}{0.2\pi} = 10 \text{ rads}^{-1}$

$a = r\omega^2 = 5 \times 10^{-2} \times 100$

$\boxed{a = 5 \text{ ms}^{-2}}$

12. **(2)**

$T_1 = 7g$

$T_2 = 5g$

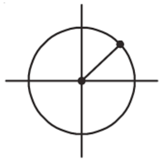
$T_1 : T_2 = 7 : 5$

13. **(2)**

If $F_{app} < f_{Lim}$

then $F_r = F_{app} = 5$ N

14. **(4)**



$\vec{r} = \frac{1}{2}\hat{i} + \frac{1}{\sqrt{2}}\hat{j}$

$\vec{v} \cdot \vec{r} = 0$ as velocity is always tangential to the path.

$(v_x\hat{i} + v_y\hat{j}) \cdot \frac{1}{2}(\hat{i} + \hat{j}) = 0$

$v_x + v_y = 0$

$\Rightarrow v_x = -v_y$

or $v_y = -v_x$

$v = \sqrt{v_x^2 + v_y^2} \Rightarrow \sqrt{2}v_x = v \Rightarrow \boxed{v_x = \frac{v}{\sqrt{2}}}$

$v_y = -\frac{v}{\sqrt{2}}$

or $v_x = -\frac{v}{\sqrt{2}}, v_y = \frac{v}{\sqrt{2}}$

So, possible value of $v \Rightarrow v_x\hat{i} + v_y\hat{j}$

$\Rightarrow \frac{v}{\sqrt{2}}\hat{i} - \frac{v}{\sqrt{2}}\hat{j}$ or $\frac{-v}{\sqrt{2}}\hat{i} + \frac{v}{\sqrt{2}}\hat{j}$

15. **(1)**

$\Sigma F = 0$

16. **(2)**

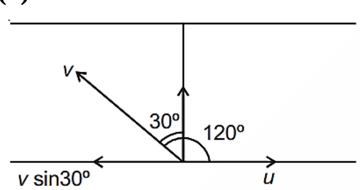
$\mu F = 50$

$F = \frac{50}{0.5} = 100$ N

17. **(4)**

$v = \sqrt{\mu Rg} = \sqrt{0.5 \times 9.8 \times 10} = \sqrt{49}$ m/s

18. **(1)**



$0.5 \times \frac{1}{2} = u \Rightarrow \boxed{u = 0.25 \text{ ms}^{-1}}$

19. **(2)**

$T = \frac{2m_1m_2g}{m_1 + m_2} = \frac{2 \times 3 \times 6 \times 10}{(3+6)} = 40$ N

20. **(3)**

$\tan\theta = \frac{v^2}{rg}$

21. **(3)**

22. **(1)**

$mg = ky$

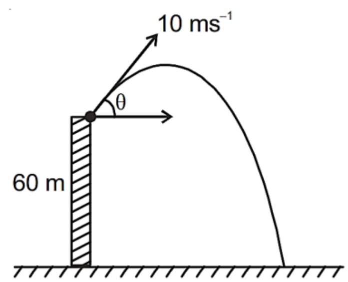
23. **(2)**

$30° < \tan^{-1}(1)$

24. **(3)**

$\mu\left(\frac{2}{3}mg\right) = \frac{mg}{3}$

25. **(1)**



$s_y = u_xT + \frac{1}{2}a_yT^2$

$-60 = 10\sin 30° \cdot T - \frac{1}{2}gT^2$

$-60 = 5T - 5T^2$

$T^2 - T - 2 = 0$

$\boxed{T = 4 \text{ s}}$

26. **(3)**

Coefficient of sliding friction has no dimension

$f = \mu_s N \Rightarrow \mu_s = \frac{f}{N}$

27. **(3)**

28. **(3)**

$m_1g - T = m_1a$ … (i)

$T - \mu(m_2 + m_3)g = (m_2 + m_3)a$ …(ii)

Solve (i) & (ii) for a

29. **(3)**

$\Delta P = \int_0^8 F dt$

So area of $F - t$ curve will give change in momentum

$\Delta P = \frac{1}{2} \times 2 \times 6 - (2 \times 3) + 4 \times 3 = 12$ Ns

30. **(1)**

For limiting condition $\mu = \dfrac{m_B}{m_A + m_C} \Rightarrow$

$$0.2 = \frac{5}{10 + m_C}$$

$$\Rightarrow\ 2 + 0.2m_C = 5 \Rightarrow\ m_C = 15kg$$

31. **(2)**

$$F = \frac{vdM}{dt} = vM$$

32. **(2)**

$$F = \frac{vdm}{dt}\ =\ 60\times10^3\times(1) = 60000\ \text{N}$$

33. **(2)**

$T = m(g + a) = 1000\ (9.8 + 1) = 10800$ N

34. **(2)**

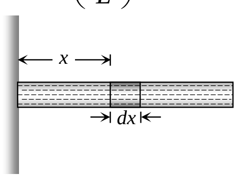
$$v = u - at$$

$$v = 0$$

$$t = \frac{v}{\mu g}$$

35. **(1)**

$$dM = \left(\frac{M}{L}\right)dx$$



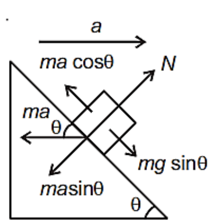
force on 'dM' mass is

$$dF = (dM)\,\omega^2 x$$

By integration we can get the force exerted by whole liquid

$$\Rightarrow\ F = \int_0^L \frac{M}{L}\omega^2 x\,dx = \frac{1}{2}M\omega^2 L$$

36. **(4)**



$$mg\sin\theta = ma\ \cos\theta$$

$$\Rightarrow\ \ a = g\tan\theta$$

$$N = ma\sin\theta + mg\cos\theta$$

$$N = \frac{mg\sin^2\theta}{\cos\theta} + mg\cos\theta = \frac{mg}{\cos\theta}$$

37. **(4)**

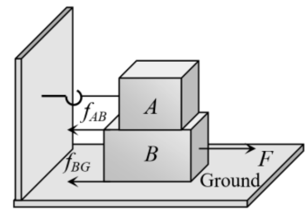
$\mu mg > F_{ext}$

38. **(2)**

39. **(2)**

Tension will be same in A & C hence $T_1 = T_3$

40. **(3)**



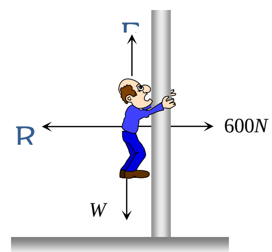
$$F = f_{AB} + f_{BG}$$

$$= \mu_{AB} m_a g + \mu_{BG}(m_A + m_B)g$$

$$= 0.2\times100\times10 + 0.3(300)\times10$$

$$= 200 + 900 = 1100\ N$$

41. **(4)**

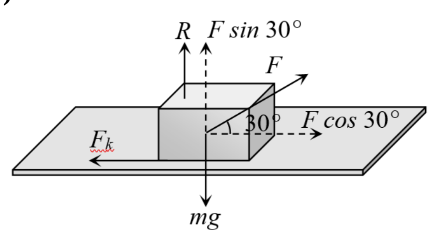


Net downward acceleration

$$= \frac{\text{Weight-Friction force}}{\text{Mass}} = \frac{(mg - \mu R)}{m}$$

$$= \frac{60\times10 - 0.5\times600}{60} = \frac{300}{60} = 5\ \text{m/s}^2$$

42. **(1)**



$$\text{Kinetic friction} = \mu_k R\ = 0.2(mg - F\sin30°)$$

$$= 0.2\left(5\times10 - 40\times\frac{1}{2}\right) = 0.2(50 - 20) = 6\ N$$

Acceleration of the block

$$= \frac{F\cos30° - \text{Kinetic friction}}{\text{Mass}}$$

$$= \frac{40\times\frac{\sqrt{3}}{2} - 6}{5} = 5.73\ \text{m/s}^2$$

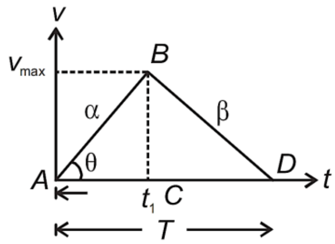
43. **(1)**

Direction of acceleration and velocity changes continuously

44. **(1)**

$$a = r\omega^2 = 14\times\left(\frac{2\pi}{7}\right)^2 = 14\times\frac{4\pi^2}{7\times7} = \frac{8\pi^2}{7}\ \ \text{m/s}^2$$

45. **(4)**



$$\boxed{v_{max} = \frac{\alpha\beta t}{\alpha+\beta}}$$

In $\Delta ABC, \tan\theta =$ slope $= \frac{v_{max}}{t_1}$

In $\Delta BCD, 1-\beta = \frac{-v_{max}}{T-t_1}$

$\alpha t_1 = \beta T - \beta t_1$

$\Rightarrow t_1 = \frac{\beta T}{\alpha+\beta}$

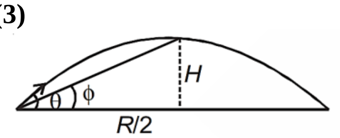
$v_{max} = \alpha \times t_1$

$$\boxed{v_{max} = \frac{\alpha\beta T}{\alpha+\beta}}$$

46. **(1)**

$\tan\theta = \frac{v^2}{Rg} \Rightarrow \tan\theta = \frac{10^2}{10\times10} = 1 \Rightarrow \theta = \frac{\pi}{4}$

47. **(3)**



$\tan\phi = \frac{H}{R/2}$

$R = 4H\cot\theta$

$\tan\phi = \frac{2H}{4H\cot\theta}$

$\tan\phi = \frac{1}{2}\tan\theta$

48. **(2)**

$T = \frac{2m_1m_2}{m_1+m_2}(g+a)$

49. **(2)**

$\tan\theta = \frac{v_y}{v_x}$

Also, $t_1 + t_2 = \frac{2u\sin\theta}{g}$

$4 = \frac{2\times40\times\sin\theta}{10}$

$\sin\theta = \frac{1}{2} \Rightarrow \theta = 30^\circ$

So, $\tan\theta = \tan30^\circ \Rightarrow \frac{1}{\sqrt{3}}$

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

50. **(2)**