YAKEEN NEET 2.0

2026

Work, Energy and Power

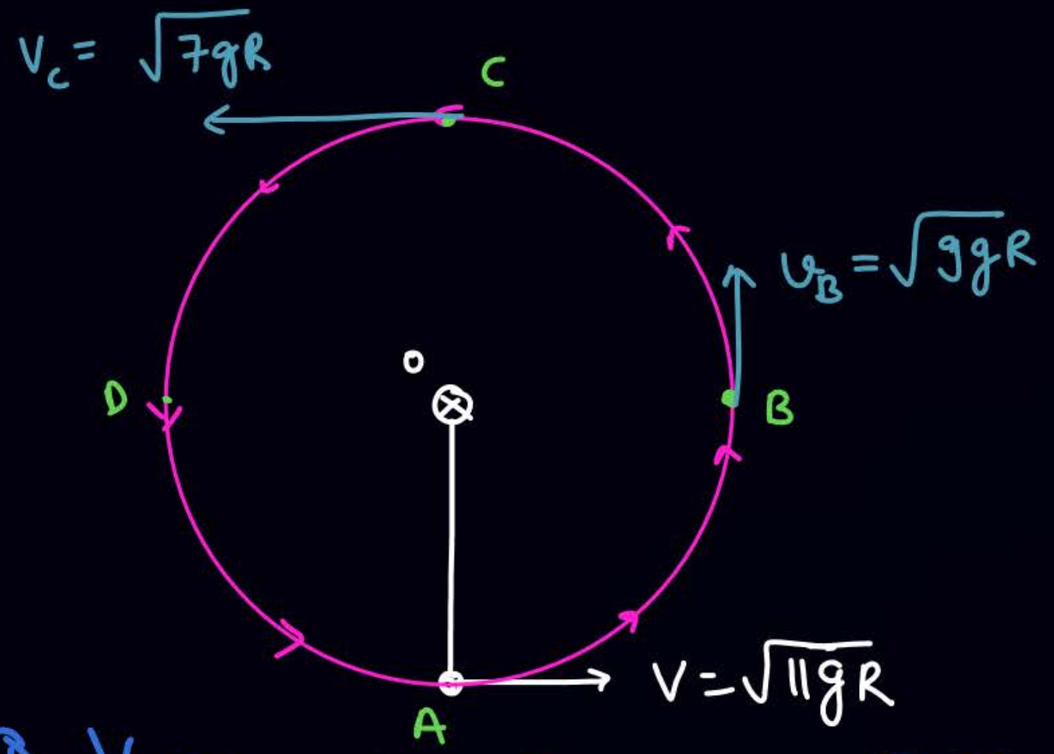
PHYSICS | Lecture 07

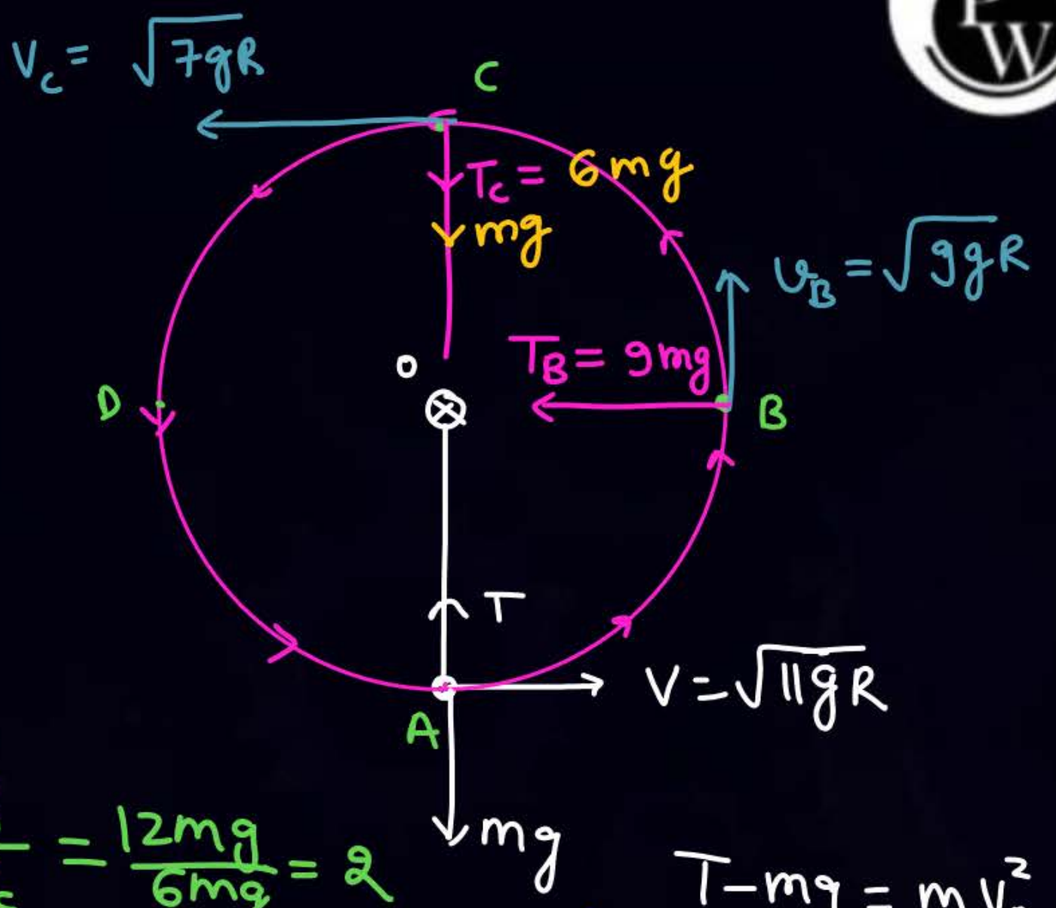
By - Saleem Ahmed Sir

Todays Goal

- Vertical circular motion. (PART 02)

Q





① $\frac{V_{max}}{V_{min}} = \frac{V_A}{V_c} = \frac{\sqrt{11gR}}{\sqrt{7gR}} = \sqrt{\frac{11}{7}}$

② $\frac{(KE)_{max}}{(KE)_{min}} = \frac{11}{7}$

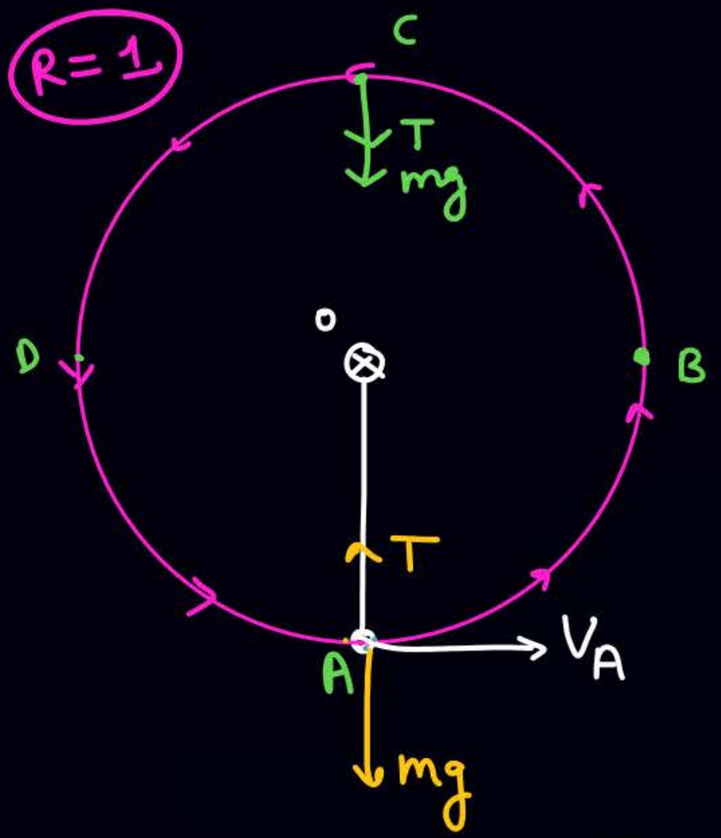
③ $\frac{T_{max}}{T_{min}} = \frac{T_A}{T_c} = \frac{12mg}{6mg} = 2$

$T - mg = \frac{mV_A^2}{R}$

$\boxed{T_A = 12mg}$

$T_c + mg = \frac{mv_c^2}{R}$

Q



$T - mg = \frac{mv_A^2}{R}$

If $\frac{T_{max}}{T_{min}} = 5$ find everything, V_C, V_A, V_B ?

$V_A = ?$

Sol^n

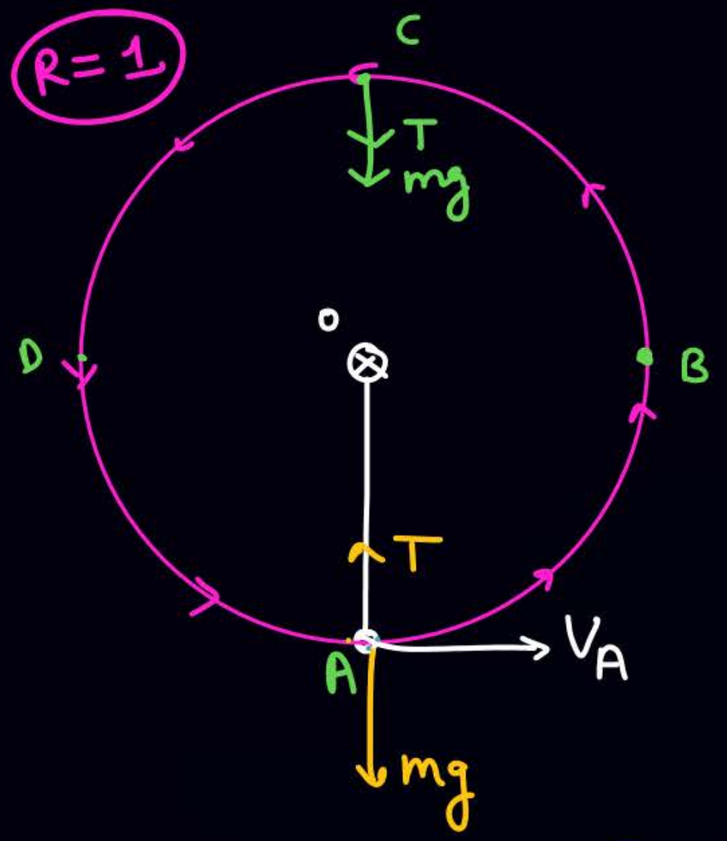
$$\frac{T_A}{T_C} = 5 \Rightarrow \frac{mg + \frac{mv_A^2}{R}}{\frac{mv_C^2}{R} - mg} = 5 \quad \text{—— (1)}$$

$$-mg2R = \frac{1}{2}mv_C^2 - \frac{1}{2}mv_A^2 \quad \text{—— (2)}$$

Solve & get $V_A = \sqrt{\frac{13}{2}gR}$

$T_c + mg = \frac{mV_c^2}{R}$

Q



$T - mg = \frac{mV_A^2}{R}$

If $\frac{T_{max}}{T_{min}} = 5$ find everything, V_C, V_A, V_B ?

$V_A = ?$

So

$\frac{T_A}{T_C} = 5 \Rightarrow T_A = 5T_C$

$mg + \frac{mV_A^2}{R} = 5\left(\frac{mV_C^2}{R} - mg\right)$

$mgR + mV_A^2 = 5mV_C^2 - 5mgR$

$-mg2R = \frac{1}{2}mV_C^2 - \frac{1}{2}mV_A^2$

$\frac{1}{2}mV_C^2 = \frac{1}{2}mV_A^2 - 2mgR$

$mV_C^2 = mV_A^2 - 4mgR$

$mgR + mV_A^2 = 5mV_A^2 - 20mgR - 5mgR$

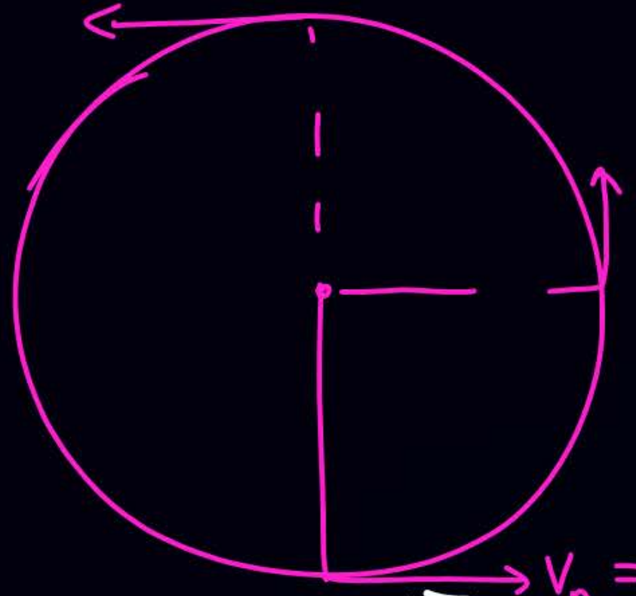
$+4mV_A^2 = +26mgR$

$V_A = \sqrt{\frac{13}{2}gR}$ = ✓

SKC box

$T_C = (n-6)\,mg$

$V_C = \sqrt{(x-4)gR}$



$V_B = \sqrt{(x-2)gR}$

$T_B = (n-3)\,mg$

$V_A = \sqrt{xgR}$

$T_A = nmg$

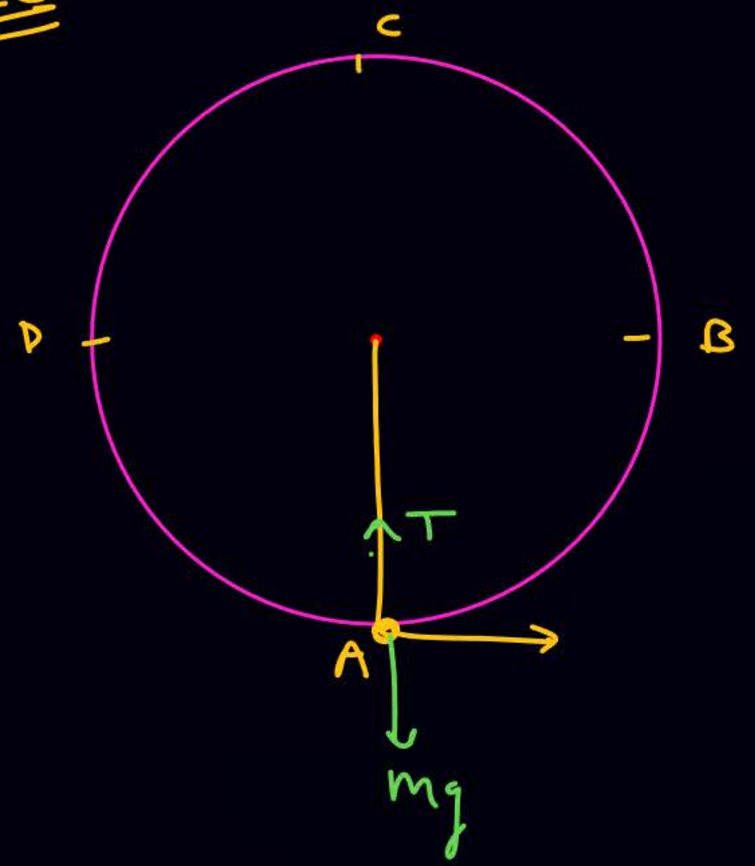
रत्ना mat

$$\frac{T_{max}}{T_{min}} = \frac{nmg}{(n-6)mg} = \frac{n}{n-6}$$

$$\frac{V_{max}}{V_{min}} = \sqrt{\frac{ngR}{(n-4)gR}} = \sqrt{\frac{n}{n-4}}$$

SKC

$R = 1$



$$\frac{T_{max}}{T_{min}} = 5 = \frac{T_A}{T_C} = \frac{nmg}{(n-6)mg}$$

$$5n - 30 = n$$

$$n = \frac{30}{4} = \frac{15}{2}$$

$$T_A = nmg = \frac{15}{2}mg$$

$$T_A - mg = \frac{mV_A^2}{R}$$

$$\frac{15mg}{2} - mg = \frac{mV_A^2}{R}$$

$$V_A = \sqrt{\frac{13}{2}gR}$$

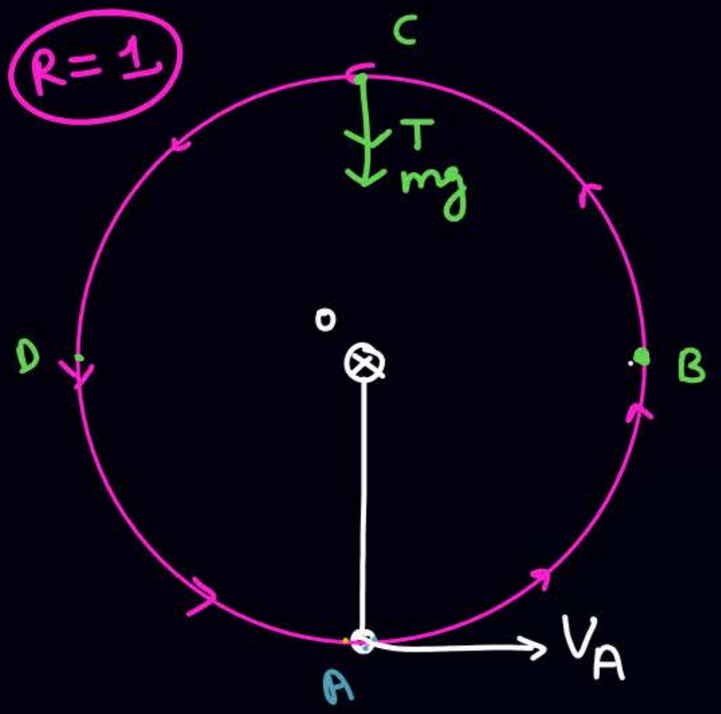
$$V_c = \sqrt{\left(\frac{13}{2} - 4\right)gR}$$

$$V_c = \sqrt{\frac{5gR}{2}} = 5$$

$R = 1$

$T_C + mg = \frac{mV_C^2}{R}$

Q



If $\frac{T_{max}}{T_{min}} = 4$

find V_A = ✓

So

$\frac{nmg}{(n-6)mg} = 4$

$4n - 24 = n$

$\boxed{n = 8}$

$T_A = 8mg$

$T_A - mg = \frac{mV_A^2}{R}$

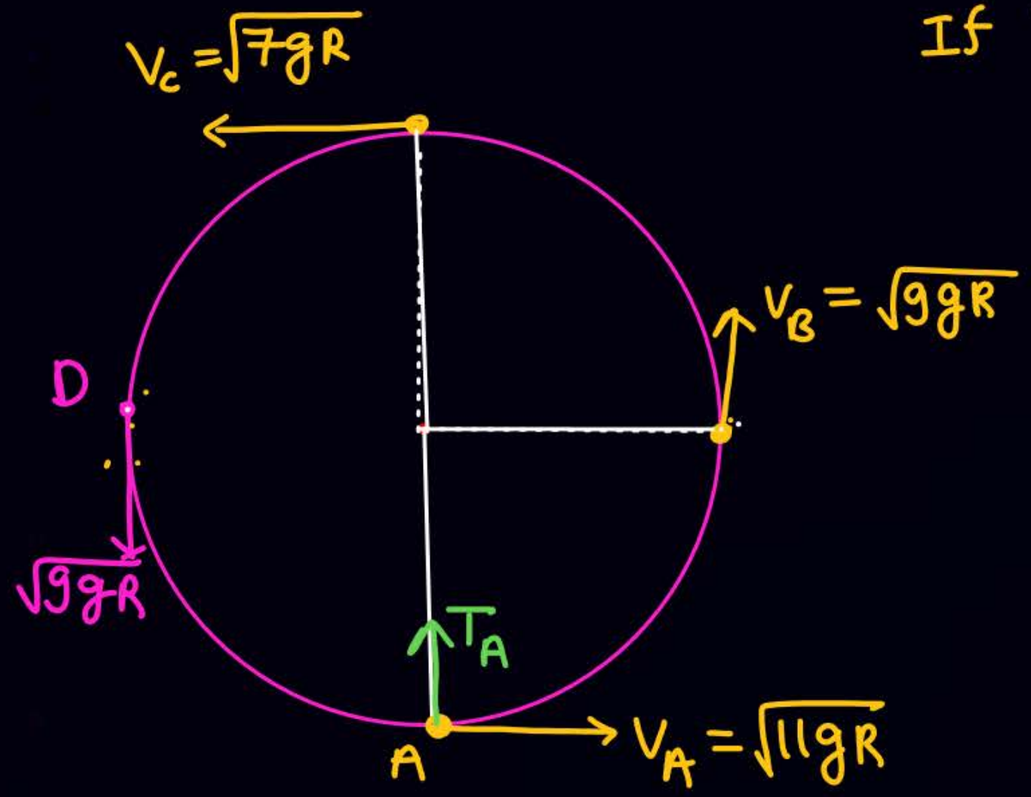
$\boxed{V_A = \sqrt{7gR}}$

$V_C = \sqrt{3gR}$

$T_A = 8mg$

$T_B = 5mg$

$T_C = 2mg$.



If V_A is $\sqrt{11gR}$ ① find $V_B = \sqrt{9gR}$, $V_C = \sqrt{7gR}$

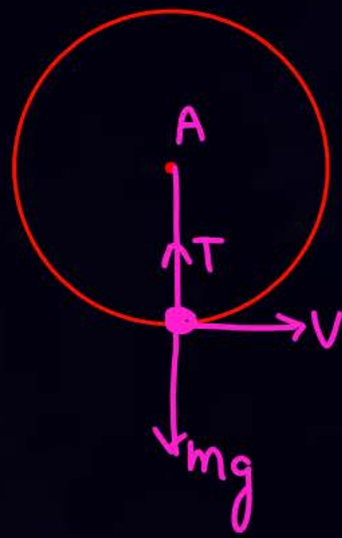
$T_A = 12mg$

$T_B = 9mg$

$T_C = 6mg$

② find acc. at A, B, C

Ⓐ ⇒



$a_t = 0$

$a_c = \frac{V^2}{R} = \frac{11gR}{R} = 11g$

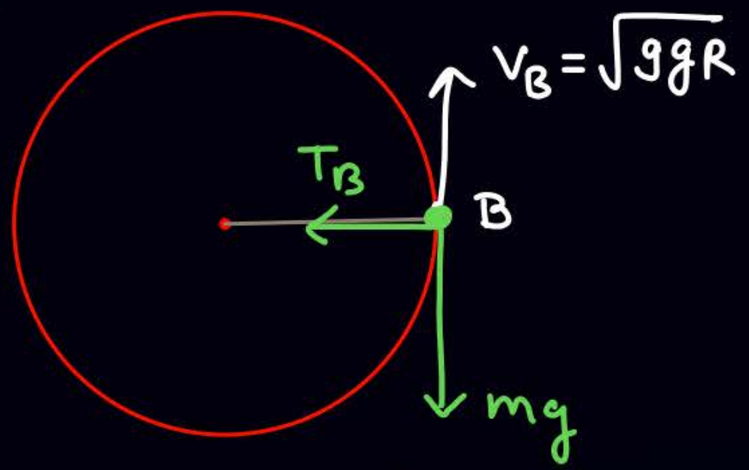
$a_{net} = \sqrt{a_t^2 + a_c^2}$

$= 11g$

$T_A - mg = \frac{mV_A^2}{R}$

$T_A = 12mg$

At B



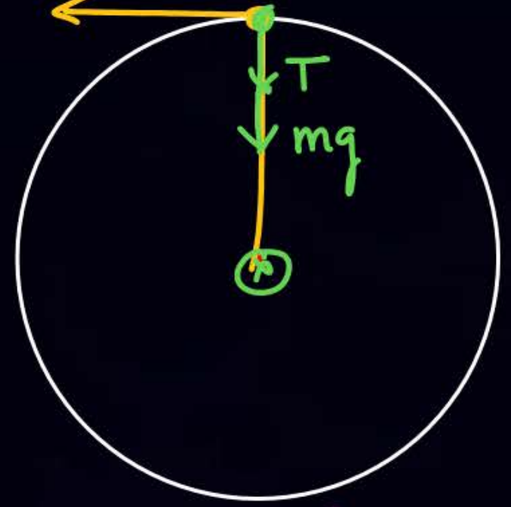
$$a_{centripetal} = \frac{V^2}{R} = \frac{9gR}{R} = 9g$$

$$mg = ma_t \Rightarrow a_t = g$$

$$a_{net} = \sqrt{(9g)^2 + g^2} = g\sqrt{82}$$

At C

$V_C = \sqrt{7gR}$

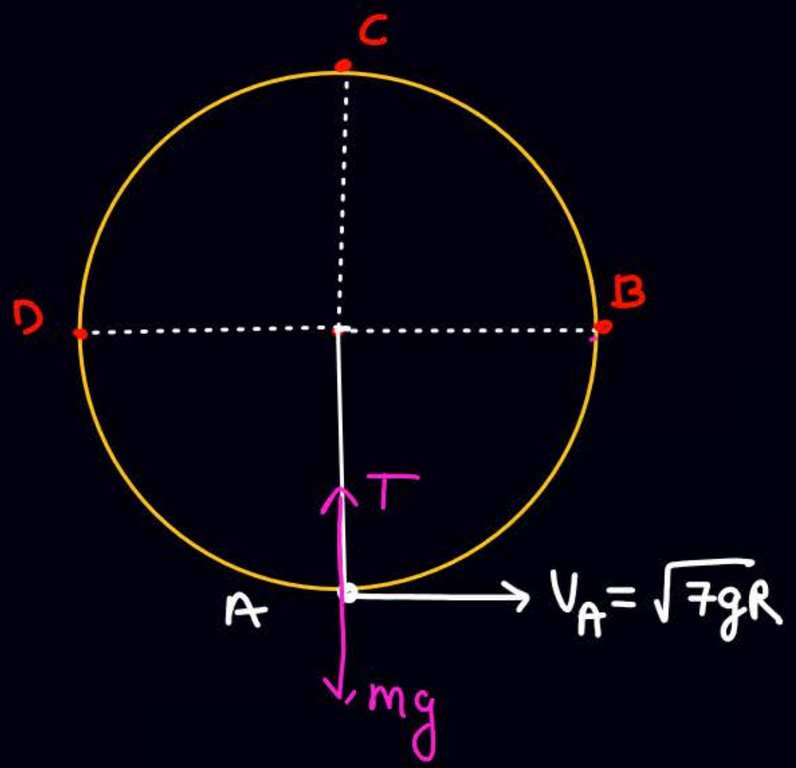


$$a_{centripetal} = \frac{V^2}{R} = \frac{7gR}{R} = 7g$$

$$a_t = 0$$

$$a_{net} = \sqrt{a_c^2 + a_t^2} = 7g$$

Q



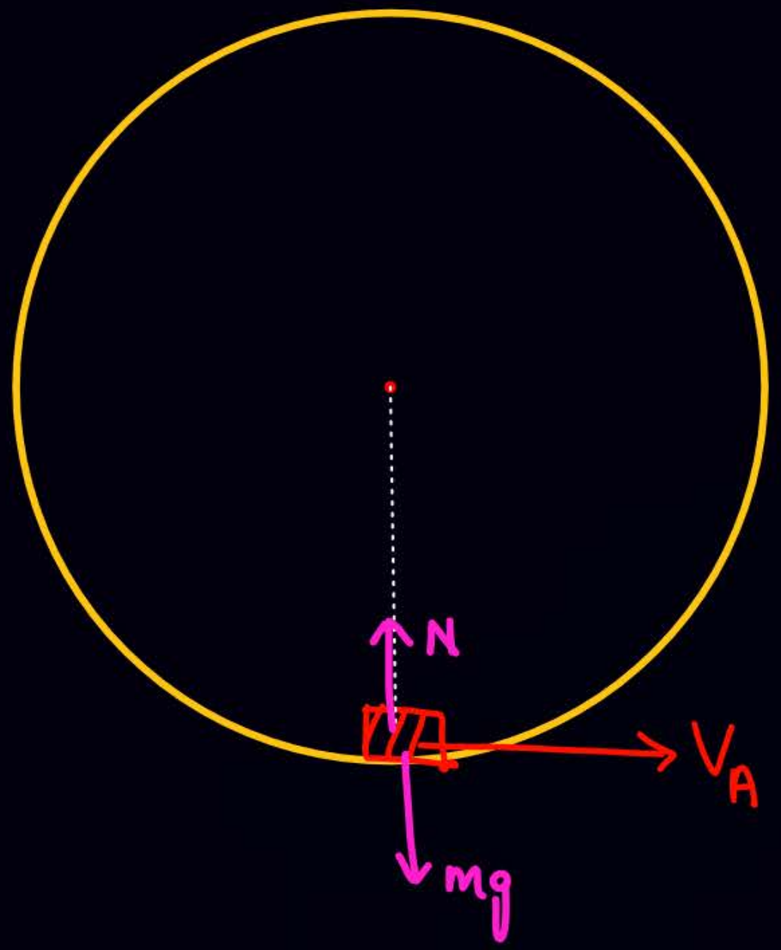
$$T - mg = \frac{m(7gR)}{R}$$

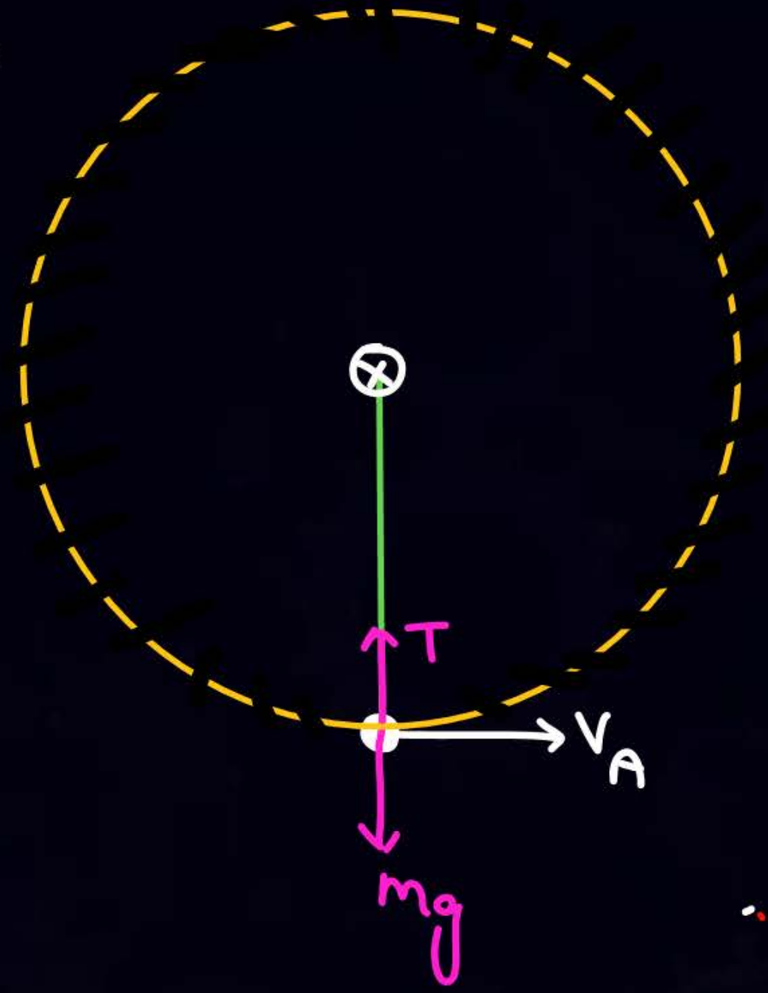
SKC box.

	v	T	a_t	$a_c = \frac{v^2}{R}$	a_{net}
A	$\sqrt{7gR}$	$8mg$	0	$7g$	$7g$
B	$\sqrt{5gR}$	$5mg$	g	$5g$	$g\sqrt{26}$
C	$\sqrt{3gR}$	$2mg$	0	$3g$	$3g$
D	$\sqrt{5gR}$	$5mg$	g	$5g$	$g\sqrt{26}$

In dono ques ki phy/maths same hai

$N \equiv T$





(gk)

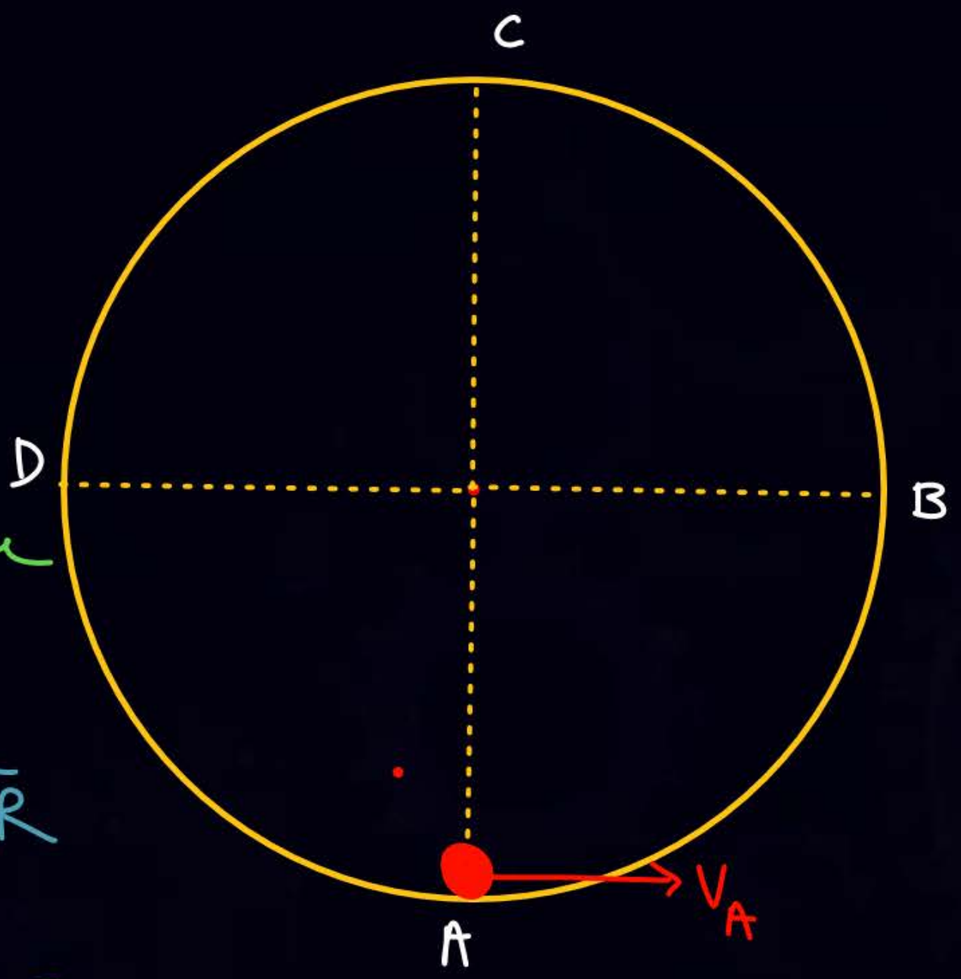
$V_A < 2gR$ ⟶ B तक नहीं पहुँचेगा
B से पहले $V=0$.

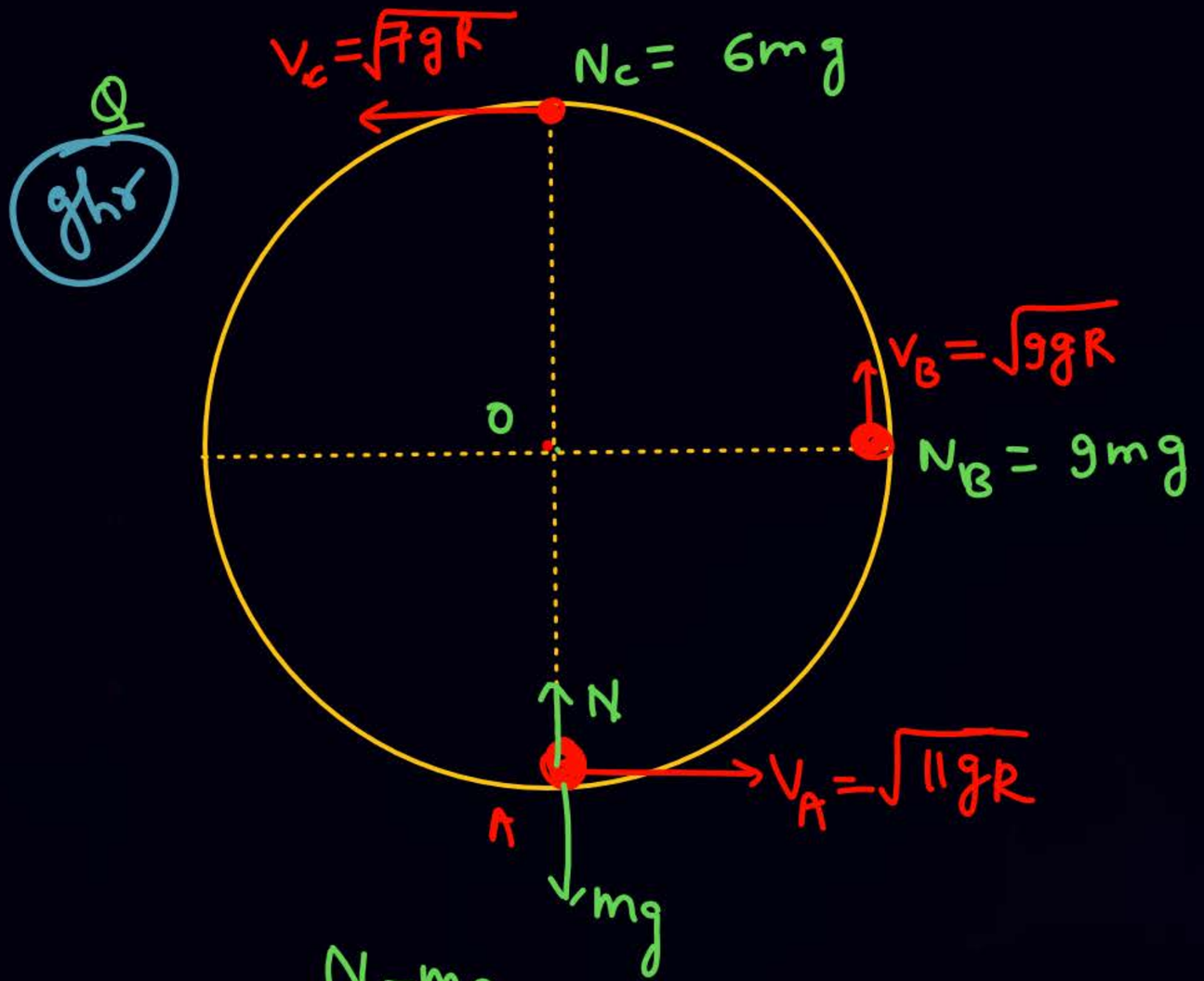
$V_A = \sqrt{2gR}$ ⟶ $V_B = 0$

$\sqrt{2gR} < V_A < \sqrt{5gR}$ ⟶ b/w B & C
$N=0$, उसके बाद projectile

$V_A = \sqrt{5gR}$ ⟶ IITJAT walla circle.
$N=0$, $V_C = \sqrt{gR}$

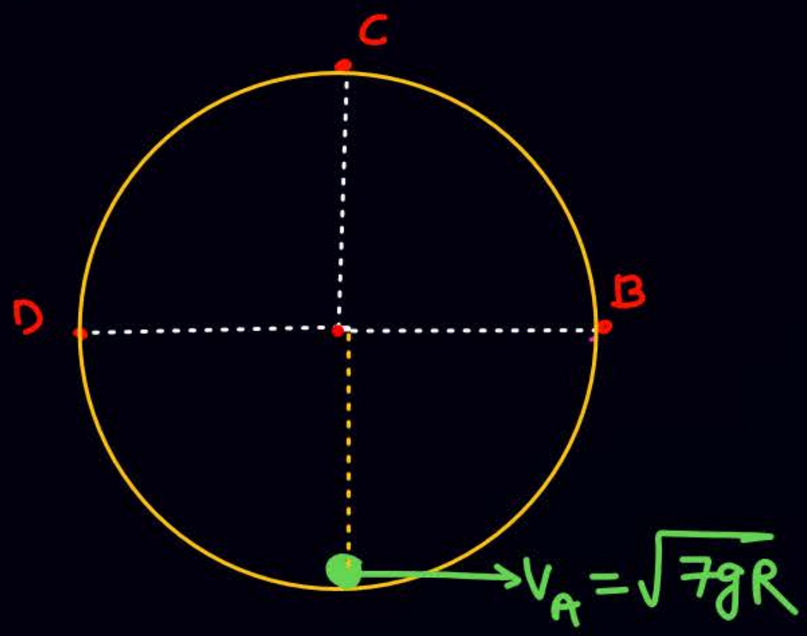
$V_A > \sqrt{5gR}$ ⟶ चम-चमाता।





$$N - mg = \frac{mV^2}{R} \Rightarrow N_A = 12mg$$

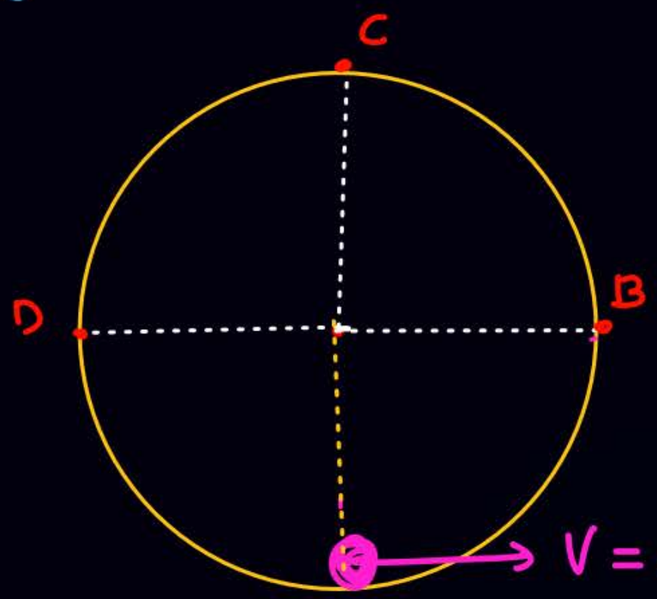
Thr Q Choice



SKC box.

	v	N	a_t	$a_c = \frac{v^2}{R}$	a_{net}
A	$\sqrt{7gR}$	$8mg$	0	$7g$	$7g$
B	$\sqrt{5gR}$	$5mg$	g	$5g$	$g\sqrt{26}$
C	$\sqrt{3gR}$	$2mg$	0	$3g$	$3g$
D	$\sqrt{5gR}$	$5mg$	g	$5g$	$g\sqrt{26}$

Choice Q ghar

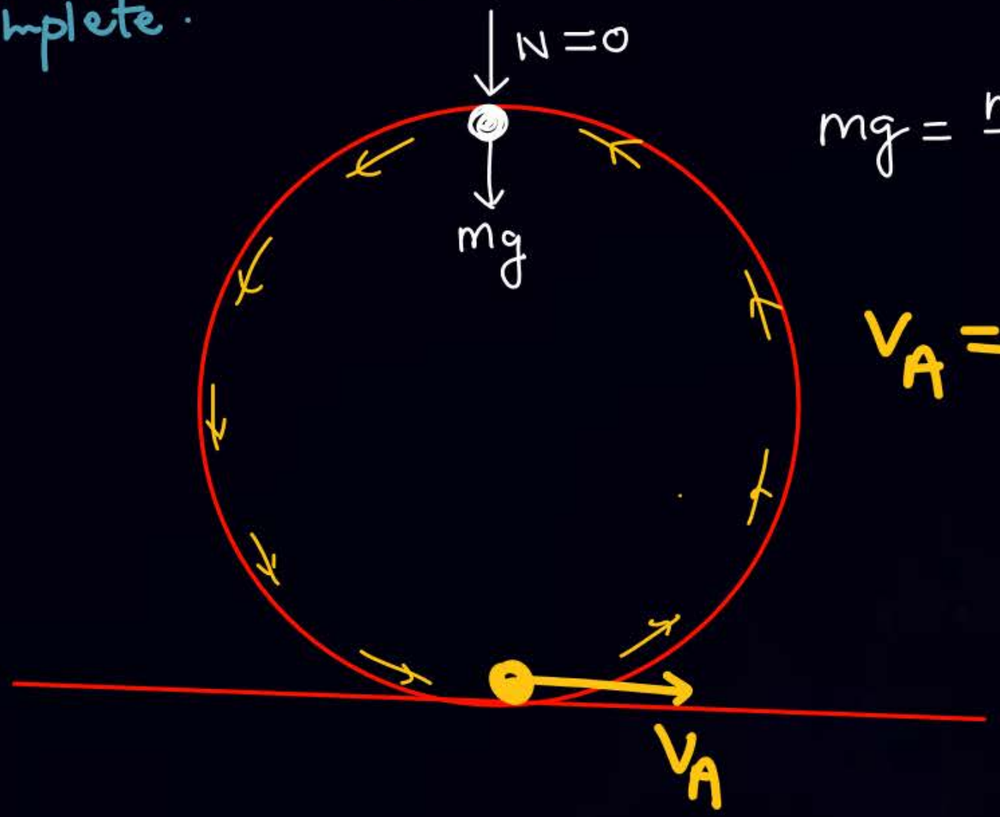


SKC box.

(समस्त वाला Table)

	v	N	a_t → same	$a_c=\frac{v^2}{R}$	a_{net}
A	$\sqrt{5gR}$	$6mg$	0	$5g$	$5g$
B	$\sqrt{3gR}$	$3mg$	g	$3g$	$g\sqrt{10}$
C	$\sqrt{gR}$	0	0	g	g
D	$\sqrt{3gR}$	$3mg$	g	$3g$	$g\sqrt{10}$

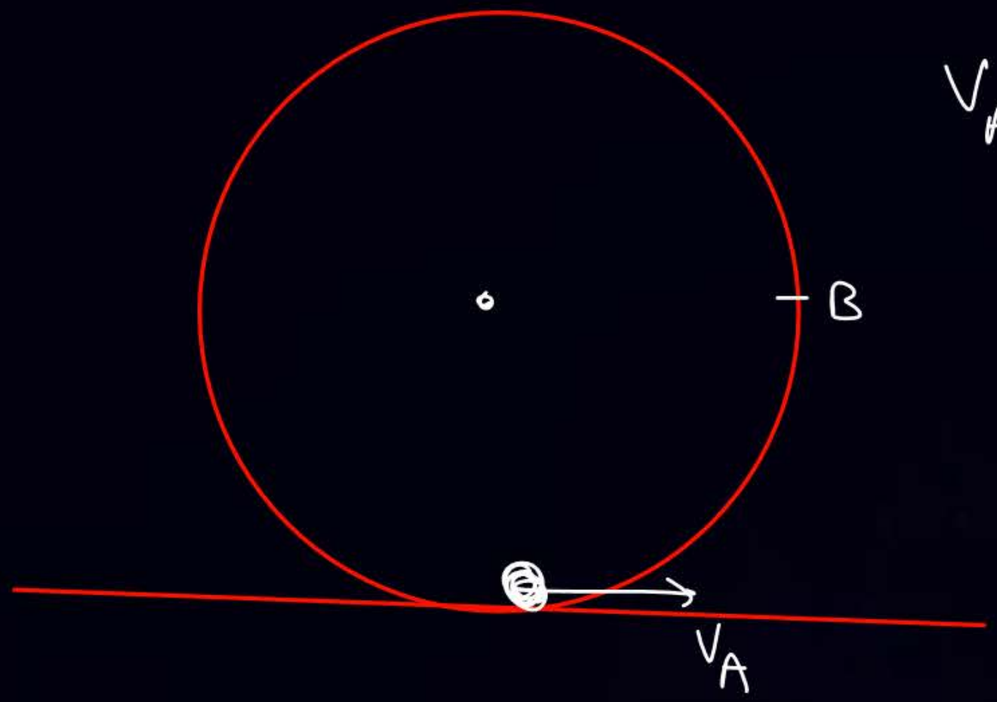
Q find min. velocity at A so that vertical circular circular motion complete.



$$mg = \frac{mV_c^2}{R}$$

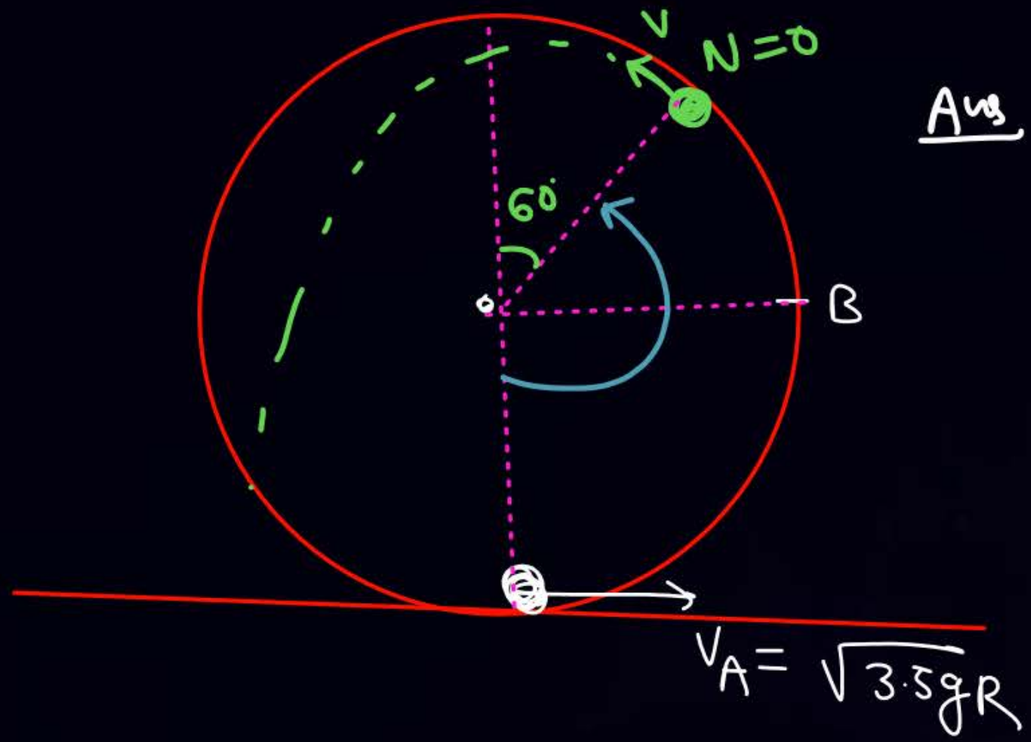
$$V_A = \sqrt{5gR}$$

Q find velocity at A so that particle reaches at B. complete.



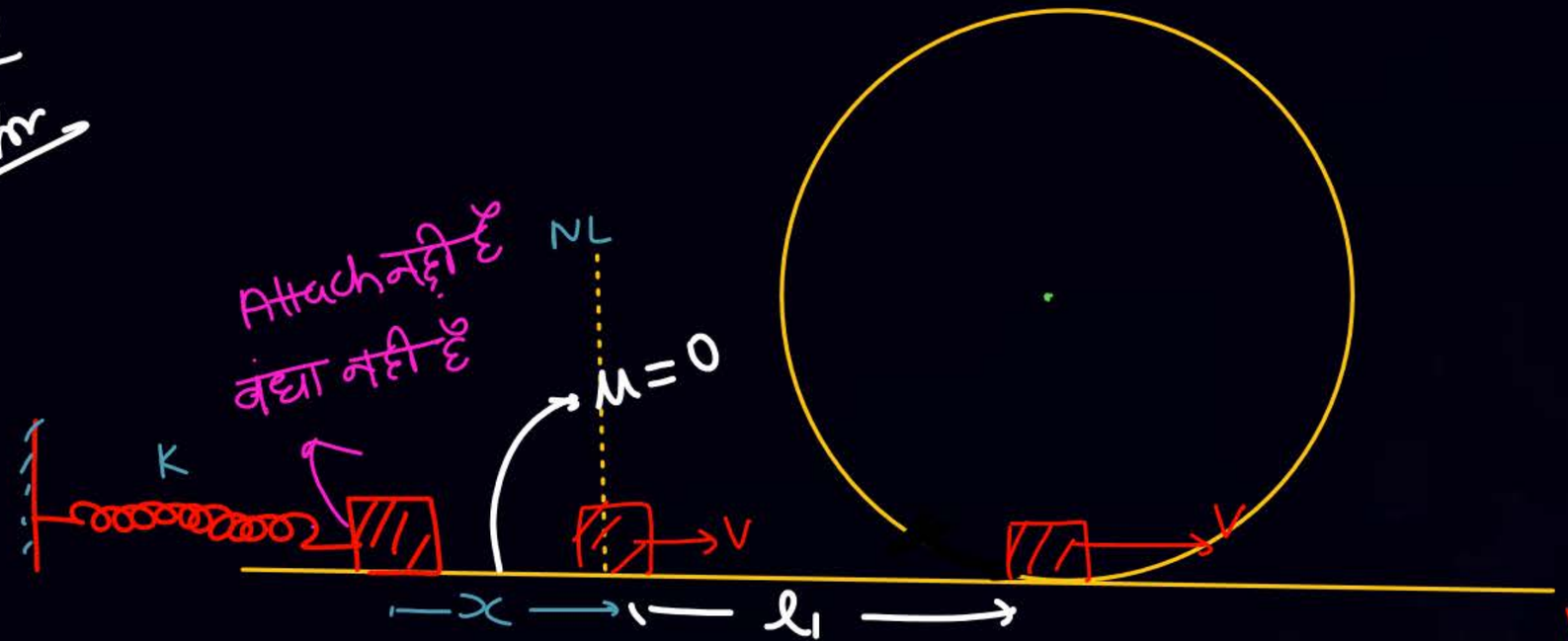
$$V_A = \sqrt{2gR}$$

Q find where $N = 0$, find angle rotated by radius vector before $N = 0$



Ans 120°

Q ghr



x_{min} So that particle complete V-C-M.

Sol' $W_g + W_{sp} + W_N = \Delta KE$

$0 - \frac{1}{2}k(0^2 - x^2) + 0 = \frac{1}{2}m(\sqrt{5gR})^2 - 0$

$x = \checkmark$

OR

$V = \sqrt{5gR}$

$\frac{1}{2}kx^2 = \frac{1}{2}mV^2 = \frac{1}{2}m(5gR)$

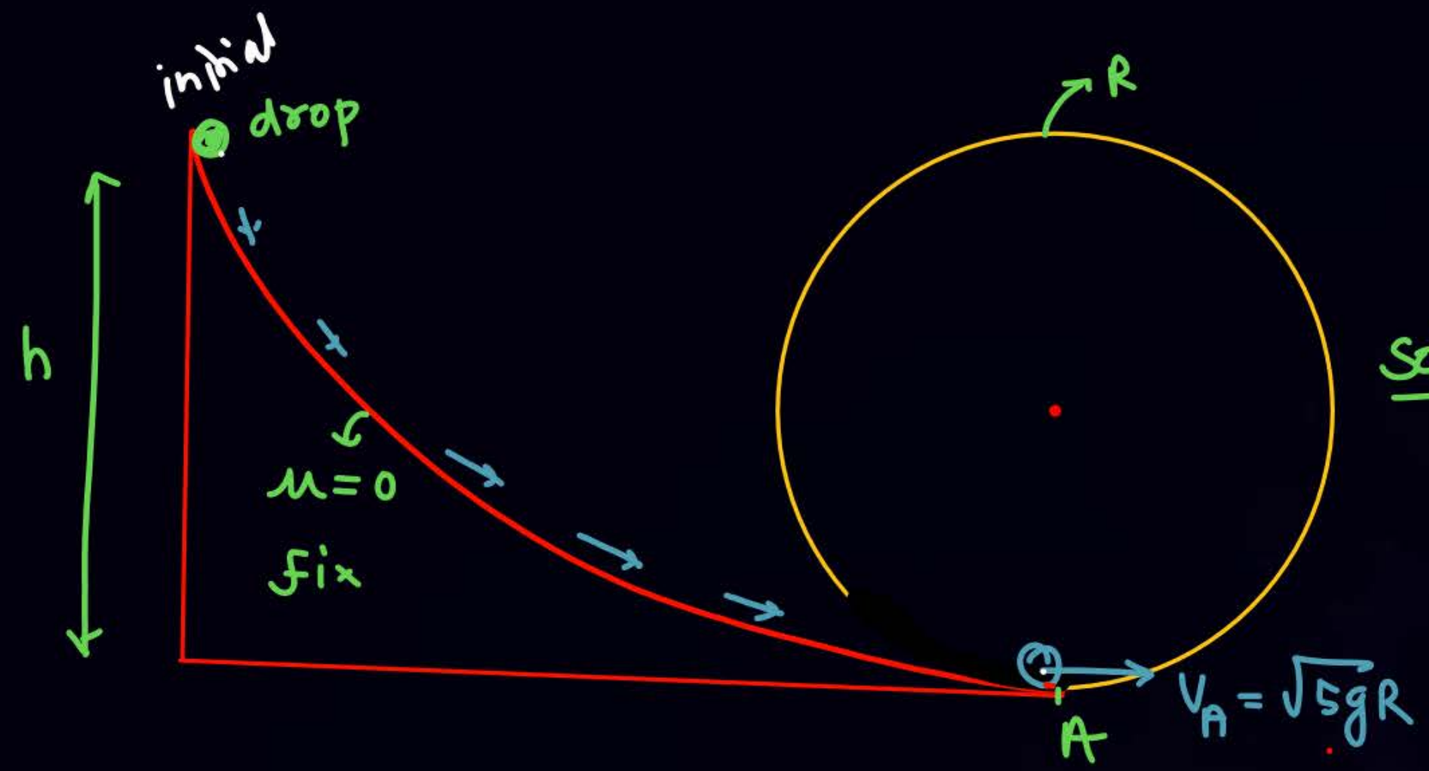
$x = \sqrt{\frac{5mgR}{k}}$

Repeat the last ques if $\mu \neq 0$, & circular part is frictionless

$$W_g + W_N + W_f + W_{sp} = \Delta KE = K_f - K_i$$

$$0 + 0 - \mu mg(l_1 + x) - \frac{1}{2}k(0^2 - x^2) = \frac{1}{2}m\left(\sqrt{5gR}\right)^2 - 0$$

Q



find h_{min} so that V.C.M. Complete

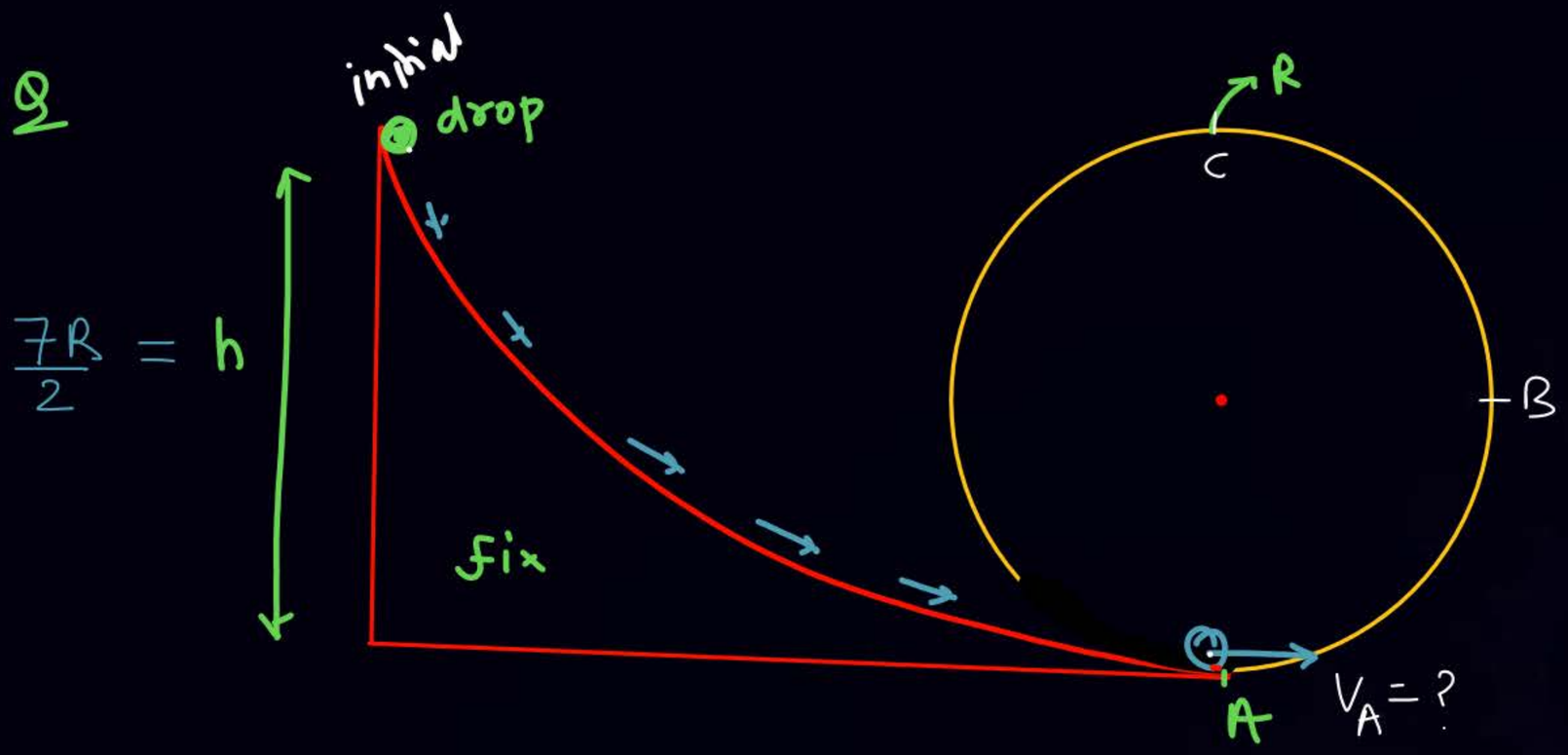
Sol^n $W_g + W_N = \Delta KE$

$mgh + 0 = \frac{1}{2}m(5gR) - 0$

$$h = \frac{5R}{2} = \frac{5d}{4}$$

(शिखर वाला circle (Daimuth) ∴ ∴ table)

Q



$\frac{7R}{2} = h$

WET

$mg\frac{7R}{2} + 0 = \frac{1}{2}mV_A^2 - 0$

$V_A = \sqrt{7gR}$

$V_B = \sqrt{5gR}$

$V_C = \sqrt{3gR}$

$N_A - mg = \frac{mV_A^2}{R}$

$N_A = mg + 7mg = 8mg$

$N_B = 5mg$

$N_C = 2mg$

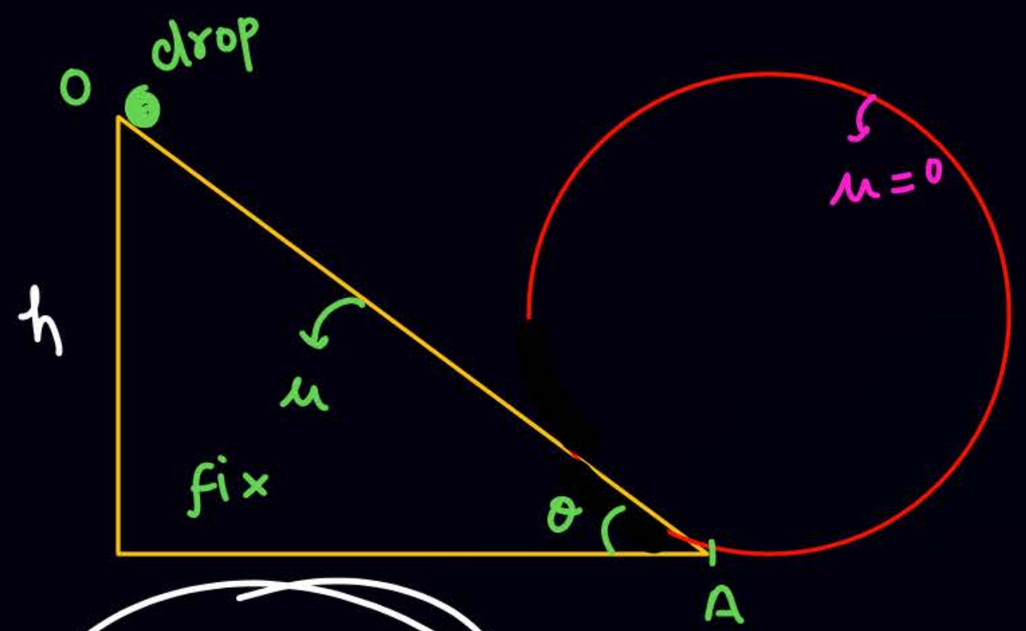
Q

$(V_A)_{min}$ so that V.C.M. completes

$(V_A)_{min} = \sqrt{5gR}$

Next class

Q



$OA = l$

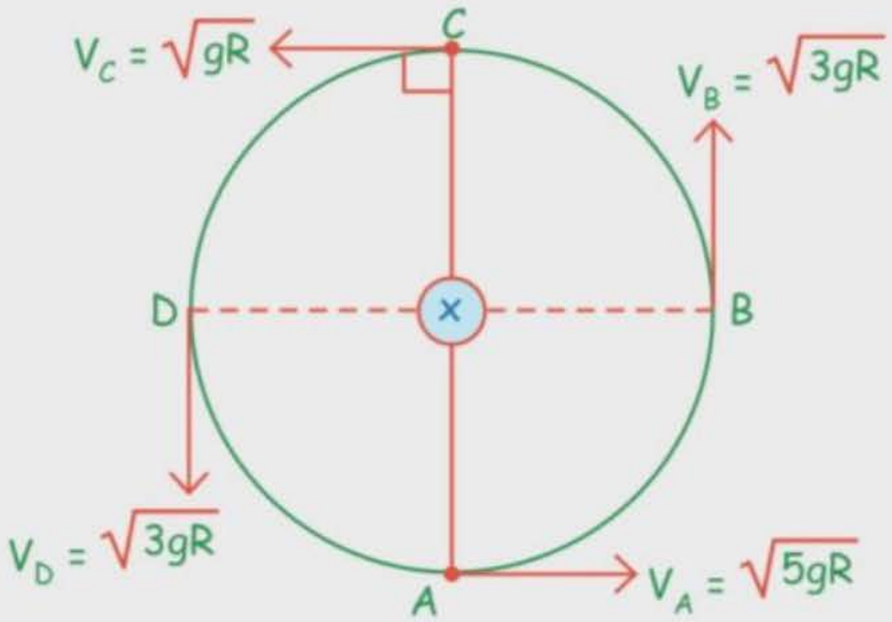
$l\sin\theta = h$

$$W_g + W_N + W_f = \Delta KE.$$

$$+mgh + 0 - \mu mg\cos\theta . l = \frac{1}{2}mv_A^2 - 0$$

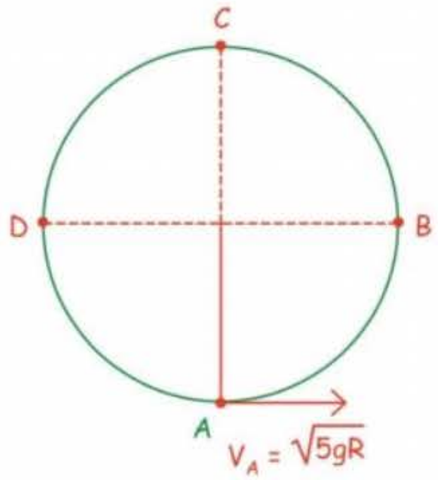
This is Very Important Part

Minimum velocity at A to complete vertical circular motion is $\sqrt{5gR}$, इस case मे remember हमने at highest point $T_c = 0$ किया, mg ने इज्जत बचाई, $V_b = \sqrt{3gR}$ और $V_c = \sqrt{gR}$



अब आपको हर point पर V, T, a_t, a_c निकालना आना चाहिए मै मस्त तरीके से हर एक-एक चीज को solve करके represent कर दे रहा हुँ plz इन्हे खुद से जरूर solve

Q. Find T, v, a_t, a_c, a_{net} at A, B, C, D points in given case.



Sol.

At point 'A'

★ $T_A - mg = \frac{mV_A^2}{R}$

$T_A - mg = \frac{m5gR}{R}$

$T_A = 6\ mg$

★ $a_c = \frac{V^2}{R} = \frac{5gR}{R} = 5g$

★ $a_t = 0$

★ $a_{net} = \sqrt{a_t^2 + a_c^2} = 5g$

★ $V_A = \sqrt{5gR}$

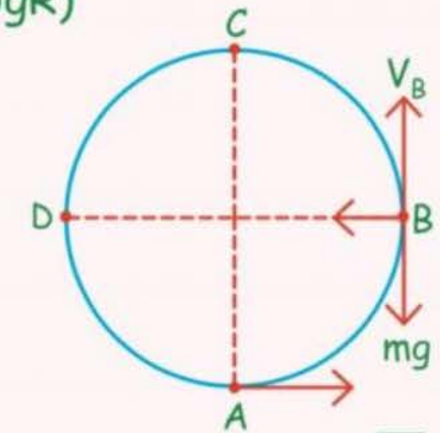
At point 'B' and 'D'

★ V_B : WET from $A \rightarrow B$

$w_g + w_T = \Delta KE$

$$-mgR + 0 = \frac{1}{2} mV_B^2 - \frac{1}{2} m(5gR)$$

$$V_B = \sqrt{3gR}$$



★ a_C : $\frac{V^2}{R} = \frac{\sqrt{(3gR)^2}}{R} = 3g$

★ $T_B = \frac{mV^2}{R} = \frac{m3gR}{R} = 3\,mg$

★ $mg = ma_t$

$a_t = g$ (downward)

★ $a_{net} = \sqrt{(3g)^2 + (g)^2} = g\sqrt{10}$

At point 'C'

★ V_C : apply WET from $A \rightarrow C$

$w_g + w_T = \Delta KE$

$-mg2R + 0 = \frac{1}{2} mV_C^2 - \frac{1}{2} m5gR;\ V_C = \sqrt{gR}$

★ $T_C : T + mg = \frac{mV^2}{R}$

$T + mg = \frac{mgR}{R} \Rightarrow T_C = 0$

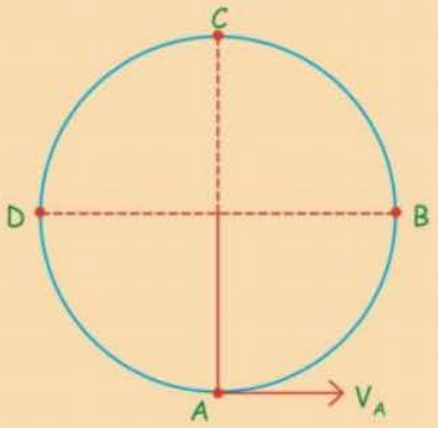
★ $a_C = \frac{V^2}{R} = \frac{gR}{R} = g$

★ $a_t = 0$

★ $a_{net} = \sqrt{(g)^2 + (0)^2} = g$

काम का डब्बा

Particle given horizontal velocity at A

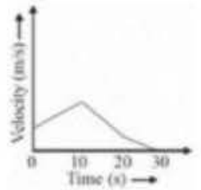


ये result जरूर याद कर लेना bcz इसके बाद आपको पहले से पता होगा की particle का motion क्या होगा।

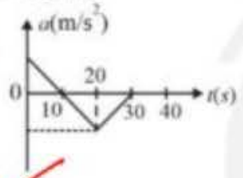
- $V_A < \sqrt{2gR}$ = particle comes to rest before 'B' (v = 0 between A & B)
- $V_A = \sqrt{2gR}$ = particle comes to rest at 'B'
- $V_A = \sqrt{5gR}$ = vertical circular motion just completed ($T_C = 0$, $V_C = \sqrt{gR}$)
- $V_A > \sqrt{5gR} \Rightarrow$ चमचमाता vertical circular motion चमचमाता $T_C \neq 0$
- $\sqrt{2gR} < V_A < \sqrt{5gR} \Rightarrow$ somewhere between B & C, T will zero and subsequently motion will be projectile.

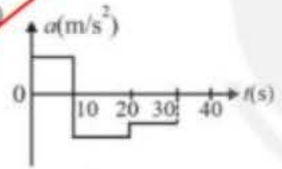
Yakeen NEET 2.0 (2026) Rank Booster Test

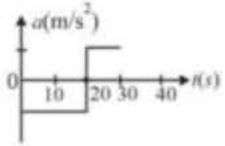
Q1 The graph shown in the figure shows the variation of velocity v with time t for a moving body.

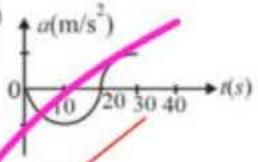


Which of the following graphs **correctly** represents the corresponding acceleration (a) - time (t) graph?

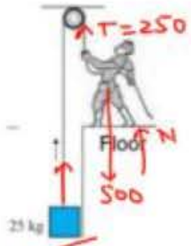
(1)


(2)


(3)


(4)


Q2 As shown in the diagram, a 50 kg man is pulling a 25 kg block using a light rope. The rope passes over a frictionless, ideal pulley. Assuming the block is being lifted at a constant velocity, what is the magnitude of the normal force exerted by the floor on the man? (Use $g = 10\ m/s^2$).

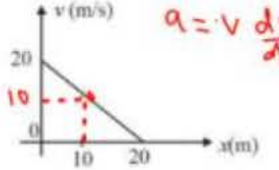


(1) 250 N
(2) 500 N
(3) 750 N
(4) 1000 N

Q3 A thin vertical circular loop of radius R rotates about its vertical diameter with a constant angular frequency ω. A small bead on the frictionless loop finds a equilibrium position w.r.t to frame of circular loop. If the angular frequency is $\omega = \left(\sqrt{\frac{2g}{R}}\right)$, what is the angle made by the radius vector (joining the center to the bead) with the vertical?

(1) 0°
(2) 30°
(3) 45°
(4) 60°

Q4 An object is on a one-way trip down a straight road. The graph below shows its speed getting slower the farther it travels. The object starts with an initial speed of 20 m/s and comes to a stop after travelling 20 meters.



Calculate the object's acceleration precisely when it crosses the 10-meter mark.

(1) $-4.6\ m/s^2$
(2) $-6.8\ m/s^2$
(3) $-10\ m/s^2$
(4) $-12\ m/s^2$

Q5 A coin is released from rest (relative to the lift) from a height h above the lift floor and it reaches the lift floor in three situations:
(i) the lift is at rest — time of fall t_1.
(ii) the lift moves upward with constant velocity — time of fall t_2.
(iii) the lift accelerates upward with constant acceleration a — time of fall t_3.
Neglect air resistance. Which relation between the times is **correct**?
(1) $t_1 = t_2 > t_3$ (2) $t_1 > t_2 = t_3$
(3) $t_2 > t_1 = t_3$ (4) $t_1 = t_2 < t_3$

Q6 A particle moves along a straight line with initial speed 11 ms^{-1} and a uniform retardation 2 ms^{-2}. The distance travelled in the 6^{th} second is:
(1) 0 m (2) 0.25 m
(3) 0.50 m (4) 1.0 m

Q7 The equation of a projectile's trajectory is given by $y = x - \left(\frac{x^2}{80}\right)$. All units are in S.I. and the acceleration due to gravity is $g = 10\ m/s^2$. Match **List-I** with **List-II:**

	List-I (Parameter)	List-II (Value in S.I unit.)	
(A)	Angle of projection	(I)	4
(B)	Initial speed (u)	(II)	$\frac{\pi}{4}$
(C)	Time of flight (T)	(III)	20
(D)	Maximum height (H)	(IV)	$20\sqrt{2}$

Choose the **correct** answer from the options given below:
(1) A-II, B-IV, C-I, D-III
(2) A-II, B-I, C-IV, D-III
(3) A-I, B-IV, C-II, D-III
(4) A-II, B-IV, C-III, D-I

Q8 A particle is moving with velocity $\vec{v} = K\left(y\hat{i} + x\hat{j}\right)$, where K is a positive constant. The general equation for its path is:
(1) $y = x^2 + c$ (2) $y^2 = x^2 + c$
(3) $y = x + c$ (4) $xy = c$

Q9 Some statements are given below:
Statement I: The number 4.9×10^{15} has an order of magnitude of 15.
Statement II: The order of magnitude of number 98,000 is 5.
Statement III: The order of magnitude for the number 0.00071 is −3.
Which of the following options is **correct**?
(1) Only Statement I is correct.
(2) Statements I and II are correct.
(3) Statements II, and III are correct.
(4) All statements are correct.

Q10 The momentum of a moving body is increased by 1% while its mass is simultaneously decreased by 2%. The kinetic energy of the body will:
(1) increase by 4%.
(2) decrease by 4%.
(3) increase by 3%.
(4) remain unchanged.

Q11 Water drops fall from a leaky tap at regular time intervals. At the exact moment the 5^{th} drop begins to fall, the 1^{st} drop hits the ground. If the distance between the 2^{nd} and 3^{rd} drops is measured to be h, what is the total height from the tap to the ground?
(1) $4h$ (2) $5h$
(3) $\left(\frac{9}{4}\right)h$ (4) $\left(\frac{16}{5}\right)h$

Q12 A metal cube is cooled, causing its each side length to contract to length 0.998 meter. Using the binomial approximation, what is the approximate volume of the cooled cube in cubic meter?
(1) 0.998 (2) 0.994
(3) 1.006 (4) 0.996

Q13 The position vector of a particle $\vec{R}$ as a function of time t is given by $\vec{R} = 5\cos(\pi t)\,\hat{i} + 5\sin(\pi t)\,\hat{j}$, where $\vec{R}$ is in meters and t is in seconds. Which one of the following statements is **wrong** for the motion of the particle?

(1) Path of the particle is a circle of radius 5 m.

(2) Acceleration vector is along $\vec{R}$.

(3) Magnitude of the acceleration vector is $5\pi^2$ m/s^2.

(4) Magnitude of the velocity of the particle is 5π m/s.

Q14 A car has an initial momentum of 25,000 kg m/s. After the driver applies the brakes, the car's momentum is reduced to 20,000 kg m/s. The final momentum is what percentage of the initial momentum?

(1) 20% (2) 75%

(3) 80% (4) 125%

Q15 A ball is thrown straight up. It passes a window at 40 meters high. The time interval between the ball passing the window on its way up and on its way back down is 2 seconds. What was the ball's initial launch speed from the ground?

(Use $g = 10$ m/s^2)

(1) 30 m/s (2) $25\sqrt{2}$ m/s

(3) 35 m/s (4) 40 m/s

Q16 A projectile is launched with a speed of 50 m/s at an angle of 37° to the horizontal. At which of the following pairs of times will it be at the same height?

(Use $g = 10$ m/s^2, $\sin(37°) = 0.6$)

(1) $t_1 = 2.5$ s, $t_2 = 4.5$ s

(2) $t_1 = 1.5$ s, $t_2 = 3.5$ s

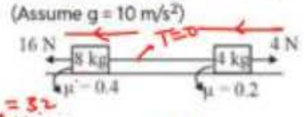
(3) $t_1 = 2.0$ s, $t_2 = 4.0$ s

(4) $t_1 = 2.0$ s, $t_2 = 5.0$ s

Q17 Two blocks, with masses of 8 kg and 4 kg, are placed on a horizontal surface and connected by a massless string. The coefficients of friction are 0.4 and 0.2, respectively, as shown in the diagram. A force of 16 N is applied to the left on the 8 kg block, and a force of 4 N is applied to the right on the 4 kg block.

What is the tension in the string?

(Assume g = 10 m/s^2)



(1) 10 N

(2) 16 N

(3) 0 N

(4) 4 N

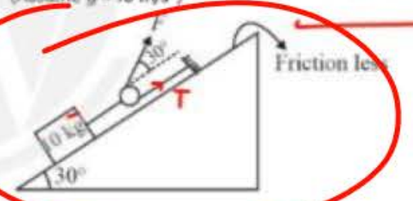
Q18 An aeroplane is flying horizontally with a velocity of 600 km/h at a height of 1960 m. When it is vertically above a point A on the ground, a bomb is released from it. The bomb strikes the ground at point B. The distance AB is: (Take $g = 9.8$ m/s^2)

(1) 3.33 km (2) 33.3 km

(3) 0.33 km (4) 6.0 km

Q19 What is the approximate minimum value of force F needed to begin moving a 10 kg block up a 30° frictionless incline plane?

(Assume $g = 10$ m/s^2)



(1) 75.6 N (2) 27 N

(3) 35.2 N (4) 40 N

Q20 A particle moves in the x-y plane with a constant acceleration $\vec{a} = \left(2\hat{i} - 4\hat{j}\right)$ m/s^2. At $t = 0$, the particle is at the origin with an initial velocity $\vec{v}_0 = \left(8\hat{i} + 12\hat{j}\right)$ m/s. The time instant when the particle velocity in the y-direction is zero is :

(1) 2 s (2) 3 s

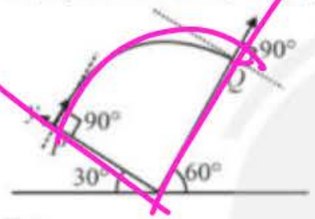
(3) 4 s (4) 6 s

Q21 A swimmer wishes to cross a river. If he crosses the river in minimum time, he takes 24 seconds

with a drift of 144 m. If he crosses the river taking the shortest route, he takes 30 seconds. What is his swimming speed in still water? (Assume constant swimming speed in both cases)

(1) 10 m/s (2) 6 m/s
(3) 8 m/s (4) 12 m/s

Q22 Two inclined planes, with angles of 30° and 60°, are placed touching each other at the base as shown. A projectile is launched from point P on the 30° incline with an initial speed of $10\sqrt{3}$ m/s. The projectile is launched perpendicular to the 30° incline and later hits the 60° incline at point Q at a perpendicular angle. What is the total time the projectile is in the air? (Assume g = 10 m/s²)



(1) 2 s
(2) 4 s
(3) 1 s
(4) 6 s

Q23 Given the vectors $\vec{A} = \hat{i} + \hat{j}$ and $\vec{B} = \hat{j} + \hat{k}$. Which of the following is a unit vector perpendicular to both $\vec{A}$ and $\vec{B}$?

(1) $\frac{1}{\sqrt{3}}\left(\hat{i} - \hat{j} + \hat{k}\right)$
(2) $\hat{i} - \hat{j} + \hat{k}$
(3) $\frac{1}{\sqrt{6}}\left(\hat{i} + 2\hat{j} + \hat{k}\right)$
(4) $\frac{1}{\sqrt{2}}\left(\hat{i} + \hat{j}\right)$

Q24 A particle moves in a straight line under an acceleration that varies with time. Its velocity-time graph is shown in the figure below. Based on the graph, analyze the following statements. (Use tan(37°) = $\frac{3}{4}$ and tan(53°) = $\frac{4}{3}$)

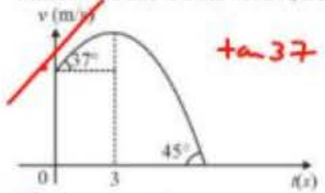
Statements:

I. The initial acceleration of the particle is $\left(\frac{4}{3}\right)$ m/s².

II. The acceleration of the particle is zero at $t = 3$ s.

III. The acceleration between 0 to 3 sec is positive and beyond 3 sec is negative.

Which of the above statements is/are **correct**?



(1) I and III only
(2) I and II only
(3) II and III only
(4) All are correct

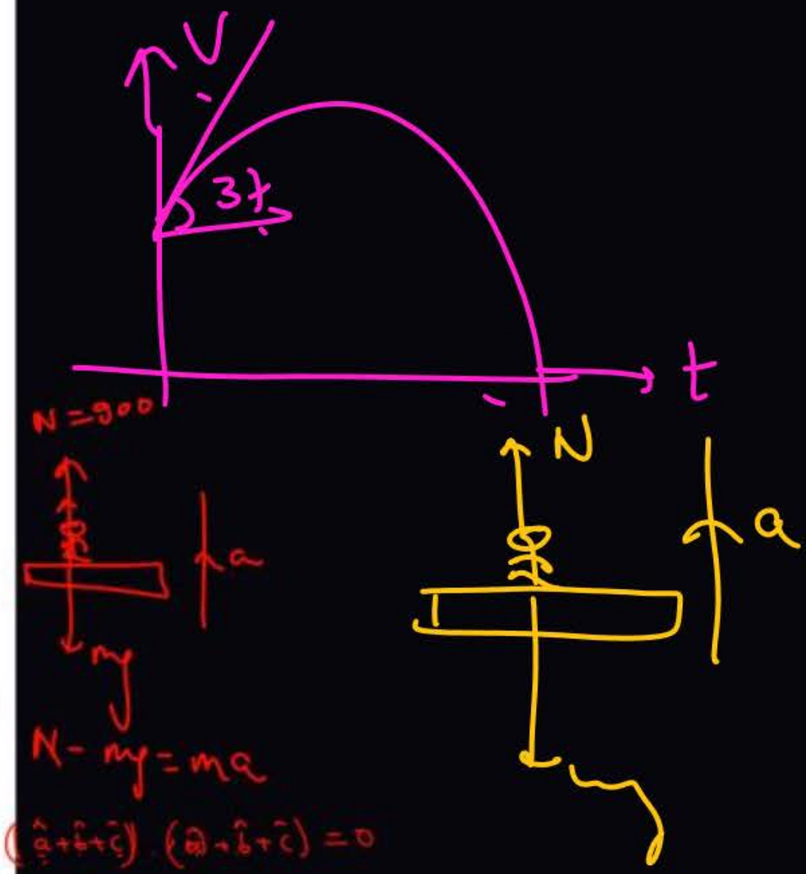
Q25 An astronaut with a mass of 75 kg stands on a digital scale inside a spacecraft. During a vertical launch, the spacecraft moves upwards with a constant acceleration. The scale shows a constant reading of 900 N. What is the acceleration of the spacecraft? (Use $g = 10$ m/s²)

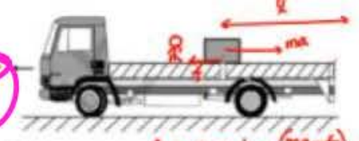
(1) 1.5 m/s² (2) 2.0 m/s²
(3) 2.5 m/s² (4) 12.0 m/s²

Q26 If $\hat{a}$, $\hat{b}$, and $\hat{c}$ are three unit vectors such that $\hat{a} + \hat{b} + \hat{c} = \vec{0}$ then the value of $\left(\hat{a} \cdot \hat{b}\right) + \left(\hat{b} \cdot \hat{c}\right) + \left(\hat{c} \cdot \hat{a}\right)$ is:

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

Q27 The rear side of a truck is open and a box of 40 kg mass is placed on the truck bed, 5 m away from the open end. The coefficient of friction between the box and the truck surface is 0.15. Starting from rest, the truck accelerates on a straight road at 2 m/s². What is the distance the truck travels by the time the box falls off the rear end? (Ignore the size of the box and use $g = 10$ m/s²)



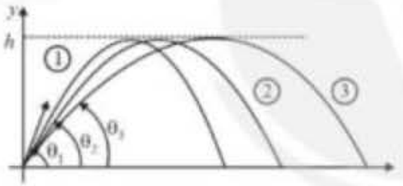


(1) 15 m
(2) 20 m
(3) 25 m
(4) 40 m

Q28 The velocity of a particle is given by $v = v_0 \sin(\omega t)$ m/s, (where t is time in second) where v_0 is a constant and $\omega = \frac{\pi}{2}$ rad/s. If the particle is at the origin at $t = 0$, its average velocity over the time interval from $t = 0$ to $t = 1$s is:

(1) $\frac{v_0}{\pi}$ m/s
(2) $\frac{2v_0}{\pi}$ m/s
(3) $\frac{v_0}{2}$ m/s
(4) $\frac{\pi v_0}{2}$ m/s

Q29 The figure shows three different flight paths for a ball projected from ground level. We can ignore the effects of air resistance. Analyze the following statements regarding the three paths shown.



Statements:

I. The time of flight is the same for all three paths.
II. The initial speed of projection is greatest for path 3.
III. The horizontal velocities are the same for all.

Which of the above statements is/are **correct**?

(1) I and II only
(2) I and III only
(3) II and III only
(4) All are correct

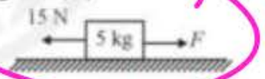
Q30 A block of mass m is placed on a rough surface whose equation is given by $y = \frac{x^3}{24}$. If the coefficient of friction is 0.5, the maximum vertical height above the ground (at origin) at which the block can be placed without slipping is: (consider region $x > 0$)

(1) $\frac{1}{12}$ m
(2) $\frac{1}{8}$ m
(3) $\frac{1}{4}$ m
(4) $\frac{1}{3}$ m

Q31 On a two-lane road, car A is travelling with a constant speed of 36 km/h. Car B is travelling behind car A in same lane and direction. Simultaneously car C is in the adjacent lane, travelling head on towards car A. Each has a speed of 54 km/h. At a certain instant, the distance AB is equal to the distance AC, both being 1 km. Car B decides to accelerate to overtake car A before meeting the on coming car C. What is the minimum acceleration of car B required to avoid an accident?

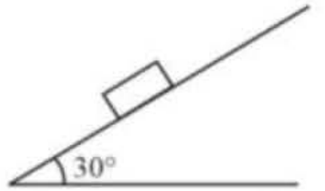
(1) 0.5 m/s^2
(2) 1.0 m/s^2
(3) 1.5 m/s^2
(4) 2.0 m/s^2

Q32 A block of mass 5 kg is placed on a horizontal surface. The coefficient of static friction between the block and the surface is $\mu = 0.2$. A constant force of 15 N is applied to the block towards the left, and a variable force F is applied towards the right, as shown in the diagram below. For the block to remain at rest, what are the maximum and minimum possible values of the force F? (Use $g = 10$ m/s^2)



(1) 15 N, 10 N
(2) 25 N, 5 N
(3) 30 N, 25 N
(4) 45 N, 25 N

Q33 A block is placed on a rough plane inclined at an angle of 30°. It is observed that the maximum force that can be applied down along the incline without the block moving is 2 N. Furthermore, the maximum force that can be applied up and along the incline without the block moving is 10 N. What is the coefficient of static friction between the block and the plane? (Take $g = 10$ m/s^2)

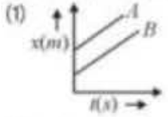


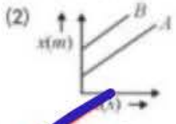
(1) $\frac{1}{2}$ (2) $\frac{\sqrt{3}}{2}$
(3) $\frac{\sqrt{3}}{4}$ (4) $\frac{2}{3}$

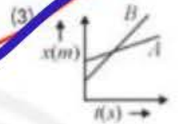
Q34 The position of a particle at time t is given by the equation $x(t) = \left(\frac{V_0}{\alpha}\right)(1 - e^{-\alpha t})$, where V_0 is a constant and $\alpha > 0$. The dimensions of V_0 and α are respectively:
(1) $[LT^{-1}]$ and $[T^{-1}]$
(2) [L] and [T]
(3) $[LT^{-1}]$ and [T]
(4) [L] and $[T^{-1}]$

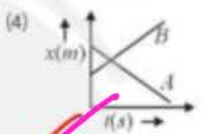
Q35 Identify the **correct** statements from the following:
I. The dot product of a vector with itself gives the square of its magnitude.
II. The cross product of two non-zero parallel vectors is a unit vector perpendicular to their plane.
III. The projection of vector $\vec{A}$ on vector $\vec{B}$ is given by $\frac{\vec{A}\cdot\vec{B}}{|\vec{A}|}$.
Choose the **correct** option:
(1) I only
(2) I and II only
(3) II and III only
(4) All are correct

Q36 The measured diameter of a rod is 3.14 cm. It is measured with a vernier caliper of LC 0.01 cm (without zero error). If the coinciding vernier division is 4, what is the main scale reading?
(1) 3.06 cm (2) 3.1 cm
(3) 3.08 cm (4) 3.0 cm

Q37 Two cyclists, Chloe (A) and David (B), are riding in the same direction along a straight line path from different starting position. David is riding at a faster constant velocity than Chloe ($v_{david} > v_{chloe}$). Which of the following position-time graphs **correctly** depicts their motion?
(1) 

(2) 

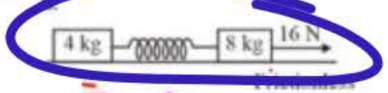
(3) 

(4) 

Q38 A firework is launched vertically upward into the air. Its height, h (in meter), after t second is described by the function $h(t) = 80t - 10t^2$. What is the time t at which the firework reaches its maximum height before exploding?
(1) 2 second (2) 4 second
(3) 8 second (4) 10 second

Q39 A rescue worker with a mass of 80 kg is being lifted from a deep hole by a cable that can withstand a maximum tension of 1000 N. In which of the following cases will the cable be at risk of breaking? (Use $g = 10\ m/s^2$)
(1) The worker is lifted upwards with an acceleration of $2.0\ m/s^2$.
(2) The worker is lifted upwards with an acceleration of $1.8\ m/s^2$.
(3) The worker is lifted upwards at a constant speed of 3 m/s.
(4) The worker is lifted upwards with an acceleration of $3.0\ m/s^2$.

Q40 Two blocks of masses 4 kg and 8 kg are connected with massless spring as shown. If the acceleration of 4 kg block is 2 m/s^2 towards right then the acceleration of 8 kg block at this instant is



(1) 4 m/s^2 (2) 2 m/s^2
(3) 1 m/s^2 (4) 6 m/s^2

Q41 A calorie is a unit of heat equal to approximately 4.2 J, where 1 J = 1 kg m^2 s^{-2}. Suppose we employ a new system of units in which the unit of mass is α kg, the unit of length is β m, and the unit of time is γ s. What is the magnitude of one calorie when expressed in this new system of units?

(1) 4.2 $\alpha\beta^2\gamma^{-2}$
(2) 4.2 $\alpha^{-1}\beta^{-2}\gamma^2$
(3) 4.2 $\alpha\beta\gamma$
(4) 4.2 $\alpha^{-1}\beta^2\gamma^{-2}$

Q42 In an experiment to determine the acceleration due to gravity (g), the period of a simple pendulum is given by the formula $T = 2\pi\sqrt{\frac{L}{g}}$. A student measures the length of the pendulum (L) to be 50.0 cm using a meter stick with an accuracy of 2 mm. The time for 50 oscillations is recorded as 100 s using a stopwatch with a resolution of 1 s. What is the maximum percentage error in the determination of g from this experiment?

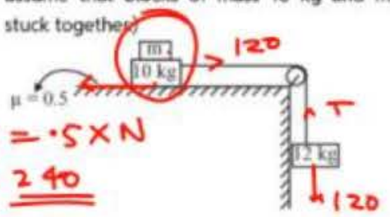
(1) 2.0% (2) 2.4%
(3) 2.8% (4) 4.4%

Q43 A substance mass 3.939 g. If its density is 1.1 g/cm^3, what is its volume reported to the **correct** number of significant figures?

(1) 3.5809 cm^3 (2) 3.581 cm^3
(3) 3.58 cm^3 (4) 3.6 cm^3

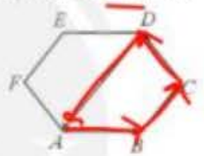
Q44 In the system shown in the figure, a block of mass 10 kg rests on a horizontal surface with a coefficient of static friction $\mu = 0.5$. A second block of mass m is placed on top of it. A light string connects the 10 kg block to a hanging block of mass 12 kg.

What is the minimum value of mass m required to keep the system stable? (Use $g = 10$ m/s^2, Let us assume that blocks of mass 10 kg and m are stuck together)



(1) 0 kg (2) 8 kg
(3) 14 kg (4) 6 kg

Q45 For a regular polygon *ABCDEF*, what is the resultant of the vectors represented by the expressions $\overrightarrow{AB} + \overrightarrow{BC} + \overrightarrow{CD} + \overrightarrow{DA}$?



(1) $\overrightarrow{AC}$
(2) $\overrightarrow{AD}$
(3) $2\overrightarrow{AD}$
(4) The null vector

Q46 The Henry's law constant for the solubility of N_2 gas in water at 298 K is 1×10^6 atm. The mole fraction of N_2 in air is 0.4. The number of moles of N_2 gas dissolved in 180 g of water at 298 K and 5 atm pressure is:

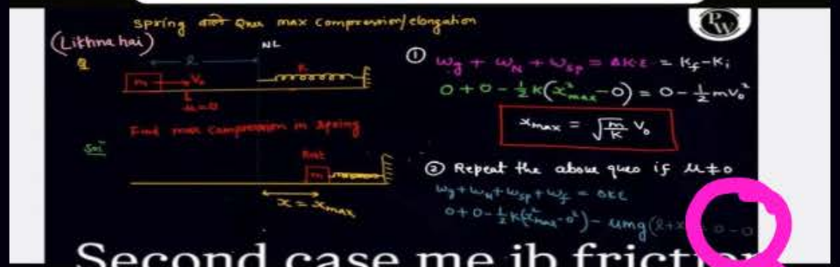
(1) 2×10^{-5}
(2) 4×10^{-5}
(3) 2×10^{-4}
(4) 4×10^{-7}

Q47 An ideal gas is taken around the cycle ABCA as:

8:49

Please explain 🙏

@SALEEM.NITT



Second case me jb friction ko consider krenge to sir initial speed v not thi vo nhi likhi jaayegi 🙏 explain sir

@SALEEM.NITT

Add to your story

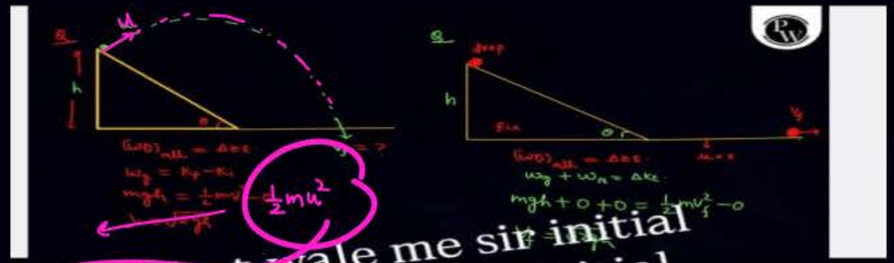
Send message...

Correction

8:49

@SALEEM.NITT

Sir please explain 🙏



First wale me sir initial velocity hai to initial speed bhi hogi to v final ka maan root u2+2gh hoga sir please explain 🙏

@SALEEM.NITT

Add to your story

Send message...

Homework

- Solve yesterday test paper again.

THANK YOU