ARJUNA NEET BATCH

KINEMATICS

LECTURE - 11

MR*

NEET

Todays goal

- Motion under gravity
- Ground to ground
- Height to ground
- Mokshi (MR*)

Today's GOAL

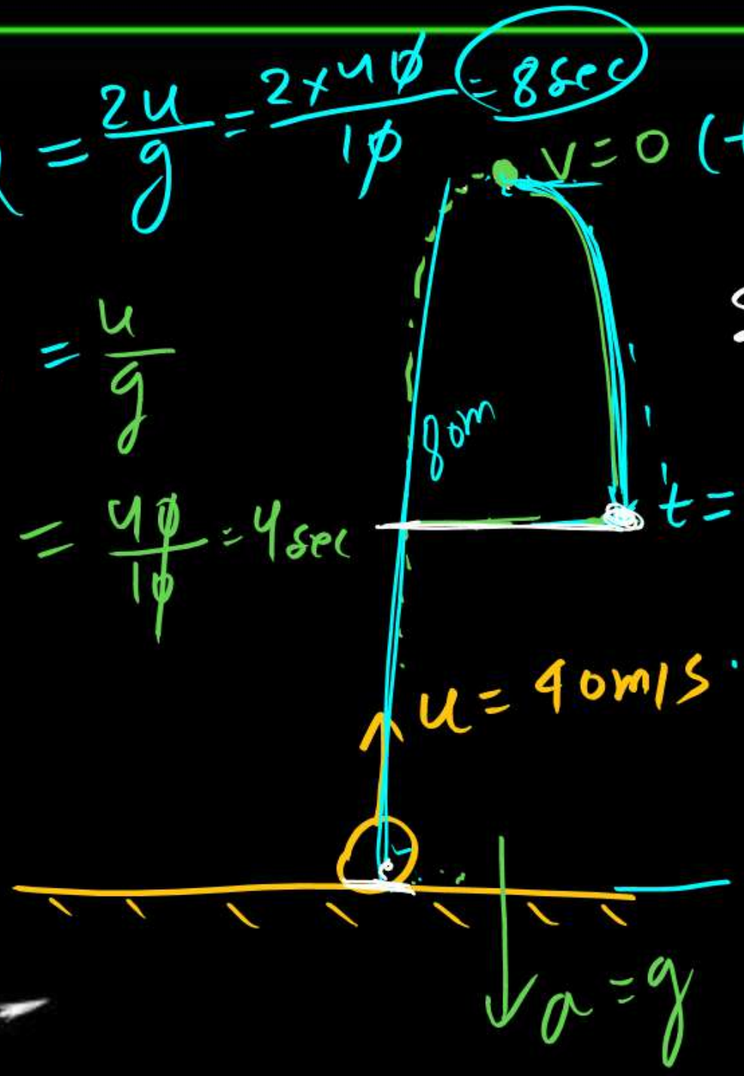
MOTION UNDER GRAVITY

Object is projected with 40 m/s then find average speed and velocity in 6 sec.

T_{Avg}

$T_{Total} = \frac{2u}{g} = \frac{2\times 40}{10} = 8\,sec$

$T_{up} = \frac{u}{g} = \frac{40}{10} = 4\,sec$



$S = ut^0 + \frac{1}{2}at^2$

$= \frac{1}{2}10(2)^2 = 20m$

$\text{Avg speed} = \frac{(\text{Total dist}^n)_{t=6se}}{6} = \frac{100}{6}$

$\text{Avg velocity} = \frac{60}{6} = 10\,m/s$

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$$S_{nth} = u + \frac{a}{2}(2n-1)$$

$$\underline{S_{n\,sec}} = u(n) + \frac{1}{2}a(n)^2$$

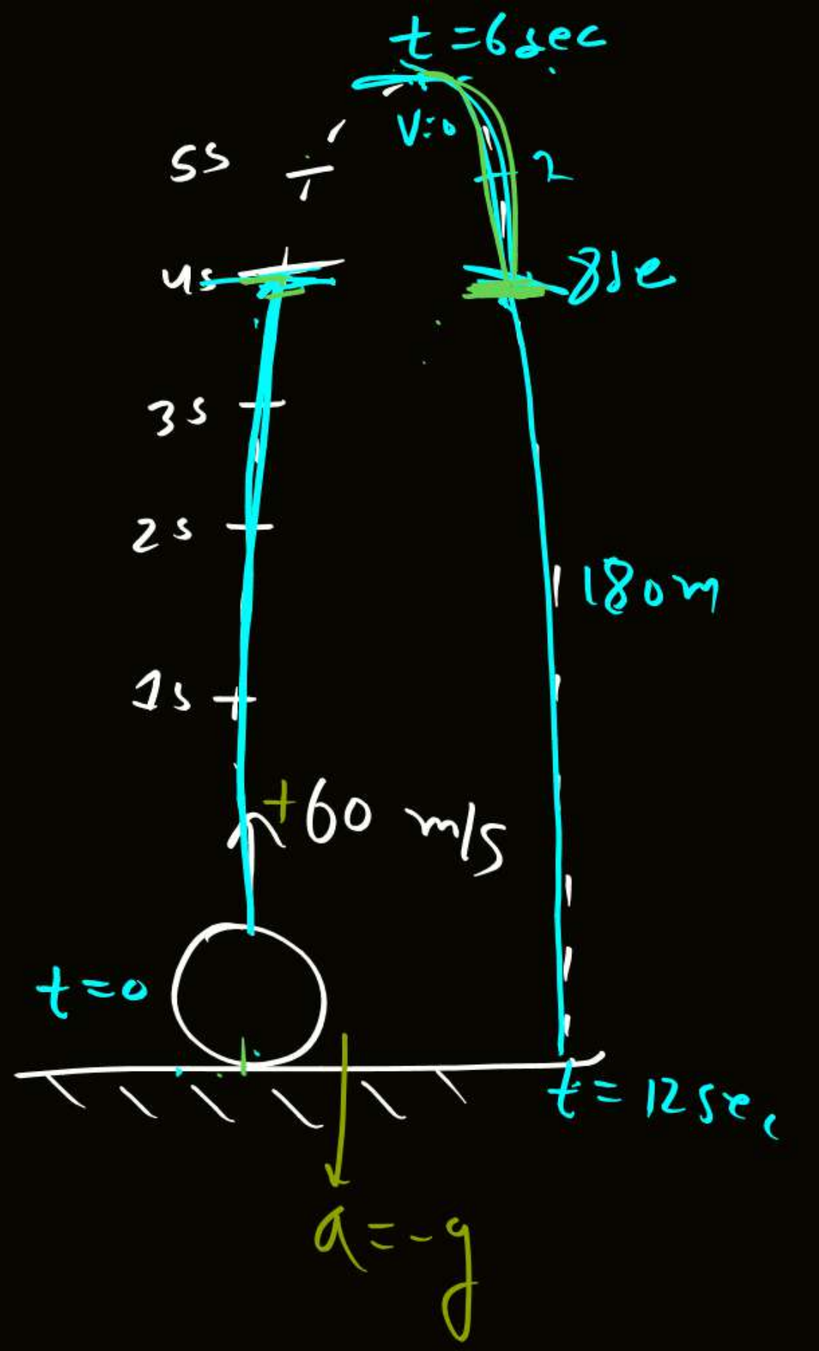
$t = n\,sec$

\# in 4-sec

(disp^n in 8 sec
(0 to 8 sec)
निले वाली

12^{th}
2^{nd}
3^{rd} 13^{th}
8^{th}
(9th)

$t = \underline{7^{th}}$ sec
ऊपर वाली



(i) $T_f = \frac{2u}{g} = \frac{2\times 60}{10} = 12\,\text{sec}$ *

(ii) $H_{max} = \frac{u^2}{2g} = \frac{60\times 60}{2\times 10} = 180\text{m}$.

(iii) disp^m in 4-sec = 160m

(iv) distance in 4-sec =

(v) disp^m in 8-sec → 160m

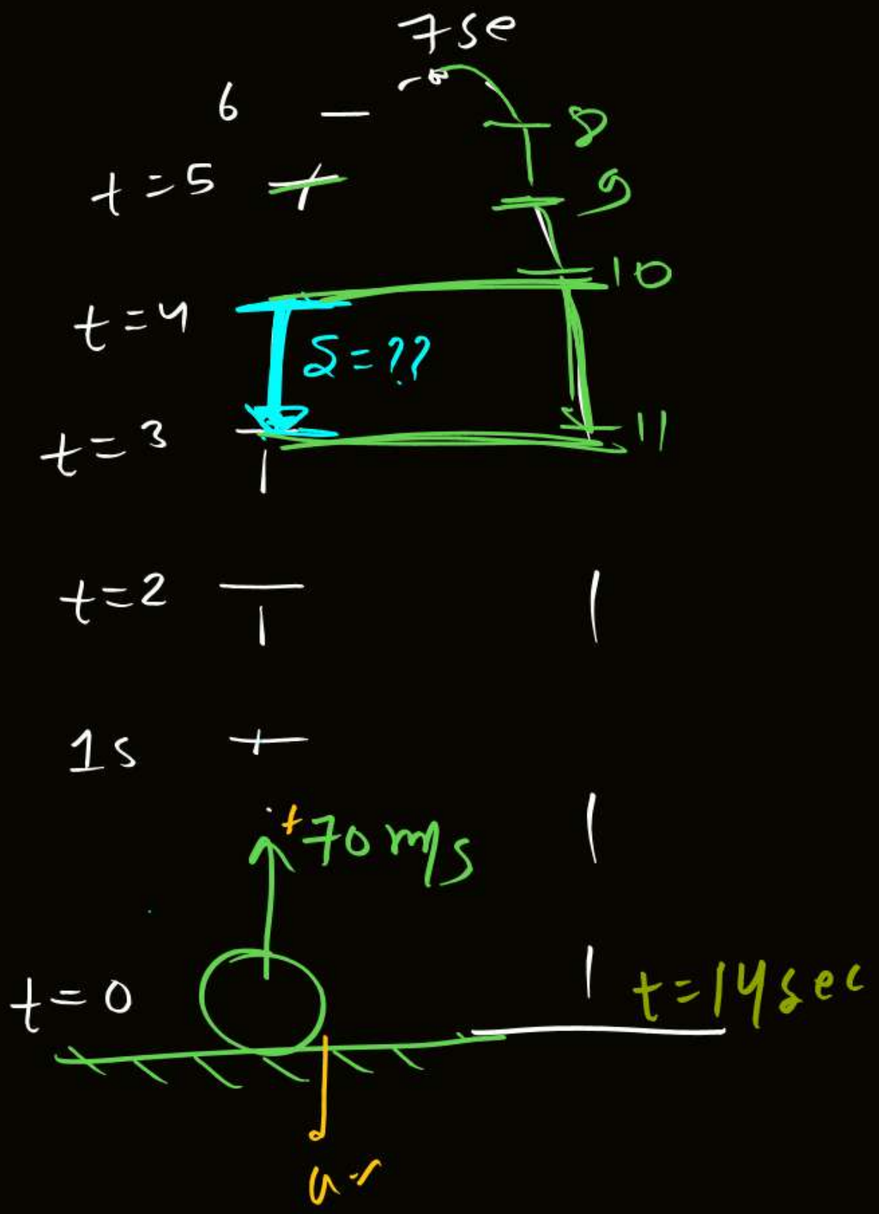
(vi) dist^n in 8-sec. = 200m

* $S = ut + \frac{1}{2}at^2$

$= 60\times 4 - \frac{1}{2}\times 10(16)^8$

$= 240 - 80 = 160\text{m}$.

$S = ut + \frac{1}{2}at^2$ *



(i) $T_f = \frac{2u}{g} = \frac{2\times 70}{10} = 14\,\text{sec}$

(ii) $H_{max} = \frac{u^2}{2g} = \frac{70\times 70}{2\times 10} = \frac{490}{2}$

$= 245\,\text{m}$

(iii) distance in 4^{th} sec (3sec से 4sec)

$n = ?$

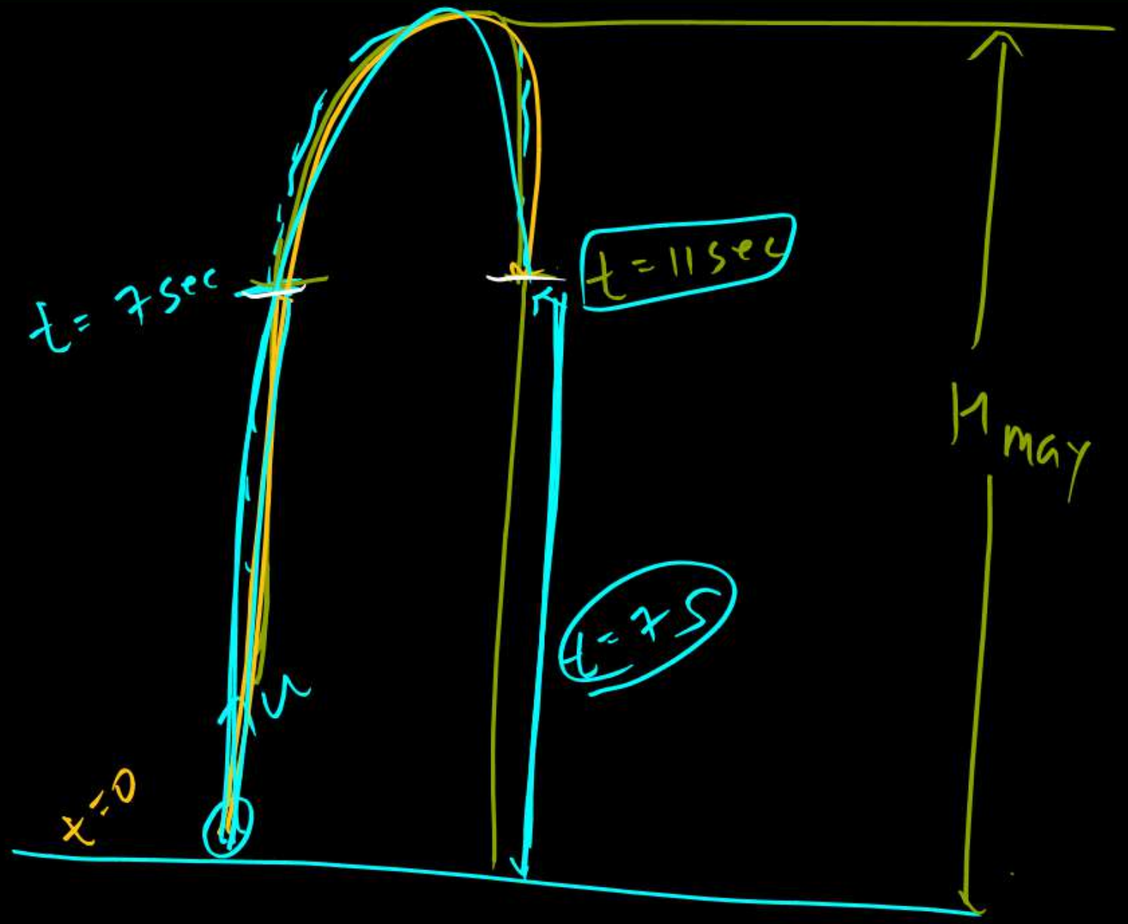
$S_{n^{th}} = u + \frac{a}{2}(2n-1)$

$= 70 - \frac{10}{2}(4\times 2 - 1)$

$= 70 - 5\times 7 = 70 - 35$

$= 35\,\text{m}$

Object is projected up and it is at same height at $t = 7$ sec and $t = 11$ sec then find maximum height.



$T_f = 11\text{sec} + 7\text{sec}$

$= 18\text{ sec}$

$t_{up} = 9\text{sec}$

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

$H_n = \frac{90 \times 9}{2g} = \frac{810}{2}$

$= 405\text{ m}$

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Object is projected up the distance travelled in 3rd sec and 8th sec then find that distance.

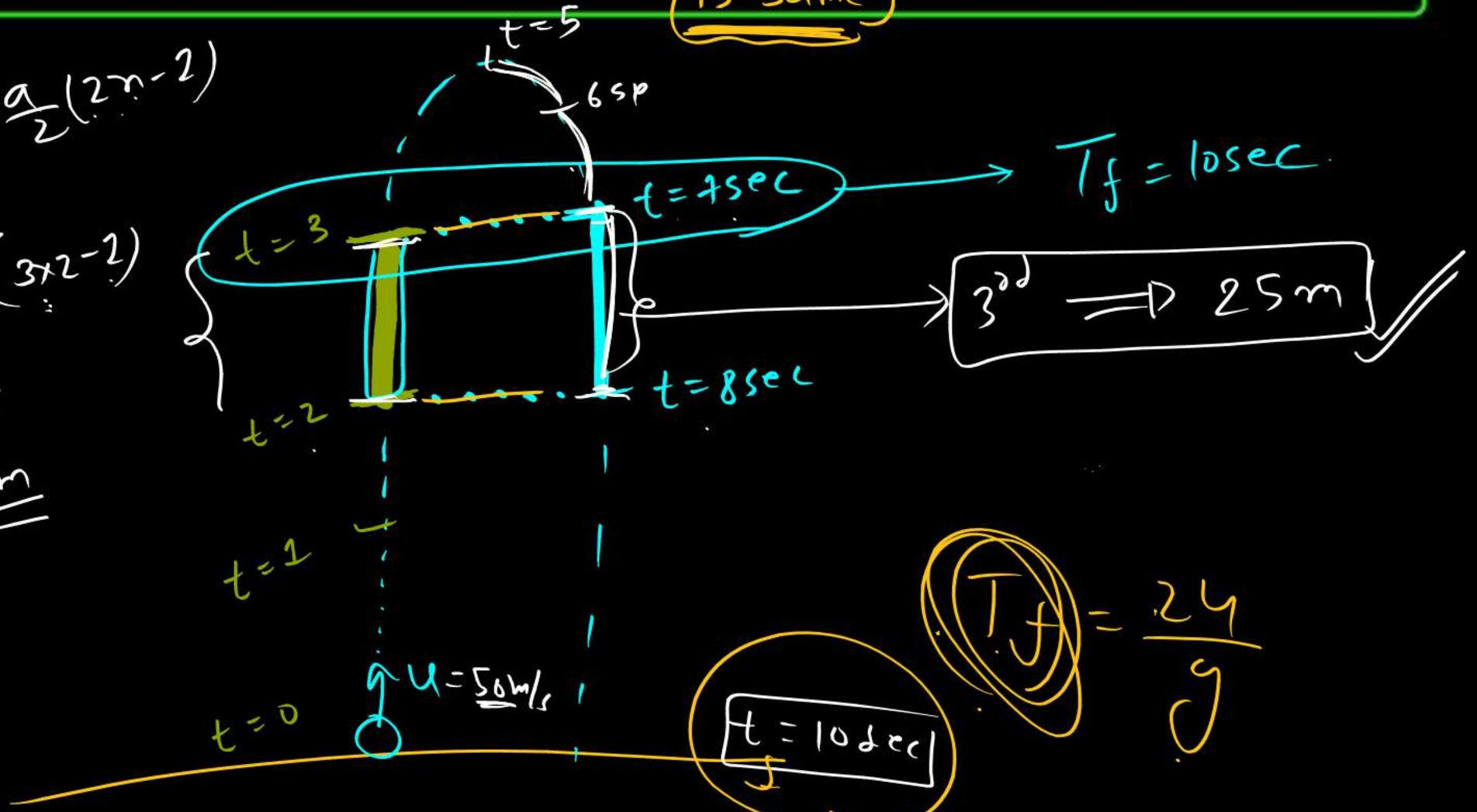
is same

$S_{nth} = u + \frac{a}{2}(2n-2)$

$= 50 - \frac{10}{2}(3\times2-2)$

$= 50 - 25$

$= 25m$



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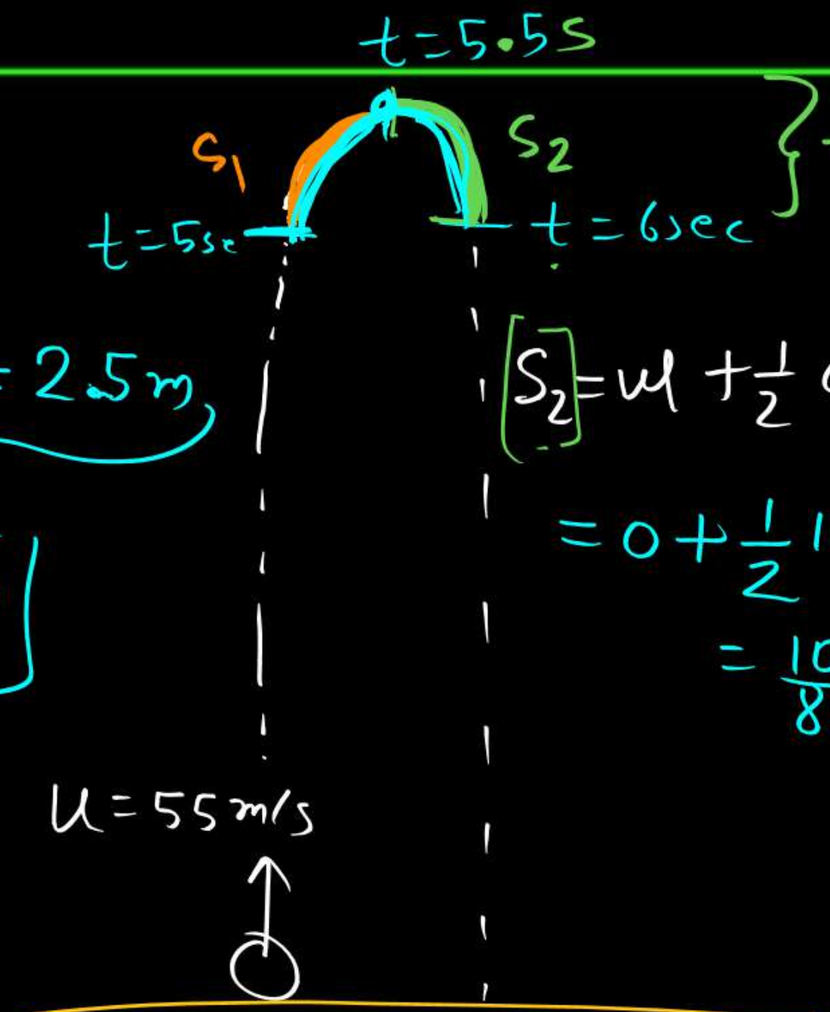
Objected is projected up with, speed 55 m/s then find distance in 6th sec of journey.



$t = \frac{1}{2}$ sec

distance = 2.5 m

$S_2 = ut + \frac{1}{2}at^2$

$= 0 + \frac{1}{2} 10 \times \left(\frac{1}{2}\right)^2$

$= \frac{10}{8} = 1.25$ m

$T_f = 11$ sec $\left(\frac{2u}{g}\right)$

$T_{up} = 5.5$ sec

time from $t = 5$sec to $t = 6$sec

→ direction Change

→ dist$^n \neq$ disp^m

disp^m = 0 m

In 6th sec

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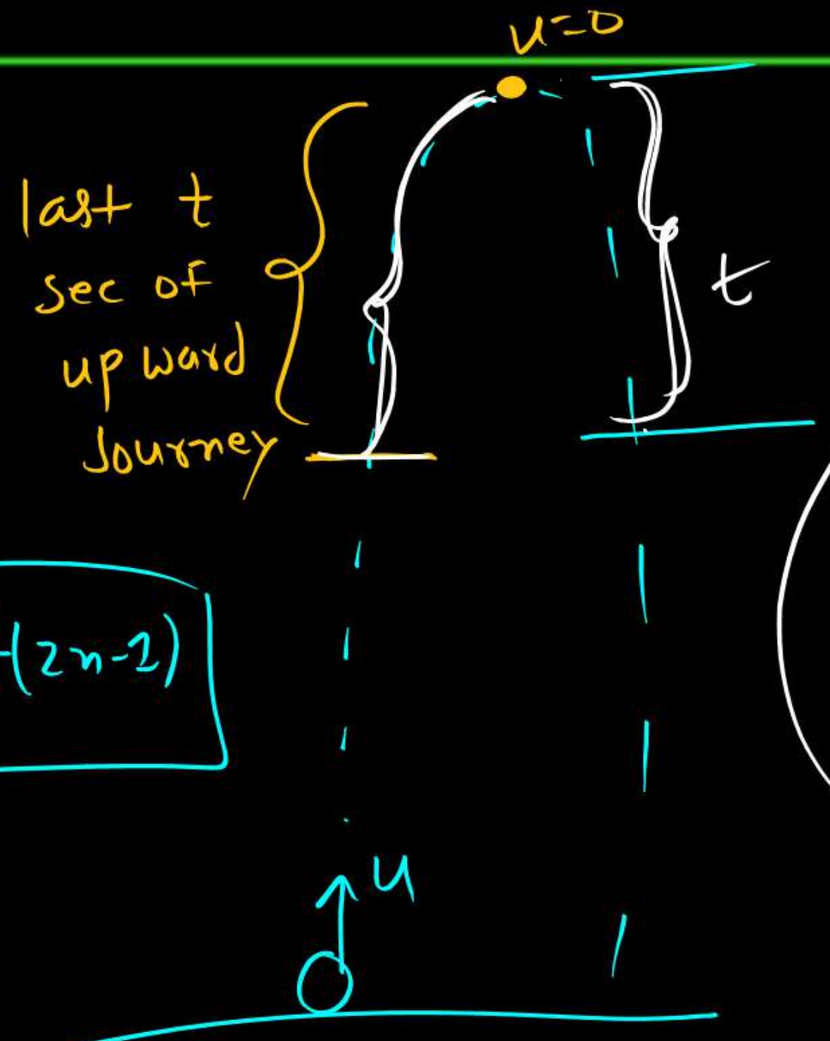
Object is projected with speed u then find distance in last 't' sec of upward journey.



$$\delta_{n^{th}} = u + \frac{a}{2}(2n-1)$$

Not applicable for 1 sec case.

distⁿ in 1st t sec of downward Journey = distance in last t-sec of upward Journey.

$$\rightarrow S_t = \cancel{ut^0} + \frac{1}{2}at^2 = \frac{1}{2}gt^2$$

$$= (5t^2)\ m$$

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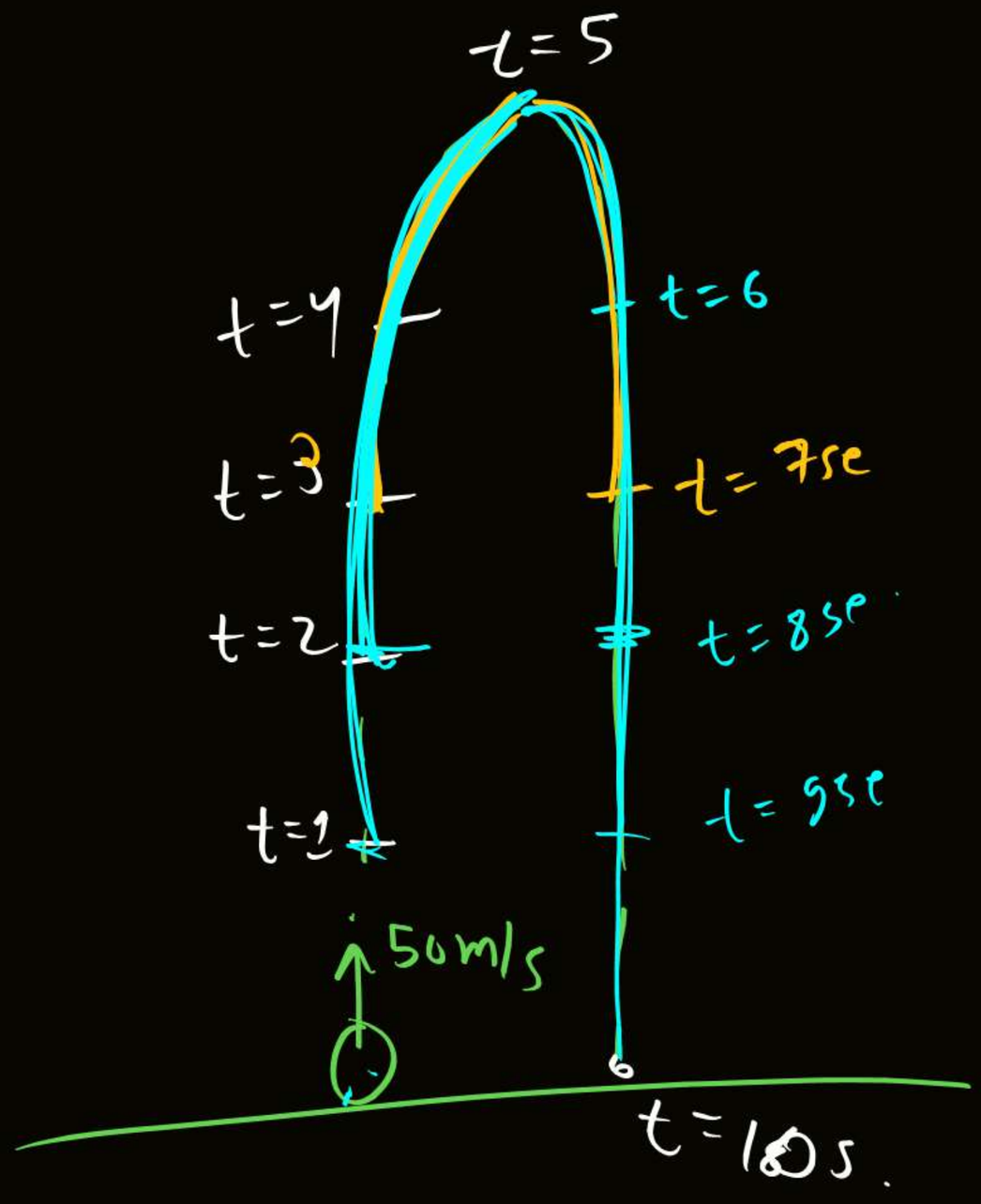

t=5
t=4
t=6
t=3
t=7sec
t=2
t=8sec
t=1
t=9sec
50m/s
t=10s

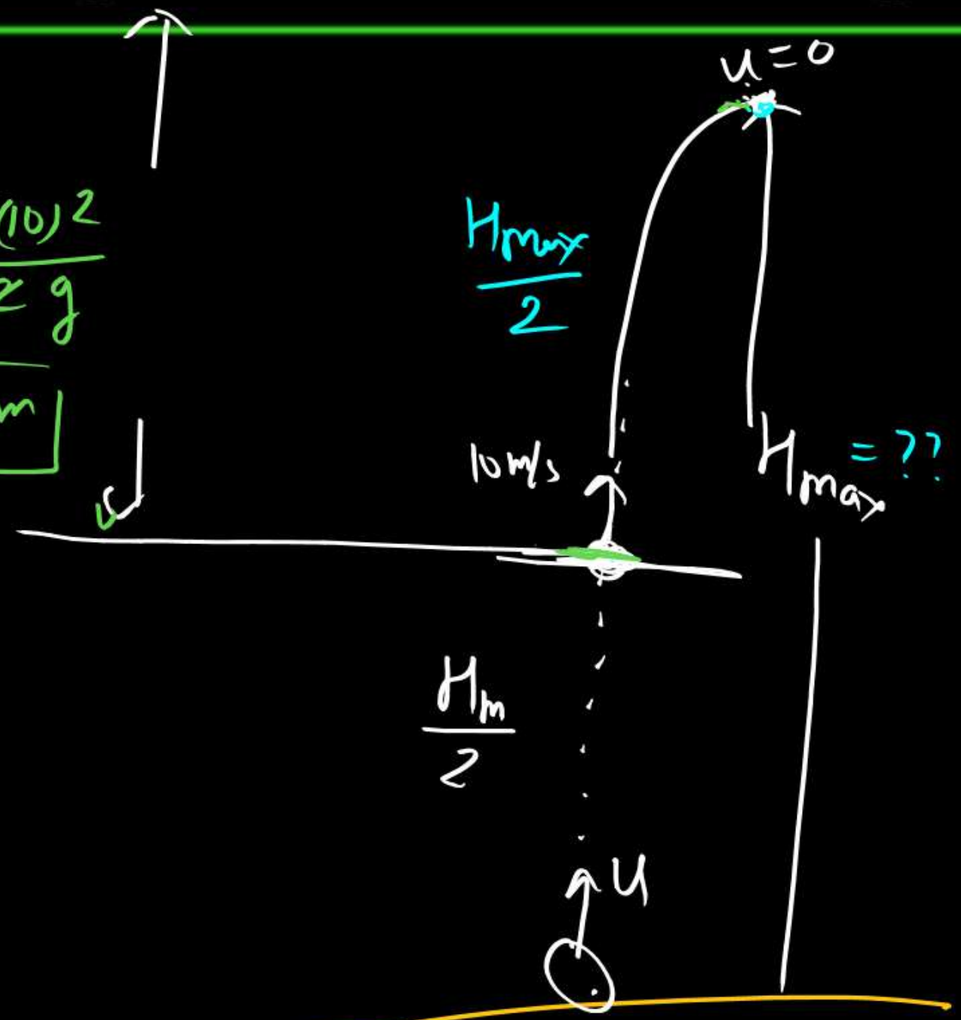
Ball is projected with speed u and its speed is 10 m/s at half of the maximum height then find maximum height.

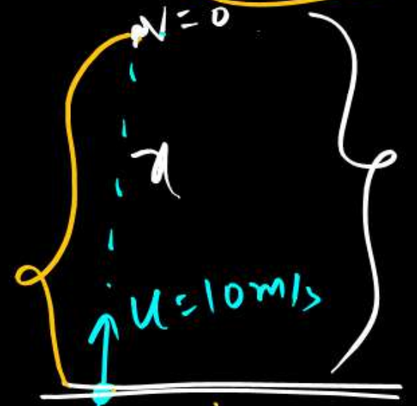
AIPMT

12 times

$\frac{H_{max}}{2} = \frac{(10)^2}{2g}$

$H_{max} = 10\,m$





$v^2 - u^2 = 2as$

$0 + (10)^2 = 2 \times 10 \times h$

$\frac{100}{20} = h$ (5m)

$H_m = 2h = 10\,m$

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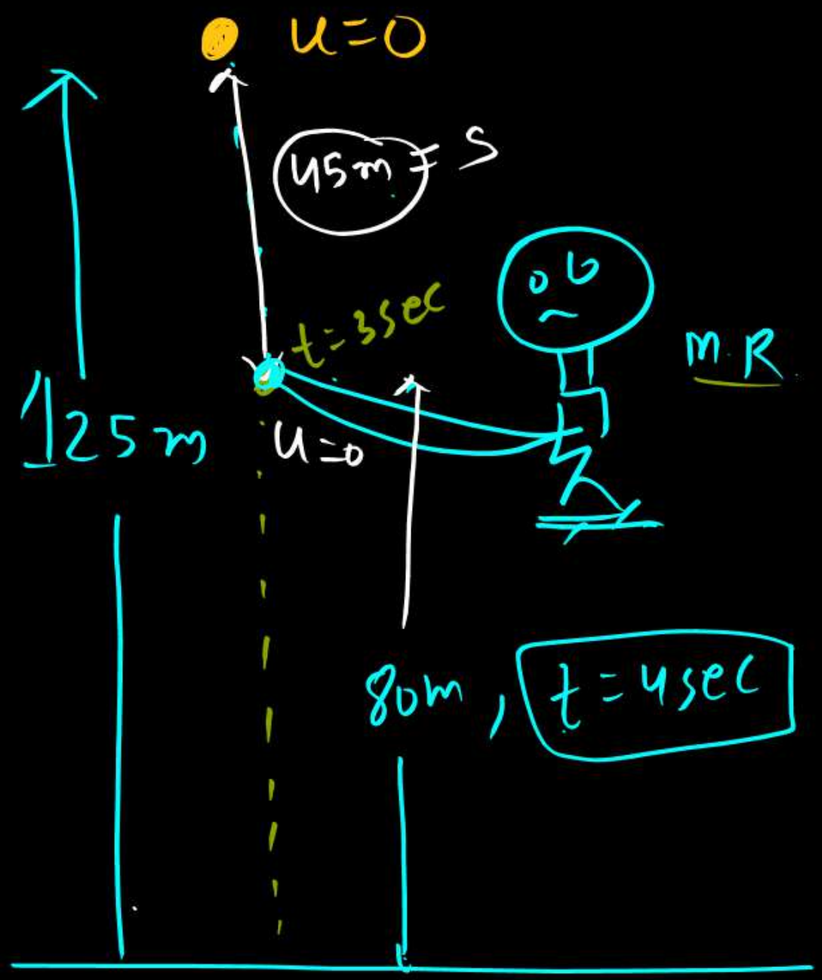
A ball is dropped from 125 m and after 3 sec it is stopped and released from rest instantaneously then find total time of flight.



T = 7sec

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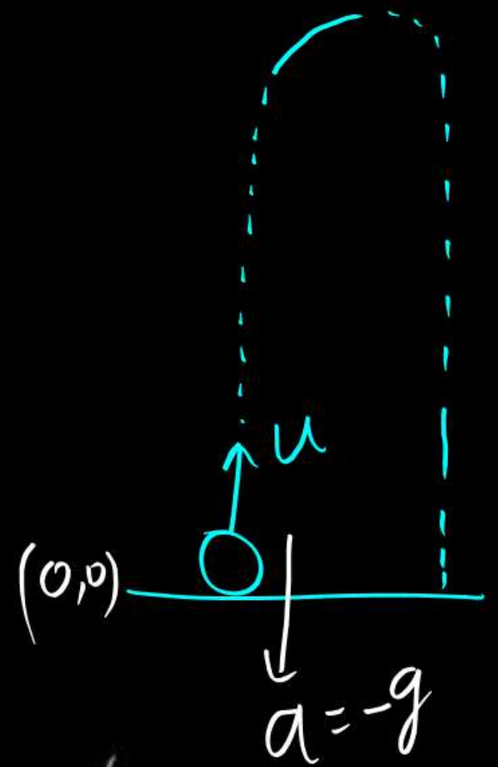
Ball is projected up with speed u then draw graph between

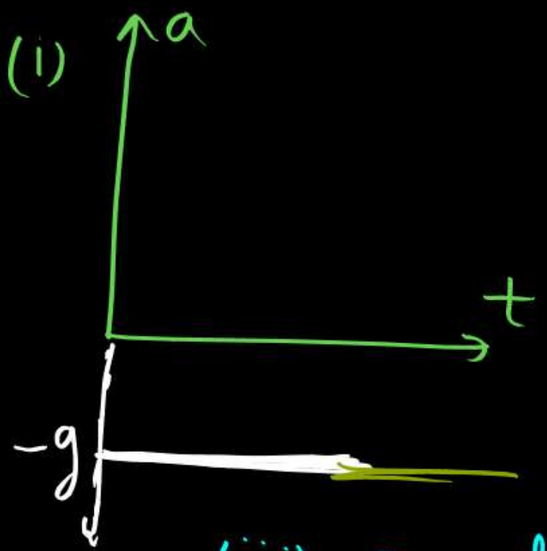
(i) a/t

(ii) v/t

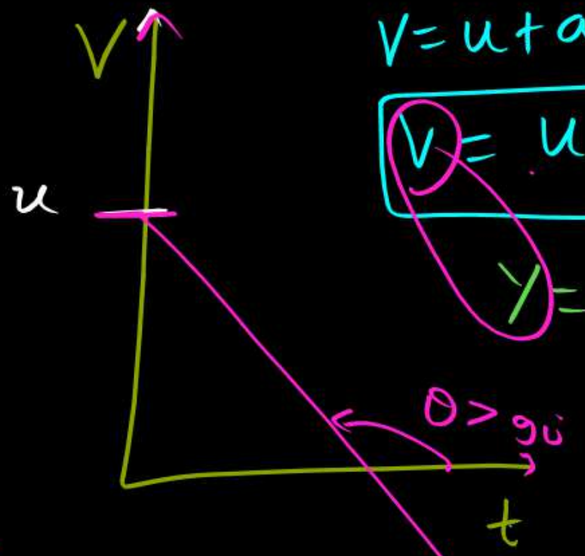
(iii) s/t → In next lecture of grap.



(i)



(ii)



$v = u + at$

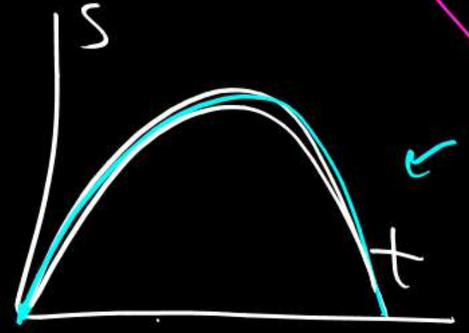
$v = u - gt$

$y = mx + c$

$0 > g$

(iii) $s = ut + \frac{1}{2}at^2$

$s = ut - \frac{1}{2}gt^2$



← Parabola

next lecture

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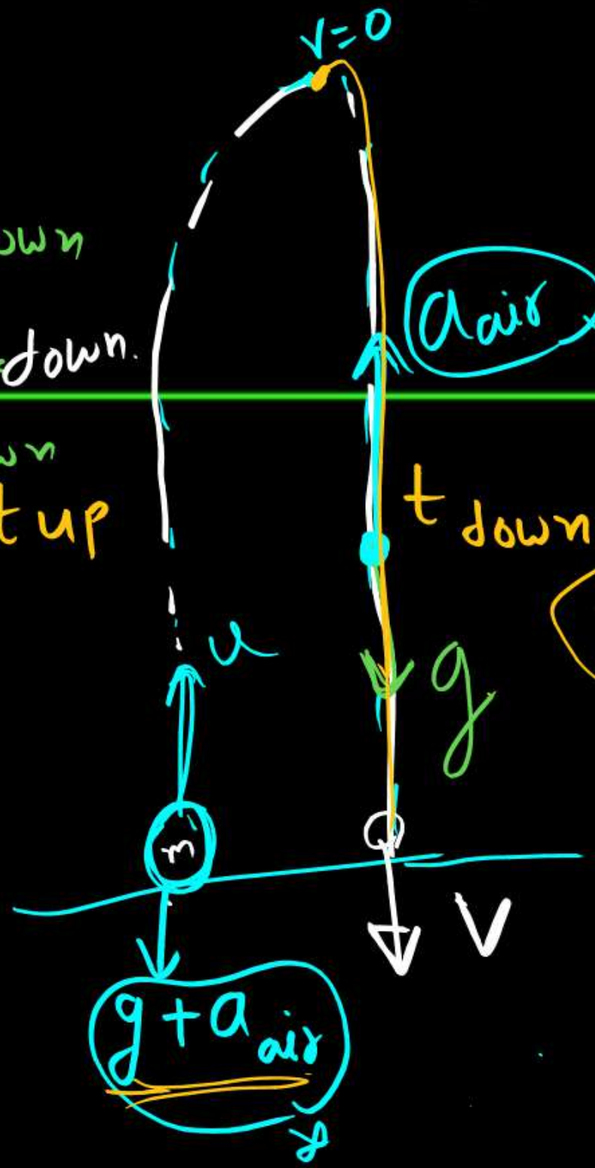
If air friction is not ignored then effect on time of flight and on speed of collision (constant air friction)

(i) $t_{up} > t_{down}$

~~(ii)~~ $t_{up} < t_{down}$

(iii) $t_{up} = t_{down}$



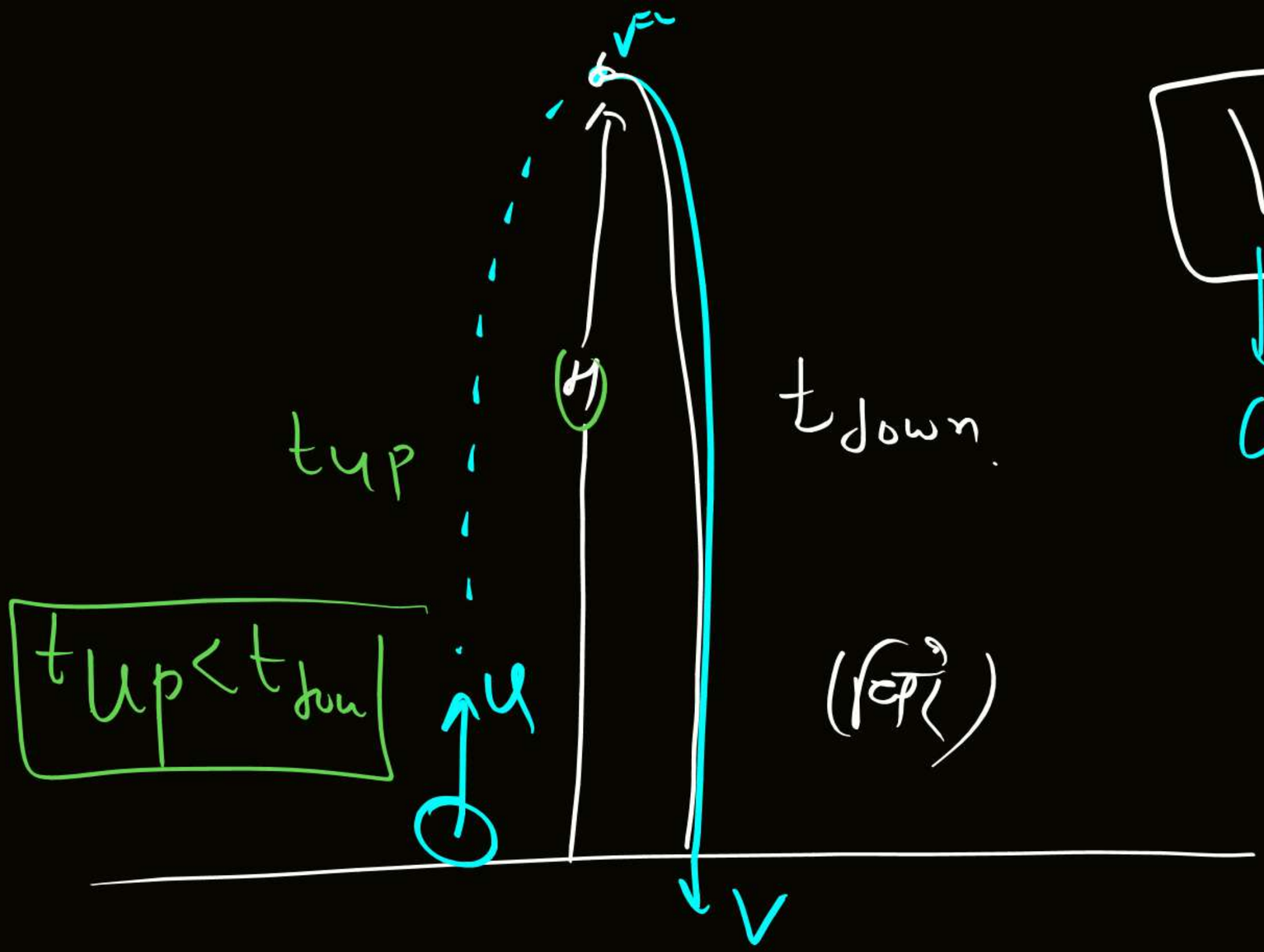
No air friction then $V = u$

$a = g - a_{air}$ (#) ⟶ $V < u$

* loss in energy due to friction

$\frac{1}{2}mu^2 > \frac{1}{2}mV^2$

$u > V$ collision



$t_{up} < t_{down}$

$V < u$

Collision

Project

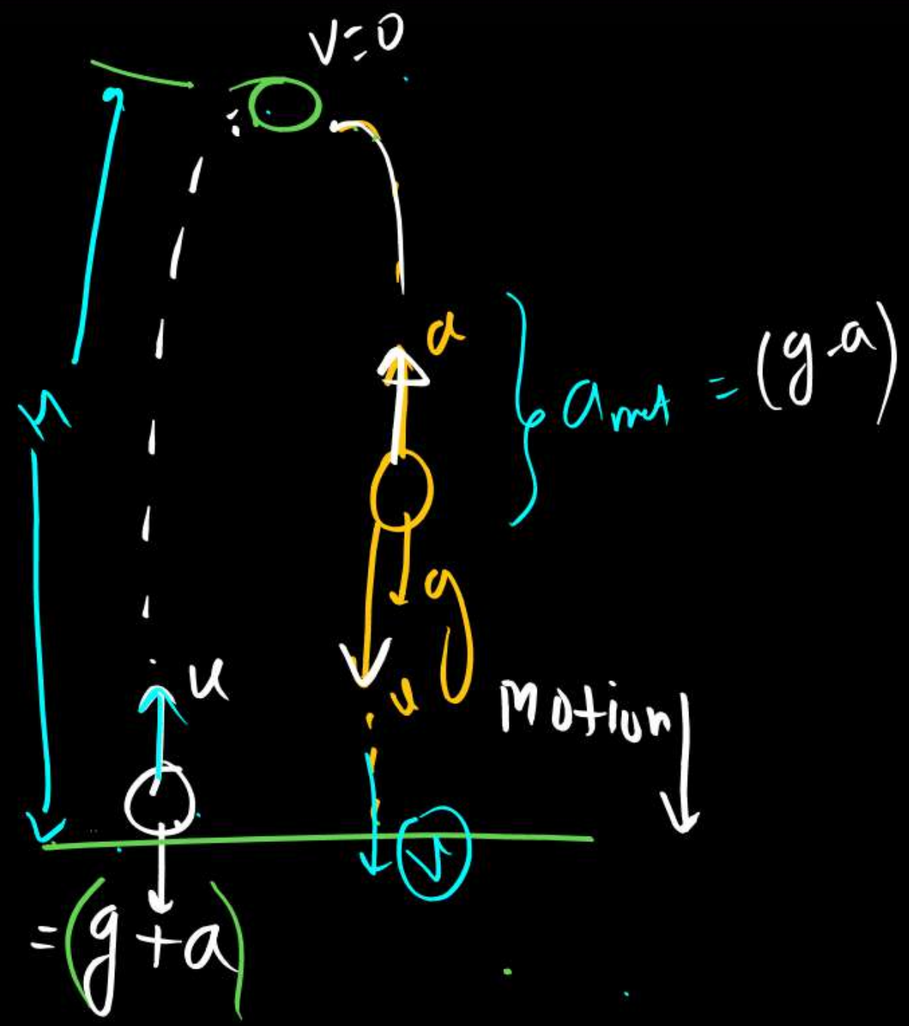
(कि?)

friction

energy

loss

Ball is projected up and constant air resistance is acting on it 2 m/s² then find $\frac{t_{up}}{t_{down}}$.



① $H = \frac{1}{2}(g+a)t_{up}^2$

$H = \frac{1}{2}(g-a)t_d^2$

$\frac{t_{up}}{t_{do}} = \sqrt{\frac{g-a}{g+a}}$

$= \sqrt{\frac{8}{12}}$

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

For upward journey

① – $H = \frac{1}{2}(g+a)t_{up}^2$ *

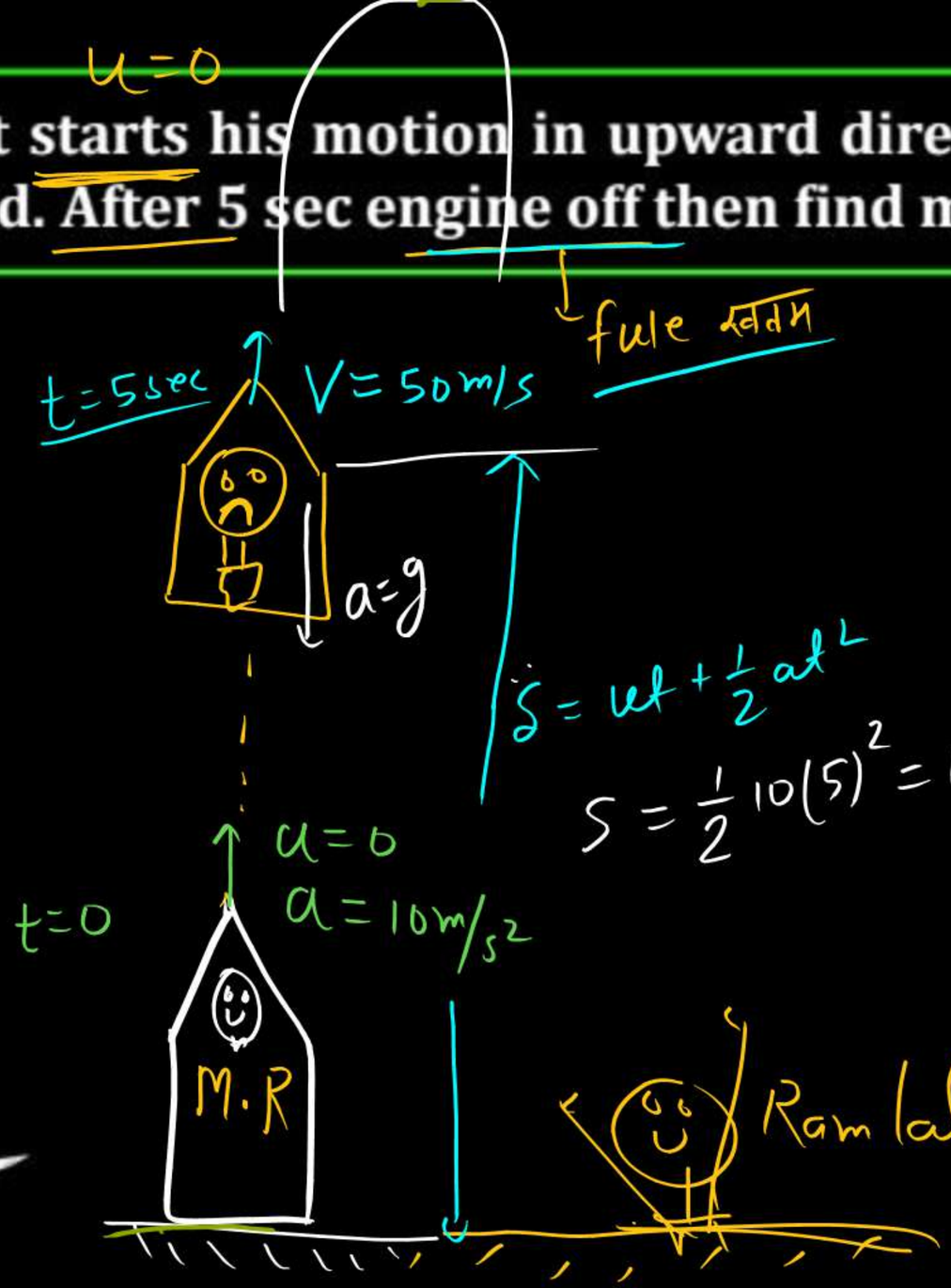
$H = (u)t_{up} - \frac{1}{2}(g+a)t_{up}^2$

$t_{up} = \frac{u}{g+a}$

For downward

① – $H = \frac{1}{2}(g-a)t_d^2$

Rocket starts his motion in upward direction with acceleration 10 m/s² upward. After 5 sec engine off then find maximum height from ground.



$s = ut + \frac{1}{2}at^2$

$s = \frac{1}{2}10(5)^2 = 125m$

$(H_{max})_{\text{after 5-sec.}} = \frac{u^2}{2g} = \frac{50\times50}{2\times10} = 125m$

$H_{max\ from\ Ground} = 250m$ //

Total time of Journey (time Of flight) = H.W

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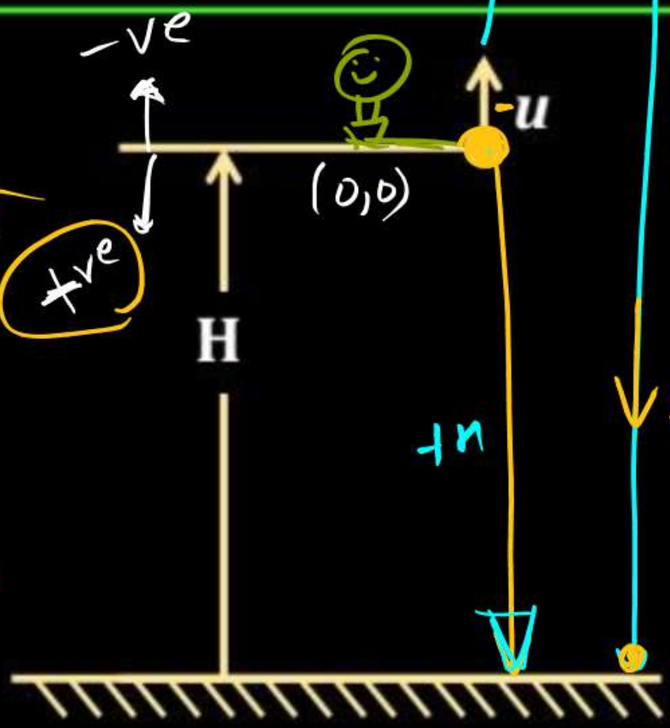
Motion under gravity from Height to ground.



$$t = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$$

$$t = \frac{\frac{2u}{g} \pm \sqrt{\frac{4u^2}{g^2}+\frac{8H}{g}}}{2\times 1}$$

$$t = \frac{2\left[\frac{u}{g} \pm \sqrt{\frac{u^2}{g^2}+\frac{2H}{g}}\right]}{2}$$

$$ax^2+bx+c=0$$

$$disp^m = +H$$

$$s = ut + \frac{1}{2}at^2$$

$$H = -ut + \frac{1}{2}gt^2 \times \frac{2}{g}$$

$$t^2 - \frac{2u}{g}t - \frac{2H}{g} = 0$$

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$$* \; t = \frac{u}{g} \pm \sqrt{\frac{u^2}{g^2} + \frac{2H}{g}}$$

यहाँ

MR^x ①

Dimⁿ ✓

MR^x ②

Let u = 0

drop

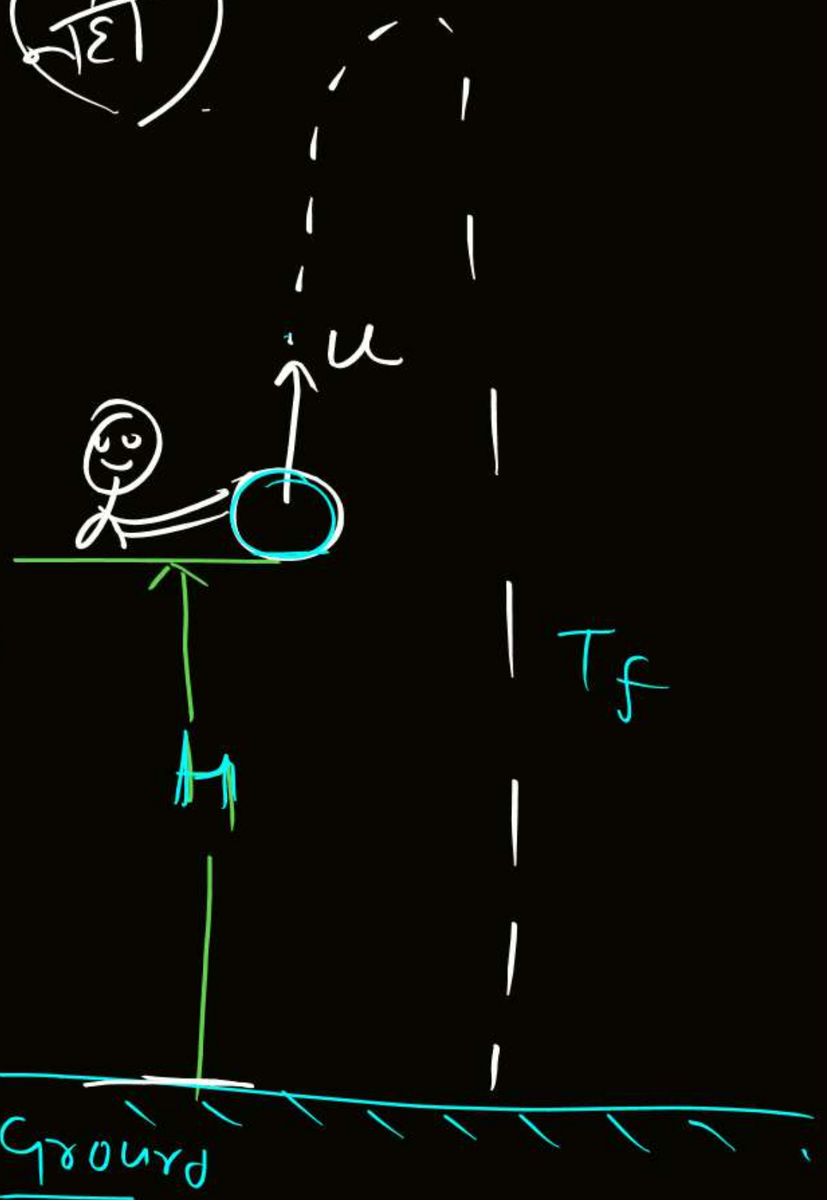
$$t = \sqrt{\frac{2H}{g}}$$

MR^x ③

Let H = 0

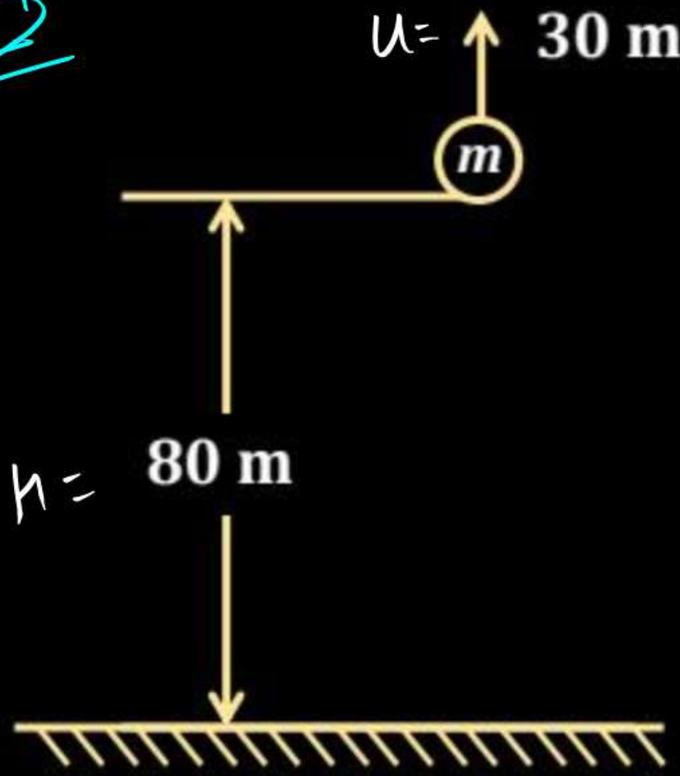
Ground to Ground.

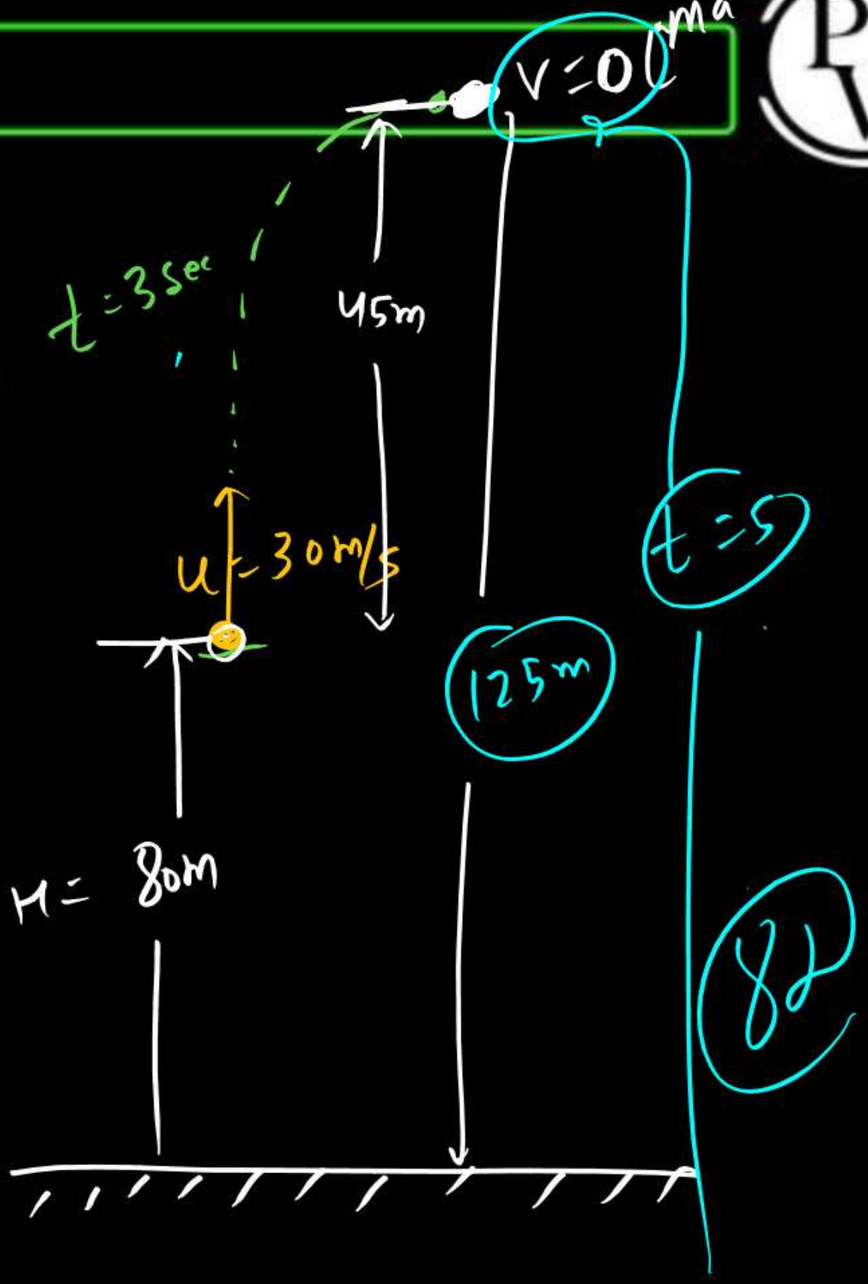
$$T = \frac{2u}{g}$$ ✓



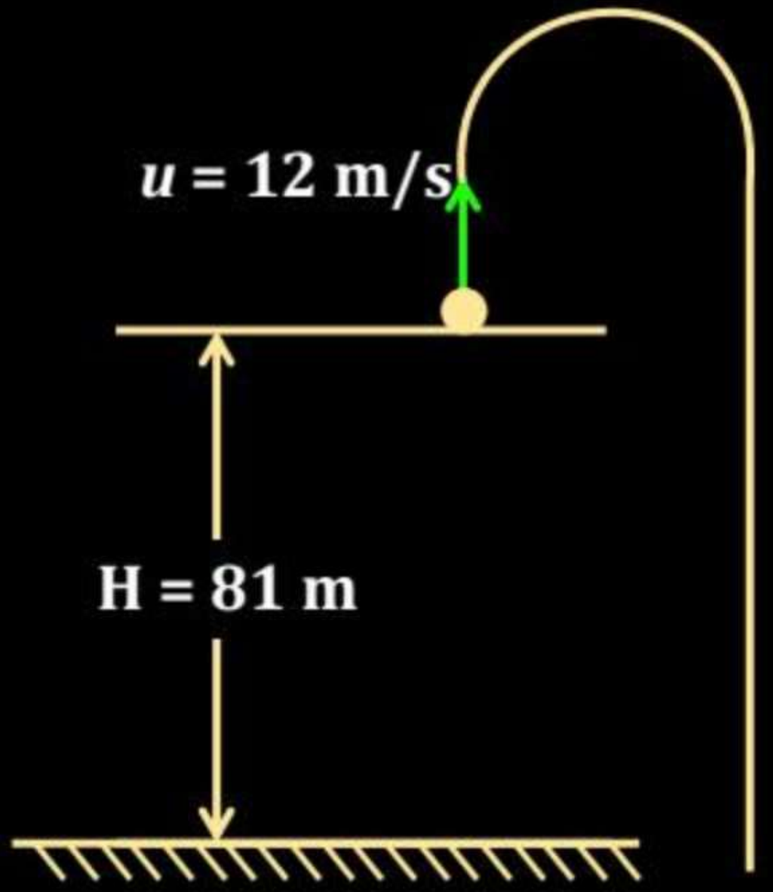
Find time of flight. =??

AIIMS





Find time of flight. [AIIMS]



(i) 5.2 sec

(ii) 4 sec

(iii) 8 sec

(iv) 3.8 sec

M.W → NO majdoori

Ball is projected up with u from height H and collide with $3u$ at ground then find H = ?

Use 3rd eqn of motion

Ball is projected with up with speed u from Height H then time of flight is 9 sec. with some speed u it is projected downward then time of flight is 4 sec. Then find time of flight when object is dropped from same height.

$t = \sqrt{t_1 t_2}$

H.W

Ans $t = 6$ sec

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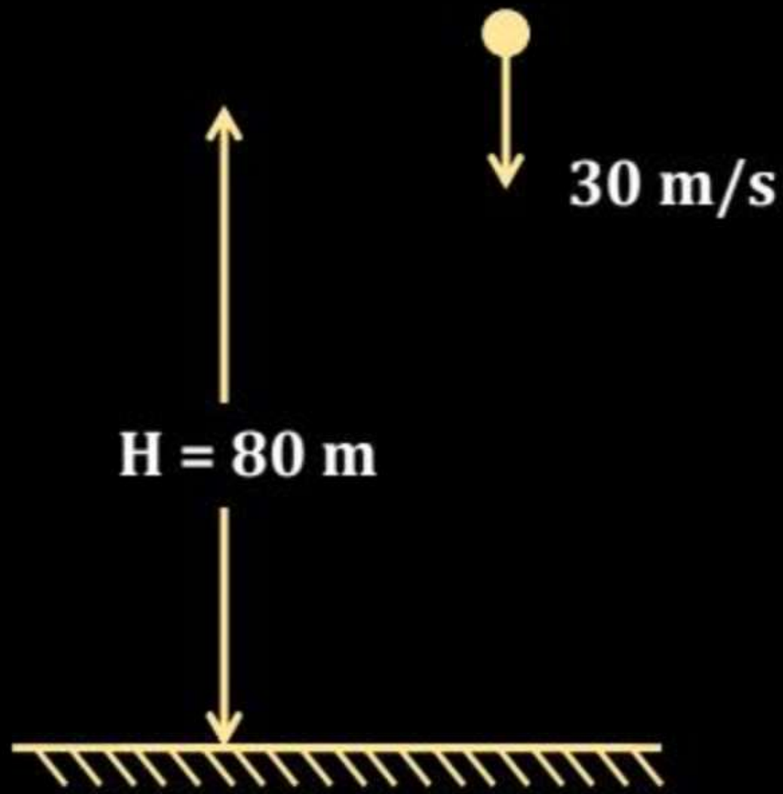
Find time of flight.



H.W

use 3rd eqn of motn find (v)

then $\frac{v-u}{a} = t$

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THANK YOU ☺