CRACK JEE 2024

MOTION IN ONE DIMENSION - L3

# MOTION UNDER GRAVITY

GRADE 11 | PHYSICS

# ANTHE

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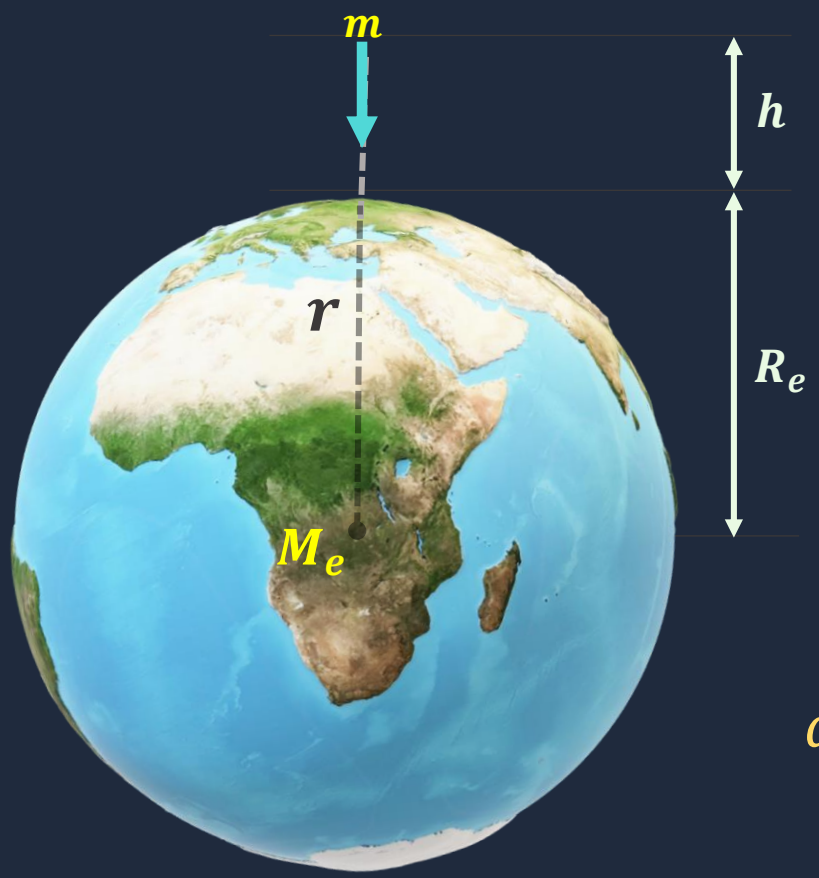
# Motion under Gravity

$$F = \frac{GM_e m}{r^2}$$




$$F = ma$$

$$a = \frac{F}{m} = \frac{GM_e}{r^2}$$

$$a = \frac{GM_e}{(R_e + h)^2}$$

$$R_e \ggg h$$

$$a = \frac{GM_e}{(R_e + h)^2} = \frac{GM_e}{R_e^2} = 9.81\ m/s^2$$

# Motion under Gravity

$$a = 9.81\frac{m}{s^2} = constant = g \approx 10\frac{m}{s^2}$$

$$v = u + at$$

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

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

$$v_{avg} = \frac{u + v}{2}$$

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

$$v = u + gt$$

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

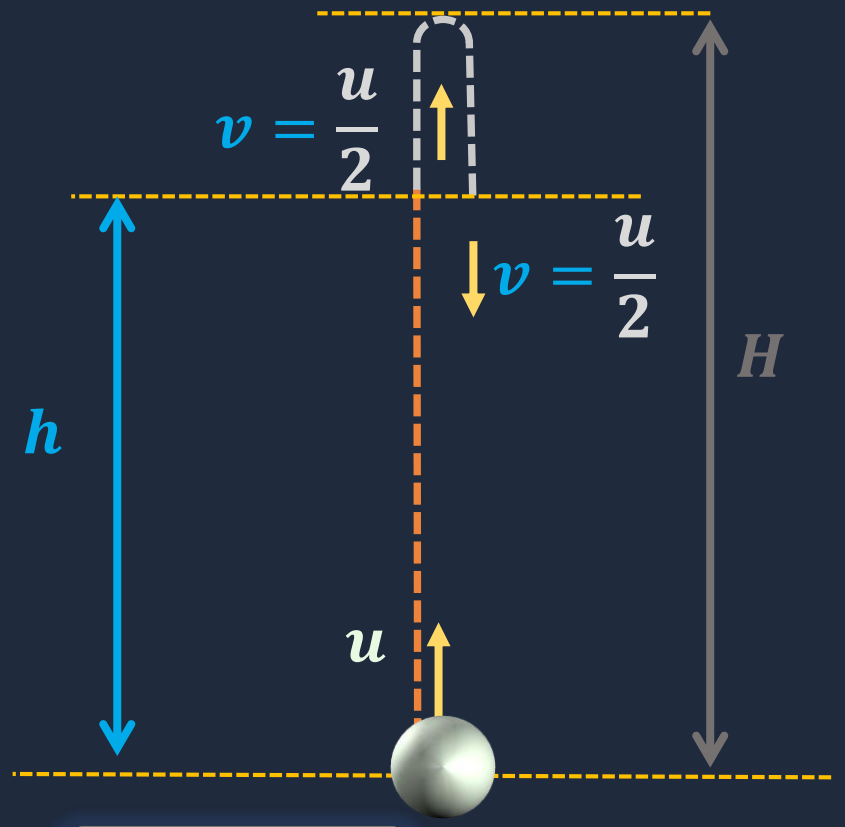
$$v^2 - u^2 = 2gh$$

$$v_{avg} = \frac{u + v}{2}$$

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

# Let's solve this

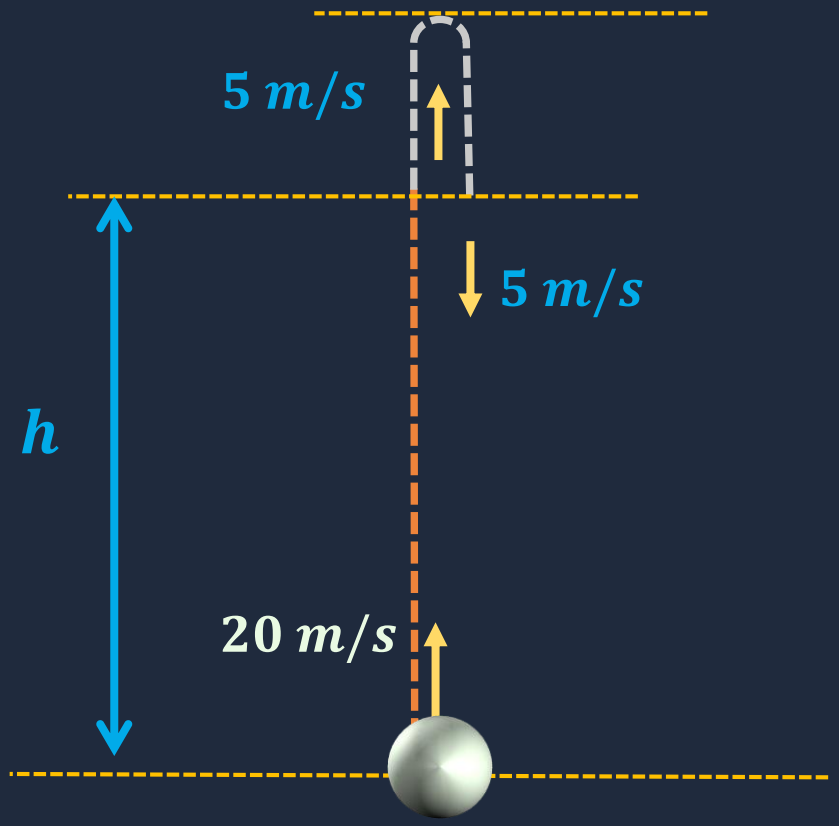
A particle is thrown upwards such that $H_{max} = H$. Find the height where speed is ½ of the maximum speed.



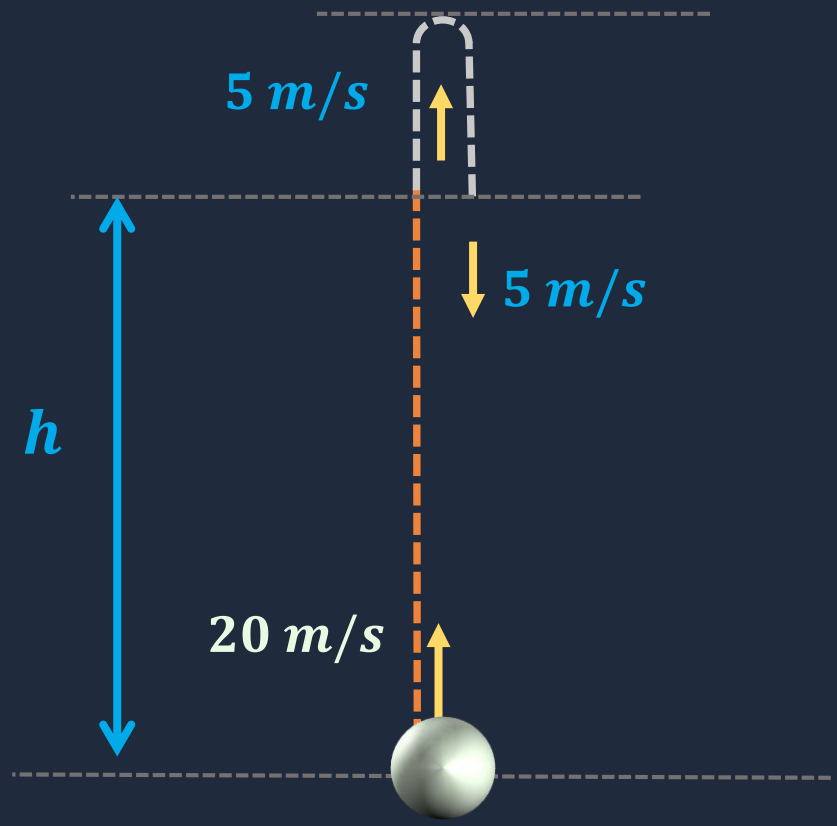

$h = 3H/4$

# Let's solve this

A particle is thrown upwards with velocity $20\ m/s$. Find the height and time where speed is $5\ m/s$.



# Let's solve this




$h = 18.75\ m$

$t_2 = 2.5\ sec$
$t_1 = 1.5\ sec$

# Let's solve this

A body dropped from the top of a tower falls through $40\ m$ during the last two seconds of its fall. The height of tower is ($g = 10\ m/s^2$ )

# Let's solve this

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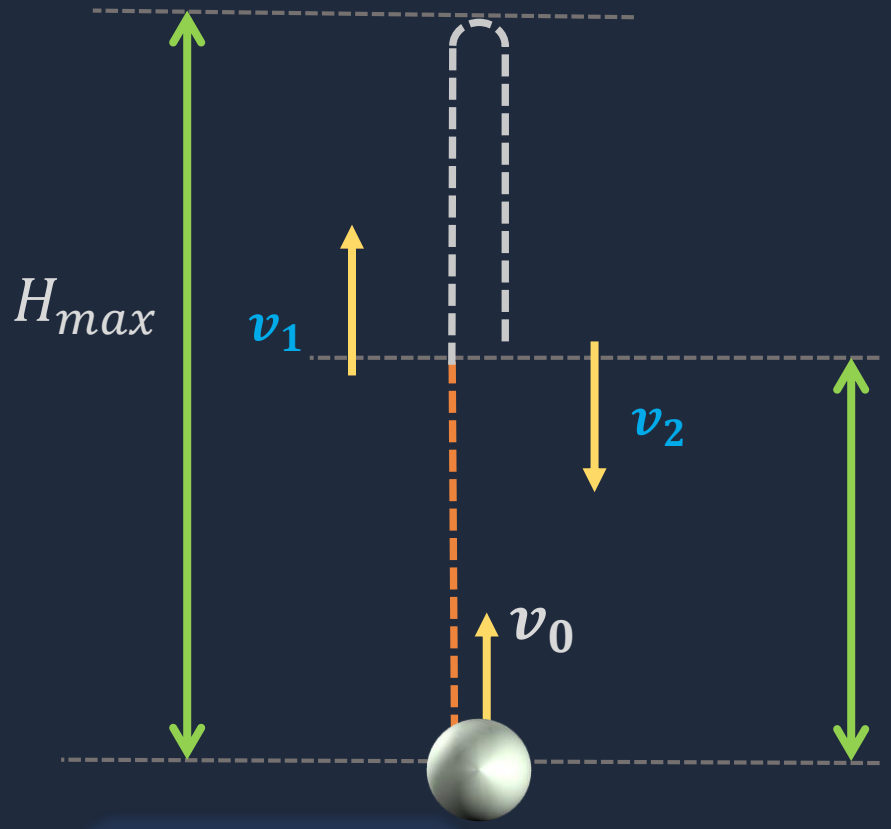
$$\boldsymbol{h = 45\ m}$$

# Let's solve this

A particle thrown upwards with speed $\boldsymbol{v_0}$. Find its velocity when height is ½ of the maximum.




$$h = \frac{H_{max}}{2}$$

$$\boldsymbol{v = \pm \frac{v_o}{\sqrt{2}}}$$

# Let's solve this

A balloon initially at rest start rising up with constant acceleration of $10\ m/s^2$. After $2\ s$ a particle drops from the balloon. After further 2 $s$, Match the following (Take $g = 10\ m/s^2$)

| **Table – 1** | **Table – 2** |
|---|---|
| $(A)$ Height of particle from ground is | $(P)$ **Zero** |
| $(B)$ Speed of particle is | $(Q)$ **10 *SI units*** |
| $(C)$ Displacement of particle is | $(R)$ **40 *SI units*** |
| $(D)$ Acceleration of particle is | $(S)$ **40 *SI units*** |

# Let's solve this

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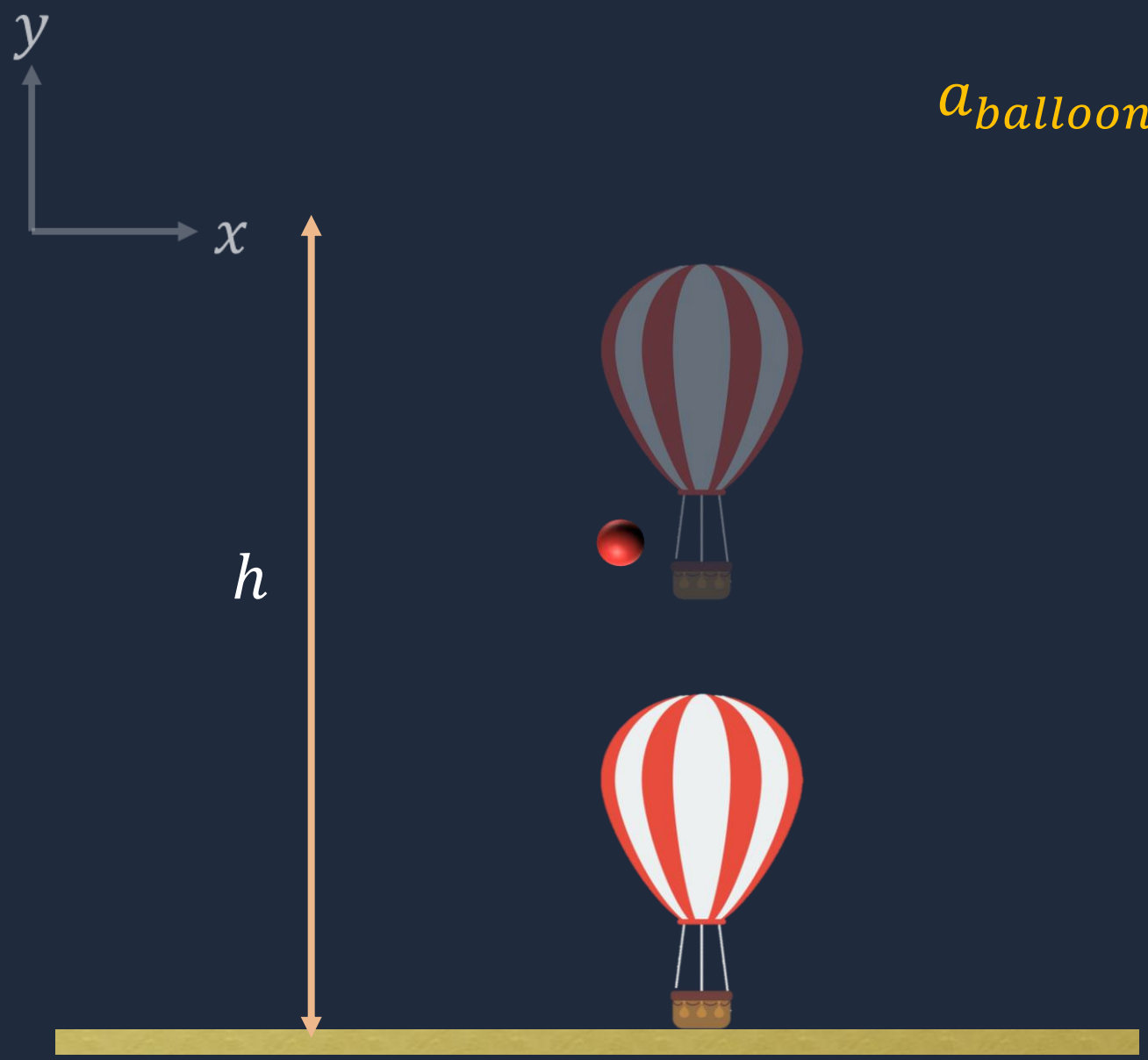
a. $(A) \rightarrow (R); (B) \rightarrow (P); (C) \rightarrow (S); (D) \rightarrow (Q)$

b. $(A) \rightarrow (R); (B) \rightarrow (Q); (C) \rightarrow (P); (D) \rightarrow (S)$

c. $(A) \rightarrow (S); (B) \rightarrow (P); (C) \rightarrow (R); (D) \rightarrow (Q)$

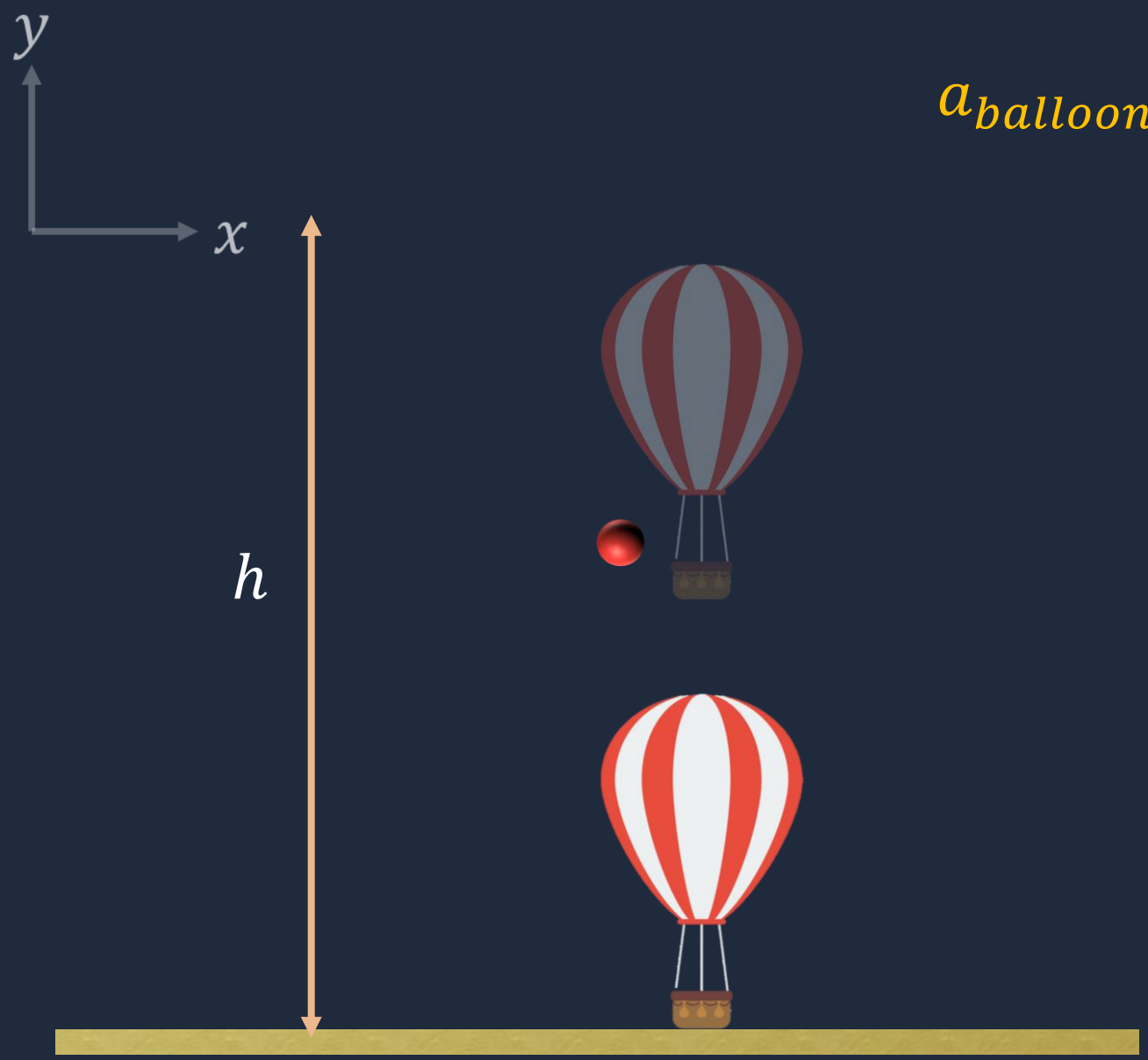
d. $(A) \rightarrow (S); (B) \rightarrow (Q); (C) \rightarrow (R); (D) \rightarrow (P)$

# Let's solve this




$$a_{balloon} = 10\ m/s^2$$

# Let's solve this

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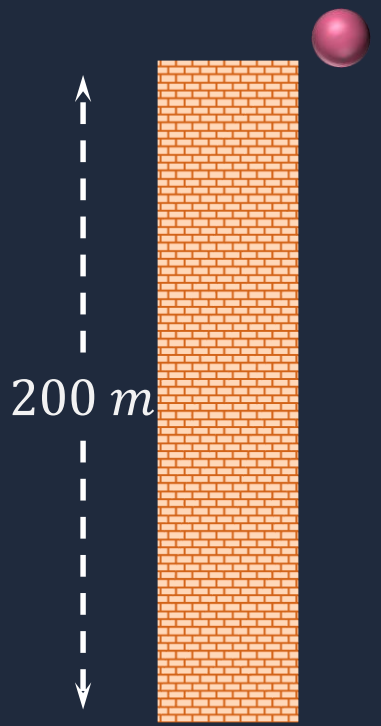
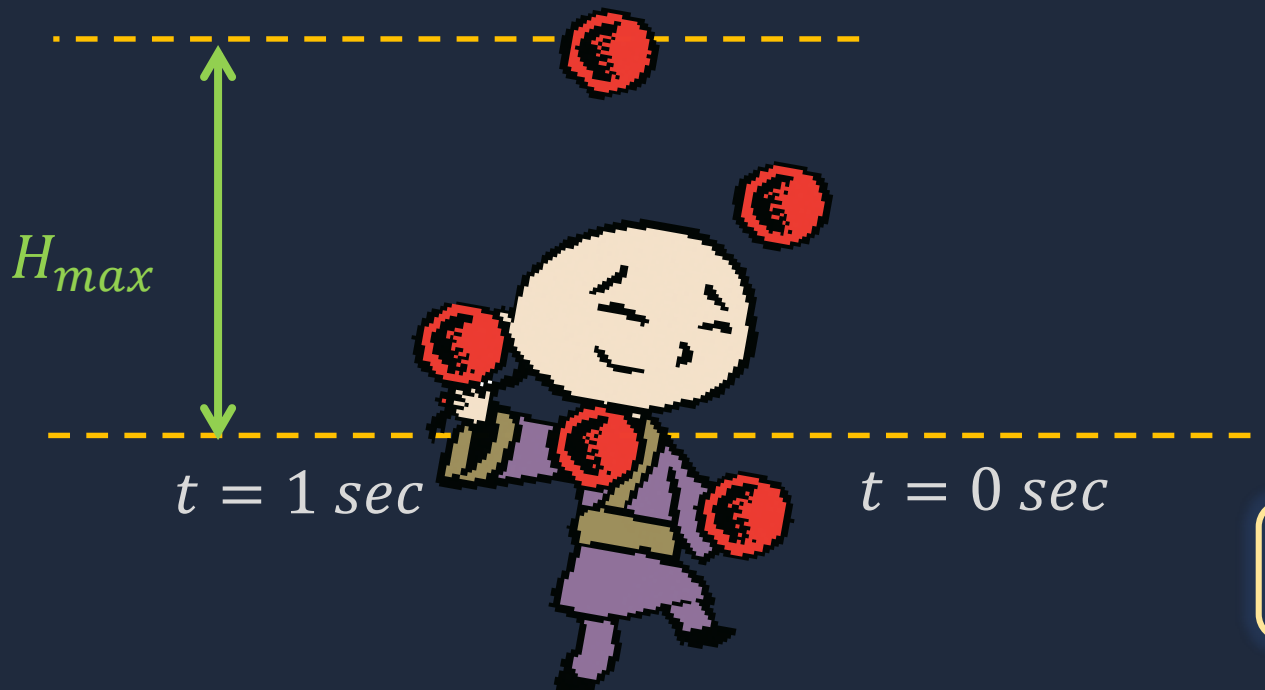
# Zabardast concept

A ball is upwards towards the top a tower of height $200\ m$, so that it just reaches the tower. Calculate distance travelled by ball in last second of journey.



# Mains wala concept

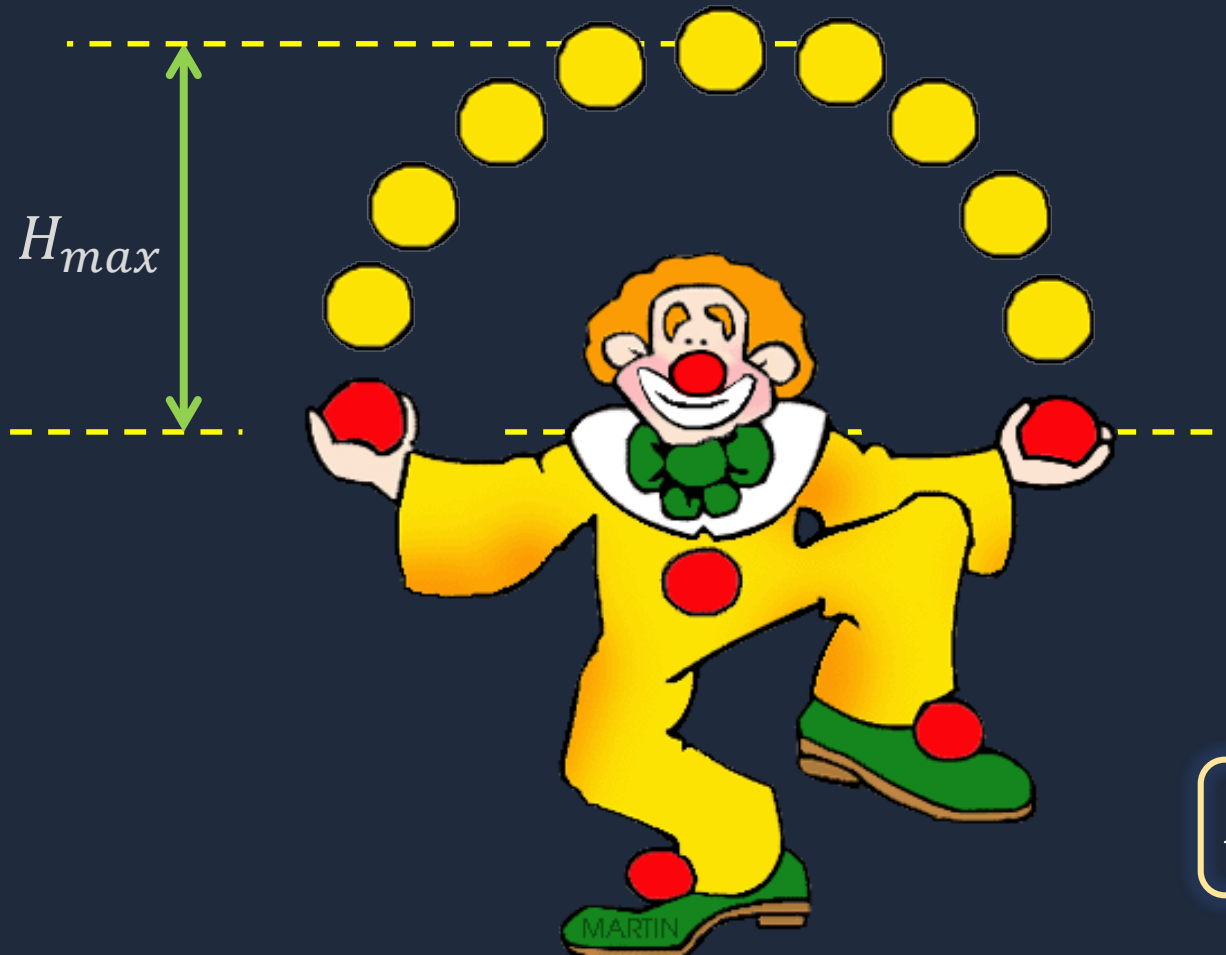
A juggler is juggling $5\ balls$ simultaneously. If the time gap to pass ball from one hand to the other is $1\ sec$ then find the maximum height attained by each ball.




$$H_{max} = 20m$$

# Ab ye karke dikhao

A juggler is juggling $11\ balls$ simultaneously. If the time gap to pass ball from one hand to the other is $0.5\ \ sec$ then find the maximum height attained by each ball.




$$H_{max} = 31.25m$$

# Ab ye karke dikhao

# Let's solve this

Water drops fall from a tap at an interval of $\mathbf{1\ s}$. Find out the position of $\mathbf{1^{st}}$ drop when $\mathbf{7^{th}}$ drop just leaves.

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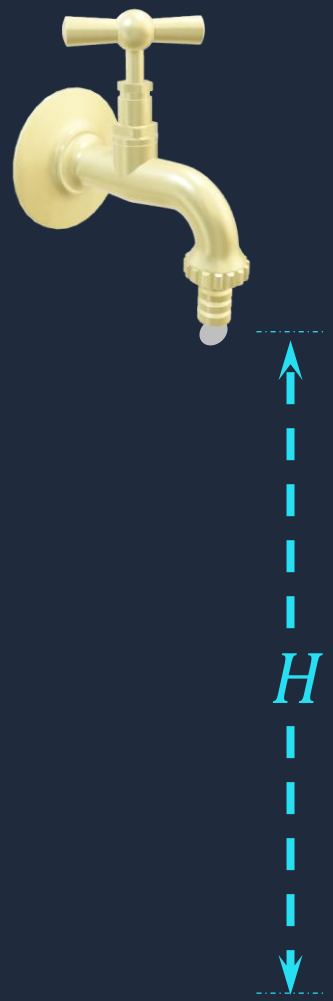


$$\boldsymbol{H = 180\ m}$$

# Let's solve this

Water drops fall from a tap at an interval of $\mathbf{1\ s}$. What is the distance between the $\mathbf{3}^{rd}$ and $\mathbf{4}^{th}$ drop when the $\mathbf{7}^{th}$ drop just leaves?


$$H = 35\ m$$

# Let's solve this

A stone is thrown vertically upward with an initial velocity $v_0$. The distance travelled in time $\frac{4v_0}{3g}$ is

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$$s = \frac{5v_0^2}{9g}$$

# Let’s solve this

A stone falls freely from rest and the total distance covered by it in the last second of its motion equals the distance covered by it in the first three second of its motion. The stone remains in the air for

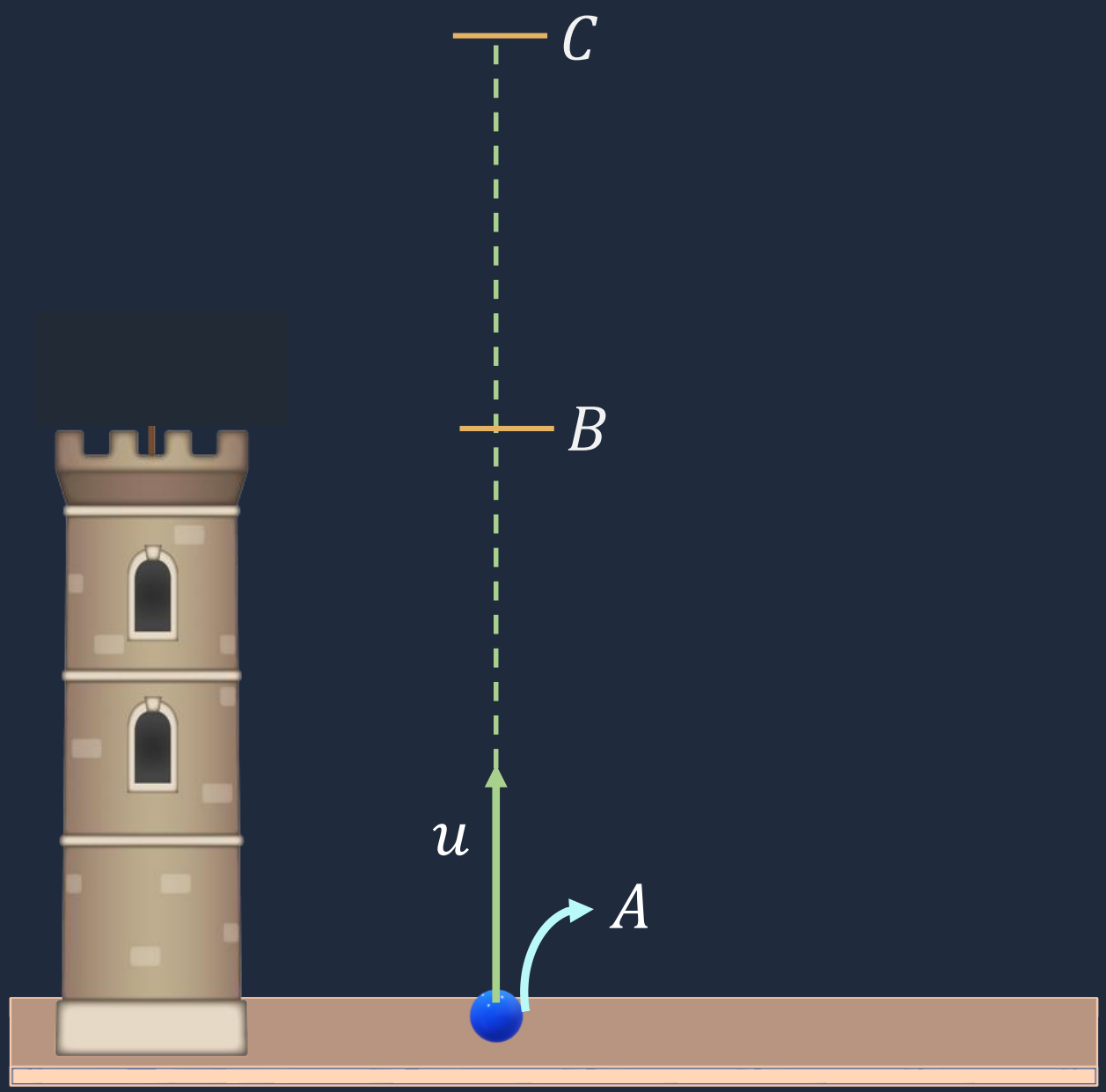
# Let's solve this

$t = 5\ s$

# Homework

A ball is projected upwards from the foot of a tower. The ball crosses the top of the tower twice after an interval of $6\ s$ and the ball reaches the ground after $12\ s$. The height of the tower is ($g = 10\ m/s^2$)

# Let's solve this



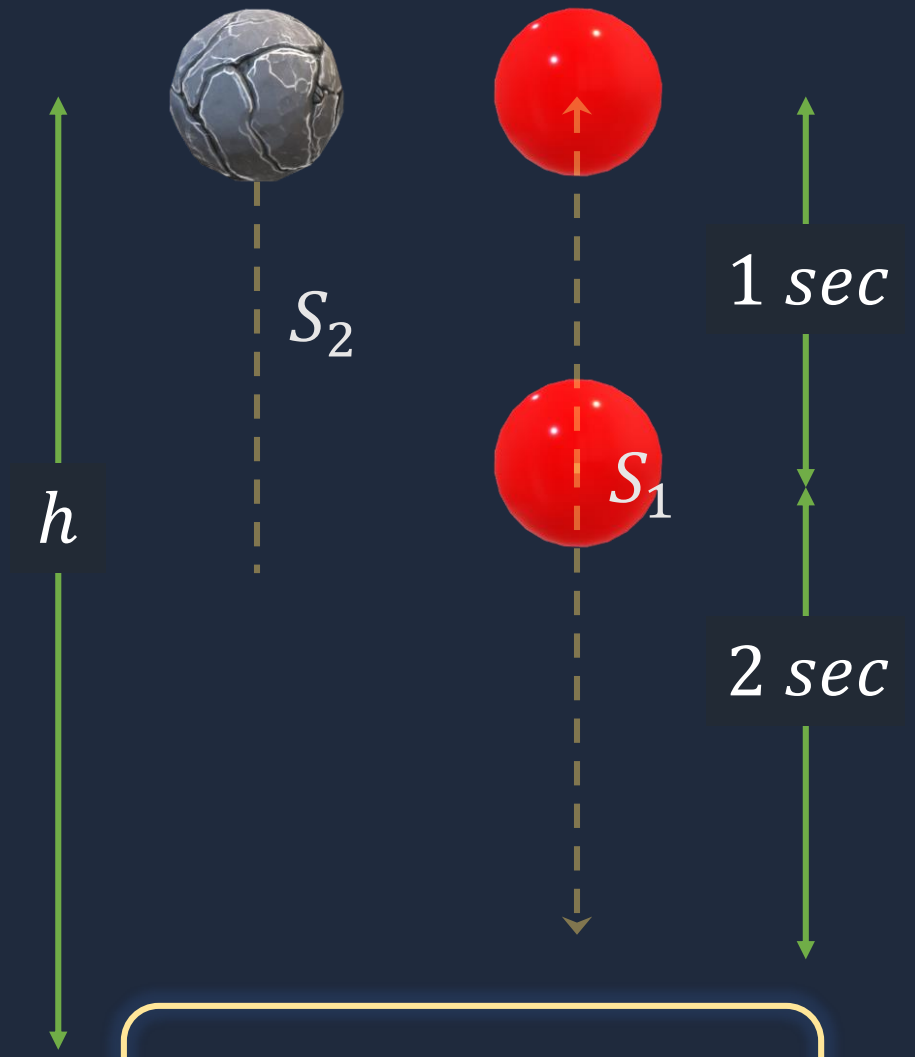
# Let's solve this

A ball is projected upwards from the foot of a tower. The ball crosses the top of the tower twice after an interval of $6\ s$ and the ball reaches the ground after $12\ s$. The height of the tower is ($g = 10\ m/s^2$)

$$h = 135\ m$$

# Let's solve this


An object is released from some height. Exactly after $1\ second$, another object is released from the same height. The distance between the two objects exactly after $2\ second$ object will be




$$S_1 - S_2 = 24.5\ m$$

# Thank You