

Kinematics – 2018 Nov AS

1. 9702/11/O/N/18/No.3

A ship is travelling with a velocity of 8.0 km h^{-1} in a direction 30° east of north.

What are the components of the ship's velocity in the east and north directions?

	component of velocity in east direction / km h^{-1}	component of velocity in north direction / km h^{-1}
A	4.0	4.0
B	4.0	6.9
C	4.6	6.9
D	6.9	4.0

$\sin 30^\circ = \frac{X}{8}$
 $X = 8 \sin 30^\circ = 4 \text{ km/h East}$
 $\cos 30^\circ = \frac{Y}{8}$
 $Y = 8 \cos 30^\circ = 6.9 \text{ km/h North}$

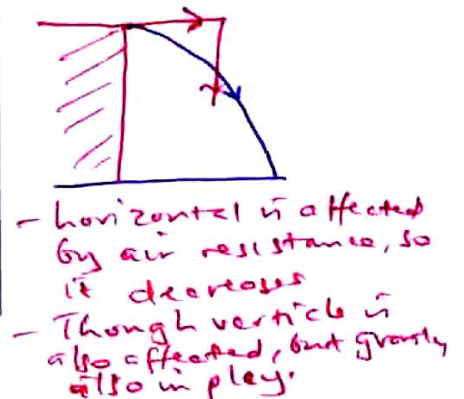
2. 9702/11/O/N/18/No.6

A tennis ball is thrown horizontally in air from the top of a tall building.

The effect of air resistance is not negligible.

What happens to the horizontal and to the vertical components of the ball's velocity?

	horizontal component of velocity	vertical component of velocity
A	constant	constant
B	constant	increases at a constant rate
C	decreases to zero	increases at a constant rate
D	decreases to zero	increases to a maximum value



3. 9702/12/O/N/18/No.6

A sprinter runs a 100 m race. The sprinter has a constant acceleration from rest of 2.5 m s^{-2} until reaching a speed of 10 m s^{-1} . The speed then remains constant until the end of the race.

Which time does it take the sprinter to run the race?

- A 8.9s B 10s **C 12s** D 14s

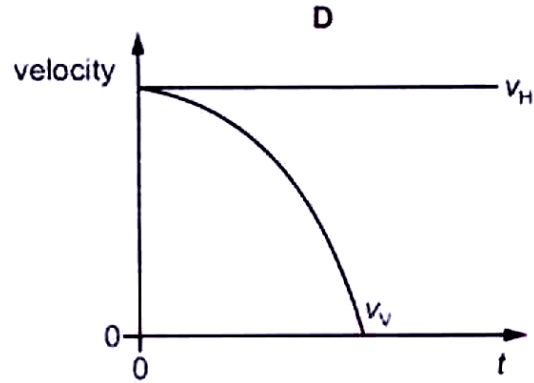
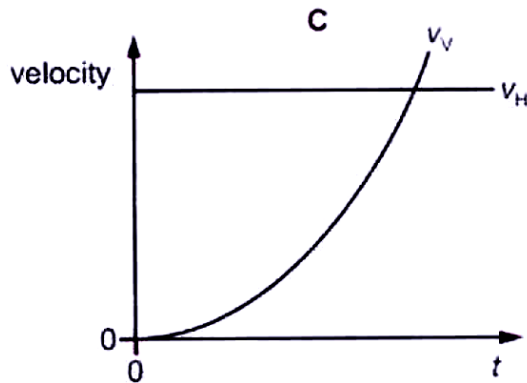
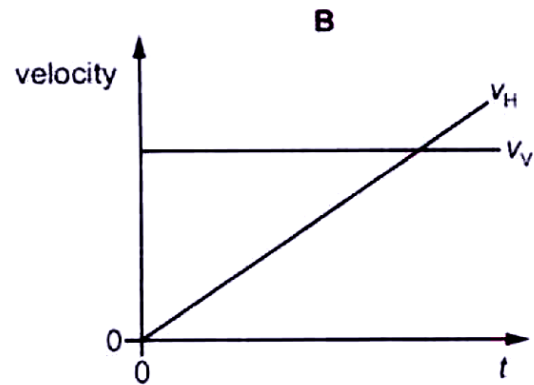
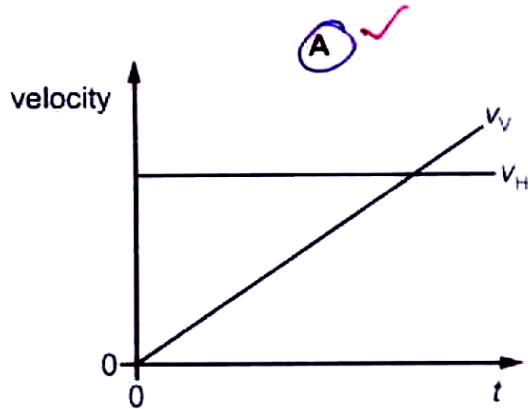
$u = 0$
 $v = 10 \text{ m s}^{-1}$
 $a = 2.5 \text{ m s}^{-2}$
 calculate distance
 $v^2 = u^2 + 2as$
 $10^2 = 0 + 2 \times 2.5 \times s$
 $s = \frac{100}{5} = 20 \text{ m}$
 calculate time
 $v = u + at$
 $10 = 0 + 2.5t$
 $t = \frac{10}{2.5} = 4 \text{ s}$

Remaining distance = 80 m
 speed = 10 m s^{-1}
 $t = \frac{d}{s} = \frac{80 \text{ m}}{10 \text{ m s}^{-1}} = 8 \text{ s}$
 Total time for race
 $4 + 8 = 12 \text{ s}$

4. 9702/13/O/N/18/No.6

A stone is projected horizontally at time $t = 0$ and falls. Air resistance is negligible. The stone has a horizontal component of velocity v_H and a vertical component of velocity v_V .

Which graph shows how v_H and v_V vary with time t ?



- Horizontal component v_H remains constant, since air resistance is negligible.
- The vertical component increase since the stone is acted upon by gravity (9.81 ms^{-2})
- So it is accelerating at a constant acc = g 9.81 ms^{-2}