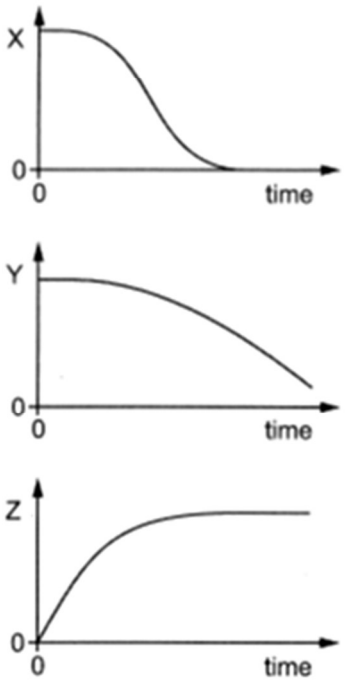
1 An object is dropped at time $t$ = 0 s from a tall building. Air resistance is significant.

Three graphs are plotted against time:

- the height of the object above the ground
- the speed of the object
- the magnitude of the resultant force on the object.




What are the quantities X, Y and Z?

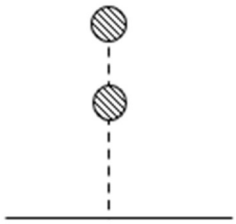
| | height of the object above the ground | speed of the object | magnitude of the resultant force on the object |
|---|---|---|---|
| **A** | X | Y | Z |
| **B** | X | Z | Y |
| **C** | Y | Z | X |
| **D** | Z | Y | X |

2 On a stationary ship, a golf ball is struck so that it flies off horizontally from the edge of the deck of the ship at a speed of 72 m $s^{-1}$ and lands in the sea at a horizontal distance of 220 m.

Assuming air resistance to be negligible, what is the vertical height of the deck above the sea?

**A** 15 m
**B** 30 m
**C** 46 m
**D** 92 m

3 Two identical stones are simultaneously released from rest from different heights as shown Air resistance is negligible.



As the stones fall, which of the following is true about the distance between them?

**A** The distance will increase continuously.

**B** The distance will decrease until they touch.

**C** The distance will remain the same.

**D** The distance will increase initially then remain the same.

4 A skydiver falls from an aircraft that is moving horizontally.
The vertical component of the velocity of the skydiver is *v*.
The vertical component of the acceleration of the skydiver is *a*.
Which row describes *v* and *a* during the first few seconds after the skydiver leaves the aircraft?

| | *v* | *a* |
|---|---|---|
| **A** | constant | constant |
| **B** | constant | decreasing |
| **C** | increasing | constant |
| **D** | increasing | decreasing |

5 A ball is thrown vertically upwards from ground level and reaches a maximum height of 12.7 m before falling back to ground level.

Assume air resistance is negligible.
What is the total time for which the ball is in the air?

**A** 1.61 s **B** 3.22 s **C** 3.88 s **D** 5.18 s

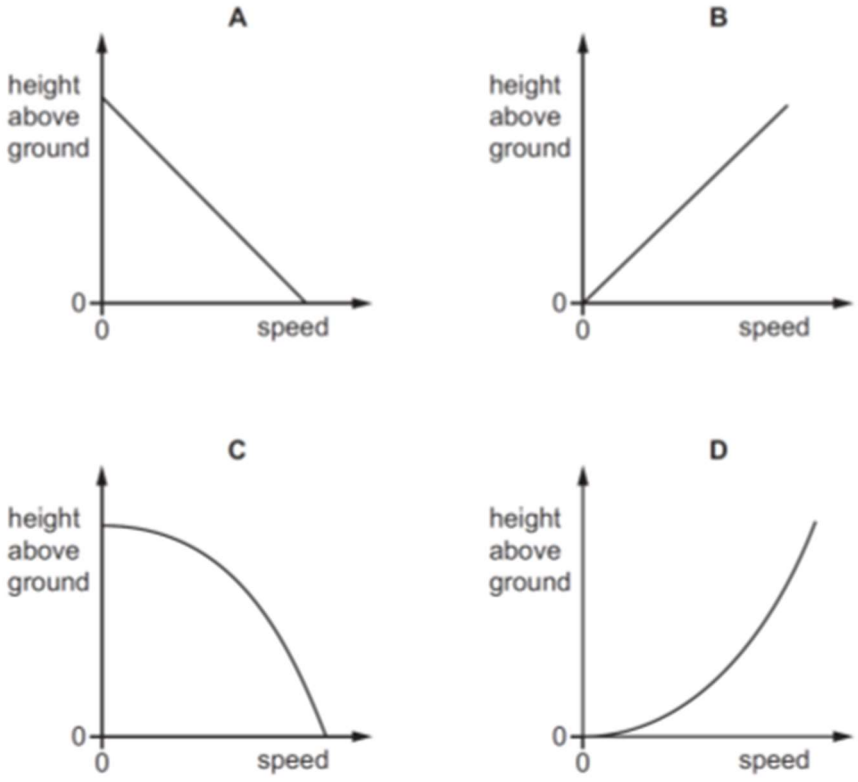
6 A car moves to the right with uniform acceleration along a straight road. Oil leaks from the car at the rate of one drop every three seconds. The diagram shows the distances between three successive oil drops on the road.


What is the acceleration of the car?

**A** 0.33 m s$^{-2}$
**B** 0.66 m s$^{-2}$
**C** 1.2 m s$^{-2}$
**D** 2.0 m s$^{-2}$

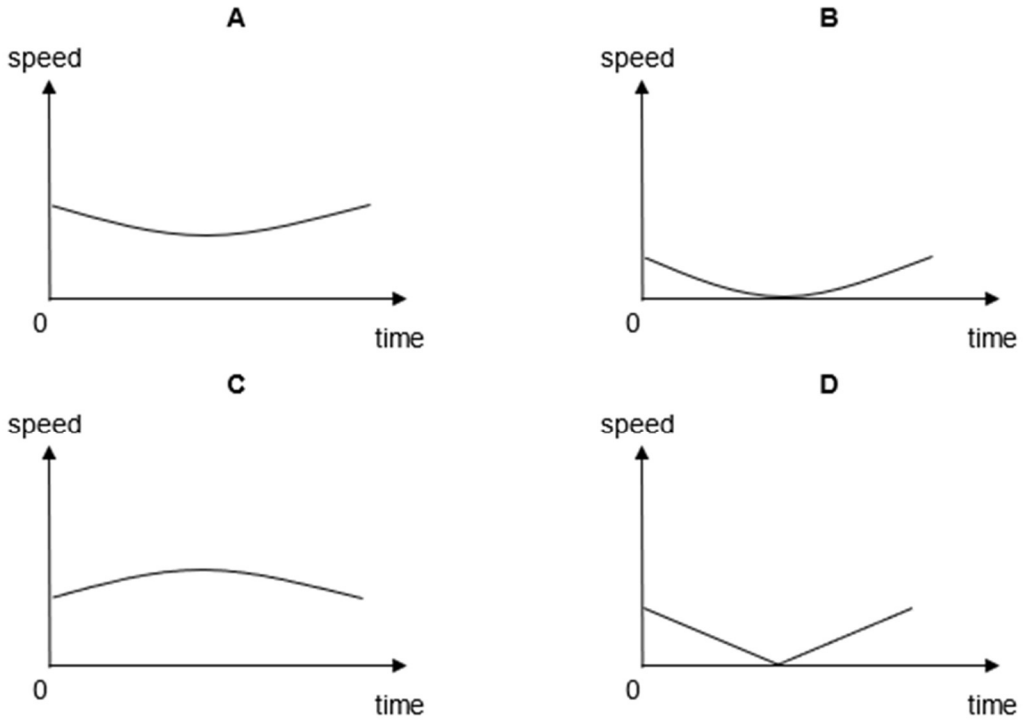
7 A ball is dropped from rest and falls towards the ground. Air resistance is negligible.

Which graph shows the variation with speed of the height of the ball above the ground?



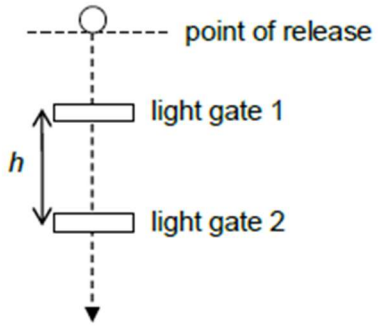
8 A projectile is shot into the air at an angle 45° above the horizontal. Air resistance is negligible.

Which of the following graphs best represents the variation of its speed with time?




9 To determine the acceleration of free fall, a steel ball is dropped above two light gates as shown.

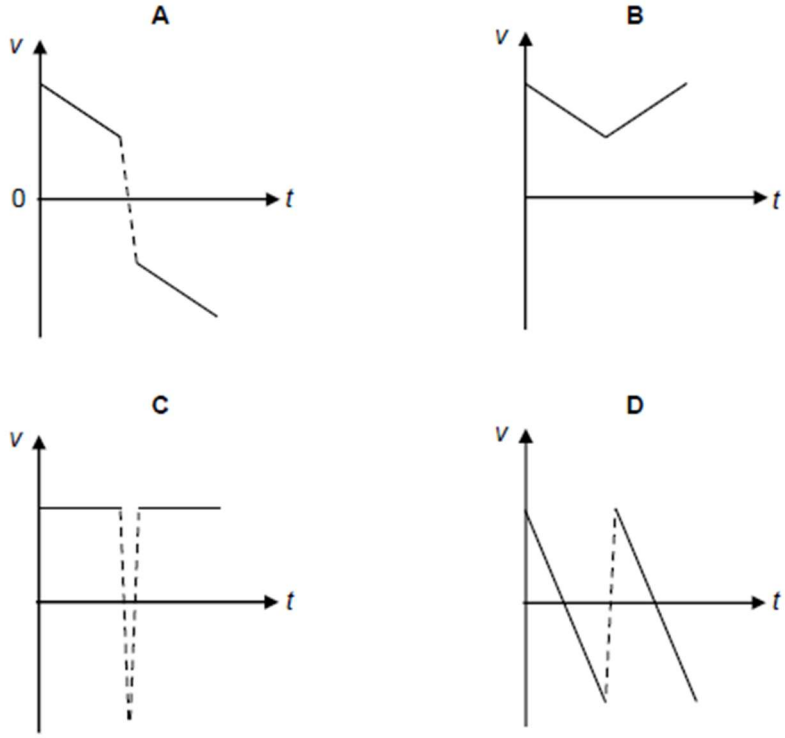
The ball passes light gate 1 and 2 at times $t_1$ and $t_2$ after release.




What is the acceleration of free fall?

**A** $\frac{2h}{t_2 - t_1}$ **B** $\frac{2h}{(t_2 - t_1)^2}$ **C** $\frac{2h}{{t_2}^2 - {t_1}^2}$ **D** $\frac{2h}{\left(\frac{t_2 + t_1}{2}\right)^2}$

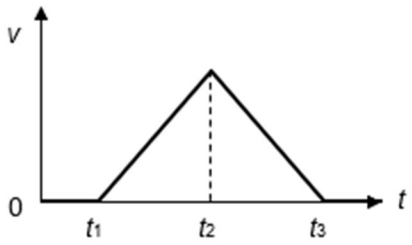
10 A tennis ball is thrown vertically upward. It hits the ceiling before it falls down. Assuming the effect of air resistance is negligible, which graph best represents the variation of velocity *v* with time *t* before and after hitting the ceiling?




11 An object is projected with velocity 40 m $s^{-1}$ at an angle of 60° to the horizontal. Air resistance is negligible.

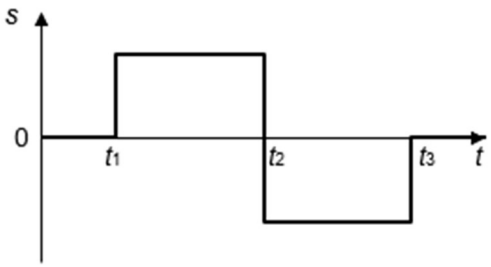
What is the speed of the object after 5.0 s?

12 The diagram shows the variation with time $t$ of the velocity $v$ of an object moving along a straight line. The intial displacement of the object is zero.

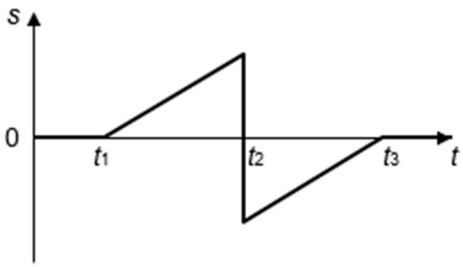



Which graph shows the variation with time $t$ of the displacement $s$ of the object?

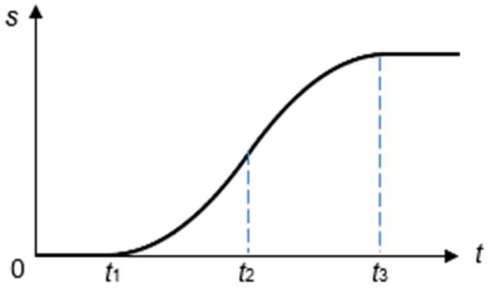
**A**



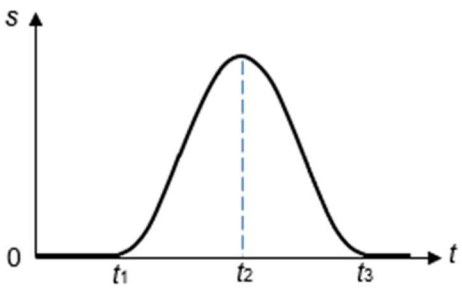

**B**



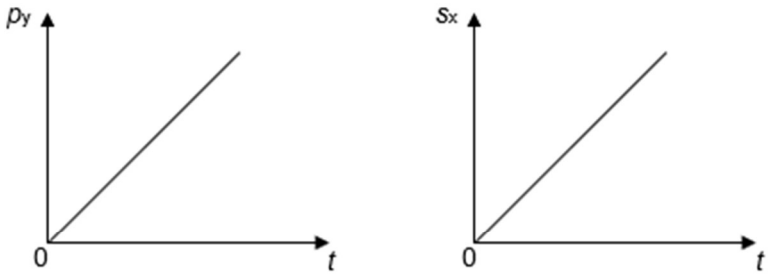

**C**




**D**



13 An object moves in the *x*-*y* plane. The graph on the left shows the variation with time *t* of the *y*-component of its momentum $p_y$ and the graph on the right shows the variation with *t* of the *x*-component of its displacement $s_x$.




Which statement describes the motion of the object?

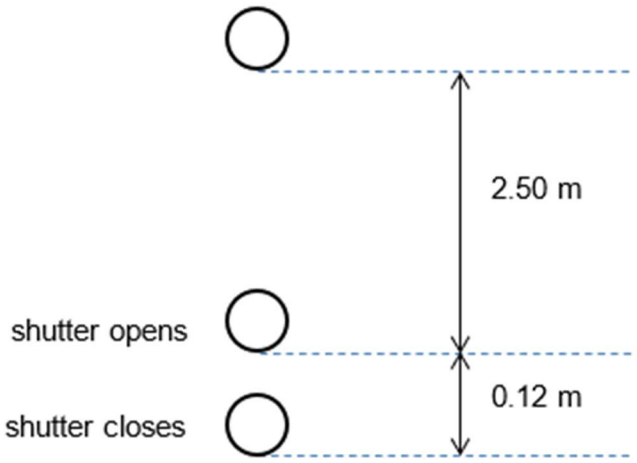
**A** It is moving in a circular path.

**B** It is moving in a parabolic path.

**C** It is moving with simple harmonic motion.

**D** It is moving with constant velocity in a straight line.

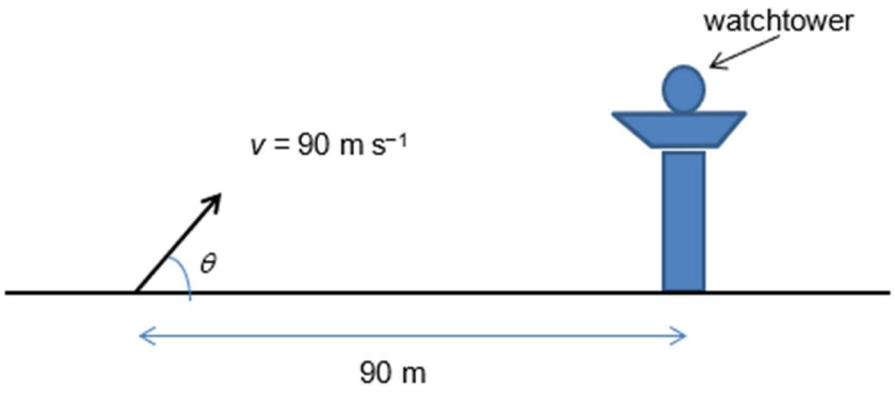
14 A photographer wishes to check the time for which the shutter on a camera stays open when a photograph is being taken. It is found that before the shutter opens, the ball falls 2.50 m from rest. During the time that the shutter remains open, the ball falls a further 0.12 m as illustrated.




What is the time that the shutter remains open?

**A** 0.017 s
**B** 0.16 s
**C** 0.71 s
**D** 0.73 s

15 A projectile is fired at a speed of 90 m $s^{-1}$ at sea level at an angle of $\theta = 31.6°$ with respect to the horizontal as shown below. The projectile hits the top of a watchtower located 90 m away.




How high is the top of the watchtower above sea level? Neglect air resistance.

**A** 49 m
**B** 72 m
**C** 83 m
**D** 113 m

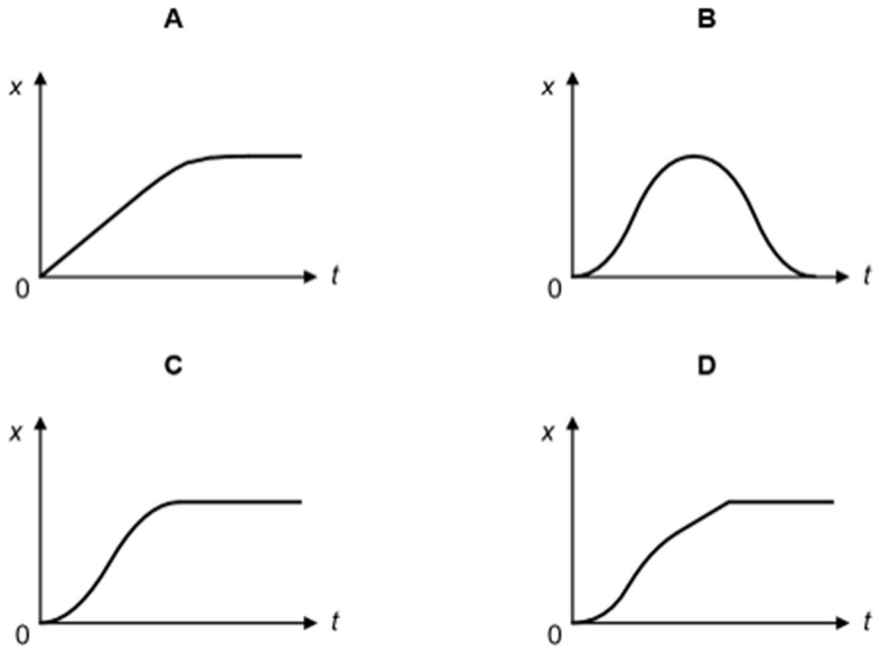
16 A train, initially at rest at a station, has a uniform acceleration of 0.20 m $s^{-2}$ until it reaches a speed of 20 m $s^{-1}$. It travels for some time at this constant speed and then has a uniform deceleration of 0.40 m $s^{-2}$ until it comes to rest at the next station. The distance between the two stations is 3000 m.

What is the time taken by the train to travel between the two stations?

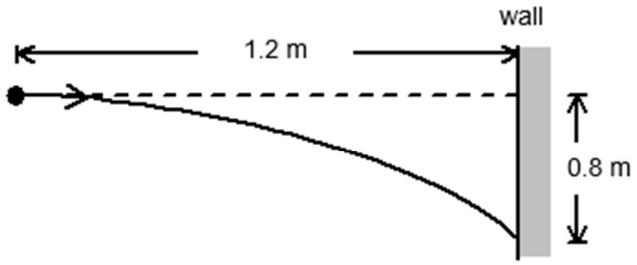
**A** 75 s **B** 150 s **C** 230 s **D** 300 s

17 A ball bearing is released from rest 10 cm above a tall measuring cylinder which is filled with oil.

Which one of the following graphs best represents the variation with time *t* of displacement *x* of the ball bearing?



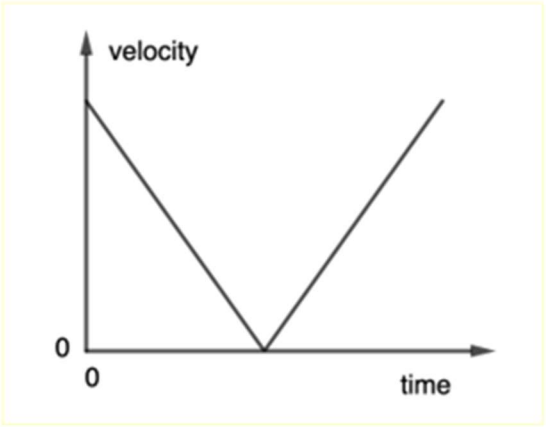

18 A small object is thrown horizontally towards a vertical wall 1.2 m away. It hits the wall 0.8 m below its initial horizontal level.




At what speed does the object hit the wall? (Neglect air resistance.)

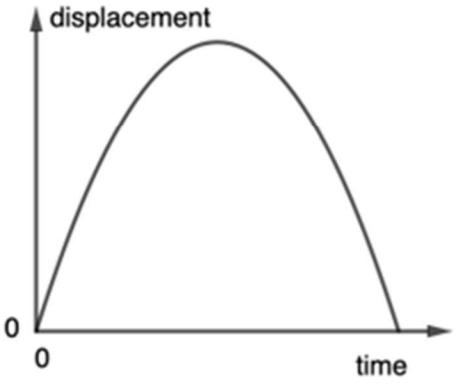
**A** 2 m s$^{-1}$ **B** 3 m s$^{-1}$ **C** 5 m s$^{-1}$ **D** 7 m s$^{-1}$

19 The graph shows how the velocity of a moving body varies with time.

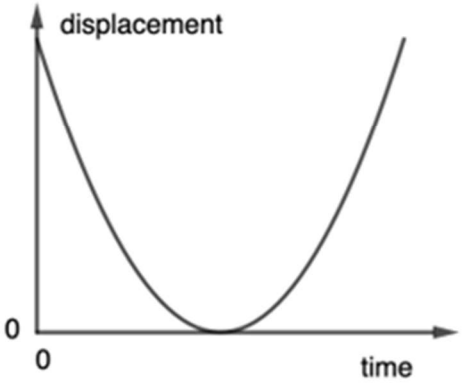



Which one of the displacement-time graphs below represents the same motion?

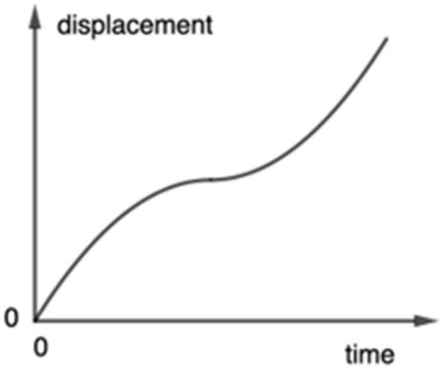
**A**



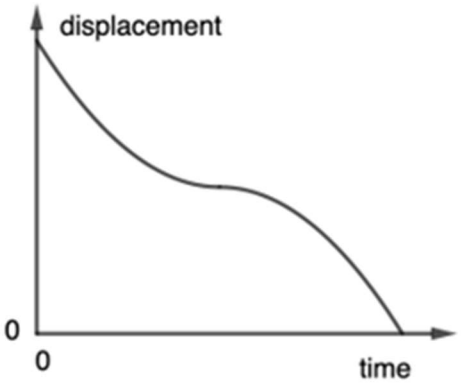

**B**




**C**




**D**



20 Ball **A** was dropped from the top of a tall building. At the same instant, an identical ball **B** was thrown downward from the same point. Neglecting the effects of air friction, what can be said of their accelerations while they were falling?

**A** Their accelerations are equal.

**B** Ball **A** has the greater acceleration.

**C** Ball **B** has the greater acceleration.

**D** It is impossible to tell since their accelerations vary greatly.