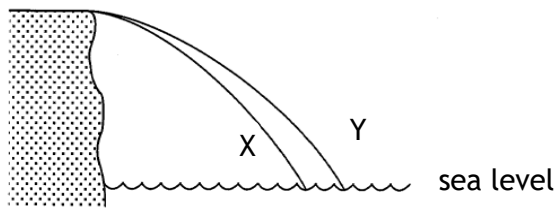


Area 5: Projectile Motion

Multiple Choice Questions 1 → 10

1. Two identical balls X and Y are projected horizontally from the edge of a cliff. The path taken by each ball is shown.

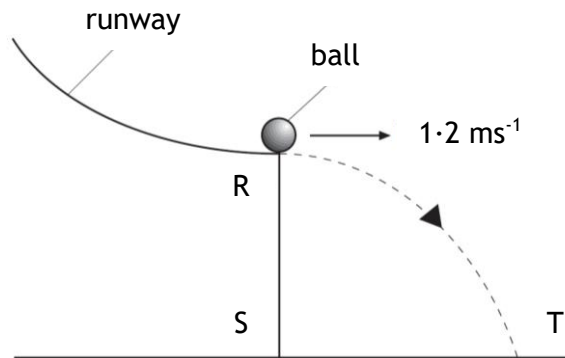


Identify which of the following statements about the motion of the balls is/are correct.

- I they take the same time to reach sea level.
- II they have the same vertical acceleration.
- III they have the same horizontal velocity.

- A I only
- B II only
- C I and II only
- D I and III only
- E II and III only

2. A ball rolls down a runway and leaves it at point R.



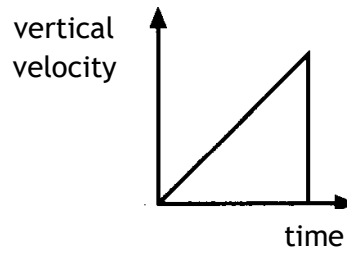
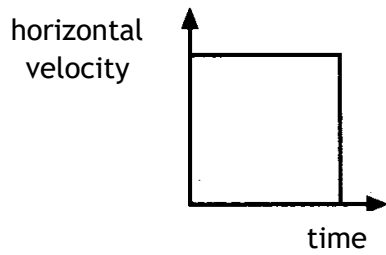
The horizontal speed of the ball at R is 1.2 ms^{-1} .
The ball takes 0.4 s to travel from R to T.

Calculate the distance from S to T.

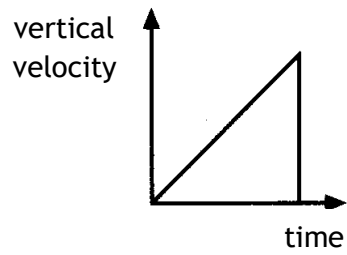
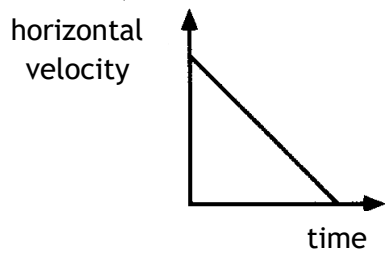
- A 0.33 m
- B 0.48 m
- C 3.0 m
- D 4.8 m
- E 12 m

3. A ball is kicked horizontally off the edge of a cliff and lands in the sea. The effect of air resistance on the ball can be ignored. Identify which pair of graphs show the horizontal and vertical velocity-time graphs for the ball during its flight.

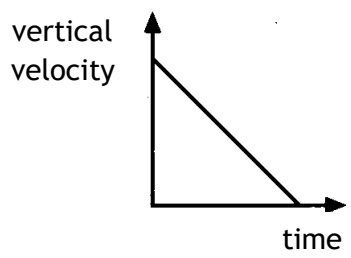
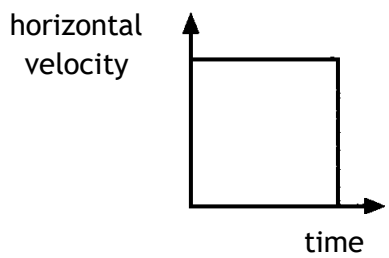
A



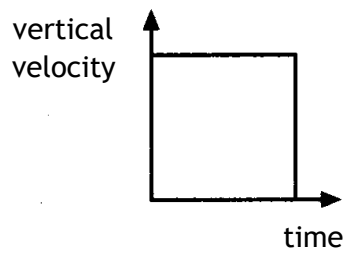
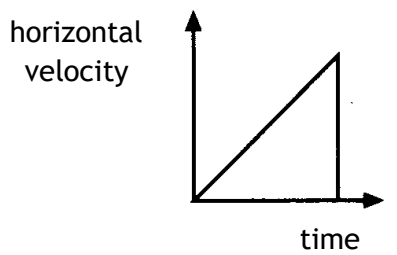
B



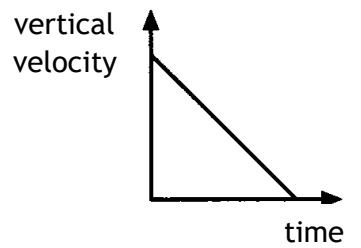
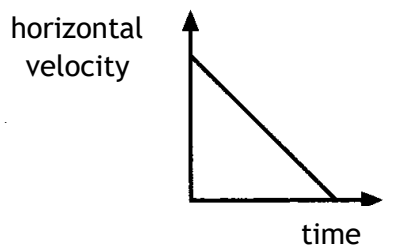
C



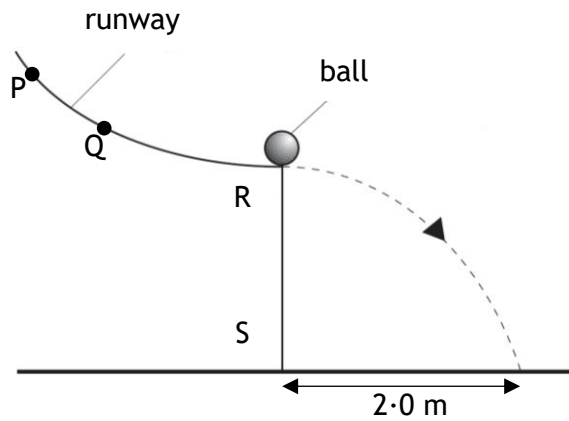
D



E



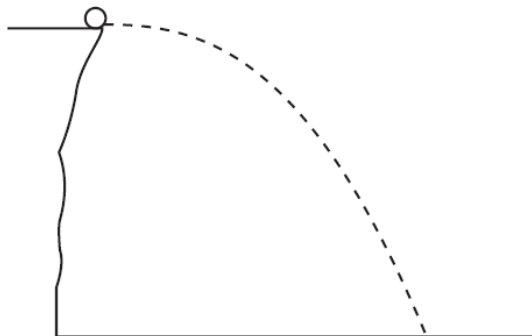
4. A ball is released from point Q on a curved runway, leaves the runway horizontally at R and lands 1 s later.



The ball is now released from point P. Identify which row describes the motion of the ball after leaving the runway.

	time to land after leaving the runway	distance from point S to landing point
A	1 s	less than 2 m
B	less than 1 s	more than 2m
C	1 s	more than 2m
D	less than 1 s	2m
E	more than 1 s	more than 2m

5. A ball is thrown horizontally from a cliff as shown.



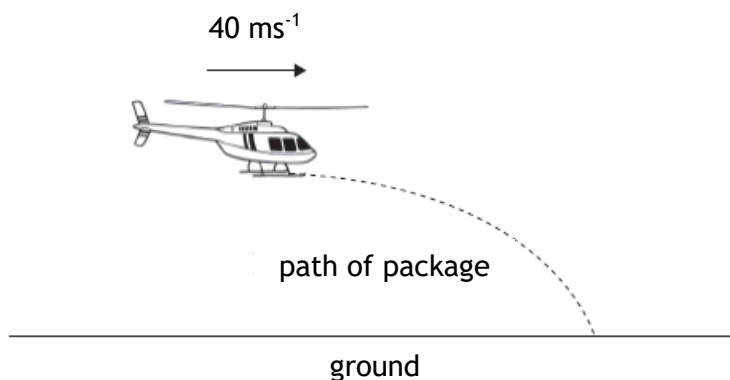
The effect of air resistance is negligible.

Identify which of the following statements about the ball is/are correct.

- I the vertical velocity of the ball increases as it falls.
- II the vertical acceleration of the ball increases as it falls.
- III the vertical force on the ball increases as it falls.

- A I only
- B II only
- C I and II only
- D I and III only
- E I, II and III

6. A package is released from a helicopter flying horizontally at a constant velocity of 40 ms^{-1} .

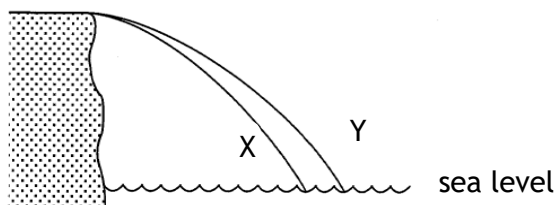


The package takes 3.06 s to reach the ground. The effects of air resistance can be ignored.

Identify which row in the table shows the horizontal velocity and vertical velocity of the package just before it hits the ground.

	horizontal velocity (ms^{-1})	vertical velocity (ms^{-1})
A	0	30
B	30	30
C	30	40
D	40	30
E	40	40

7. Two identical balls X and Y are projected horizontally from the edge of a cliff. The path taken by each ball is shown.



Identify which of the following statements about the motion of the balls is/are correct.

- I they take the same time to reach sea level.
 - II they have the same vertical acceleration.
 - III they have the same final vertical velocity.
- A I only
 - B II only
 - C III only
 - D I and II only
 - E I, II and III

8. A seagull is flying horizontally at a speed of 8.0 ms^{-1} . The seagull drops a piece of food which hits the ground 2.5 s later.

Identify which row in the table shows the horizontal velocity, vertical velocity and horizontal displacement of the package just before it hits the ground.

	horizontal velocity (ms^{-1})	vertical velocity (ms^{-1})	horizontal displacement (m)
A	0	8.0	8.0
B	8.0	20	20
C	8.0	24.5	20
D	24.5	24.5	61.3
E	33	50	196

9. A package falls vertically from a helicopter. After some time the package reaches its terminal velocity.

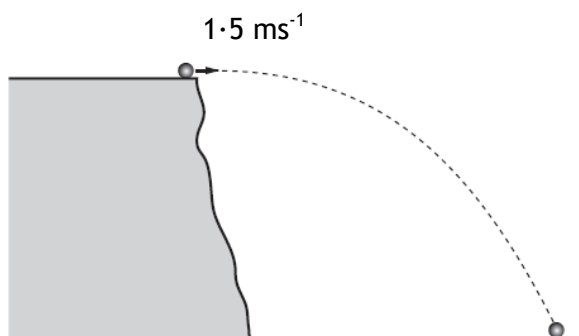
A group of students make the following statements about the package when it reaches its terminal velocity.

- I the weight of the package is less than the air resistance acting on the package.
- II the forces acting on the package are balanced.
- III the package is accelerating towards the ground at 9.8 ms^{-2} .

Identify which of these statements is/are correct.

- A I only
- B II only
- C III only
- D I and III only
- E II and III only

10. A ball is projected horizontally with a velocity of 1.5 ms^{-1} from a cliff as shown.



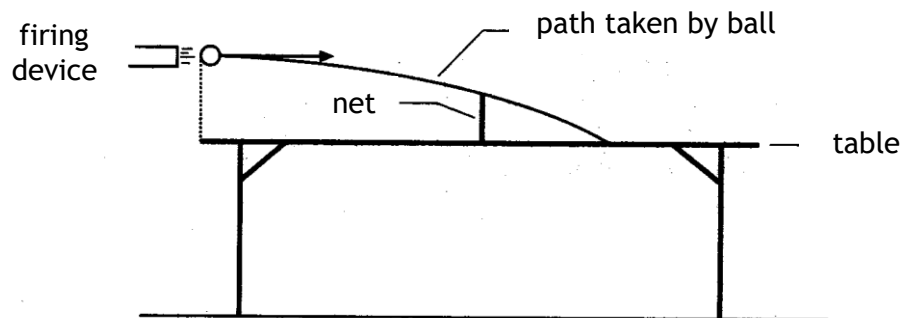
The ball hits the ground 1.22 s after it leaves the cliff. The effects of air resistance are negligible.

Identify which row in the table shows the horizontal velocity, vertical velocity and the vertical displacement of the ball just before it hits the ground.

	horizontal velocity (ms^{-1})	vertical velocity (ms^{-1})	vertical displacement (m)
A	12	12	7.32
B	12	1.5	1.83
C	1.5	12	7.32
D	1.5	13	1.83
E	0	12	7.32

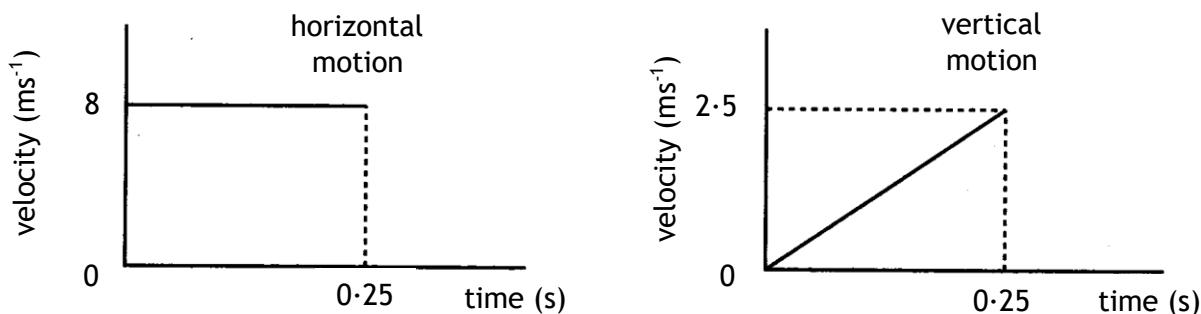
Full Response Questions 11→ 13

11. Table tennis players can practise using a device which fires balls horizontally.



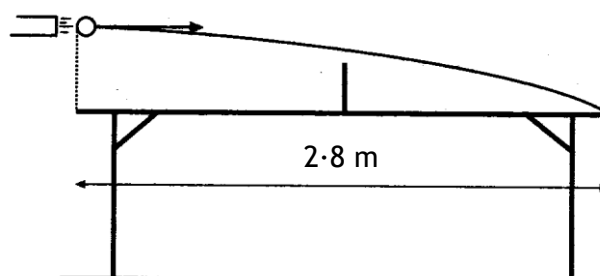
The following graphs describe the horizontal and vertical motions of a ball from the instant it leaves the device until it bounces on the table 0.25 s later.

The effects of air resistance are assumed to be negligible.



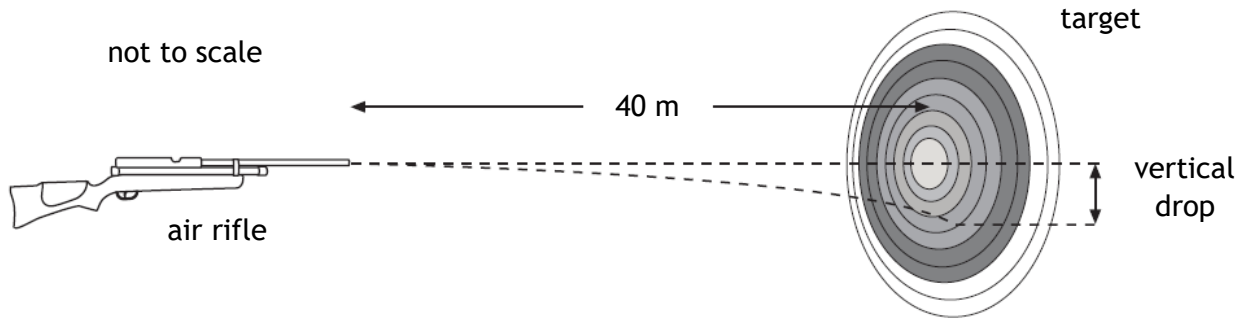
- (a) Explain why the shape of the path taken by the ball is curved.
- (b) Using the graphs, answer the following questions.
 - (i) State the instantaneous speed of the ball, as it leaves the device.
 - (ii) Calculate the instantaneous speed of the ball immediately before hitting the ground.
 - (iii) Calculate the height above the table at which the ball is released.
- (c) The device is adjusted to fire a second ball which lands at the end of the table.

The height and position of the device are not changed.



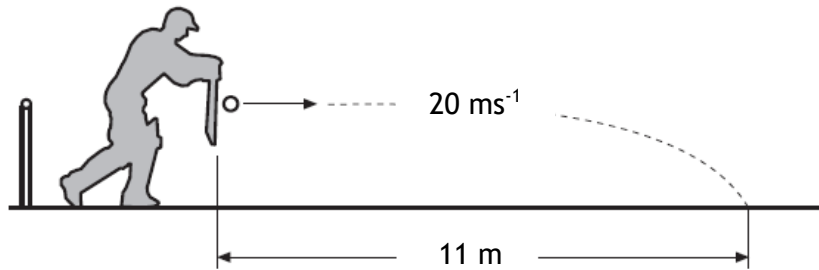
Assuming that the effects of air resistance are negligible, calculate the instantaneous speed of the second ball as it leaves the device.

12. At a firing range a pellet is fired horizontally at a target 40 m away. It takes 0.20 s for the pellet to reach the target.



- (a) Calculate the vertical velocity of the pellet on reaching the target.
- (b) Calculate the vertical drop.

13. A cricketer strikes the cricket ball. The ball leaves the bat horizontally at 20 ms^{-1} . It hits the ground at a distance of 11 m from the point where it was struck.



Assume that air resistance is negligible.

- (a) Calculate the time of flight of the ball.
- (b) Calculate the vertical velocity of the ball as it reaches the ground.
- (c) Create a graph of vertical velocity against time for the ball.
You must include numerical values on both axes.
- (d) Calculate the vertical distance travelled by the ball during its flight.