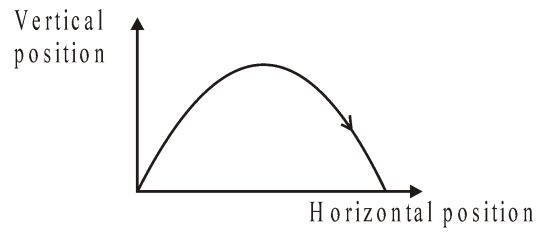


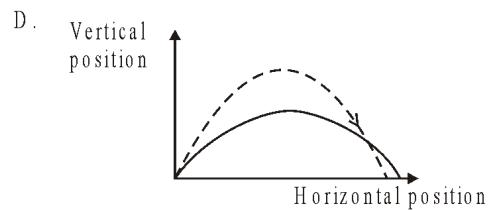
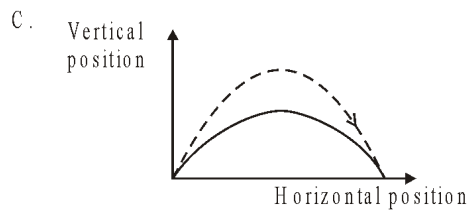
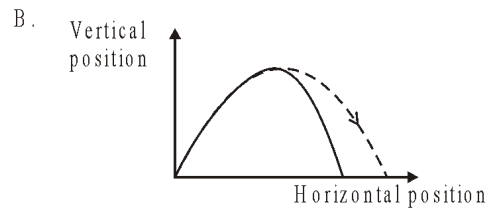
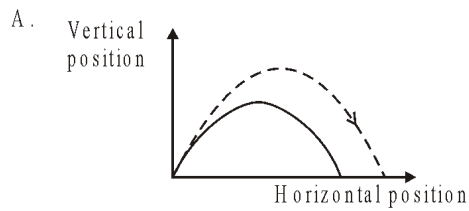
1. A raindrop falling through air reaches a terminal velocity before hitting the ground. At terminal velocity, the frictional force on the raindrop is
- A. zero.
  - B. less than the weight of the raindrop.
  - C. greater than the weight of the raindrop.
  - D. equal to the weight of the raindrop.**

(1)

2. The diagram below shows the path of a projectile in the absence of air resistance.

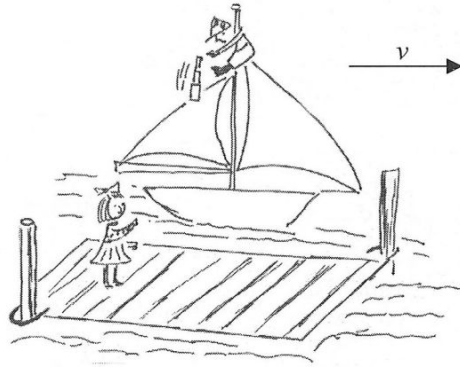


Which **one** of the following diagrams best represents the path of the projectile under the same initial conditions when the air resistance is taken into account? (*The path in absence of air resistance is shown for comparison as a dotted line.*)

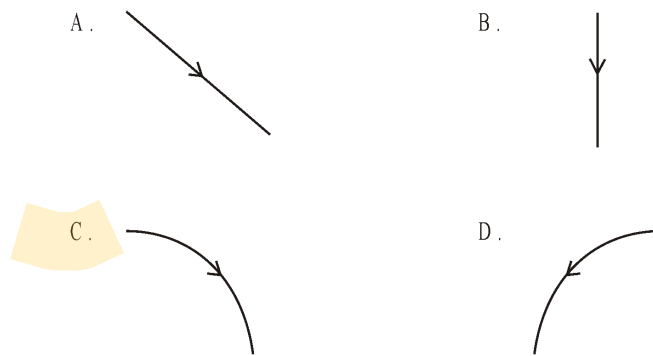


(1)

3. A sailing boat is moving with constant velocity  $v$  to the right parallel to the dock.



Sailor Hulot, up on the mast, drops his telescope at the moment he is opposite Lucie who is standing on the dock. Which **one** of the following best shows the path of the falling telescope as seen by Lucie?



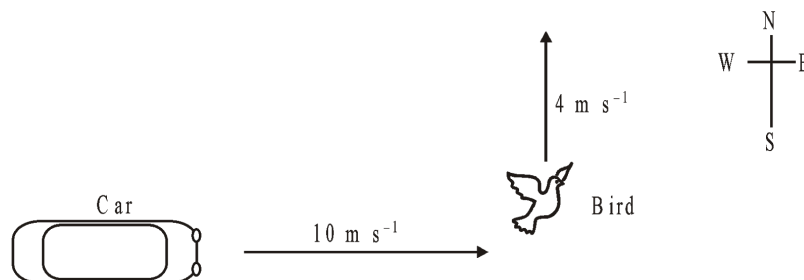
(1)

4. A stone is thrown horizontally from the top of a high cliff. Assuming air resistance is negligible, what is the effect of gravitational force on the horizontal and on the vertical components of the velocity of the stone?

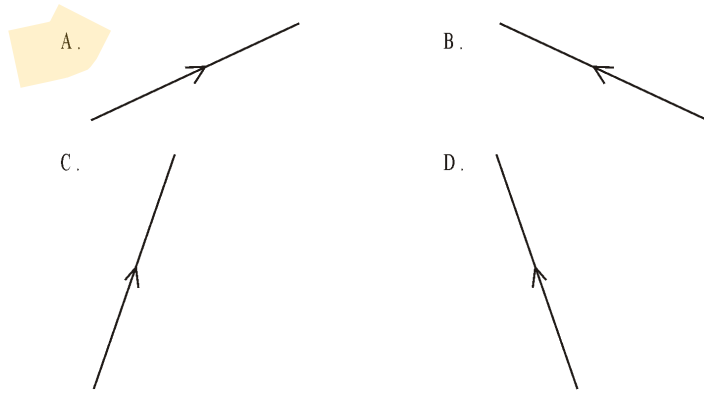
	Vertical component of velocity	Horizontal component of velocity
A.	increases to a constant value	stays constant
B.	increases continuously	stays constant
C.	increases to a constant value	decreases to zero
D.	increases continuously	decreases to zero

(1)

5. A car is heading due East at a speed of  $10 \text{ m s}^{-1}$ . A bird is flying due North at a speed of  $4 \text{ m s}^{-1}$ , as shown below.

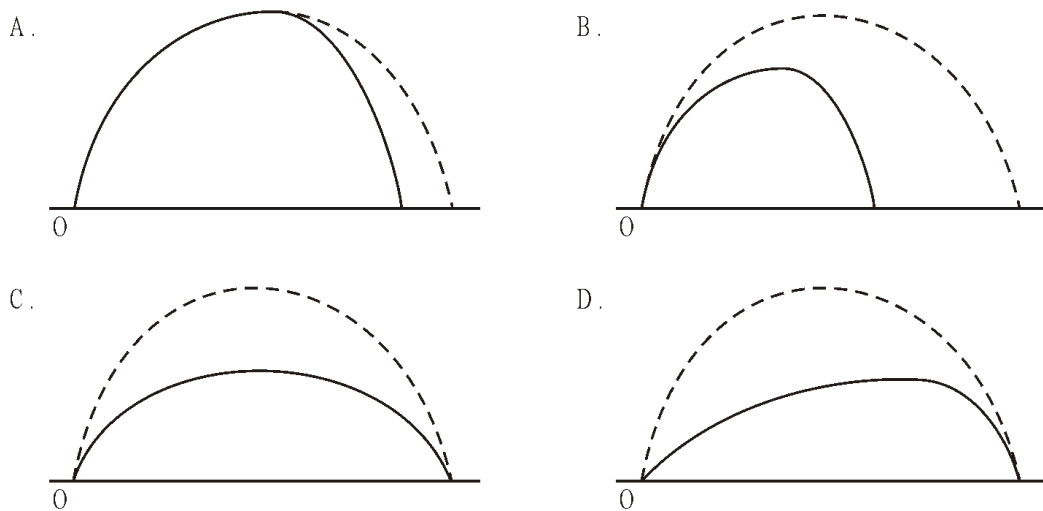


Which **one** of the following vectors represents the velocity of the bird relative to a person in the car?



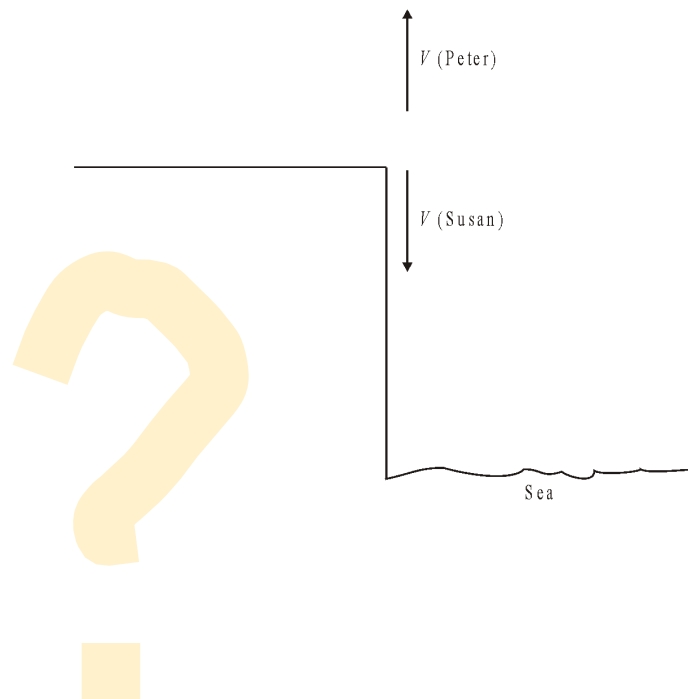
(1)

6. A stone is thrown from O at an angle to the horizontal. Which sketch below best shows the path of the stone when air resistance is **not** neglected? On each sketch, the broken line shows the path for the same stone in a vacuum.



(1)

7. Peter and Susan both stand on the edge of a vertical cliff.

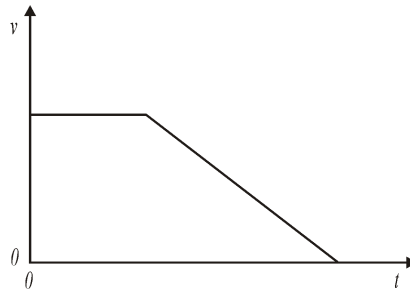


8. Which **one** of the following is a true statement concerning the vertical component of the velocity and the acceleration of a projectile when it is at its maximum height? (*The acceleration of free fall is  $g$ .*)

	Vertical component of velocity	Acceleration
A.	maximum	zero
B.	maximum	$g$
C.	zero	zero
D.	zero	$g$

(1)

9. The diagram below shows the variation with time  $t$  of the velocity  $v$  of an object.

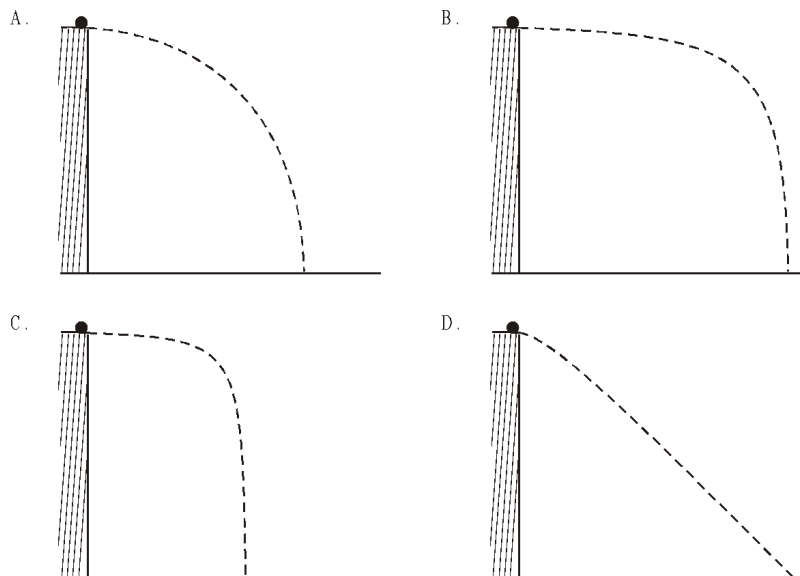


The area between the line of the graph and the time-axis represents

- A. the average velocity of the object.
- B. the displacement of the object.
- C. the impulse acting on the object.
- D. the work done on the object.

(1)

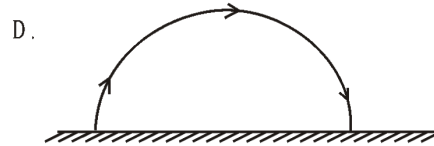
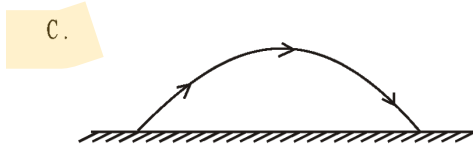
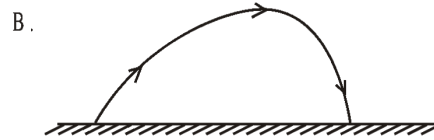
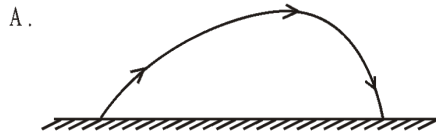
10. A ball is thrown horizontally from the top of a cliff. Air resistance is negligible. Which of the following diagrams best represents the subsequent path of the ball?



(1)

11. A boy throws a small stone at an angle to the horizontal.

Which **one** of the following sketches best shows the path of the stone as it rises and then falls back to Earth? Air resistance is negligible and the acceleration of free fall is constant.



(1)

12. A stone is thrown at an angle to the horizontal. Ignoring air resistance, the horizontal component of the initial velocity of the stone determines the value of

- A. range only.
- B. maximum height only.
- C. range and maximum height.
- D. range and time of flight.

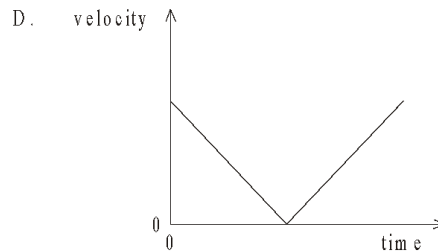
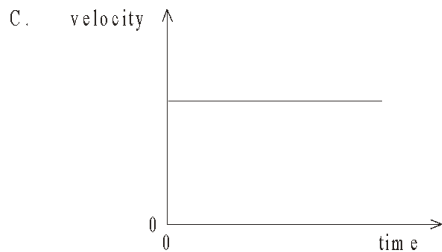
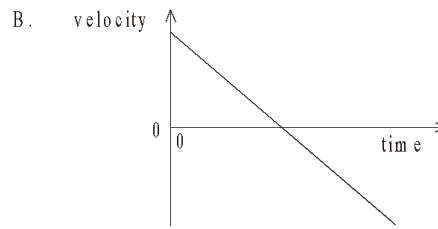
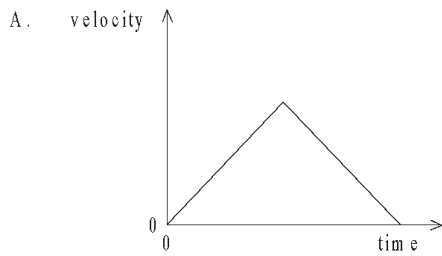
(1)

13. A stone is projected horizontally from the top of a cliff. Neglecting air resistance, which *one* of the following correctly describes what happens to the horizontal component of velocity and to the vertical component of velocity?

	Horizontal component of velocity	Vertical component of velocity
A.	Decreases	Increases
B.	Decreases	Constant
C.	Constant	Constant
D.	Constant	Increases

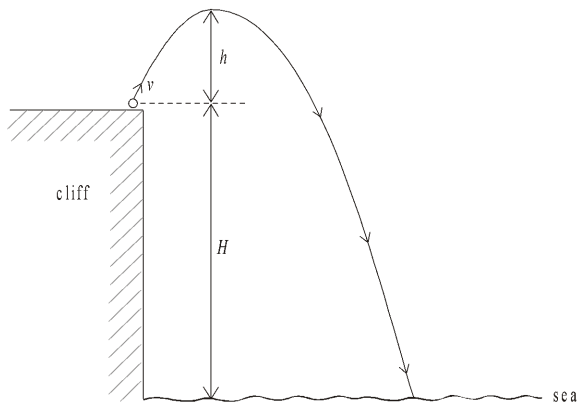
(1)

14. An archer shoots an arrow at an angle to the horizontal. Air resistance is negligible. Which of the following graphs best represents the variation with time of the **horizontal component** of the arrow's velocity from the time it is launched to the time just before it hits the ground?



(1)

15. A stone is thrown with speed  $v$  from the top of a cliff of height  $H$ , as shown below.



The stone is thrown at an angle to the horizontal so that it rises to a height  $h$  above the top of the cliff before falling into the sea. The acceleration of free fall is  $g$ . Air resistance is negligible.

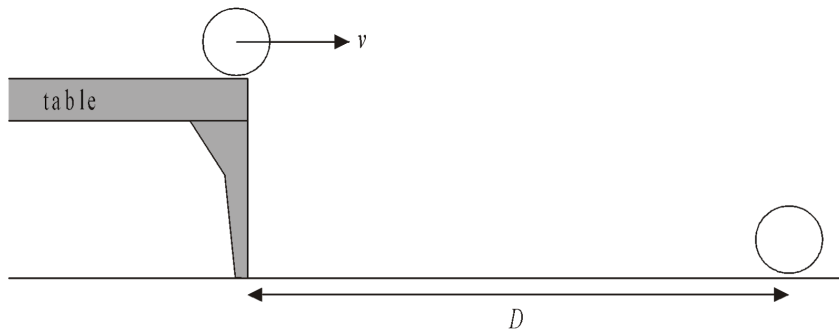
Which **one** of the following expressions gives correctly the speed of the stone as it hits the sea?

- A.  $v + \sqrt{2gh}$
- B.  $v + \sqrt{2gH}$
- C.  $\sqrt{2g\{h+H\}}$
- D.  $\sqrt{v^2 + 2gH}$

(1)

16. A ball rolls off a horizontal table with velocity  $v$ . It lands on the ground a time  $T$  later at a distance

$D$  from the foot of the table as shown in the diagram below. Air resistance is negligible.

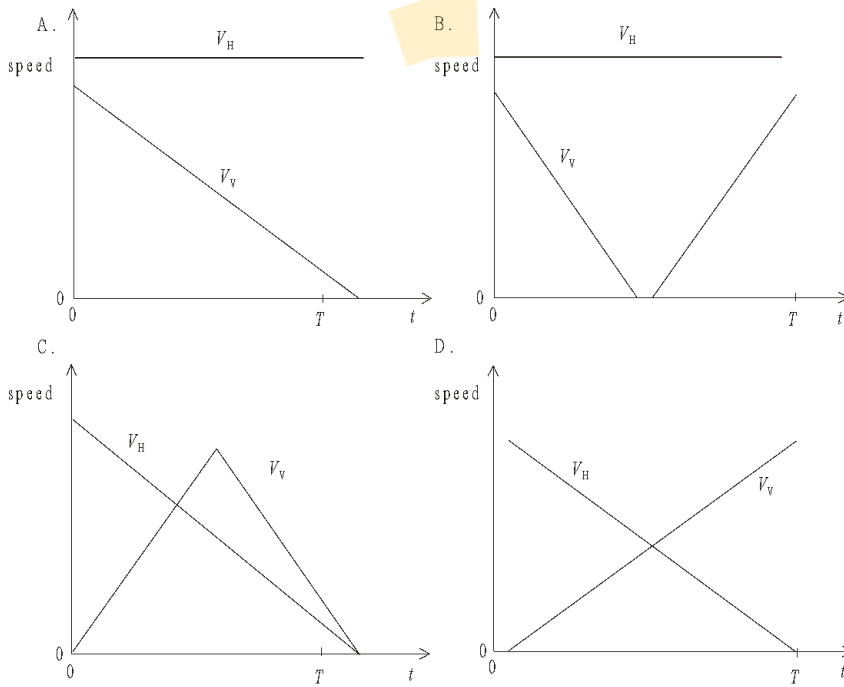


A second **heavier** ball rolls off the table with velocity  $v$ . Which **one** of the following is correct for the heavier ball?

	<b>Time to land</b>	<b>Distance from table</b>
A.	$T$	$D$
B.	$T$	less than $D$
C.	less than $T$	$D$
D.	less than $T$	less than $D$

(1)

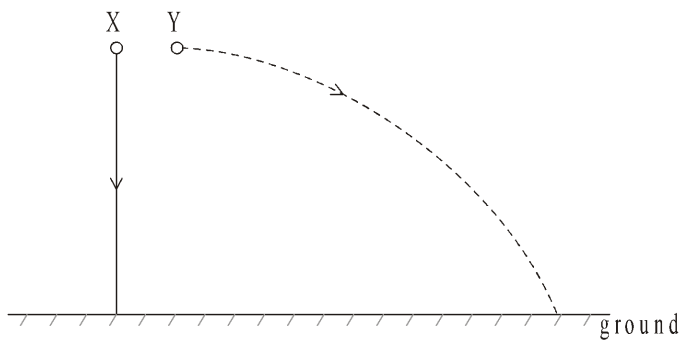
17. A projectile is fired from the ground at time  $t = 0$ . It lands back on the ground at time  $t = T$ . Which of the following sketch graphs best shows the variation with time  $t$  of the vertical speed  $V_v$  and horizontal speed  $V_H$  of the projectile? Air resistance is negligible.



(1)



18. Two identical metal spheres X and Y are released at the same time from the same height above the horizontal ground. Sphere X falls vertically from rest. Sphere Y is projected horizontally as shown below.



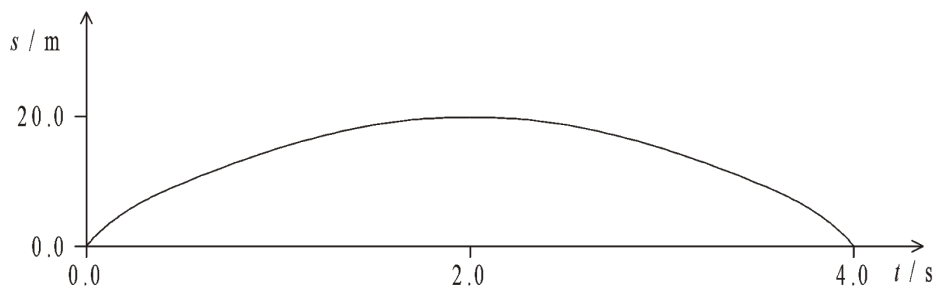
Air resistance is negligible.

Which of the following statements is correct?

- A. Sphere X hits the ground before sphere Y because it travels a shorter distance.
- B. Sphere Y hits the ground before sphere X because its initial velocity is greater.
- C. The spheres hit the ground at the same time because horizontal motion does not affect vertical motion.
- D. The spheres hit the ground at the same time because they have equal weights.

(1)

19. The graph below shows the variation with time  $t$  of the displacement  $s$  of an object moving along a straight-line.

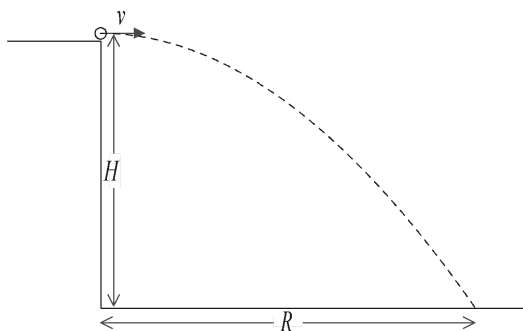


The best estimate of the instantaneous speed of the object at  $t = 2.0$  s is

- A. 0.0 ms<sup>-1</sup>.
- B. 0.2 ms<sup>-1</sup>.
- C. 5.0 ms<sup>-1</sup>.
- D. 10.0 ms<sup>-1</sup>.

(1)

20. A particle is projected horizontally with speed  $v$  from a height  $H$ . It lands a horizontal distance  $R$  from the point of launch as shown in the diagram below.

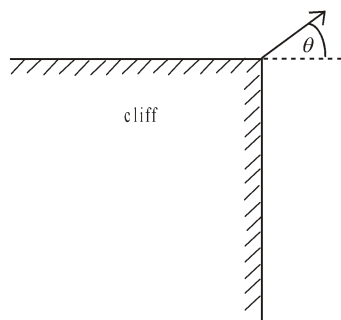


A second particle is projected horizontally from the same height with speed  $2v$ . Neglecting air resistance the horizontal distance travelled by this particle is

- A.  $R$ .
- B.  $\sqrt{2}R$ .
- C.  $2R$ .
- D.  $4R$ .

(1)

21. A stone is thrown from the top of a cliff with speed  $v$  at an angle  $\theta$  above the horizontal, as shown.



Air resistance is negligible and the acceleration of free fall is  $g$ .

What is the horizontal velocity of the stone a time  $t$  after the stone has been thrown?

- A.  $v \sin \theta$
- B.  $v \sin \theta - gt$
- C.  $v \cos \theta$
- D.  $v \cos \theta - gt$

(1)

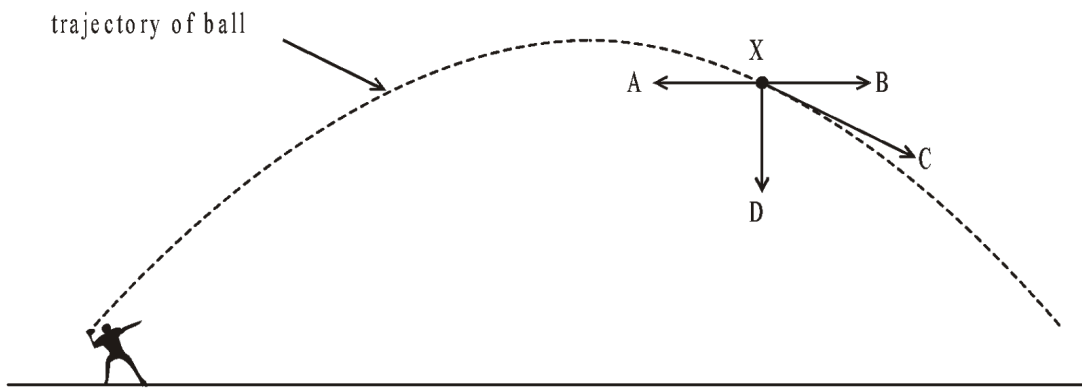
22. A car has a speed of  $+15 \text{ m s}^{-1}$  relative to the ground. It passes a cyclist travelling in the same straight-line. The speed of the car relative to the cyclist is  $+12 \text{ m s}^{-1}$ .

The speed of the cyclist relative to the ground is

- A.  $-3.0 \text{ m s}^{-1}$ .
- B.  $-1.5 \text{ m s}^{-1}$ .
- C.  $+1.5 \text{ m s}^{-1}$ .
- D.  $+3.0 \text{ m s}^{-1}$ .

(1)

23. The diagram below shows the trajectory of a ball thrown into the air. There is no air resistance.



Which arrow gives the direction of the resultant force on the ball at the point X?

- A. A
- B. B
- C. C
- D. D

(1)