

AP Physics B

Instructor: Mr. Butler

Practice Quiz

Vectors, Projectiles and Relative Velocity

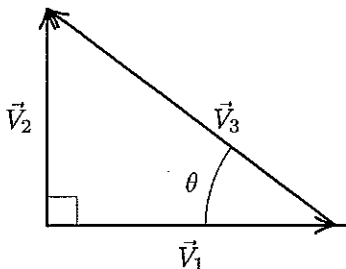
1. Composition by component method does not involve which of the following steps?
- A. Resolving vectors into components
 - B. Applying trigonometry
 - C. Applying the *Pythagorean Theorem*
 - D. Drawing a vector diagram attaching the vectors tip-to-tail
 - E. The method involves all of the above steps

2. Which of the following sets of vectors cannot have a resultant equal to zero?
- A. 10, 10, and 10 N
 - B. 10, 10, and 20 N
 - C. 10, 20, and 20 N
 - D. 10, 20, and 40 N
 - E. All of the above

3. Consider three vectors given in the situation shown below:

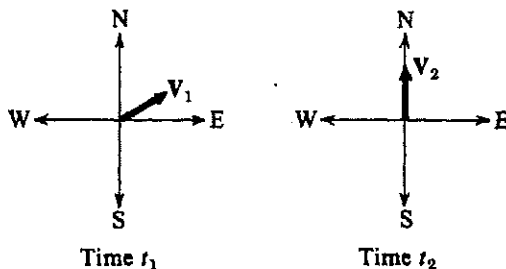
The vector \vec{V}_3 in the diagram is equal to:

- A. $\vec{V}_1 - \vec{V}_2$
- B. $\vec{V}_1 + \vec{V}_2$
- C. $\vec{V}_2 - \vec{V}_1$
- D. $\vec{V}_1 \cos \theta$
- E. $\vec{V}_1 / (\cos \theta)$



4. The *Equilibrant*
- A. is a vector that causes a state of equilibrium.
 - B. balances a system of forces.
 - C. is equal in magnitude and opposite in direction to the resultant.
 - D. produces a vector sum of zero in a force system.
 - E. All of the above

5. Consider the situation shown below:

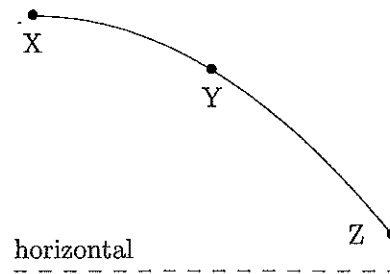


Vectors \vec{V}_1 and \vec{V}_2 shown above have equal magnitudes. The vectors represent the velocities of an object at times t_1 , and t_2 , respectively. The average acceleration of the object between time t_1 and t_2 was

(A) zero (B) directed north (C) directed west (D) directed north of east (E) directed north of west

6. Consider the situation shown below:

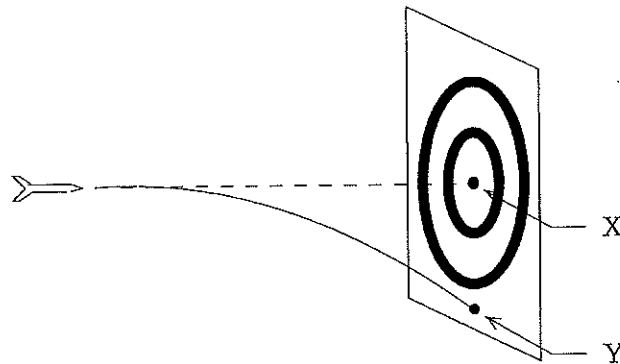
A stone is thrown horizontally and follows the path XYZ shown. The direction of the acceleration of the stone at point Y is:



- A. ↓
- B. →
- C. ↘
- D. ↙
- E. ↗

7. Consider the situation shown below:

A dart is thrown horizontally toward X at 20 m/s as shown. It hits Y 0.1 s later. The distance XY is:



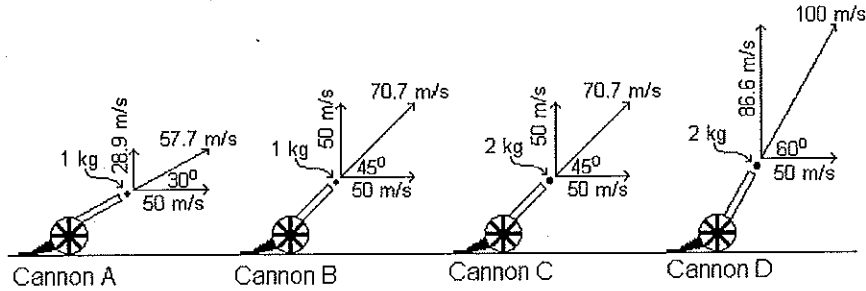
- A. 2 m
- B. 1 m
- C. 0.5 m
- D. 0.1 m
- E. 0.05 m

8. Two projectiles are fired simultaneously with the same initial velocity. Projectile A is fired at 30° and projectile B at 60° . Which of the following is true?

- A. The magnitude of their vertical velocity components will be the same at every point in their trajectories.
- B. The magnitude of their horizontal velocity components will be the same at every point in their trajectories.
- C. The two projectiles reach the same *maximum* height, but not at the same time.
- D. Both projectiles reach the same range, but land at different times.
- E. Both projectiles reach the same range and land at the same time.

9. Consider the situation below:

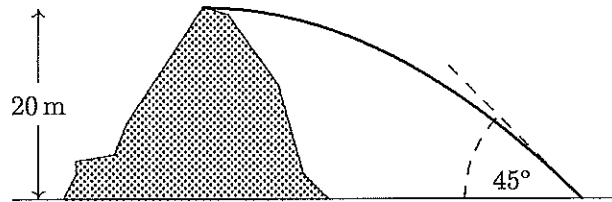
The diagram below shows four cannons firing shells with different masses at different angles of elevation. The horizontal component of the shell's velocity is the same in all four cases. In which case will the shell have the greatest range if air resistance is neglected?



- (A) cannon A (B) cannon B only (C) cannon C only (D) cannon D
 (E) Both cannons B and C have the greatest range

10. Consider the situation below:

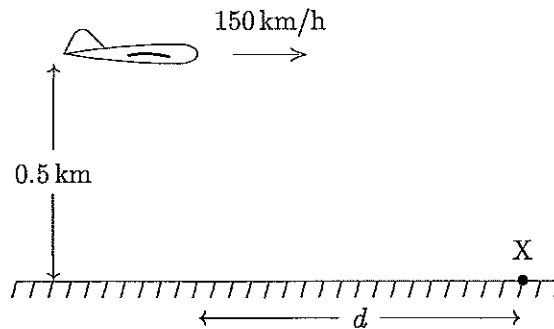
A ball is thrown horizontally from the top of a 20-m high hill. It strikes the ground at an angle of 45° . With what speed was it thrown?



- A. 14 m/s
 B. 20 m/s
 C. 28 m/s
 D. 32 m/s
 E. 40 m/s

11. Consider the situation below:

The airplane shown is in level flight at an altitude of 0.50 km and a speed of 150 km/h. At what distance d should it release a heavy bomb to hit the target X? Take $g = 10 \text{ m/s}^2$.



- A. 150 m
 B. 295 m
 C. 420 m
 D. 2550 m
 E. 15,000 m

12. Two projectiles are fired simultaneously with the same initial velocity. Projectile A is fired at 30° and projectile B at 60° . Which of the following is true?

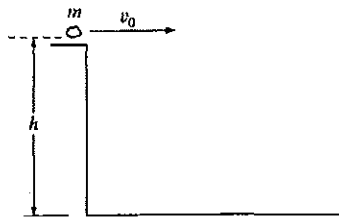
- A. The magnitude of their vertical velocity components will be the same at every point in their trajectories.
- B. The magnitude of their horizontal velocity components will be the same at every point in their trajectories.
- C. The two projectiles reach the same *maximum* height, but not at the same time.
- D. Both projectile reach the same range, but land at different times.
- E. Both projectiles reach the same range and land at the same time.

13. Consider the following situation:

A bullet shot horizontally from a gun:

- A. strikes the ground much later than one dropped vertically from the same point at the same instant
- B. never strikes the ground
- C. strikes the ground at approximately the same time as one dropped vertically from the same point at the same instant
- D. travels in a straight line
- E. strikes the ground much sooner than one dropped from the same point at the same instant

14. Consider the following situation:

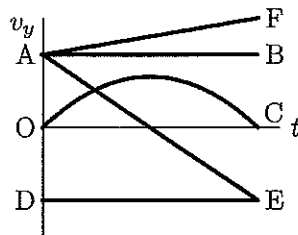


A rock of mass m is thrown horizontally off a building from a height h , as shown above. The speed of the rock as it leaves the thrower's hand at the edge of the building is v_0 . How much time does it take the rock to travel from the edge of the building to the ground?

- (A) $\sqrt{hv_0}$ (B) $\frac{h}{v_0}$ (C) $\frac{hv_0}{g}$ (D) $\frac{2h}{g}$ (E) $\sqrt{2h/g}$

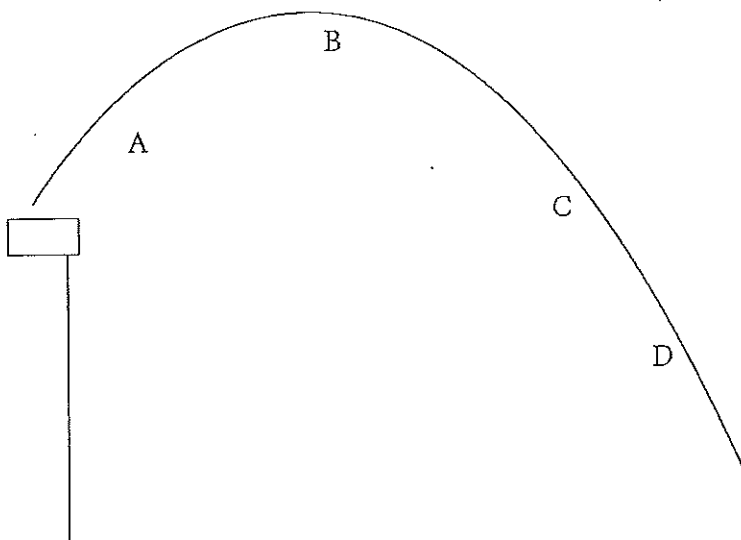
15. Consider the following situation:

Which of the curves on the graph below best represents the vertical component v_y of the velocity versus the time t for a projectile fired at an angle of 45° above the horizontal?



- A. OC
- B. DE
- C. AB
- D. AE
- E. AF

Use the diagram below for questions 16-19. It shows the trajectory of a projectile.



16. In the figure above, the magnitude of the projectile's velocity is greatest at point
- A. A
 - B. B
 - C. C
 - D. D
 - E. The magnitude of the projectile's velocity remains constant.
17. In the figure above, the horizontal component of the projectile's velocity at point A is
- A. zero.
 - B. equal to the vertical component of the projectile's velocity at point C.
 - C. equal in magnitude but opposite in direction to the horizontal component of the projectile's velocity at point D.
 - D. equal to the horizontal component of its initial velocity.
 - E. all of the above
18. In the figure above, which point has the same magnitude of instantaneous velocity as the initial velocity?
- A. A
 - B. B
 - C. C
 - D. D
 - E. all of the above
19. The instantaneous velocity of the projectile is
- A. always equal to the vector sum of its x and y components.
 - B. at every point directed tangent to the trajectory.
 - C. continually changing in both magnitude and direction.
 - D. is completely horizontal at the apex of the trajectory.
 - E. all of the above
20. Consider the following situation:

At a particular instant, a stationary observer on the ground sees a package falling with speed v_1 at an angle to the vertical. To a pilot flying horizontally at constant speed relative to the ground, the package appears to be falling vertically with a speed v_2 at that instant. What is the speed of the pilot relative to the ground?

- (A) $v_1 + v_2$ (B) $v_1 - v_2$ (C) $v_2 - v_1$ (D) $\sqrt{v_1^2 - v_2^2}$ (E) $\sqrt{v_1^2 + v_2^2}$

Answers

1. D
2. D
3. C
4. E
5. C
6. A
7. C
8. D
9. E
10. B
11. C
12. D
13. C
14. E
15. D
16. D
17. D
18. C
19. E
20. D