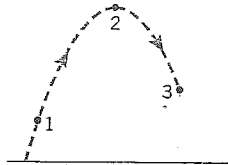


# Physics 12 - Open book

## Section 3.3 Projectile Motion

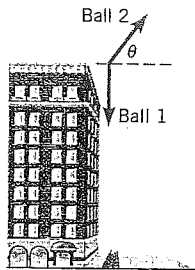
1. The drawing shows projectile motion at three points along the trajectory. The speeds at the points are  $v_1$ ,  $v_2$ , and  $v_3$ . Assume there is no

air resistance and rank the speeds, largest to smallest. (Note that the symbol  $>$  means "greater than.") (a)  $v_1 > v_3 > v_2$  (b)  $v_1 > v_2 > v_3$  (c)  $v_2 > v_3 > v_1$  (d)  $v_2 > v_1 > v_3$  (e)  $v_3 > v_2 > v_1$

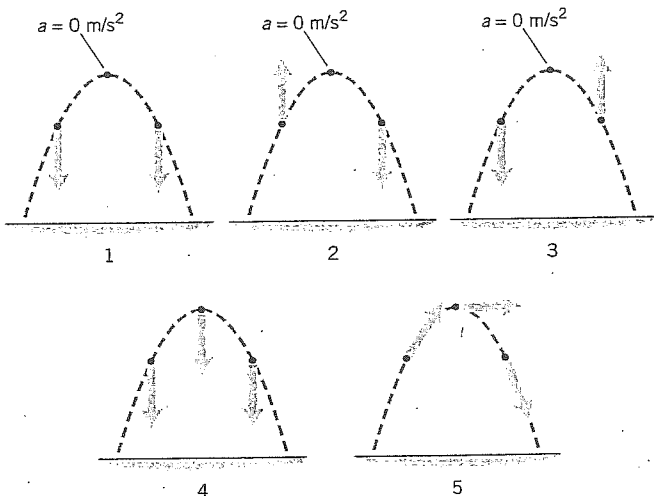


Question 1

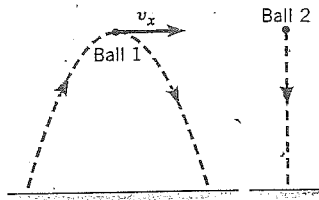
3. Two balls are thrown from the top of a building, as in the drawing. Ball 1 is thrown straight down, and ball 2 is thrown with the same speed, but upward at an angle  $\theta$  with respect to the horizontal. Consider the motion of the balls after they are released. Which one of the following statements is true? (a) The acceleration of ball 1 becomes larger and larger as it falls, because the ball is going faster and faster. (b) The acceleration of ball 2 decreases as it rises, becomes zero at the top of the trajectory, and then increases as the ball begins to fall toward the ground. (c) Both balls have the same acceleration at all times. (d) Ball 2 has an acceleration in both the horizontal and vertical directions, but ball 1 has an acceleration only in the vertical direction.



4. Each drawing shows three points along the path of a projectile, one on its way up, one at the top, and one on its way down. The launch point is on the left in each drawing. Which drawing correctly represents the acceleration  $\vec{a}$  of the projectile at these three points? (a) 1 (b) 2 (c) 3 (d) 4 (e) 5

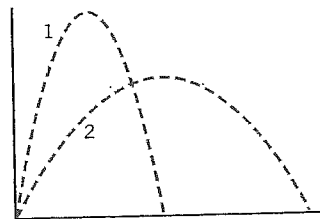


6. Ball 1 is thrown into the air and it follows the trajectory for projectile motion shown in the drawing. At the instant that ball 1 is at the top of its trajectory, ball 2 is dropped from rest from the same height. Which ball reaches the ground first? (a) Ball 1 reaches the ground first, since it is



moving at the top of the trajectory, while ball 2 is dropped from rest. (b) Ball 2 reaches the ground first, because it has the shorter distance to travel. (c) Both balls reach the ground at the same time. (d) There is not enough information to tell which ball reaches the ground first.

9. Two objects are fired into the air, and the drawing shows the projectile motions. Projectile 1 reaches the greater height, but projectile 2 has the greater range. Which one is in the air for the greater amount of time? (a) Projectile 1, because it travels higher than projectile 2. (b) Projectile 2, because it has the greater range. (c) Both projectiles spend the same amount of time in the air. (d) Projectile 2, because it has the smaller initial speed and, therefore, travels more slowly than projectile 1.



### Section 3.4 Relative Velocity

14. A slower-moving car is traveling behind a faster-moving bus. The velocities of the two vehicles are as follows:

$$\vec{v}_{CG} = \text{velocity of the Car relative to the Ground} = +12 \text{ m/s}$$

$$\vec{v}_{BG} = \text{velocity of the Bus relative to the Ground} = +16 \text{ m/s}$$

A passenger on the bus gets up and walks toward the front of the bus with a velocity of  $\vec{v}_{PB}$ , where  $\vec{v}_{PB}$  = velocity of the Passenger relative to the Bus = +2 m/s. What is  $\vec{v}_{PC}$ , the velocity of the Passenger relative to the Car?

- (a)  $+2 \text{ m/s} + 16 \text{ m/s} + 12 \text{ m/s} = +30 \text{ m/s}$   
 (b)  $-2 \text{ m/s} + 16 \text{ m/s} + 12 \text{ m/s} = +26 \text{ m/s}$   
 (c)  $+2 \text{ m/s} + 16 \text{ m/s} - 12 \text{ m/s} = +6 \text{ m/s}$   
 (d)  $-2 \text{ m/s} + 16 \text{ m/s} - 12 \text{ m/s} = +2 \text{ m/s}$

15. Your car is traveling behind a jeep. Both are moving at the same speed, so the velocity of the jeep relative to you is zero. A spare tire is strapped to the back of the jeep. Suddenly the strap breaks, and the tire falls off the jeep. Will your car hit the spare tire before the tire hits the road? Assume that air resistance is absent. (a) Yes. As long as the car doesn't slow down, it will hit the tire. (b) No. The car will not hit the tire before the tire hits the ground, no matter how close you are to the jeep. (c) If the tire falls from a great enough height, the car will hit the tire. (d) If the car is far enough behind the jeep, the car will not hit the tire.

16. The drawing shows two cars traveling in different directions with different speeds. Their velocities are:

$$\vec{v}_{AG} = \text{velocity of car A relative to the Ground} = 27.0 \text{ m/s, due east}$$

$$\vec{v}_{BG} = \text{velocity of car B relative to the Ground} = 21.0 \text{ m/s, due north}$$

The passenger of car B looks out the window and sees car A. What is the velocity (magnitude and direction) of car A as observed by the passenger of car B? In other words, what is the velocity  $\vec{v}_{AB}$  of car A relative to car B?

- 2 Give the directional angle of  $\vec{v}_{AB}$  with respect to due east.

