

Motion, Vectors & Scalars

Pre-Test

1. True or false: When gravity is the only force acting on a projectile near the Earth, the horizontal component of its velocity does not change. Explain why.
2. Why is speed characterized as a scalar quantity and velocity characterized as a vector quantity?
 - a. Speed has both a magnitude and direction associated with it.
 - b. Velocity has both a magnitude and direction associated with it.
 - c. Both speed and velocity are essentially the same quantity.
 - d. Velocity only has a magnitude associated with it.
 - e. None of the above answers are sufficient.
3. Suppose you are flying in an airplane that is traveling at 100 kilometers per hour (km/hr). The plane suddenly encounters a crosswind (wind that blows at right angles to the motion of the plane). Do you predict the plane to travel at a speed greater than, less than, or equal to 100 km/hr. Why?
4. In that absence of air resistance, why does the horizontal component of velocity for a projectile remain at a constant rate while the vertical component is constantly changing? Explain your answer.
5. New Jersey is one of the few states to incorporate the use of “circles” as an alternative means for having stoplight intersections. Circles are good in that they keep vehicles moving at a steady rate, unlike lighted intersections. However, they can be dangerous if you are not familiar with driving through them. You and your friend are taking a circle for the first time. While traversing through the circle your friend who is in the passenger seat leans over and glances at your speedometer. The speed limit in the circle is 25 miles per hour. Your friend promptly asks you how fast you are moving. What do you say?
 - a. “I am traveling at a velocity of 25 miles per hour.”
 - b. “I am traveling at a speed of 25 miles per hour.”
 - c. “Hard to say, my speed is constantly changing as I travel around the circle.”
 - d. “Hard to say, my velocity is constantly changing as I travel around the circle.”
 - e. More than one answer is correct. (If so, which ones? _____)
6. You and your friend decide to be very courageous and adventurous. You want to get a taste of some fresh mountain air so you decide to go to the Himalaya mountains in India and climb the tallest mountain in the world-Mount Everest. Everest has a peak height of ~29,000 feet. Ready and packed with all necessities you march on. In a matter of three days you have found that you have ascended a total of 5,000 feet, only 15% of the way there. Both of you are feeling very dizzy,

- lightheaded, and out-of-breath. (This is because as you get higher in the Earth's atmosphere, there is less and less oxygen. Such a "thin" atmosphere starves your brain of precious oxygen.) In fact, being inexperienced climbers you must call a helicopter to take you back to base camp at the bottom of the mountain. How far have you and your friend traveled in terms of: (1) distance, (2) displacement?
- 5,000 feet, 5,000 feet
 - 5,000 feet, 0 feet
 - 10,000 feet, 0 feet
 - 10,000 feet, 10,000 feet
7. Driving in your car at a velocity of 65 miles per hour North on the Garden State Parkway, you reach a toll-booth, to which you must come to a complete stop. How do you describe your motion in terms of velocity and acceleration?
- Consistently decreasing velocity, negative acceleration.
 - Consistently decreasing velocity, positive acceleration.
 - Constant velocity, no acceleration.
 - Constant velocity, negative acceleration.
 - Not enough information given.

8. What is the resultant addition vector of the following two vector quantities, in the following two situations:

$$v_1 = 3\text{m/s North}$$

$$v_2 = 6\text{m/s South}$$

$$v_3 = 4\text{m/s East}$$

Situation 1: $v_1 + v_3$

Situation 2: $v_1 + v_2 + v_3$

- 7m/s North, 9m/s South
 - 5m/s Southeast, 5m/s Southeast
 - 1m/s Northeast, 13m/s Northeast
 - 5m/s Northeast, 5m/s Southeast
 - Not enough information given
9. You are at a basketball game. You watch a player jump up in the air and make a slam-dunk. Being a physics inclined individual, you think to yourself, "Which component of the basketball player's velocity does his 'hang time' depend on? The vertical component, horizontal component, or both?" What was your answer? Explain why.

Web Site URL to learn the content:

- <http://www.glenbrook.k12.il.us/gbssci/phys/Class/1DKin/U1L3a.html>
(Access lessons 1 through 4 in completion)

Distance vs. Displacement

2. <http://www.shs.d211.org/SCI/rlw/Applets/displacement/DDis.html>

Vector Addition

3. <http://members.xoom.com/Surendranath/Applets.html> (Vector Addition)
4. <http://www.shs.d211.org/SCI/rlw/Applets/physengl/resultant.htm>
5. http://users.erols.com/renau/velocity_composition.html
6. <http://members.xoom.com/Surendranath/Math/Coor.html>

CHALLENGE!

7. <http://members.xoom.com/Surendranath/CirclePlus/CirclePlus.html>

(Use the above applets to solidify your knowledge of vector quantities and how they are used.)

Post-Test

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