

Grab Your 2-D Glasses!

One- and Two-Dimensional Motion

Concept Questions (5 Points Each) Answer questions using complete sentences:

1. Can an object have a varying velocity if its speed is constant? If yes, give examples:
2. In a marathon, is it possible for a runner with the greatest speed crossing the finish line to lose the race? Explain.
3. Can an object have a northward velocity and a southward acceleration? If yes, give an example:
4. Is it possible for an object to have a negative acceleration while increasing in speed? If so, give an example:
5. Two rowers, who can row at the same speed in still water, set off across a river at the same time. One heads straight across and is pulled downstream somewhat by the current. The other heads upstream at an angle so as to arrive at a point opposite the starting point. Which rower reaches the opposite side first? Explain:
6. Often, traffic lights are timed so that if you travel at a certain constant speed, you can avoid all red lights. Discuss how the timing of the lights is determined, considering that the distance between lights varies.

7. Two objects are thrown vertically upward, first one, then, a bit later, the other. Is it possible that both reach the same maximum height at the same time? Explain:
8. A rifle, at a height H above the ground, fires a bullet parallel to the ground. At the same instant, from the same height, a second bullet is dropped from rest. In the absence of air resistance, which bullet strikes the ground first? Explain:
9. A football quarterback throws a pass on the run and then keeps running without changing his velocity. Can he throw the pass and then catch it himself? Give your reasoning.
10. A wrench is accidentally dropped from the mast on a sailboat. Will the wrench hit at the same place on the deck whether the sailboat is at rest or moving with constant velocity? Explain your reasoning.
11. A student stands at the edge of the top of a building, and throws a ball (Ball A) straight up into the air with a velocity of V . The student then throws a second identical ball (Ball B) straight down, with a velocity of V . Which ball strikes the ground with a greater speed? Explain your reasoning.
12. Consider the following combinations of signs and values for velocity and acceleration of a particle with respect to a one-dimensional x axis. Describe what the particle is doing in each case, and give a real-life example for an automobile on an east-west one-dimensional axis, with east considered to be the positive direction.

| | <u>Velocity</u> | <u>Acceleration</u> |
|-----|-----------------|---------------------|
| (a) | Positive | Positive |
| (b) | Positive | Negative |
| (c) | Positive | Zero |
| (d) | Negative | Positive |
| (e) | Negative | Negative |
| (f) | Negative | Zero |
| (g) | Zero | Positive |
| (h) | Zero | Zero |