Part I

1. An object goes from one point in space to another. After it arrives at its destination

   (a) its displacement is the same as its distance traveled.

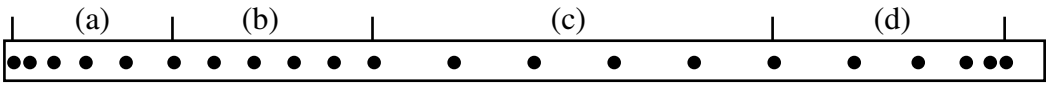
   (b) its displacement is always greater than its distance traveled.

   (c) its displacement is always smaller than its distance traveled.

   (d) its displacement is never larger than its distance traveled.

   Answer: (d). Displacement is always the distance between the initial position and the final position. The distance depends on the path taken so can be longer but not shorter.

2. The diagram below shows a piece of a ticker tape which passed through a vibrating marker which vibrated at a constant rate of 20 $s^{-1}$




   Which region shows where the average velocity was greatest?
   Answer: (c). During this interval the change in position is greatest.

3. Again referring to the ticker tape above, which region shows where the magnitude of the acceleration was greatest?
   Answer: (d). During this interval the velocity (measured by the spacing between dots), changes the most.

4. A kangaroo jumps straight into the air. During the time the kangaroo is in the air its velocity

   (a) is constant.

   (b) is decreasing.

   (c) first increases then decreases.

   (d) first decreases then increases.

   Answer: (b) The velocity starts positive then decreases to zero at the top of the jump and then as the kangaroo falls the velocity becomes negative. Hence it decreases. (The speed decreases and then decreases.)

5. A ball is thrown straight up from height H while a second is thrown straight down. Neglect air resistance. Immediately after the balls have been released

   (a) the one thrown up has the greater acceleration.

   (b) the one thrown down has the greater acceleration.

   (c) the accelerations are the same.

(d) neither ball accelerates after it has been released.

Answer (c): When an object is acted on by gravity alone the acceleration is always constant and directed downward.

6. A rock which is dropped from rest reaches a speed of about 10 m/s in 1 second. How far would you expect it to fall in one second?

   (a) about 10 m

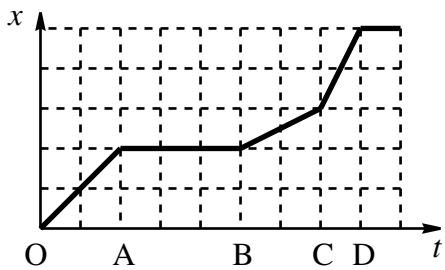
   (b) more than 10 m

   (c) less than 10 m

   (d) any of the above.

   Answer: (c) less than 10 m because it starts at rest so is not traveling at 10 m/s the whole time.

7. The motion of a particle is described by the position-time graph shown below. During which interval is the *instantaneous* velocity of the particle greatest?




   (a) OA (b) AB (c) BC (d) CD

   Answer (d): Instantaneous velocity is the slope of the position time graph.

8. For the above position-time graph during which interval is the *average* velocity greatest.

   (a) OA (b) OB (c) OC (d) OD

   Answer (a): During this interval $\Delta x/\Delta t$ is largest.

Part II

1. A student travels 12 miles to Evergreen and the trip takes 15 minutes. When she arrives she hears on the radio that a snow storm is about to hit Olympia so she decides to head back home – hoping to miss the worst of the storm. Unfortunately she gets caught in the storm and averages a measly 10 miles per hour on the return trip.

   (a) What is the average speed in miles per hour on the way to college?
   The average speed is $\bar{s} = d/t = 12$ miles/0.25 hours = 48 mi/hr

   (b) How long does the return trip take?
   $\bar{s} = d/t$ so $t = d/\bar{s}$. Thus $t = 12/10 = 1.2$ hours for the return trip.

   (c) What is the average speed for the round trip?
   The average speed is total distance over total time which is 24/1.45=16.6 mi/hr. Notice the average speed is not the average of the speed on the two legs of the trips (29 mi/hr) since the car spends more time going at the slower speed of 10 mi/hr.

   (d) What is the average velocity for the round trip?
   Since the car returns to the starting point the displacement is zero so the average velocity is zero.

2. In each of the following cases state whether the motion is accelerated or not.

   (a) A meteoroid traveling in outer space with negligible gravitational influence.
   no acceleration.

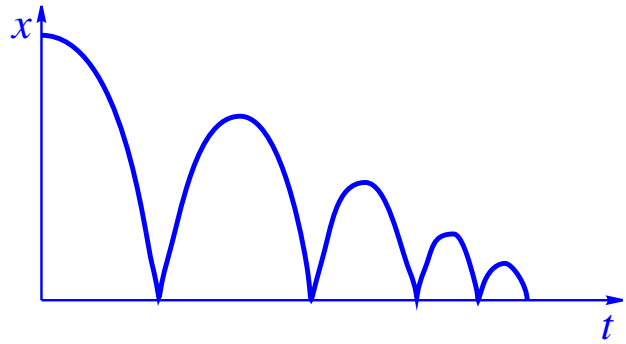
   (b) A satellite orbiting earth at a constant speed of 30,000 km/hr
   accelerating due to changing direction.

   (c) An ice skater coasting on ice in a straight line.
   She would slow down and hence be accelerating.

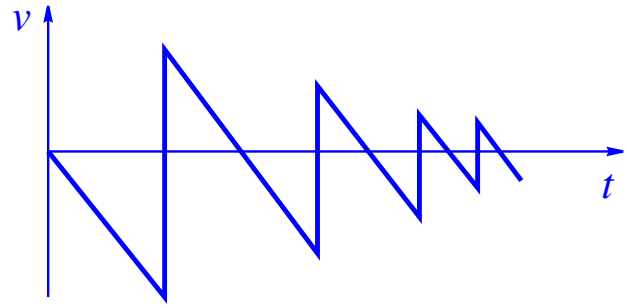
   (d) A skydiver falling at terminal velocity?
   At terminal velocity speed and direction are constant, so no acceleration.

3. A ball is dropped from above the ground and bounces several times before coming to rest. Assuming the ground is the origin and the positive direction is measure upwards sketch graphs of

   (a) position vs. time




   (b) velocity vs. time




   (c) acceleration vs. time