**Conceptual Questions:**

*\*\*Please consider significant figures and if possible, draw visual graphics\*\**

1. Two buses depart from Chicago, one going to New York and one to San Francisco. Each bus travels at a speed of 30 m/s. Do they have equal velocities?
2. Is the average speed of a vehicle a vector or a scalar quantity?
3. One of the following statements is incorrect. (a)The car traveled around the track at a constant velocity. (b) The car traveled around the track at a constant speed. Which statement is incorrect? Why?
4. An object moving with a constant acceleration can certainly slow down. But can an object ever come to a permanent halt if its acceleration truly remains constant? Explain.
5. Two objects are thrown vertically upward, first one, and then, a bit later, the other. Is it possible that both reach the same maximum height at the same instant?

**Problems**

***(Displacement, Speed and Velocity)***

1. An 18-year-old runner can complete a 10.0 km course with an average speed of 4.39 m/s. A 50 year old runner can cover the same distance with an average speed of 4.27 m/s. How much later (in seconds) should the younger runner start in order to finish the course at the same time as the older runner?
2. A bicyclist makes a trip that consists of three parts, each in the same direction (due north) along a straight road. During the first part, she rides for 22 minutes at an average speed of 7.2 m/s. During the second part, she rides for 36 minutes at an average speed of 5.1 m/s. Finally, during the third part, she rides for 8.0 minutes at an average of 13 m/s. (a) How far has the bicyclist traveled during the entire trip? (b) What is her average velocity for the trip?
3. For a standard production car, the highest road-tested acceleration ever reported occurred in 1993, when a Ford RS200 Evolution went from zero to 26.8 m/s (60 mi/h) in 3.275 s. Find the magnitude of the car’s acceleration.
4. A runner accelerates to a velocity of 4.15 m/s due west in 1.50 s. His average acceleration is 0.640 m/s2, also directed due west. What was his velocity when he began accelerating?

***(Equations of Kinematics for Constant Acceleration)***

1. A cart is driven by a large propeller or fan, which can accelerate or decelerate the cart. The cart starts out at the position *x* = 0 m, with an initial velocity of +5.0 m/s and a constant acceleration due to the fan. The direction to the right is positive. The cart reaches a maximum positive of *x* = +12.5 m, where it begins to travel in the negative direction. Find the acceleration of the cart.
2. A Volkswagen Beetle goes from 0 to 60.0 mi/h with an acceleration of +2.35 m/s2. (a) How much time does it take for the Beetle to reach this speed? (b) A top-fuel dragster can go from 0 to 60.0 mi/h in 0.600 s. Find the acceleration (m/s2) of the dragster?
3. A speed ramp at an airport is basically a large conveyor belt on which you can stand and be moved along. The belt of one ramp moves at a constant speed such that a person who stands still on it leaves the ramp 64 s after getting on. Clifford is in real hurry, however, and skips the speed ramp. Starting from the rest with an acceleration of 0.37 m/s2, he covers the same distance as the ramp does, but in one –fourth the time. What is the speed at which the belt of the ramp is moving?
4. A race driver is made a pit stop to refuel. After refueling, he leaves the pit area with an acceleration whose magnitude is 6.0 m/s2; after 4.0 s he enters the main speedway. At the same instant, another car on the speedway and traveling at a constant speed of 70.0 m/s overtakes and passes the entering car. If the entering car maintains its acceleration, how much time is required for it to catch the other car?

***(Freely Falling Bodies)***

1. From the top of the cliff, a person uses a slingshot to fire a pebble straight downward, which is the negative direction. The initial speed of the pebble is 9.0 m/s. (a) what is the acceleration (magnitude and direction) of the pebble during the downward motion? Is the pebble decelerating? Explain. (b) After 0.50 second, how far beneath the cliff top is the pebble?
2. Two identical pellet guns are fired simultaneously from the edge of a cliff. These guns impart an initial speed of 3.0 m/s to each pellet. **Gun** **A** is fired straight forward upward, with the pellet going up and then falling down, eventually hitting the ground beneath the cliff. **Gun B** is fired straight downward. In the absence of air resistance, how long after the **pellet B** hits the ground does **pellet A** hit the ground?
3. An astronaut on a distant planet wants to determine its acceleration due to gravity. The astronaut throws a rock straight up with a velocity of +15 m/s and measures a time of 20.0 s before the rock returns to his hand. What is the acceleration (magnitude and direction) due to gravity on this planet?
4. A woman on a bridge 75.0 m high sees a raft floating at a constant speed on a river below. She drops a stone from rest in an attempt to hit the raft. The stone is released when the raft has 7.00 m more to travel before passing under the bridge. The stone hits the water 4.00 m in front of the raft. Find the speed of the raft.