**Conceptual Questions:**

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

1. An object is thrown upward at an angle $θ$ above the ground, eventually return to earth. (a) Is there any place along the trajectory where the velocity and acceleration are perpendicular? If so, where? (b) Is there any place where the velocity and acceleration are parallel? If so, where? In each case, explain.
2. The speedometer of your car shows that you are traveling at a constant speed of 35 m/s. It is possible that your car is accelerating? If so, explain how could this happen?
3. The equations of kinematics *(not included)* describe the motion of an object that has a constant acceleration. These equations cannot applied to uniform circular motion. Why not?
4. It is possible for an object to have acceleration when the velocity of the object is constant? When the speed of the object is constant? When the speed of the object is constant? In each case, give your reasoning?
5. What is a chance of a light car safely rounding an unbanked curve on icy road as compared to that of heavy car: worse, the same, better? Assume that both cars have the same speed and equipped with identical tires. Account your answer.
6. A penny is placed on a rotating turntable. Where on the turntable does the penny require the largest centripetal force to remain in place? Give your reasoning.

**Problems**

***(Uniform Circular Motion & Centripetal Acceleration)***

1. How long does it take a plane, traveling at a constant speed of 110 m/s, to fly around once around a circle whose radius is 2850 m?
2. A car travels at a constant speed around a circular track whose radius is 2.6 km. The car goes once around the track in 360 s. What is the magnitude of the centripetal acceleration of the car?

***(Centripetal Force)***

1. In a skating stunt known as “crack-the-whip,” a number of skaters holds hands and form a straight line. They try to skate so that the line rotates about the skater at one end, who acts as a pivot. He is skating at a speed of 6.80 m/s. Determine the magnitude of the centripetal force that acts on him.
2. A child is twirling a 0.0120-kg ball on a string in a horizontal circle whose radius is 0.100 m. The ball travels once around the circle in 0.500 s. (a) Determine the centripetal force acting on the ball. (b) If the speed is doubled, does the centripetal force double? If not, by what factor does the centripetal force increase?
3. Two banked curves have the same radius. Curve A is banked at an angle of 13o, and banked B is curved at an angle of 19o. A car can travel around curve A without relying on friction at a speed of 18 m/s. At what speed these car travels around curve B without relying on friction?

***(Satellites in Circular Orbits, Apparent weightlessness and Artificial Gravity)***

1. A satellite is placed in orbit 6.00 x105 m above the surface of Jupiter. Jupiter has a mass of 1.90 x 1027 kg and a radius of 7.14 x 107. Find the orbital speed of the satellite.
2. A satellite is in a circular orbit about the earth (ME = 5.98 x 1024). The period of the satellite is 1.20 x 104 s. What is the speed at which the satellite travels?
3. The earth orbits around the sun once per year at the distance of 1.50 x 1011m. Venus orbits the sun at a distance of 1.08 x 1011 m. these distances are between the centers of the planets and the sun. How long (in earth days) does it take for Venus to make one orbit around the sun?