Circular Motion & Centripetal Acceleration

Name: ____ Date: ___________________________

Answer the questions in full.

1. Calculate the magnitude of the centripetal acceleration of electron moving around a nucleus with a speed of 2.18×10^{6} m/s. The diameter of the electron's orbit is 1.06×10^{-10} m.

2. A car, travelling at 25 m/s around a circular curve, has a centripetal acceleration of magnitude 8.3 m/s/s. Calculate the radius of the curve.

3. A cowboy is about to lasso a calf with a rope that is undergoing uniform circular motion. The time for one revolution of the is 1.2 seconds. The end of the rope is 4.3 m from the centre of the circle. Calculate the magnitude of the centripetal acceleration.

4. A ball on a string, moving in a horizontal circle of radius 2.0m, undergoes a centripetal acceleration of magnitude 15 m/s/s. Calculate the speed of the ball.

5. Mercury orbits the Sun in an approximately circular path, at an average distance of 5.79×10^{10}m, with a centripetal acceleration of magnitude 4.0×10^{-2} m/s/s. Calculate the period of revolution around the Sun, in seconds? Convert it to "Earth days."

6. Two balls at the ends of two strings are moving at the same tangential speed in a horizontal circular path. One string is three times as long as the other. Compare the magnitudes of the two centripetal accelerations.

7. A penny is sitting on a record (the old-school CDs!) which makes 23 revolutions in 5 seconds. The penny is 20 cm from the centre of rotation of the record.
   a) Calculate the centripetal acceleration and tangential speed of the penny at the 20cm position.
   b) If you moved the penny outwards towards the edge of the record explain what happens to the period of rotation, size of the tangential speed and the centripetal acceleration.
   c) Calculate the distance the penny would have to be from the edge of the record in order to reduce its centripetal acceleration to half the value from part a).
   d) Calculate the number of revolutions per minute (r.p.m) that the record would have to rotate at in order for the penny to experience double the centripetal acceleration it had in question a) when it is at the same position of 20cm from the centre of rotation.

8. Two people are standing apart from one another (radially on the same line from the centre) on a very large metal disc that is rotating. Person 1, who is 9 m to the centre of rotation, measures that they are travelling with a tangential speed of 15 km/h. The other person measures that they are travelling at 23 km/h. How far apart are the two people?