Uniform Circular Motion Worksheet

1. A car of mass 1200 kg is travelling 8.33 ms^{-1} around a bend of radius 100 m.
   a) Calculate its centripetal acceleration.
   b) Calculate its centripetal acceleration if it travels, at the same speed, around a bend of radius 70 m.
   c) Identify the force causing the centripetal acceleration.
   d) Calculate the magnitude of the centripetal force for the values used in part a.

2. Two cyclists are riding identical bicycles around a bend in a flat road at the same speed. Archibald weighs 80 kg and Nigel weighs 60 kg.
   a) State which person has the greater centripetal acceleration acting on him.
   b) State which one has the greater force acting.

3. The Moon orbits the Earth in an approximately circular path with a mean radius of 3.84×10^{8} m. The Moon completes one orbit every 27.3 days.
   a) Calculate the orbital speed of the Moon
   b) Calculate the centripetal acceleration of the Moon
   c) Identify the force causing the centripetal acceleration.

4.
   a) State whether or not an object in uniform circular motion has:
      (i) a constant speed,
      (ii) a constant radius,
      (iii) a constant velocity.
   b) For cases in part a) where you answered no, explain why.

5. A mass of 2.00 kg is attached to a string and whirled in a circle of radius 0.800 m. The breaking strain of the string is 250 N.
   a) Calculate the maximum speed at which the mass can rotate before the string breaks.
   b) Calculate how long will it take the mass to make 5 rotations at maximum speed.
   c) Draw a diagram with an explanation of the motion of the mass if the string breaks.

6. If you rotate a mass on the end of a string, you feel the string pulling your hand. Explain whether or not this is because the mass is being pulled towards the outside of its circle of motion.

7. A bend of radius 300 m is to be constructed on a freeway.
   a) Calculate the banking angle necessary for a car travelling at 25 ms^{-1} to have no reliance on friction for its centripetal acceleration.
   b) State the force providing the centripetal acceleration in such a case.