W5.01

Simple Circular Motion – Key

1. A turntable rotates at a frequency of 30 rpm. A quarter is placed 20 cm from the center.
   a. Find the period of the rotation.

      $T = 1/f = 2$ sec

   b. Find the speed of the quarter.

      $v = 2\pi r/T = 0.2\pi$ m/sec = 0.63 m/sec

   c. Find the centripetal acceleration of the quarter.

      $a_c = v^2/r = 0.2\pi^2$ m/sec^2 = 1.97 m/sec^2

   d. Find the coefficient of friction necessary to keep the quarter on the turntable.

      $F_f = \mu mg = ma \rightarrow \mu = 0.197$

2. A rope is used to pull a block in a circle on a frictionless surface. If the rope is two meters long and it breaks at 150 N, what is the maximum tangential speed of a 2-kg block? How long does one revolution take?

   $F_c = mv^2/r \rightarrow v = (F_c r/m)^{1/2} = 12.25$ m/sec

   $T = 2\pi r/v = 1.03$ sec