AP Physics 1

3.1 – Analysis of Circular Motion

Assessment

"And around and around we go!"

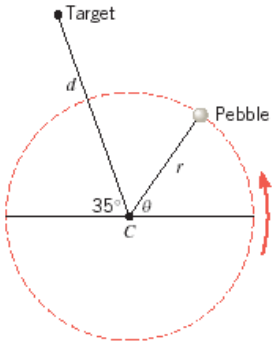
Name: _____ Period: _____

1) How long does it take a plane, traveling at a constant speed of 110 m/s, to fly once around a circle whose radius is 2.850 km?

2) The following table lists data for the speed and radius of three examples of uniform circular motion. Find the magnitude of the centripetal acceleration for each example.

	Radius	**Speed**
Example 1	0.50 m	12 m/s
Example 2	Infinitely large	35 m/s
Example 3	1.8 m	2.3 m/s

3) One kind of slingshot consists of a pocket that holds a pebble and is whirled on a circle of radius r. The pebble is released from the circle at the angle θ, so that it will hit the target. The distance to the target from the center of the circle is d. The circular path is parallel to the ground, and the target lies in the plane of the circle. The distance d is ten times the radius r. The effect of gravity on the freefall of the pebble is negligible in such a short distance. Find the angle θ.



4) A car travels at constant speed around a circular track whose radius is 2.6 km. The car goes around the track once in 6 minutes. What is the magnitude of the centripetal acceleration of the car?

5) For you biology folks: The aorta is a major artery, rising upward from the left ventricle of the heart and curving down to carry blood to the abdomen and lower half of the body. The curved artery can be approximated as a semicircular arch whose diameter is 5.0 cm. If blood flows through the aortic arch at a speed of 0.32 m/s, what is the magnitude, in m/s^2, of the blood's centripetal acceleration?

6) The second hand and the minute hand on a certain type of classroom clock are the same length. Find the ratio ($a_{c,\ second}/a_{c,\ minute}$) of the centripetal accelerations of the tips of the second hand and the minute hand.

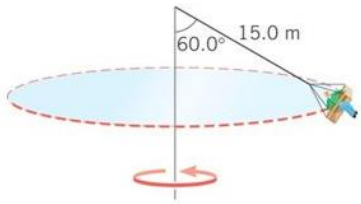
7) Computer-controlled display screens provide drivers in the Indianapolis 500 with a variety of information about how well their cars are performing. For instance, as a car is going through a turn, a speed of 221 mi/h (98.8 m/s) and centripetal acceleration of 3.00 g (three times the acceleration due to Earth's gravity) are displayed. Determine the radius of the turn (in meters).

8) Earth rotates once a day about an axis passing through the north and south poles and is perpendicular to the plane of the equator. Assuming Earth is a perfect sphere (it isn't!) with a radius of 6.38×10^6 m, determine the speed and centripetal acceleration of a person situated
   a. at the equator.
   b. at a latitude 30.0^o north of the equator.

9) A 0.015 kg ball is shot from the plunger of a pinball machine. Because of a centripetal force of 0.028 N, the ball follows a circular arc whose radius is 0.25 m. What is the speed of the ball?

10) A pair of fuzzy dice is hung by a string from the rear-view mirror of a van (you may consider the two dice as one object suspended from a cord). When the van goes straight ahead at a speed of 28 m/s, the dice hang vertically down. But when the van maintains this same speed around an unbanked curve (radius = 150 m), the dice swing toward the outside of the curve, with the string making an angle θ with the vertical. Find θ.

11) A swing ride at a carnival consists of chairs that are swung in a circle by 15.0 m cables attached to a vertical rotating pole, as shown. Suppose that the total mass of a chair and its occupant is 179 kg.
   a. Determine the tension in the cable.
   b. Find the speed of the chair.



12) (Inquiry problem. Hold on…) A stone has a mass of 6.0×10^{-3} kg and is wedged into the tread of an automobile tire, as shown. The coefficient of static friction and each side of the tread channel is 0.90. When the tire surface is rotating at a maximum speed of 13 m/s, the stone flies out of the tread. The magnitude F_N of the normal force that each side of the tread channel exerts on the stone is 1.8 N. Assume that only static friction supplies the centripetal force and determine the radius r of the tire.