

Name:

AP Centripetal Force Numeric Review

1. Jake and his kayak have a combined mass of 80 kg. Jake is on the ocean in his kayak. The water is gently rolling such that there are successive dips and swells. Jake's kayak begins descending into a dip at an initial speed of 10 m/s. The dip has radius 5 meters. What is the upward normal force on Jake at the bottom of the dip?
2. Jake and his kayak have a combined mass of 80 kg. Jake is on the ocean in his kayak. The water is gently rolling such that there are successive dips and swells. Jake's kayak begins ascending a swell at an initial speed of 15 m/s. The swell has radius 10 meters. What is the upward normal force on Jake at the top of the swell?
3. A block slides into a 'loop de loop' of radius 9 meters. What is the minimum velocity at the top such that the block will maintain contact with the loop at the top? No friction.
4. An object with mass .3 kg at the end of a rope is whirled horizontally in a .6 meter radius circle. The speed of the mass is 5 m/s. What is the tension in the rope?
5. Tarzan has a mass of 90 kg and reaches a speed of 30 m/s as he swings on a vine. What is the tension in the vine at the bottom of his swing? Vine length is 5 meters.

6. What is the minimum velocity that a bucket of water can be spun vertically (radius $r = .8$ meters) such that no water is spilled?

7. A large cylinder is spun at 25 rpm with a person inside. What is the minimum static friction coefficient for which the person will not slide? Radius of the large cylinder is 5 meters.

8. What is the maximum speed with a 1600 kg car can make a turn around a curve of radius 30 meters on a level road without skidding? μ of static friction is .7

9. A curve on a racetrack of radius 80 meters is banked at an angle of 20 degrees. At what speed can a car take this curve without assistance from friction? Please include a free body diagram in your solution.

10. A stone-age hunter stands on a cliff overlooking a flat plain. He places a 2 kg rock in a sling and ties it to a 1.5 meter long vine. He swings the rock in a horizontal circle around his head. The plane of motion is 40 meters above the plain below. When the tension in the vine reaches 300 N, the vine snaps. If the rock is moving perpendicular to the cliff edge as the vine snaps, how far out from the cliff will the rock land?