Level 4 #22 Vertical Circular Motion Problems

1.Sheila (m=62 kg) is riding the Demon roller coaster ride. The turning radius of the top of the loop is 12 m. Sheila is upside down at the top of the loop and experiencing a normal force which is one-half of her weight. (a) Write an expression for the ∑Fy and set it equal to Fc, as the centripetal force is a net force. (b) Determine Sheila's speed.

FBD

2. A loop de loop track is built for a 938-kg car. It is a completely circular loop - 14.2 m tall at its highest point. The driver successfully completes the loop with an entry speed (at the bottom) of 22.1 m/s and a speed at the top of 14.5 m/s. Draw an FBD and write ∑Fy for the top and bottom of the loop.

(a) Determine ac and Fn at the top of the loop. (b) Determine ac and Fn at the bottom of the loop.

FBD

3**.** In 2002, professional skateboarder Bob Burnquist became the first to successfully navigate a 360° full pipe turn. (a) Write ∑Fy and set it equal to Fc. Determine the minimum speed which would be required at the top of the circular loop to make it through the 1.8-m radius pipe. (At the minimum speed, what is the value of Fn at the top of the loop?)

FBD

4. A pail of water is rotated in a vertical circle of radius 0.30 m. (a) What is the pail’s minimum speed at the top of the circle if no water is to spill out? (b) What is the normal force acting on the water if the pail is rotated at twice the minimum speed?

FBD

### 5. A teenager (m= 75.0 kg) tries to cross a river by swinging on a 7.0 m long rope. What is the maximum speed he can have at the bottom of the swing if the breaking strength of the vine is 1,100 N?

FBD

6. Amy drives her car at a constant 12 m/s speed over a bridge whose shape is bowed in the vertical arc of a circle (it is concave down). Find the direction and magnitude of the force exerted by the car seat on Amy as she passed the top of the 30-m radius arc.

FBD

7. find the speed at which Amy’s car would just be catching air (no support force from the ground).

FBD