

Planet Holloway - Websheet 7.5

AP Physics C - Chapter 7 Rotation and Centripetal Force and Gravity

You may print this out and write on it or work on your own paper.

Show all work.

Assume: ($g_{\text{earth}} = 10 \text{ m/s/s}$), (ccw = counter clockwise)

1. The wheel on a unicycle goes from 6 rad/s to 48 rad/s in 3 seconds. What angular displacement does the wheel go through during this interval. If the wheel has a radius of 40 cm, how far does the unicycle travel during this 3 seconds?
2. A bucket in a new well is hoisted up by a rope which winds up on a cylinder with radius 0.1 m. How many rev/s must the cylinder turn in order to raise the bucket at 1.2 m/s?
3. In the problem above, a handle is attached to the winding cylinder with a radius of 30 cm. What is the angular speed of the handle if the bucket is to move 6 m up in 10 seconds?
4. A 45 cm automobile tire is located on the Slothmobile, belonging to a slightly less known superhero, who jumps on the gas and takes off with an acceleration of 4 m/s/s. What is the angular speed of the wheel after 5 seconds?
5. Mr. H, feeling rather spunky, spins a 0.4 kg pomegranate horizontally over his head at the end of a 2 m string with a constant rate of 10 rev/s. What is the tension in the cord?
6. An 8 kg Ostrich egg is transported to the surface of planet Holloway where it is measured to weigh a “whoppin’” 800 N. If the radius of planet Holloway is half that of Earth, then what is the planet’s mass? ($m_e = 6 \times 10^{24} \text{ kg}$)
7. If planet Holloway has a radius 40% greater than Earth, but the same mass, what is the acceleration due to gravity at its surface? Assuming density is constant, what is the acceleration due to gravity 40% of the way to the center of planet Holloway?

1. 14 rad/s/s; 32.4 m

2. 1.9 rev/s

3. 6 rad/s

4. 44.44 rad/s

5. 3158.3 N

6. $1.5 \times 10^{25} \text{ kg}$

7. 5.1 m/s/s; 3.06 m/s/s