

Quiz 6

Names: _____ Group: # _____

1. You're staring at your roommate's bike wheel while they're working on it in your living room. You notice a rock in the tire tread and that it rotates 4 revolutions every second. You also notice a dried up smashed bug stuck to the spokes 20 cm from the tread. The wheel is 60 cm in diameter. Because you love Chapter 6 in your physics class so much, you can't help yourself and begin calculating the frequency, period, angular velocity, linear velocity and the centripetal acceleration for both the bug and the rock so that you can compare them. You get extra credit for calculating linear velocity and acceleration two different ways.
2. The moon's mass is 7.36×10^{22} kg, its radius is 1.74×10^6 m. Find g on the moon.
3. What would happen to a satellite in orbit around the earth if the satellite's mass were to become twice its original mass?
 - a. Nothing
 - b. It would go faster but stay in the same orbit.
 - c. It would go slower but stay in the same orbit.
 - d. Its orbit would degrade and it would crash into the earth
4. What would happen to a satellite in orbit around the earth if the earth's mass were to become twice its original mass (but the same diameter)?
 - a. Nothing
 - b. It would go faster but stay in the same orbit.
 - c. It would go slower but stay in the same orbit.
 - d. Its orbit would degrade and it would crash into the earth
5. Demonstrate mathematically your answers to #3 and #4 using a free body diagram and Newton's laws.

$$G = 6.67 \times 10^{-11} \text{ Nm}^2/\text{kg}^2$$

$$T^2 = \frac{4\pi^2}{GM} r^3$$

$$v = \omega r$$

$$w = mg$$

$$F_G = \frac{Gm_1m_2}{r^2}$$

$$v = \frac{2\pi r}{T} = \sqrt{\frac{GM}{r}}$$

$$a = \frac{v^2}{r} = \omega^2 r$$

$$\Sigma \vec{F} = m\vec{a}$$

$$1 \text{ radian} = 57.3^\circ$$

$$f = \frac{1}{T}$$

$$g = 9.8 \text{ m/s}^2$$