

Today

- Review of topics for quiz tomorrow.
- These include: 1) angular velocity, 2) centripetal acceleration, 3) centripetal force and 4) amusement park physics.
5) universal gravitation.
- We should have time to review all topics.

Angular Velocity

- The “speed” that something moved around a circle.
- This is determined by the circumference of the circle divided by the time it takes to travel around it once.

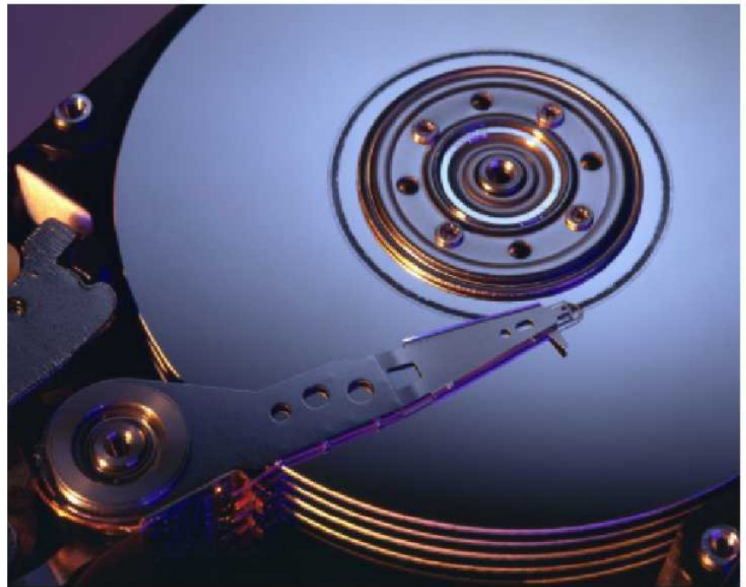
A hard drive spins at 7200 RPM. If the disc has a radius of 0.07m, what is the speed of the edge of the hard drive?

$$r = 0.07 \text{ m}$$
$$7200 \text{ } \cancel{\text{rot}}/\text{min}$$

$$120 \frac{\text{rot}}{\text{Sec}}$$

$$t = ?$$

$$V = 53 \frac{\text{m}}{\text{s}}$$





CD Exploding 23000 rpm



How Strong is it?

A ninja spins a slingshot with a 0.6kg stone in it. The slingshot is 1.3m long and makes one rotation every 1.2s. What is the tension in the string?

$$K: r = 1.3 \text{ m}$$

$$m = 0.6 \text{ kg}$$

$$t = 1.2 \text{ s}$$

$$U \cdot T = F_c$$

$$\text{Eqns } F_c = a_c m$$

$$21.3 \text{ N}$$





SKATEBOARD LOOP SWITCH/BOB BURNQUIST



Loop of Death

A skateboarder goes through a loop with a radius of 1.7m. If he does not want to fall from the top, what is the maximum time that he can spend making 1 revolution?

$$r = 1.7 \text{ m}$$

$$a_c = \geq 9.8 \text{ m/s}^2 \quad t^2 a_c = \frac{4\pi^2 r}{t^2} \Rightarrow t^2$$

$$t = ? \quad \Rightarrow \frac{t^2 a_c}{a_c} = \frac{4\pi^2 r}{a_c} \Rightarrow t^2 = \frac{4\pi^2 r}{a_c}$$

$$t = \sqrt{\frac{4\pi^2 r}{a_c}} = 2.6 \text{ s}$$

An angry carny turns the carousel up so that it rotates at 20 rpm. If a 30 kg girl sits 15 m from the center, what is the force that she holds onto the horse so she is not thrown from the ride?

$$t = 3 \text{ s}$$

$$r = 15 \text{ m}$$

$$m = 50 \text{ kg}$$

$$F_c = 1974 \text{ N}$$

$$a_c = 6.7g$$



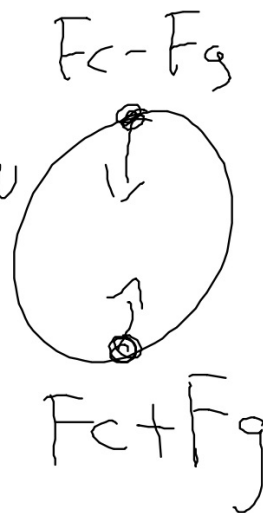
A 0.0005 kg ant is inside of a barrel with a radius of 0.5 m. If the barrel rotates every 1 seconds, what is the normal force on the ant at the top and bottom of the barrel?

$$F_g = mg = 0.0049 \text{ N}$$

$$F_c = 0.00985 \text{ N}$$

$$F_c - F_g = 0.000976 \text{ N}$$

$$F_c + F_g = 0.015 \text{ N}$$



A 90kg person gets on the gravitron with a radius of 6.5m. If the coefficient of friction is 0.6, what speed does the ship need to be moving in order for the rider not to slip?

$$m = 90 \text{ kg}$$

$$r = 6.5 \text{ m}$$

$$\mu = 0.6$$

$$a_c = 16.3 \text{ m/s}^2$$

$$a_c = v^2 / r \Rightarrow \sqrt{v^2} = \sqrt{a_c r} \Rightarrow v = 10.3 \text{ m/s}$$



Scientists at ESA used gravity to "slingshot" a satellite to a comet!

The Rosetta spacecraft mission: an animated journey to the comet

As scientists from the European Space Agency attempt to make a soft landing on a moving comet, The Telegraph charts Rosetta's journey from Earth to '67P Churyumov-Gerasimenko'

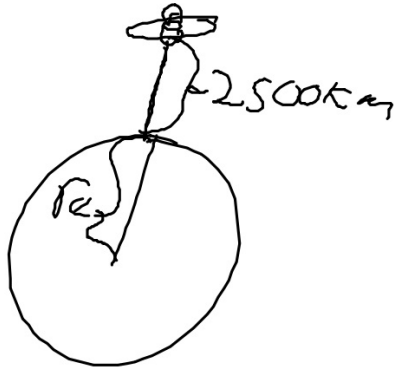


$M_e = 5.98 \times 10^{24} \text{ kg}$, $r_e = 6.38 \times 10^6 \text{ m}$ and

$G = 6.67384 \times 10^{-11} \text{ m}^3 \text{ kg}^{-1} \text{ s}^{-2}$

What is the force of earth on an object $6.7 \times 10^7 \text{ kg}$ that

sits 2500 km above the surface of the earth?



A man stands on the wing of a plane. If the plane is going ____ km/hr, what is the maximum radius that the plane can make so that the man does not fall?

