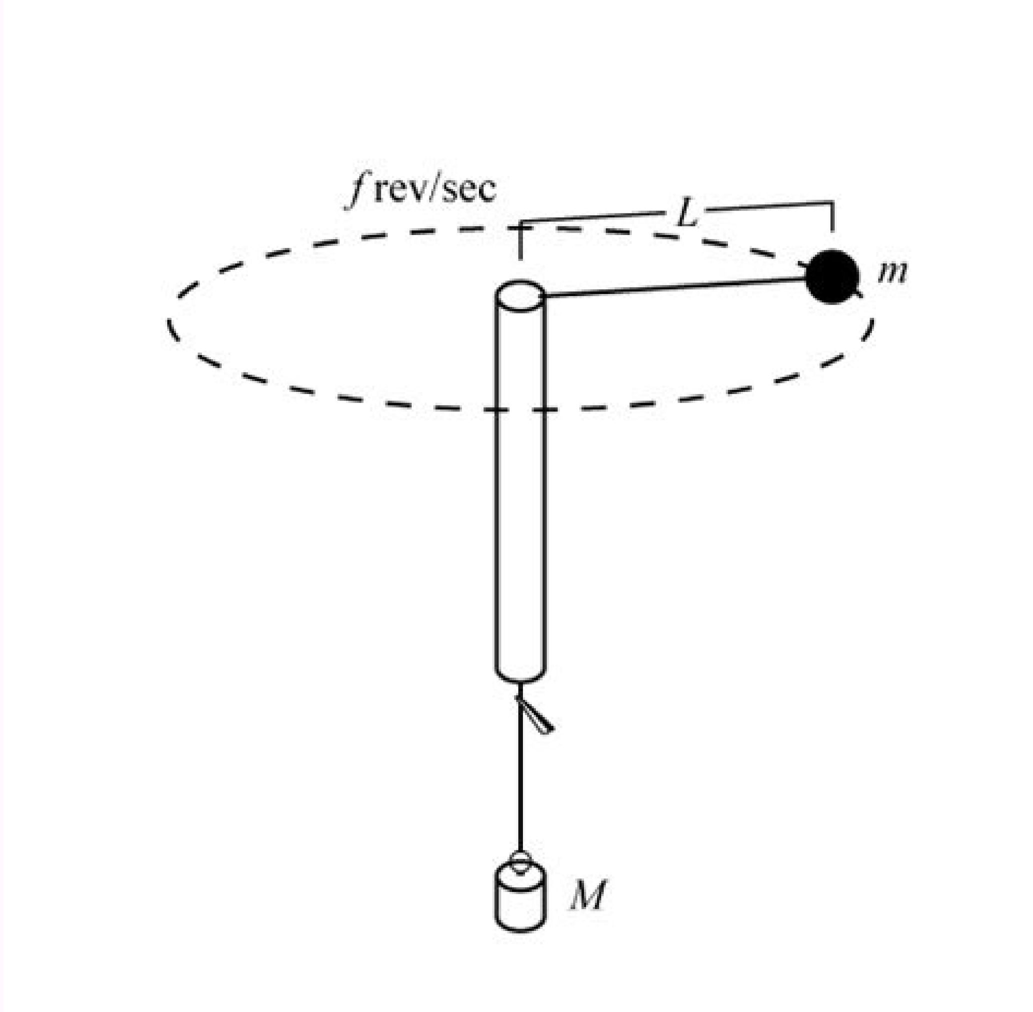
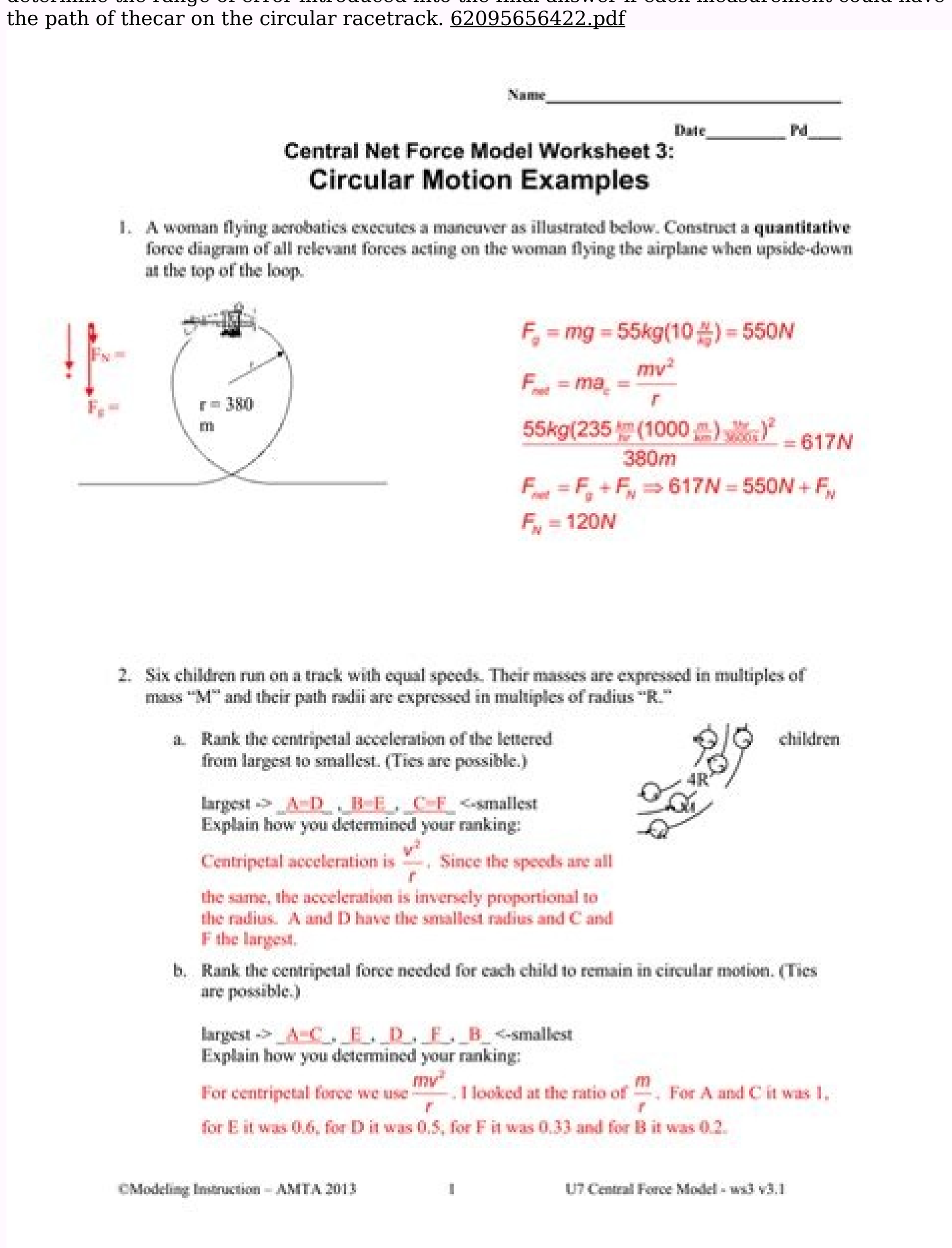
Uniform circular motion simulation worksheet answers

What causes uniform circular motion. Uniform circular motion worksheet answer key.



Uniform circular motion simulation answer key. talk show script template

Practice Problems: Uniform Circular Motion Solutions 1. (moderate) A racecar, moving at a constant tangential speed of 60 m/s, takes one lap around a circular track in 50 seconds. Determine the magnitude of the acceleration of the car.a = v2/r T = 2πr/v.....r = Tv/2πcombine...a = v2/(Tv/2π)= v/(T/2π)a = (60)/(50/6.28) = 7.5 m/s2 2. (moderate) An object that moves in uniform circular motion has a centripetal acceleration of 13 m/s2. If the radius of the motion is 0.02 m, what is the frequency of the motion?a = v2/r 13 = v2/0.02v = 0.51 m/sv = 2πr/T0.51 = 6.28(0.02)/TT = 0.25 sf = 1/Tf = 1/(0.25) = 4 Hz 3. (easy) Find the centripetal acceleration for an object on the surface of a planet (at the equator) with the following characteristics: radius = r = 4x106 m and 1 day = 100000 seconds.a = v2/r = (2πr/T)2/r = 4π2r/T2a = 4(3.14)2(4x106)/(100000)2 = 0.016 m/s2 4.(moderate) For an object in uniform circular motion rank the changes listedbelow regarding the effect each would produce on the magnitude of thecentripetal acceleration of the object? Assume all other parameters stayconstant except that noted in the description of the change.Change A: The speed of the object doublesChange B: The radius of the motion triplesChange C: The mass of the object triplesChange D: The radius of the motion becomes half as bigChange E: The mass of the object becomes half as bigChange F: The speed of the object becomes half as bigSince a = v2/r, the mass doesn't affect the acceleration magnitudeas long as the speed and the radius stays the same. Of course, the object wouldhave to be forced differently to keep the speed the same if the mass changes.We will discuss this concept when we cover Newton's 2nd Law.Change A: The acceleration quadruplesChange B: The acceleration becomes 1/3 as bigChange C: The acceleration doesn't changeChange D: The acceleration doublesChange E: The acceleration doesn't changeChange F: The acceleration becomes 1/4 as bigChange F < Change B < Change C = Change E < Change D < Change A 5. pirates of the caribbean piano sheet roblox (moderate) Outline a procedure by which the centripetal acceleration of a car moving with constant speed on a circular racetrack could be determined. List the standard lab apparatuses needed to make the measurements and the calculations a student can make with the measurements to determine the acceleration. Additionally, determine the range of error introduced into the final answer if each measurement could have an error of 10%. This type of question is very important for your test preparation. Please take your time and answer it completely.Measurement devices needed:A long measuring tapeA stopwatchStep 1: Use the measuring tape to determine the radius (r) of the path of thecar on the circular racetrack. 62095656422.pdf



Name____________________________

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Central Net Force Model Worksheet 3:

Circular Motion Examples

1. A woman flying aerobatics executes a maneuver as illustrated below. Construct a **quantitative** force diagram of all relevant forces acting on the woman flying the airplane when upside-down at the top of the loop.

$F_N =$

$F_g =$

r = 380 m

$F_g = mg = 55kg(10\frac{N}{kg}) = 550N$

$F_{net} = ma_c = \frac{mv^2}{r}$

$\frac{55kg(235\frac{km}{hr}(1000\frac{m}{km})\frac{1hr}{3600s})^2}{380m} = 617N$

$F_{net} = F_g + F_N \Rightarrow 617N = 550N + F_N$

$F_N = 120N$

2. Six children run on a track with equal speeds. Their masses are expressed in multiples of mass "M" and their path radii are expressed in multiples of radius "R."

a. Rank the centripetal acceleration of the lettered children from largest to smallest. (Ties are possible.)

largest -> _A=D_, _B=E_, _C=F_ <-smallest

Explain how you determined your ranking:

Centripetal acceleration is $\frac{v^2}{r}$. Since the speeds are all the same, the acceleration is inversely proportional to the radius. A and D have the smallest radius and C and F the largest.

4R

b. Rank the centripetal force needed for each child to remain in circular motion. (Ties are possible.)

largest -> _A=C_, _E_, _D_, _F_, _B_ <-smallest

Explain how you determined your ranking:

For centripetal force we use $\frac{mv^2}{r}$. I looked at the ratio of $\frac{m}{r}$. For A and C it was 1, for E it was 0.6, for D it was 0.5, for F it was 0.33 and for B it was 0.2.

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Model the car as a point particle. Use thegeometric center of the car as the location of this point.Step 2: Use the stopwatch to determine the time (T) needed for the car to moveonce around the track.Calculations:speed = v = 2πr/TDetermine the acceleration: a = v2/r = (2πr/T)2/r = 4π2r/T2 Since the each measurement has a possible error of 10%, the worst case scenariowould be if the radius measurement was 10% too high and the time measurementwas 10% too low.Example:If the actual radius is 10.0 m and the radius measurement is 11.0 mIf the actual time is 10.0 s and the time measurement is 9.0 sActual acceleration = a = 4π2(10.0)/(10.0)2 = 0.40π2 m/s2Measured acceleration = am = 4π2(11.0)/(9.0)2 = 0.54π2 m/s2% Error = [(Measured – Actual)/Actual]100% %Error = [(0.54π2 – 0.40π2)/0.40π2]100% = +35 %These measurements would result in an answer that is 35% too high. This is thelargest expected error that is too high. However, one can also determine an answer that is too low. This occurs at its maximum level when the radius is 10% too low and the time measurement is 10% too high:Example:If the actual radius is 10.0 m and the radius measurement is 9.0 mIf the actual time is 10.0 s and the time measurement is 11.0 sActual acceleration = a = 4π2(10.0)/(10.0)2 = 0.40π2 m/s2Measured acceleration = am = 4π2(9.0)/(11.0)2 = 0.30π2 m/s2% Error = [(Measured – Actual)/Actual]100%% Error = [(0.30π2 – 0.40π2)/0.40π2]100% = -25 % When the other extremes occur, the % error is in between the calculations shownabove.Example:If the actual radius is 10.0 m and the radius measurement is 11.0 mIf the actual time is 10.0 s and the time measurement is 11.0 sActual acceleration = a = 4π2(10.0)/(10.0)2 = 0.40π2 m/s2Measured acceleration = am = 4π2(11.0)/(11.0)2 = 0.36π2 m/s2% Error = [(Measured – Actual)/Actual]100% % Error = [(0.36π2 – 0.40π2)/0.40 2]100% = -10 %Example:If the actual radius is 10.0 m and the radius measurement is 9.0 mIf the actual time is 10.0 s and the time measurement is 9.0 sActual acceleration = a = 4π2(10.0)/(10.0)2 = 0.40π2 m/s2Measured acceleration = am = 4π2(11.0)/(11.0)2 = 0.44π2 m/s2% Error = [(Measured – Actual)/Actual]100%% Error = [(0.44π2 – 0.40π2)/0.40π2]100% = +10 % When the measurements are not at the extremes, the % error again will fall inbetween its maximum positive and maximum negative values.Example:If the actual radius is 10.0 m and the radius measurement is 10.5 mIf the actual time is 10.0 s and the time measurement is 9.5 sActual acceleration = a = 4π2(10.0)/(10.0)2 = 0.40π2 m/s2Measured acceleration = am = 4π2(10.5)/(9.5)2 = 0.47π2 m/s2% Error = [(Measured – Actual)/Actual]100%% Error = [(0.47π2 – 0.40π2)/0.40π 2]100% = +18 % 6. (moderate) A particle is moving at a constant speed in a circular trajectory centered on the origin of an xy coordinate system. At one point (x = 4 m, y = 0 m) the particle has a velocity of -5.0j m/s. Determine the velocity and acceleration when the particle is at:a.

x = 0, y = -4 m The velocity is always tangent to the trajectory.v = -5i m/s (because the circular motion is clockwise on the axis system)a = v2/r = 52/4 = 6.25 m/s2a = 6.25j m/s2(always directed toward the center)b. x = -4 m, y = 0 v = 5j m/sThe acceleration magnitude is constant, so we still have a = 6.25 m/s2a = 6.25i m/s2 (always directed toward the center)c. x = 0, y = 4 m v = 5i m/s a = -6.25j m/s2 d. x = -2.83, y = 2.83 mThe velocity will still have a magnitude of 5 m/s, and will still be tangent to the trajectory. At the point referred to, the angle of the tangent is 45°.v = 5m/s(cos45i + sin45j)v = 3.54i +3.54j m/sThe acceleration will still have the same magnitude, and again, must point toward the center. In this case, at a 315° angle.a = 6.25 m/s2(cos315i + sin315j)a = 4.42i - 4.42j m/s2 7. (moderate) A stunt pilot executes a uniform speed circular path in an airplane. The initial velocity (in m/s) of the plane is given by vo = 2500i + 3000j. neural network projects with python pdf One minute later the velocity of the plane is v = -2500i - 3000j. Find the magnitude of the acceleration.First find the speed:v = (25002 + 30002)½ = 3905 m/sFor uniform circular motion: a = v2/r and T = 2πr/vCombine to show that a = 2πv/TSince T is the period of the motion, and the given data report that it takes one minute to reverse the velocity (the components have reversed), the period is 2 minutes (120 s). a = 2π(3905)/120a = 204 m/s2 8. (moderate) This problem is not refering to an object in uniform circular motion, but it deals with motion in two dimensions. The velocity (in m/s) of a particle moving in the x-y plane is given by:v = (6.0t – 4.0t2)i + 8.0 j a. What is the acceleration when t = 3.0 seconds?a = dv/dta = (6.0 - 8.0t)i a = (6.0 - 24.0)i = -18.0i m/s2b.

When, if ever, is the acceleration zero?a = 0 = 6.0 - 8.0t6.0 = 8.0tt = 6.0/8.0 = 0.75 sc. bombay cat lifespan When, if ever, is the speed zero?The speed can never be zero, because there is always a component of the velocity in the j direction.