

X2.8

205

PHYS-205(8) (Kaldon-18454)

Name _____

WMU - Spring 2001

Exam 2 - 100,000 points + 20,000 ☆ points Book Title _____

05/24/2001 • Rev.3

State Any Assumptions You Need To Make – Show All Work – Circle Any Final Answers
Use Your Time Wisely – Work on What You Can – Be Sure to Write Down Equations
Feel Free to Ask Any Questions

☆2a ☆2b ☆2c ☆2e

Go CART / No-Go CART (35,000 points)

1.) (a) "The Sunday, April 29, 2001 Firestone Firehawk 600 CART race at Texas Motor Speedway was canceled. On the 1.5-mile oval, drivers sustained loads of up to 5 $\frac{1}{2}$ Gs for 18 of the 22 seconds it took to complete a single lap. Twenty-one of the 25 drivers in the starting field reported disorientation as a result, and given the potential for a driver "grey out," or loss of consciousness, according to Dr. Steve Olvey, CART Director of Medical Affairs, the decision was made to cancel the event in the best interests of driver safety."



Consider that at 235 mph (105 m/s), a race car going around one of the curves at Texas Motor Speedway undergoes a centripetal acceleration of 5.50 gee's. What is the radius r of this curve?

(b) The banking of the curves is a maximum of 24°. For a car ($m = 1200$ kg) going around a 24° banked turn *without* friction, what is the value of the normal force, F_N ?



(c) If there was no friction, what would be the "natural" speed of this banked curve? *If you did not get an answer to (a), use $r = 255$ m.*



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(d) If the coefficients of friction between the tires and the pavement are 1.00 and 0.810, then what is the fastest speed, v , that the car could go around this 24° banked curve safely without slipping?

(e) If we ignore wind resistance and the jerk of changing gears, what is the shortest distance that one of these CART race cars can go from rest to 235 mph (105 m/s)?



Same But Different. Always Different. (30,000 points)

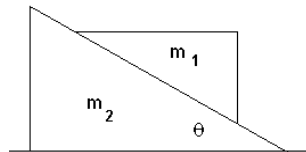
2.) ☆(a) A force $F = 15.5N + Cx$ does 1450 J of work going from $x_0 = 1.00\text{ m}$ to $x = 3.00\text{ m}$. What is the magnitude of the force at $x_0 = 1.00\text{ m}$?

☆(b) An object of mass $m = 3.00\text{ kg}$ begins its motion at $x_0 = 3.00\text{ m}$, $v_0 = 3.00\text{ m/s}$, $a_0 = 3.00\text{ m/s}^2$ and an initial jerk of $j_0 = 3.00\text{ m/s}^3$. Find the equation for the force, F , acting on this object, where the motion of the object is determined by the following equation:

$$\frac{d^4x}{dt^4} = 3.00\text{ m/s}^4$$

☆(c) Find the work done when $\vec{F} = 5.00N\hat{i} + 6.00N\hat{j}$ and the displacement is 3.33 m @ 270° .

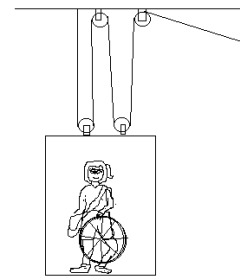
(d) Two wedge masses are stacked together as shown. Draw the Free Body Diagrams for both wedges and indicate whether Block 2 needs to be moving to the Left or the Right so that Block 1 does not slide. There is no friction in this problem. *Note that $m_1 < m_2$.*



☆(e) An object of mass 6.25 kg has a force that follows the following equations. Find the vector position \vec{s} at time $t = 1.00\text{ sec}$. *Assume all other constants are zero.*

$$F_x(t) = 6.00N + 6.00\text{ N/s}t + 6.00\text{ N/s}^2t^2$$

$$F_y(t) = 6.00N + 6.00\text{ N/s}t + 6.00\text{ N/s}^2t^2$$

Dark Angel Rules (35,000 points)

3.) Sarah is a bicycle messenger just like Max on *Dark Angel*. Today Sarah is riding up in an elevator (loaded mass = 877 kg) from the first floor to the top floor at 10.0 m/s for 46.0 seconds. (a) Find the tension T of the elevator cable. *Assume that the cables attaching to the elevator are purely vertical.*

(b) Find the work needed to lift the loaded elevator at 10.0 m/s for 46.0 seconds.

(c) Find the work that the motor needs to do on the cable to lift the loaded elevator at 10.0 m/s for 46.0 seconds.

(d) Find the power of the motor to do this work. *Give answer first in Watts, then in horsepower (h.p.).*

(e) At the top floor, as Sarah gets off, a penny on the floor falls down the elevator shaft. What will be the penny's speed when it reaches the first floor?