X2.c 205

PHYS-205(6) (Kaldon-40534) **Name** _____
WMU-Fall 2000
Exam 2 - 100,000 points + 20,000 ☆ points **Book Title** _____

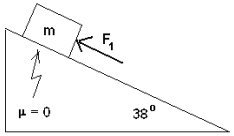
10/15/2000•Rev.2

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

THE MILLENNIUM FORCE, CEDAR POINT, SANDUSKY OHIO (50,000 points)

1.) For the Year 2000, Cedar Point built a new roller coaster to beat six performance records. The first hill of the roller coaster is 310 feet high (94.6 m). The speed at the bottom of the first drop is 92 mph (!) (41.1 m/s). (a) Use conservation of energy to find the speed v_0 at the top of the first hill, assuming no friction *OR* the work done by friction from the top of the first hill to the bottom of the first drop, assuming $v_0 = 0$. You may take the mass of the cars and riders to be 8550 kg.

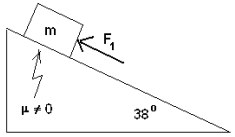
(b) At the bottom of the first drop, the track must curve vertically or you'll crash into the ground. The ride is advertised to max out accelerations at 4.50 *g*'s. If this were to be reached on this curve, then you would feel a maximum apparent weight of $m(4.50)g$ at the bottom of the curve. We can pretend that this is U.C.M., with our 92 mph top speed (41.1 m/s). Find the radius *r* of this circle.



(c) A block ($m = 322\ kg$) sits on an inclined plane of 38°. If there is no friction, what magnitude force F_1 is needed to keep the block from sliding?

(d) A block ($m = 322\ kg$) sits on an inclined plane of 38°. If the coefficients of friction are 0.58 and 0.63, what magnitude force F_1 is needed to keep the block from sliding?

NOTE: Very few people got this problem completely correct -- why would the complete answer give a RANGE of values for F_1 ?
Hint: Static friction can point EITHER way in this problem!



(e) If the block is moving *up* the incline at $v = 1.22\ m/s$, find the magnitude of the force F_1.

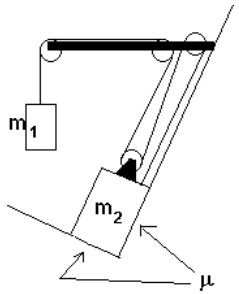
And Now the Stars of Star Problems, *Sir Isaac Newton & The Calculus*! (50,000 points)

2.) ☆(a) A nail is driven into a wall with a resistance force $F = -C x^2$. Find the work needed to drive the nail into the wall to a depth *D*.

☆(b) An object of mass $m = 4.00\ kg$ experiences a force, $F_x = (4.00\,N) - (1.00\,N/m)\,x$. Find the work it takes to move the object from $x = 0$ to $x = 4.00\ m$.

☆(c) Find the value of the *jerk* of this same object at the position $x = 4.00\ m$.

(d) In the following picture, Block 1 would be going down if there is no friction. But there is friction. Draw the Free Body Diagram of *Block 2*.



☆(e) An object of mass 6.35 kg has a motion that follows the following equations. Find the vector force $\vec{F}$ at time t = 0.

$$v_x(t) = 1.00\,m/s + 2.00\,m/s^2\,t + 3.00\,m/s^3\,t^2$$
$$a_y(t) = 1.00\,m/s^2 + 2.00\,m/s^3\,t + 3.00\,m/s^4\,t^2$$