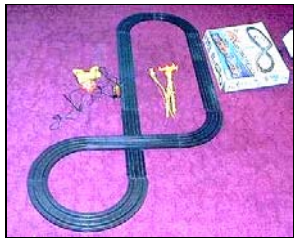
PHYS-205(H9) (Kaldon-28632) **Name** _____
WMU - Winter 2002
Exam 1 - 100,000 points + 20,000 ☆ points **Book Title** _____

1/29/2002•Rev.5

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

PHYS-205(H9) EXAM 1



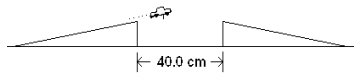
Slot Cars!

Rock-Em, Sock-Em Slot Cars (50,000 points)

1.) When Dr. Phil was a kid, some of his friends had HO-scale slot cars – little toy electric cars with a guide pin that stuck down into the plastic roadway so they'd (mostly) stay on the road. A typical setup might have 60.0 feet of track (18.3 meters) and cars traveling at 8.88 m/s. (a) How long does it take for a slot car to race around the track one time at this speed?

(b) If it takes 4.02 meters for the slot car to get up to speed from rest, what is the acceleration of the car?

(c) The big new feature that came out one year was putting a jump into the kit. If the gap is 40.0 cm wide and the launch/landing heights are the same, what is the angle θ of the ramp, if $v_0 = 8.88$ m/s ? *NOTE: If you cannot solve this problem directly, try solving part (d) first using $v_{0x} = 8.88$ m/s, and take a 2000 point penalty.*



(d) How much time does it take the slot car to cross the 40.0 cm gap? *See the NOTE in part (c).*

(e) Zipping along at 8.88 m/s, the slot car goes around a curve of radius 18" (45.7 cm). Find the centripetal acceleration, a_c, of the car.

"Can You Survive FOX-TV's New Show *The Star Problem Chamber*?" (50,000 points)

2.) An equation of motion is based on the fourth derivative: $\frac{d^4y}{dt^4} = \frac{2.00m \cdot s}{t^5} + 4.00\ m/s^4 + (11.00m/s^7)t^3$.

And all other *y*-component constants are zero. ☆(a) Find the equation for the *y*-component of the acceleration, a_y, of this object.

☆(b) Find the equation for the *y*-component of the velocity, v_y, of this object.

☆(c) Find the equation for the position, *y*, of this object.

(d) If $a_x = 5.25\ m/s^2$, find the vector acceleration, $\vec{a}$, in Standard Form for the time $t = 1.01$ *seconds. If you did not get answers to (a), use* $\vec{a}_y = -(1.23m/s^5)t^3\,\hat{j}$.

☆(e) Find the value of the seventh derivative, $\frac{d^7y}{dt^7}$, at time $t = 1.01$ *seconds.*

$$\frac{d^4y}{dt^4} = \frac{2.00m \cdot s}{t^5} + 4.00\ m/s^4 + (11.00m/s^7)t^3$$