Physics 2010
Fall 2001
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EXAM 1

2

Name:_____ Student ID #:_____

TA (circle one): Cook Costello Flitcroft Johnson Young

A tortoise and a hare challenge each other to a 1.00 km race along a straight track. Unable to contain himself the hare gets an early start and moves across the starting line with a constant velocity of 4.00 m/s. The tortoise, being a tortoise, arrives at the starting line 40.0 s later and starting from rest accelerates uniformly at 0.0500 m/s^2.

A. (12 PTS) One minute (1.00 minute) after the tortoise starts her race which animal is ahead, and by what length?

HARE → v_H = CONST

TORT | $v_{oT}=0$ $a=0.05 m/s^2$

$x_o=0$

$t = 60s + 40s$

$= 100s$

$x_H = x_{oH} + v_{oH}t + \frac{1}{2}a_H t^2 = v_{oH}t = (4m/s)(100s)$

4 PTS $= 400\ m$

$x_T = x_{oT} + v_{oT}t_T + \frac{1}{2}a_T t_T^2 = \frac{1}{2}a_T(t)^2$

$= \frac{1}{2}(.05 m/s^2)(60s)^2 =$ 90 m 4 PTS

HARE IS LEADING BY 310 m AFTER 4 PTS

B. (12 PTS) Which animal finishes the race first and by what distance is the winner ahead of the second place finisher when the winner crosses the finish line?

TIME TO FINISH: HARE: $t = \frac{1000\ m}{4.00\ m/s} = 250s$ $(x_H = v_H t)$

TORTOISE BEATS HARE. WOW!

DIST. TORT. LEADS BY AT FINISH

TORTOISE $t = \sqrt{\frac{2x_T}{a_T}} + 40s$ 8 PTS $(x_T = \frac{1}{2}a_T t^2)$

$= \sqrt{\frac{2000\ m}{.05 m/s^2}} + 40s = 240s$

LEAD $= 1000\ m - v_H(240s)$

$= 1000m - (4m/s)(240s) =$ **40m** 4 PTS

C. (12 PTS) On the graphs below show the position vs time, the velocity vs time and the acceleration vs time of the contestants. Each graph should have two plots Let $t_0=0$ BE TIME HARE STARTS

2 PTS EACH PLOT