

PHY101ARC Midterm 1, 2/17/06
Professor Surajit Sen
Spring 2006

PRINT Last Name: _____

PRINT First Name & Middle Initial _____

Student ID #: _____

INSTRUCTIONS

- This is a closed book exam except that you are allowed one 8.5"x11" sheet with whatever you wish to write on it
- There is 1 short answer question and 4 problems – you must attempt them all
- Allow approximately 15 minutes for each problem
- You must show ALL your work to receive full credit
- Numerical answers must have the right units in every step of you calculation and the appropriate number of significant figures
- Use the back of the problem page if you need more space and mark OVER on the front to indicate that there is material at the back side

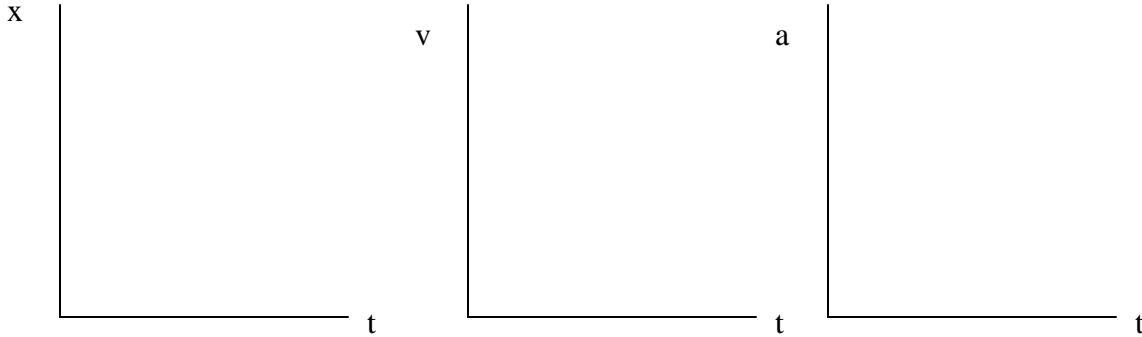
PROBLEM NUMBER	MAXIMUM SCORE	YOUR SCORE	GRADER
1	20		
2	20		
3	20		
4	20		
5	20		
TOTAL	100		

PLEASE DO NOT WRITE ON YOUR EXAM BOOK AFTER IT HAS BEEN GRADED AND RETURNED. IF YOU WRITE ON THIS BOOK, THIS BOOK CAN NO LONGER BE USED FOR PURPOSES OF REGRADING. IF YOU NEED TO MARK SOMETHING, USE A POST-IT NOTE TO DO SO.

1. Short Questions

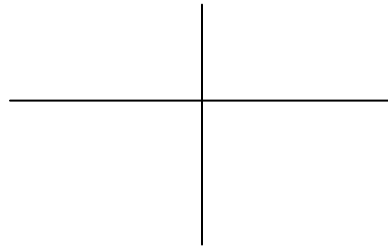
(a) A particle is moving at constant acceleration. Sketch its position (x) vs t, velocity (v) vs t and acceleration (a) vs t.

2x3 = 6



(b) Draw the free body diagram for the crate in the problem of a man dragging a crate using the axes drawn below. Assume the surface has friction.

A free-body diagram of a man dragging a crate. The diagram shows *all* the forces acting on the man, and *only* forces acting on the man.



4

(c) Recall discussions about static and kinetic friction in the class and in the book. Tell me why can't one use an "=" sign in the equation below. Use no more than 2 sentences.

$$f_s \leq \mu_s n$$

3

(d) Explain in one sentence why in circular motion the acceleration is centrally directed.

3

Problem 1. A roach was moving along at velocity $v_R = 1.00$ m/s. A gecko was behind the roach. The gecko saw the roach at a distance $x_0 = 1.00$ m ahead of it. The greedy gecko took off instantly at an acceleration $a_G = 0.50$ m/s².

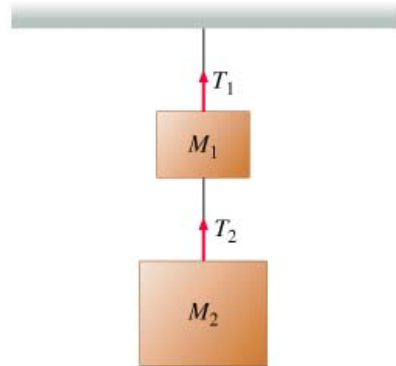
- (a) Find the time t at which the gecko catches and consumes the crunchy roach. The time t is measured from when the chase begins.
- (b) Find the distance x_R traveled by the roach before it dies!

Problem 2. A rock is thrown vertically upward with a speed of $v_0 = 12.0$ m/s from the roof of a building that is $H = 60.0$ m above the ground. Take the origin at the top of the building.

- (a) Draw a picture to describe the problem. Choose your axes, state next to the figure what you know and what you don't.
- (b) In how many seconds (t) after being thrown does the rock strike the ground?
- (c) What is the speed (v_f) of the rock just before it strikes the ground? Assume free fall.

Problem 3. The masses M_1 and M_2 are hanging from a ceiling as shown. The strings are massless. Assume the upward direction to be positive. The acceleration due to gravity is g .

- (a) Find tension the T_2 when the masses are at rest.
(b) Find the tension T_1 when the masses are at rest.



Problem 4: Two boxes with masses M_1 and M_2 are connected by a light string that passes over a light frictionless pulley. Box M_1 rests on a frictionless ramp that rises at $\theta = 30^\circ$ above the horizontal, and the system is released from rest.

- Make free body diagrams of each box.
- Find the tension T in the string.
- Find the acceleration a of the system (use the axes shown).

