Physics 2048 Test 2
Dr. Jeff Saul
Spring 2001

Name:______________________
Table:_____
Date:______________

READ THESE INSTRUCTIONS BEFORE YOU BEGIN

- Before you start the test, **WRITE YOUR NAME ON EVERY PAGE OF THE EXAM.**

- Calculators are permitted, but no notes or books are allowed

- If you have ANY questions while taking the test, please be sure to ask me. The purpose of the test is not to give you trick problems to catch you in an error. The purpose is to give you an opportunity to "show what you know!"

- On problems 2, 4, & 5 your answers will be evaluated on how you got them. Remember that to get full credit on a problem you will need to
  - Make a list of given information and indicate what you are trying to find
  - Start from general principles
  - Solve for the unknown quantity in symbols before plugging in numbers
  - Substitute numbers with units
  - Include units with all numeric quantities

  Partial credit will be given for correct steps shown, even if the final answer is wrong.

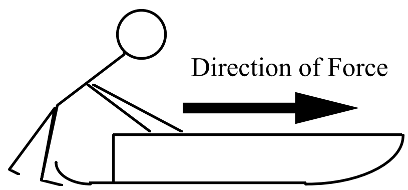
- Write clearly and logically so that I can understand what you are doing and can give you as much partial credit as you deserve. I cannot give credit for what you are thinking, only for what you show on your paper.

- If on a multistep problem you can't do a particular part, don't give up. Go on to the next part anyway. If necessary, define a variable name for the quantity you couldn't find and express your answer in terms of it.

Problem	Points Possible	Score
Group Problem	25	
1	15	
2	15	
3	10	
4	15	
5	20	
Total	100	

Problem 1 (Short Answer: 15 points)

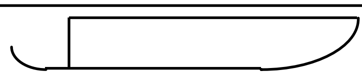
A sled on ice moves in the ways described in questions 1-7 below. *Friction is so small that it can be ignored.* A person wearing spiked shoes standing on the ice can apply a force to the sled and push it along the ice. Choose the <u>one</u> force (**A** through **G**) which would **keep the sled moving** as described in each statement below. You may use a choice more than once or not at all but choose only one answer for each blank. If you think that none is correct, answer choice **J**.



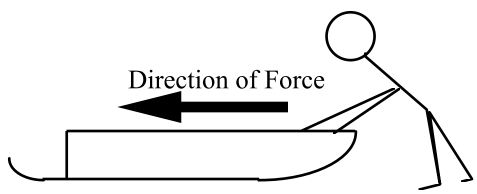
A. The force is toward the **right** and is **increasing** in strength (magnitude).

B. The force is toward the **right** and is of **constant** strength (magnitude).

C. The force is toward the **right** and is **decreasing** in strength (magnitude).



D. No applied force is needed



E. The force is toward the **left** and is **decreasing** in strength (magnitude).

F. The force is toward the **left** and is of **constant** strength (magnitude).

G. The force is toward the **left** and is **increasing** in strength (magnitude).

_______a. Which force would keep the sled moving toward the right and speeding up at a steady rate (constant acceleration)?

_______b. Which force would keep the sled moving toward the right at a steady (constant) velocity?

_______c. The sled is moving toward the right. Which force would slow it down at a steady rate (constant acceleration)?

_______d. Which force would keep the sled moving toward the left and speeding up at a steady rate (constant acceleration)?

_______e. The sled was started from rest and pushed until it reached a steady (constant) velocity toward the right. Which force would keep the sled moving at this velocity?

_______f. The sled is slowing down at a steady rate and has an acceleration to the right. Which force would account for this motion?

_______g. The sled is moving toward the left. Which force would slow it down at a steady rate (constant acceleration)?

Problem 2 (Estimation Problem: 15 points)

You have joined a volunteer fire department. They are looking to buy a new rescue net because the old one broke. (A rescue net is the circular trampoline-like net fireman hold to catch people falling from buildings.) The cost increases dramatically with the strength of the net and your fire department has a very limited budget. You need to buy the cheapest rescue net that meets your department's needs. Assuming that the force exerted by the rescue net is constant and that the tallest building in your region is 5 stories high, what is the maximum force the rescue net would need to withstand? Remember the idea is stop people before they hit the ground.

Problem 3 (Essay 10 points)
You may use diagrams and equations but no calculations in your response for this problem.

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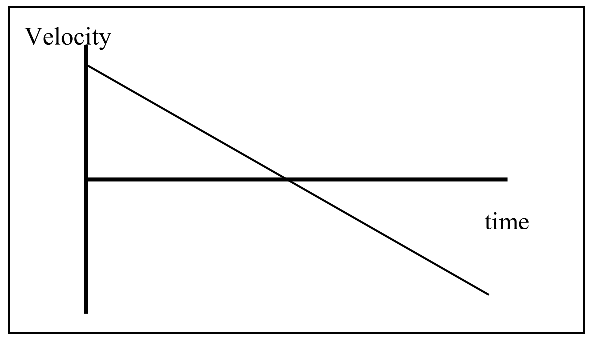
A cart can move to the right or left along a horizontal track (the positive part of the x axis) as shown in the figure below. Assume that friction is small enough that it can be ignored. A sonic range is used (as shown) to measure the position, velocity, and acceleration of the cart. The track is not necessarily flat or horizontal. In addition, the track may be tipped or the cart may be pulled or pushed. For the first run, the sonic ranger displays a graph of the velocity that looks like the graph shown at the right.

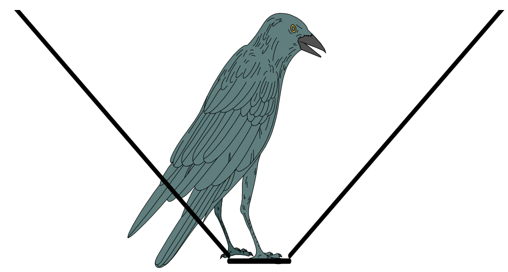


- Describe the motion of the cart in words
- Draw graphs showing what the sonic ranger would display for the cart's position and the cart's acceleration.
- USE WHAT YOU'VE LEARNED FROM CLASS SO FAR to explain in words how you came up with your answers

Problem 4 (15 points)

A crow is sitting on a telephone wire near a field, waiting patiently for the farmer to leave so he can eat the farmer's corn. The crow is standing on a small piece of wire made straight by the force of his feet.

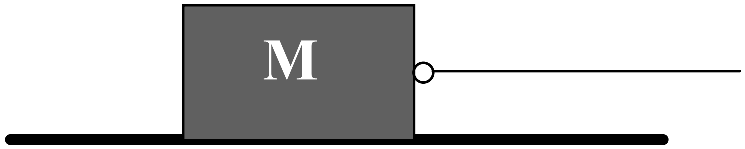
(a) Identify all the forces acting on the crow and on the piece of wire under the crow's feet. Give any relationships between these forces that you can and explain where they come from.



b.) The angles that the left piece of wire and the right piece of wire make with the flat piece on the bottom are the same and equal to θ. If the crow has a mass of 0.5 kg, and $\theta = 150^{\circ}$, find the tension in the wire. Assume the mass of the wire is negligible.

Problem 5 (20 points)

A worker is pulling a heavy crate along the floor with a rope. The crate has a mass *M* and the coefficient of friction between the crate and the floor is μ.



a.) If the worker is pulling so that the crate is moving at a constant velocity, $\vec{v}_0$, what is the magnitude of the force exerted by the worker? Explain how you know.

b.) Does how hard the worker pulls depend on whether her little brother of mass *m* is sitting of the top of the crate? Explain your reasoning.

c.) If her little brother is sitting on top of the crate and $M = 50$ kg, $m = 30$ kg, $\mu = 0.4$, and $v_0 = 4$ m/s, how hard does she have to pull to keep the crate moving?