Physics 2048 Test 2 Name:_____
Dr. Jeff Saul Group:_____
Fall 2001 Date:_____

READ THESE INSTRUCTIONS BEFORE YOU BEGIN

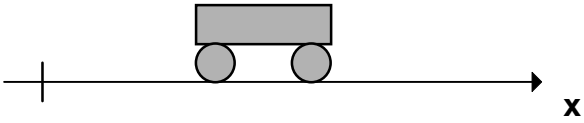
- Before you start the test, **WRITE YOUR NAME ON EVERY PAGE OF THE EXAM.**
- Calculators are permitted, but no notes or books are allowed
- If you have ANY questions while taking the test, please be sure to ask me. The purpose of the test is not to give you trick problems to catch you in an error. The 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	20	
2	10	
3	15	
4	15	
5	15	
Total	100	

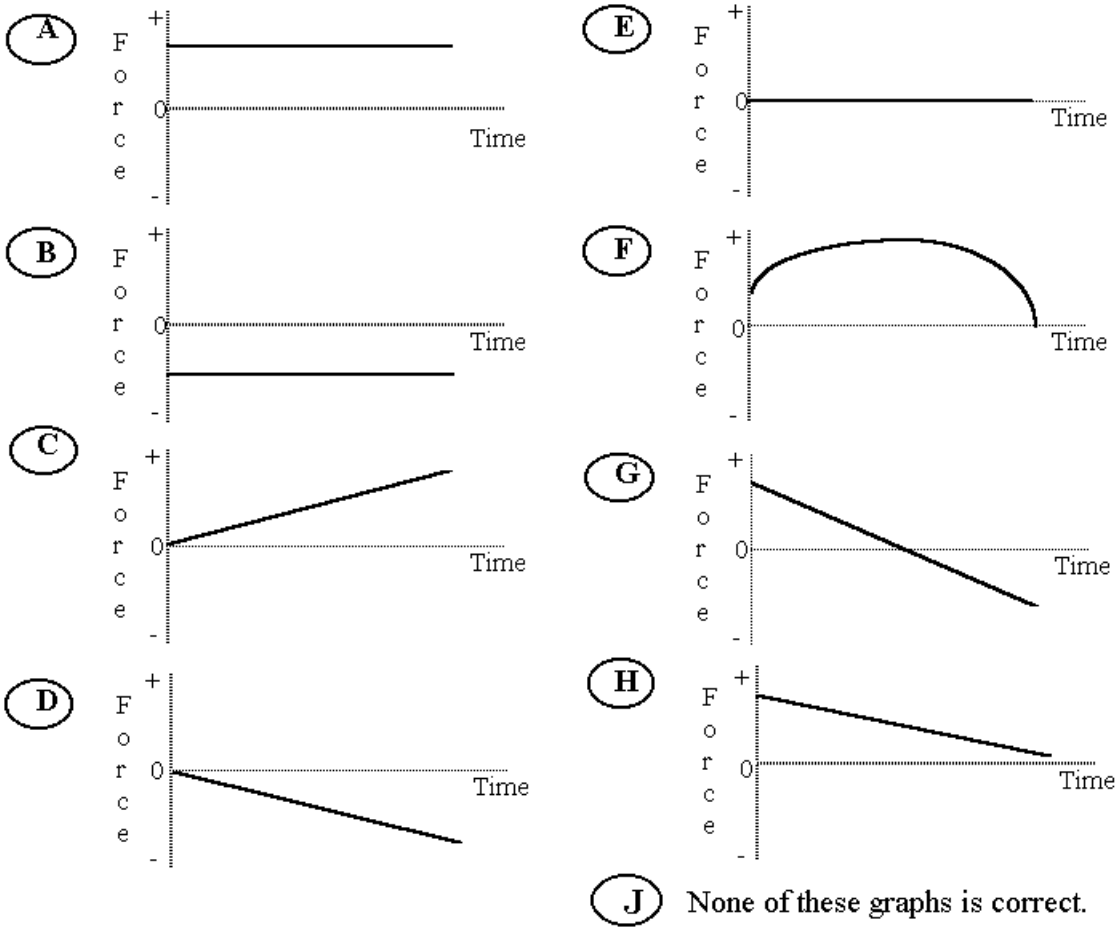
Problem 1 (Short Answer: 20 points)

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 force is applied to the cart. Choose the one force graph (A through H) for each statement below which would allow the described motion of the car to continue.



You may use a choice more than once or not at all. If you think that none of the graphs represents the correct answer, choose J.

(a) The cart moves toward the right (away from the origin) with a steady velocity.
(b) The cart moves toward the right and is speeding up at a steady rate (constant acceleration).
(c) The cart moves toward the left (toward the origin) with a steady (constant) velocity.
(d) The car moves toward the right and is slowing down at a steady rate (constant acceleration).
(e) The cart moves toward the right, speeds up and then slows down.
(f) The cart moves toward the left and is speeding up at a steady rate (constant acceleration).



Problem 2 (Estimation Problem: 10 points)

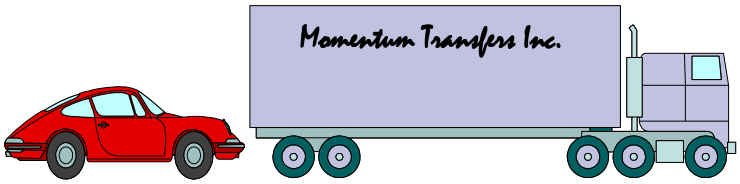
You are helping a friend decorate a room for his little sister's birthday party when your friend rubs the balloon his hand and sticks it on the wall. It stays stuck to the wall. Use a free body diagram to determine the magnitude, direction, and type of force that is holding the balloon up.

Problem 3 (Essay 15 points)
You may use words, diagrams, and equations but no calculations in your response for this problem.

In the baseball game last night, a batter hit a ball almost straight up. Explain what is happening to the ball in terms of the laws of motion we have studied. Illustrate your discussion using free-body diagrams and graphs of position, velocity, acceleration, and net force vs. time. Restrict your description to the time interval starting just after the ball has left the bat until just before it is caught.

Problem 4 (15 points)

Jack left the lights in his truck on while in a truck stop in Kansas and his battery went dead. Fortunately, his friend Al was there. Unfortunately, Al was driving his Geo Metro. Fortunately, the road was very flat. Jack was able to convince Al to give his truck a long slow push to get it up to 20 miles/hour. At this speed, Jack can let in the truck's clutch and the truck's engine should start up.



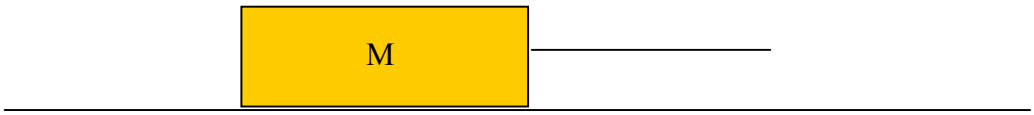
(a) Al begins to push the truck. It takes him 5 minutes to get the truck up to a speed of 20 miles/hour. During the time that Al's Geo is pushing the truck, draw separate free body diagrams for the Geo and for the truck. Order all the horizontal forces by magnitude from largest to smallest. If any are equal, state that explicitly. Explain your reasoning.

(b) If the truck was accelerating uniformly over the 5 minutes, how far did Al have to push the truck before Jack could let in the clutch?

(c) Suppose the mass of the truck is 4000 kg, the mass of the car is 800 kg, and the coefficient of friction between the vehicles and the road is 0.1. At one instant when they were trying to get the truck moving, the car was pushing the truck and exerting a force of 1000 N, but neither vehicle moved. What was the frictional force between the truck and the road? Explain your reasoning.

Problem 5 (15 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. (Assume the rope is horizontal.)



(a) If the worker is pulling so that the crate is moving at a constant velocity, v_0, what force is the worker using? Explain how you know.

(b) Does how hard she has to pull depend on whether her little brother (mass = m) is sitting on top of the crate? Explain your reasoning.

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

Group Test 2 (25 points) Physics 2048 Fall 2001

While visiting a friend in San Francisco you decide to drive around the city. You turn a corner and are driving up a steep hill. Suddenly, a small boy runs out on the street chasing a ball. You slam on the brakes and skid to a stop leaving a 50-foot long skid mark on the street. The boy calmly walks away but a policeman watching from the sidewalk walks over and gives you a ticket for speeding. You are still shaking from the experience when he points out that the speed limit on this street is 25 mph. After you recover your wits, you examine the situation more closely. You determine that the street makes an angle of 20 degrees with the horizontal and that the coefficient of friction between your tires and the street is 0.80. Your car's information book tells you that the mass of your car is 1570 kg. You weigh 130 lb. Witnesses say that the boy had a weight of about 60 lb. and took 3.0 seconds to cross the 15 foot wide street. Should you fight the ticket in court?

- USE THE GOAL PROTOCOL AND GROUP ROLES TO SOLVE THIS PROBLEM
- Make sure everyone's name and their group role is on the GOAL Answer sheets
- YOU MAY USE UP TO 2 WHITE BOARDS PER GROUP
- WORK ONLY WITH YOUR GROUP MEMBERS
- NO BOOKS, NOTES, OR SCRATCH PAPER ARE ALLOWED

YOU WILL BE GRADED ON YOUR REASONING AND HOW WELL YOU USED THE GOAL PROTOCOL IN ADDITION TO THE CORRECTNESS OF YOUR ANSWER