Physics 2048 Test 3 Name:_____
Dr. Jeff Saul Table:_____
Spring 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.

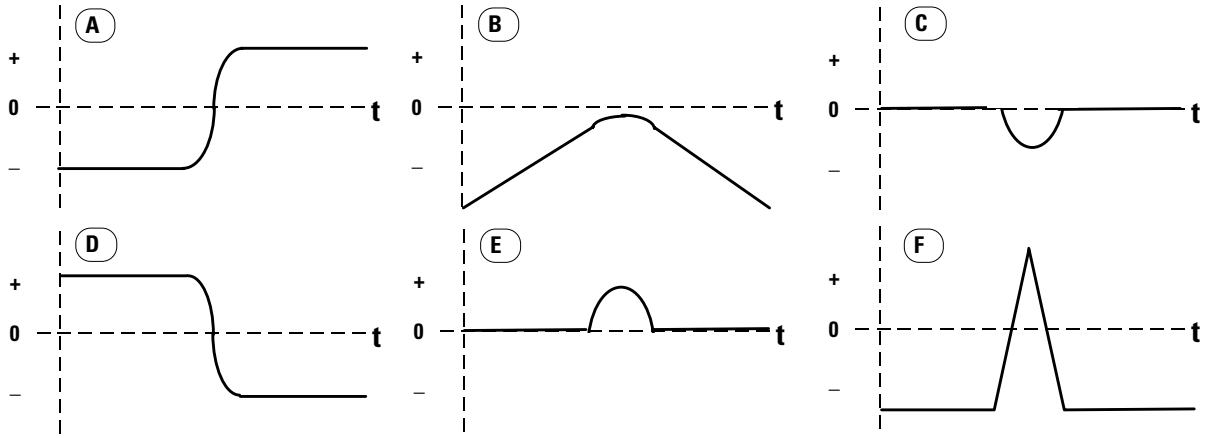
- If on a multi-step problem you can't do a particular part, don't give up. Go on to the next part anyway. If necessary, define a variable name for the quantity you couldn't find and express your answer in terms of it.

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) no explanation required, but no partial credit either.

Two carts on an air track are pushed towards each other. Initially, cart 1 moves in the positive x direction and cart 2 moves in the negative x direction. They bounce off each other elastically. The graphs below describe some of the variables associated with the motion as a function of time. For the experiment described and for each item in the list below, identify which graph is a possible display of that variable as a function of time. If none apply, write N (for none).

(a) the momentum of cart 1
(b) the force on cart 1
(c) the position of cart 2
(d) the force on cart 2
(e) the position of cart 1.



Problem 2 (Estimation Problem: 15 points)

Suppose all the cars in the country were lined up a row pointing the same way and accelerated to highway speed in 10 seconds at a constant rate. What would be the magnitude of the force applied to the road? (Make sure all assumptions and explanations are explicit.)

Problem 3 (Essay 10 points) You may use diagrams, equations, and words, but not calculations to answer this problem.

Describe 2 real world situations that can be explained at least in part by the table shown below

Materials	μ_s	μ_k
Steel on steel	0.74	0.57
Aluminum on steel	0.61	0.47
Copper on steel	0.53	0.36
Rubber on concrete (dry)	1.0	0.8
Rubber on concrete (wet)	0.3	0.25
Wood on wood	0.25-0.5	0.2
Glass on glass	0.94	0.4
Teflon on Teflon	0.04	0.04
Teflon on steel	0.04	0.04
Waxed wood on wet snow	0.14	0.1
Waxed wood on dry snow	0.10	0.04
Metal on metal (lubricated)	0.15	0.06
Ice on ice	0.1	0.03
Synovial joints in humans	0.01	0.003
Very rough surfaces		1.5

Problem 4 (15 points)

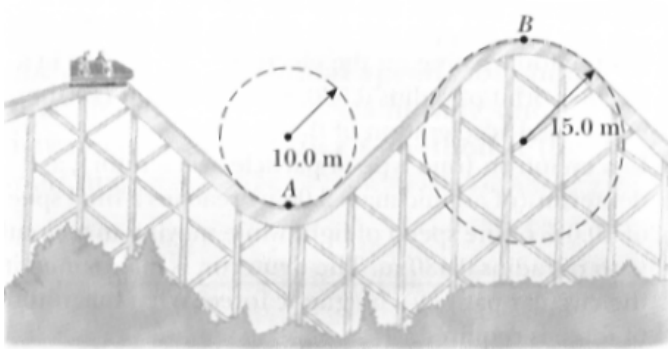
A spaceship of mass 2×10^6 kg is cruising along at a speed of 5×10^6 m/s when the antimatter reactor fails, blowing the ship into three pieces. One piece, having a mass of 5×10^5 kg, is blown straight backwards with a speed of 2×10^6 m/s. A second piece, of mass 8×10^5, continues forward at 1×10^6 m/s.

a. Determine the direction of the third piece. Explain your reasoning.

b. What is the velocity of the third piece?

Problem 5 (20 points)

A roller-coaster car has a mass of 500 kg when fully loaded with passengers as shown on the right.



a. If the car has a speed of 20.0 m/s at point A, what is the force exerted by the track at this point?

b. What is the maximum speed the car can have at point B and stay on the track?

Practice Group Test 3 (25 points) Physics 2048

You are a volunteer at the Campus Museum of Natural History. Because of your interest in the environment and your physics experience, you have been asked to assist in the production of an animated film about the survival of hawks in the wilderness. In the script, a 1.5-kg hawk is hovering in the air so it is stationary with respect to the ground when it sees a goose flying below it. The hawk dives straight down. When it strikes the goose and digs its claws into the goose's body, it has a speed of 60 km/hr. The goose, which has a mass of 2.5 kg, was flying north at 30 km/hr just before it was struck by the hawk and killed instantly. The animators want to know the velocity (magnitude and direction) of the hawk and dead goose just after the strike.

- USE THE GOAL PROTOCOL AND GROUP ROLES TO SOLVE THIS PROBLEM
- Make sure everyone's name and their group role on the GOAL Answer sheets
- WORK ONLY WITH YOUR GROUP MEMBERS
- NO BOOKS OR NOTES ALLOWED
- YOU WILL BE GRADED ON YOUR REASONING AND HOW WELL YOU USED THE GOAL PROTOCOL IN ADDITION TO THE CORRECTNESS OF YOUR ANSWER
- **YOU MUST START FROM GENERAL PHYSICS PRINCIPLES, I.E. KINEMATIC EQUATIONS, NEWTON'S SENCOND LAW, ETC.**