Physics 1st Honors

3D Force Project

Based on the physics scenario chosen in class you / your group are / is responsible for:

- Creating and writing up a problem using the given scenario (as true to life as possible)
- IGNORE AIR RESISTANCE
- Solving the created problem using numerical as well as pictorial methods
- Designing a 3D representation of the situation (NO bigger than 50cm x 50cm x 50cm) that creatively depicts all of the forces acting on the objects within the system. You may use any materials to construct your 3D representation. This includes materials such as Playdoh, clay, Legos, other toys etc

You / your group will need to turn in

- A typed up copy of your problem
- A typed up copy or neatly written pen copy of the solution and 2D drawing
- A physical, 3D model of the situation with appropriate "force vectors"

You / your group will be graded on the project's

- Solutions to the problem (30 points / 20 solution, 10 drawing)
    - Complete solution and drawing for each object
    - Solution for each object showing appropriate steps
    - Drawing of scenario, System Schema and Force Diagram for both objects
    - Accurate drawing of force diagram with force vectors drawn to scale and appropriate angles, labeled with agent-object notation
    - Must include scale legend for relative sizes of vectors
- 3D model (20 points)
    - Inclusion of all force vectors on all objects
    - Vectors in appropriate areas, correct magnitude
    - Force vectors labeled with agent-object notation
    - Correctly depicts situation

This project will count as a test grade.

DUE DATE: MARCH 30, 2009

List of Scenarios

Two ice-skaters are standing on the ice at the Spectrum after a Flyers' win. Skater 1 has a weight of 1500N and Skater 2 other has a mass of 75kg. After the game, the zamboni hasn't run yet so the ice has a coefficient of friction $\mu_k = .13$. Skater 1 pushes skater 2 away with a force of 500N, what happens to each skater? How much force does Skater 2 apply to Skater 1? What is the magnitude and direction of each skater's acceleration?

Two ice-skaters are playing tug-of-war in the Rockefeller Center ice-skating rink. Skater 1 has a weight of 245N and Skater 2 has a weight of 735N. The smooth, new ice has a coefficient of friction of $\mu_k = .05$. Skater 2 pulls on the rope with a force of 300N, what happens to each skater? How much force does the rope apply to Skater 2? What is the magnitude and direction of each skater's acceleration?

A large cannon with a mass of 1650kg is waiting on the railroad tracks outside a castle to stop any passers by. The cannon accidentally misfires and shoots a 35kg cannon ball horizontally. The railroad tracks have a coefficient of friction $\mu_s = 1.4$. The cannon exerts a force of 8400N on the cannon ball when it is shot out. What force does the cannon ball exert on the cannon? What is the magnitude and direction of the cannon and the cannon ball's horizontal acceleration?

Flo is vacationing in her rowboat on Lake Erie and enjoying the Cleveland skyline. Flo exercises regularly and only weighs 535N. Her boat on the other hand isn't so fit and has a mass of 78kg. Flo decides to cool off on this hot summer day and dives into the lake. The cold water has a coefficient of friction $\mu_k = .70$ between the boat and the water. As she jumps off, the boat exerts a force of 720N on her. What force does Flo exert on the boat? What is the magnitude and direction of Flo's and the boat's acceleration?

Two men who reenact medieval battles in their free time are relaxing on separate boats (35kg each). Suddenly, Lancelot grabs his jousting stick (that he's secretly packed) and challenges Count de Monet to a jousting competition. Unfortunately Count de Monet (120kg) did not bring his jousting stick. Lancelot and his jousting stick have a mass of 70kg. Lancelot jabs Count de Monet in the chest with a force of 540N. The water has a coefficient of friction $\mu_s = .70$. Without his stick, how much force does Count de Monet exert on the jousting stick? What is the magnitude and direction of the acceleration of the Count and the boat? Assume that both people do not fall out of either boat.