UNIT 8 HOMEWORK

UNIT 8 HOMEWORK AFTER SESSIONS ONE AND TWO

➡ **SmartPhysics:** *View the Prelecture 10 "Center of Mass" before the class of next session and answer the checkpoint questions. (The online Homework is due the next day.)*

• *Work Supplemental Problem SP8-1*

SP8-1) [20 pts] Hands-on inclined plane problem: Your table group is to take some very simple data and come up with a theoretical estimate of the angle with respect to the horizontal so that a 4-battery fan cart with its fan thrusting it up the track does not move. In order to do the calculations you will need to make some very simple measurements. Between session 1 and session 2 the following equipment will be available on the lecture demo table.

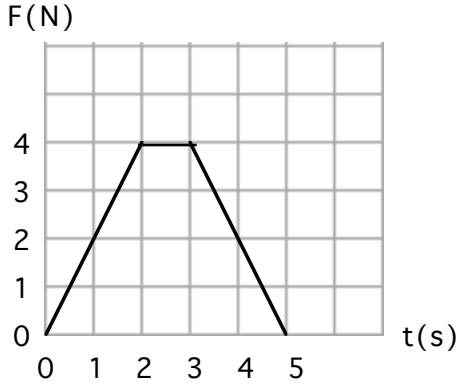
- a fan cart with 4 batteries
- a spring scale
- a balance or scale

Take whatever measurements you need in order to *calculate* the angle with respect to the horizontal through which a track should be tilted so the cart will not move when placed on the cart. *The rule in making these measurements is that you must not place the cart on a track that is tilted up.* **Hint:** You may want to review pages 7-39 and 7-40 in your Activity Guide and/or Examples in the text.

Note: If your group seems to have a correct analysis of this hands-on problem, the instructor may raise a track to the specified angle to demonstrate the viability of your solution.

• *Work Supplemental Problem SP8-3*

SP8-3) The force F_x acting on a 0.80 kg particle varies in time as shown in the figure below. Find (a) The impulse of the force, (b) the final velocity of the particle if it is initially at rest, and (c) the final velocity of the particle if it is initially moving along the x-axis with a velocity of –2.00 m/s.



UNIT 8 HOMEWORK AFTER SESSION THREE

➡ **SmartPhysics:** *View the Prelecture 11 "Conservation of Momentum" before the class of next session and answer the checkpoint questions. (The online Homework is due the next day.)*

• *Complete Unit 8 entries in the Activity Guide*
You probably didn't have time to finish Session 3 in class.

• *Work Problems 21, 30 and the Review Problem.*
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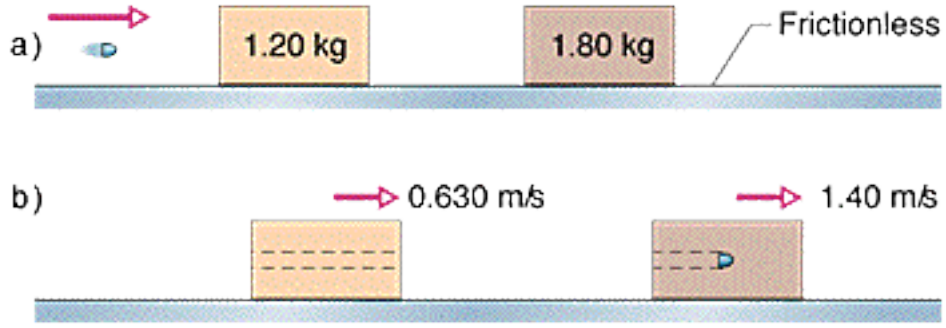
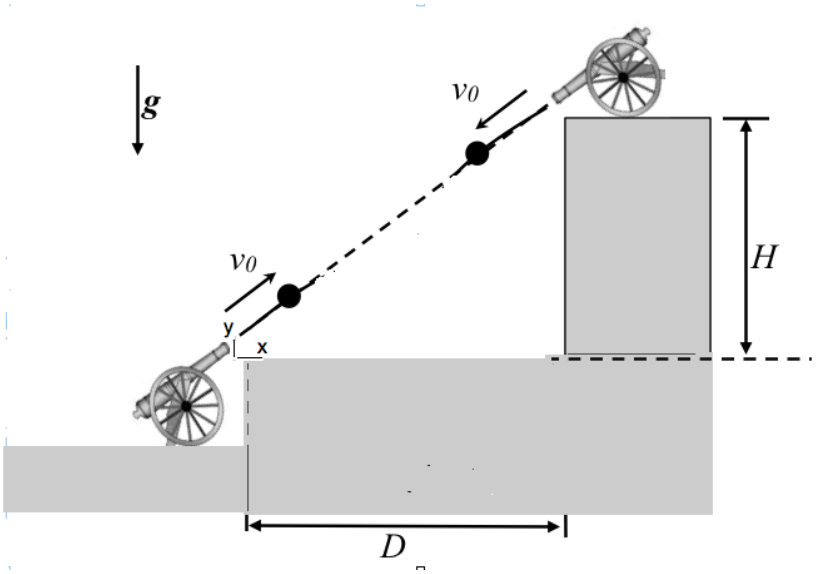
- **21: Spacecraft** A spacecraft is separated into two parts by detonating the explosive bolts that hold them together. The masses of the parts are 1200 kg and 1800 kg; the magnitude of the impulse on each part from the bolts is 300 N · s. With what relative speed do the two parts separate because of the detonation?

- **30: Bullet and Two Blocks** A 4.50 g bullet is fired horizontally at two blocks at rest on a frictionless tabletop. The bullet passes through the first block, with mass 1.20 kg, and embeds itself in the second, with mass 1.80 kg. Speeds of 0.630 m/s and 1.40 m/s, respectively, are thereby given to the blocks (Fig. 7-28b). Neglecting the mass removed from the first block by the bullet, find (a) the speed of the bullet immediately after it emerges from the first block and (b) the bullet's original speed.



Review Problem

11. Two cannons aimed directly at each other fire simultaneously. The cannon balls have the same speed immediately after being fired. Some time later, the cannon balls collide at point P.



Assume $D = H$ in the following questions. Answer (a), (b), (c) and (d) using symbolic equations.

(a) What is the x coordinate at which the balls will collide?

(b) The lowest point at which the balls can collide is $y = 0$. Show that if the collision is at $y = 0$ then the equation for how much time it takes for the balls to collide after firing is $t = \sqrt{D/g}$.

(c) Using the previous result show that the minimum velocity for the balls to collide at $y = 0$ is $v_{0,\text{min}} = \sqrt{gD/2}$.

(d) If $v > v_{0,\text{min}}$ derive the x and y coordinate of the collision point P. (The origin is at the tip of the bottom cannon's muzzle.)

(e) If $H = D = 72$ m and $v_0 = 160$ m/s what are the coordinates of P in metres?