Physics 1A, Section 2

October 7, 2010

Quiz #1

- covers:
  - Frautschi et al., chapters 1-3
  - lectures/sections through yesterday (Oct. 6)
  - homework #1
- due Monday at noon

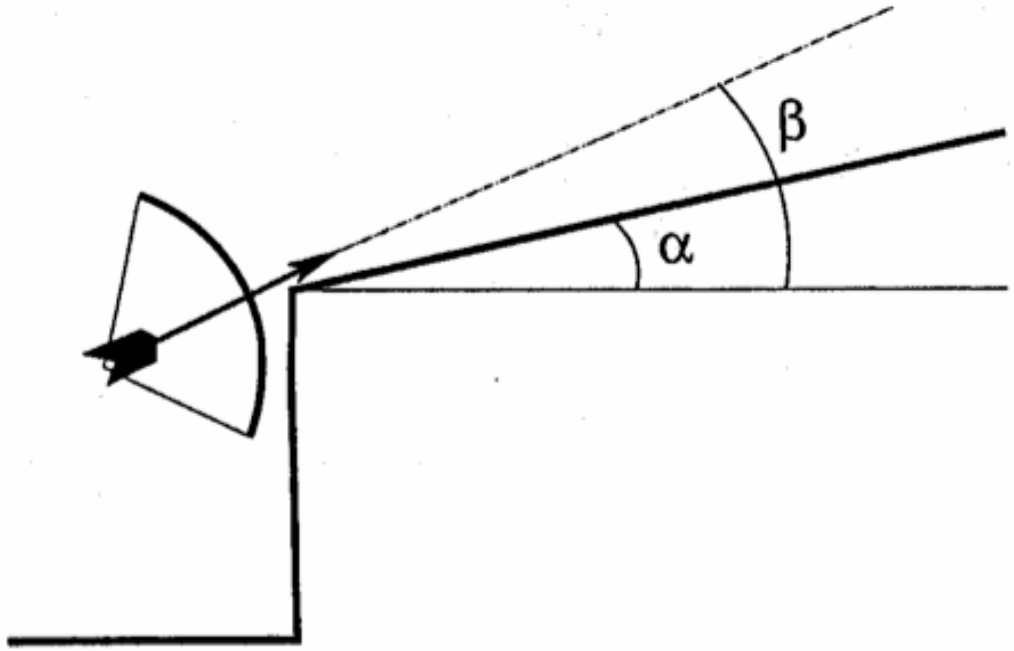
Reference Frames

- See Frautschi section 4.3 for an introduction to the concept.

- elevator problem from homework #1:

  - The elevator reaches a velocity of v_0 = 0.5 m/s just before it reaches the second floor. At this point the velocity remains constant at 0.5 m/s. As it passes the second floor you again drop the ball from a height of 2 m above the floor.
  - (3 points) (c) How long does it take the ball to hit the floor of the elevator?

Quiz Prob. 19



Robin Hood is standing at the foot of a hill which makes an angle α with the horizontal. For practicing his recently learnt Phys 1a formulas, he shoots an arrow from a point on the hill, with initial velocity v_0 and under an angle $\beta > \alpha$ with the horizontal. Neglect both the size of the arrow and air friction.

(a) (2 points) Express the time needed for the arrow to land in terms of α, β, v_0, and the gravitational acceleration g.

(b) (1 point) Show that the distance between the origin and the place of landing is given by

$$l = \frac{2v_0^2}{g\cos^2(\alpha)}\sin(\beta-\alpha)\cos(\beta).$$

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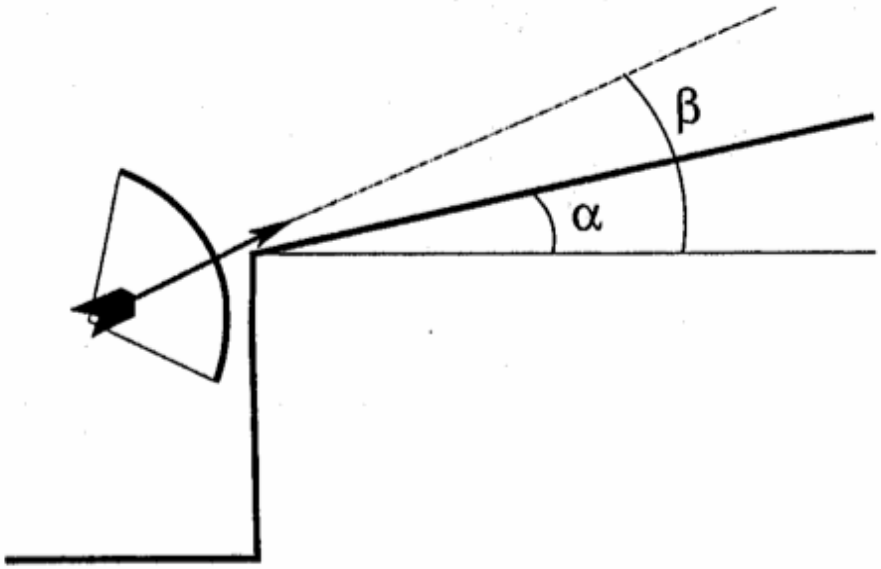

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(b) (1 point) Show that the distance between the origin and the place of landing is given by

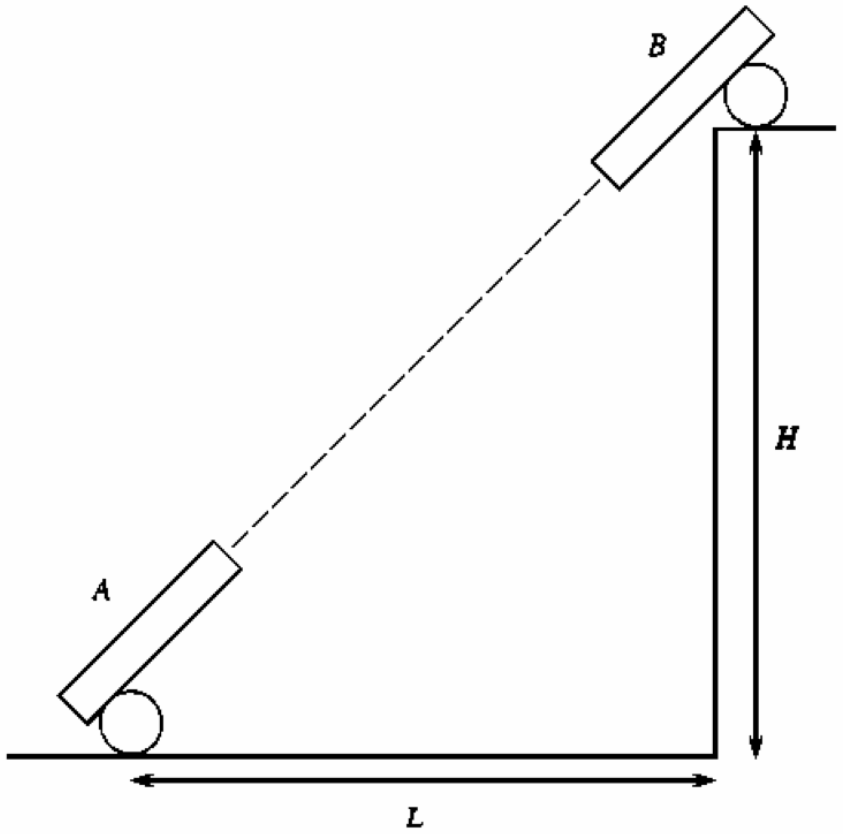
$$l = \frac{2v_0^2}{g\cos^2(\alpha)} \sin(\beta - \alpha)\cos(\beta).$$

- Answer:

  a) $t = 2\, v_0 \sin(\beta - \alpha) / (g \cos\alpha)$

Final Prob. 1

Cannon A is located on a plain a distance L from a wall of height H. On top of this wall is an identical cannon (cannon B). Ignore air resistance throughout this problem. Also ignore the size of the cannons relative to L and H.



(**3 points**) (a) The two groups of gunners aim the cannons directly at each other. They fire at each other simultaneously, with equal muzzle speeds v_0. What is the value v_{min} of v_0 for which the two cannon balls collide just as they hit the ground?

(**3 points**) (b) Describe what happens for muzzle velocities greater than v_{min} and less than v_{min}?

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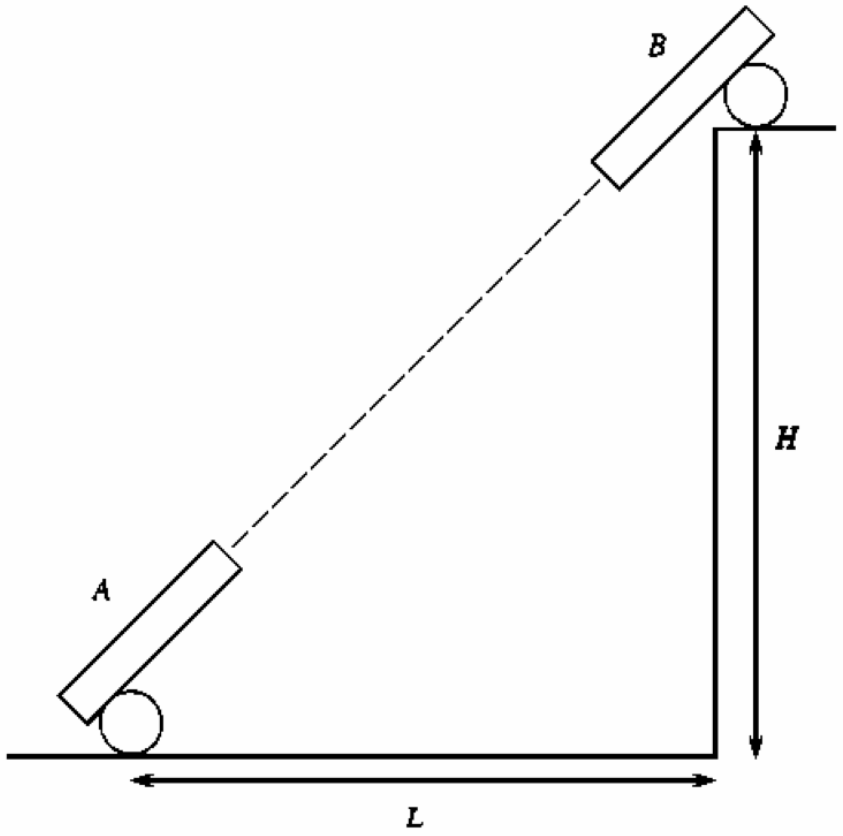

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- Answer:
  a) $v_{min} = (1/2)[g(H^2+L^2)/H]^{1/2}$
  b) $v>v_{min}$: collide
  $v<v_{min}$: hit ground first

Monday, October 11:

- Quiz Problem 18 (vectors)
- Quiz Problem 27 (vectors)

- *Optional, but helpful, to try these problems in advance*