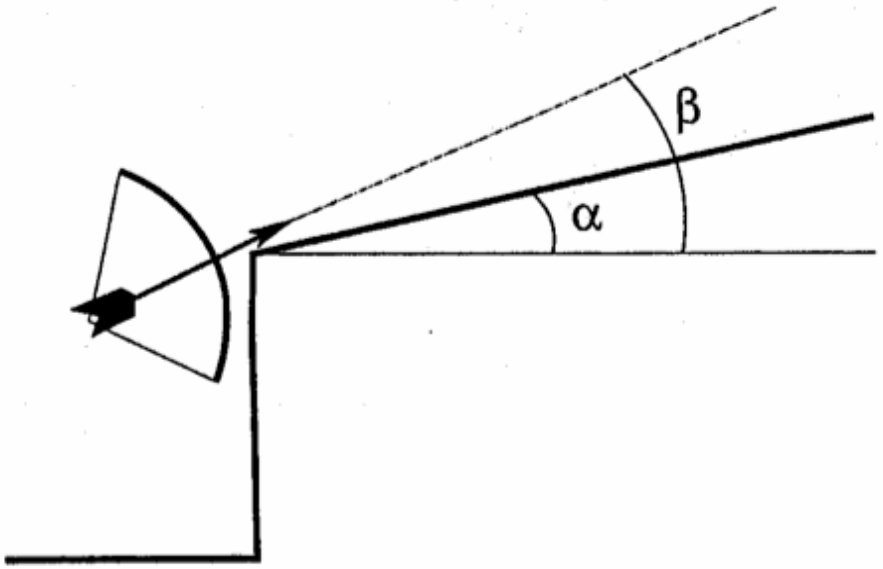
Physics 1A, Section 6

October 9, 2008

First Quiz

- covers:
  - T.M.U. chapters 1-4
  - lectures/sections through today (Oct. 9)
  - homework #1
- open book (T.M.U., Feynman Vol. I), open class notes
- Pick it up tomorrow before/after the lecture

Quiz Problem 19



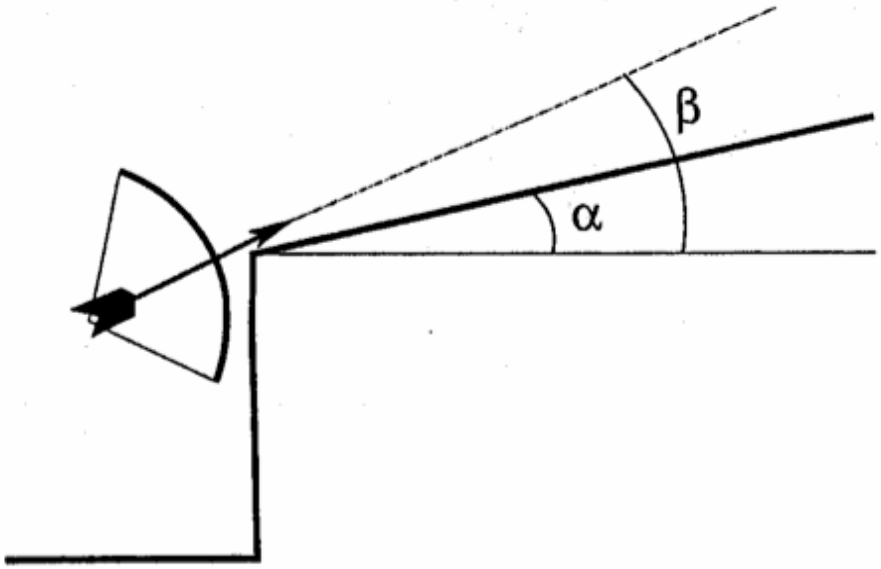
Robin Hood is standing at the foot of a hill which makes an angle α with the horizontal. For practicing his recently learnt Phys 1a formulas, he shoots an arrow from a point on the hill, with initial velocity v_0 and under an angle $\beta > \alpha$ with the horizontal. Neglect both the size of the arrow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

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

Quiz Problem 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

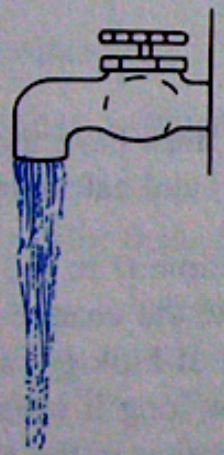
$$l = \frac{2v_0^2}{g\cos^2(\alpha)} \sin(\beta - \alpha)\cos(\beta).$$

- Answer:

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

T.M.U.
3.7

7. A cylindrical stream of water flows at a speed v_0 out of a pipe. The amount of water flowing through a cross section of the stream is the same at all distances from the pipe; that is, if five liters (5 L) flow out of the pipe in 1 s, then 5 L also flow past a point 1 m below the end of the pipe. Since the falling water accelerates downward the stream must get narrower the farther it gets from the end of the pipe.

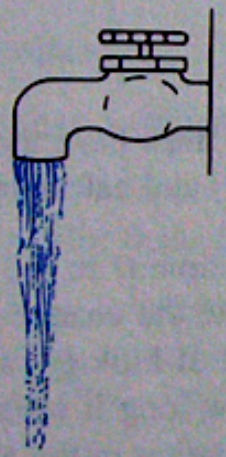


(a) Find an equation for the change dr/dy in the radius r of the stream with respect to distance y below the end of the pipe.

(b) If the pipe is 10 cm across and the water flows out at 2.0 m/s, at which distance beneath it will the radius of the stream be 2.5 cm?

T.M.U. 3.7

7. A cylindrical stream of water flows at a speed v_0 out of a pipe. The amount of water flowing through a cross section of the stream is the same at all distances from the pipe; that is, if five liters (5 L) flow out of the pipe in 1 s, then 5 L also flow past a point 1 m below the end of the pipe. Since the falling water accelerates downward the stream must get narrower the farther it gets from the end of the pipe.



(a) Find an equation for the change dr/dy in the radius r of the stream with respect to distance y below the end of the pipe.

(b) If the pipe is 10 cm across and the water flows out at 2.0 m/s, at which distance beneath it will the radius of the stream be 2.5 cm?

- Answer:
  a) $r = r_0 v_0^{1/2} (v_0^2 + 2gy)^{-1/4}$ ➔ $dr/dy = -r_0 v_0^{1/2} g/2 (v_0^2 + 2gy)^{-5/4}$
  b) 3.1 m

Monday, October 13:

- Quiz Problem 18
- Quiz Problem 27

- *Optional, but helpful, to look at these in advance.*