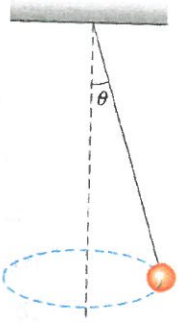
QUIZ 6, PHY 191 B, Wednesday, Oct 12, 2016 (20 pts)

[see both sides of sheet!]

SHOW WORK CLEARLY OTHERWISE ZERO CREDIT!!

Question 1:

Consider a conical pendulum with an 80.0 kg bob on a 10.0 m wire making an angle 3.8^0 with the vertical and moving in a horizontal circle, as shown below.

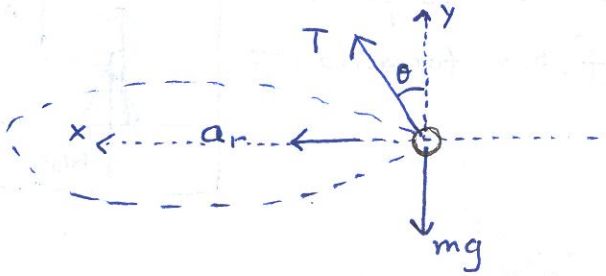


The radial acceleration of the bob toward the center of the circle is

a) 0.38 m/s^2 b) 0.46 m/s^2 c) 0.58 m/s^2 d) 0.65 m/s^2 e) 0.86 m/s^2

ANSWER (d) (1 pt)

i) Draw a free body diagram for the bob. Indicate the forces acting on the bob, and to the side indicate the direction of the net acceleration. (2 pts)



ii) Write down the equations of motion in the appropriately chosen axes-system ("to tilt, or not to tilt, that is the question") (4pts)

$x: \quad T\sin\theta = ma_r \qquad -(i)$

$y: \quad T\cos\theta - mg = 0 \qquad -(ii)$

iii) Solve these equations of motion to find the radial (or centripetal) acceleration. (3pts)

Solve for T from eqn(ii), say, and plonk in eqn.(i).

$T = \frac{mg}{\cos\theta}$ $\xrightarrow{\text{in eqn.(i)}}$ $\frac{mg}{\cos\theta}\sin\theta = ma_r$

$\Rightarrow a_r = g\tan\theta$

$= 9.8\sin 3.8^\circ$

$= 0.65 \text{ m/s}^2$

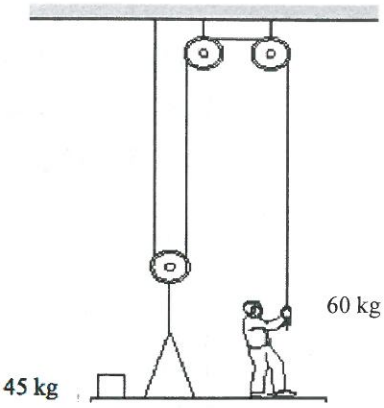
TURN SHEET OVER

Question 2:

A 60 kg person stands on a 45 kg platform. He pulls down on the rope attached to the platform via the frictionless system shown, with a force of 350N. If he pulls the platform up at a steady rate, what is the *contact force between him and the platform*?

Ignore friction, and pick the closest answer (assume $g = 10\ m/s^2$ for this question).

a) 100 N b) 250 N c) 300 N d) 350 N e) 400 N

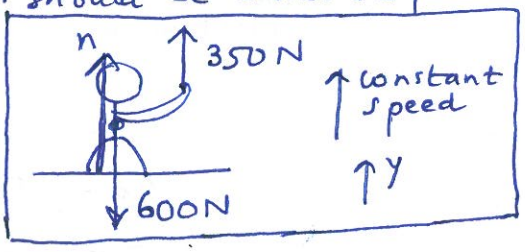


ANSWER (b) (1 pt)

i) What is the system you should choose in order to solve this problem? Draw a f. b. d. for the appropriately chosen system. (3 pts)

Since the problem asks for a contact force (a.k.a. "normal force") between the person & the platform, we should not consider the system to be "person + platform". Instead our system should be either the person or the platform. Let's go with the person.

f. b. d. for person →



ii) Write down the equation of motion using this f. b. d.. (3 pts)

$$y: \quad F_{net_y} = ma_y^{\,0}$$

$$n + 350 - 600 = 0$$

(350: force w/ which he pulls on rope (i.e., rope pulls back on him); 600: mg)

iii) Now solve for the contact force between the person and the platform. (3 pts)

$$n = 600 - 350 = 250\ N$$