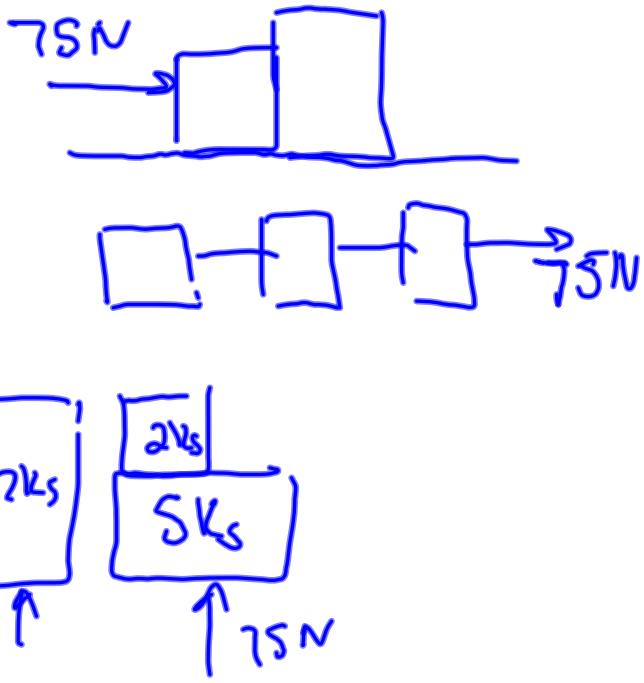
Reminders 10-24-07:
-Exam 2 Average 61%
-Next Homework Due 11/1!!!
-Circular Motion Questions due Wednesday 10/31.
-Physics 2Y is T 2:15-3:20 next semester. Is this problematic?
- Students need a 50% average in lab to pass this course. Presently there are 6 people with a lab average under 50%. If those averages remain under 50% at the end of the semester the course grade is automatically F!!!

Objectives:
-Centripetal Acceleration
-Centripetal Force
-Examples



Centripetal force

force(s) causing an object to go in a circular path.

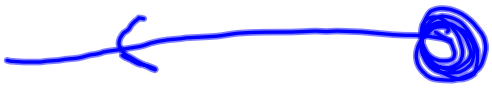
Do not include $\frac{mv^2}{r}$ in FBD.

$$\sum F = \frac{mv^2}{r}$$

Cause → Effect

- **An 0.12 kg object attached to a string is whirled in a horizontal circle whose radius is 0.75m. The velocity of the object is 3.0m/s. What is the centripetal acceleration and the centripetal force acting on the object? What is the tension in the string?**

$r = 0.75\,m \qquad v = 3.0\,\frac{m}{s}$



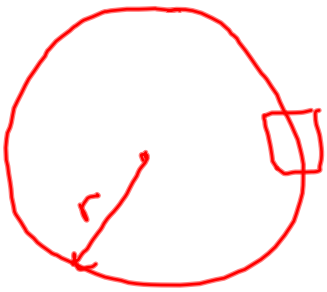
$0.12\,kg$

$$a_c = \frac{v^2}{r} = \frac{\left(3.0\,\frac{m}{s}\right)^2}{0.75\,m} = 12\,\frac{m}{s^2}$$

$$F_c = m\frac{v^2}{r} = (0.12\,kg)\left(12\,\frac{m}{s^2}\right) = 1.4\,N$$

$$T = 1.4\,N$$

- An automobile is rounding a turn of constant radius of curvature. A passenger notices that the arm rest is pushing toward the center of the turn with a constant force. The passenger has a mass of 78 kg. The force of the armrest on him is 150 N. The forward speed of the automobile is 21 m/s.
  - What is the acceleration of the car?
  - What is the radius of the turn?
  - What is the frictional force acting on the car?



$m = 78\,kg$

$v = 21\,m/s$

$F_c = 150\,N = m\frac{v^2}{r} = ma$

$= \frac{150\,N}{78\,kg} = 1.9\,\frac{m}{s^2}$

$a = \frac{v^2}{r} \quad r = \frac{v^2}{a} = \frac{\left(21\,\frac{m}{s}\right)^2}{1.9\,\frac{m}{s^2}} = 230\,m$

$f_s = m_{car}\left(1.9\,\frac{m}{s^2}\right)$

What's the max. speed the car can go in circular path without slipping?

$\frac{mv^2}{r} = \mu_s N = \mu_s m g$

$\frac{mv^2}{r} = \mu_s m g$

$v = \sqrt{\mu_s g r}$

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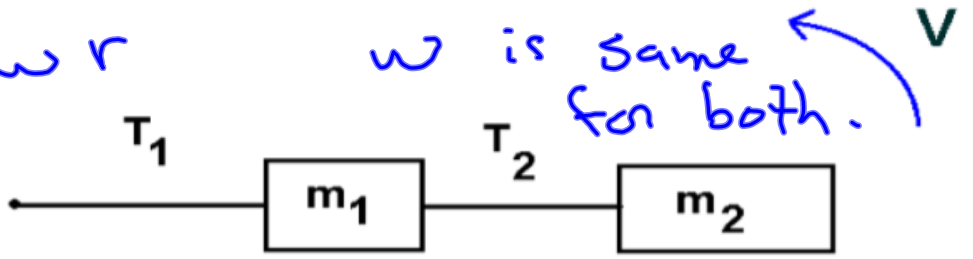
Consider the following scenerio.

The masses are moving in a circular path.

$V = \omega r$ ω is same for both.



Which string is most likely to break first?

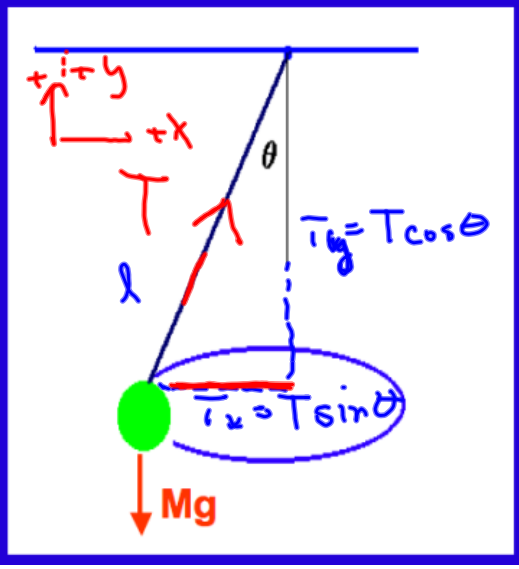
$T_2 = \frac{m_2 v_2^2}{r_2}$

$T_1 - T_2 = \frac{m_1 v_1^2}{r_1}$

$T - \frac{m_2 v_2^2}{r_2} = \frac{m_1 v_1^2}{r_1}$

$T_1 = \frac{m_1 v_1^2}{r_1} + \frac{m_2 v_2^2}{r_2}$

- A pendulum of mass 2.00kg and length 1.00m swings in a horizontal circle with a constant speed v. If θ=30° calculate v and the the tension in the string.



$$\sum F_x = T\sin\theta = ma = m\frac{v^2}{r}$$

$$\sum F_y = T\cos\theta = mg$$

$$T = \frac{mg}{\cos\theta} = \frac{(2\text{ kg})(9.80)}{\cos 30} = 22.6\text{ N}$$

$$\frac{T\sin\theta = \frac{mv^2}{r}}{T\cos\theta = mg}$$

$$\tan\theta = \frac{v^2}{rg}$$

$$v = \sqrt{rg\tan\theta}$$

$$= \sqrt{l\sin\theta\, g\tan\theta}$$

$$v = \sqrt{1\sin 30\, g\tan 30}$$

$$= 1.68\text{ m/s}$$

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