

# University Physics 1A

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## Air resistance

One model of air resistance:

$$F_{air} = K_1 v^2$$

This model has many common everyday uses. Another model uses a constant for  $K_2$  depending on the size, shape, and other properties of the object.

$$F_{air} = K_2 v$$

For a falling object:

$$F_{net} = F_{air} - mg$$

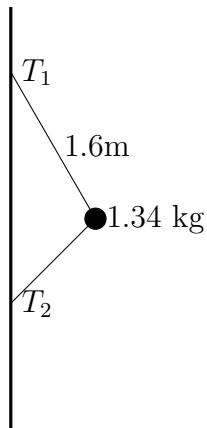
For some  $v$ ,  $F_{air} - mg = 0$ , which means the acceleration is 0. This is the point at which the object has reached “terminal velocity”.

$$K_1 v^2 - mg = 0$$

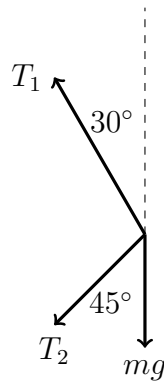
$$v^2 = \frac{mg}{K_1}$$

## Practice Problem

A ball of mass 1.34kg is attached to a vertical rod by two strings. The top string is 1.60m long and makes a  $30.0^\circ$  angle with the rod, while the bottom string makes a  $45.06^\circ$  angle with the rod. The rod is rotated at 1 revolution every 1.20s. Find the tension in each string.



Free body diagram:



$$\begin{aligned} \frac{1\text{rev}}{1.2\text{s}} &= \frac{2\pi r}{1.2\text{s}} \\ &= 4.189 \frac{\text{m}}{\text{s}} \end{aligned}$$

Horizontal net force:

$$\begin{aligned} -T_1 \sin(30) - T_2 \sin(45) &= ma_x = -m \frac{v^2}{r} \\ T_1 \sin(30) + T_2 \sin(45) &= 29.39\text{N} \end{aligned}$$

Vertical net force:

$$\begin{aligned} T_1 \cos(30) - T_2 \cos(45) - mg &= ma_y = 0 \\ T_1 \cos(30) - T_2 \cos(45) &= 13.13\text{N} \end{aligned}$$

Solving for the system of equations:

$$T_1 = 31.1N$$

$$T_2 = 19.5N$$

## Reminders and Homework

Complete the homework on TheExpertTA and WebAssign.

**Remember to bring the Activities Manual.**

You can find all my notes at <http://omgimanerd.tech/notes>. If you have any questions, comments, or concerns, please contact me at [alvin@omgimanerd.tech](mailto:alvin@omgimanerd.tech)