

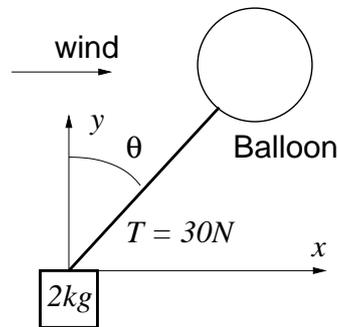
Problem 4 (15pts) A balloon and a block:

A balloon is tied to a block. The mass of the block is $2kg$. The tension of the string between the balloon and the block is $30N$. Due to the wind, the string has an angle θ relative to the vertical direction. $\cos \theta = 4/5$ and $\sin \theta = 3/5$. Assume the acceleration of gravity is $g = 10m/s^2$. Also assume the block is small so the force on the block from the wind can be ignored.

(a) Find the x -component and the y -component of the force \vec{F} exerted on the block by the string.

(b) Find the x -component and the y -component of the acceleration \vec{a} of the block.

(c) Assume the mass of the balloon is zero and the force of the wind on the balloon is in the x -direction. Find the magnitude of the force of the wind on the balloon.



Solution:

(a) The magnitude of the force (from the string) is $T = 30N$.

The x -component = $T \sin \theta = 30 \times \frac{3}{5} = 18N$.

The y -component = $T \cos \theta = 30 \times \frac{4}{5} = 24N$.

(b) The total force on the block is:

the x -component = $18N$.

the y -component = $24 - mg = 24 - 20 = 4N$.

The x -component of the acceleration = $18N/2kg = 9m/s^2$.

The y -component of the acceleration = $4N/2kg = 2m/s^2$.

(c) Since the mass of the balloon is zero, the net force on the balloon must be zero. The x -component of the force on the balloon by the string is $-18N$. The force from the wind on the balloon must balance that force and thus must be $18N$.