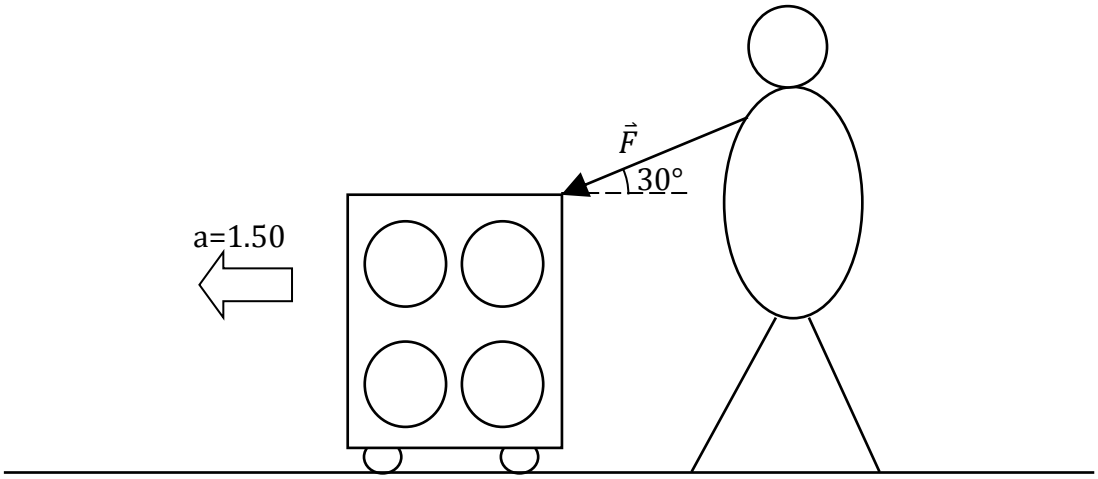
Lab 6 Pre-Lab

In my past life, I used to play in a rock band. Every time before a show we would have to load all of our gear piece-by-piece into the concert venue. Fortunately, most of the large amps and speakers had wheels and glided freely once you got them moving, but they were still a pain to accelerate from rest.

Below is a diagram of someone pushing a large, 30.0 kg speaker along a flat sidewalk. Since the top of the speaker is only 1.10 m tall, they must push downward on the speaker at an angle of 30° above the horizontal to make it move forward. Its acceleration is given in the diagram below.



Please answer the following questions in order:

a) Draw a free-body diagram for the speaker, assuming there is no friction in the wheels. Make sure you've drawn and labeled every force acting on it. If any force acts at an angle, it is recommended to break that force up into the x- and y-components, and re-draw the F-B diagram with each component drawn separately.

b) Assume the person pushes with enough force to make the speaker accelerate forward at a rate of 1.50 m/s^2. What is the net force on the speaker in the y-direction? Don't think too hard on this— remember that there are two ways to compute the net force. Choose the easier of the two. [But remember to show your work or your reasoning]

c) What is the net force on the speaker in the x-direction?
[Hint: this is only slightly less obvious than part b. You will still need to show your work.]

d) What magnitude of force must the person push with (at this angle) in order to make the speaker accelerate forward at this rate? [Hint: solve for an unknown in the x-direction, and then use trig functions to determine the magnitude of the overall force $|\vec{F}|$.]

e) What is the normal force on the speaker? Remember, there may be more than just gravity pushing down on it in the y-direction.

f) If there actually was friction acting on the speaker, and if the coefficient of kinetic friction was 0.15, what would the friction force acting on the speaker be? You may take any of your answers to the above parts as knowns here.