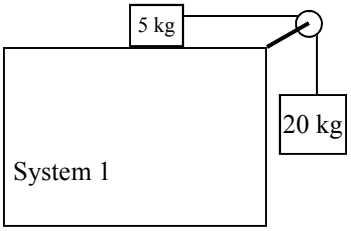
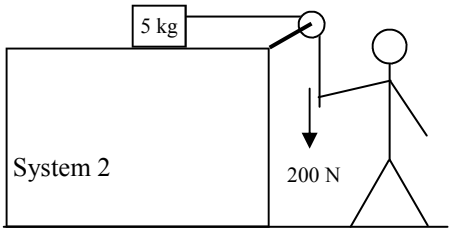
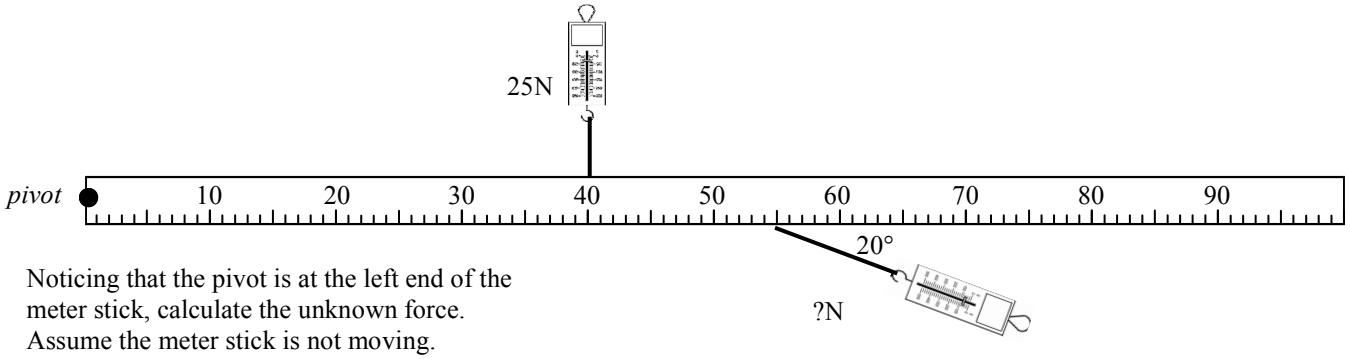
PreAP Forces 13



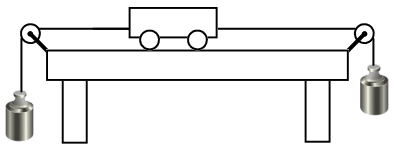
1. System 1 has a 20 kg object connected (via a rope) to a 5 kg object. Assume there is no friction on the table.
   A. How much force pulls down the 20 kg object?
   B. * If the 20 kg object had nothing attached to it, what would be its acceleration?
   C. So, what is the maximum acceleration of system 1?
   D. As the top mass gets bigger, does the acceleration of the system increase or decrease?
   E. Why?
   F. How much mass is there in the system?
   G. Calculate the * acceleration and tension in this system.



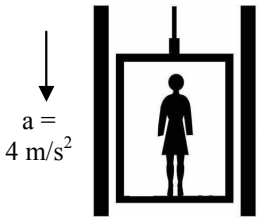
2. System 2 has the 20 kg mass replaced by a 200N force. (*Thanks, Jim!)*
   A. How much force is on the rope, now?
   B. As Slim Jim pulls harder and harder, does the acceleration of the system increase or decrease?
   C. * How much mass is there in the system?
   D. What is the maximum acceleration of system 2?
   E. Calculate the acceleration and tension in this system.
   F. Why is it different?



3. Noticing that the pivot is at the left end of the meter stick, calculate the unknown force. Assume the meter stick is not moving.



4. A cart has two equal masses pulling on it. Answer: could be, must be, can't be.
   A. Accelerating?
   B. At rest?
   C. At constant speed to the left?
   D. Slowing down to the right?
   E. At constant speed?



5. Once again our 65kg lady is in the elevator. (*If she just used the stairs she could give up her health club membership!)* Pretend she is standing on a bathroom scale (*so vain*).
   A. What does the scale read (in Newtons)?
   B. If the elevator is moving at constant speed, what does the scale read?

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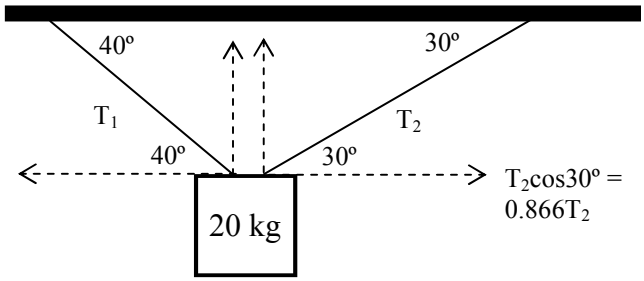
Challenge Problem: have FAITH in the process.

6. A 20 kg object is suspended from the ceiling by two ropes. Calculate the tension in each rope.



A. Since it is suspended, its acceleration must equal what?

I already helped by showing what angles are the same, drawing the x and y components of the tensions, and giving one of the components.

B. On the diagram, follow my example and write the x and y components for each rope.

C. Don't forget the force pulling down on the mass.

D. Since it is suspended, the left forces must equal the right forces and the ____ forces must equal the _____ forces.

E. Write horizontal $\sum F = ma$ below.
You will have variables (T_1 and T_2).

F. * Write vertical $\sum F = ma$ below.
You will have variables (T_1 and T_2).

G. OK—here's the trick: cos and sin of any angle is a decimal. Cos35ºT = 0.8192T, for example. You now have 2 equations and 2 unknowns. Solve for both tensions.

1B) -10 m/s^2
1G) a = 8 m/s^2
2C) infinity (depending only on how hard Jim can pull and Jim's pretty beefy [obvious, right?])

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