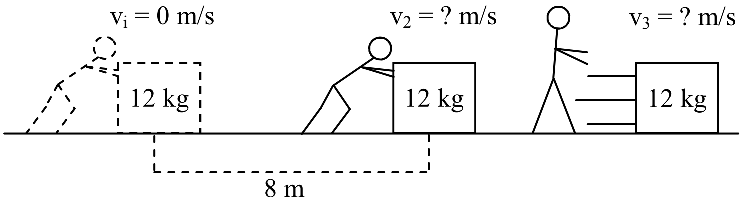
PreAP Forces 4



1. Slim Jim pushes on a 12 kg object for 10 seconds. Jim pushes for 8 m, then stops pushing the object.
   A. * Below the picture use a kinematic equation to calculate the acceleration of the mass.

   B. Now, use F = ma to calculate the magnitude of Slim Jim's force.

   C. If the surface is frictionless, how does v_3 compare to v_2?

   D. If the surface has friction, how does v_3 compare to v_2?

There are two major categories of forces: contact forces (when objects are actually touching) and field forces (forces that act at a distance and don't need to be touching).

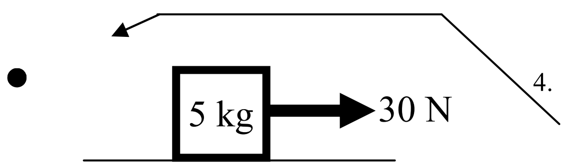
2. Contact or Field force?

   A. _____Tension
   B. _____Normal force
   C. _____Can cause accelerations
   D. _____Gravity
   E. _____* Electrostatic force (*like a balloon rubbed on hair*)

   Why this matters: Newton's Third Law: "For every force there is an equal and opposite force." But this opposite force must be of the same type: contact forces oppose contact forces; field forces oppose field forces. Also, these Third Law forces cannot be acting on the same object. Reverse the words: " Force 1 is object X on Y. The 3rd Law Force is object Y on X."

3. A box is sitting on a table.
   A. What force opposes the normal force pushing up on the box?
   B. What force opposes the force of weight pulling down on the box?

Let me talk you thru how you NEED to do EVERY force problem.



4. * A 5 kg mass is acted on by a 30 N force. There is no friction on the ground.
   Step 1: Using a dot as the object, draw all of the forces acting on the object (known as a "Force Diagram").
   Step 2: Write ΣF = ma for the both the x and y-directions:
   Step 3: Put in what numbers you know.
   (*Hints: Since the object is not jumping up or crashing thru the ground, what is the a_y?)*
   Step 4: Calculate unknowns. (*Find the normal force in the y-direction and the acceleration in the x-direction.*)

   This is how you solve ALL force problems.

$\Sigma F_x = ma_x$ $\Sigma F_y = ma_y$

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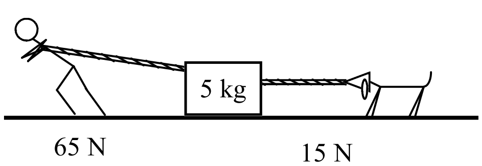
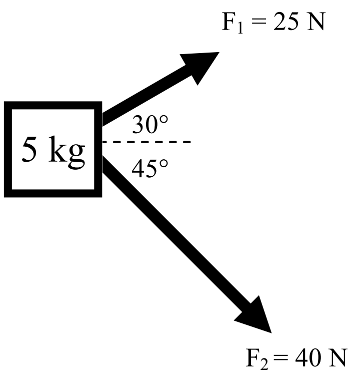


5. Slim Jim is pulling on an 5 kg box and his dog Bim tries to "help". Calculate the acceleration of the object (*pretend Jim is pulling parallel to the floor*). Show all of the above steps!

6. Now two forces pull on the 5 kg mass, but at angles. You are looking DOWN on the object.



A. Which force is bigger (greater magnitude)?

B. So, which force will the resultant be closer to? (*Which force will it accelerate toward?)*

C. Which components will add together: the x components (horizontal parts of the force) or the y-components (vertical parts)?

D. Which components will subtract from each other: x's or y's?

E. Split the two forces into their x and y-components (draw them on the diagram).

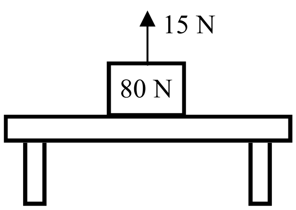
F. Add up all the x-components and y-components (find total x and total y).

G. * Use total x and total y to find the net force on the object, using what you learned about vectors last chapter (give magnitude and direction). *See "Adding Vectors" notes.*

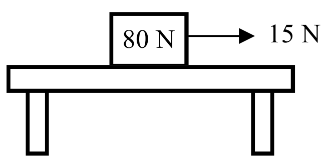
Since ΣF = ma, the acceleration will be in the direction of the net force.

H. Calculate the acceleration of the object (*magnitude and direction, of course).*

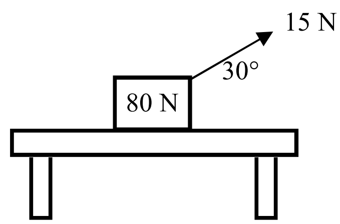
7. Using the LONG METHOD from Q4 (ΣF = ma), calculate the normal force acting on each of the objects below. Also, notice that I gave you the weight of the object, not the mass.



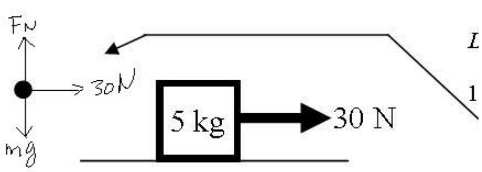
A.



B.



C. *



$\Sigma F_x = ma_x$ | $\Sigma F_y = ma_y$

$30 = 5(a_x)$ | $F_N - mg = ma_y$

$30 = 5a$ | $F_N - mg = 0$

$a = 6\ m/s^2$ | $F_N = mg$

$F_N = 50\ N$

1A) You have v_i, t, and x, so a = 0.16 m/s^2

2E) Field force. A charged balloon can cause your hair to stand up, even though it is no touching your hair.

4A) see below

6E) 52.4 N at −17.5°

7C) 72.5 N

