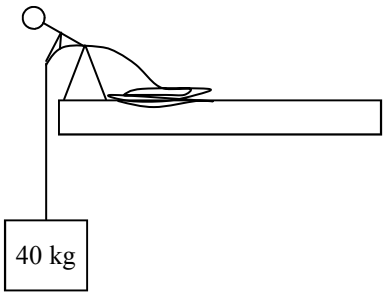
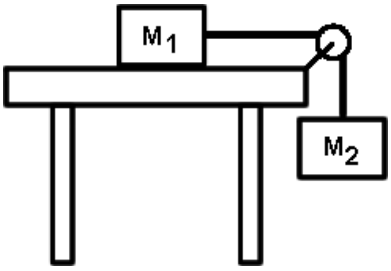
**A-Day: Due Mon., Nov 2**
**B-Day: Due Tues., Nov 3**

# 2009 Forces 5



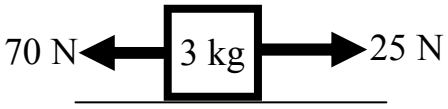

1. Slim Jim is lifting a box. He lifts it with an acceleration of 2 m/s$^2$.
   A. Draw all of the forces acting on the object.
   B. Which force (or forces) is positive?
   C. Which force (or forces) is negative?
   D. Put the forces into the left side of the F = ma equation below.
   E. Put the mass and acceleration into the right side and solve for the tension in the rope.

$$\Sigma F = ma$$

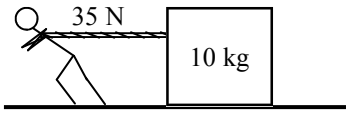



2. If there is friction on the table, draw and label all of the forces acting on the two masses at the left.

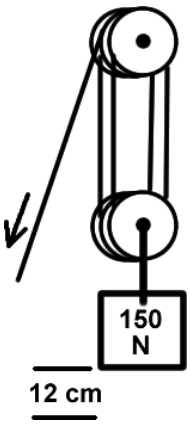
3. Suzie the slouch is sitting on the school bus. When the bus accelerates forward,
   A. Which way does Suzie move relative to the bus?
   B. Which way does Suzie move relative to the ground?
   C. Which of Newton's Laws does this show?




4. A. What is the net force acting on the object at left?
   B. What is the acceleration of the object?
   C. Can the object be at rest?
   D. Can the object be moving at constant speed?




5. Slim Jim pulls with 35 N on a 10 kg box across the floor at constant speed. There is friction between the box and the floor.
   A. Since it is at constant speed, what is its acceleration?
   B. Draw all of the forces on the box.
   C. In the x-direction only, use ΣF = ma to find the force of friction on the box.
   D. Since it is moving, did you find static or kinetic friction?
   E. How much normal force is acting on the object?
   F. Write the equation for friction:
   G. Calculate the coefficient of friction.




*Use the "Lever, Pulleys, and Incline Plane" notes*:

6. A. How many support ropes does the pulley have?
   B. Since each rope must shorted by the same amount, how much rope is pulled out of the pulley to raise the object 12 cm?
   C. How much force is necessary to lift the object?

7. In the gravity equation, what does "r" stand for, exactly?

8. Let's learn how mass and distance affect the gravitational force. In the following table calculate the gravitational force for each of the situations. Leave "G" in your answer. This is for comparison, so you don't need to fully calculate your answer.

| Situation | $m_1$ = | $m_2$ = | r = | $F_g$ = (keep G in the equation) |
|---|---|---|---|---|
| 1. control | 1 | 1 | 1 | $F_g = G\frac{m_1 m_2}{r^2} = G\frac{1(1)}{1^2} = G\frac{1}{1} = 1G$ |
| 2. double the mass | 2 | 1 | 1 | |
| 3. half the mass | 1 | 0.5 | 1 | |
| 4. double the distance | 1 | 1 | 2 | |
| 5. half the distance | 1 | 1 | .5 | |

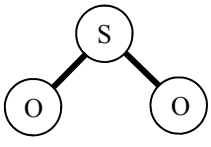
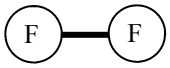
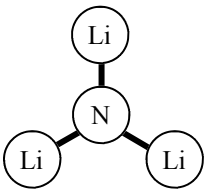
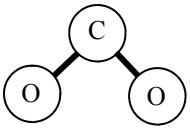
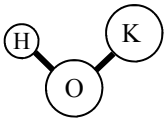
9. Use the information you just collected to answer the following.
   A. If the distance between two masses doubles, by how much does the force change?
   B. If the mass doubles, by how much does the force change?
   C. If the distance between two masses is halved, by how much does the force change?
   *Now, continue the logic*:
   D. If one of the masses is tripled, by how much does the force change?
   E. If the distance is tripled, by how much does the force change?
   F. If the distance is 1/3 the original, by how much does the force change?

10. Calculate the force of gravity between a 12,000 kg space ship that is 250 m away from a $5.4\times10^9$ kg asteroid.

11. A. Mark the fulcrum of lever A above.
    B. Which of the two levers at the increases your force the most (makes it very easy to lift the object)?

A  B 

12. Fill in the following:

| | | | | |
|---|---|---|---|---|
|  |  |  |  |  |
| *Atoms:* ___<br>*Elements:* ___<br>*Molecules:* ___<br>*Compounds:* ___ | *Atoms:* ____<br>*Elements:* ____<br>*Molecules:* ____<br>*Compounds:* ___ | *Atoms:* ____<br>*Elements:* ____<br>*Molecules:* ____<br>*Compounds:* ___ | *Atoms:* ____<br>*Elements:* ____<br>*Molecules:* ____<br>*Compounds:* ____ | *Atoms:* ____<br>*Elements:* ____<br>*Molecules:* ____<br>*Compounds:* ____ |