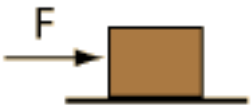
Applications of Newton's Second Law

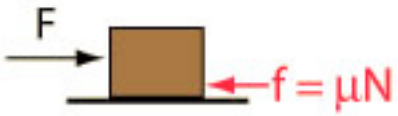
http://hyperphysics.phy-astr.gsu.edu/hbase/N2st.html

For each problem, draw a freebody diagram. Show your calculations (including formulas) on a separate sheet of paper. Check your answers by going to the URL above, clicking "remove or add friction", and then the appropriate picture. In the new window, enter the information given in the problem.

1) A horizontal force of 15N is applied to an air hockey puck with mass 0.020 kg. What is its acceleration?

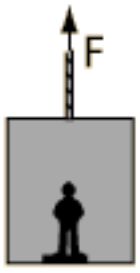


2) The same force is applied to the puck in #1, but the air is off on the air hockey table. There is now a coefficient of friction, μ, of 0.20 between the puck and the table.
   a) What is the frictional force (f) on the puck?
   b) What is the net force (F_{net}) on the puck?
   c) What is the acceleration of the puck?

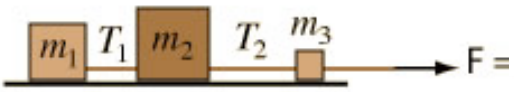


3) A force of 1255N is applied to the 150.0kg hovercraft on the left which pushes 200.0kg hovercraft in front of it. (μ=0)
   a) What is the acceleration of the hovercrafts?
   b) What force does the 150 kg hovercraft exert on the 200 kg hovercraft?

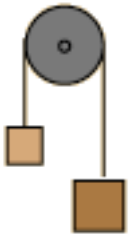
4) A 60.0 kg person is standing on a bathroom scale in an elevator. What does the scale read when the elevator
   a) is at rest?
   b) moves at a constant velocity between floors?
   c) begins to rise from the bottom floor with an acceleration of $+2.0 m/s^2$?
   d) slows down before reaching the top floor with an acceleration of $-2.0 m/s^2$?
   e) begins to descend from the top floor with an acceleration of $-1.5 m/s^2$?
   f) slows down before reaching the bottom floor with an acceleration of $+1.5 m/s^2$?
   g) the cable breaks and you are free falling?



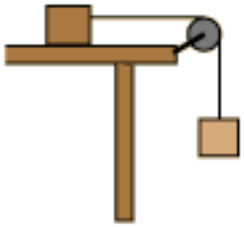
5) You are lifting a bowling ball on a rope. The bowling ball has a mass of 2.3 kg.
   a) What is the tension in the rope if you are lifting up with a constant velocity of 2.5 m/s?
   b) What is the tension in the rope if you are lifting up with an acceleration of $3.0 m/s^2$?



6) In the diagram above, m_1 = 5.0 kg, m_2 = 7.0 kg and m_3 = 2.0 kg. If the three masses are being pulled along a frictionless surface by a force F=25 N, find
   a) the acceleration of the system
   b) the tension in string 1 (T_1)
   c) the tension in string 2 (T_2)



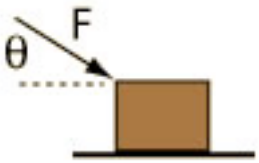
7) In an Atwood machine, the smaller mass is 2.0 kg and the larger mass is 8.0 kg. Find
   a) the acceleration of the system
   b) the tension in string



8) In a modified Atwood machine with μ=0, the mass on the table is 2.0 kg and the hanging mass is 8.0 kg. Find
   a) the acceleration of the system
   b) the tension in string

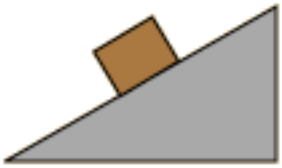
9) Repeat #8 if μ=0.55.

10) A force of 95N is applied to an 25kg baby carriage at an angle of 63° with the horizontal. The carriage has great wheels and friction can be ignored.
   a) What is the net force on the baby carriage?
   b) What is the acceleration of the baby carriage?



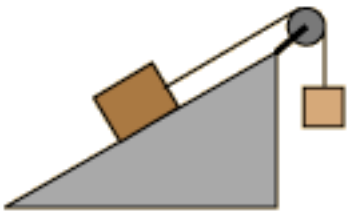
11) Repeat #3 for when the wheels lock on the baby carriage. The coefficient of friction is 0.50.
   a) What is the frictional force (f) on the baby carriage?
   b) What is the net force (F_{net}) on the baby carriage?
   c) What is the acceleration of the baby carriage?

12) A 0.55 kg cart is on a frictionless air track inclined at 30.0°.
   a) Find the acceleration of the cart.
   b) How long would it take the cart to get to the bottom if the height of the incline were 2.0m?
   c) How long would it take the same cart to freefall 2.0 m?
   d) What would the cart's speed be at the bottom of the incline?



13) Find the acceleration of the cart in #7 if friction is added (μ=0.35).

14) A frictionless 40.0° incline has a mass of 2.0 kg placed upon it. It is attached by a rope over a pulley to a mass of 5.0 kg which hangs vertically.
    a) What is the acceleration of the system?
    b) What is the tension in the connecting rope?



15) Repeat #9 if the surface has a coefficient of friction of 0.40.