Phy 2053 Announcements

1. Clicker quizzes will start counting for your course grade TODAY
   - You will get your first real scores that count by email on Thursday.
   - If you have not gotten an email with your clicker scores, your clicker is not properly registered.
2. Webassign homework #2 due on Wednesday by midnight
3. Prof Chan will change his Wednesday office hours from 11 am – 12 pm to 3-4 pm.
4. Access to homework solutions (and exam solutions)
   - Username: chan (all lower case)
   - Password: Send e-mail to Reitze

HITT RF Remote Login Procedure:

The radio channel number for this room is "07" (zero, seven).

It is STRONGLY recommended to login your remote for every class just to be sure it is on the correct radio channel and working before class.

1. PRESS AND HOLD THE DOWN ARROW KEY until the GREEN light on the remote turns RED.
2. PRESS THE "0" KEY and you will see the RED light flash GREEN.
3. PRESS THE "7" KEY and you will see the RED light flash GREEN.
4. PRESS AND RELEASE THE DOWN ARROW KEY again and you will see the red light search for the receiver, if it BLINKS GREEN MULTIPLE TIMES you are logged in.

From the last time – Newton's 1st and 2nd Laws

- Newton's First Law - An object moves with a velocity that is constant in magnitude and direction, unless acted on by a nonzero net force
  - Concepts of inertia and mass introduced
- Newton's Second Law - The acceleration of an object is directly proportional to the net force acting on it and inversely proportional to its mass.

$$\vec{\mathbf{a}} \propto \frac{\sum \vec{\mathbf{F}}}{m} \text{ or } \sum \vec{\mathbf{F}} = m\vec{\mathbf{a}}$$

  - Contact forces and field forces
  - If an object is not accelerating, the sum of the forces acting on it must be ZERO.

Gravitational Force

- Mutual force of attraction between any two objects
- Expressed by Newton's Law of Universal Gravitation:

$$F_g = G\frac{m_1 m_2}{r^2}$$

  - Weight - magnitude of the gravitational force acting on an object of mass *m* near the Earth's surface
    - $w = mg$, where g is the acceleration due to gravity

Newton's Third Law

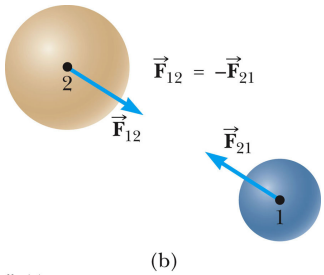
- If object 1 and object 2 interact, the force exerted by object 1 on object 2 is equal in magnitude but opposite in direction to the force exerted by object 2 on object 1.

$$\vec{\mathbf{F}}_{12} = -\vec{\mathbf{F}}_{21}$$

  - Equivalent to saying a single isolated force cannot exist

Newton's Third Law cont.

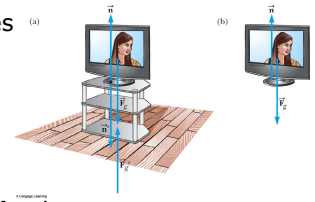
- F_{12} may be called the *action* force and F_{21} the *reaction* force
  - Actually, either force can be the action or the reaction force
- The action and reaction forces act on **different** objects



(b)

Forces Acting on an Object

- Newton's Law uses the forces acting *on* the object
- $\vec{\mathbf{n}}$ *and* $\vec{\mathbf{F}}_g$ are acting on the television

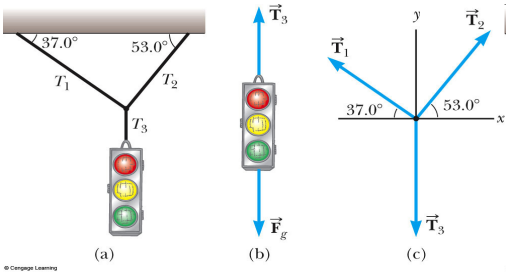


$\vec{\mathbf{n}}$ is called the 'normal force'

Free Body Diagram

- Must identify all the forces acting on the object of interest
- Choose an appropriate coordinate system

Free Body Diagram



Equilibrium

- An object either at rest or moving with a constant velocity is said to be in *equilibrium*
- The net force acting on the object is zero (since the acceleration is zero)

$$\sum \vec{\mathbf{F}} = 0$$

Equilibrium cont.

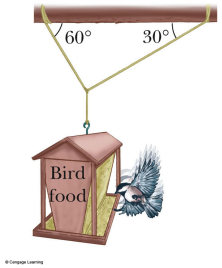
- Easier to work with the equation in terms of its components:

$$\sum F_x = 0 \text{ and } \sum F_y = 0$$

- This could be extended to three dimensions

Example #4.19

A 150 N bird feeder is supported by three cables as shown below. Find the tension in each cable



Multiple Objects – Example

- When you have more than one object, the problem-solving strategy is applied to each object
- Draw free body diagrams for each object
- Apply Newton's Laws to each object
- Solve the equations

Example #4.21

Two blocks each of mass 3.5 kg are fastened to the top of an elevator. (a) If the elevator accelerates upward at 1.6 m/s^2, find the tensions T_1 and T_2 in the upper and lower strings. (b) If the strings can withstand a maximum tension of 85 N, what maximum acceleration can the elevator have before the first string breaks?