Peer Led Team Learning
- PLTL
- ES105
- CRN 21823
- Looking like evening class: some have requested it to start at 6:30 or 7, so they can have dinner and then go to it?
- Day of the week still to be determined
- Please put your name on the sign-up list if you are interested

Study of Motion
Aristotle—4th century BC
- Student of Plato
- Tutor of Alexander
- Used logic to describe natural world: collected, classified
- Motion ceased when objects in their proper place
- Thought speed of falling objects depended on their weight
- Ignored friction, air resistance
- Influential for 2000 years

Galileo
- Studied Copernicus’ work of 1543
- Use experiment to test logical ideas
- Discovered speed not dependent on weight, only on amount of time for falling

Galileo’s Study of Motion
- Defined ‘inertia’: keep moving in same direction and speed without outside influences—resistance to change of motion
- Speed not dependent on weight, only on amount of time for falling
- Noted that gravity increased speed of falling objects, decrease speed of rising objects

Galileo’s investigation of motion
- Used inclined planes to slow the descent of objects, because he didn’t have a precise timer

Galileo’s inclined planes
- Balls roll down faster and faster
- Roll up slower and slower
- Weight not a factor

Mass
- Measure of inertia
- How much matter is there
- Corresponds to weight—the influence of the acceleration of gravity on the mass
- They are proportional

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**Mass**
- Measured in kilograms
- Influence of gravity gives weight
  - Pounds lb.
  - Newtons N
- On Earth: 1 kg = 9.8 N
- Not a measure of volume

**Inertia vs. weight**
- Weight is the force, due to gravity—pulling iron ball down
- Inertia is resistance to change of movement—ball is not moving
- Pull slowly, you increase force and break string that is holding the ball up
- Rapid jerk will break string below ball, because it has large mass that is not moving—has inertia

**Force**
- Weight is a force due to gravity
- Force is VECTOR QUANTITY
- Vectors have magnitude and direction
- Multiple vectors add up

**Applied forces**

<table>
<thead>
<tr>
<th>Applied forces</th>
<th>Net force</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 N</td>
<td></td>
</tr>
<tr>
<td>5 N</td>
<td>10 N</td>
</tr>
<tr>
<td>10 N</td>
<td>5 N</td>
</tr>
</tbody>
</table>

**Objects not moving**
- Force of weight is equal to force of string holding it up
- The sum of the forces is zero
- There is mechanical equilibrium

**Support Force**
- Weight acts downward
- Atoms push back upward
- Forces equal—in equilibrium

**Dynamic Equilibrium**
- Can be moving
- At a constant speed in a straight line
- Net forces are zero

**Friction**
- Force that acts to resist motion
- Always in opposite direction to applied force
- When you are pushing something, and it moves at a constant speed, the frictional force is the same as the pushing force
A pair of parallel forces of 8 N and 12 N can have a resultant of

1. 4 N.
2. 20 N.
3. Both of the above.
4. Neither of the above.

• Explanation:
  When parallel, \( 12 \text{ N} + 8 \text{ N} = 20 \text{ N} \),
  or \( 12 \text{ N} - 8 \text{ N} = 4 \text{ N} \).

Study of Motion

• Speed—how fast
• Velocity—how fast and what direction
• Acceleration—how fast it is changing how fast

Common units of speed

• Miles per hour mph
  – Means ‘miles per hour’
  – Don’t use this abbreviation of the words
  – Use mi./h
• Kilometers per hour km/h
• Meters per second m/s

Speed of cheetah

\[
\frac{100m}{4s} = \frac{25m}{s}
\]

Speed

\[ speed = \frac{\text{distance}}{\text{time}} \]

\[
\frac{320\text{km}}{4\text{h}} = \frac{80\text{km}}{\text{h}}
\]

Distance equation

Rate \times time = distance

• Keep units with numbers, so you know you have set up the problems correctly