Chapter 1

Objectives
a) Identify what is mechanics/statics
b) Work with two types of units
c) Round the final answer appropriately
d) Apply problem solving strategies
What is Mechanics?

- Study of what happens to a body when FORCES are applied to it
- Body and/or forces could be large or small

Branches of Mechanics

- Engineering Mechanics
  - Rigid Bodies (Things that do not change shape)
  - Deformable Bodies (Things that do change shape)
  - Fluids
    - Incompressible
    - Compressible

Statics
Dynamics
Systems of Units

• Four fundamental physical quantities
  - Length, mass, time, force
• One equation relates them: \( F = ma \)
• We use this equation to develop systems of units
• Units are arbitrary names we give to the physical quantities
• We will work interchangeably with two unit systems: SI (Metric) and US Customary (English)

Unit Systems

<table>
<thead>
<tr>
<th>Name</th>
<th>Length</th>
<th>Time</th>
<th>Mass</th>
<th>Force</th>
</tr>
</thead>
<tbody>
<tr>
<td>International System of</td>
<td>meter</td>
<td>second</td>
<td>kilogram</td>
<td>newton*</td>
</tr>
<tr>
<td>Units (SI)</td>
<td>(m)</td>
<td>(s)</td>
<td>(kg)</td>
<td>(N)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>( \frac{kg \cdot m}{s^2} )</td>
</tr>
<tr>
<td>U.S. Customary System</td>
<td>foot</td>
<td>second</td>
<td>slug*</td>
<td>pound</td>
</tr>
<tr>
<td>(FPS)</td>
<td>(ft)</td>
<td>(s)</td>
<td>( \frac{lb \cdot s^2}{ft} )</td>
<td>(lb)</td>
</tr>
</tbody>
</table>

*Derived unit.
Numerical Calculations

• Must have dimensional “homogeneity.” Dimensions have to be the same on both sides of the equal sign
  – distance = speed \times time
• Use an appropriate number of significant figures
  – 3 for answer, at least 4 for intermediate calculations
• Be consistent when rounding off
  – Equal to or greater than 5, round up (3528 \rightarrow 3530)
  – Smaller than 5, round down (0.03521 \rightarrow 0.0352)

Problem Solving Strategy - 3-Step Approach

Interpret:  
Read carefully and determine what is given and what is to be found. Ask, if not clear. If necessary, make assumptions and indicate them.

Plan:  
Think about steps needed to solve a given problem. Think of alternative solutions. Choose the best one.

Execute:  
Carry out your steps. Use appropriate diagrams and equations. Estimate your answers. Avoid simple calculation mistakes. Reflect on/revise your work.
Summary

• Identify what is mechanics/statics
• Work with two types of units
• Round the final answer appropriately
• Apply problem solving strategies