
M R
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فيزياء
استاتيكا
دوائر كهربية
الكترونيات
ميكانيكا الانشائات
هيدروليكا
مدرس خصوصي
اونلاين
حضوري
يحصل الطالب علي
. مقاطع فيديوهات لشرح المقرر بشكل وافي
. ملخص للمادة Pdf للمذكرة والمراجعة
. محاضرات مباشرة علي برنامج زووم
لمناقشة الأجزاء الغير مفهومة
. تواصل مستمر مع معلم المادة
للتواصل
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Statics
الاستاتيكا

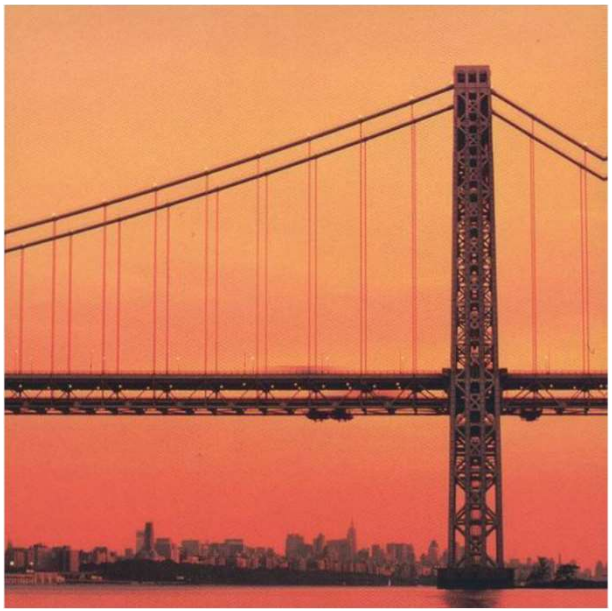
لطلاب كلية الهندسة

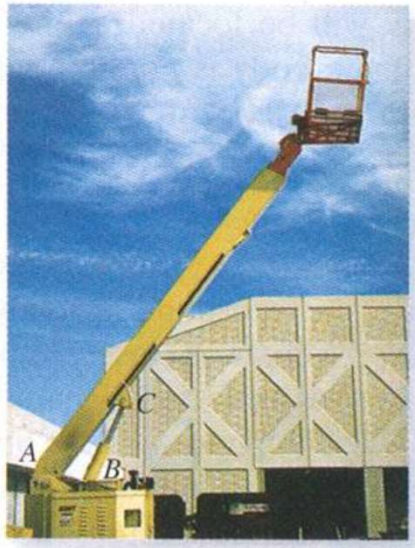
General principles

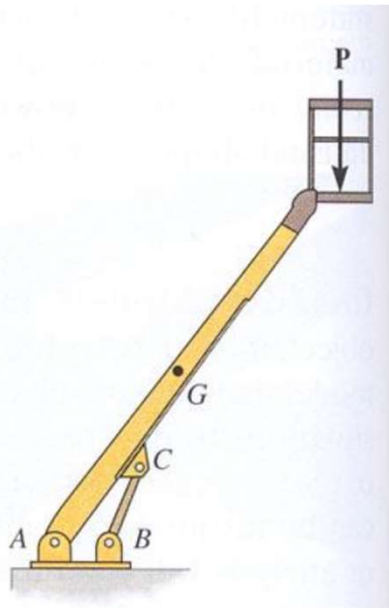
- Mechanics
- Fundamental Concepts
- Units of Measurement
- The International System of Units
- Numerical Calculations
- General Procedure for Analysis

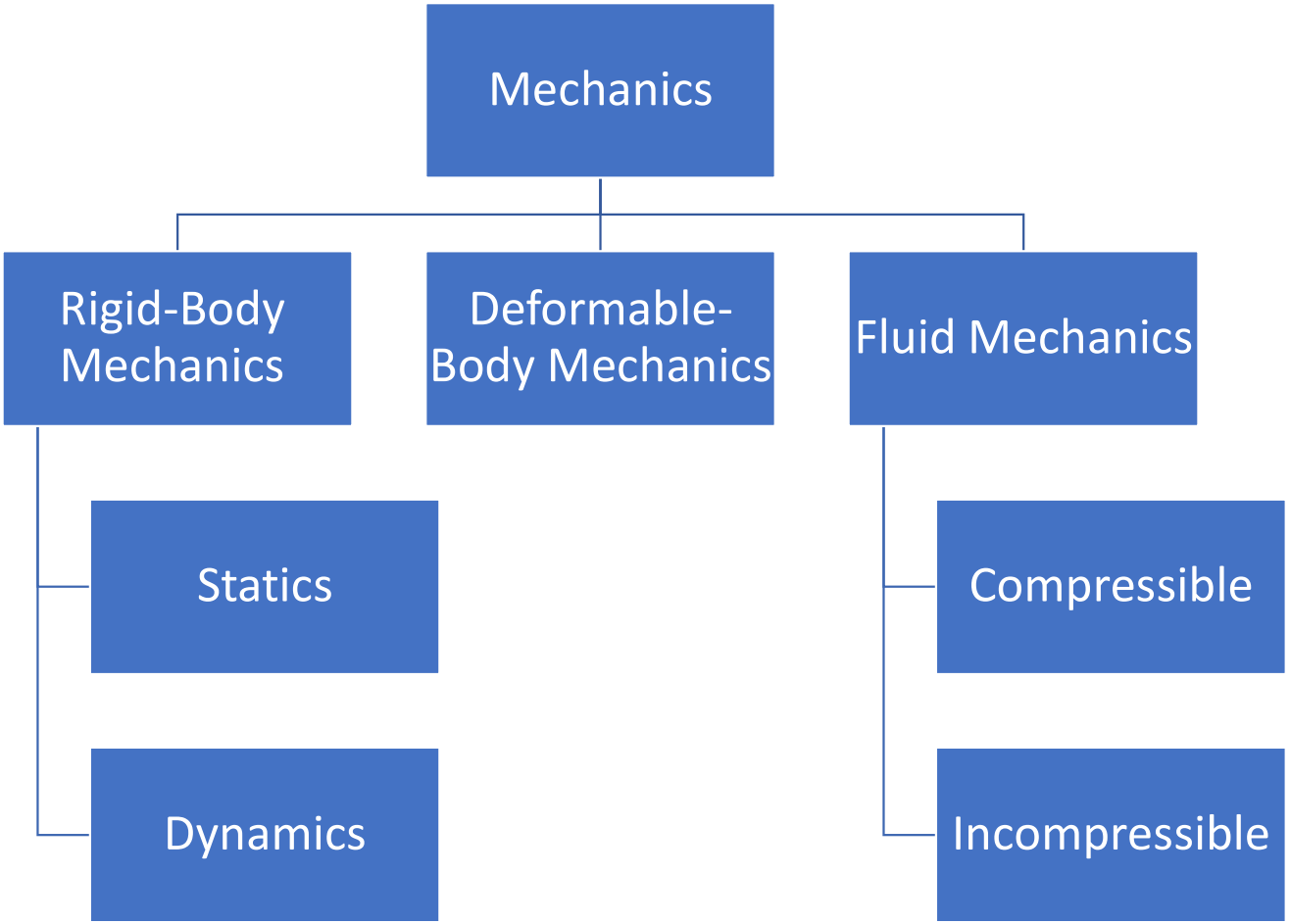
WHAT IS MECHANICS?

- Study of what happens to a "thing" (the technical name is "BODY") when FORCES are applied to it.
- Either the body or the forces could be large or small



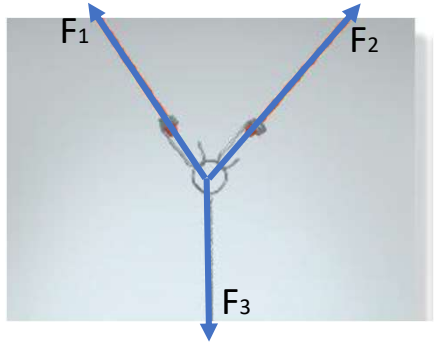




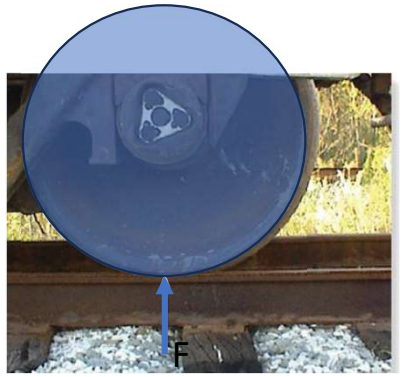

Mechanics
Rigid-Body Mechanics
Deformable-Body Mechanics
Fluid Mechanics
Statics
Dynamics
Compressible
Incompressible

Fundamental Concepts

- **Idealizations**. Models or idealizations are used in mechanics in order to simplify application of the theory. Here we will consider three important idealizations.



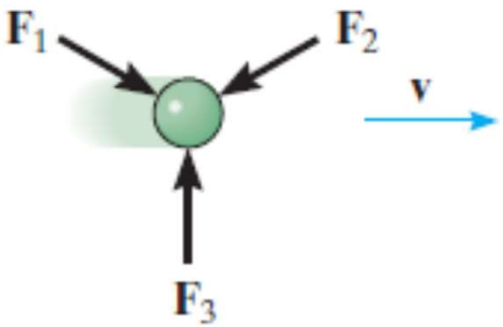
- Particle has a mass but a size that can be neglected
- Rigid Body does not deform under load
- Concentrated Force are assumed to act at a point on a body.



Fundamental Concepts

Newton's Three Laws of Motion

- **First Law**. A particle originally at rest, or moving in a straight line with constant velocity, tends to remain in this equilibrium state provided the particle is not subjected to an unbalanced force.



Equilibrium

Fundamental Concepts

Newton's Three Laws of Motion

- **Second Law.** A particle acted upon by an unbalanced force F experiences an acceleration a that has the same direction as the force and a magnitude that is directly proportional to the force.
- If the particle has a mass m, this law may be expressed mathematically as:

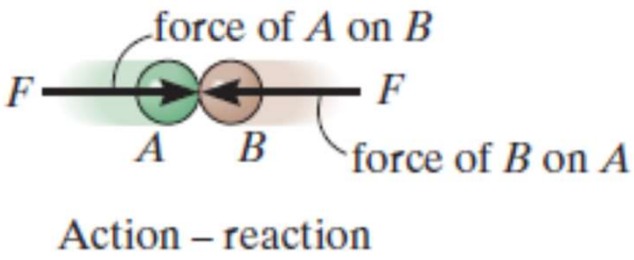
$$F=ma$$

Accelerated motion

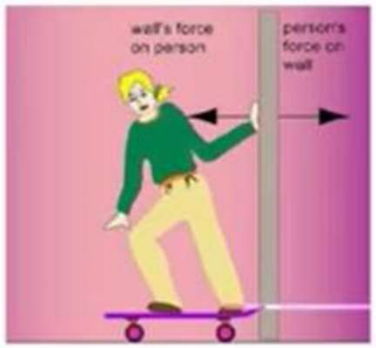
Fundamental Concepts

Newton's Three Laws of Motion

- **Third Law.** The mutual forces of action and reaction between two particles are equal, opposite, and collinear

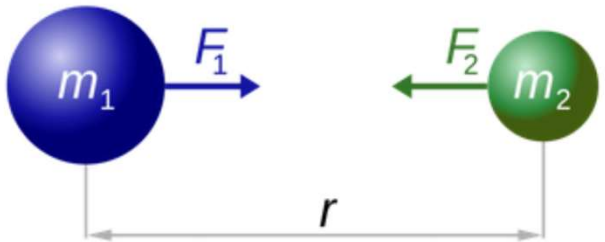


Action – reaction



Fundamental Concepts

- **Newton's Law of Gravitational Attraction**



$$F_1 = F_2 = G\frac{m_1 \times m_2}{r^2}$$

where

F = force of gravitation between the two particles

G = universal constant of gravitation; according to experimental evidence, $G = 66.73(10^{-12})\ \mathrm{m^3/(kg \cdot s^2)}$

m_1, m_2 = mass of each of the two particles

r = distance between the two particles

Fundamental Concepts

- Weight

In the case of a particle located at or near the surface of the earth, however, the only gravitational force having any sizable magnitude is that between the earth and the particle. Consequently, this force, called the weight, will be the only gravitational force considered in our study of mechanics.

$$W = mg$$

UNITS OF MEASUREMENT

- Four fundamental physical quantities.
- Length
- Mass
- Time
- Force

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Units of Measurement

TABLE 1–1 Systems of Units

Name	Length	Time	Mass	Force
International System of Units	meter	second	kilogram	newton*
SI	m	s	kg	$\left(\frac{\text{kg} \cdot \text{m}}{\text{s}^2}\right)$ N
U.S. Customary FPS	foot	second	slug*	pound
	ft	s	$\left(\frac{\text{lb} \cdot \text{s}^2}{\text{ft}}\right)$	lb

*Derived unit.

Common Conversion Factors

- 1 Ib = 4.4482 N
- 1 slug = 14.5938 kg
- 1 ft = 0.3048 m
- 1 in = 0.0254 m

Example: Convert a torque value of 47 lb in into SI units.
Answer is 5.310 N • m?

47 (4.4482 N) (0.0254 m)

47 lb.in = 5.31 N.m

EXAMPLE 1.1

Convert 2 km/h to m/s How many ft/s is this?

1 km = 1000 m, 1 h = 60 × 60 = 3600 s

$2\ \frac{km}{h} = 2 \times \frac{1000\ m}{3600\ s} = 0.556\ m/s$

$0.556\ \frac{m}{s} = 0.556 \times \frac{\frac{1}{0.3048}\ ft}{s}$

$= 1.823\ ft/s$

1 lb = 4.4482 N
1 slug = 14.5938 kg
1 ft = 0.3048 m
1 in = 0.0254 m

$1\ m = \frac{1}{0.3048}\ ft$