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King Saud University
College of Science
Physics & Astronomy Dept.

Phys 145 (General Physics)

Chapter 3: Newton's Law of Motion

Week n° 04

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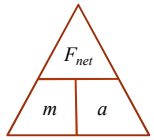
Chapter 3: Newton's Laws of Motion (Second part)

- **We will learn in this second part of this chapter 3:**
- Newton's second law
- Static friction
- Kinetic friction

Newton's Second Law

- The acceleration of an object $\vec{a}$ is directly proportional to the net force $\overrightarrow{F_{net}}$ acting on it.
- The proportionality constant is the mass *m:*

$$\overrightarrow{F_{net}} = m\vec{a}$$



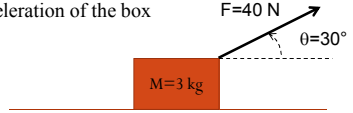
Object accelerating

The two vectors net force and acceleration have the same direction.

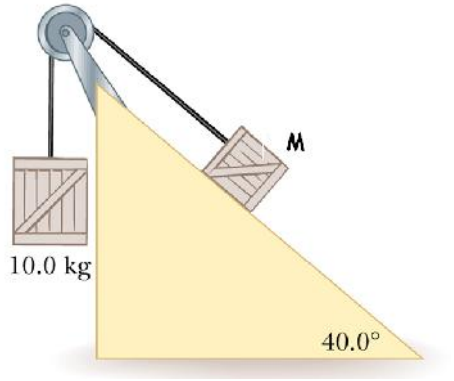
In the S.I, the net force is in N, the mass in kg and the acceleration in m/s².

Example 4.1

Calculate the acceleration of the box

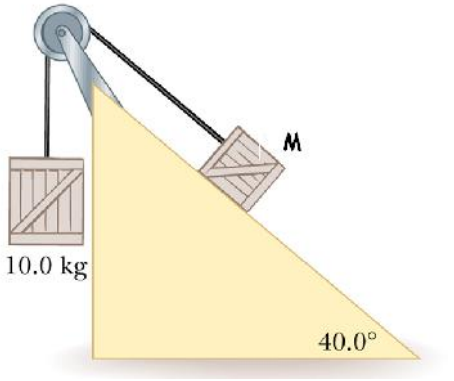


Example 4.2



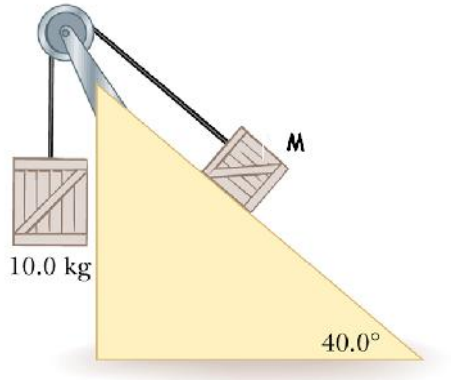
Calculate the mass M such that the box slides at constant velocity.

Example 4.3



Calculate the acceleration if M = 5kg

Example 4.4



Calculate the acceleration if M = 20 kg

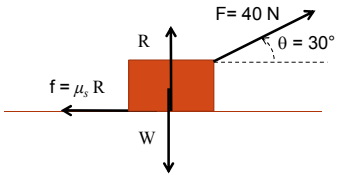
Video 01 of week 04:
Forces and Newton's laws

Static friction

Friction (إحتكاك) is a force that always acts to resist to motion of one object sliding on another.

In the static case, the object is in equilibrium.

Example 4.5

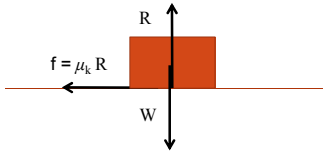


The coefficient of static friction μ_s is a number between 0 and 1.

Kinetic friction

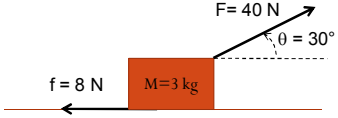
Friction (إحتكاك) is a force that always acts to resist to motion of one object sliding on another.

In the kinetic case, the object is accelerating.



The coefficient of kinetic friction μ_k is a number between 0 and 1.

Example 4.6



Calculate the acceleration of the box.

Coefficient of kinetic friction = μ_k = 0.2

Video 02 of week 04: Newton' laws

Summary of week 04

- The Newton's second law is explained.
- Applications of this law are presented.
- Static friction with examples is presented.
- Kinetic friction with examples is presented.

Quiz for week 04