Virtual Learning

Physics

Newton's First Law of Motion: Inertia

April 13, 2020

Physics

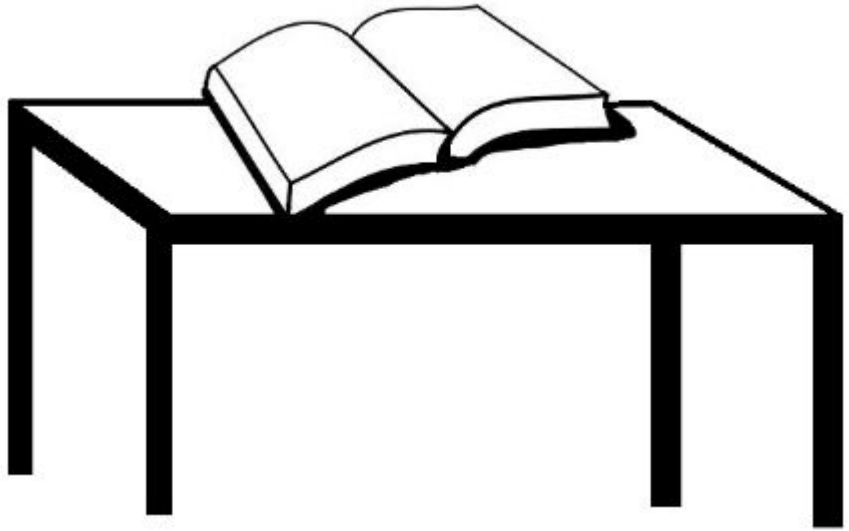
Newton's First Law of Motion: Inertia: April 13,2020

Objective/Learning Target:

Students will explore and explain Newton's First Law of motion, explaining several examples along the way.

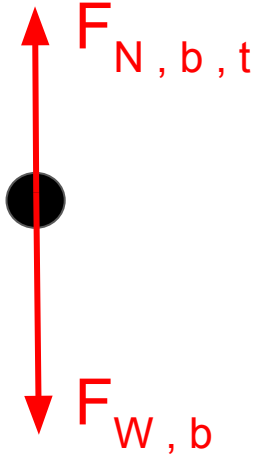
Quick Review

1. Draw a free body force diagram for a book at rest on a table.



Quick Review Answer

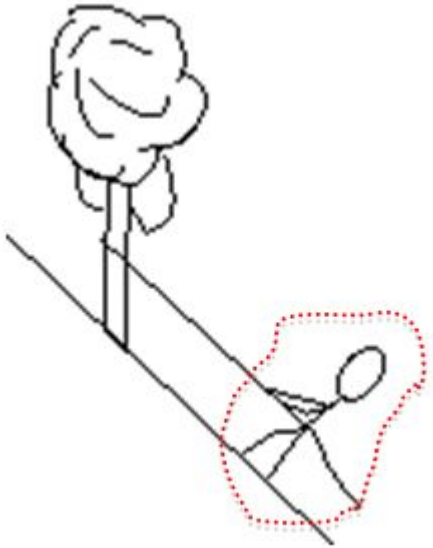
1) Normal Force on the book by the table.



Weight of book by gravity of earth

Quick Review

2) Draw a force diagram for the climber who has stopped to rest. Label the force vectors and use equality marks on the vectors.



Quick Review Answer

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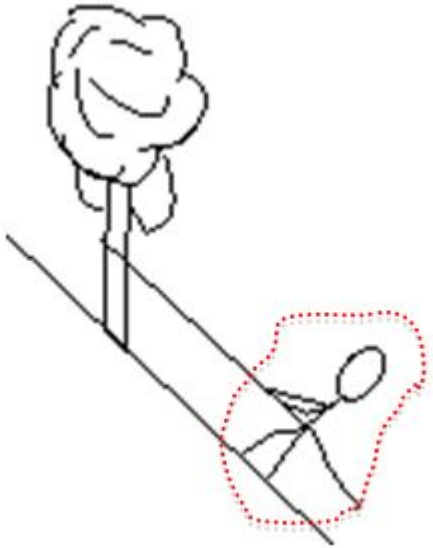
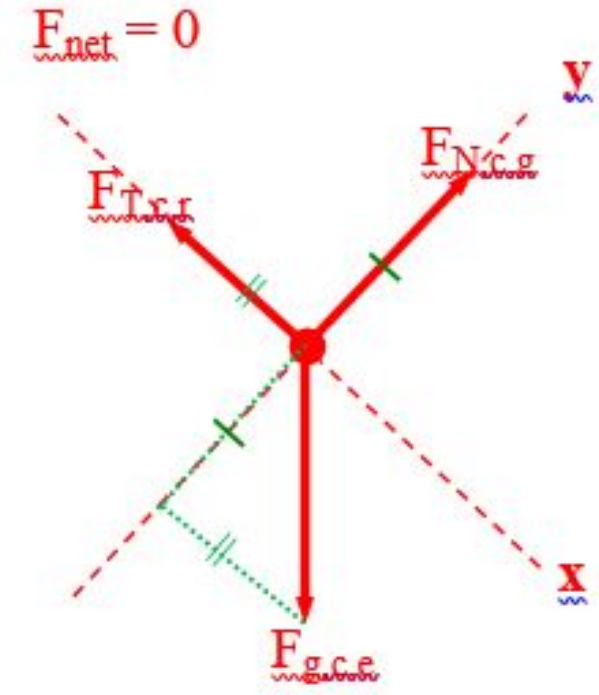




Newton’s First Law of Motion: Inertia

Link:Newton's First Law of Motion: Inertia

Directions:

- Read through Newton’s First law of motion and Inertia
- Work through any examples on a separate piece of paper before you scroll down to the solution.
- On a separate piece of paper complete the practice problems on the following slides.
- Check your answers.
- For additional practice check out the conceptual questions and the problems and exercises in the table of contents for the online text linked above.

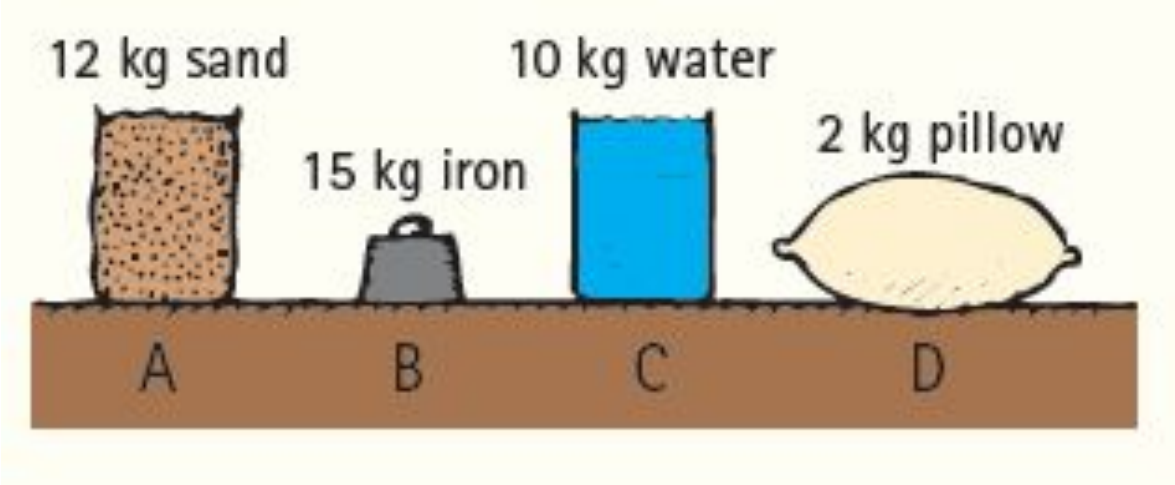
Practice Problem #1

Different materials, A, B, C, and D, rest on a table.

(a) Rank how much they resist being set into motion, from greatest to least.

(b) Rank the support (normal) forces the table exerts on them, from greatest to least.

(c) Rank the objects Inertia from greatest to least.



Practice Problem #1 Answer

Different materials, A, B, C, and D, rest on a table.

(a) Rank how much they resist being set into motion, from greatest to least.
B,A,C,D

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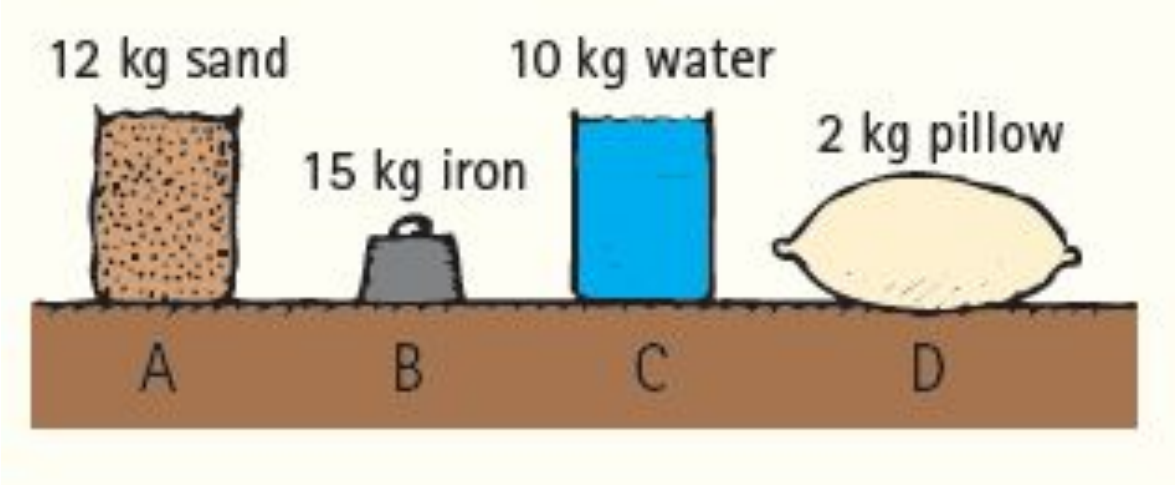
(c) Rank the objects Inertia from greatest to least. B,A,C,D



Practice Problem #2

a) Explain how the tablecloth pull demonstration works?
b) Why is it important that you pull slightly downward when you attempt to whip the cloth from beneath the dishes?
c) What occurs if you pull slightly upward?

Practice Problem #2 Answer

This is a demonstration of Inertia. An object at rest stays at rest. The demo works best if the following are adhered to.

- Make sure the dishes have a smooth bottom, heavier works better.
- The tablecloth is short enough to be pulled completely out from under the dishes, does not have a sewn lip that might catch the dishes as it slides out from underneath, and is made from a slick material.
- Pull slightly down as not to add a vertical component to your force. This would cause the dishes to lift vertically and topple over
- Try it with a sheet of paper and a heavy object!!!!

Practice Problem #3

Cars are equipped with two different safety devices that protect you from the affects of Inertia during a collision.

a) Whiplash is a common car crash injury. Using Newton's First Law of Motion (Inertia), explain how whiplash occurs, and how well adjusted headrests help prevent it.
b) Seatbelts are the second safety device. Using Newton's Law of Inertia, explain how seatbelts keep you safe in a collision.

Practice Problem #3 answer

Cars are equipped with two different safety devices that protect you from the affects of Inertia during a collision.

a) Whiplash is a common car crash injury. Using Newton's First Law of Motion (Inertia), explain how whiplash occurs, and how well adjusted headrests help prevent it.

b) Seatbelts are the second safety device. Using Newton's Law of Inertia, explain how seatbelts keep you safe in a collision.

Watch the following video clip (Car Safety and Inertia) for the explanation:

Practice Problem #4

A massive ball is suspended on a string and slowly pulled by another identical string attached to it from below, as shown.

a) Which string is more likely to break?
b) If the lower string is instead snapped downward, which string is more likely to break.
c) Explain your answers above in terms of Inertia.

Practice Problem #4 Answer

A massive ball is suspended on a string and slowly pulled by another identical string attached to it from below, as shown.

a) Which string is more likely to break?
b) If the lower string is instead snapped downward, which string is more likely to break.
c) Explain your answers above in terms of Inertia.

The following video clip (Inertia Ball) explains and demonstrates this situation.

Additional Practice

For additional practice check out the conceptual questions and the problems and exercises in the table of contents from the online text linked above.