

AAA Learn PressBooks with Newton's Laws

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PLAY AROUND WITH PRESSBOOKS

JENNIFER KIRKEY AND OPENSTAX

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Introduce Yourself

Welcome to Pressbooks.

Pressbooks is a publishing PLATFORM, and the one preferred by BCcampus.

- What is your name?
- What is your role here at the college?
- What do you want to get out of this workshop?

Why Pressbooks?

Please log onto your computer and visit my catalog at Pressbooks

<https://pressbooks.bccampus.ca/catalog/kirkeyj>

Pressbooks is a publishing platform.

Why should YOU use Pressbooks?

- It looks great on the web.
- It looks great in print.
- It exports easily to a variety of formats including PDF, EPUB, Mobi, Kindle .¹
- Open textbooks, or the more general OER or Open Educational Resources are books that are copyright free, normally available at low or no costs to students. Free and legal to share and modify.
- BCcampus² preferred³ format <https://pressbooks.bccampus.ca/>
- Based on WordPress⁴, so already familiar to many people.

1. "PDFs are where textbooks go to die." says Clint Lalonde, UBC and BCcampus Tech guru.

2. <https://bccampus.ca/>

3. BCcampus is funded by the Ministry of Advanced Skills and Training. <https://bccampus.ca/about-us/>

4. <https://wordpress.org/>. 35% of the Web uses WordPress

Introduction to the book is the type of thing you put into Front Matter

In the Front Matter of my book is where I put my introductions, the course outline, etc.

Pressbooks - First Part - What your book might contain

Pressbooks automatically formats the “book” into

- . Front Matter (Introductions, I put my course outline here)**
- . Parts**
- . Chapters**
- . Back Matter (appendices)**

1. Newton's First Law of Motion: Inertia (chapter from an Open Stax textbook)

This is part of a chapter from Open Stax College Physics. It is free, and it was legal for me to import this and adapt it for my course. My questions, etc .

Learning Objectives

At the end of this section the student will be able to

- define mass and inertia
- define Newton's First Law of Motion

Experience suggests that an object at rest will remain at rest if left alone, and that an object in motion tends to slow down and stop unless some effort is made to keep it moving. What **Newton's first law of motion** states, however, is the following:

NEWTON'S FIRST LAW OF MOTION

A body at rest remains at rest, or, if in motion, remains in motion at a constant velocity unless acted on by a net external force.

Note the repeated use of the verb "remains." We can think of this law as preserving the status quo of motion.

Rather than contradicting our experience, **Newton's first law of motion** states that there must be a *cause* (which is a net external force) *for there to be any change in velocity (either a change in magnitude or direction)*. We will define *net external force* in the next section. An object sliding across a table or floor slows down due to the net force of friction acting on the object. If friction disappeared, would the object still slow down?

The idea of cause and effect is crucial in accurately describing what happens in various situations. For example, consider what happens to an object sliding along a rough horizontal surface. The object quickly grinds to a halt. If

we spray the surface with talcum powder to make the surface smoother, the object slides farther. If we make the surface even smoother by rubbing lubricating oil on it, the object slides farther yet. Extrapolating to a frictionless surface, we can imagine the object sliding in a straight line indefinitely. Friction is thus the *cause* of the slowing (consistent with Newton's first law). The object would not slow down at all if friction were completely eliminated. Consider an air hockey table. When the air is turned off, the puck slides only a short distance before friction slows it to a stop. However, when the air is turned on, it creates a nearly frictionless surface, and the puck glides long distances without slowing down. Additionally, if we know enough about the friction, we can accurately predict how quickly the object will slow down. Friction is an external force.

Key Takeaways

Newton's first law is completely general and can be applied to anything from an object sliding on a table to a satellite in orbit to blood pumped from the heart.

Experiments have thoroughly verified that any change in velocity (speed or direction) must be caused by an external force. The idea of *generally applicable or universal laws* is important not only here—it is a basic feature of all laws of physics. Identifying these laws is like recognizing patterns in nature from which further patterns can be discovered. The genius of Galileo, who first developed the idea for the first law, and Newton, who clarified it, was to ask the fundamental question... “

What is the cause?” Thinking in terms of cause and effect is a worldview fundamentally different from the typical ancient Greek approach when questions such as “Why does a tiger have stripes?” would have been answered in Aristotelian fashion, “That is the nature of the beast.” True perhaps, but not a useful insight.

Mass

The property of a body to remain at rest or to remain in motion with constant velocity is called **inertia**. Newton's first law is often called the **law of inertia**. As we know from experience, some objects have more inertia than others. It is obviously more difficult to change the motion of a large boulder than that of a basketball, for example. The inertia of an object is measured by its **mass**. Roughly speaking, mass is a measure of the amount of “stuff” (or matter) in something. The quantity or amount of matter in an object is determined by the numbers of atoms and molecules of various types it contains. Unlike weight, mass does not vary with location. The mass of an object is the same on Earth, in orbit, or on the surface of the Moon. In practice, it is very difficult to count and identify all of the atoms and molecules in an object, so masses are not often determined in this manner. Operationally, the masses of objects are determined by comparison with the standard kilogram.

Check Your Understanding

1: Which has more mass: a kilogram of cotton balls or a kilogram of gold?

Issac Newton said in a letter to Robert Hooke “If I have seen further it is by standing on the shoulders of Giants”.¹

Section Summary

- **Newton's first law of motion** states that a body at rest remains at rest, or, if in motion, remains in motion at a constant velocity unless acted on by a net external force. This is also known as the **law of inertia**.
- **Inertia** is the tendency of an object to remain at rest or remain in motion. Inertia is related to an object's mass.
- **Mass** is the quantity of matter in a substance.

Conceptual Questions

1: How are inertia and mass related?

2: What is the relationship between weight and mass? Which is an intrinsic, unchanging property of a body?

Exercises

Type your own exercises here. Here are the ones from Open Stax College Physics

1. A cleaner pushes a 4.00-kg laundry cart in such a way that the net external force on it is 8.00 N. Calculate the magnitude of its acceleration.

2.

Since astronauts in orbit are apparently weightless, a clever method of measuring their masses is needed to monitor their mass gains or losses to adjust diets. One way to do this is to exert a known force on an astronaut and measure the acceleration produced. Suppose a net external force of 50.0 N is exerted and the astronaut's acceleration is measured to be 0.893 m/s^2 . (a) Calculate her mass. (b) By exerting a force on the astronaut, the vehicle in which they orbit experiences an equal and opposite force. Discuss how this would affect the measurement of the astronaut's acceleration. Propose a method in which recoil of the vehicle is avoided.

3.

In [Figure 4.7 shown here](#): the net external force on the 24-kg mower is stated to be 51 N. If the force of friction opposing the motion is 24 N, what force F (in newtons) is the person exerting on the mower? Suppose the mower is moving at 1.5 m/s when the force F is removed. How far will the mower go before stopping?



Person pushing a lawn mower. Image credit: OpenStax College Physics, CC0.

Solutions

Check Your Understanding

1: They are equal. A kilogram of one substance is equal in mass to a kilogram of another substance. The quantities that might differ between them are volume and density.

Conceptual Questions

1: How are inertia and mass related? They are the same. Mass is a measure of inertia. The more mass the more inertia.

2: What is the relationship between weight and mass? Which is an intrinsic, unchanging property of a body? Mass is an intrinsic unchanging property. Weight is a force and it depends on gravitational force. You weigh 1/6 on the Moon but you have the same inertia.

Problems and Exercises

1. $a = 2.00 \text{ m/s}^2$

2. 56.0 kg

3. a) 75 N b) (Jennifer's notes. I often dislike the wording used by OpenStax. I would add more parts to this question. Namely, what is the net force acting on the mower when the person stops pushing, then what is the acceleration, then what is the distance travelled until it stops.) That would be 24 N to the left, so the acceleration is a deceleration of 1.00 m/s^2 to the left or -1.00 m/s^2 . displacement = 1.1 m .

2. Equations are in LaTeX

Simple equations can be used with the word processing features.

$$ax^2 + bx + c = 0 \quad \text{or} \quad x = a/b.$$

You can add special characters such as the Greek alphabet

$$\sin \theta = 1.00 \quad \theta = 45.0 \text{ degrees} \quad 5.67 \, \Omega$$

LaTeX

For more complex equations you want to use LaTeX.

Free, open source software that writes equations that look good on the web and in print.

$$x = \frac{a}{b}$$

You can bold them.

$$\boldsymbol{x} = \frac{\boldsymbol{a}}{\boldsymbol{b}}$$

$$\boldsymbol{x} = \sqrt{\boldsymbol{y}}$$

$$\boldsymbol{Force}_{\text{gravity}} = G \frac{\boldsymbol{m_1 m_2}}{r^2}$$

$$\int_a^b x^2 dx$$

$$\int_a^b x^2 dx$$

$$\int_a^b x^2 dx$$

$$F = m \frac{d^2 x}{dt^2}$$

$$\vec{A}_x = \frac{\partial f(x)}{\partial x}$$

$$\tan \theta = \frac{\sin \theta}{\cos \theta}$$

This is what it looks like in the Admin mode. I just did a screen capture and then cut and pasted it into the book.

[latex] $x = \frac{a}{b}$ [/latex]

You can bold them.

[latex] $\boldsymbol{x = \frac{a}{b}}$ [/latex]

[latex] $\boldsymbol{x = \sqrt{y}}$ [/latex]

[latex] $\boldsymbol{Force_{\textbf{gravity}}} = G \frac{m_1 m_2}{r^2}$ [/latex]

[latex] $\int_a^b x^2 dx$ [/latex]

[latex] $\displaystyle \int_a^b x^2 dx$ [/latex]

[latex] $\displaystyle \int \limits_a^b x^2 dx$ [/latex]

[latex] $F = m \frac{d^2 x}{dt^2}$ [/latex]

[latex] $\vec{A}_{\text{x}} = \frac{\partial f(x)}{\partial x}$ [/latex]

Equation in LaTeX. A screen shot from Pressbooks.

3. Enhanced Media - one of the best features of PressBooks

You can add

- standard hyperlinks
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- PhET simulations, or other HTML5 simulations
- H5P which gives “check your knowledge” quizzes inside the book as the person is reading it.
- Your own videos. You do not have to go through YouTube

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A PhET simulation to help you with these concepts. If you are reading this book online it will open automatically below. Direct link here:

<https://phet.colorado.edu/en/simulation/forces-and-motion-basics>

An interactive or media element has been excluded from this version of the text. You can view it online here:

<https://pressbooks.bccampus.ca/learnpressbooksnewton/?p=192>

A good video. Cats on a slippery floor demonstrating inertia. Direct link: <https://youtu.be/Ev-DcW7q4Pc> If you are reading this book online it will open automatically below this sentence. Remember you have to be careful with the copyright of YouTube content, but that is true no matter what you are doing at the College. This video is from the original artist. I normally use government videos from NASA, etc, that are copyright free.



A YouTube element has been excluded from this version of the text. You can view it online here:

<https://pressbooks.bccampus.ca/learnpressbooksnewton/?p=192>

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Here is a video I made using my iPhone. You could download it here.

[Slinky down calculus and physics books](#)

You can add H5P interactive elements right in the book, if they are reading it online.

An interactive or media element has been excluded from this version of the text. You can view it online here:

<https://pressbooks.bccampus.ca/learnpressbooksnewton/?p=192>

4. **Choose a theme**

There are many standard themes. This books uses “Clarke” as in “Arthur C. Clarke”. It looks great with subtitles.

5. **Pressbooks Workshop March 2020**

PART II

This is the Second Part - Cover pages , Importing and Exporting

Here is where I am going to put all the extra stuff.

6. **Choose your own cover and input other images.**



koala

The image on the cover of this presentation is from Douglas College. It is an aerial view of the Coquitlam Campus. I added the text by using the photo editor in my MacBook. It does not export into the print copy but you can see it on the web.



You can add your own photos. “Add Media” button in the upper left corner of the editing page.



Books for sale. This is a photo by Jennifer Kirkey taken in 2016 outside the Douglas College bookstore at the start of the semester. Every single paper is someone trying to sell their textbook.

7. Export as PDF for print, Mobi, Kindle, etc.

You can export your book in a variety of formats. Open textbooks do not have to be e-books.

8. Importing a book

You can import a book from somewhere else, in a variety of formats.

BCcampus has a list of open textbooks, many of which are in Pressbooks.

<https://open.bccampus.ca/browse-our-collection/>

OpenStax from Rice University in Texas is making all of their catalogue available in Google Docs.

<https://openstax.org/subjects>

PART III

This is the Third Part - it is hidden in the web view

You can hide chapters. You and other editors can work on them but no one else sees them.

9. **Hidden text**

You can hide chapters and parts so you and the editorial team can work on them but no one else can see them.

If you export as a PDF you will see what is here, but people accessing online cannot view it.