On Tue, Sep 21, 2010 at 7:04 PM, Blenda "Bobs" Singletary <[bobs.singletary@gmail.com](mailto:bobs.singletary@gmail.com)> wrote:

Would someone please give me a simple explanation of how a linear set of collision balls on a track demonstrate Newton's Third Law of motion? I get the concept of Conservation of Momentum but need help in "locating" the opposing force that would demonstrate the Third Law.

Thanks,

Bobs

Could you provide a more complete description of the setup? Is this an air track, or are you talking about Newton's cradle, which is the five balls hanging down next to each other. It is quite possible that Newton's third law has nothing to do with the operation of this.

Bill

Unless I am mistaken, the opposing force is what decelerates the initial striker. If we were playing pool, a perfect collision would stop the cue ball dead in its tracks and send the other ball on its way. The forces would all be acting in the same plane but in opposite directions.

Perry

It really doesn't matter if the collision is perfect or not. Force is the name we give to how objects interact with each other. So first there is no single disembodied force, they always come in pairs, A acting on B and B acting on A. The magnitudes of those two forces are the same under all circumstances...thats the third law.

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Hi Joseph,

Which is why I said the third law might be sort of irrelevant here.

It's always operating, but that doesn't mean it's crucial to the event. I need to know exactly what the event is first, of course.

Bill

Greetings  
  
You stated "but need help in "locating" the opposing force that would demonstrate the Third Law"  
  
Let us say that the force is the force of object A on object B. I would write: FA on B.  The reaction force is FB on A. , just the reversal of the action force. Thus is you know the action object force and what it is acting on, just reverse the two and you have the answer.  
  
When I teach force interactions, I demand that my studentds use subscripts to identify the cauise object and the oject to which it is acting on, Demand this. It really helps.  
  
Dick

On Sep 23, 2010, at 7:50 AM, Scott Orshan wrote:

The notes I hand out for Newton's 3rd (There's some subscript formatting, so I hope it comes through clearly. If not, I'll post a PDF):

A force is a push or a pull, caused *only* by Gravity, the Electromagnetic Force, or one of the two Nuclear forces, strong and weak.

It is impossible to have a single force. Forces *always* exist in pairs, between two objects.

There are some simple rules about these force pairs.

The two forces are equal in magnitude.

The two forces are pointed in opposite directions, either toward each other or away from each other.

The two forces are between the *same* objects.

They start and end at the same time – they have the same duration.

Although we don’t always do it, it is a good practice to write what is acting on what. For example, in a free body diagram, instead of labeling the pull of a rope on a cart FApplied, it should really be labeled FRope on Cart, to remind us that there is an opposite force,

FCart on Rope

You may have heard of these force pairs described as “actions” and “reactions,” and Newton’s 3rd stated “Every action has an equal and opposite reaction.” I do not like these descriptions. They are not precise physics descriptions. Those words have strong meanings outside of physics. The following examples are NOT legitimate force pairs:

“I pushed Jimmy, so his brother pushed me” – Yes, two forces, but they violate all of the above rules.

“I pushed Jimmy, so after school, he pushed me back, and it was the same force in the opposite direction, SO THERE!” – Sorry, they didn’t happen at the same time.

“Gravity pulls down on the book, and the table pushes back up on the book” – Surprisingly, this is not a force interaction pair. Gravity acts between the Earth and the book, and the support force acts between the table and the book. Each of those has its own equal and opposite force. The book pulls back on the Earth, and the book pushes down on the table.

To describe the gravitational force between the Earth and the Book, you would have to show FEarth on Book, and FBook on Earth. For the Book/Table pair, you would use FTable on Book and FBook on Table.

These equal force pairs lead directly to the principle of Conservation of Momentum.

On Wed, Sep 22, 2010 at 11:30 AM, RICHARD HECKATHORN <[geepaw@wowway.com](mailto:geepaw@wowway.com)> wrote:

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Dick

----- Original Message -----  
From: Carlos Schroeder <[sciencecarlos@gmail.com](mailto:sciencecarlos@gmail.com)>  
To: Blenda Bobs Singletary <[bobs.singletary@gmail.com](mailto:bobs.singletary@gmail.com)>  
Cc: [physicalscience@list.nsta.org](mailto:physicalscience@list.nsta.org)  
Sent: Tue, 21 Sep 2010 23:34:52 -0400 (EDT)  
Subject: Re: Demonstrating Newton's Third Law

I love this video (see linke below). I don't tell students where it was shot, but do tell them there's a surprise as to where it was done. After the first seconds, they're awed by the setting.

<http://www.youtube.com/watch?v=4IYDb6K5UF8>

Carlos Schroeder

Scott,

A good description. If I might offer a couple of suggestions .......   First, the statement that the forces are between the same objects might be confusing. I know what you mean, but it could be interpreted as the forces being somehow "within" one object (because of the word same). Second, I would suggest using the word "system" in place of object. Yes, most often we deal with objects as separate systems, but not always. Sometimes the system we choose is part of an object or a collection of objects. For example, if you want the tension 3/4 of the way along a rope, you must separate the rope into different systems so the force you're interested in is external to one of your systems. I focus on this because the process of choosing a system when using Newton's laws was a main component of research I did in cognitive science. It turns out that a large portion of students are unaware that it is possible to choose a system when applying the laws, primarily because in all problems they do the choice is either obvious or has been made for them. The understanding that one can choose different systems turns out to be a major predictor of how well students do on unfamiliar (transfer) problems. Those who don't understand system choice fail completely when a problem requires nonstandard system choices, such as the rope tension mentioned above or, say, finding the tension in a train coupling five cars away from the engine.

Aside from formal research, I have found that knowing about system choices makes many other concepts clearer, such as the business of external forces and knowing when conservation of momentum is conserved. By the way, your recommendation of using labels for forces (a on b or c on d, etc.) goes a long way toward helping students keep things straight. I highly recommend that others follow the practice. The words "on" or "from" should be part of the subscript in every single force they label in a free body diagram.

And we should ban "action-reaction" from science vocabulary! It leads to lots of confusion.

Bill

William C. Robertson, Ph.D.