



*Phis's World*

## Episode 3: Newton's 2nd Law – Be Gentle If You Care



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Script: Xia Hong

01/2015

Once upon a time ...



I'm back!

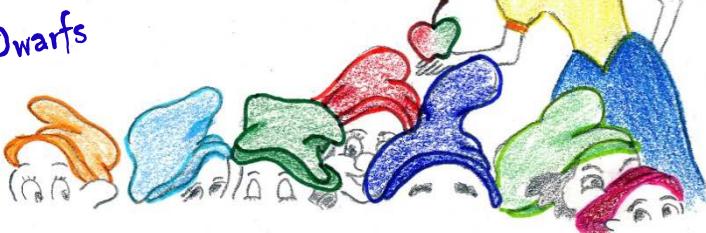
Hi, Phis.  
How was school?



Pretty Good.  
How was your  
day? What are  
you reading?



Snow White and  
Seven Dwarfs



Xia  
7-27-14



This is my birthday  
gift from Aunt  
May. I like books in  
print that I can  
hold in my hands!



Err...

Let me get  
some food.  
I'm hungry.

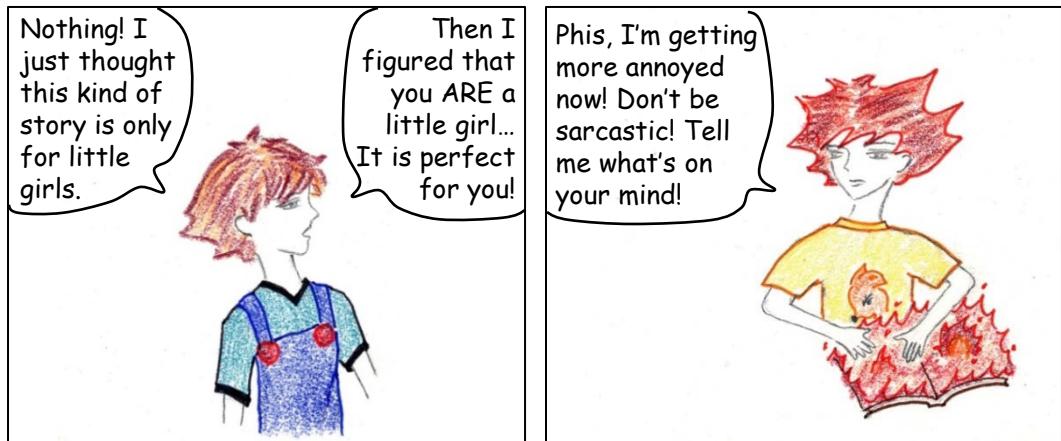
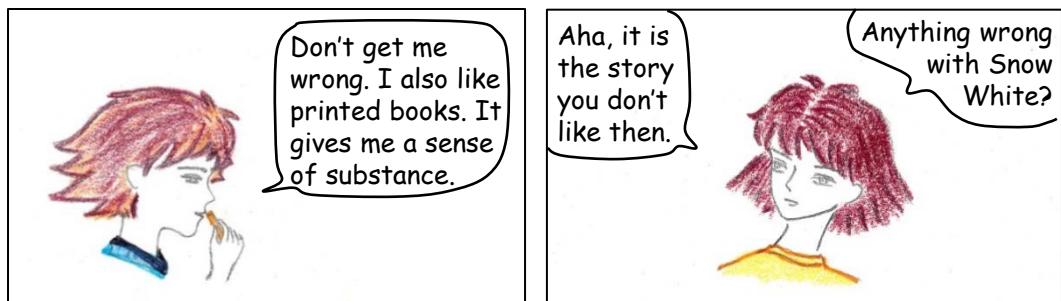


Wait... what's  
wrong?



Do you think  
it's odd that  
I don't read  
on my smart  
phone?





You know, since I started learning physics, I have started to notice a lot of things that previously had skipped my mind.

For example, let's reconsider what happened to Snow White within:

### Newton's 2nd Law

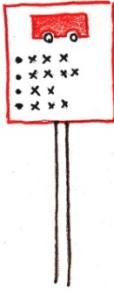
$$F = ma = \frac{\Delta p}{\Delta t}$$

$\Delta$  : change  
 $p$  : momentum  
 $t$  : time

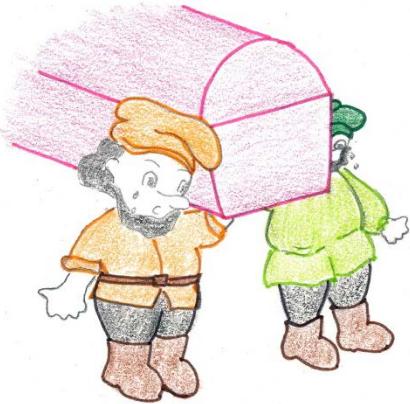
This means when there's no force applied, or  $F = 0$ , there should be no change in momentum, or  $\Delta p = 0$ .

On the other hand, to have some drastic changes in momentum, you need to apply BRUTAL force to the object, i.e. Snow White.

When we are at rest or moving in a constant motion, there is no change in  $p$ , so no force applied.



When Snow White was carried by the seven dwarfs, they were so gentle and moved in a constant speed so that there was no force exerted on Snow White.



When there is a car crash, there is huge force generated.



And then...

Snow White met the prince...  
How romantic... Err?

**Oops !**



He must have run over Snow White.

He was not gentle nor polite.

He did NOT care!

Let's come back to Snow White:

To stop her from choking on the apple, there is a huge change in momentum  $p$  in a short period of time  $t$ .

$\Delta p$  : large

$\Delta t$  : small

## Newton's 2nd Law

$$F = ma = \frac{\Delta p}{\Delta t}$$

→  $F$  : Huge !

Like in a car crash, there must be huge force generated when the prince runs over Snow White.

CONCLUSION:

**THE PRINCE DID NOT CARE ABOUT SNOW WHITE !**

Now let me ask: If he didn't care about Snow White as a country girl he met in the first place—

What made him decide to marry her?



Her beauty?

Her royal blood?



Or her status as the sole heiress of a kingdom?

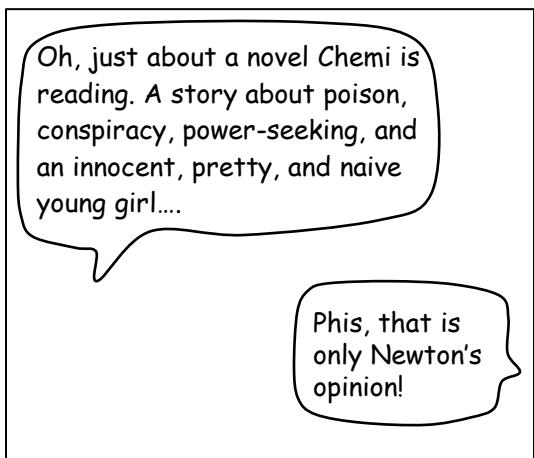


Any other questions? About Snow White or Newton's 2<sup>nd</sup> Law?

$$F = ma ?$$

Err, yes! You have not told me yet—what is **m**? And what is **a**?

Dad! You are home.



To read more about the stories of Phis, please visit us at [www.physics.unl.edu/~xhong/hong/Phis/PhisHome.html](http://www.physics.unl.edu/~xhong/hong/Phis/PhisHome.html).



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This project is supported by National Science Foundation Grant CAREER No. DMR-1148783 and the Nebraska Center for Materials and Nanoscience.