

# Interactive Notes-“Forces & Newton’s 3 Laws”

## Student Materials (per group of 4 students):

Demo 1	1-ping pong ball 1-golf ball
Demo 2	1-plastic ring 1-penny 1-bottle -to catch the penny
Demo 3	1-styrofoam plate with removable wedge 1-marble
Demo 4	1-small plastic or paper cup 1-”flippy board”
...and	4-note sheets

## Additional Teacher Materials:

PowerPoint

1 beaker of water- to pour water into the little cups in demo #4

1-mop and some towels- for spills during demo #4

1-tennis ball, tennis ball on a string, and bowling ball (optional, but very helpful for further illustrations.

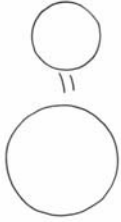
Use the bowling ball whenever referring to massive objects.)

## Beforehand:

- Insert page and paragraph numbers from relevant pages in your textbook at the bottom of slides 1 and 2 if you choose to have the class read from it together. This is a good way to connect with your textbook as well as transition into the next demo. You can also delete these page inserts, or Copy and Paste them onto later slides if needed.
- Keep an extra set of materials up front so you can show students how the demos work. It’s much easier to *show* them what to do than just tell them.
- Demos 2-4 require some building and cutting. Do all this well a week or so in advance so you’re finished early and have time to play around with them yourself.
- As with any other demonstration, try these out ahead of time for yourself so you know how they work best and so you know what to expect. Practicing will also help you decide what to say and how to say it. There is plenty of room for other anecdotes and explanations, like roller coasters and planets.
- Print extra copies of the notes pages on paper for yourself, students that are slow writers or can’t see well, and for absentees. Click “File” → “Print” → then where it says “Print what:” select “Handouts” → and then “OK”.
- If you’ve never taken the time to put a tennis ball on a string, you’d be surprised how often you use it if you had one. Drill a hole in a tennis ball just big enough to slip the “V” end of a toggle bolt through. Tie a string securely to the screw head, and you’re in business.

1.

**Interactive Notes: Forces & Newton's 3 Laws**



**Do:** Dropped a ping pong ball on top of a golf ball.

**See:** The ping pong ball shot off like a rocket.

**What's Happening:** A **force** is a push or pull. Forces cause things to begin moving, speed up, slow down, stop moving, and change direction. Here, we put the force of a golf ball into a ping pong ball.

Read p. 1 together

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Ask student #1 to drop the ping pong ball by itself on the table a few times and watch how it rebounds (it bounces about halfway back, losing that energy into the table). Then have them drop the golf ball by itself and observe what it does. Now have the student drop the two stacked together with the ping pong on top of the golf ball (demonstrate how to hold). If the balls land just right they'll observe an "explosive" event as the ping pong ball shoots off across the room!

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The reason for this lies in the difference in mass between the 2 balls. The golf ball is more massive than the ping pong ball, so it requires more energy to lift and has more energy when it falls. To make this point more dramatically (and memorably) you can set a bowling ball next to your ping pong ball and ask which needs more energy. When the golf ball and ping pong ball are dropped together and hit the table, some energy is transferred from the golf ball to the ping pong ball. To prove this point watch again how the golf ball bounces by itself compared to when the ping pong ball is on top of it- it bounces much less high the second way. That missing energy is what went into the ping pong ball. But why did it shoot off? The balls are deceiving you. Remember how much more massive the golf ball is compared to the ping pong ball. They do not have them same amount of energy- the golf ball has more because it is more massive. And that "more" transferred is what created your rocket.

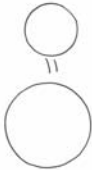
If you're looking for more excitement a tennis ball dropped on top of a basketball (outside, of course) is the best combination.

*(end of Teacher Notes preview)*

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**Interactive Notes: Forces & Newton's 3 Laws**



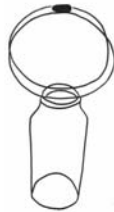
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Read p. 1 together

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**Do:** Yanked a ring out from under a penny.

**See:** It dropped into the bottle.

**What's Happening:** **Newton's 1<sup>st</sup>** law states that objects at rest stay at rest and those in motion stay in motion, unless acted on by a force. They resist change (**inertia**).

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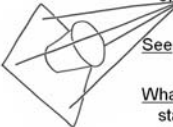


**Do:** Rolled a marble around a plate, then removed a wedge.

**See:** It went straight when it was free of the inward push of the plate.

**What's Happening:** **Newton's 2<sup>nd</sup>** law states that objects always go in the direction they're forced. The marble moved in an unnatural (circular) path because the plate forced it to. However, it's own tendency was to go straight.

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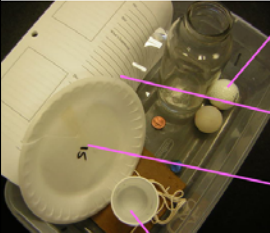
**Do:** Swung a flippy board with a cup of water on it.

**See:** The water stayed in the cup!

**What's Happening:** **Newton's 3<sup>rd</sup>** law states that forces act in pairs, and that for every action there is an equal and opposite reaction. The cup stayed because as it pushed down on the board the board pushed back up on it.

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**Clean Up-** this is what your box needs to look like in 3 minutes.



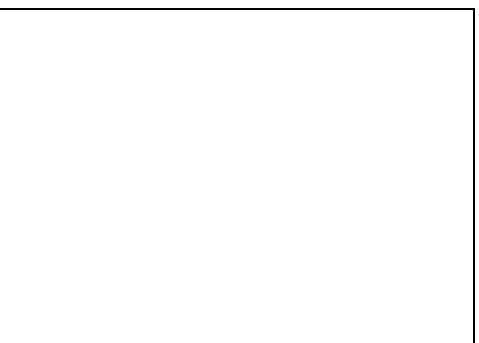
**Person 1**  
•Make sure the number on each ball matches your table number

**Person 2**  
•Count 4 new note sheets  
•Make sure penny is in box

**Person 3**  
•Tape wedge back on plate  
•Make sure marble is in box

**Person 4**  
•Empty the water in cup, if necessary

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◆ **Student Handout**

◆ **Drawings & Pictures**

Topic: \_\_\_\_\_ Date: \_\_\_\_/\_\_\_\_/\_\_\_\_

Do: \_\_\_\_\_

See: \_\_\_\_\_

What's happening: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Do: \_\_\_\_\_

See: \_\_\_\_\_

What's happening: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



Drawing-Flippy Board    Drawing-Marble On Plate    Drawing-Penny On Ring Over Bottle

Drawing-Ping Pong Ball On Golf Ball    Pic-Flippy Board    Pic-Marble On Plate

Pic-Penny On Ring Over Bottle    Pic-Ping Pong On Golf Ball    Student Materials

◆ **Homework handout 1-finish the statements**

◆ **Homework handout 2-drop test**

**Rewrite and finish these statements.**

**Newtons 1<sup>st</sup> law states...**

- Things that are moving...
- Things that aren't moving...
- Things that are heavier...
- A ball rolled on the ground comes to a stop because...

**Newtons 2<sup>nd</sup> law states...**

- A force applied to a ball causes it to...
- The harder something is pushed...
- Increasing the mass while applying the same force...

**Newtons 3<sup>rd</sup> law states ...**

- When you pull up on a bowling ball...
- When two forces are equal and opposite, the object...

**Focus on this:** Gravity, the one we always forget about, is always active. But is it fair to all objects? At home tonight drop a heavy and lightweight unbreakable object at the same time from the same height, and record what happens. Don't forget to predict what you think will happen before starting.

My heavy object is a \_\_\_\_\_

My lightweight object is a \_\_\_\_\_

I predict that when both are dropped at the same time from the same height...

- The heavy one will land first
- The light one will land first
- They will both land at the same time
- Other guess: \_\_\_\_\_

Results- check which hit first for each drop

	Heavy	Light	Tie
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

And the winner is: \_\_\_\_\_!!!!

Comment: Thought- What are you thinking right now?