Class: Physics 112

Lesson Title: Newton's First Law of Motion

Class Size: **24**
Time: **60 mins**

Curriculum Outcomes:

325-8 Apply Newton's laws of motion to explain inertia; the relationship among forces, mass, and acceleration; and the interaction of forces between two objects.

Learning Objectives:

1. Students will experience/ visualize the physical process of inertia.
2. Students will be able to understand Newton's first law of motion through the examples of real life circumstances.
3. Students will grasp the basic concept that an object in motion will stay in motion, and an object at rest will stay at rest.

Materials:

- Rolly carts (From the Elementary School)
- Rope
- Whiteboard and whiteboard markers

Preparation beforehand:

- Before class even begins, a table should be drawn onto the side whiteboard that looks like the chart below. This chart will be filled in with students' ideas as we discuss the kinulation.

1	2	3
(student input)	(student input)	(student input)

- Having a large space, such a gymnasium, to do this kinulation would be beneficial. That way the students would have more space to spread out and perform their required tasks.

Introduction:

1. When class begins, students will break off into groups of two. One partner will follow Instructor A into room 206, and the other partner will remain in room 205 with Instructor B.
    a. Instructor B (Room 205) –This group will have small talk –keeping the students in the dark as to what is going to happen.
    b. Instructor A (Room 206) –These students will be considered the "opposing forces". This group will be given a set of instructions to follow when reunited with their partner. The students will be required to perform three tasks:
    (1) They will have a string attached to their rolly cart. Their partner will be seated onto the rolling cart and their task will be to abruptly tug the string on Instructor A's count of three;
    (2) Their next task, on Instructor A's count of three, will be to pull their partner slowly on the rolly cart and then make an abrupt turn –causing their partner to tip over; and
    (3) Their last task will be to stand behind their partner- as their partner is sitting on the rolly cart- and on Instructor A's cue, they will push their partner's cart forward (making sure to solely push the cart and not kick their partner. Once the student's know their three specific tasks, they will each be given a rolly cart and return to room 205 where they will re-group with their partners.
2. Explain what a kinulation is (broken up into kinesthetic and simulation). Tell them that these are used to help students learn difficult concepts that are otherwise difficult to picture. It allows students to become part of the demonstration, and therefore easier to remember and learn. Ask students if they would like to try one.

Activity :

1. As a full class, those students who were with Instructor B will be instructed to sit down on the rolly cart and remain seated at all times as the kinulation and discussion happens. Then, as the groups are with their partners, we will go through each one of the three tasks (in order) as discussed in room 206. Instructor B's group will be focused on what she is saying, while instructor A's group will be focused on instructor A for their cues to perform each task.
    Tasks:

(1) First, the "opposing force" will be holding a rope that is attached to a rolly-cart- which their partner is sitting on at rest- and at the count of three they will abruptly pull the rope; causing the roll cart to move forwards while the person sitting on the cart attempts to remain at rest.

(2) Second, the "opposing force" will be holding the rope, once again, that is attached to the rolly - cart. However, this time they will slowly walk forward and pull the rolly-cart behind them (with their partner on it). Then, on the count of three, they will make an abrupt right turn causing the rolly-cart to follow along while the person ("object") on the cart will try to continue moving straight at the same velocity.

(3) For the third task, the "opposing force" will be standing behind their partner (who is on the rolly-cart). At the count of three, the opposing force will nudge the rolly-cart forward from under their partner. This opposing force will cause the rolly-cart to move forward, while the "object"/person on the cart will try to stay at rest.

2. After each task is completed –before moving on to the next task- the class will take time to fill in the initial chart (from "Preparation beforehand") and list the observations they had from each task.
3. Partners will then switch positions and we will go through all three tasks once again. This time around, instruct students to really think about what is happening. Once the tasks are done, we will add any extra observations to our chart.
4. Discuss with students the different examples of motion in each of the three tasks.
5. Talk about how these activities relate to the law of motion (specifically inertia).

Conclusion – Possible wrap-up questions:

1. What other examples of the Law of Motion can you think of in real-life?
   Ex:
   - When a car come to an abrupt halt, such as hitting a deer. The natural reaction for the person in the car would be to continue at the same velocity, which would send them through a window.
   - When you stir your coffee with a stick and the coffee continues to spin in a circular motion even after the stick is removed.
   - When you go on certain amusement park ride that lifts you high in the sky and drops you down at high velocity. This causes you to become light headed from the blood "rushing to your head".
   - When you jump off a moving skateboard and stumble over your feet and fall.
   - When you run into a close line and it causes you to fall backwards and making your feet come off the ground.
   - Getting whiplash in a car after colliding into something.
   - Concussion occurs because your brain continues to move when your outside skull is stopped by a force, which causes the injury.
   - Shaking a bottle of ketchup.
   - A toy thrown up in a moving train will move along with the train.
2. What similarities or differences are there between the three tasks?