

Objectives

- Observe Newton's Laws of Motion

Materials

- 2 Glass marbles
- Metal marble
- Grooved ruler
- 2 Spring scales

Procedure

Newton's Laws of Motion concern the relationship between forces and motion. A **force** is a push or pull. Gravity pulls everything near the earth, down towards the earth, so gravity is a force.

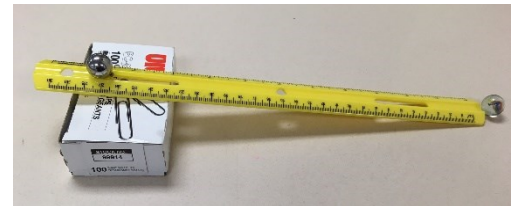
Newton's 1st Law of Motion (Teacher demo coin, card, cup)

1. Place a marble on your desk so that it is at rest (not moving).
2. Observe the marble for a minute. What happens to it? _____
3. Without applying a force to the marble, make it move. Remember gravity is a force, so tipping the desk is the same as applying a force. Were you able to move the marble? _____
4. Roll the marble across your desk at a moderate speed so that it has no sidewise spin. Describe the path the marble took. _____
5. Without a sidewise spin, tipping the desk, or applying a force, can you make the marble take a curved path? _____

Newton's 2nd Law of Motion

Part 1

1. Make a ramp using the grooved ruler and a book.
2. Place a glass marble on your desk at the end of the ramp.
3. Release the other glass marble from the top of the ramp so that it rolls and hits the marble on the desk. Observe the velocity of the marble that was on the desk.
4. Place a glass marble on the desk at the end of the ramp.
5. Release the metal marble from the top of the ramp so that it rolls and hits the glass marble on the desk. Observe the velocity of the metal marble.
6. Which marble on the desk (1st or 2nd) had a larger force applied to it? _____
7. Which marble had the larger final velocity? _____
8. What was the marble's initial velocity in both cases? _____
9. Define acceleration. _____
10. Which marble had the larger acceleration? _____
11. What is the relationship between force and acceleration? _____



Part 2

12. Place a glass marble on your desk at the end of the ramp.
13. Release the other glass marble from the top of the ramp so that it rolls and hits the marble on the desk. Observe the velocity of the marble that was on the desk.
14. Place a metal marble on the desk at the end of the ramp.
15. Release the glass marble from the top of the ramp so that it rolls and hits the metal marble on the desk. Observe the velocity of the metal marble.
16. Which marble on the desk (glass or metal) had a larger force applied to it? _____
17. Which marble had the larger final velocity? _____
18. Which marble had the larger acceleration? _____
19. Which marble had more mass? _____
20. What is the relationship between mass and acceleration? _____

Newton's 3rd Law of Motion

1. Take two spring scales and hook their ends together. Lay them horizontally on the desk.
2. Gently pull on one spring scale so it reads 4 N.
3. What do the scales read for the force? _____, _____
4. Apply 3-N force. What do the scales read? _____, _____
5. With the scales hooked together, try to pull only one scale so that the other one does not experience a force. Were you successful, explain. _____

