

"To Make the Best Better"

4-H Youth Development



Discipline: All
Age Level: All
Time: 30 minutes

Next Generation Science Standard : HS-PS2-1
Analyze data to support the claim that Newton's 2nd Law of Motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.

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Mass and Velocity

Objective/Success Indicators: Members discover and describe different properties of lead and steel (mass, inertia, and momentum). They can then decide which type (material, construction) and size (diameter, weight) of arrow, ammunition or shot size is appropriate for a shooting sport event or activity.

Assessment Question: Which will travel further down range given equal velocity and same diameter, lead or steel?

Supplies:

Six standard size golf balls
Six standard size, hollow, practice golf balls
½ inch lead fishing weight
½ inch steel ball bearing
Post-it Notes

Lesson Outline:

1. Ask for input from the group to compare the properties of lead and steel. Write them on a large post it, whiteboard, etc. if you wish.
2. Hand out Post-it Notes and pencils and have everyone hypothesize (predict) what will happen in each part of the experiment. Use a Post-it for each prediction, and stick it underneath each of the signs posted in the room. If desired, have lead be on the left side and steel on the right side. The questions are:
 - a. Which will hit the ground first?
 - b. Which will bounce higher?
 - c. Which will go further down range?
3. Pass around the golf ball and the practice golf ball and ask the group which one represents steel and which one represents lead. If they are unsure, cue them with a question about which is heavier, lead or steel? The regular golf ball should represent lead, and the practice golf ball steel.
4. Ask for several youth (4-6) to assist with the experiment. Conduct the exercises below, using your volunteers.
 - a. Give half the volunteers a steel ball bearing and the other half a lead fishing weight. Explain to the rest of the group that they must watch to see which hits the ground first. Count down 3-2-1-drop. Record the results on the chart.
 - b. Retrieve the steel and lead weights. Drop it again, but this time have the group ready to record how high each one bounces. Assign several to watch each type so that you have



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a more accurate measure. Record the results.

c. Repeat a and b, but this time use the golf ball and practice golf ball.

d. Lay out the 100 ft measuring tape, and consider taping the floor with marks at 10 ft intervals as a point of reference, or use hats, shoes, kneeling rolls, along the side to assist.

e. Give each volunteer BOTH a regular and practice golf ball. Have them throw the balls down range as hard as they can. Measure the distance travelled before the first bounce and record it on the chart.

5. Gather around the data chart, and review what happened. Compare the actual results with the hypotheses from the Post-it notes. Discuss, and then answer the questions: Which hits the ground first, steel or lead? Which bounces higher, steel or lead? Which will go further down range, steel or lead? If you are comfortable, this is the time to explain the terms mass, weight, inertia, and momentum and how they relate to lead and steel shot.

6. Application- Introduce steel and lead shot, and ask the kids how what they learned today can be applied when selecting shotgun shells. If there's time, they can make a list of things that they need to consider. If possible point out which considerations are actually questions of mass, weight, inertia and/or momentum.

Going Further: Put together a scenario for hunting pheasant or some other game bird, and make judging classes where the kids select the best choice of ammunition, choke, or even type of shotgun. At the next meeting, the kids can judge the classes and discuss them.

Background Information:

Mass is a volume measurement. Mass is always constant.

Weight is a function of gravity (9.8m/s²). Objects with a higher mass will weigh more than objects with a lower mass. Would a bowling ball on Earth weigh the same on the moon or Jupiter?

Inertia is a measure of resistance of a body to change its motion.

Momentum is mass in motion. Mathematically it is mass x velocity.

Steel is less dense than lead. The pellets weigh one-third less than lead pellets of the same size.

- Steel retains less energy and may not kill birds cleanly at the same ranges.
- Steel with the same weight and shot size contains more pellets than lead, making loads that contain more shot than necessary. Compensate for the lighter weight by using a shot one or two sizes larger than the lead shot size.

Steel is harder than lead shot.

- Birds may bleed more freely because the steel penetrates better without clogging the wound channels with feather balls.
- Steel shot spreads less and has denser shot patterns, resulting in less margin for error in gun handling and trigger timing. Compensate by using a more open choke like an improved cylinder or modified choke rather than a full choke. This is especially true for shots within 50 yards.

https://www.hunter-ed.com/alaska/studyGuide/Two-Major-Differences-Between-Lead-and-Steel-Shot/201001_700049164/