

SUGGESTED ACTIVITIES

(Motion)

From *Invitations to Science Inquiry 2nd Edition* by Tik L. Liem:

<u>Activity</u>	<u>Page Number</u>	<u>Concept</u>
Get the Egg in the Glass*	366	Newton's First Law
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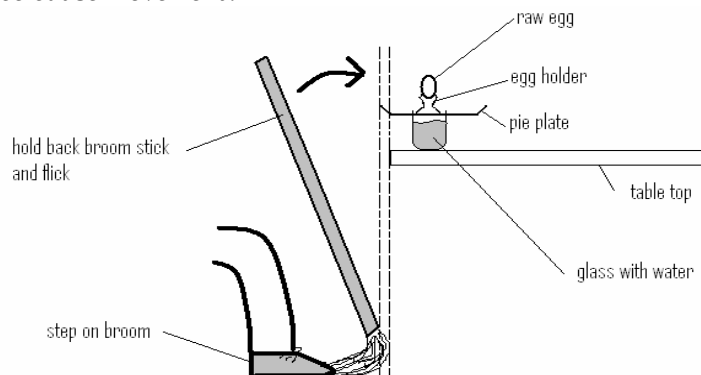
*note: You can use a cardboard toilet paper tube cut in half instead of an egg holder. If you have to, bend the cardboard in to hold the egg.

From *Harcourt Science Teacher's Ed. Unit E: (For ALL grade levels)*

<u>Activity</u>	<u>Page Number</u>	<u>Concept</u>
Changes in Motion	F33 (5th grade text)	Motion
How Mass and Velocity Affect Momentum	F39 (5th grade text)	Momentum
Orbits and Inertia	F47(5th grade text)	Inertia

GET THE EGG IN THE GLASS

A. Question: *Does force cause movement?*



B. Materials Needed:

1. One raw egg.
2. One egg holder.
3. One aluminum pie plate.
4. A large drinking glass.
5. A household broom.

C: Procedure:

1. Fill the glass three quarters full with water.
2. Put the empty pie plate on the glass and center the egg holder and raw egg on the pie plate directly over the glass.
3. Place the glass with everything else on top, close to the edge of the table such that the rim of the pie plate hangs over the table edge.
4. Ask the students: "How can I get the egg in the glass with the broom without breaking it?"
Anticipated answer: "Have no idea!"
5. Hold the broom directly in front of the set up, push down on it so the sweep part of the broom bends. Place one foot on the broom while holding back the wooden handle, then suddenly release the pole and flick it hard against the pie plate.

D: Anticipated Results:

Students should see the egg fall exactly into the glass.

E: Thought Questions for Class Discussion:

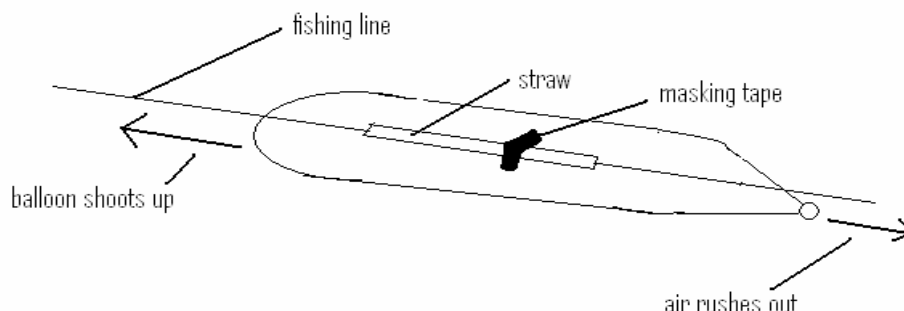
1. What made the egg fall exactly in the glass?
2. What was the function of the water in the glass?
3. What would happen if we had a plate without a rim on the glass?
4. Why did the pie plate have to protrude over the table edge?
5. Would any other object in the egg holder end up in the glass?

F: Explanation:

The broom stick hit the edge of the pie plate without hitting the glass or the egg, because its motion was stopped by the table edge. This sudden force moved the pie plate out from under the egg carrying with it the egg holder, as this was caught by the plate's rim. The egg was at rest and tended to stay at rest (first part of Newton's First Law). The water was needed to catch the raw egg and prevent it from breaking. Any other object on the egg holder would have fallen in the glass, provided it has a heavy enough mass (and thus have enough inertia).

THE BALLON RACE

A. Question: *What happens when forces acting on an object are unbalanced?*



B. Materials Needed:

1. Two long cylindrical balloons.
2. A roll of fishing line (or smooth sting).
3. Two straws.
4. Masking tape.

C: Procedure:

1. Divide the class in two groups: there is going to be a race!
2. Have one student of each group tie one end of 10m length of fishing line to a pipe (or fire sprinkler) close to the ceiling at one end of the classroom (in the front).
3. Bring the other end of the fishing line to the rear of the classroom and have another student of each group push the fishing line through the straw, and hold the line tight.
4. Now have another student of each group blow up the balloon and hold the mouth closed (do not put a knot in it), and hold the balloon under the straw with its mouth facing the rear of the room.
5. Let another student tape the balloon to the straw (one strip of tape over the middle of the straw). You are now ready for the race.
6. Have the students release the balloon on the count of three.

D: Anticipated Results:

Students should observe the movement of the balloon in the upward direction.

E: Thought Questions for Class Discussion:

1. In which direction did the air of the balloon go?
2. What made the balloon shoot up?
3. Will a smaller or larger balloon shoot up faster?
4. If we want the balloon to shoot down, which way do we have to face the balloon's mouth?

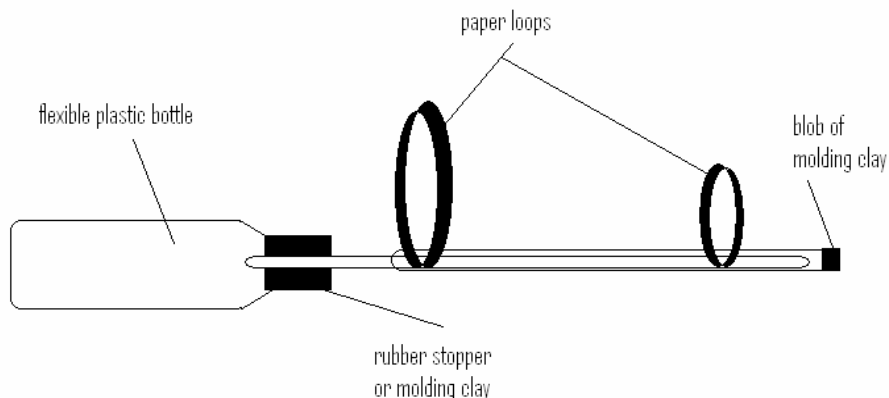
F: Explanation:

At the time that the balloon was held with its mouth closed at the rear of the room, all forces inside the balloon were balanced by an equal and opposite force. This will also be the case when we put a knot in the balloon's mouth or in the case of a closed pressured chamber in space.

When the balloon is released, the downward force is eliminated, and the resultant force is upwards. This is quite similar to the operation of a pressure chamber in a rocket or satellite. When a left turn has to be made, a valve on the tight hand side of the vehicle is opened.

THE STRAW ROCKET

A. Question: *What should be expected for every action according to Newton?*



B. Materials Needed:

1. A plastic flexible bottle.
2. Two drinking straws of two different sizes.
3. Some molding clay.
4. Construction paper.

C: Procedure:

1. Prepare the 'bottle starter' by putting a roll of molding clay around one end of the smaller straw and fitting it into the mouth of the plastic flexible bottle - test for leaks by plugging the other end of the straw with a finger, then squeezing the bottle: this should feel hard to squeeze when there are no leaks.
2. Prepare the rocket by taping two paper loops to the larger straw. One smaller loop to the front end and a larger loop to the back end. Stuff the front end of the straw with a blob of clay.
3. You are now ready to launch the rocket. Place the larger straw over the smaller one, hold the paper loops on the top side of the rocket with another straw, and squeeze the bottle with a sudden motion.

D: Anticipated Results:

Students should observe the rocket propel forward.

E: Thought Questions for Class Discussion:

1. What made the rocket move forward?
2. Why does the smaller straw have to fit tightly in the bottle?
3. What is the function of the blob of clay in the larger straw?
4. What is the function of the paper loops?
5. What initial action gave the rocket its energy to shoot forward?

F: Explanation:

By squeezing the plastic bottle, air is blown through the smaller straw into the larger straw. As this latter one is plugged at the front end, a higher pressure is built up in the larger straw and this makes the rocket shoot forward. As Newton's Law states: **For every action there is an equal and opposite reaction.** The action here is air shooting out of the rear of the rocket (larger straw), and the reaction is that the rocket moves forward. The function of the paper loops is to keep the straw floating in a horizontal direction. Toys that shoot plastic balls by squeezing a plastic gun, and air guns (Beebee guns) are applications of this basic principle of action is reaction.

THE FUNNY MARBLES

A. Question: *How do moving objects affect stationary objects?*

B. Materials Needed:

1. A plastic ruler (30cm long, with center groove).
2. Seven identical marbles.

C: Procedure:

1. Place the seven marbles in the groove of the ruler all next to and touching each other.
2. Now take one marble and let it roll from about 10cm away, with some speed against the other six (only one will move away).
3. Place the marbles back on their original position and do the same with two marbles bumping against the remaining five.
4. Now separate four marbles and before letting them roll against the remaining three, ask the students: "How many marbles will move ways?"

D: Anticipated Results:

Students should observe the movement of marbles.

E: Thought Questions for Class Discussion:

1. When one marble bumps against six, why does only one marble move away?
2. Are the other five marbles moving much faster after collision?
3. How many would move away if five marbles were pushed against two?
4. Would a marble twice as heavy also move only one way?
5. Would the end marble move also faster when one is hitting the row with a faster speed?

F: Explanation:

This event demonstrates the conservation of momentum. If all the marbles are identical in mass and size, whatever number rolls against a row of stationary ones will move the same number away from the stationary row. These last moving marbles are just taking over the momentum that the first marbles were imparting to the row of stationary marbles. **The momentum of a moving object is the product of its mass and its velocity (mv).** When this is imparted to another stationary object, this second object will have the same initial momentum ($mv_1 = mv_2$). When both objects have the same mass, the velocity of the second object (v_2) will be the same as the first object's velocity (v_1). When the moving ball is twice as heavy ($m_1 = 2m_2$), then two balls with masses m_2 will move away. A faster moving marble will impart the same speed to a marble of the same mass. A marble with half the mass of a stationary one will only impart half the speed to the heavy marble.

Applications of this principle are encountered in head-on collisions of trucks and cars, where the truck driver almost survives the accident but not the car passengers.