

Physics

Activity- Balloon Race

Name: _____

Objective:

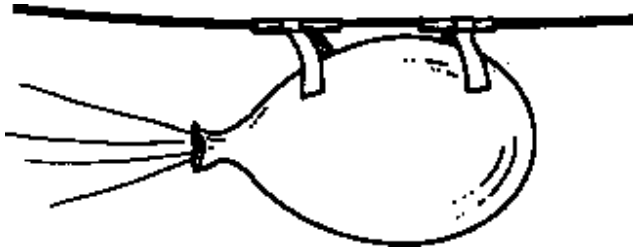
The purpose is to figure out how to shoot the balloon from the back of the room to hit the blackboard at the front of the room, using the fishing line as a track for the balloon to follow. race will be timed and a winner determined. The fishing line will be attached to the top of the blackboard. The other end may be held in a team member's hand so that the line is taut throughout the time of the flight. The line may not be moved up and down to help the balloon move toward the blackboard, however.

Materials:

balloon, a plastic straw, some tape, and a 5 meter length of fishing line or string

Procedure:

- Build a balloon rocket as shown below.
- After blowing up the balloon and pinching off the mouth, the straw should be taped to the balloon.
- Still holding the balloon closed, the fishing line should be threaded through the straw.



Upon releasing the balloon it should take off up the fishing line toward the target.

RESPONSE:

1. Explain in your own words how the balloon moves from a physicist's point of view. Identify any/all forces acting on it.

2. Use your same logic to explain how a real rocket flies.

EXPLANATION:

In both types of rockets the air inside the system pushing on the rocket sends it forward. But at the same time the rocket (balloon) is pushing back on the air!! This is what accounts for the air coming out the back.

In a general way we sum this up by saying that whenever one object exerts a force on another one, the second one exerts an equal and opposite force on the first one. Note that the two forces are not on the same object, however. This is generally known as **Newton's Third Law of Motion**.

Other examples:

1. If you push against a wall, the wall pushes back on you with an equal force. If this wasn't true and you pushed harder on the wall, the wall would move. If, on the other hand, the wall pushed back harder on you, you would fall over backwards!
2. When you go swimming, you push the water backward with your arms, and the water pushes you forward with an equal force.
3. When you walk across the ground, you push against the ground and the ground pushes against you.
4. When the tires of a car push against the road, the road pushes back on the tires.
5. When the gases that come from combustion of the fuel in a rocket push forward on the rocket the rocket pushes backward on the gases which move backward out of the rocket.
6. What happens when you fire a rifle? The rifle acts on the bullet and the bullet acts on the rifle. The bullet goes forward and the rifle kicks backward.

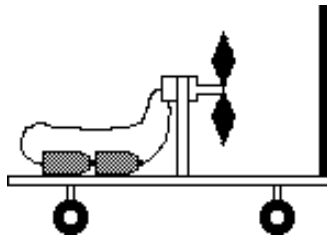
In talking about Newton's Third Law it is often stated that for every action there is a reaction. What is often omitted is that the action force is on one object and the reaction force is on a different object. A simple method of determining these forces is to reverse the subject and the direct object of the sentences describing the forces.

- a.) The boy pushed the wall. The wall pushed the boy.
- b.) The ground pushed me. Me pushed the ground
- c.) The rocket pushed the fuel. The fuel pushed the rocket.

Will It or Won't It Work?

1. Obtain some type of device with wheels. Some options would be a roller-skate, a toy car, a dynamics cart, etc.

2. You also need some type of portable fan, possibly like one of those battery operated ones that you can attach to your visor in your automobile. If you wanted to do this on a large scale you could use a movable chair with wheels and a large electric fan with a long extension cord.
3. Affix to the rear of the cart a piece of cardboard (10 cm x 10 cm) that is perpendicular to the bottom of the cart.
4. Aim the fan at the sail (the cardboard).



Predict what will happen when the fan is turned on.

Predict what will happen if the sail is removed and the fan turned on.

Explain what happens.