

Scientific Method

Rocket Engines and Newton's Third Law

INTRODUCTION: What would happen if you stood still while wearing skates and threw baseballs away from you? Would you move? How about if you sat on a skateboard and did the same thing?

OBJECTIVE: Newton's Third Law says that for every action there is an equal and opposite reaction. This means that if you push someone away from you, you are pushed backwards with the same force that you exerted. In the same manner, if a rocket's exhaust exerts 150 Newtons of force against a concrete launch pad, the same force is exerted on the rocket. This is what causes the rocket to be lifted into the air. In this activity, we will investigate the reaction using a balloon as the engine and a straw as the rocket. We will be careful to change only the one item whose effect we will observe. This is called the experimental **variable**. All other conditions must be kept completely identical. These conditions are called **controls**.

PROCEDURE:

A) *State the Problem:*

B) *Gather Information (Skip this step)*

C) *Form a Hypothesis:*

D) *Experiment* (see procedure below):

- 1) Pull your flight string from where it is attached across the room. String should be 4 – 6 meters long.
- 2) Inflate your balloon to the 3 cm diameter indicated in the chart.
- 3) Hold the balloon closed so that it can be quickly reopened later.
- 4) Attach the balloon to the straw, open end towards you, closed end towards the board. (see diagram).
- 5) Facing the string attachment, hold the flight string level near its free end.
- 6) Start the straw at the mark on the string.
- 7) Release the rocket (balloon) and allow it to fly down the string.
- 8) Holding the string level, measure the distance traveled by the rocket.
- 9) Repeat steps 1 – 8 twice for this diameter, and record the data in the chart.
- 10) Repeat the entire procedure for each diameter in the chart.
- 11) Graph average distances versus balloon diameter using the graph provided.

E) **Record Data:**

Diameter of Balloon

Distance Traveled by Balloon

	Trial 1	Trial 2	Trial 3	Total	Average
3 cm					
6 cm					
9 cm					
12 cm					
15 cm					

F) **Form Conclusion:**

QUESTIONS:

1) What is the manipulated variable of the experiment? _____

2) What is the responding variable of the experiment? _____

3) Name three (3) controls for this experiment (that is 3 things that are the same):

a) _____

b) _____

c) _____

4) How would Newton's Third Law affect you if you threw baseballs away from you while standing on skates or sitting on a skateboard?
