CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
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Project Number
J0122

Project Title
An Investigation into the Magnus Effect

Abstract

Objectives/Goals
This experiment shows the relationship between the spin of a thrown ball & the movement of that ball off a straight-line path.

Methods/Materials
A double-wheeled baseball-pitching machine was used to adjust the rotational speed of the ball. The rotational speed of the ball was set at zero RPMs to begin the experiment. Using an adjustable stroboscope to measure rotational speed, both wheels were set at 1445 RPMs. This consistently threw the ball in a straight path, hitting a zero mark made on a wall 40 feet away. The linear speed of the ball was set at 47 mph or 21 m/sec. This linear speed was kept constant by increasing the right wheel's rotational speed while decreasing the left wheel's rotational speed an equal amount. Controlling linear speed & establishing a 0 starting point were 2 controls of the experiment. At each setting, 10 pitches were thrown & the location the ball struck the wall was recorded. Three additional controls for this experiment were: using the same dimpled pitching machine ball for all trials, positioning the ball in the machine the same each time,& once the pitching machine was set to throw balls to the zero mark, it was not moved until all testing was completed.

Results
When the wheel speed was set to 475 RPMs the ball's rotational speed was 2090 RPMs, as a result, the ball curved left in the direction it was spinning on average 20 in. or 50.8 cm. When the wheel speed was set to 922 RPMs, the ball's rotational speed was 4057 RPMs, as a result, the ball curved left in the direction it was spinning on average 27 in. or 66.0 cm. When the wheel speed was set to 1392 RPMs the ball's rotational speed was 6125 RPMs, as a result, the ball curved left in the direction it was spinning on average 32 in. or 81.3 cm.

Conclusions/Discussion
The greatest curve of the ball from a straight-line path was on average 32 in. or 81.5 cm & was a result of the Magnus Effect in which the ball surface drags along with it a layer of air. This air or wake of air flowing off the spinning ball is bent or turned in the opposite direction of the direction of spin. This lateral force causes the ball to curve. Physical principles involved in the Magnus Effect are Bernoullis Principle which discusses how air moving at different speeds results in higher & lower air pressures on either side. Newtons first law of motion helps(equal and opposite reation)explain why the ball continues to curve as it continues to spin.

Summary Statement
This experiment shows the relationship between the spin of a thrown ball and the movement of that ball off a straight-line path.

Help Received
My father, securring and adjusting the machine, my mother with the display board, and Mr. Dan Halbur (physics teacher at Foothill High School), explaining the conversions and calculations.