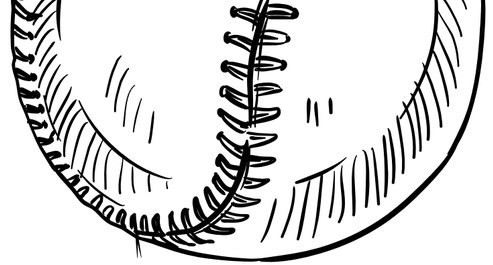
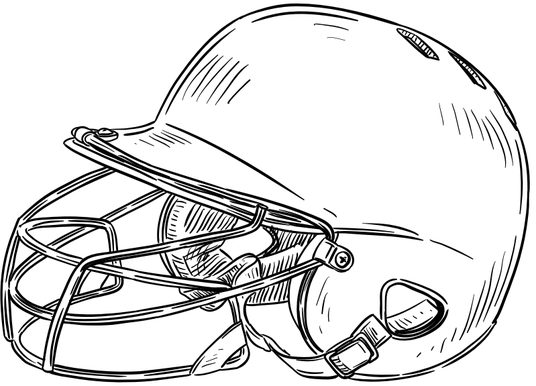
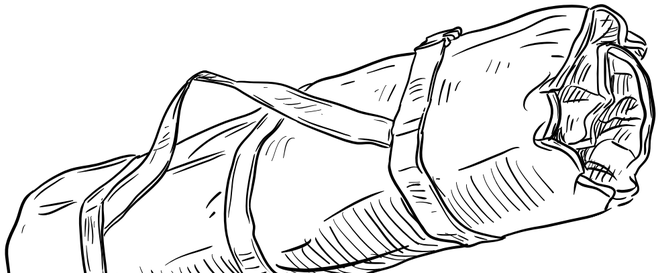
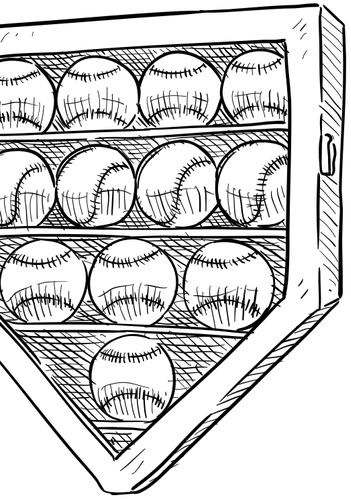
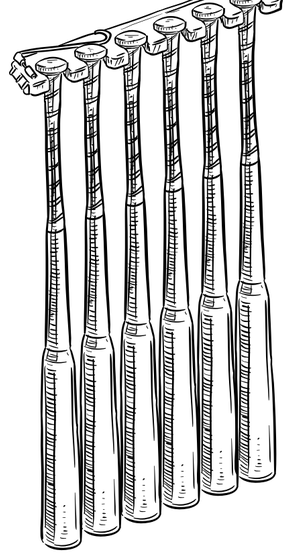


HOW DOES THE TEMPERATURE OF A BASEBALL AFFECT HOW FAR IT TRAVELS?





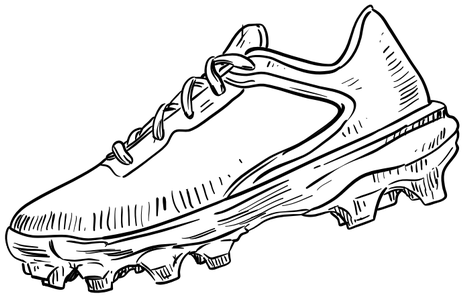


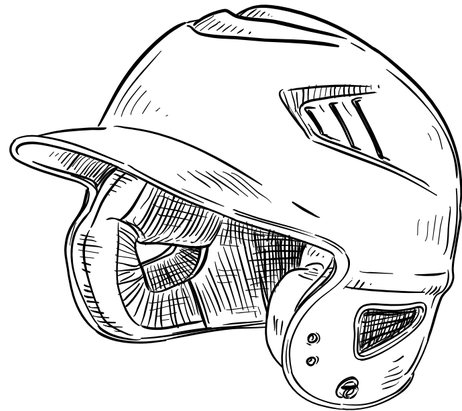


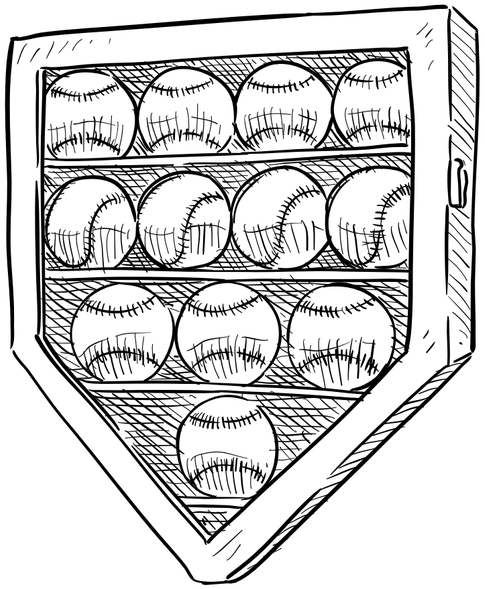
PROBLEM STATEMENT

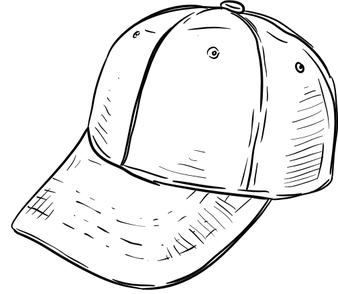
If a baseball is heated up then it will travel further when thrown at the same constant speed.

I predict this because when the baseball is heated up, the air molecules are spaced out and move faster, increasing the kinetic energy inside the ball. I think this will give it more momentum to travel further.





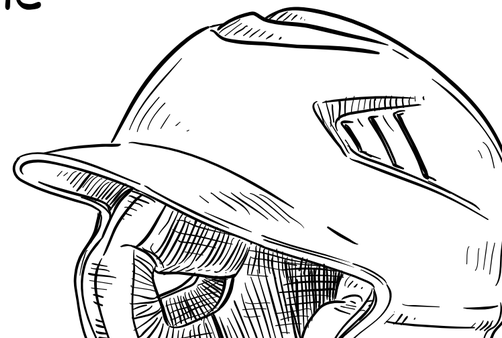




RESEARCH

In my research I learned that the outside environmental temperature has been tested and studied for its affects on how far a baseball will travel. For example, baseball is typically played in the Spring because the outside temperature is not too cold or hot, making the game more fair to play around the country.

I could not find information or previous tests that studied how the temperature of the ball itself impacts how far it will travel when thrown at the same constant speed. I wanted to test this problem because I cannot control the weather, but I can control the temperature of the baseball itself.



MATERIALS

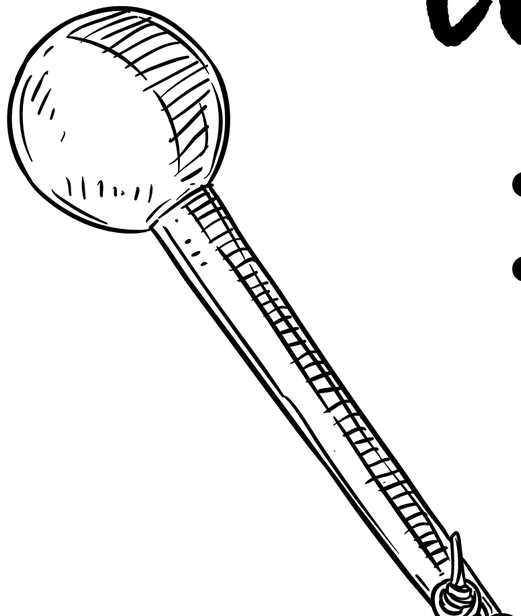
1. pitching machine
2. 3 baseballs
3. freezer
4. microwave
5. open area
6. measuring tape
7. notebook & pencil
8. temperature gun (laser thermometer)

VARIABLES

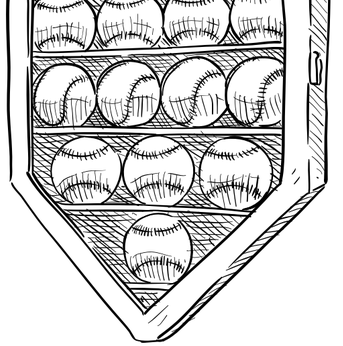
- temperature of the baseballs (freezing vs. heated vs. ambient)

CONSTANTS

- Pitching machine settings
- Baseball type (brand, size, material all identical)

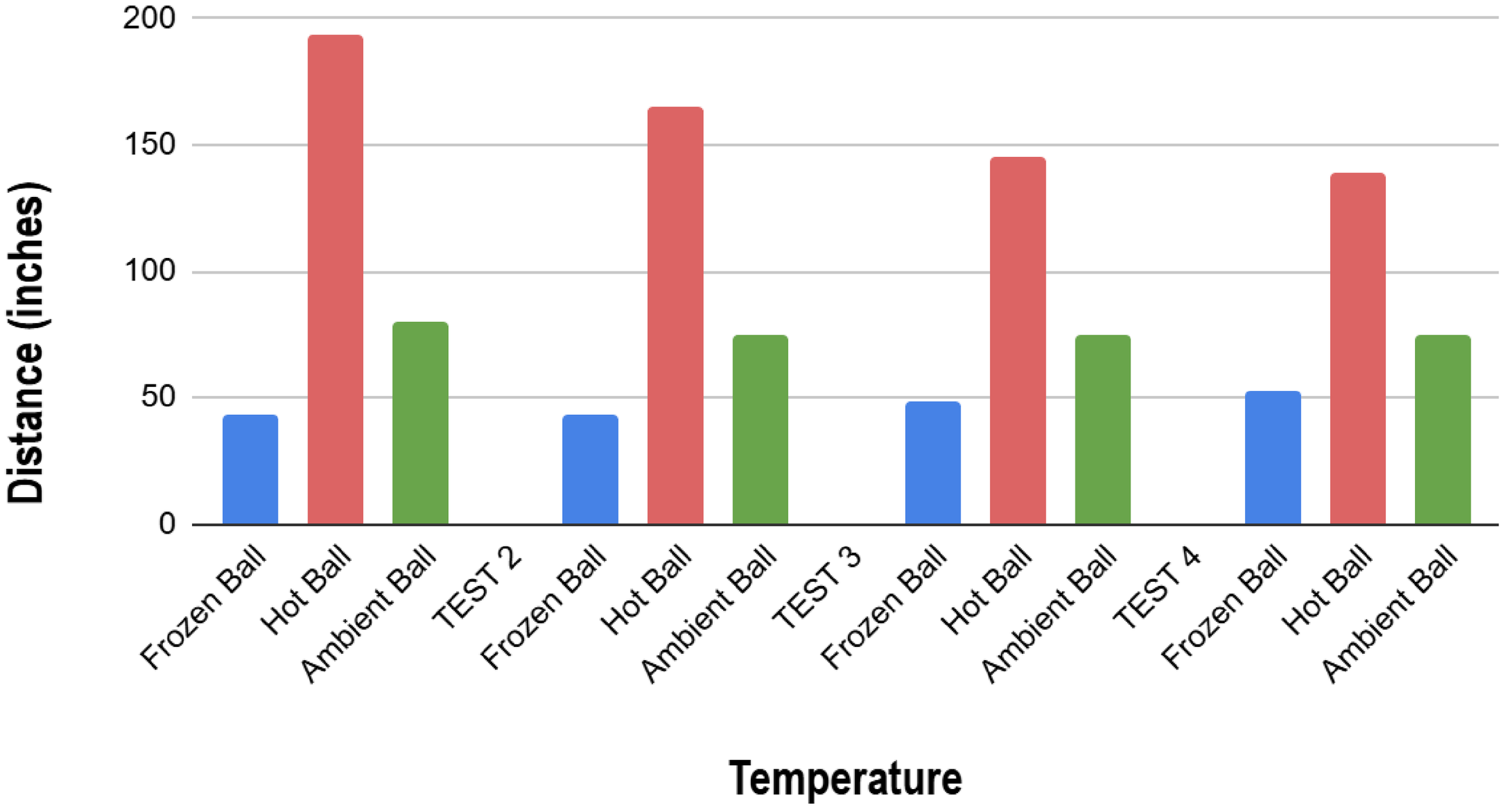


PROCEDURE



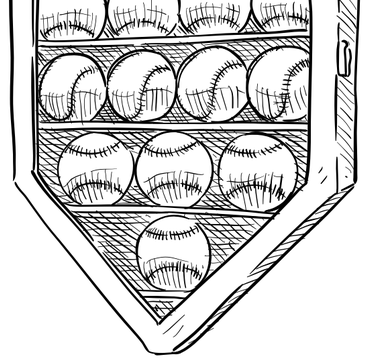
1. Take your 3 baseballs. Freeze 1 baseball to a temperature of 43.5 degrees fahrenheit (cold). Heat up 1 baseball to a temperature of 194 degrees fahrenheit (hot). Keep 1 baseball out at an ambient temperature, about 80.5 degrees fahrenheit.
2. Set up your pitching machine. Set all settings (to be kept the same across all tests).
3. Place the frozen baseball in the pitching machine and release. Watch where it lands. Place a marker (such as a rock) on the landing site of the frozen baseball.
4. Place the hot baseball in the pitching machine and release. Watch where it lands. Place a marker (such as a rock) on the landing site of the heated baseball.
5. Place the ambient-temperature baseball in the pitching machine and release. Watch where it lands. Place a marker (such as a rock) on the landing site of the ambient-temperature baseball.
6. Use a tape measure to measure the distance from the edge of the bottom of the pitching machine to each marked spot where each baseball landed. Record your data in your data notebook.
7. Repeat Steps 1-6 at least four times.
8. Analyze the results (aka the data) from each of the four tests.

Distance by Baseball Temperature



Distance by Baseball Temperature		
	Ball Temp (F)	Distance (inches)
TEST 1		
Frozen Ball	43.5	244.5 inches
Hot Ball	194	220.5 inches
Ambient Ball	80.5	253.5 inches
TEST 2		
Frozen Ball	42.9	236 inches
Hot Ball	165	262 inches
Ambient Ball	74.5	251 inches
TEST 3		
Frozen Ball	48.5	248 inches
Hot Ball	145	255 inches
Ambient Ball	74.5	268 inches
TEST 4		
Frozen Ball	53	249 inches
Hot Ball	139	258 inches
Ambient Ball	74.5	263.5 inches

RESULTS



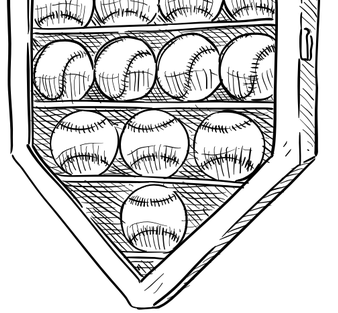
I meant to conduct my tests as follows:

1. freeze and heat 2 baseballs
2. pitch
3. measure
4. repeat after "resetting" temperatures of baseballs.

Instead, I did this for 3 tests in a row:

1. freeze and heat 2 baseballs
2. pitch
3. measure
4. reload and test again without re-freezing or re-heating

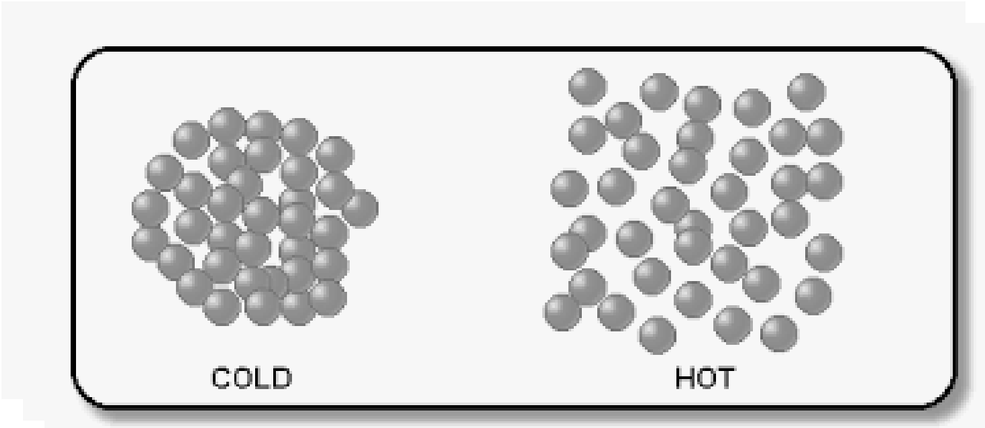
The way I ended up conducting the tests allowed the temperature of the cold ball to rise and the hot ball to lower.



RESULTS

Even with my mis-steps you can see that the cold ball travels a little further as it warms up. As the hot ball cools down, it is still hotter than the other baseballs and travels much further than the others in each test. Therefore, the hotter baseball traveled further each time.

It makes sense that the movement of molecules within the baseball at different temperatures would influence how far it travels.



Conclusions

According to the data ,the hot ball did travel further than the cold and ambient balls each time. I did find that it was hard to get the exact temperature of the baseballs each time.

If I had done the procedure as-intended, I think the hot ball would have traveled as it did in Test 1.

The results do support my hypothesis that the warmer the baseball, the farther it will travel.

This test is meaningful to the game of baseball. Warming up a baseball can help a team cheat. If you use a hot ball when your team is up to bat, the ball will go farther. If you trade baseballs to a cold one when the opposing team is up to bat, it won't travel as far. This is one of the reasons umpires are in charge of holding the baseballs.