



Highly Commended

# Scientific Inquiry

## Year 3-4

Jacob Brumby

Stirling East Primary School

**Investigation Planner:**  
**What happens to the height of the bounce of a basketball when you change the temperature of the ball?**

**Name- Jacob Brumby**

**Choosing variables:**

**I will change:**

**I will measure:**

<b>The temperature of a basketball.</b>	<b>How high the ball bounces</b>
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**I will not change** (so that it is fair):

- the ball ( I will use the same ball for all measurements).
- The pressure of the ball is pumped up to (8 PSI)
- The height which the ball is dropped from (160cm)
- The type of floor the ball is dropped onto (bamboo floorboards)
- The height of the camera filming

**My testable question is:**

What happens to (dependent variable)

the height the ball bounces.

When we change (independent variable)

the temperature of the ball

?

**My prediction is:**

What do you think will happen?

The hotter the ball is the higher it will bounce.

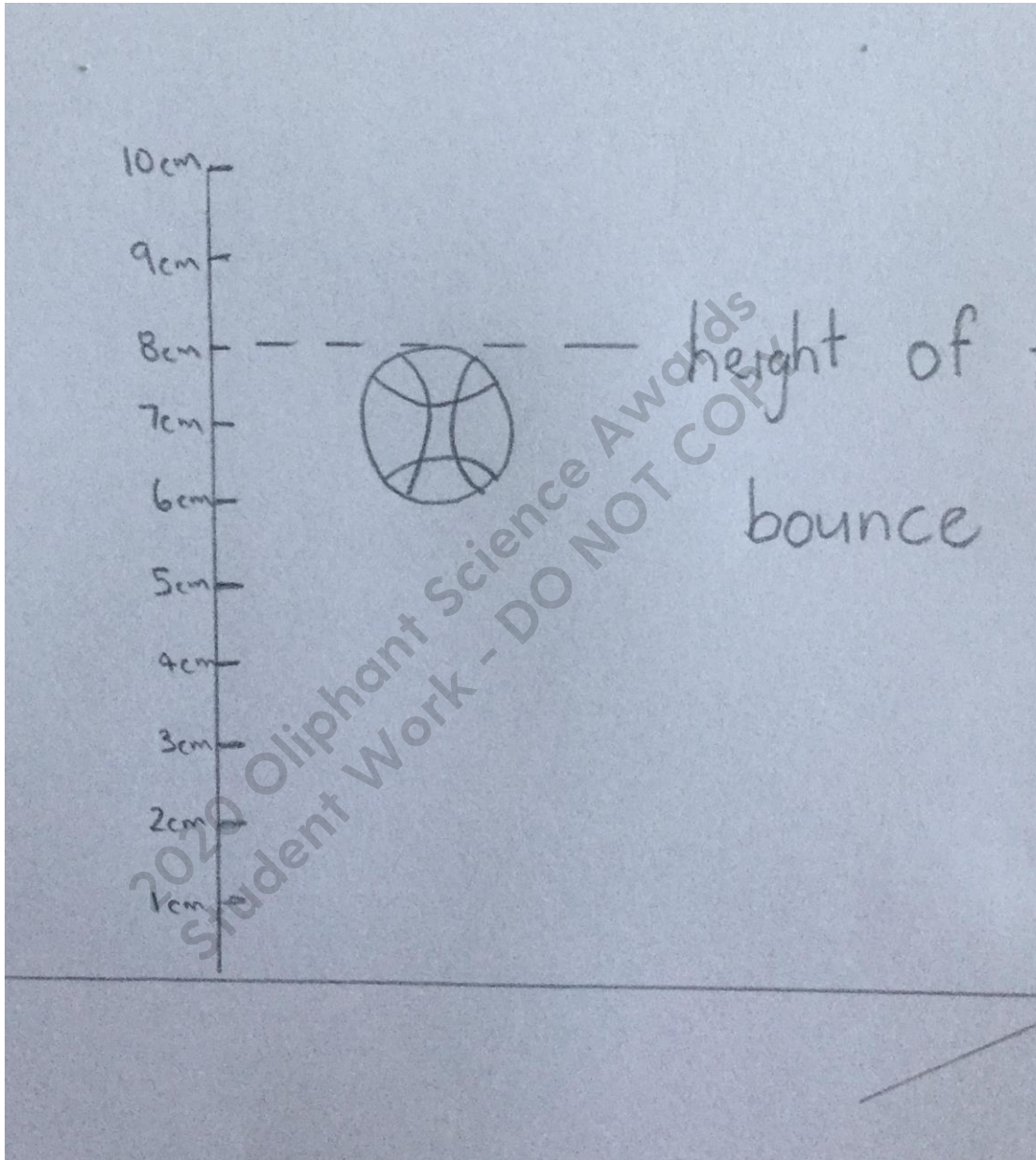
**My procedure:**

- 1. Take a size 3 basketball and pump up to 8 PSI**
- 2. On a plain wall make a height grid like this one:**



- 3. Have the ball at room temperature (20°C)**
- 4. Climb up a ladder with the ball and with arms out straight drop the ball to the ground from a height of 160cm.**

5. Using a slow motion camera at a steady height and distance, video the ball as it bounces back up and measure the height of the bounce against the height grid on the wall.
  - measure the top of the ball.



6. Repeat Steps 4 and 5 ten times, record each result and average the results.
7. Make sure the ball is still inflated to 8 PSI.
8. Repeat steps 4 and 5 with the ball that has been in the freezer overnight for 12 hours at  $-4^{\circ}\text{C}$ . After each bounce return the ball to the freezer for 1 hour before repeating the test. Perform this measurement 10 times in total. Average the results.

9. Make sure the ball is still inflated to 8PSI.
10. Repeat steps 4 and 5 with the ball that has been in the oven at 45°C for 1 hour. Return the ball to the oven between each bounce for 1 hour. Perform this measurement 10 times and average the results.
11. Plot the height of the bounce of the ball against temperature of the ball.

Materials needed for the investigation:

1. Size 3 basketball
2. Ball pump
3. Ladder
4. Tape measure
5. Video camera
6. Freezer
7. Oven

Safety precautions for your investigation:

- Don't go above the top rung of the ladder.
- Use oven gloves when using the oven.

### Data collection

What I will change (independent variable):

What I will measure (dependent variable):

the temperature of the ball.	the height of which the ball bounces.
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How I will collect and record the data:

I will slow motion video the bounce and I will record the results in a table.

Number of times I will carry out the investigation:

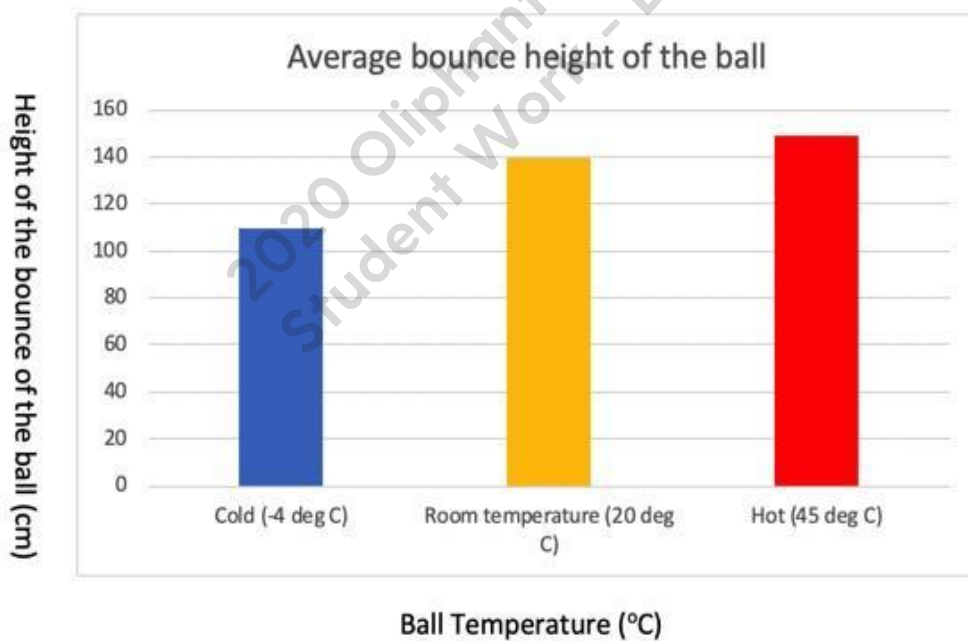
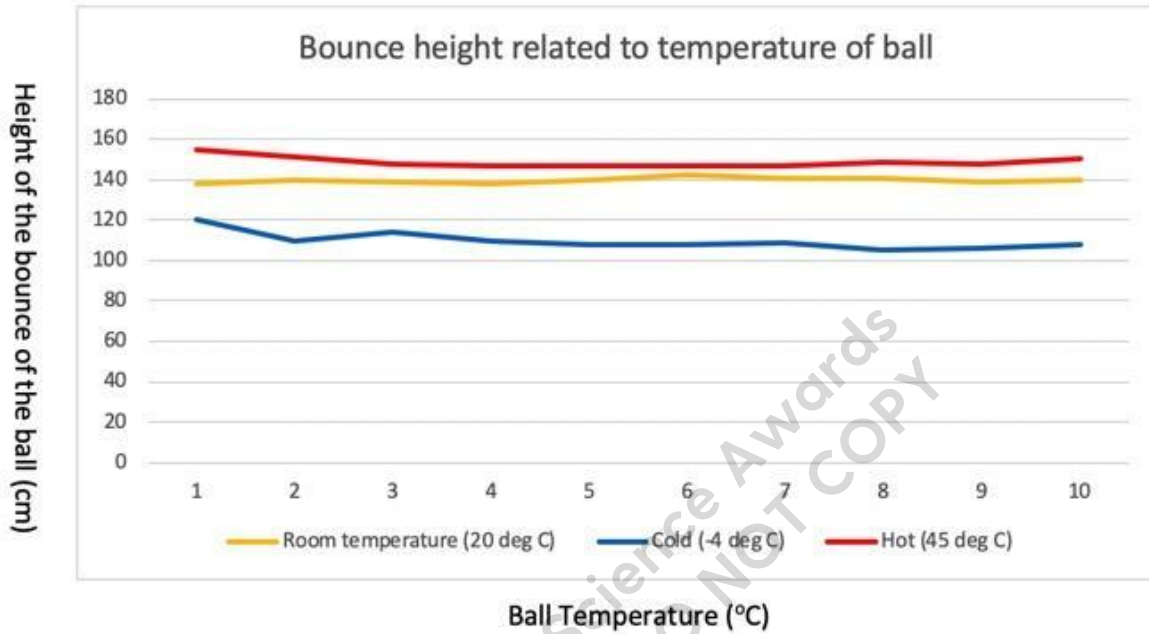
30.      10 cold  
           10 room temperature  
           10 hot

A sample table for recording my data:

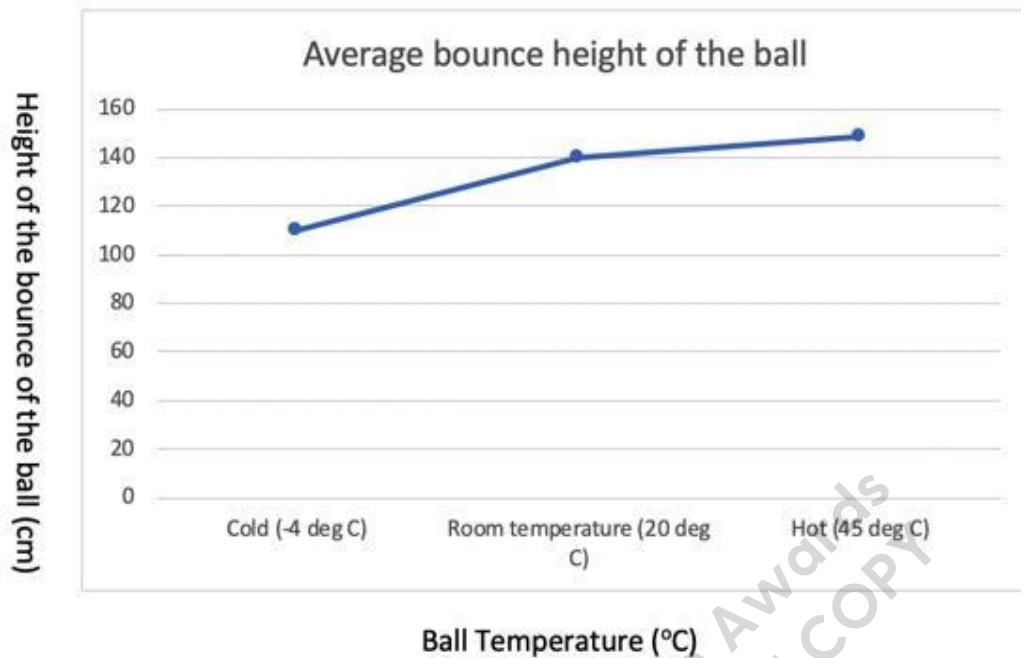
What I changed (independent variable): The temperature in Celsius	What I measured (dependent variable): The height of the bounce in centimetres										Average
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6	Trial 7	Trial 8	Trial 9	Trial 10	
<b>Cold (-4°C)</b>	120	110	114	110	108	108	109	105	106	108	<b>109.8</b>
<b>Room temperature (20°C)</b>	138	140	139	138	140	142	141	141	139	140	<b>139.8</b>
<b>Hot (45°C)</b>	155	151	148	147	147	147	147	149	148	150	<b>148.9</b>

## Graphing results

Title of graph: Bounce height related to temperature of ball







### Finding patterns in the results:

#### Data discussion

Describe what happened in your investigation by explaining the relationship(s) between the variables shown on the graph.

**My data showed the ball bounced higher or lower depending on the temperature. The hotter the temperature the higher the ball bounced. I suspect that when I heated up the ball, the air pressure inside the ball increased, which made the ball bounce higher.**

How did your data show this?

**My results show that on average a ball heated up to 45 degrees bounced 148.9cm when dropped from a height of 160cm. Whereas a cold ball cooled to -4 degrees and dropped from the same height on average only bounces 109.8cm high. The difference in bounce height between a hot ball and a cold ball is 39.1cm.**

## Evaluation

What do the results tell us about your original question?

**My results for my original question tell me that when the ball is hot it bounces higher. When it is cold it bounces lower.**

In what way was the result different to your prediction?

**My results show that my prediction that a hotter ball will bounce higher was accurate.**

Did you have any unexpected results? Why do you think these occurred?

**After reviewing my results I had ONE unexpected result which occurred with trial 1 with a cold ball. With this attempt the ball bounced 120 cm high. This measurement is 10.2 cm higher than the average height of the cold ball bounced.**

**I think it occurred because I was too slow getting the ball to the drop position. As a result the ball's temperature was probably higher than the other cold balls.**

Are your results reliable?

**My results are reliable because my experiment had a consistent method.**

**That is :**

- the ball ( I will use the same ball for all measurements).
- The pressure of the ball is pumped up to (8 PSI)
- The height which the ball is dropped from (160cm)
- The type of floor the ball is dropped onto (bamboo floorboards)
- The height of the camera filming.

**The ball was made hotter or colder for the same amount of time.**

**My results are also reliable because i did ten trials for each temperature and there wasn't much difference between the height of the bounce for each trial and the group average for that temperature.**

What improvements might you make to your experimental design?

**I could stand straighter on the ladder because it could affect how and where I drop the ball. I could also try to get to the ladder at about the same time for each attempt, so that the ball is at a consistent temperature to bounce for that group.**

### **Conclusion**

**My conclusion is that the air pressure in the ball is affected by its surrounding temperature. If you make the ball hotter the air inside expands, which increases the air pressure inside the ball, and the ball bounces higher when dropped.**

The next thing I want to know is:

**Whether different gases inside a ball will affect how high it bounces when dropped.**

To investigate this I will change:

I will measure:

<b>the different types of gases in the ball eg. helium, carbon dioxide, oxygen, and room air.</b>	<b>how high the ball will bounce.</b>
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