

MYP Science Practical – Ping-Pong Investigation

Introduction:

A Ping-pong ball is also made out of normal matter, and therefore its performance is affected by some factors. The factors that the bounciness of the ping-pong ball can be affected by is the temperature at which the ball is kept, initial height the ball is thrown from, amount of force used in order to throw the ball, the type of material the ball is made out of, the surface it is bounced on and the weight of the ping-pong ball itself. In this experiment I will be investigating one of the variables, which is the effect of temperature on the bounciness of the ball.

Aim:

To find out the effect of temperature on the bounciness of a ping-pong ball.

Hypothesis:

I think that temperature would have an effect on the bounce of a ping-pong ball. In my opinion, the ping-pong ball would bounce more higher when it is kept in cold temperatures. This is because anything kept in cold temperatures, becomes stiffer. On the other hand when something is kept in hot temperatures, it becomes loose and starts to melt. Therefore this would be also seen in a Ping-pong ball and thus I think that the colder the temperature the ball is kept in, the higher it would bounce. Some materials can face some temperatures until some extent, but as ping-pong balls are made out of plastic, they are unable to bear temperatures and thus are affected by them.

Apparatus:

5 Ping-pong Balls; 1 500ml Beakers; Thermometer; Bunsen Burner; Ice Cubes; Gauze Mat; Tongs; 1 meter ruler and Sticky Tape.

Method:

1. Take the 1m ruler and using sticky tape stick it to some strong base like a vertical standing cupboard. Make sure the ruler is facing the right way, with the 0cm mark on the floor.
2. Take a beaker and half fill it with water. Take a Bunsen burner and place a gauze mat on top of it. Then place a thermometer inside the beaker and heat the water up till 45 degrees Celsius. Then place the ping-pong ball inside the water. Then close the Bunsen burner and take the beaker off using a tong. Then try to keep the ball submerged in the water for about 5 minutes.
3. Take the ball out of the water after five minutes and holding it with a tong, throw it from the top of the ruler, from 1 meter above the ground. As soon as the ball is thrown and looks at how high it bounces back.
4. Heat the water in the beaker again until 45 degrees Celsius. Then leave it for 5 minutes and put the ball back in. Then repeat step 3 again, and note the result as try 2.
5. Repeat Step 4 again once more and note the results.
6. Then take another beaker and again half fill it with water. Then heat this water until 75 degrees Celsius and place the ball again within the water and repeat the previous steps like

done for 45 degrees Celsius. Note down all results and there should be three tries for 75 degrees Celsius also.

7. Then repeat the previous steps with 100 degrees Celsius. Therefore until now there should be results for three temperatures and for each temperatures three readings should be recorded.
8. Take a beaker and fill it half way with ice cubes. Then place the ping-pong ball and a thermometer into the beaker.
9. Then take more ice and add it over the thermometer and ping-pong ball. Then after the thermometer reads 0 degrees Celsius leave it for five minutes.
10. Then take the ping-pong ball out of the beaker and throw it from 1 meter and measure how high it bounces. Do this three times.
11. Then take another ping-pong ball and just leave it at room temperature (25 degrees Celsius) for five minutes. Then bounce it from 1 meter and check how high it bounces back. Do this three times and record each reading.

Results:

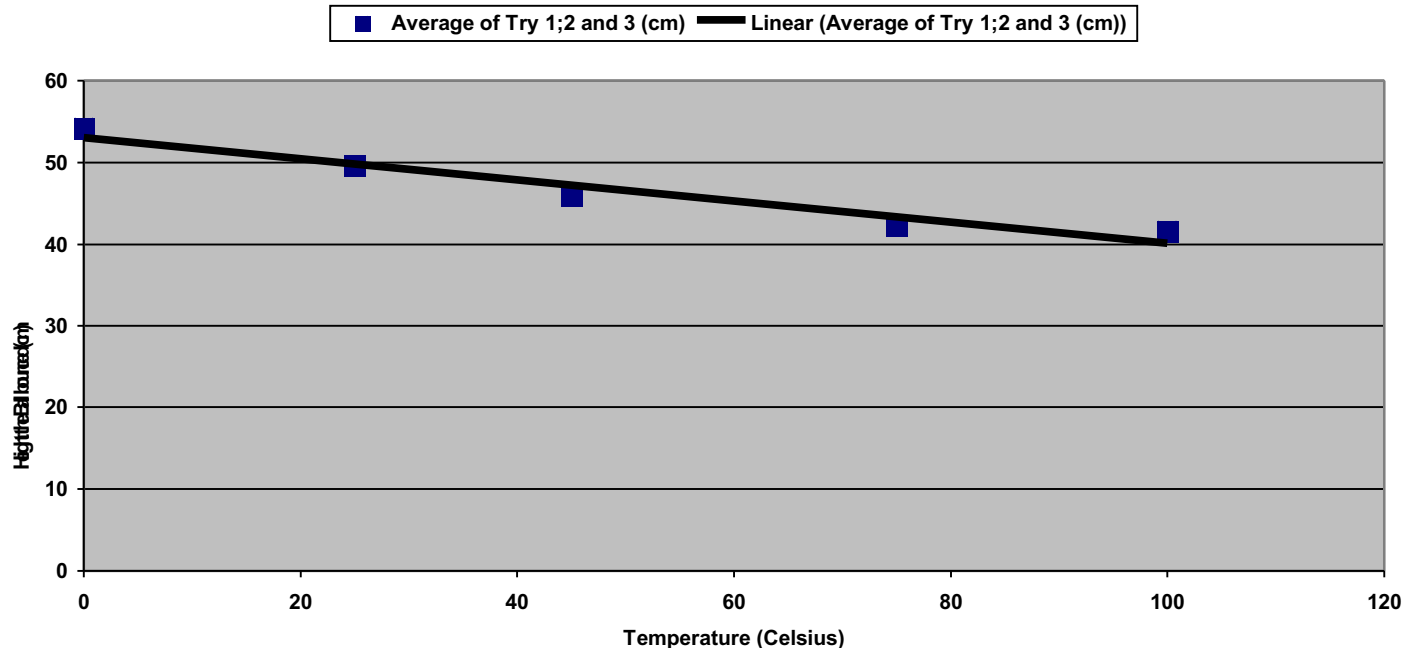
Temperature (Degrees Celsius)	The Height of the ball bouncing back (cm) Try 1	The Height of the ball bouncing back (cm) Try 2	The Height of the ball bouncing back (cm) Try 3
0	54	56	53
25	48	50	51
45	45	47	46
75	43	43	41
100	42	40	43

Temperature (Degrees Celsius)	Average of Try 1;2 and 3 (cm)
0	54.3
25	49.6
45	46
75	42.3
100	41.6

Data Analysis:

From the graph below we can see a scatter graph that compares the temperature with the average of the height of the ball bouncing. From the graph we can see a existing relationship between both the factors. As the temperature increases the height that the ball bounces decreases. From the best-fit line, we can see that the height of the ball bouncing will keep dropping as the temperature increases.

The Height the Ball Bounced in Specific Temperatures



Conclusion:

From the graph above, and the data analysis it can be concluded that my hypothesis was correct. I had earlier predicted that as the temperature would be decreased the height of the bounce of the ping-pong ball would increase. There is a confirmed relationship between the two variables and I have sufficient evidence to support my ideas.

So the reason why these results have come up is quite simple. As the ball is kept in cold temperature, the particles inside the object come close together and thus become harder. On the other hand when the ball is kept in hot temperatures, the particles inside the ball matter start to move faster and move apart from each other. This therefore makes the ball expand into a egg shape. The ball is made out of plastic. So therefore when the ball is heated or kept in hot temperature it makes the plastic expand. When the plastic expands the layer becomes thin and therefore turns soft and therefore bounces less. At room temperature, the particles in the ball are at normal state and therefore that can be said as the neutral point of the particles.

This ping-pong investigation is not picked out of the air, but has some purpose behind it. The results we have retrieved from this experiment can be used in our daily life, and is already being used in many sports around the world. Before games, some balls like games using ping-pong balls are kept in the fridge in order to give the game some extra touch and to give the ball more bounce. The effect the ball is under has serious effects on the game, especially where the ball bounces and how far it goes. But some games, like baseball, cricket does not need these things to be done to the balls. This is because the balls they use have different materials, and therefore temperature doesn't have a huge effect on the way the balls react.

Errors:

The results from this experiment overall seem reliable and accurate as the procedure which I have followed is quite accurate and perfect. But it is possible that there could have been some errors, which we couldn't avoid, or did by mistake. These are as listed below:

1. The height the ball was thrown from could have been incorrect. Thus if it was thrown from a higher position it would have bounced back higher and thus giving incorrect results.
2. The reading taken of where the ball bounced back to the specific height could be wrong and thus having incorrect results.
3. The temperature reading taken could be wrong and thus the ball's performance might not have actually changed.
4. After the ball was taken out of the specific temperature, the temperature of the ball could have changed and thus giving incorrect results.
5. As the ball was placed in the hot water, as the ball was made out of plastic, it could have changed its form, and become more looser and thus resulting in a lower bounce result.
6. To have the ball floating above water would have altered the results as only half of the ball is being affected due to that temperature, while the other side would have a different temperature.

Improvements:

The experiment and the procedure could be improved by:

- (for error 1) the ball could be kept right next to the ruler in order to get more accurate results
- (for error 4) after the ball was taken out of the specific temperature it could be quickly dropped. Therefore a more smart idea would be to have the 1 meter ruler quite close to the temperature place.
- (for error 5) instead of keeping the ball in hot water for a longer time, the time could be reduced in order to avoid the shape of the ball changing.
- (for error 6) try the maximum to keep the ball inside the water, as this would affect all sides of the ball and have more accurate results.

Errors 2, 3 cannot be improved on as they require taking readings. Taking readings can never be perfect and thus these errors cant be avoided. These errors cant be avoided by doing the experiment again or even changing the procedure as it is almost impossible to remove all possible sources of errors because there is always some source of human error and no instrument can be so perfect to give 100% accurate results.

Extension:

The experiment could be extended in the following methods, which are listed below:

- By testing out more variables. Therefore rather than only testing temperature, more variables which are written in the introduction can be used to test the effect of the variables on a ping-pong ball.
- By further developing the temperature experiment. By extending the experiment, we would have to consider the errors more carefully and try to follow the improvements. Then we could also have more temperature variables. Also we could have more tries and the ball could be thrown from different height in order to see the effects.