Deflategate Presentation

Group #3

Claim

The change in temperature recorded in Wells report could not have accounted for the lower than regulation psi of the Patriot's balls recorded by NFL officials.

Evidence

The temperature on the field at half time was 50 degrees Fahrenheit. Since the temperature of the balls was not measured when psi was taken we took the average on field and locker room temperature which was calculated at 60 degrees Fahrenheit. Blakeman's average recorded psi in the locker room for the Patriots’ balls came to 25.81 psi. Prioleau average psi was measured at 26.2 psi.

Table

Temperature and Volume at Deflategate

Ball Number	Initial Temp F	Final Temp F	*Initial Temp K*	*Final Temp K*	*Initial P (psi)*	Final P (psi)
Blakeman 10	67	48	292.5944444	282.0388889	26.14313235	25.2
Blakeman 7	68	49	293.15	282.5944444	27.54170386	26.55
Blakeman 7 (2)	69	50	293.7055556	283.15	27.53975808	26.55
Average Blakeman	71	61	294.8166667	289.2611111	26.30570745	25.81
Average Blakeman (2)	69	72.5	293.7055556	295.65	25.64025161	25.81
Average Prioleau	71	61	294.8166667	289.2611111	26.7031978	26.2
Colt Average	71	61	294.8166667	289.2611111	27.72240383	27.2

In the spreadsheet, the italicized columns are dependent variables, and we manipulated the three underlined columns. The temperatures are converted to Kelvin from Fahrenheit. The final pressures come from the recorded data in the Wells report. The remaining variable, initial pressure, is calculated through a rewrite of Gay-Lussac's law, P2 = (P1/T1) * T2.

Important Points

Ball Number	Initial Temp F	Final Temp F	*Initial Temp K*	*Final Temp K*	*Initial P (psi)*	Final P (psi)
P10	67	48	292.5944444	282.0388889	26.14313235	25.2

This point uses the lowest recorded psi for the patriots, an initial temperature of 67, and a final temperature on the field of 48. Using this, the initial pressure would be 26.1 psi. This demonstrates that even if the balls had been measured on the coldest possible field temperature, the ball with the lowest pressure would still have had an initial temperature below the accepted range.

Important Points

Ball Number	Initial Temp F	Final Temp F	*Initial Temp K*	*Final Temp K*	*Initial P (psi)*	Final P (psi)
Average Blakeman	71	61	294.8166667	289.2611111	26.30570745	25.81

We chose a final temperature that is the average of the temperature on the field and the temperature in the room where psi was measured. We picked the highest initial temperature. The psi was the average psi that Blakeman measured. All of this would have accounted for an initial pressure of 26.3 psi.

Average Prioleau	71	61	294.8166667	289.2611111	26.7031978	26.2

Using the data from the other referee yields similar results.

The reason we chose to use 61 is because it is the average of the field temperature during halftime and the temperature where the balls were measured. We know that the balls would adjust to the temperature of the room at a certain point, but to put it in the Patriots' favor, we chose an average that would imply the balls had not fully adjusted to temperature yet. We can't calculate for sure the exact temperature at which the balls were measured because we don't know how to perform calculations of heat loss.

Important Points

We used the same temperature conditions as the previous slide.

- Final temperature = average of field conditions and room where it was measured
- Highest initial temperature

This time, we used the average temperature of all the Colts' balls. The initial temp using Gay-Lussac's law would be

Ball Number	Initial Temp F	Final Temp F	*Initial Temp K*	*Final Temp K*	*Initial P (psi)*	Final P (psi)
Colt Average	71	61	294.8166667	289.2611111	27.72240383	27.2

Reasoning

Reasoning

Using Gay-Lussac's law, the initial pressure divided by the initial temperature, in Kelvin, will equal the final pressure divided by the final temperature. The linear relationship with pressure and temperature and keeping the moles and volume the same has an equal slope that can be used to find a missing value including the initial temperature. The decrease in temperature from initial to final will increase the pressure from initial to final, making a larger initial pressure. The use of Gay-Lussac's law is only applicable because the air is assumed to be an ideal gas. Ideal gases have no particle interaction and the particles do not take up a significant volume. Additionally, any change in pressure could not be a result of heavy forces during football, as demonstrated in the Wells report. The report showed that the humidity of the room and natural leak rate was negligible, so moles would be constant. The volume of the balls was constant as well. Thus, Gay-Lussac's law can be applied since all of the other crucial factors appear to be constant. Meaning the patriots had to of under inflated their balls due to initial pressures (found by Gay-Lussac's law) in the footballs being lower than the acceptable pressures of 27.2-28.2. It is not conclusive that all of the balls were surely under inflated, partially because we don't know the exact temperature at which they were measured. However, our data shows that even if the environmental change was enough o significantly impact inflation, at least some of the balls were initially under regulation.

Reasoning

Our data shows…
The regulation psi for an American football is 27.2 psi to 28.2 psi. There is a 1.0 psi amount of leeway to have the footballs inflated at.

Summary
To summarize, we used Gay-Lussac's law to calculate the initial pressures of the footballs given the final pressure. We used several data points for thoroughness, even hypothetical situations that would favor a strong environmental impact. Despite all this, it is clear that some of the Patriots' balls were under inflated, while the Colts' balls met regulatory standards.