

# Deflategate

Student Group #1

# Claim

The environmental conditions of the day were not significant enough to deflate the Patriots' footballs to their halftime pressure.

# Patriots' Evidence

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

$$P_1 = 27.2 \text{ psi}$$

$$T_1 = 294.8 \text{ Kelvin}$$

$$T_2 = 282 \text{ Kelvin}$$

$$\frac{27.2}{294.8} = \frac{P_2}{282}$$

$$P_2 = 282 \cdot \frac{27.2}{294.8}$$

$$P_2 = 26$$

25.80 psi (average Ref 1)

26.19 psi (average Ref 2)

25.20 psi (lowest Ref 1)

25.60 psi (lowest Ref 2)

In our calculations we used the highest initial temperature and the lowest on the field temperature to yield the greatest possible difference in pressure. We calculated the lowest possible pressure change to be 1.2 psi. The Patriots' footballs on average with Ref #1 had a greater change in psi of 1.4. Ref #1's greatest change in pressure was 2 psi. This suggests an external force other than the environment caused this pressure change.

# Colts' Evidence

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

$$P_1 = 27.7 \text{ psi}$$

$$T_1 = 294.8 \text{ Kelvin}$$

$$T_2 = 282 \text{ Kelvin}$$

$$\frac{27.7}{294.8} = \frac{P_2}{282}$$

$$P_2 = 282 \cdot \frac{27.7}{294.8}$$

$$P_2 = 26.5$$

27.30 psi (average Ref 1)

27.10 psi (average Ref 2)

27.20 psi (lowest Ref 1)

26.85 psi (lowest Ref 2)

In our calculations we used the highest initial temperature and the lowest on the field temperature to yield the greatest possible difference in pressure. We calculated the lowest possible pressure change to be 1.2 psi. The Colts' footballs on average with Ref #1 had a smaller change in psi of .4 psi. Ref #1's greatest change in pressure was .5 psi. This suggests an external force other than the environment was not present.

# Reasoning

The results of Experiment were based on the following assumptions-

- ▶ For the volume of a football from the pressure range of 25.2 - 28.2 volume is constant at 4.24 L. Volume and moles are proportional therefore both remain constant.
- ▶ The reasoning above allows us to use Gay-Lussac's Law ( $P_1/T_1 = P_2/T_2$ ) to calculate the theoretical psi for the footballs used for each team.
- ▶ The Patriot's and Colt's footballs were under the same environmental conditions.
- ▶ The 13.5 minutes the Patriot's footballs were inside before measurement had a negligible impact on their psi.

# Reasoning

The Patriot's and Colt's balls were both experiencing the same environmental conditions, and the Patriot's change in psi was consistently higher than the Colt's change in psi. In addition, the Patriot's change in psi was consistently higher than the theoretical possible amount of change (due to the environment) in psi (theoretical change=1.2psi, Patriot's average change=1.4psi). Therefore, this suggests that there was tampering with the balls before the game to achieve this deflation.