The Rugby Ball Problem

Gabriel Labaigt

Oval Ball official characteristics

Official rugby ball specs by World Rugby :

- Length :

  580 mm < L < 620 mm

- Small perimeter :

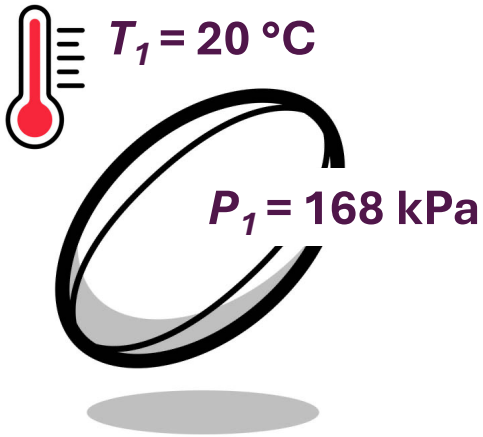
  280 mm < p < 300 mm

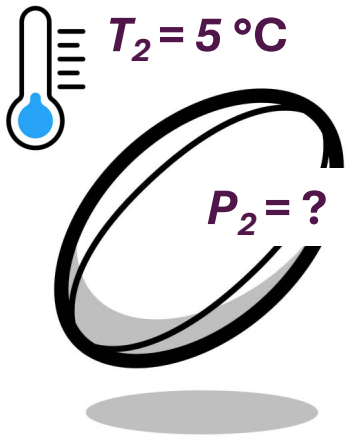
- Pressure :

  167 kPa < P < 170 kPa

Problem

Before a rugby game in winter,
should the ball be inflate **inside** or **outside** ?





Does the pressure of the ball still meets World Rugby standards ?

Modeling

Hypothesis :

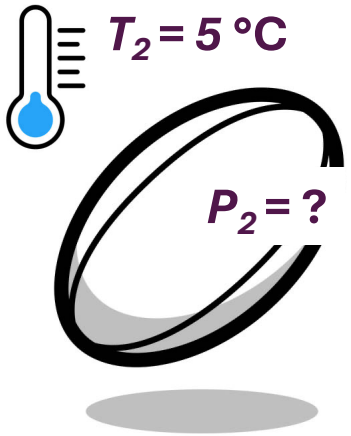
- The gas inside the ball is **ideal.**
- The volume of the ball is **constant.**

Ideal gas equations :

$$P_1V = nRT_1 \text{ and } P_2V = nRT_2$$

Pressure outside :

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



Modeling and solution

Hypothesis :

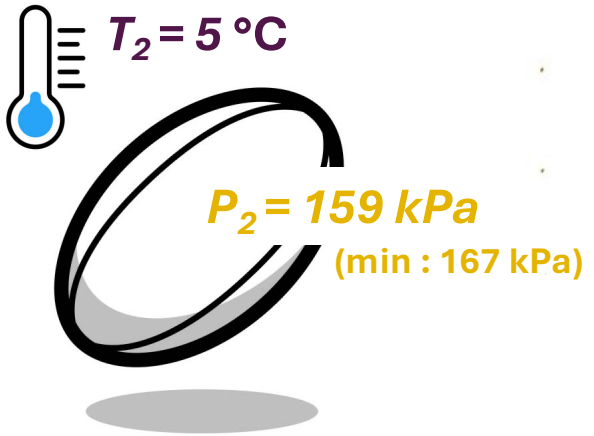
- ❖ The gas inside the ball is **ideal.**
- ❖ The volume of the ball is **constant.**

Ideal gas equations :

$$P_1V_1 = nRT_1 \text{ and } P_2V_2 = nRT_2$$

Pressure outside :

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



Conclusion : The ball must be re-inflated