

What air is made of and why it presses

Grade 7 science (Year 8 · Class 7) · Lab

Name: _____ Date: _____ Class: _____

Can we weigh air? In this lab you add measured amounts of air to a football with a hand pump and watch the mass on a sensitive scale. The results let you calculate the mass of air in one stroke and the volume of air the pump moves.

Level: Grade 7 science (Year 8 · Class 7) · **Curriculum:** MS-ESS2-5

Aim

To show that air has mass, to find the mass added by each stroke of a hand pump and to estimate the volume of air in one stroke.

Equipment

- A football or volleyball with a valve, deflated
- Hand pump and needle adaptor
- Digital scale reading to 0.1 g
- Notebook and pen for a results table

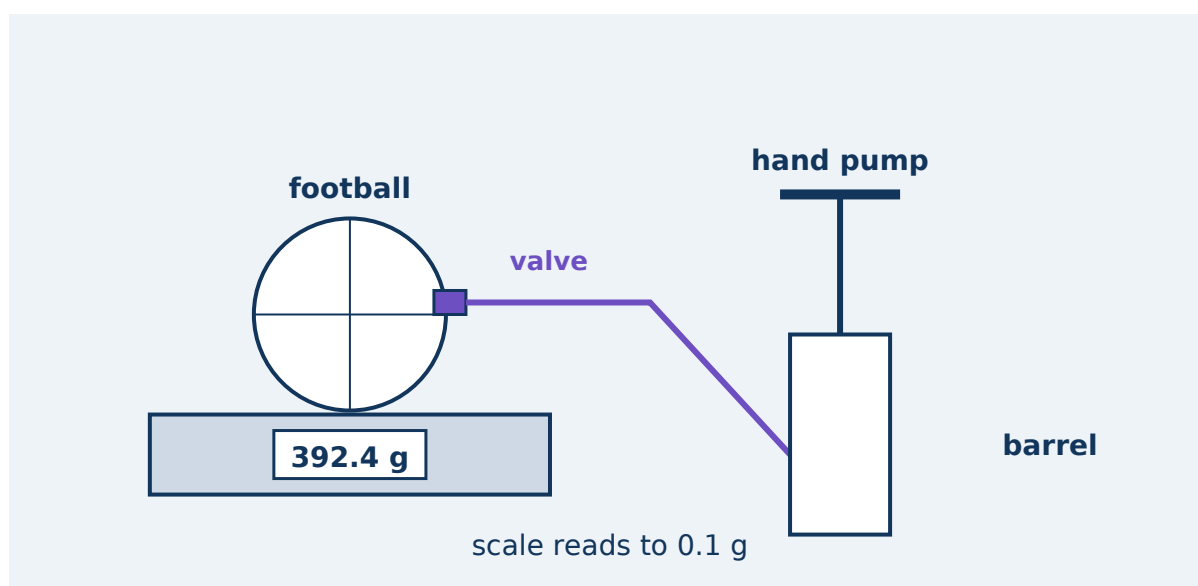
Safety

Safety

Do not over-inflate the ball, because it can burst and the valve can pop out. Keep your face away from the valve and the pump hose, and stop pumping if the ball feels very hard.

Method

1. Let all the air out of the ball. Place it on the scale and record the mass.
2. Connect the pump. Give exactly 10 full strokes and disconnect the pump immediately.
3. Place the ball on the scale again and record the mass.
4. Repeat steps 2 and 3 until you have done 40 strokes in total.
5. Plot a graph of mass against the number of strokes.



Set-up for adding air to a ball and weighing it.

Results

Sample measurements:

Total pump strokes	0	10	20	30	40
Mass of ball (g)	392.4	398.5	404.2	410.4	416.3

Analysis questions

Question 1 Total gain

Calculate the total increase in mass after 40 strokes.

Question 2 Mass per stroke

Calculate the mean mass added by one stroke.

Question 3 The graph

Describe the graph of mass against strokes and state its gradient.

Question 4 Volume of one stroke

The density of air is 1.2 g per litre. Calculate the volume of air added by one stroke.

Question 5 Prediction

Predict the mass of the ball after 60 strokes.

Question 6 Sources of error

Suggest two reasons why the mass gained may be smaller than expected.

Question 7 Conclusion

State what the investigation shows about air.

Question 8 Better method

Describe one change to the method that would make the mass gain of each stroke more precise.