

26. Balloon pressure

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26. Balloon pressure

Determine the **pressure** of **air** inside **inflated** balloon.

Theoretical background

$$F_a - G = F$$

F_a - Archimedian force

G - gravitational force

F - measured weight

$$V = \frac{4}{3}\pi R^3$$

R - radius of the balloon

$$\rho g V - m g = m' g$$

ρ - density of air in the room

g - acceleration on Earth surface

V - volume of the balloon

m - mass of the balloon+air

m' - mass from the measurements

Theoretical background

$$m = m_a + m_b$$

m_b - mass of uninflated balloon

m_a - mass of air in the balloon

$$p = \frac{nRT}{V}$$

p - pressure in the balloon

R - universal gas constant

T - temperature of the air

$$n = \frac{m_a}{M_r(\text{air})}$$

n - number of moles

m_a - mass of air in the balloon

$M_{r(\text{air})}$ - molar mass of air

$$R = 8.31$$

$$T = 300 \text{ K}$$

$$M_r(\text{gas}) = 29 \text{ g/mol}$$

Experimental setup

- ✓ Latex balloons (4 different sizes)
- ✓ Digital scale
- ✓ Tape measure



Experimental procedure

- ✓ Measure radius of the balloon



$$l = 2\pi R$$

l - circumference

R - radius of the balloon

Experimental procedure

- ✓ Measure mass of the balloons



No	Mass of uninflated balloon
1	0.74
2	0.79
3	0.79

- ✓ Average mass: 0.77 g

Experimental procedure

- ✓ Measure mass of the balloons



N (balloon)	1	2	3	4
mass measured	0.79	0.63	1.08	0.98
	0.81	0.73	1.09	0.96
	0.82	0.65	1.03	0.91
	0.74	0.64	0.97	
	0.78		0.99	
average	0.788	0.6625	1.032	0.95

Data analysis

✓ Defining the pressure

mass of air	0.018	-0.1075	0.262	0.18
number of moles	0.00062069	-0.00371	0.009034	0.006206897
pressure	18338.7486	-37645.6	58964.99	27976.50881

Errors

- ✓ Measure mass of the balloons
- ✓ Assume the balloon as a sphere

Conclusion

- ✓ We determined average pressure, but there were significant sources of error

35093.41441 Pa

Thank you!