

# Ideal gas law

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## Identification page

**Instructions:** Print this page and the following ones before your lab session to prepare your lab report. Staple them together with your graphs at the end. If you forgot to print it before your lab, you can reproduce it by hand but you have to follow the exact format (same number of pages, same items on each page, same space to answer question).

Complete all the identification fields below or 10% of the lab value will be deducted from your final mark for this lab.

For in-lab reports, hand in your report to your demonstrator at the end of the sessions or you will receive a zero for this lab.

For take-home reports, drop your report in the right box or 10% of the lab value will be deducted from your mark. Refer to the *General information* document for the details of the late report policy.

Experiment title: Ideal gas law

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Name: \_\_\_\_\_

Student number: \_\_\_\_\_

Lab group number: \_\_\_\_\_

Course code: PHY

Demonstrator: \_\_\_\_\_

Date of the lab session: \_\_\_\_\_

Partner's name: \_\_\_\_\_

## Data sheet

**Instructions:** This lab report is due at the end of the lab session. We recommend completing the [Data sheet](#) before starting the [Questions](#) section.

### Part 1 - Pressure vs. temperature (constant volume and constant number of molecules)

- [4] Prepare Graph 1. Submit it online before the end of the lab session.

### Part 2 - Pressure vs. volume (constant temperature and constant number of molecules)

- [0.5] Record the room temperature.

$$T_{\text{room}} = ( \quad \pm \quad )$$

- [2.5] **Table 1 – Pressure in a syringe as a function of the increasing and decreasing volume**

		Increasing $V$ from 10 mL to 20 mL		Decreasing $V$ from 20 mL to 10 mL	
$V$	$1/V$	$P$	$\Delta P (\pm 0.25\%)$	$P$	$\Delta P (\pm 0.25\%)$
(mL)	(1/L)	(kPa)	(kPa)	(kPa)	(kPa)
20					
18					
16					
14					
12					
10					

- [4] Prepare Graph 2. Submit it online before the end of the lab session.

**Part 3 - Pressure vs. number of molecules (constant volume and constant temperature)**

[1] **Table 2 – Pressure in a volume of 10 mL as a function of the number of *puffs* of air**

$n$	$P$	$\Delta P (\pm 0.25\%)$
( <i>puffs</i> )	(kPa)	(kPa)
1		
2		
3		
4		
5		
6		

[4] Prepare Graph 3. Submit it online before the end of the lab session.

## Questions

### Part 1 - Pressure vs. temperature (constant volume and constant number of molecules)

- [1] According to your results, explain how  $P$  varies with  $T$ .

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- [2] Is it correct to state that the pressure is proportional to the Celsius temperature scale? i.e., does doubling the temperature in  $^{\circ}\text{C}$  produces a doubling of the pressure?

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- [2] Use the results from your fit to determine the temperature at which the pressure of the gas should drop to zero (no need for uncertainty calculations). Discuss.

**Part 2 - Pressure vs. volume (constant temperature and constant number of molecules)**

- [1] According to your results, explain how  $P$  varies with  $V$ .

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- [3] Assuming that air is an ideal gas, calculate the theoretical number of moles of gas you had in your syringe when you started with a volume of 10 mL (no need for uncertainty calculations). Repeat for the volume of 20mL.

- [3] Using the results from your linear fits in Graph 2, calculate how many moles of gas you had in your syringe during both parts (from 10 to 20 mL and from 20 to 10 mL) of this experiment. Calculate the percentage differences with the theoretical values from the previous question.

- [2] Can you explain if there is any difference in your results obtained from the two methods (10 to 20 mL) or (20 to 10 mL)?

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- [4] Prepare Graph 2. Submit it online before the end of the lab session.

**Part 3 - Pressure vs. number of molecules (constant volume and constant temperature)**

- [1] According to your results, explain how  $P$  varies with  $n$ .

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- [2] Why did you always bring the piston back to 10 mL in this part of the experiment?

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**Conclusion**

- [2] Can we consider air as an ideal gas? If not, why? If so, under what conditions?

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Total : \_\_\_\_\_ / 35 (for the report and graphs)