

PHYSICS

TASK 1: GAS PROPERTIES

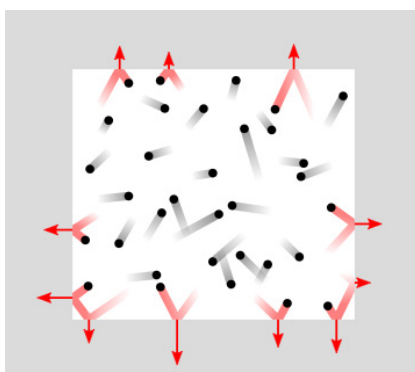
STUDENT'S VERSION

TIME ALLOCATION

A maximum of **50 minutes** in total are required for carrying out the performance task. It is suggested that you should spend 5-10 minutes to tidy up your written work and the work space.

INTRODUCTION

Gases expand or contract when temperature changes. When a gas is confined in a sealed container so that change in volume is forbidden, it will result in a change of quantity called "pressure". In this task, you are going to investigate how gas pressure changes with temperature.



(Source: Wikipedia/Pressure)

MATERIALS & APPARATUS



Figures: (left to right) Metal can for pressurised gas, the pressure gauge and heat bath.

MATERIALS & APPARATUS (CONT.)



A sealed can fitted to a pressure gauge

- Sealed metal bottle attached to a pressure gauge:
 - For desirable results, soft drink cans are not appropriate for the experiment as they change shape on different temperatures. Thicker aluminum cans are more appropriate for the experiment and they are largely available online at affordable price.
 - The pressure gauge should have a range from -0.1MPa to $+0.06\text{MPa}$. Pressure gauges sold from online stores are also workable in this activity.
 - Screws might be needed to connect the pressure gauge to the sealed metal bottle.
- Self-fusing pipe repair tape (for sealing metal bottle). The sealing of can is the most crucial part of the task.
- Hot water (50 to 90 degree Celsius), ice, dry ice (Optional), thermometers (steel spring type preferred)
- Calculator, graph paper, ruler, pencil, blank paper
- Sticky tape, eraser, two plastic buckets
- 1 vacuum flask with dry ice (optional),
- Warm water in heat bath (50 degree Celsius), hot water in heat bath (80 degree Celsius)
- Magnifying lens, timer
- Heat insulating gloves, plastics bags
- Cleaning cloths or tissue.

PRECAUTIONS

1. Please be careful when handling hot water and dry ice (if any). **Do not touch the metal can with hot water or dry ice with a bare hand.**
2. Handle containers (Glass and bottle with hot water/dry ice) **with care.**
3. Please keep the work area **clean and tidy** throughout the experiment.

QUESTIONS

Feel free to use any given stationery if you find helpful.

Converting table in Reading from the pressure gauge to True pressure

<i>Reading from the pressure gauge</i>	0	+0.01	+0.02	+0.03	+0.04	+0.05
<i>The true pressure (in atm*)</i>	1 atm	1.1 atm	1.2 atm	1.3 atm	1.4 atm	1.5 atm

<i>Reading from the pressure gauge</i>	0	-0.01	-0.02	-0.03	-0.04	-0.05
<i>The true pressure (in atm*)</i>	1 atm	0.9 atm	0.8 atm	0.7 atm	0.6 atm	0.5 atm

*Atm is a unit represents Atmospheric Pressure

1. Read the reading from the pressure gauge before the experiment. The pointer of the pressure gauge roughly pointed to zero. What is the **real** pressure?

2. What is the relation between pressure and temperature?

QUESTIONS (CONT.)

3. Suppose P_1 is the pressure when the metal bottle was dipped into water with temperature T_1 , and P_2 is the pressure when the metal bottle was dipped into water with temperature T_2 . Student A claimed that
- “If the metal bottle was dipped into water with temperature between T_1 and T_2 , the resultant gas pressure would be between P_1 and P_2 ”.
- Do you agree with the statement? Explain your answers briefly.
4. Student B claimed that the pressure would drop to zero when the temperature of the sealed bottle is extremely low. Do you agree? Explain your idea briefly.
- a. Agree
- b. Disagree, what is your reasoning?
5. How would you figure out if there was any air leaking from the metal can?
6. Discuss any source of error of this experiment.

QUESTIONS (CONT.)

7. Do you have any suggestion of improvement to this experiment?

8. Can you suggest as many as possible real-life examples that make use of the observed relationship between pressure and temperature?

REMARKS

All the draft work will be collected and assessed.