

## 6.1 Gas models and absolute temperature

Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

Total: 10 marks

**KEY WORDS** absolute temperature • ideal gas

### Objective

Gas models and absolute temperature. Supported SL concept preparation; original classroom practice, not an official IB paper or assessed learner work.

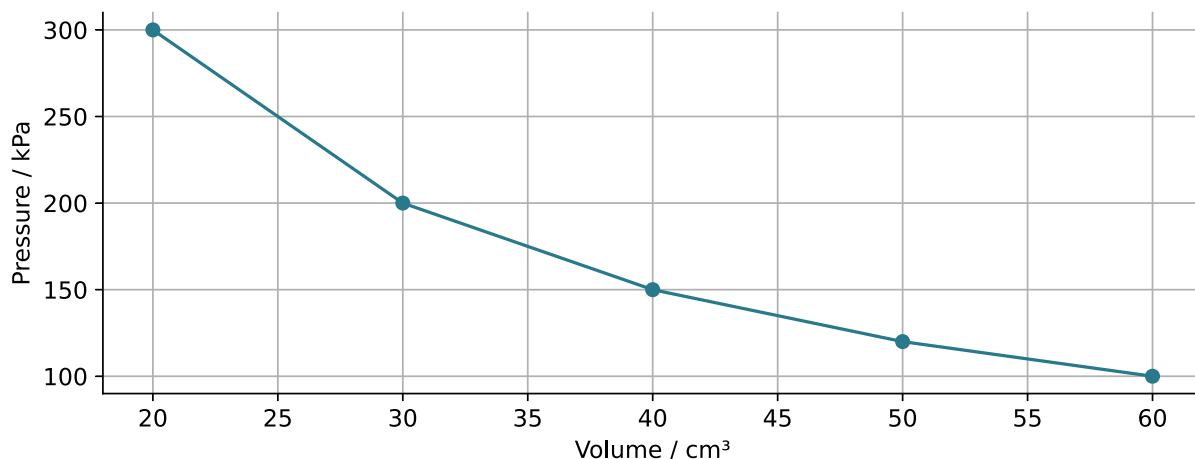
### 1 Key knowledge and worked examples

#### ■ What would explain this observation?

- A sealed gas container changes pressure when heated. Celsius ratios cannot predict the pressure change because the gas model uses **absolute temperature**.
- Start with a prediction. State the quantities or features you would compare, then decide what evidence could distinguish two explanations.

#### ■ Build the model

- In a gas model, particles move randomly and pressure results from momentum transfer at walls. The **ideal gas** equation connects pressure, volume, amount and absolute temperature.
- absolute temperature: Temperature on the kelvin scale; ideal gas: A gas model with specified simplifying assumptions.



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### ■ Choose evidence that can test it

- At fixed amount and volume, pressure is proportional to kelvin temperature. At fixed temperature and amount, pressure is inversely proportional to volume. State which quantities are fixed before choosing a relationship.
- Use approved apparatus with a temperature range and pressure limit set by the teacher. Allow thermal equilibrium and record pressure against kelvin temperature. Never heat an improvised sealed vessel.

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### ■ Work from known quantities

- State the known values and their units. Choose the relation because its assumptions fit this case, then rearrange before substitution.
- Known: pressure is 100 kPa at 300 K, with fixed volume and amount. At 330 K,  $p_2/p_1 = T_2/T_1$ .  $p_2 = p_1 T_2/T_1 = 100 \times 330/300 = 110$  kPa. A 30 °C rise is a 30 K change, but the temperature ratio must use kelvin.

### Example:

At fixed volume, pressure is 120 kPa at 300 K. Find pressure at 350 K. Use the same sequence: known quantities → model → relation → substitution → unit and interpretation.

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### ■ Check the conclusion and its limits

- An ideal gas is a model with conditions of validity. Celsius zero is not zero molecular motion, and internal energy is not determined by pressure alone.
- Return to the original observation. Explain what the result supports, which conditions it assumes, and one way to test a competing explanation.

### Warn:

A gas pressure ratio can always use Celsius temperatures. This claim is false: An ideal gas is a model with conditions of validity. Celsius zero is not zero molecular motion, and internal energy is not determined by pressure alone.

### Key:

Gas models and absolute temperature: At fixed amount and volume, pressure is proportional to kelvin temperature. At fixed temperature and amount, pressure is inversely proportional to volume. State which quantities are fixed before choosing a relationship.

## 2 Practice

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**2.1** Which scale belongs in a gas-law temperature ratio? Choose one answer.

- **A** Celsius
- **B** Kelvin
- **C** Either scale without conversion

[1]

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**2.2** At fixed volume, pressure is 120 kPa at 300 K. Find pressure at 350 K. Show the relation, substitution and units.

[2]

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**2.3** Decide whether this claim is true and justify: A gas pressure ratio can always use Celsius temperatures.

[2]

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**2.4** Temperature on the kelvin scale: write the technical term.

[1]

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### 3 Exam-style questions

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**3.1** An ideal gas changes from  $300\text{ K}$ ,  $100\text{ kPa}$ ,  $V$  to  $450\text{ K}$  and  $2V$  at fixed amount. Find pressure. Explain why using only a temperature ratio would fail. [4]

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