

YEAR 2 | MODULE 5 | PACK 03

Ideal-gas laws and experiments

Official past-paper questions

2017-2023 | OCR A H556 | 5.1.4(a),(d); links to 5.1.1

26 marks | 4 question entries

One practice session

Use: attempt the session after learning its content. Try without notes; record any help used. Mark the session, identify the reason for lost marks, then revisit those questions after a few days.

Format: all MCQs appear first with their complete answer boxes. Written extracts retain the original paper's answer space. Only the subparts named in the source reference are assigned.

Reserved: all 2024 and 2025 papers are excluded. These files contain official examination questions only; no sample, specimen or practice papers.

Name: _____

First attempt: _____ Score: _____ / 26

[Official data, formulae and relationships booklet](#)

Question index

TP identifiers are stable across the question packs and mark schemes; Q numbers refer to this pack.

Question / source	Marks	Page
Q01 TP04	1	3
June 2018 H556/01 Q14		
Q02 TP25	5	4
June 2019 H556/03 Q1(a)-(b)		
Q03 TP27A	4	6
November 2020 H556/01 Q21(a)		
Q04 TP18BE	16	7
June 2017 H556/01 Q17(b)-(e)		

Q01 | TP04

1 mark

June 2018 | H556/01 | Q14

- 14** The volume of one mole of an ideal gas is V . The gas exerts pressure p and has thermodynamic temperature T .

Which of the following has the units $\text{J mol}^{-1} \text{K}^{-1}$?

A pV

B $\frac{p}{T}$

C $\frac{V}{T}$

D $\frac{pV}{T}$

Your answer

[1]

Q02 | TP25

5 marks

June 2019 | H556/03 | Q1(a)-(b)

- 1 A toy rocket is made from a 1.5 litre plastic bottle with fins attached for stability.

The bottle initially contains 0.30 litres of water, leaving 1.2 litres of trapped air at a temperature of 17°C .

A pump is used to increase the pressure of the air within the plastic bottle to $2.4 \times 10^5 \text{ Pa}$ at the start of lift-off.

Fig. 1.1 shows the rocket at the start of lift-off.

1 litre = 10^{-3} m^3

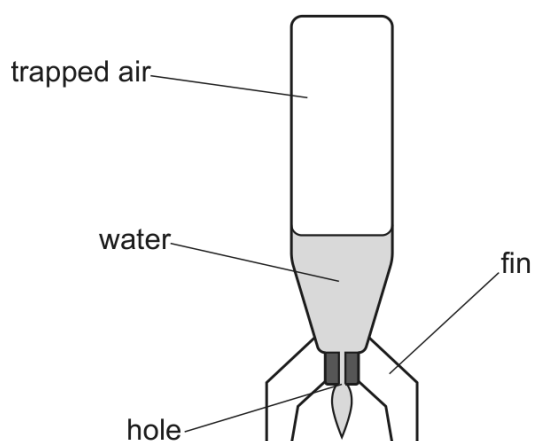


Fig. 1.1

- (a) Calculate, in moles, the amount of trapped air in the bottle at the start of lift-off.

amount of air = ... mol [2]

Only (a) and (b) are assigned; the mechanics parts (c) and (d) are omitted.

Q02 | TP25 - continued

5 marks

June 2019 | H556/03 | Q1(a)-(b)

- (b) The trapped air pushes the water downwards out of the hole, causing the rocket to rise. The temperature of this air remains constant.

Calculate the final pressure of the trapped air just before all the water has been released.

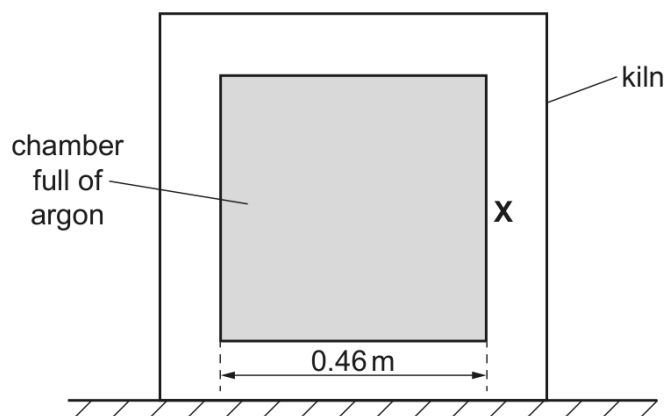
final pressure = ... Pa [3]

Q03 | TP27A

4 marks

November 2020 | H556/01 | Q21(a)

- 21 A kiln used to harden ceramics is shown below.



The internal chamber is a cube. Each side of this cube has length 0.46 m. The chamber is sealed and full of argon. Argon behaves as an ideal gas.

- (a) The kiln is initially at 20 °C.
The argon in the kiln has an initial pressure of 100 kPa.
- (i) Calculate the amount of argon n in the chamber in moles.

$n = \dots\dots\dots$ mol [2]

- (ii) The temperature of the kiln is increased from 20 °C to 1300 °C.

Calculate the pressure in kPa at 1300 °C.

pressure = $\dots\dots\dots$ kPa [2]

Only (a)(i)-(ii) are assigned.

Q04 | TP18BE

16 marks

June 2017 | H556/01 | Q17(b)-(e)

- 17 A group of students are conducting an experiment in the laboratory to determine the value of absolute zero by heating a fixed mass of gas. The volume of the gas is kept constant. Fig. 17.1 shows the arrangement used by the students.

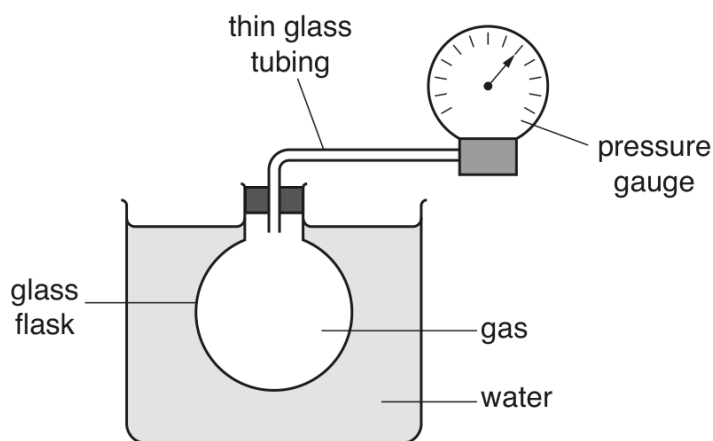


Fig. 17.1

The gas is heated using a water bath. The temperature θ of the water is increased from 5°C to 70°C . The temperature of the water bath is assumed to be the same as the temperature of the gas. The pressure p of the gas is measured using a pressure gauge.

The results from the students are shown in a table.

$\theta/^{\circ}\text{C}$	p/kPa
5 ± 1	224 ± 3
13 ± 1	231 ± 3
22 ± 1	238 ± 3
35 ± 1	248 ± 3
44 ± 1	
53 ± 1	262 ± 3
62 ± 1	269 ± 3
70 ± 1	276 ± 3

Only (b)-(e) are assigned. The original apparatus and results table are retained; (a) is omitted.

Q04 | TP18BE - continued

16 marks

June 2017 | H556/01 | Q17(b)-(e)

- (b) Fig. 17.2 shows the pressure gauge. Measurements of p can be made using the kPa scale or the psi (pounds per square inch) scale. The students used the psi scale to measure pressure and then converted the reading to pressure in kPa.

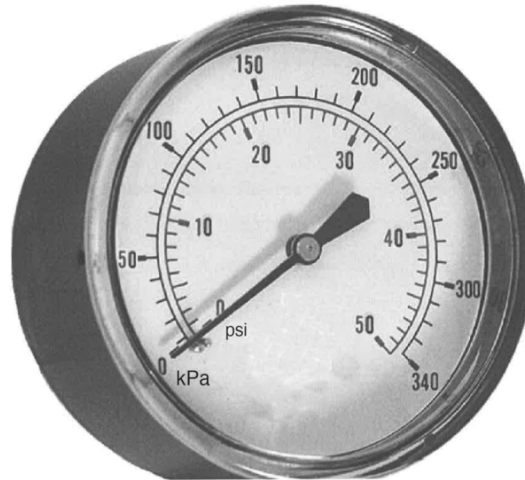


Fig. 17.2

- (i) Suggest why it was sensible to use the psi scale to measure p .

.....
 [1]

- (ii) The students made a reading of p of 37.0 ± 0.5 psi when θ was $44 \pm 1^\circ\text{C}$. Convert this value of p from psi to kPa. Complete the table for the missing value of p . Include the absolute uncertainty in p .

1 pound of force = 4.448 N
 1 inch = 0.0254 m

[2]

Only (b)-(e) are assigned. The original apparatus and results table are retained; (a) is omitted.

Q04 | TP18BE - continued

16 marks

June 2017 | H556/01 | Q17(b)-(e)

(c) Fig. 17.3 shows the graph of p against θ .

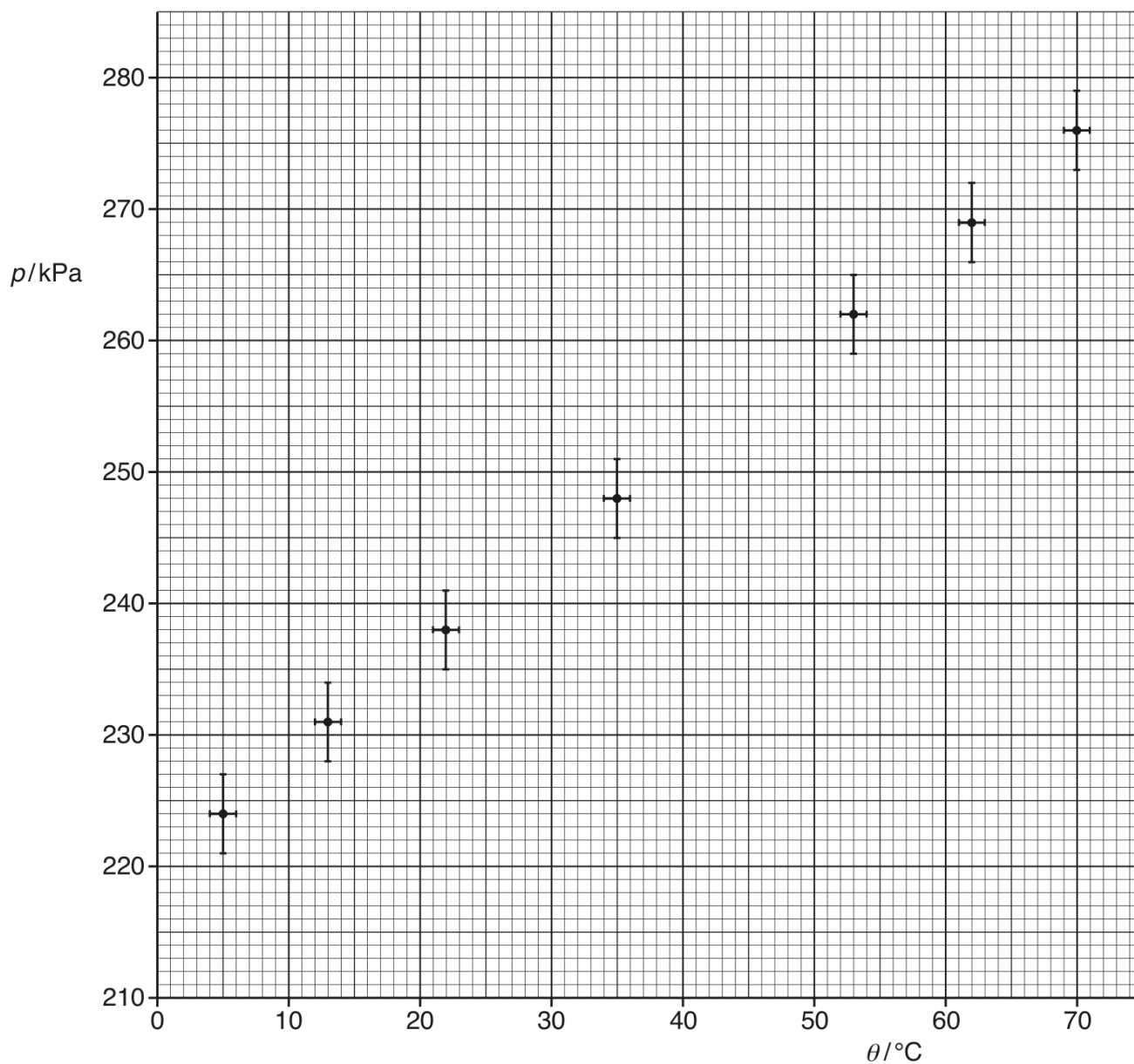


Fig. 17.3

(i) Plot the missing data point and the error bars on Fig. 17.3.

[1]

Only (b)-(e) are assigned. The original apparatus and results table are retained; (a) is omitted.

Q04 | TP18BE - continued

16 marks

June 2017 | H556/01 | Q17(b)-(e)

- (ii)* Explain what is meant by *absolute zero*. Describe how Fig. 17.3 can be used to determine the value of absolute zero. Determine the value of absolute zero. You may assume that the gas behaves as an ideal gas.

[6]

Only (b)-(e) are assigned. The original apparatus and results table are retained; (a) is omitted.

Q04 | TP18BE - continued

16 marks

June 2017 | H556/01 | Q17(b)-(e)

- (d) Describe, without doing any calculations, how you could use Fig. 17.3 to determine the actual uncertainty in the value of absolute zero in (c)(ii).

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..... [2]

- (e) The experiment is repeated as the water bath quickly cools from 70 °C to 5 °C. Absolute zero was found to be -390 °C.

Compare this value with your value from (c)(ii) and explain why the values may differ. Describe an experimental approach that could be taken to avoid systematic error in the determination of absolute zero.

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..... [4]

Only (b)-(e) are assigned. The original apparatus and results table are retained; (a) is omitted.