FREE REVISION PACK

Kinetic Theory of Gases

AQA A-level Physics · 7408 · Specification 3.6.2.3

Easy | Hard | Multiple choice · past-paper questions

5	5	≈ 10 min
QUESTIONS	TOTAL MARKS	SUGGESTED TIME*

Contents

Q	LEVEL	FOCUS	SOURCE	MARKS
1	Easy	Mean square speed of an air molecule	AQA June 2018 · A-level Paper 2 · Q10	1 mark
2	Easy	The cause of Brownian motion	AQA June 2018 · A-level Paper 2 · Q11	1 mark
3	Easy	Root mean square speed of three molecules	AQA June 2024 · A-level Paper 2 · Q9	1 mark
4	Easy	Compressing a gas at constant temperature	AQA November 2021 · A-level Paper 2 · Q8	1 mark
5	Hard	Change in momentum of a molecule hitting a wall	AQA June 2018 · A-level Paper 2 · Q12	1 mark

Key ideas to have ready

- $pV = \frac{1}{3}Nm(c_{rms})^2$. Mean kinetic energy of a molecule: $\frac{1}{2}m(c_{rms})^2 = (3/2)kT = 3RT / (2N_A)$.
- c_{rms} = √(mean of the squared speeds). It depends only on the temperature (for a given gas), not on pressure or volume.
- Brownian motion: smoke particles move randomly because fast-moving air molecules hit them unevenly. It is evidence for the existence of molecules.
- When a molecule bounces elastically off a wall, its momentum changes by 2mv cos θ, at right angles to the wall.

How to use this pack

1. The questions are grouped into levels (Easy and Hard). Work through them in order, and check your answers at the end of each level before moving on.
2. Every question is multiple choice with one correct answer. Write down your working anyway; that is how you find mistakes.
3. The separate mark scheme uses the same numbers and explains every answer.

Levels are based on how students did in AQA's examiner reports where that information exists, plus our own difficulty rating. *About 1.5 minutes per question.

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Easy

Definitions and one-step ideas. Most students get these right.

Questions 1–4

Only **one** answer per question is allowed. For each question, completely fill in the circle alongside the appropriate answer.

AQA June 2018 · A-level Paper 2 · Q10

1 The average mass of an air molecule is 4.8×10^{-26} kg

What is the mean square speed of an air molecule at 750 K?

[1 mark]

A 3.3×10^5 m^2 s^{-2} ⬭

B 4.3×10^5 m^2 s^{-2} ⬭

C 6.5×10^5 m^2 s^{-2} ⬭

D 8.7×10^5 m^2 s^{-2} ⬭

AQA June 2018 · A-level Paper 2 · Q11

2 A transparent illuminated box contains small smoke particles and air.
The smoke particles are observed to move randomly when viewed through a microscope.

What is the cause of this observation of Brownian motion?

[1 mark]

A Smoke particles gaining kinetic energy by the absorption of light ⬭

B Collisions between smoke particles and air molecules ⬭

C Smoke particles moving in convection currents caused by the air being heated by the light ⬭

D The smoke particles moving randomly due to their temperature ⬭

AQA June 2024 · A-level Paper 2 · Q9

3 Three molecules have speeds $2.00v$, $4.00v$ and $5.00v$.

What is the c_{rms} speed of these molecules?

[1 mark]

A $3.50v$ ⬭

B $3.67v$ ⬭

C $3.87v$ ⬭

D $26.0v$ ⬭

AQA November 2021 · A-level Paper 2 · Q8

4 A gas occupies a volume V. Its particles have a root mean square speed (c_{rms}) of u.
The gas is compressed at constant temperature to a volume $0.5V$.

What is the root mean square speed of the gas particles after compression?

[1 mark]

A $\frac{u}{2}$ ⬭

B u ⬭

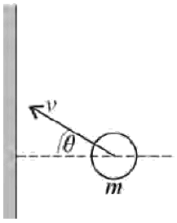
C $2u$ ⬭

D $4u$ ⬭

Hard Several steps, often with a trap built in. Fewer than 3 in 10 students get these right. **Question 5**

AQA June 2018 · A-level Paper 2 · Q12

5 The diagram shows a gas particle about to collide elastically with a wall.



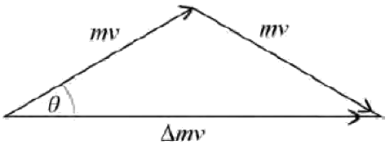
Which diagram shows the correct change in momentum Δmv that occurs during the collision?

[1 mark]

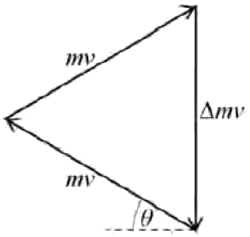
A



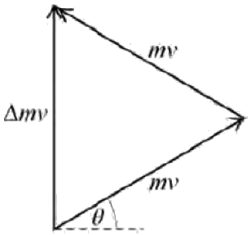
B



C



D



End of questions. Check your answers with the matching mark scheme. More free packs and 1-to-1 tuition:
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