FREE REVISION PACK

Stationary Waves

AQA A-level Physics · 7407 / 7408 · Specification 3.3.1.3

Easy | Medium | Hard | Multiple choice · past-paper questions

8	8	≈ 10 min
QUESTIONS	TOTAL MARKS	SUGGESTED TIME*

Contents

Q	LEVEL	FOCUS	SOURCE	MARKS
1	Easy	Finding the harmonic number from node spacing	AQA June 2025 · AS Paper 2 · Q16	1 mark
2	Easy	Statements about harmonics on a 1.0 m rope	AQA November 2020 · A-level Paper 1 · Q18	1 mark
3	Easy	Properties of a stationary wave	AQA June 2022 · AS Paper 2 · Q18	1 mark
4	Medium	Phase and amplitude of three points	AQA November 2021 · A-level Paper 1 · Q18	1 mark
5	Medium	Touching a string one third of the way along	AQA June 2018 · AS Paper 2 · Q17	1 mark
6	Medium	Tripling the tension in a vibrating wire	AQA June 2025 · AS Paper 2 · Q5	1 mark
7	Hard	Wavelength from two resonance lengths	AQA June 2024 · A-level Paper 1 · Q15	1 mark
8	Hard	Which quantity is proportional to f?	AQA June 2025 · A-level Paper 1 · Q14	1 mark

Key ideas to have ready

- A stationary wave forms when two waves of the same frequency travel in opposite directions and superpose. Nodes (zero amplitude) and antinodes (maximum amplitude) are fixed.
- Adjacent nodes (or antinodes) are $\lambda/2$ apart. All points between two adjacent nodes are in phase; points in neighbouring loops are in antiphase.
- On a string fixed at both ends the n-th harmonic has n loops: $L = n\lambda/2$. First harmonic $f = (1/2L)\sqrt{(T/\mu)}$, where μ is the mass per unit length.
- In a pipe closed at one end, resonances occur at lengths $\lambda/4$, $3\lambda/4$, ... so successive resonance lengths differ by $\lambda/2$.

How to use this pack

1. The questions are grouped into levels (Easy, Medium 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 1–3

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

AQA June 2025 · AS Paper 2 · Q16

1 A string vibrates at the Nth harmonic.
The separation x between adjacent nodes is 0.60 m.

The string now vibrates at the $(N+1)$th harmonic and x decreases by 0.12 m.

What is N?

[1 mark]

A 3 ⬭

B 4 ⬭

C 5 ⬭

D 6 ⬭

AQA November 2020 · A-level Paper 1 · Q18

2 Stationary waves are set up on a rope of length 1.0 m fixed at both ends.

Which statement is **not** correct?

[1 mark]

A The first harmonic has a wavelength of 2.0 m. ⬭

B The midpoint of the rope is always stationary for even-numbered harmonics. ⬭

C A harmonic of wavelength 0.4 m can be set up on the rope. ⬭

D There are five nodes on the rope for the fifth harmonic. ⬭

AQA June 2022 · AS Paper 2 · Q18

3 A stationary wave forms on a uniform string.

Which statement is correct?

[1 mark]

A The amplitude of oscillations is a maximum at the nodes. ⬭

B The distance between two adjacent nodes equals one wavelength. ⬭

C The oscillations at two adjacent antinodes are in antiphase. ⬭

D The time period of oscillating sections varies along the string. ⬭

Medium

Two or three steps. Roughly a third to a half of students get these right.

Questions 4–6

AQA November 2021 · A-level Paper 1 · Q18

4 The diagram shows a stationary wave on a string at one instant in time.
P, **Q** and **R** are three points on the string.



Which row is correct?

[1 mark]

A	**P** is in antiphase with **R**	**P** has the same amplitude as **Q**	⬭
B	**P** is out of phase with **R**	**P** has the same amplitude as **R**	⬭
C	**P** is in phase with **Q**	**P** has the same amplitude as **R**	⬭
D	**P** is out of phase with **Q**	**P** has a smaller amplitude than **R**	⬭

AQA June 2018 · AS Paper 2 · Q17

5 The fundamental frequency f is the lowest frequency heard when a stretched string is vibrating.

The string is now lightly touched one third of the way along its length.

What is the lowest frequency heard?

[1 mark]

A $\frac{f}{3}$ ⬭

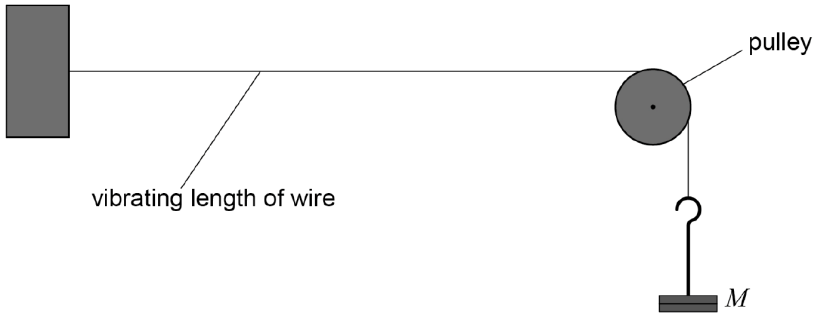
B $\frac{2f}{3}$ ⬭

C f ⬭

D $3f$ ⬭

AQA June 2025 · AS Paper 2 · Q5

6 A horizontal length of wire vibrates between a fixed point and a frictionless pulley.
The tension in the wire is caused by the weight of a mass M.
The frequency of the first harmonic of the vibrating wire is 420 Hz.



An additional mass of $2M$ is added to M to increase the tension.
No other change is made.

What is the new frequency of the first harmonic of the wire?

[1 mark]

A 210 Hz ⬭

B 590 Hz ⬭

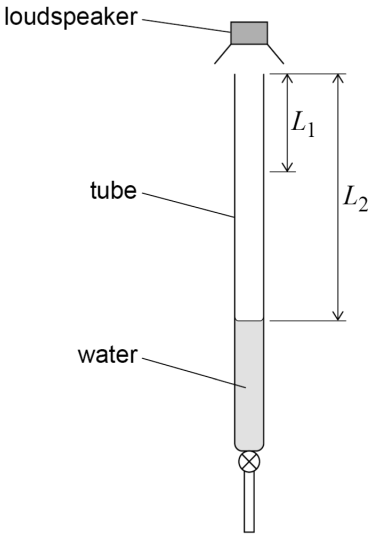
C 730 Hz ⬭

D 840 Hz ⬭

Hard Several steps, often with a trap built in. Fewer than 3 in 10 students get these right. **Questions 7–8**

AQA June 2024 · A-level Paper 1 · Q15

7 A loudspeaker producing a single-frequency sound is mounted above a tube filled with water. A tap at the bottom of the tube is opened to allow the water to run out.



A student observes the change in loudness of the sound emitted by the tube as the water runs out.
When the length of the column of air in the tube reaches L_1, the loudness is at its first maximum.
The next maximum is reached when the length of the column of air is L_2.

What is the wavelength of the sound emitted by the loudspeaker?

[1 mark]

A L_2 ⬭

B $2L_1$ ⬭

C $L_2 - L_1$ ⬭

D $2(L_2 - L_1)$ ⬭

AQA June 2025 · A-level Paper 1 · Q14

8 In an investigation of stationary waves on different wires, the frequency f of the first harmonic is measured.

Which quantity produces a straight-line graph through the origin when plotted against f?
In each case all other variables are kept constant.

[1 mark]

A $\frac{1}{\text{diameter of the wire}}$ ⬭

B (mass per unit length of the wire)^2 ⬭

C length of the wire ⬭

D (tension in the wire)^2 ⬭

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