FREE REVISION PACK

Mass–Spring Systems & Pendulums

AQA A-level Physics · 7408 · Specification 3.6.1.3

Medium | Multiple choice · past-paper questions

5	5	≈ 10 min
QUESTIONS	TOTAL MARKS	SUGGESTED TIME*

Contents

Q	LEVEL	FOCUS	SOURCE	MARKS
1	Medium	Frequency of a mass on a spring	AQA November 2020 · A-level Paper 1 · Q25	1 mark
2	Medium	How frequency depends on the hanging mass	AQA June 2019 · A-level Paper 1 · Q31	1 mark
3	Medium	Length of a pendulum whose period doubles	AQA November 2020 · A-level Paper 1 · Q30	1 mark
4	Medium	When two pendulums are next in phase	AQA June 2019 · A-level Paper 1 · Q30	1 mark
5	Medium	Period on a stiffer spring	AQA June 2024 · A-level Paper 1 · Q31	1 mark

Key ideas to have ready

- Mass–spring system: $T = 2\pi\sqrt{(m / k)}$. It does not depend on g.
- Simple pendulum (small angles): $T = 2\pi\sqrt{(l / g)}$. It does not depend on the mass.
- So $f \propto 1/\sqrt{m}$ for a mass–spring system and $T \propto \sqrt{l}$ for a pendulum.
- For a hanging spring, $k = mg / x$, where x is the static extension.

How to use this pack

1. The questions are grouped into levels (Medium). 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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Medium

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

Questions 1–5

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

AQA November 2020 · A-level Paper 1 · Q25

1 A mass of $0.90\ \text{kg}$ is suspended from the lower end of a light spring of stiffness $80\ \text{N m}^{-1}$.

When the mass is displaced vertically and released, it undergoes vertical oscillations of small amplitude.

What is the frequency of the oscillations?

[1 mark]

A $0.071\ \text{Hz}$ ⬭

B $0.67\ \text{Hz}$ ⬭

C $1.50\ \text{Hz}$ ⬭

D $14\ \text{Hz}$ ⬭

AQA June 2019 · A-level Paper 1 · Q31

2 The frequency of oscillation of a vertical spring is f when the mass hanging from the spring is m.

What is the relationship between f and m?

[1 mark]

A $f \propto m^{-\frac{1}{2}}$ ⬭

B $f \propto m^{-2}$ ⬭

C $f \propto m^{\frac{1}{2}}$ ⬭

D $f \propto m^{2}$ ⬭

AQA November 2020 · A-level Paper 1 · Q30

3 The period of a simple pendulum is doubled when the pendulum length is increased by $1.8\ \text{m}$.

What is the original length of the pendulum?

[1 mark]

A $0.45\ \text{m}$ ⬭

B $0.60\ \text{m}$ ⬭

C $0.90\ \text{m}$ ⬭

D $3.6\ \text{m}$ ⬭

AQA June 2019 · A-level Paper 1 · Q30

4 Two pendulums **A** and **B** oscillate with simple harmonic motion.
The time period of **A** is $2.00\ \text{s}$ and the time period of **B** is $1.98\ \text{s}$.

A and **B** are released in phase.

What is the number of oscillations of **A** before **A** and **B** are next in phase?

[1 mark]

A 49 ⬭

B 50 ⬭

C 99 ⬭

D 100 ⬭

AQA June 2024 · A-level Paper 1 · Q31

5 When a mass **M** is suspended from a spring, the spring extends by a distance x.
M is displaced vertically and, when released, it oscillates with a period T.

M is removed and suspended from a different spring. The spring extends by a distance $\frac{x}{2}$.

M is again displaced vertically and released.

What is the new period of oscillations of **M**?

[1 mark]

A $\frac{T}{2}$ ⬭

B $\frac{T}{\sqrt{2}}$ ⬭

C $T\sqrt{2}$ ⬭

D $2T$ ⬭

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