FREE REVISION PACK

Energy in SHM

AQA A-level Physics · 7408 · Specification 3.6.1.2

Easy | Medium | Multiple choice · past-paper questions

5	5	≈ 10 min
QUESTIONS	TOTAL MARKS	SUGGESTED TIME*

Contents

Q	LEVEL	FOCUS	SOURCE	MARKS
1	Easy	Potential energy of a pendulum against displacement	AQA June 2018 · A-level Paper 1 · Q31	1 mark
2	Easy	Maximum kinetic energy from amplitude and frequency	AQA June 2018 · A-level Paper 1 · Q30	1 mark
3	Easy	Total energy in terms of f and A	AQA November 2020 · A-level Paper 1 · Q24	1 mark
4	Medium	Kinetic energy–time graph from a displacement–time graph	AQA June 2019 · A-level Paper 1 · Q29	1 mark
5	Medium	Maximum kinetic energy from T and A	AQA November 2021 · A-level Paper 1 · Q31	1 mark

Key ideas to have ready

- In free SHM the total energy is constant and swaps between kinetic and potential.
- Total energy = maximum kinetic energy = $\frac{1}{2}mv_{max}^2 = \frac{1}{2}m(\omega A)^2 = 2\pi^2 mf^2A^2$.
- Potential energy $\propto x^2$ (a parabola against displacement). Kinetic energy is maximum at equilibrium and zero at the amplitude.
- Kinetic energy is never negative and peaks twice in each period.

How to use this pack

1. The questions are grouped into levels (Easy and 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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Easy

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

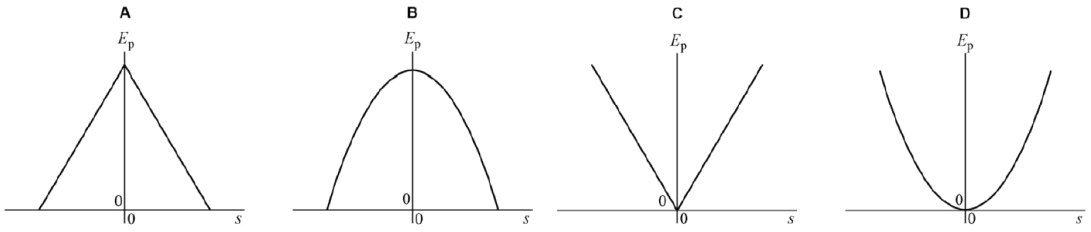
Questions 1–3

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

AQA June 2018 · A-level Paper 1 · Q31

1 Which graph shows how the gravitational potential energy E_p of a simple pendulum varies with displacement s from the equilibrium position?

[1 mark]



A ⬭ B ⬭ C ⬭ D ⬭

AQA June 2018 · A-level Paper 1 · Q30

2 An object of mass 0.15 kg performs simple harmonic motion. It oscillates with amplitude 55 mm and frequency 0.80 Hz

What is the maximum value of its kinetic energy?

[1 mark]

A 5.7×10^{-3} J ⬭

B 11×10^{-3} J ⬭

C 0.57 J ⬭

D 11 J ⬭

AQA November 2020 · A-level Paper 1 · Q24

3 A particle of mass m undergoes simple harmonic motion with amplitude A and frequency f.

What is the total energy of the particle?

[1 mark]

A $2\pi mfA^2$ ⬭

B $2\pi^2 mf^2A^2$ ⬭

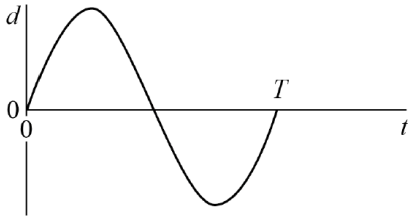
C $4\pi^2m^2f^2A$ ⬭

D $4\pi^2mf^2A^2$ ⬭

Medium Two or three steps. Roughly a third to a half of students get these right. **Questions 4–5**

AQA June 2019 · A-level Paper 1 · Q29

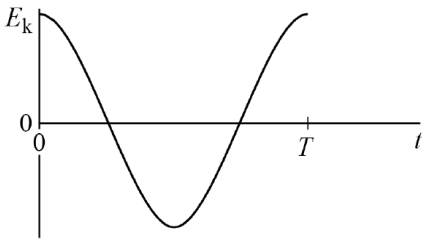
4 The graph shows the variation of displacement d with time t for a particle moving with simple harmonic motion of period T.



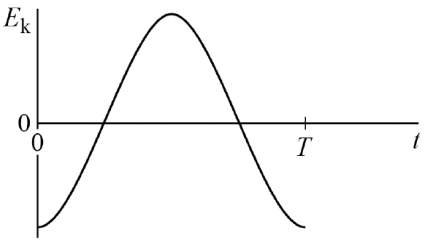
Which graph shows the variation of kinetic energy E_k of the particle with time?

[1 mark]

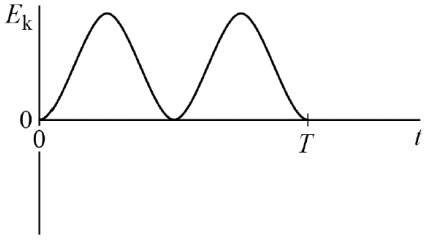
A



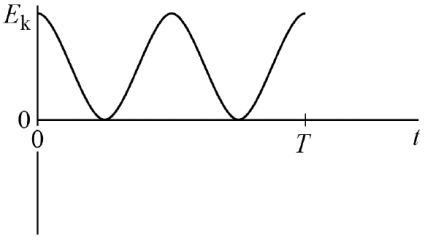
B



C



D



AQA November 2021 · A-level Paper 1 · Q31

5 A particle of mass m is oscillating with simple harmonic motion.
The period of the oscillation is T and the amplitude is A.

What is the maximum kinetic energy of the particle?

[1 mark]

A $\frac{mA^2}{2T^2}$ ⬭

B $\frac{\pi^2 mA^2}{2T^2}$ ⬭

C $\frac{2mA^2}{T^2}$ ⬭

D $\frac{2\pi^2 mA^2}{T^2}$ ⬭

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