GET BETTER AT PHYSICS · MARK SCHEME

Energy in SHM: tiered multiple choice

AQA A-level Physics · 7408 · Specification 3.6.1.2 · 5 questions · 5 marks

1 mark per correct letter | Worked reasoning for every question | **How students did** = from AQA examiner reports, where available

Answer key

Q1	Q2	Q3	Q4	Q5
D	A	B	D	D

Easy

Questions 1–3

1 **D**

Potential energy of a pendulum against displacement · AQA June 2018 · A-level Paper 1 · Q31

The potential energy is zero at the equilibrium position and rises in proportion to s^2 on either side, giving a parabola with its minimum at s = 0: graph D.

Watch out: C has straight sides ($E_p \propto |s|$); A and B have a maximum, not a minimum, at equilibrium.

How students did: 74.3% of students got this right in June 2018.

2 **A**

Maximum kinetic energy from amplitude and frequency · AQA June 2018 · A-level Paper 1 · Q30

$v_{max} = 2\pi fA = 2\pi \times 0.80 \times 0.055 = 0.276$ m s^{-1}. $E_{k(max)} = ½ \times 0.15 \times 0.276^2 = 5.7 \times 10^{-3}$ J.

Watch out: Convert 55 mm to 0.055 m. Leaving it in mm gives an answer 10^6 times too big.

How students did: 66.6% of students got this right in June 2018.

3 **B**

Total energy in terms of f and A · AQA November 2020 · A-level Paper 1 · Q24

Total energy = $½mv_{max}^2 = ½m(2\pi fA)^2 = 2\pi^2mf^2A^2$.

Watch out: Square every part of 2πfA. Only m stays to the first power.

Medium

Questions 4–5

4 **D**

Kinetic energy–time graph from a displacement–time graph · AQA June 2019 · A-level Paper 1 · Q29

The particle starts at equilibrium (d = 0), moving at maximum speed, so E_k starts at a maximum. E_k is zero at each maximum displacement and maximum again each time d = 0, so it peaks twice per period and is never negative: graph D.

Watch out: C has the right shape but starts at zero, which would mean the particle starts at maximum displacement.

5 **D**

Maximum kinetic energy from T and A · AQA November 2021 · A-level Paper 1 · Q31

$v_{max} = \omega A = 2\pi A / T$. $E_{k(max)} = ½m(2\pi A / T)^2 = 2\pi^2mA^2 / T^2$.

Watch out: B uses $\omega = \pi / T$ instead of $2\pi / T$; A and C leave out π altogether.

End of mark scheme. Answers from AQA's published keys; explanations written for this pack. AQA material is © AQA. More free packs and 1-to-1 tuition: **www.getbetteratphysics.co.uk**

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