GET BETTER AT PHYSICS · MARK SCHEME

Simple Harmonic Motion: tiered multiple choice

AQA A-level Physics · 7408 · Specification 3.6.1.2 · 6 questions · 6 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	Q6
C	D	B	B	D	B

Easy

Questions 1–3

1 **C**

Maximum speed from the period and amplitude · AQA June 2022 · A-level Paper 1 · Q31

$v_{max} = \omega A = (2\pi / T) \times A = (2\pi \div 1.4) \times 12 = 54$ mm s^{-1}.

How students did: This was one of the easiest questions on the June 2022 paper.

2 **D**

Reading a displacement–time graph · AQA June 2017 · A-level Paper 1 · Q32

At time T the displacement is at its maximum, so the restoring force is at its maximum, not zero. D is the incorrect statement. At T/4 and 3T/4 the particle passes through equilibrium (maximum speed, zero potential energy); at T/2 it is at maximum displacement (maximum acceleration).

Watch out: This asks for the statement that is **not** correct.

3 **B**

Speed at a given displacement · AQA June 2024 · A-level Paper 1 · Q30

$\omega = 2\pi / T = 2\pi \div 2\pi = 1$ rad s^{-1}. $v = \omega\sqrt{(A^2 - x^2)} = 1 \times \sqrt{(0.60^2 - 0.20^2)} = \sqrt{0.32} = 0.57$ m s^{-1}.

Watch out: Use $v = \omega\sqrt{(A^2 - x^2)}$. The maximum speed $\omega A = 0.60$ m s^{-1} applies only at equilibrium.

Medium

Questions 4–6

4 **B**

Pendulum bob when its acceleration is zero · AQA June 2025 · A-level Paper 1 · Q25

The acceleration is zero at the equilibrium position, the lowest point of the swing. There the speed (and so the momentum) is a maximum and the bob is at its lowest, so its gravitational potential energy is a minimum: row B.

5 **D**

Phase between displacement and acceleration · AQA June 2018 · A-level Paper 1 · Q29

$a = -\omega^2 x$, so the acceleration always has the opposite sign to the displacement. The two are in antiphase: a phase difference of π rad.

Watch out: Velocity is π/2 out of phase with displacement; acceleration is π out of phase.

How students did: 48.0% of students got this right in June 2018.

6 **B**

Minimum value at the end of the oscillation · AQA June 2023 · A-level Paper 1 · Q31

Q is a point of maximum displacement, where the mass momentarily stops. Its kinetic energy is zero there, its minimum value. The acceleration, the potential energy and the resultant force are all at their maximum.

Watch out: At the end points of SHM everything linked to displacement is at a maximum; everything linked to speed is at a minimum.

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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