GET BETTER AT PHYSICS · MARK SCHEME

Projectile Motion: tiered multiple choice

AQA A-level Physics · 7407 / 7408 · Specification 3.4.1.4 · 7 questions · 7 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	Q7
C	A	C	A	C	D	B

Easy

Questions 1–3

1 **C**

Time of flight · AQA June 2018 · A-level Paper 1 · Q23

Vertical component of velocity = 25 sin 35° = 14.3 m s^{-1}. Time to go up and come back down = $2u_v$ / g = 2 × 14.3 / 9.81 = 2.9 s.

Watch out: 1.5 s (A) is only the time to the top. 4.2 s (D) uses 25 cos 35°, the horizontal component.

How students did: 70.2% of students got this right in June 2018.

2 **A**

Particle deflected sideways · AQA June 2024 · A-level Paper 1 · Q21

Sideways ("vertical") motion starts from zero: s = ½at², so t = √(2 × 8 × 10^{-2} / 4 × 10^{14}) = 2 × 10^{-8} s. In that time it travels 1.0 × 10^{7} × 2 × 10^{-8} = 0.2 m along its original direction.

Watch out: C is the time, not the distance.

3 **C**

Three objects leaving a bench · AQA June 2019 · AS Paper 2 · Q25

All three start with zero vertical velocity from the same height, so they hit the floor at the same time (A and B are wrong) with the same vertical speed. W has the largest horizontal speed (it lands furthest away), so its total speed is greatest.

How students did: Over 60% of students got this right in June 2019.

Medium

Questions 4–6

4 **A**

Two balls falling side by side · AQA June 2017 · AS Paper 2 · Q28

Both balls fall the same vertical distance in the same time, so they stay level. Only X moves horizontally: 0.10 × 1.0 = 0.10 m towards Y. Separation = 0.25 − 0.10 = 0.15 m.

Watch out: 4.9 m is how far each ball falls, not the distance between them.

How students did: Less than half of students got this right in June 2017.

5 **C**

Displacement at maximum height · AQA June 2023 · A-level Paper 1 · Q18

At the top the vertical velocity is zero, so $u_v = gt = 9.81 \times 2.0 = 19.6$ m s^{-1}. At 45°, $u_h = u_v = 19.6$ m s^{-1}. Height = ½ × 9.81 × 2.0² = 19.6 m; horizontal distance = 19.6 × 2.0 = 39.2 m. Displacement = √(39.2² + 19.6²) ≈ 44 m, so 45 m.

> **Watch out:** Displacement is measured in a straight line from P. 20 m is only the height and 40 m is only the horizontal distance.

How students did: Fewer than 40% of students got this right in June 2023.

6 **D**

Doubling the launch speed · AQA June 2024 · A-level Paper 1 · Q20

The time of flight is proportional to u sin θ and the horizontal speed to u cos θ. Range = horizontal speed × time, so it is proportional to u². Doubling u multiplies the range by 4: 4d.

How students did: In June 2024 a wrong answer was more popular than the correct one.

Hard

Question 7

7 **B**

Acceleration on a trampoline · AQA June 2018 · AS Paper 2 · Q22

Once she leaves the trampoline, the only force on her is her weight. Her acceleration is g downwards the whole time she is in the air: on the way up, at the top and on the way down.

> **Watch out:** At the highest point her velocity is zero but her acceleration is still g. Acceleration and velocity are different things.

How students did: Only 26.9% of students got this right in June 2018.

End of mark scheme

Answers from AQA's published keys; explanations written for this pack. AQA material is © AQA.
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