GET BETTER AT PHYSICS · MARK SCHEME

Motion Graphs: tiered multiple choice

AQA A-level Physics · 7407 / 7408 · Specification 3.4.1.3 · 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
B	A	B	B	D	B

Easy

Questions 1–3

1 **B**

From velocity–time to acceleration–time · AQA June 2016 · AS Paper 2 · Q19

Acceleration is the gradient of the velocity–time graph. The gradient is steepest at the start and falls towards zero as the velocity levels off, so the acceleration starts high and decreases towards zero: graph B.

How students did: 67% of students got this right in June 2016.

2 **A**

Distance between two cars · AQA June 2019 · A-level Paper 1 · Q13

Distance = area under each line. Q: ½ × 8 × 40 = 160 m. P starts at t = 1 s: ½ × 2 × 20 = 20 m while accelerating, then 20 × 5 = 100 m, so 120 m. The gap is 160 − 120 = 40 m.

Watch out: P leaves one second after Q, so its area starts at t = 1 s, not at the origin.

3 **B**

Bouncing ball velocity–time graph · AQA June 2017 · A-level Paper 1 · Q23

Take downwards as positive. While the ball is in the air its acceleration is g, so the graph is a straight line of constant gradient. At each bounce the velocity suddenly reverses (from positive to negative), then rises again through zero along a line of the same gradient. Only B shows this.

Watch out: A, C and D never show the velocity going negative, so they describe speed, not velocity.

Medium

Questions 4–6

4 **B**

From speed–time to distance–time · AQA 2020 · AS Paper 2 · Q22

Distance can only increase, and the gradient of the distance–time graph is the speed. The speed starts at zero, rises to a maximum and falls back to zero at T, so the gradient is zero at the start, steepest in the middle and zero again at T: the S-shaped graph B.

Watch out: A and C show the distance decreasing, which is impossible. D is steepest at the start and end, the opposite of the speed graph.

5 **D**

Speed from an acceleration–time graph · AQA June 2024 · AS Paper 2 · Q19

Change in velocity = area under the acceleration–time graph = ½ × (2 + 6) × 5.0 = 20 m s^{-1}. The object already had 4.0 m s^{-1}, so its speed is 4.0 + 20 = 24 m s^{-1}.

> **Watch out:** 20 m s^{-1} (C) is only the change in speed. Add the starting speed.

How students did: In June 2024 the correct answer was the most popular choice.

6 **B**

Displacement from a velocity–time graph · AQA 2021 · AS Paper 2 · Q23

0–20 s: the area of the trapezium is ½ × (10 + 20) × 15 = 225 m forwards. 30–40 s: the velocity is negative, so the triangle ½ × 10 × 7 = 35 m is backwards. Distance from the start = 225 − 35 = 190 m.

> **Watch out:** 260 m (C) adds the backwards part. That is the total distance travelled, not the distance from the start.

End of mark scheme

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