GET BETTER AT PHYSICS · MARK SCHEME

Impulse & Force–Time Graphs: tiered multiple choice

AQA A-level Physics · 7407 / 7408 · Specification 3.4.1.6 · 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
D	B	D	C	D	D	D

Easy

Questions 1–2

1 **D**

Momentum from a force–time graph · AQA June 2017 · AS Paper 2 · Q19

Momentum gained = area under the graph = 4 × 4 (rectangle) + ½ × (4 + 10) × 6 (trapezium) = 16 + 42 = 58 kg m s^{-1}.

How students did: Most students got this right in June 2017; each wrong answer was chosen by about 15%.

2 **B**

What the area under F–t means · AQA June 2025 · AS Paper 2 · Q19

Area under a force–time graph = force × time = impulse, which equals the change in momentum of the object.

How students did: This was one of the more successful questions on the June 2025 paper.

Medium

Questions 3–5

3 **D**

Air through a jet engine · AQA June 2024 · A-level Paper 1 · Q24

F = (mass per second) × Δv, so the mass per second = 42 000 / 540 = 77.8 kg s^{-1}. In one minute: 77.8 × 60 ≈ 4.7 × 10^3 kg.

Watch out: 78 kg (C) is the mass in one second, not one minute.

4 **C**

Golf ball: from F–t graph to kinetic energy · AQA November 2021 · A-level Paper 1 · Q25

The area is roughly a triangle: ½ × 16 × 10^{-3} s × 0.60 × 10^3 N ≈ 4.8 N s. So v ≈ 4.8 / 0.046 ≈ 100 m s^{-1} and E_k = ½ × 0.046 × 100² ≈ 250 J (or $E_k = p^2 / 2m$).

Watch out: Watch the units on the axes: kN and ms.

5 **D**

Ball bouncing off the ground · AQA June 2022 · A-level Paper 1 · Q26

Speed before impact = $\sqrt{(2 \times 9.81 \times 1.8)} = 5.94$ m s^{-1} downwards. Speed after = $\sqrt{(2 \times 9.81 \times 1.1)} = 4.65$ m s^{-1} upwards. The direction reverses, so $\Delta p = 0.058 \times (5.94 + 4.65) = 0.614$ N s.

> **Watch out:** 0.075 N s (B) subtracts the speeds and ignores the change of direction.

How students did: This was the hardest question on the June 2022 paper; a wrong answer was more popular than the correct one.

Hard

Questions 6–7

6 **D**

Car crumple zone · AQA June 2016 · AS Paper 2 · Q27

The car stops in 0.30 m: $a = v^2 / 2s = 10^2 / (2 \times 0.30) = 167$ m s^{-2}, so $F = 500 \times 167 \approx 83\,000$ N. (Or: kinetic energy $\frac{1}{2} \times 500 \times 10^2 = 25\,000$ J, and $F = 25\,000 / 0.30$ m.)

> **Watch out:** Check the power of ten in your final step: each option differs by a factor of 10.

How students did: Only 29% of students got this right in June 2016; more chose C than the correct answer.

7 **D**

Momentum–time graph from a force pulse · AQA June 2018 · AS Paper 2 · Q26

Force = rate of change of momentum, so the force is the gradient of the momentum–time graph. The force starts at zero, rises to a peak and falls back to zero, so the momentum graph starts flat, is steepest at the peak force, then levels off at a constant value: graph D.

> **Watch out:** A copies the shape of the force graph. When the force stops, the ball keeps its momentum; it does not fall back to zero.

How students did: Only 18.8% 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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