GET BETTER AT PHYSICS · MARK SCHEME

Impulse & Force–Time Graphs: tiered multiple choice

Edexcel IAL Physics · Unit 4 (WPH14) · Specification points 81–82 · 6 questions · 6 marks

1 mark per correct letter

Worked reasoning for every question

How students did = from Pearson examiner reports, where available

Answer key

Q1	Q2	Q3	Q4	Q5	Q6
C	C	D	D	A	B

Easy

Questions 1–3

1 **C**

Area under a force–time graph · Edexcel IAL June 2024 · Unit 4 · Q8

The area under a force–time graph is force × time, which is the impulse. Impulse equals the change in momentum of the ball.

How students did: 91% of students got this right in June 2024.

2 **C**

Change in momentum from force and time · Edexcel IAL October 2023 · Unit 4 · Q2

Impulse = change in momentum = $F\Delta t = 150 \times 15 = 2250$ kg m s^{-1} (a decrease, as the drag opposes the motion).

How students did: 88% of students got this right in October 2023.

3 **D**

Force from a molecule hitting a wall at an angle · Edexcel IAL October 2020 · Unit 4 · Q5

Only the velocity component perpendicular to the wall changes. With θ measured from the wall, that component is v sin θ, and it reverses: the change in momentum is 2mv sin θ. Average force = change in momentum ÷ time = 2mv sin θ / t.

> **Watch out:** The component parallel to the wall is unchanged, so it does not contribute to the force.

How students did: 70% of students got this right in October 2020.

Medium

Questions 4–5

4 **D**

Force on an atom that rebounds · Edexcel IAL January 2024 · Unit 4 · Q9

Taking the original direction of motion (towards the surface) as positive: change in momentum = (−mv) − (+mv) = −2mv. Mean force = $\Delta p/\Delta t = -2mv/\Delta t$: twice the momentum, directed away from the surface.

> **Watch out:** The momentum reverses, so the change is 2mv, not mv.

How students did: 47% of students got this right in January 2024.

5 **A**

Average force on a wall from a rebounding ball · Edexcel IAL January 2023 · Unit 4 · Q9

The ball's velocity changes from u (towards the wall) to v (away from it), so the change in momentum is m(u + v). The average force is m(u + v)/t, and by Newton's third law the ball exerts this force on the wall.

How students did: 44% of students got this right in January 2023.

Hard

Question 6

6 **B**

Impulse on a wall from a rebounding ball · Edexcel IAL January 2020 · Unit 4 · Q3

The ball's momentum changes from mv (towards the wall) to mv away from it, a change of 2mv. Impulse = change in momentum, and by Newton's third law the wall receives an impulse of the same size: 2mv (in the ball's original direction of travel).

> **Watch out:** The ball reverses, so the change is 2mv, not mv. A minus sign depends on which direction you call positive; here the impulse on the wall is towards the wall.

How students did: 29% of students got this right in January 2020.

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

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