FREE REVISION PACK

Impulse & Force–Time Graphs

AQA A-level Physics · 7407 / 7408 · Specification 3.4.1.6

Easy | Medium | Hard | Multiple choice · past-paper questions

7	7	≈ 10 min
QUESTIONS	TOTAL MARKS	SUGGESTED TIME*

Contents

Q	LEVEL	FOCUS	SOURCE	MARKS
1	Easy	Momentum from a force–time graph	AQA June 2017 · AS Paper 2 · Q19	1 mark
2	Easy	What the area under F–t means	AQA June 2025 · AS Paper 2 · Q19	1 mark
3	Medium	Air through a jet engine	AQA June 2024 · A-level Paper 1 · Q24	1 mark
4	Medium	Golf ball: from F–t graph to kinetic energy	AQA November 2021 · A-level Paper 1 · Q25	1 mark
5	Medium	Ball bouncing off the ground	AQA June 2022 · A-level Paper 1 · Q26	1 mark
6	Hard	Car crumple zone	AQA June 2016 · AS Paper 2 · Q27	1 mark
7	Hard	Momentum–time graph from a force pulse	AQA June 2018 · AS Paper 2 · Q26	1 mark

Key ideas to have ready

- **Impulse** = force × time = change in momentum: $F\Delta t = \Delta p$ (unit N s, the same as kg m s^{-1}).
- The **area under a force–time graph** is the impulse, so it equals the change in momentum.
- Force = rate of change of momentum, so the gradient of a momentum–time graph is the resultant force.
- When an object rebounds, its velocity changes sign: the change in momentum uses the sum of the speeds.

How to use this pack

1. The questions are grouped into levels (Easy, Medium and Hard). Work through them in order, and check your answers at the end of each level before moving on.
2. Every question is multiple choice with one correct answer. Write down your working anyway; that is how you find mistakes.
3. The separate mark scheme uses the same numbers and explains every answer.

Levels are based on how students did in AQA's examiner reports where that information exists, plus our own difficulty rating. *About 1.5 minutes per question.

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Easy

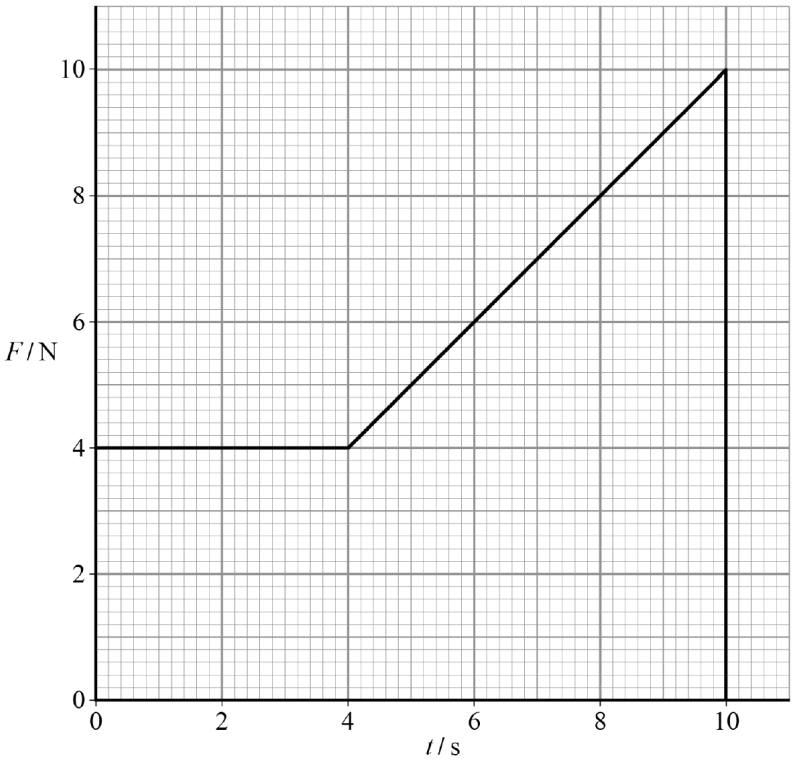
Definitions and one-step ideas. Most students get these right.

Questions 1–2

Only **one** answer per question is allowed. For each question, completely fill in the circle alongside the appropriate answer.

AQA June 2017 · AS Paper 2 · Q19

1 The graph shows how the force F applied to an object varies with time t.



What is the momentum gained by the object from $t = 0$ to $t = 10$ s?

[1 mark]

A $18\ \text{kg m s}^{-1}$ ⬭

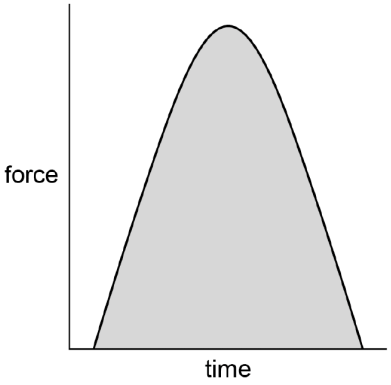
B $32\ \text{kg m s}^{-1}$ ⬭

C $40\ \text{kg m s}^{-1}$ ⬭

D $58\ \text{kg m s}^{-1}$ ⬭

AQA June 2025 · AS Paper 2 · Q19

2 The graph shows how the force acting on an object varied with time.



The shaded area represents:

[1 mark]

A the change in kinetic energy of the object. ⬭

B the change in momentum of the object. ⬭

C the distance travelled by the object. ⬭

D the total force that acted on the object. ⬭

Medium

Two or three steps. Roughly a third to a half of students get these right.

Questions 3–5

AQA June 2024 · A-level Paper 1 · Q24

3 An average force of $42\ \text{kN}$ acts on the air passing through a jet engine. This force causes the speed of the air to increase by $540\ \text{m s}^{-1}$.

What mass of air passes through the engine in one minute?

[1 mark]

A $7.7 \times 10^{-2}\ \text{kg}$ ⬭

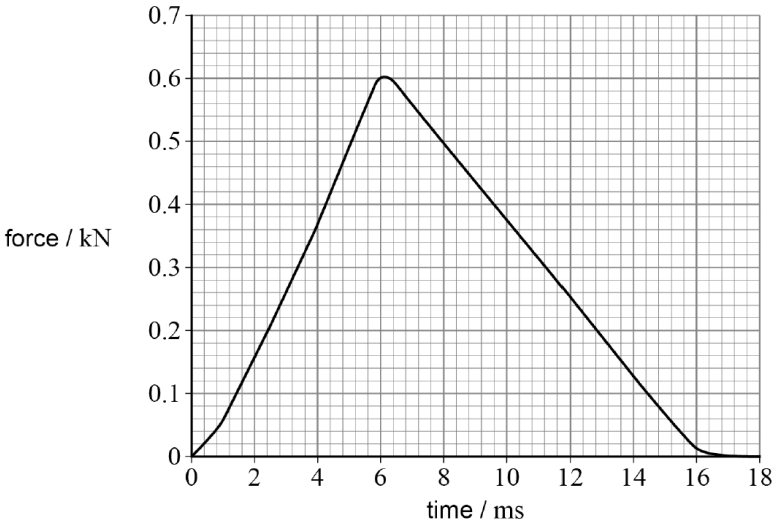
B $4.7\ \text{kg}$ ⬭

C $78\ \text{kg}$ ⬭

D $4700\ \text{kg}$ ⬭

AQA November 2021 · A-level Paper 1 · Q25

4 A golf ball has a mass of $46\ \text{g}$ and is initially stationary.
The diagram shows the variation with time of the force acting on the golf ball as it is hit with a golf club.



What is an estimate of the kinetic energy of the golf ball immediately after it is hit?

[1 mark]

A $5\ \text{J}$ ⬭

B $50\ \text{J}$ ⬭

C $250\ \text{J}$ ⬭

D $500\ \text{J}$ ⬭

AQA June 2022 · A-level Paper 1 · Q26

5 A tennis ball has a mass of $58\ \text{g}$.
The ball is dropped from rest from a height of $1.8\ \text{m}$ above the ground and falls vertically.
The ball rebounds vertically to a height of $1.1\ \text{m}$.
The effect of air resistance is negligible.

What is the change in momentum of the ball during its collision with the ground?

[1 mark]

A $0.040\ \text{N s}$ ⬭

B $0.075\ \text{N s}$ ⬭

C $0.215\ \text{N s}$ ⬭

D $0.614\ \text{N s}$ ⬭

Hard Several steps, often with a trap built in. Fewer than 3 in 10 students get these right. **Questions 6–7**

AQA June 2016 · AS Paper 2 · Q27

6 In a test a $500\ \text{kg}$ car travelling at $10\ \text{m s}^{-1}$ hits a wall. The front $0.30\ \text{m}$ of the car crumples as the car is brought to rest.

What is the average force on the car during the impact?

[1 mark]

A 830 N ⬭

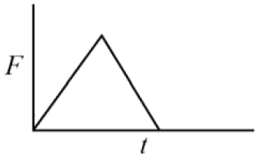
B 7500 N ⬭

C 8300 N ⬭

D 83 000 N ⬭

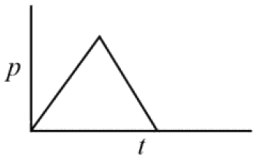
AQA June 2018 · AS Paper 2 · Q26

7 The graph shows how the resultant force F on a football, which is initially at rest, varies with time t.

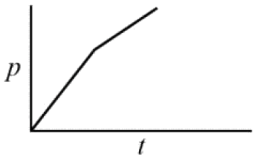


Which graph shows how the momentum p of the football varies with time t?

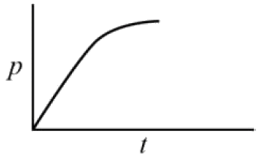
A



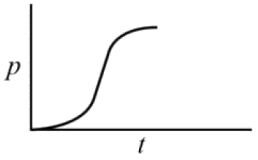
B



C



D



[1 mark]

End of questions. Check your answers with the matching mark scheme. More free packs and 1-to-1 tuition: **www.getbetteratphysics.co.uk**