AQA GCSE Physics | 8463

SPECIFICATION POINT 4.5.6.2.1

Newton's First Law

Past-paper questions

Tier	**Higher**
Question groups	**5**
Available paper years	**2011–2025**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

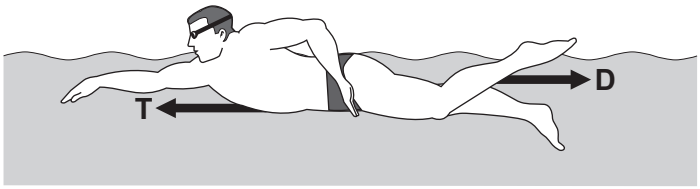
Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.5.6.2.1 Newton's First Law

Question 01

January 2011 | PHY2H | Original Q1 | Legacy

1 (a) The diagram shows the horizontal forces acting on a swimmer.



1 (a) (i) The swimmer is moving at constant speed.
Force **T** is 120 N.

What is the size of force **D**?

..... N
(1 mark)

1 (a) (ii) By increasing force **T** to 140 N, the swimmer accelerates to a higher speed.

Calculate the size of the initial resultant force acting on the swimmer.

.....

.....

Initial resultant force = ... N
(1 mark)

1 (a) (iii) Even though the swimmer keeps the force **T** constant at 140 N, the resultant force on the swimmer decreases to zero.

Explain why.

.....

.....

.....

.....

.....

.....
(3 marks)

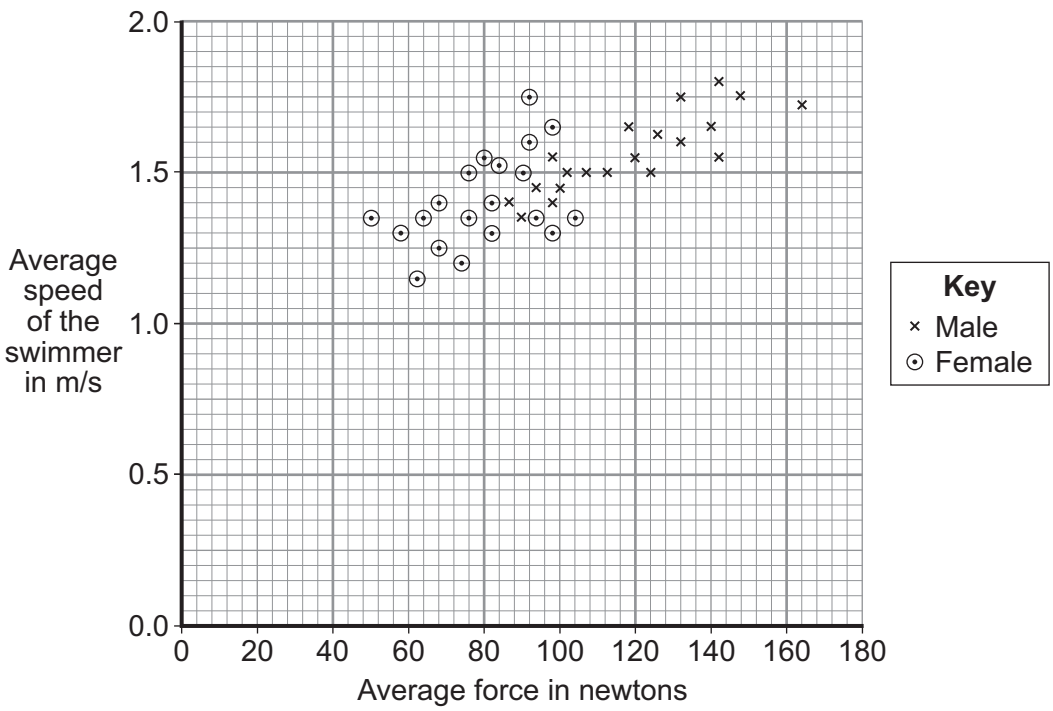
Question 1 continues on the next page

4.5.6.2.1 Newton's First Law

Question 01 · continued

1 (b) A sports scientist investigated how the force exerted by a swimmer's hands against the water affects the swimmer's speed.
The investigation involved 20 males and 20 females swimming a fixed distance.
Sensors placed on each swimmer's hands measured the force 85 times every second over the last 10 metres of the swim.
The measurements were used to calculate an average force.
The average speed of each swimmer over the last 10 metres of the swim was also measured.

The data from the investigation is displayed in the graph.



1 (b) (i) What was the dependent variable in this investigation?

.....

(1 mark)

1 (b) (ii) Explain **one** advantage of measuring the force 85 times every second rather than just once or twice every second.

.....

.....

.....

.....

(2 marks)

4.5.6.2.1 Newton's First Law

Question 01 · continued

1 (b) (iii) Give **one** way in which the data for the male swimmers is different from the data for the female swimmers.

.....

.....

(1 mark)

1 (b) (iv) Considering only the data from this investigation, what advice should a swimming coach give to swimmers who want to increase their average speed?

.....

.....

(1 mark)

10

Turn over for the next question

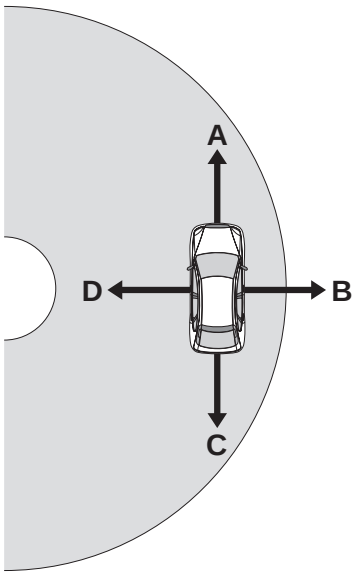
4.5.6.2.1 Newton's First Law

Question 02

June 2015 | PH3HP | Original Q2 | Legacy

2 (a) **Figure 3** shows a car travelling around a bend in the road. The car is travelling at a constant speed.

Figure 3



There is a resultant force acting on the car. This resultant force is called the centripetal force.

2 (a) (i) In which direction, **A**, **B**, **C** or **D**, does the centripetal force act on the car?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

2 (a) (ii) State the name of the force that provides the centripetal force.

[1 mark]

.....

4.5.6.2.1 Newton's First Law

Question 02 · continued

2 (a) (iii) State **two** factors that affect the size of the centripetal force acting on the car.

[2 marks]

1 .....

2 .....

2 (b) **Figure 4** shows a racing car.

Figure 4



The racing car should not roll over when racing.

State **two** features of the car that make it difficult for the car to roll over.

[2 marks]

1 .....

.....

2 .....

.....

6

4.5.6.2.1 Newton's First Law

Question 03

June 2019 | 8463/2H | Original Q6

0 6 . 1 An adult of mass 80 kg has more inertia than a child of mass 40 kg

What is inertia?

[1 mark]

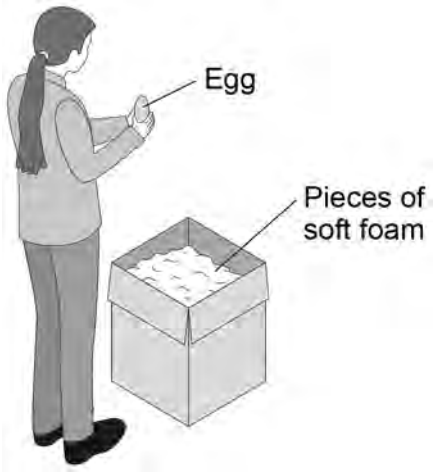
0 6 . 2 A teacher demonstrated the idea of a safety surface.

She dropped a raw egg into a box filled with pieces of soft foam.

The egg did not break.

Figure 10 shows the demonstration.

Figure 10



Explain why the egg is less likely to break when dropped onto soft foam rather than onto a concrete floor.

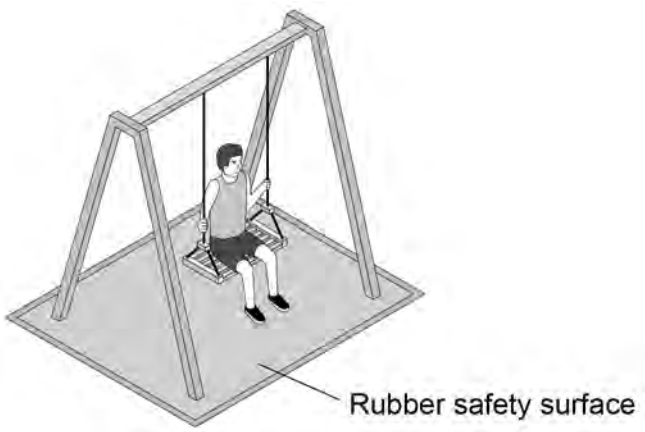
[3 marks]

4.5.6.2.1 Newton's First Law

Question 03 · continued

0 6 . 3 **Figure 11** shows a child on a playground swing. The playground has a rubber safety surface.

Figure 11



A child of mass 32 kg jumped from the swing.

When the child reached the ground she took 180 milliseconds to slow down and stop.

During this time an average force of 800 N was exerted on her by the ground.

Calculate the velocity of the child when she first touched the ground.

Use the Physics Equations Sheet.

[4 marks]

Velocity = _____ m/s

8

4.5.6.2.1 Newton's First Law

Question 04

November 2020 | 8463/2H | Original Q4

0 4 A door is fitted with a security lens and a lock.

The security lens allows a person to see a visitor before opening the door.

The security lens is concave.

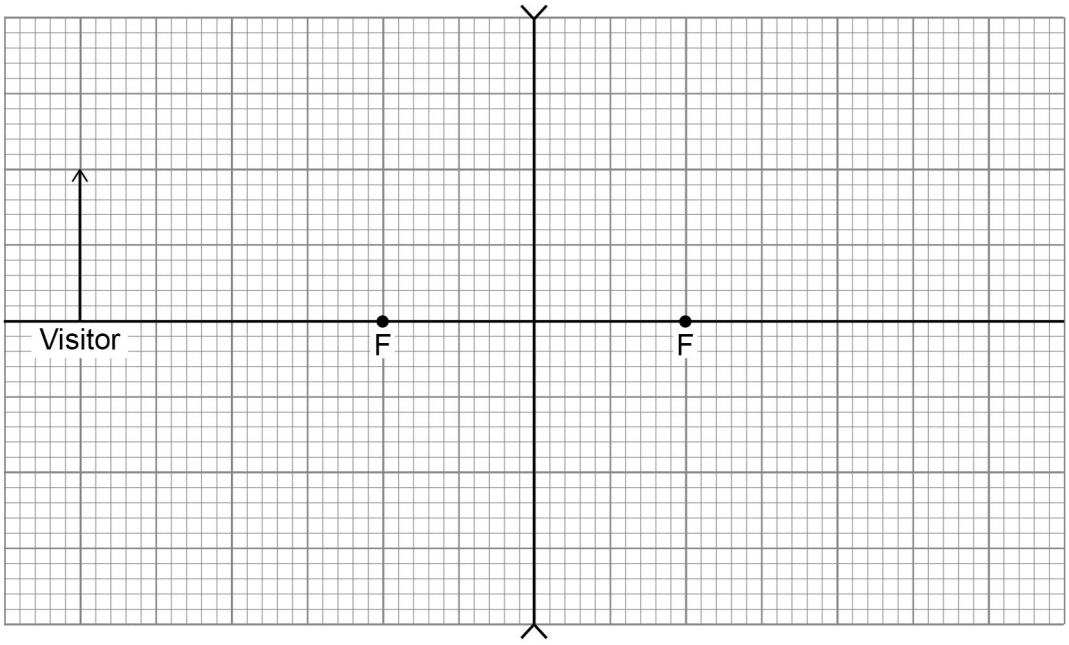
0 4 . 1 **Figure 5** is an incomplete ray diagram representing a visitor standing near the security lens.

Complete **Figure 5** to show how an image of the visitor is formed by the concave lens.

Draw an arrow to represent the image.

[3 marks]

Figure 5



0 4 . 2 The visitor moves further away from the security lens in the door.

How does the size of the image change?

[1 mark]

Tick (✓) **one** box.

Decreases ☐

Increases ☐

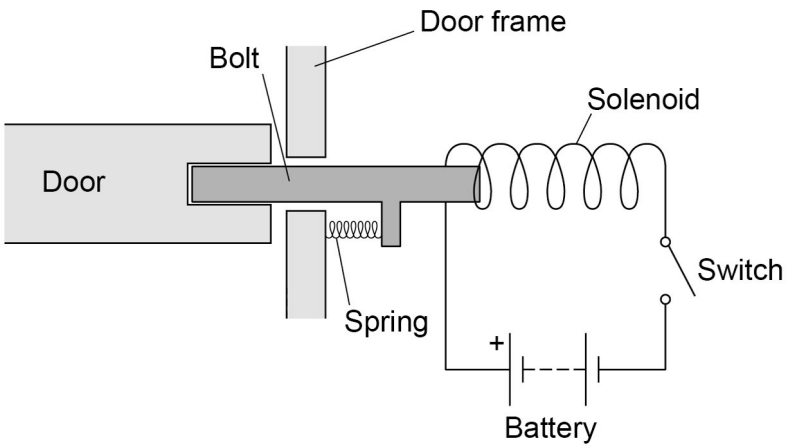
Stays the same ☐

4.5.6.2.1 Newton's First Law

Question 04 · continued

Figure 6 shows a diagram of the lock. The door unlocks when the switch is closed.

Figure 6



0 4 . 3 Which material should the bolt be made from?

[1 mark]

Tick (✓) **one** box.

Aluminium ☐

Brass ☐

Copper ☐

Iron ☐

0 4 . 4 Explain why the door unlocks when the switch is closed.

[3 marks]

4.5.6.2.1 Newton's First Law

Question 04 · continued

0 4 . 5 When the door unlocks, a force of 2.88 N is applied to the spring.

The spring extends by 1.50 cm.

Calculate the spring constant of the spring.

[4 marks]

Spring constant = _____ N/m

0 4 . 6 Give **two** ways the resultant force on the bolt could be increased.

[2 marks]

1 _____

2 _____

14

4.5.6.2.1 Newton's First Law

Question 05

June 2025 | 8463/2H | Original Q6

0 6 A car manufacturer makes two cars, **X** and **Y**.

The cars are identical, apart from their mass.

Car **X** has a greater mass than car **Y**.

0 6 . 1 How does the maximum acceleration of car **X** compare with the maximum acceleration of car **Y**?

[1 mark]

0 6 . 2 Cars have air bags that inflate to protect the driver if the car stops very suddenly.

Explain how air bags reduce the chance of injury to the driver.

[3 marks]

Question 6 continues on the next page

4.5.6.2.1 Newton's First Law

Question 05 · continued

0 6 . 3 Car **X** has a mass of 1400 kg and is travelling at 18 m/s.

The driver applies the brakes.

The car has a constant deceleration and comes to a stop in a distance of 24 m.

Calculate the resultant force on the car.

Use the Physics Equations Sheet.

[5 marks]

Resultant force = _____ N

0 6 . 4 Explain why braking causes an increase in the temperature of the brakes.

[2 marks]

4.5.6.2.1 Newton's First Law

Question 05 · continued

0 6 . 5 The driver of a car applies the brakes so the car has a large deceleration.

Give **two** possible risks of a large deceleration.

[2 marks]

1 _____

_____

2 _____

_____

13

Turn over for the next question