AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.5.4.2.1

Newton's First Law

Past-paper questions

Tier	**Foundation**
Question groups	**3**
Available paper years	**2018–2024**

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.

6.5.4.2.1 Newton's First Law

Question 01

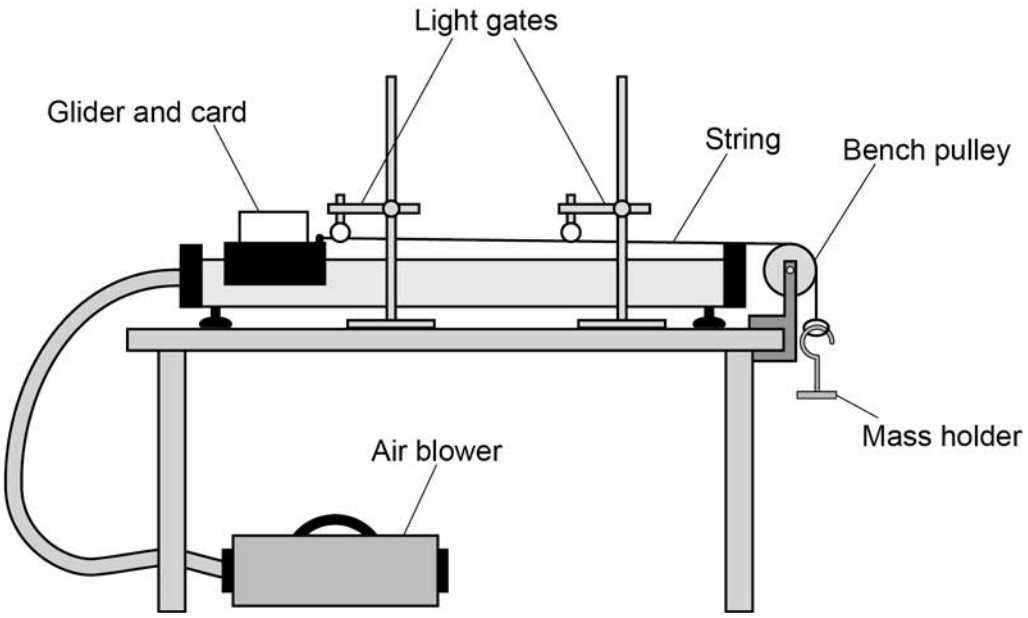
June 2018 | 8464/P/2F | Original Q7

0 7 A student investigated acceleration using gliders, an air track and light gates.

The air track reduces friction between the glider and the track to zero.

Figure 11 shows the apparatus.

Figure 11



The glider was released from rest and moved along the track.

The mass holder hit the ground before the card passed through the second light gate.

0 7 . 1 Which **two** statements describe the effect this would have on the glider?

[2 marks]

Tick **two** boxes.

Its acceleration would decrease to zero. ☐

Its acceleration would increase. ☐

The resultant force on it would decrease to zero. ☐

The resultant force on it would increase. ☐

Its speed would increase. ☐

6.5.4.2.1 Newton's First Law

Question 01 · continued

0 7 . 2 The mass holder should **not** hit the ground before the card passes through the second light gate.

Suggest **one** way that the student could stop this happening.

[1 mark]

Question 7 continues on the next page

6.5.4.2.1 Newton's First Law

Question 01 · continued

The student increased the resultant force acting on the glider by adding more masses to the mass holder.

She calculated the acceleration of the glider for each resultant force.

Each test was done three times.

Table 2 shows the results.

Table 2

Resultant force in N	Acceleration in m/s^2			Mean acceleration in m/s^2
	Test 1	Test 2	Test 3	
0.20	1.3	1.2	1.3	1.26667
0.39	2.6	2.5	2.6	2.6
0.59	3.8	3.8	3.9	3.8
0.78	5.1	5.1	5.1	5.1
0.98	6.4	7.2	6.4	6.7

0 7 . 3 The student made **two** mistakes in the mean acceleration column.

Identify the mistakes the student made.

Suggest how each mistake can be corrected.

[4 marks]

Mistake _____

_____

Correction _____

_____

Mistake _____

_____

Correction _____

_____

6.5.4.2.1 Newton's First Law

Question 01 · continued

June 2018 | 8464/P/2F | Original Q7

0 7 . 4 Write a conclusion for this investigation.

Use the data in **Table 2**

[1 mark]

Question 7 continues on the next page

6.5.4.2.1 Newton's First Law

Question 01 · continued

0 7 . 5 The student used a constant resultant force to accelerate the glider.

The student changed the mass of the glider and calculated the new acceleration.

She repeated this for different masses of the glider, keeping the resultant force constant.

The results are shown in **Table 3**

Table 3

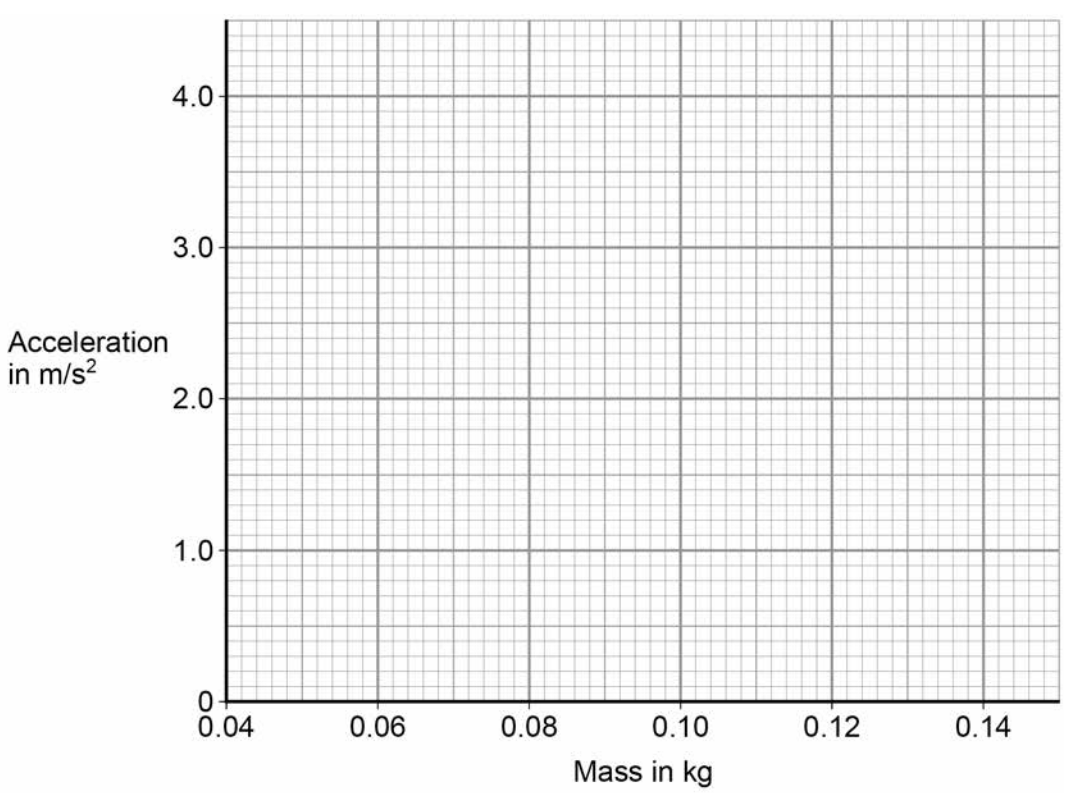
Mass of the glider in kg	Acceleration in m/s^2
0.060	3.5
0.080	2.6
0.10	2.0
0.12	1.7
0.14	1.4

Plot the results on **Figure 12**

Draw a line of best fit.

[3 marks]

Figure 12



6.5.4.2.1 Newton's First Law

Question 01 · continued

June 2018 | 8464/P/2F | Original Q7

0 7 . 6 Describe the relationship between mass and acceleration.

[1 mark]

12

Turn over for the next question

6.5.4.2.1 Newton's First Law

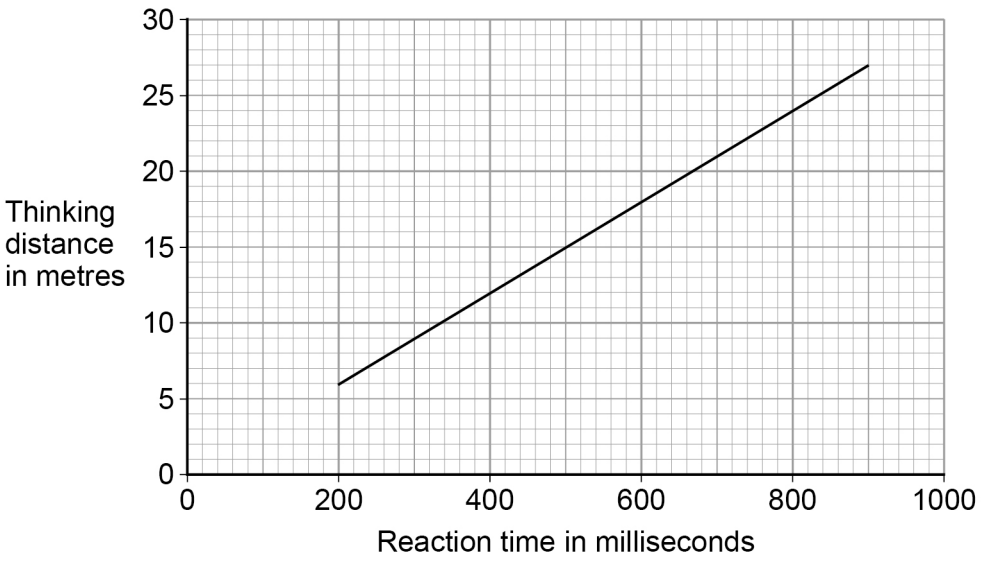
Question 02

June 2019 | 8464/P/2F | Original Q4

0 4 The thinking distance of a car depends on the reaction time of the driver.

Figure 6 shows how thinking distance varies with reaction time for a car travelling at 30 m/s

Figure 6



0 4 . 1 The reaction time of a driver can double if the driver is distracted.

Explain the effect doubling the reaction time has on the thinking distance.

Use data from **Figure 6**.

[2 marks]

0 4 . 2 Give the reason why there are no values of thinking distance for reaction times less than 200 milliseconds.

[1 mark]

6.5.4.2.1 Newton's First Law

Question 02 · continued

A driver measured her reaction time using an online test. She did the test five times.

Table 2 shows the results.

Table 2

Reaction time in milliseconds				
258	265	302	248	327

0 4 . 3 How does the data in **Table 2** show that it was important that the driver did the test five times?

[1 mark]

0 4 . 4 Calculate the mean reaction time of the driver.

[2 marks]

Mean reaction time = _____ ms

0 4 . 5 The driver is driving her car at 30 m/s

Determine the thinking distance.

Use **Figure 6** and your answer from Question **04.4**

[1 mark]

Thinking distance = _____ m

6.5.4.2.1 Newton's First Law

Question 02 · continued

0 4 . 6 The driver applies the brakes and the car comes to a stop.

The force exerted by the brakes affects the braking distance.

Give **two** other factors that affect the braking distance.

[2 marks]

1 _____

2 _____

0 4 . 7 Write down the equation that links distance, force and work done.

[1 mark]

_____

0 4 . 8 When the driver applies the brakes, there is a constant resultant force of 6.0 kN on the car.

The car travels a distance of 75 m before stopping.

Calculate the work done in stopping the car.

[3 marks]

_____

_____

_____

_____

_____

_____

Work done = _____ J

13

6.5.4.2.1 Newton's First Law

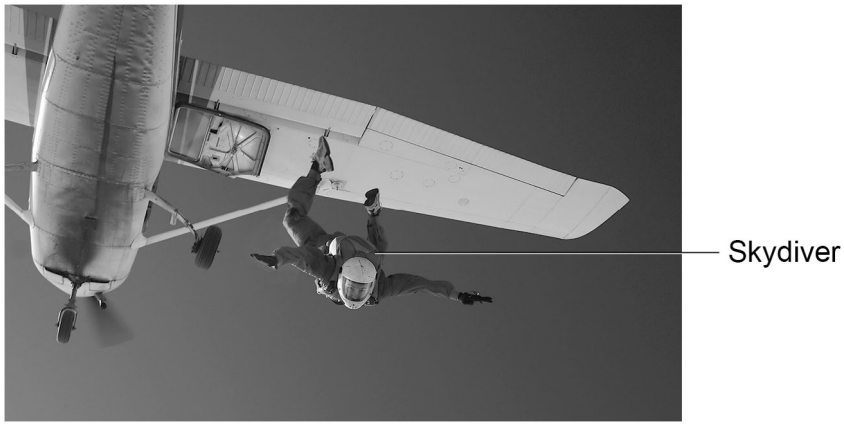
Question 03

June 2024 | 8464/P/2F | Original Q1

0 1 **Figure 1** shows a skydiver jumping from an aeroplane.

The skydiver is accelerating downwards.

Figure 1



0 1 . 1 Which force causes the skydiver to accelerate?

[1 mark]

Tick (✓) **one** box.

- Electromagnetic force ☐
- Gravitational force ☐
- Magnetic force ☐

0 1 . 2 Which force increases as the skydiver accelerates?

[1 mark]

Tick (✓) **one** box.

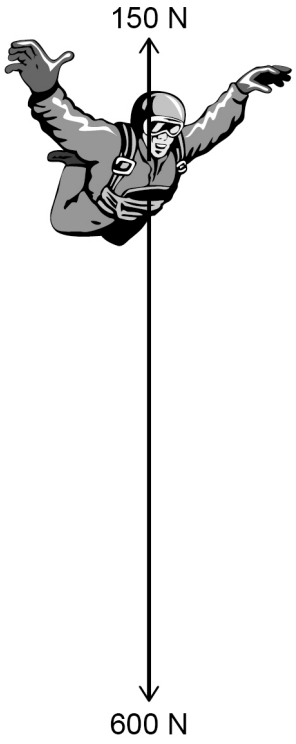
- Air resistance ☐
- Normal contact force ☐
- Tension ☐

6.5.4.2.1 Newton's First Law

Question 03 · continued

Figure 2 shows the two forces acting on the skydiver a few seconds after jumping from the aeroplane.

Figure 2



0 1 . 3 Calculate the resultant force acting on the skydiver in **Figure 2**.

[1 mark]

Resultant force = _____ N

Question 1 continues on the next page

6.5.4.2.1 Newton's First Law

Question 03 · continued

0 1 . 4 Eventually the skydiver stops accelerating and falls at a constant velocity.

What is the resultant force acting on the skydiver when falling at a constant velocity?

[1 mark]

Tick (✓) **one** box.

0 N ☐

150 N ☐

600 N ☐

0 1 . 5 What name is given to the constant velocity of the skydiver?

[1 mark]

Tick (✓) **one** box.

Average velocity ☐

Initial velocity ☐

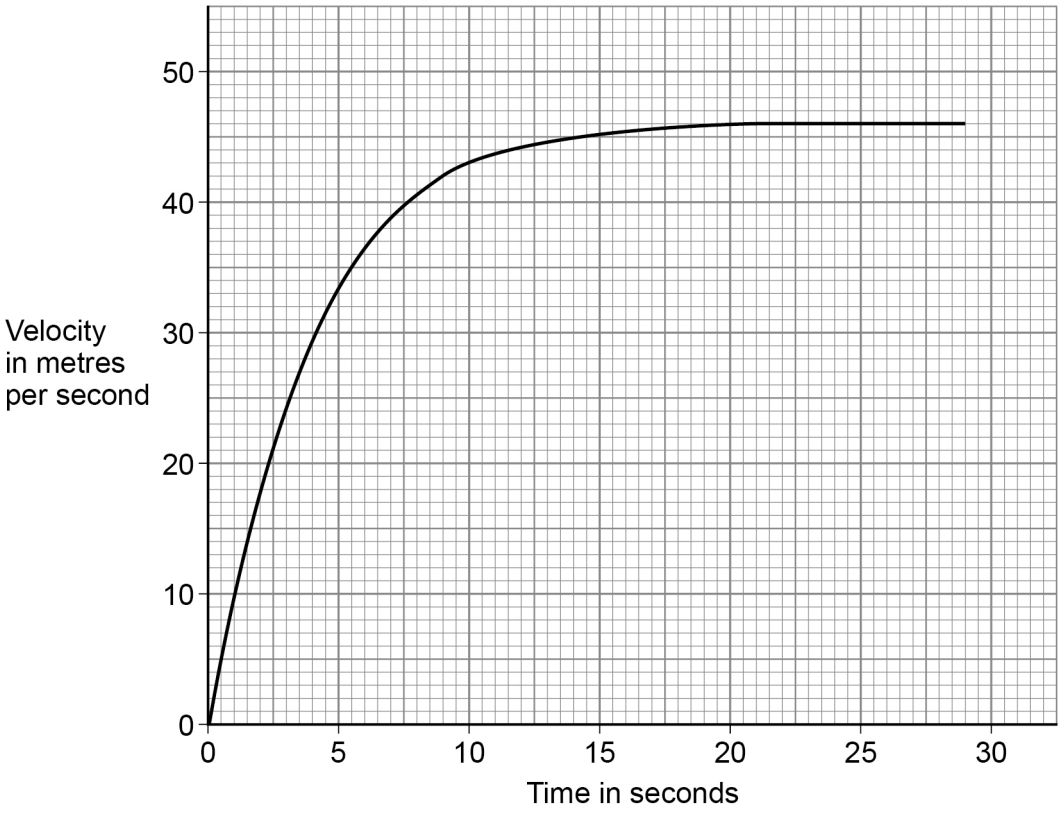
Terminal velocity ☐

6.5.4.2.1 Newton's First Law

Question 03 · continued

Figure 3 shows a velocity–time graph for the skydiver.

Figure 3



0 1 . 6 How many seconds did the skydiver accelerate for?

Use **Figure 3**.

[1 mark]

_____ s

0 1 . 7 What was the constant velocity of the skydiver?

Use **Figure 3**.

[1 mark]

_____ m/s

6.5.4.2.1 Newton's First Law

Question 03 · continued

0 1 . 8 After opening a parachute, the skydiver fell at a constant speed of 3.6 m/s for 25 seconds.

Calculate the distance travelled by the skydiver during this time.

Use the equation:

distance travelled = speed × time

[2 marks]

Distance travelled = _____ m

9