AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.5.1.4

Resultant forces

Past-paper questions

Tier	**Foundation**
Question groups	**12**
Available paper years	**2018–2025**

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.

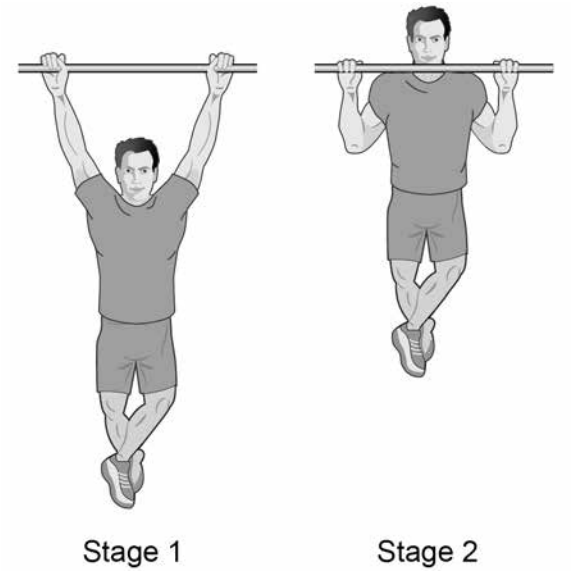
6.5.1.4 Resultant forces

Question 01

June 2018 | 8464/P/2F | Original Q3

0 3 **Figure 4** shows a man doing two stages of a pull up. In both diagrams the man is stationary.

Figure 4



0 3 . 1 Complete the sentence.

Choose the answer from the box.

[1 mark]

equal to	**less than**	**more than**

In stage 1 the downwards force of the man on the bar is _____ the upwards force of the bar on the man.

0 3 . 2 The man has a mass of 85 kg

Gravitational field strength = 9.8 N/kg

Calculate the weight of the man.

Use the equation:

weight = mass × gravitational field strength

[2 marks]

_____

_____

Weight = _____ N

6.5.1.4 Resultant forces

Question 01 · continued

0 3 . 3 The man raises his body a vertical distance of 0.63 m to go from stage 1 to stage 2

Calculate the work done by the man.

Use your answer to question **03.2**

Use the equation:

work done = force × distance

[2 marks]

Work done = _____ J

0 3 . 4 The man was **not** moving at stage 2

How much work is done by the man at stage 2?

[1 mark]

Work done = _____ J

0 3 . 5 A woman uses the bar to do a pull up.

The woman has a mass of 62 kg

She accelerates at 11 m/s^2

Calculate the resultant force on the woman.

Use the equation:

force = mass × acceleration

[2 marks]

Force = _____ N

8

6.5.1.4 Resultant forces

Question 02

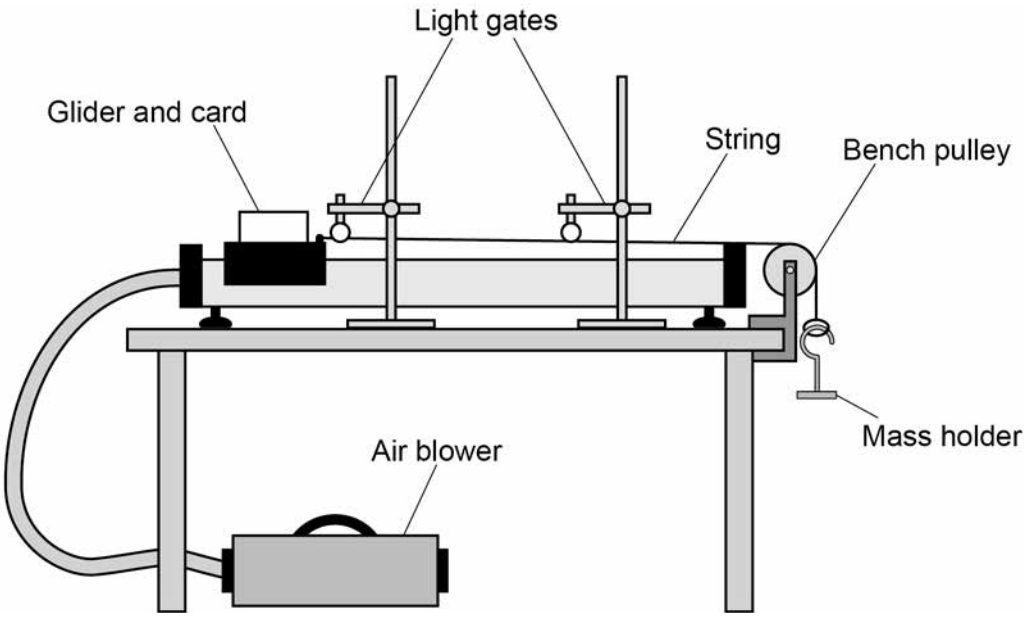
June 2018 | 8464/P/2F | Original Q7

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. ☐

6.5.1.4 Resultant forces

Question 02 · 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

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 _____

_____

6.5.1.4 Resultant forces

Question 02 · continued

0 7 . 4 Write a conclusion for this investigation.

Use the data in **Table 2**

[1 mark]

Question 7 continues on the next page

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

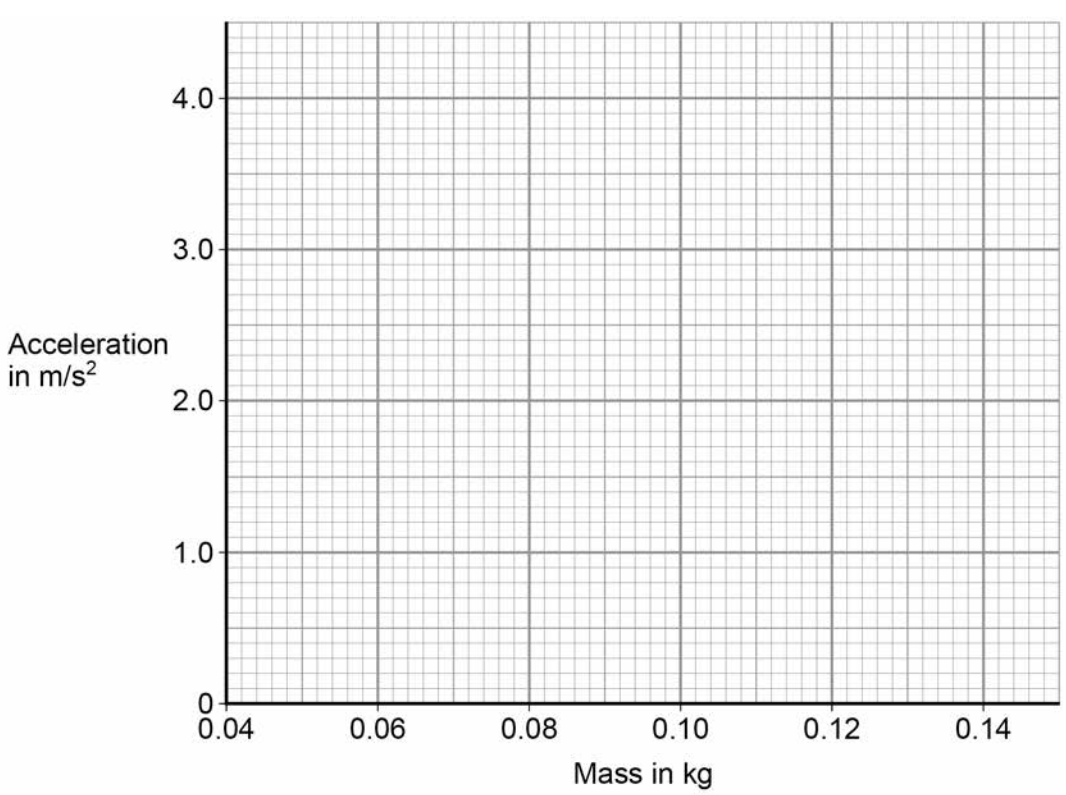
Mass of the glider in kg	Acceleration in m/s^2
0.060	3.5
0.080	2.6
0.10	2.0
0.12	1.7
0.14	1.4

Plot the results on **Figure 12**

Draw a line of best fit.

[3 marks]

Figure 12



6.5.1.4 Resultant forces

Question 02 · continued

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

[1 mark]

12

Turn over for the next question

6.5.1.4 Resultant forces

Question 03

June 2019 | 8464/P/2F | Original Q3

0 3 **Figure 4** shows two children playing table tennis.

The boy hits the ball from one end of the table.

Figure 4



0 3 . 1 Why does the velocity of the ball change when the boy hits it?

[1 mark]

Tick (✓) **one** box.

The direction of the ball does not change. ☐

There is a resultant force on the ball. ☐

The mass of the ball increases. ☐

The speed of the ball is constant. ☐

6.5.1.4 Resultant forces

Question 03 · continued

0 3 . 2 The ball has an average speed of 11 m/s

The ball takes 0.25 s to travel the same distance as the length of the table.

Calculate the length of the table.

Use the equation:

distance travelled = speed × time

[2 marks]

Length of table = _____ m

Question 3 continues on the next page

6.5.1.4 Resultant forces

Question 03 · continued

0 3 . 3 A table tennis ball should only be used if it bounces to at least 75% of the height it was dropped from.

A manufacturer tested a table tennis ball.

Table 1 shows the results.

Table 1

Height ball was dropped from in cm	Height of bounce in cm
30.0	25.1

Determine whether the ball can be used.

Use the data from **Table 1**.

[3 marks]

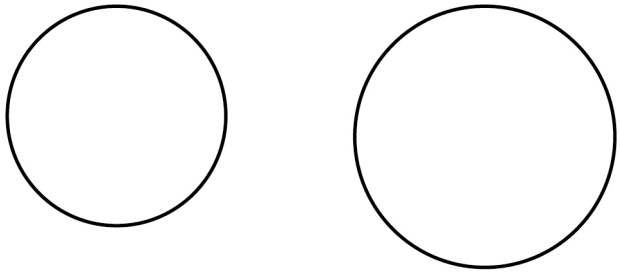
6.5.1.4 Resultant forces

Question 03 · continued

0 3 . 4 **Figure 5** shows two table tennis balls.

The balls are different sizes but have the same mass.

Figure 5



Both balls were dropped onto the table from the same height.

After they were dropped, the resultant force on the smaller ball was greater than the resultant force on the larger ball.

Explain why.

[2 marks]

8

6.5.1.4 Resultant forces

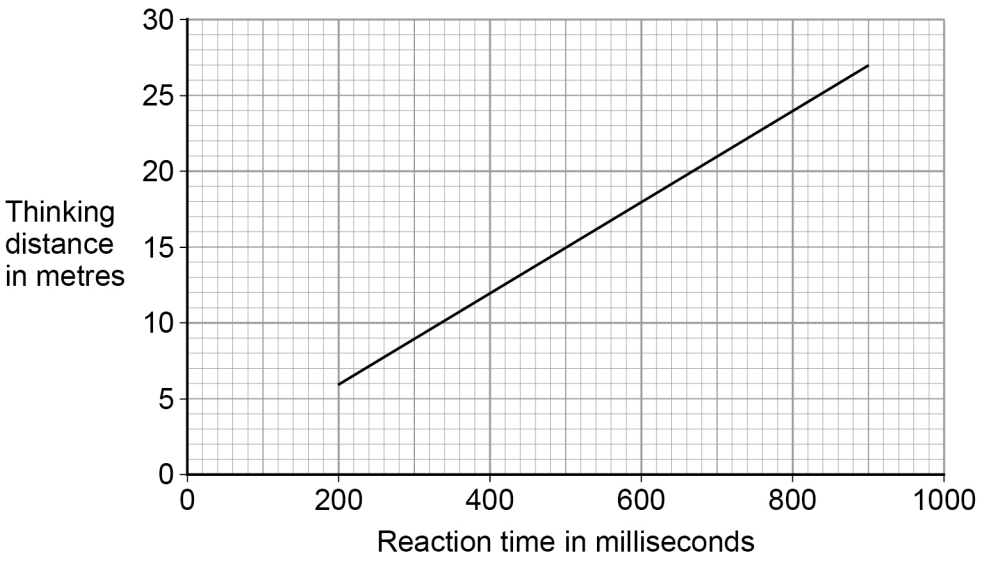
Question 04

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]

Question 04 · 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

6.5.1.4 Resultant forces

Question 04 · 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

6.5.1.4 Resultant forces

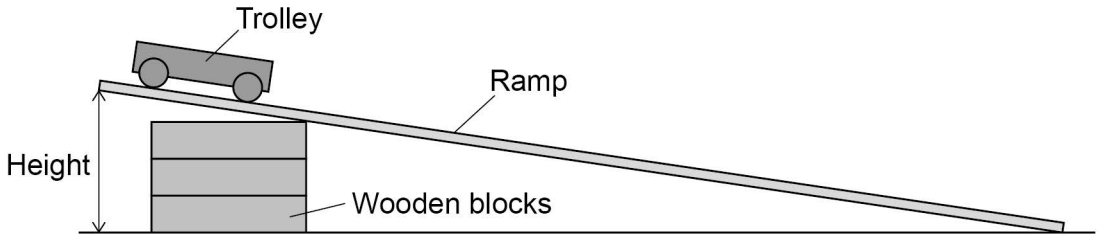
Question 05

November 2020 | 8464/P/2F | Original Q7

0 7 A student investigated how the height of a ramp affects the acceleration of a trolley down the ramp.

Figure 11 shows some of the equipment used.

Figure 11



0 7 . 1 Plan an investigation to determine how the height of the ramp affects the acceleration of the trolley.

[6 marks]

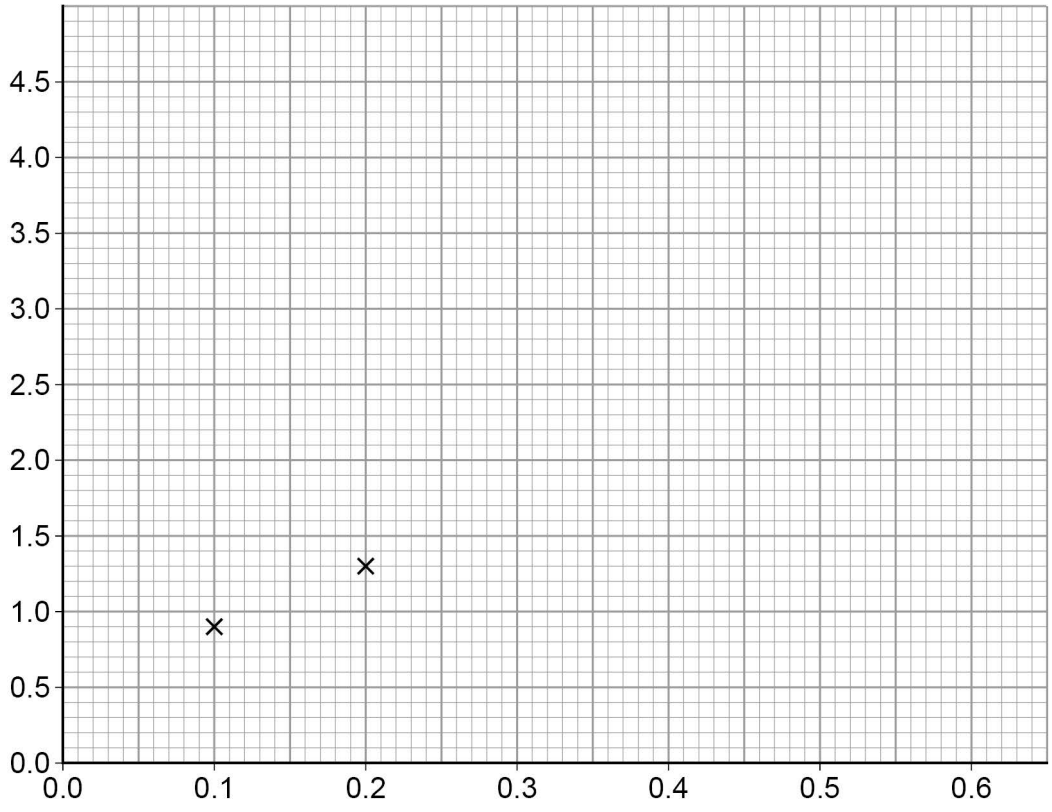
Table 2 shows the results.

Table 2

Height of ramp in metres	0.1	0.2	0.3	0.4	0.5	0.6
Acceleration in m/s^2	0.9	1.3	2.1	3.2	3.9	4.3

The first two results have been plotted on **Figure 12**.

Figure 12



0 7 . 2 Complete **Figure 12**.

You should:

- label the axes
- plot the remaining results from **Table 2**
- draw a line of best fit.

[4 marks]

Question 7 continues on the next page

6.5.1.4 Resultant forces

Question 05 · continued

0 7 . 3 Write down the equation that links acceleration (a), mass (m) and resultant force (F).

[1 mark]

0 7 . 4 When the resultant force on the trolley was 0.63 N the acceleration of the trolley was 2.1 m/s^2

Calculate the mass of the trolley.

[3 marks]

Mass of trolley = _____ kg

14

6.5.1.4 Resultant forces

Question 06

November 2021 | 8464/P/2F | Original Q1

0 1 Forces are either contact forces or non-contact forces.

0 1 . 1 Which of the following is a non-contact force?

[1 mark]

Tick (✓) **one** box.

Electrostatic force ☐

Friction force ☐

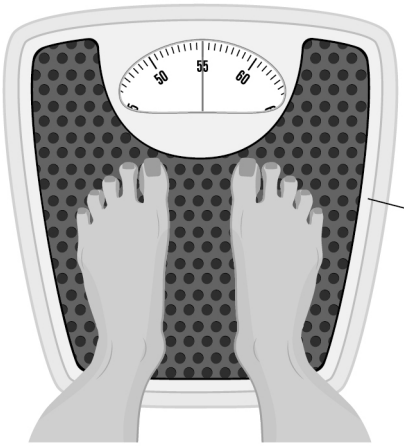
Tension force ☐

6.5.1.4 Resultant forces

Question 06 · continued

Figure 1 shows a person standing on some bathroom scales.

Figure 1



The person exerts a downward force on the scales and the scales exert an upward force on the person.

0 1 . 2 Which sentence about the forces is true?

[1 mark]

Tick (✓) **one** box.

The downward force is less than the upward force. ☐

The downward force is the same size as the upward force. ☐

The downward force is greater than the upward force. ☐

0 1 . 3 What is the name of the upward force on the person?

[1 mark]

Tick (✓) **one** box.

Air resistance ☐

Normal contact force ☐

Weight ☐

6.5.1.4 Resultant forces

Question 06 · continued

0 1 . 4 The person on the scales has a mass of 55 kg.

gravitational field strength = 9.8 N/kg

Calculate the weight of the person.

Use the equation:

weight = mass × gravitational field strength

[2 marks]

Weight = _____ N

0 1 . 5 The gravitational field strength is **not** the same at all points on the surface of the Earth.

The gravitational field strength is weakest at the equator.

A person travelled from the UK to the equator.

What happened to the weight of the person?

[1 mark]

Tick (✓) **one** box.

- The weight decreased. ☐
- The weight remained the same. ☐
- The weight increased. ☐

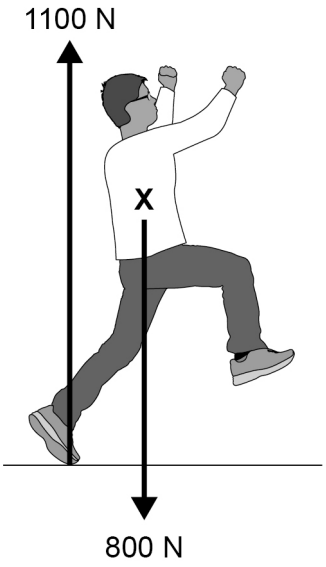
6.5.1.4 Resultant forces

Question 06 · continued

Figure 2 shows the forces acting on a person.

The person is about to jump.

Figure 2



0 1 . 6 The arrow representing the weight of the person is drawn from point **X**.

What is the name given to point **X**?

[1 mark]

Tick (✓) **one** box.

Centre of force ☐

Centre of mass ☐

Centre of weight ☐

0 1 . 7 Determine the size of the resultant force on the person in **Figure 2**.

[1 mark]

Resultant force = _____ N

8

6.5.1.4 Resultant forces

Question 07

November 2021 | 8464/P/2F | Original Q7

0 7 Professional rugby players wear a tracking device that measures their velocity and acceleration.

Figure 9 shows a player wearing a tracking device.

The player is tackling another player who is running with the ball.

Figure 9



0 7 . 1 Velocity and acceleration are both vector quantities.

What is a vector quantity?

[1 mark]

Tick (✓) **one** box.

- A quantity with both magnitude and direction ☐
- A quantity with direction only ☐
- A quantity with magnitude only ☐

6.5.1.4 Resultant forces

Question 07 · continued

0 7 . 2 Which of the following is a vector quantity?

[1 mark]

Tick (✓) **one** box.

- Displacement ☐
- Distance ☐
- Time ☐
- Work done ☐

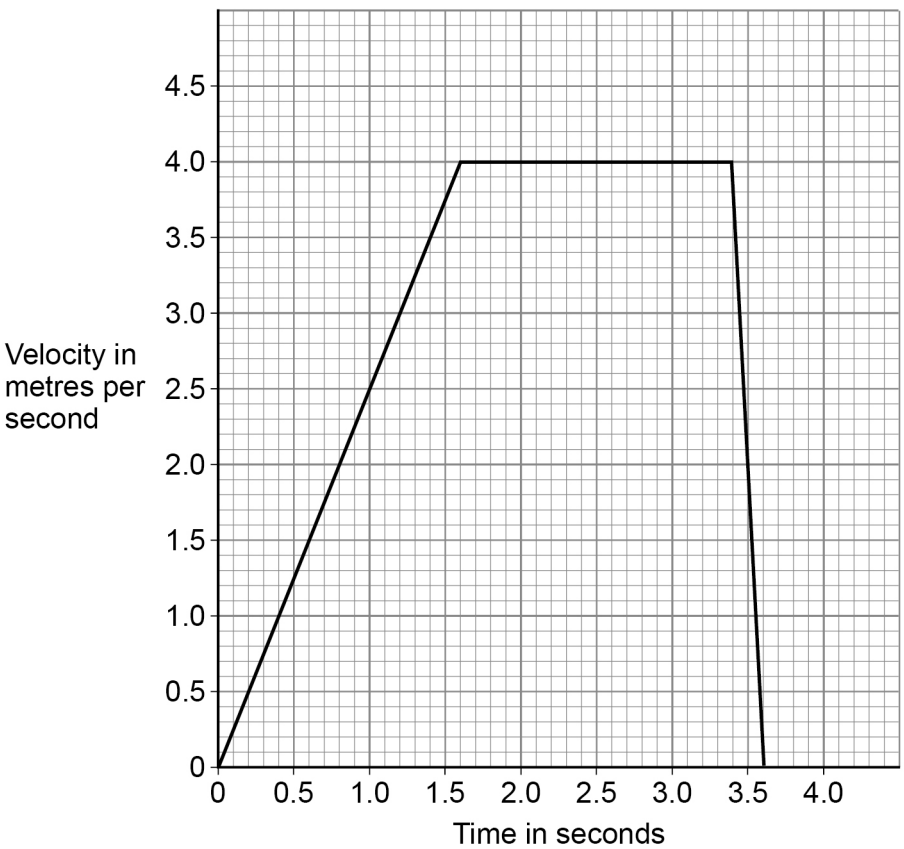
Question 7 continues on the next page

6.5.1.4 Resultant forces

Question 07 · continued

Figure 10 shows a velocity–time graph for the player running with the ball.

Figure 10



0 7 . 3 Determine the acceleration of the player between 0 and 1.6 s.

[2 marks]

Acceleration = _____ m/s^2

0 7 . 4 Describe the motion of the player between 3.4 s and 3.6 s.

[1 mark]

6.5.1.4 Resultant forces

Question 07 · continued

The force exerted on the player when she is tackled causes her to accelerate.

0 7 . 5 Write down the equation which links acceleration (*a*), mass (*m*) and resultant force (*F*).

[1 mark]

0 7 . 6 The player accelerates at 25 m/s^2 when a resultant force of 1800 N acts on her.

Calculate the mass of the player.

[3 marks]

Mass = _____ kg

0 7 . 7 The tracking device sends data to a computer during the game.

Suggest **one** advantage of the data being sent during the game.

[1 mark]

10

6.5.1.4 Resultant forces

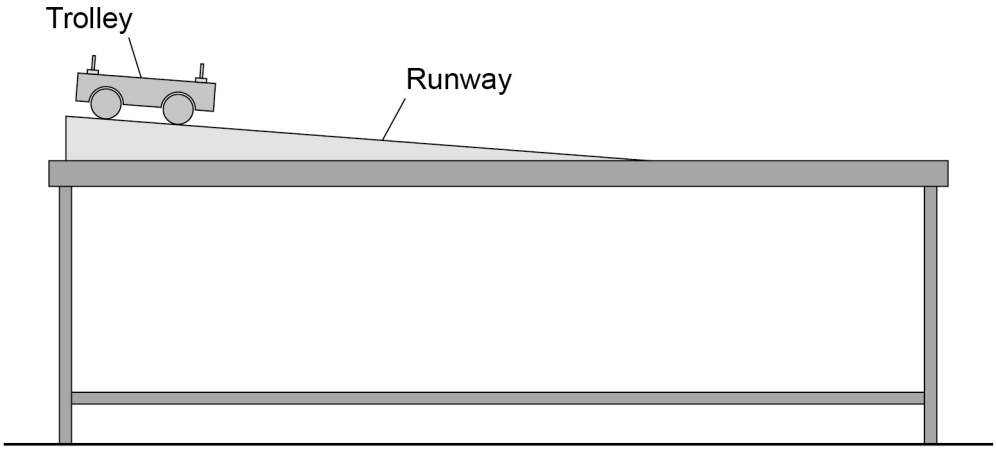
Question 08

June 2023 | 8464/P/2F | Original Q7

0 7 A student investigated how the acceleration of a trolley is affected by the force acting on the trolley.

Figure 16 shows some of the equipment used.

Figure 16



6.5.1.4 Resultant forces

Question 08 · continued

0 7 . 1 Describe a method the student could use.

Your answer should include any extra equipment needed.

[6 marks]

Question 7 continues on the next page

Question 08 · continued

Table 2 shows one set of results for a similar investigation.

Table 2

Resultant force in newtons	Acceleration in m/s^2
1.2	1.6

0 7 . 2 Which of Newton's laws predicts that the acceleration of the trolley is proportional to the resultant force on the trolley?

[1 mark]

Tick (✓) **one** box.

First law ☐

Second law ☐

Third law ☐

0 7 . 3 Determine the acceleration of the trolley when the resultant force is 3.6 N.

Use **Table 2**.

[2 marks]

Acceleration = _____ m/s^2

6.5.1.4 Resultant forces

Question 08 · continued

Use the Physics Equations Sheet to answer questions **07.4** and **07.5**.

0 7 . 4 Write down the equation that links acceleration (*a*), mass (*m*) and resultant force (*F*).

[1 mark]

0 7 . 5 A resultant force of 0.42 N acts on a different trolley.

The acceleration of the trolley is 1.2 m/s^2.

Calculate the mass of the trolley.

[3 marks]

Mass of trolley = _____ kg

13

6.5.1.4 Resultant forces

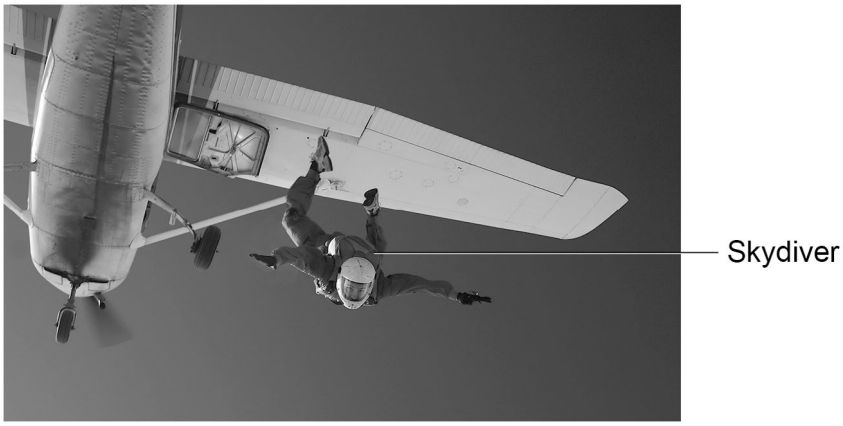
Question 09

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.

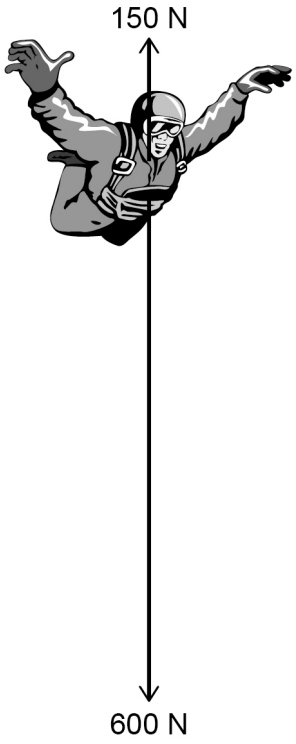
- Air resistance ☐
- Normal contact force ☐
- Tension ☐

6.5.1.4 Resultant forces

Question 09 · 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

6.5.1.4 Resultant forces

Question 09 · 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.

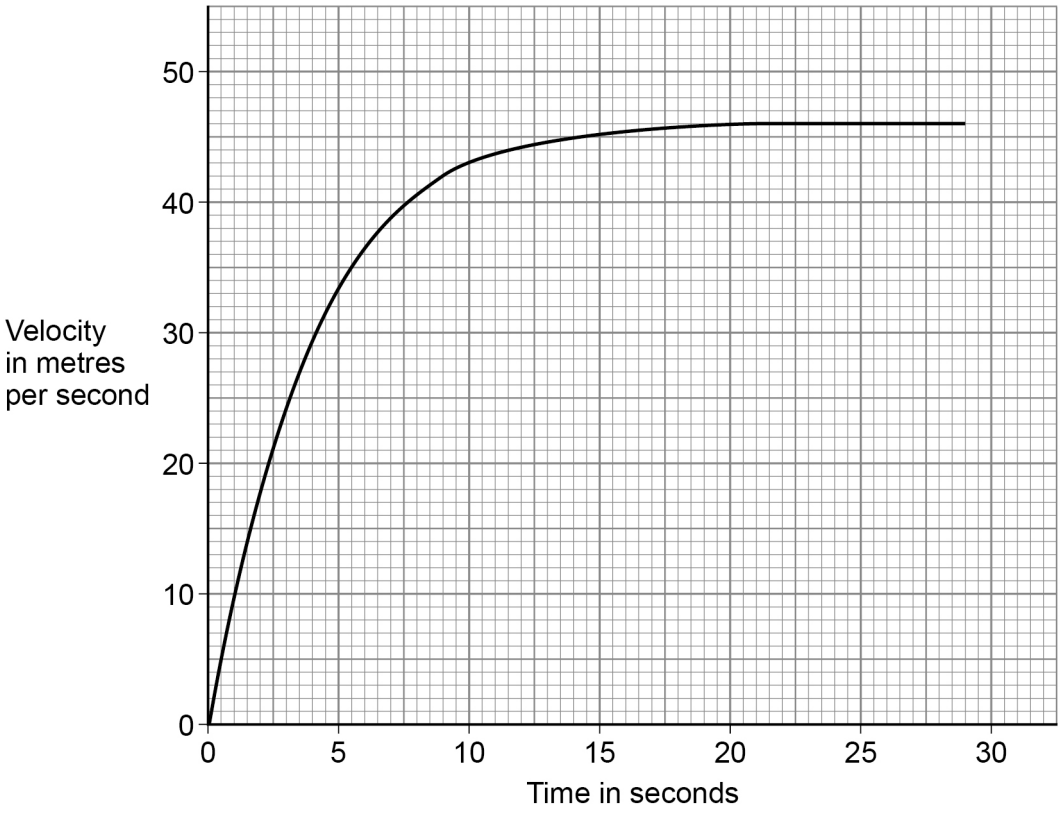
- Average velocity ☐
- Initial velocity ☐
- Terminal velocity ☐

6.5.1.4 Resultant forces

Question 09 · 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

6.5.1.4 Resultant forces

Question 09 · 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

6.5.1.4 Resultant forces

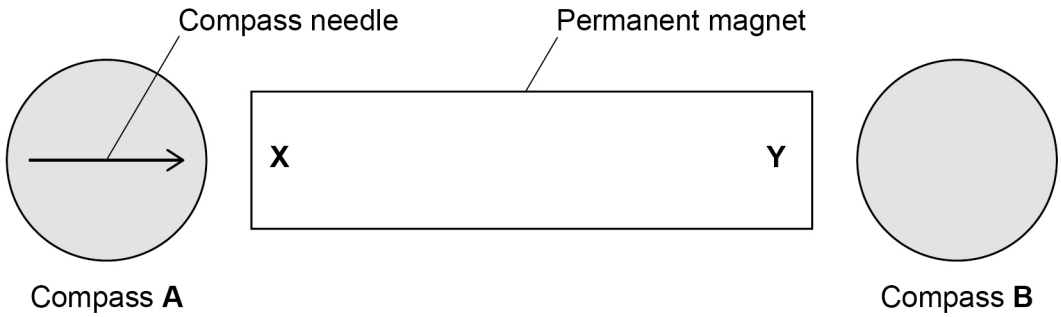
Question 10

June 2024 | 8464/P/2F | Original Q4

0 4 **Figure 8** shows a permanent magnet and two magnetic compasses.

The poles of the magnet are labelled **X** and **Y**.

Figure 8



0 4 . 1 The direction of the compass needle in compass **A** is shown.

Give the names of the poles labelled **X** and **Y** in **Figure 8**.

[2 marks]

X _____

Y _____

0 4 . 2 Draw an arrow on compass **B** in **Figure 8** to show the direction of the magnetic field at that position.

[1 mark]

6.5.1.4 Resultant forces

Question 10 · continued

Figure 9 shows security tags on some clothes in a shop.

Security tags can be detected if clothes are taken out of the shop with tags still attached.

Figure 9



The tags are attached to the clothes by pins made from a magnetic material.

A shop assistant can use a magnet to remove the pins.

0 4 . 3 Which of the following are magnetic materials?

[2 marks]

Tick (✓) **two** boxes.

- Aluminium ☐
- Copper ☐
- Iron ☐
- Lead ☐
- Nickel ☐
- Tin ☐

6.5.1.4 Resultant forces

Question 10 · continued

0 4 . 4 Which of the following describes the force between a magnetic material and a magnet?

[1 mark]

Tick (✓) **one** box.

The force is always attractive. ☐

The force is always repulsive. ☐

The force can be either attractive or repulsive. ☐

0 4 . 5 The shop assistant removes a security tag and drops the tag into a collecting bin.

As it falls, the tag accelerates at 9.8 m/s^2.

The mass of the tag is 0.030 kg.

Calculate the resultant force acting on the tag.

Use the equation:

resultant force = mass × acceleration

[2 marks]

Resultant force = _____ N

8

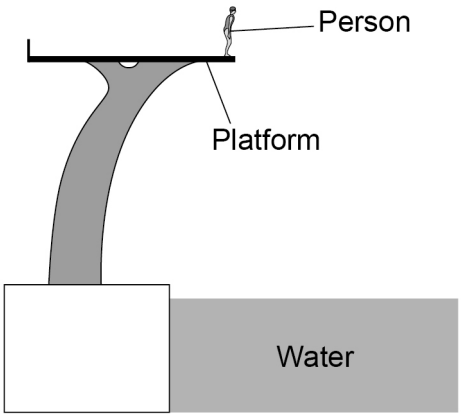
6.5.1.4 Resultant forces

Question 11

June 2025 | 8464/P/2F | Original Q1

0 1 **Figure 1** shows a person about to dive from a high platform into a pool of water.

Figure 1



0 1 . 1 The person dived from the platform into the water.

The time taken between the person leaving the platform and entering the water was measured by four people.

The measurements were:

2.1 s 1.9 s 1.3 s 2.0 s

Which measurement is anomalous?

[1 mark]

Tick (✓) **one** box.

2.1 s ☐

1.9 s ☐

1.3 s ☐

2.0 s ☐

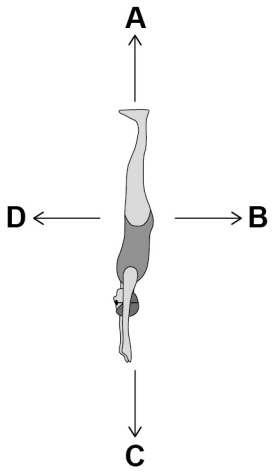
6.5.1.4 Resultant forces

Question 11 · continued

0 1 . 2 Air resistance acted on the person during the dive.

Figure 2 shows the person moving vertically downwards.

Figure 2



Which arrow on **Figure 2** shows the direction of the air resistance acting on the person?

[1 mark]

Tick (✓) **one** box.

A ☐

B ☐

C ☐

D ☐

Question 1 continues on the next page

6.5.1.4 Resultant forces

Question 11 · continued

0 1 . 3 Air resistance is a contact force.

Which force is also a contact force?

[1 mark]

Tick (✓) **one** box.

Friction ☐

Gravitational force ☐

Magnetic force ☐

0 1 . 4 What happened to the size of the air resistance force as the speed of the person increased?

[1 mark]

0 1 . 5 After entering the water, the person decelerated for a time of 0.35 s.

The deceleration of the person was 60 m/s^2.

Calculate the change in velocity of the person.

Use the equation:

change in velocity = deceleration × time

[2 marks]

Change in velocity = _____ m/s

6.5.1.4 Resultant forces

Question 11 · continued

0 1 . 6 The mass of the person was 75 kg.

Calculate the resultant force on the person when the deceleration was 60 m/s^2.

Use the equation:

resultant force = mass × deceleration

[2 marks]

Resultant force = _____ N

8

Turn over for the next question

6.5.1.4 Resultant forces

Question 12

June 2025 | 8464/P/2F | Original Q6

0 6 In a dog-sled race, a team of dogs pull on a rope attached to a sled.

Figure 12 shows a dog-sled team.

Figure 12



Use the Physics Equations Sheet to answer questions **06.1** and **06.2**.

0 6 . 1 What equation links distance travelled, speed and time?

[1 mark]

Tick (✓) **one** box.

distance travelled = speed × time ☐

speed = time × distance travelled ☐

time = distance travelled × speed ☐

6.5.1.4 Resultant forces

Question 12 · continued

0 6 . 2 The longest dog-sled race in the world covers a distance of 1 500 000 m.

One team finished the race in a time of 670 000 s.

Calculate the average speed of this team during the race.

[3 marks]

Average speed = _____ m/s

0 6 . 3 At the start of the race, 6 dogs pulled on the rope.

The average forward force on the sled from **each** dog was 370 N.

The backwards force on the sled from friction was 520 N.

Calculate the resultant force on the sled.

[2 marks]

Resultant force = _____ N

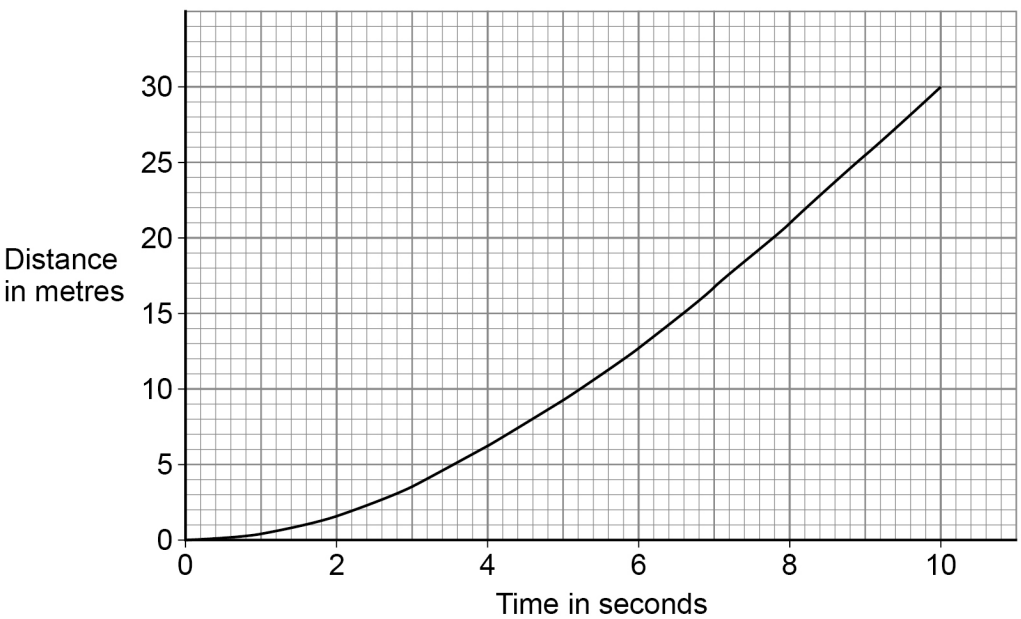
Question 6 continues on the next page

6.5.1.4 Resultant forces

Question 12 · continued

Figure 13 shows a distance–time graph for the sled at the start of the race.

Figure 13



0 6 . 4 What does the gradient of the graph in **Figure 13** represent?

[1 mark]

6.5.1.4 Resultant forces

Question 12 · continued

0 6 . 5 Later in the race, the sled moved at a constant speed along a flat, horizontal path.

What was the relationship between the size of the horizontal forces acting when the sled moved at a constant speed?

[1 mark]

Tick (✓) **one** box.

friction + air resistance < pull of the rope on the sled ☐

friction + air resistance = pull of the rope on the sled ☐

friction + air resistance > pull of the rope on the sled ☐

0 6 . 6 The rope exerted a force on the sled when the sled was moving.

What is the Newton's Third Law pair to the force of the rope on the sled?

[1 mark]

Tick (✓) **one** box.

The force of friction on the sled ☐

The force of the dogs on the rope ☐

The force of the sled on the rope ☐

9