AQA GCSE Physics | 8463

SPECIFICATION POINT 4.5.6.1.3

Velocity

Past-paper questions

Tier	**Higher**
Question groups	**4**
Available paper years	**2005–2015**

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.

4.5.6.1.3 Velocity

Question 01

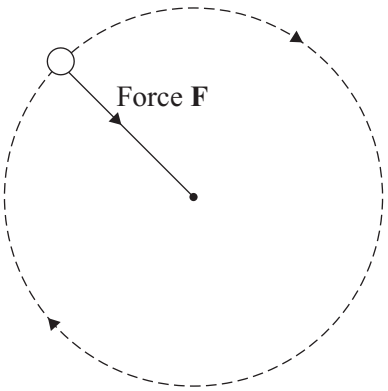
June 2005 | 3451 | Original Q5 | Legacy

5 (a) A student has fastened a ball to a piece of string and is swinging it round in a horizontal circle.



(i) The diagram below shows an overhead view of the movement of the ball.

Add an arrow, from the centre of the ball, to show the direction in which the ball would move if the string broke at this instant.



(1 mark)

(ii) Complete the table to show how force **F** changes if the student changes what he is doing. In each case, all the other factors stay the same.

If the student	Force F needs to
uses a ball with a greater mass	.....
swings the ball at a greater speed	.....
swings the ball with a shorter piece of string	.....

(3 marks)

4.5.6.1.3 Velocity

Question 01 · continued

MARGIN BLANK

(b) The Moon orbits the Earth in a circular path.

Use words from the box to complete the **three** spaces in the sentence.

direction	resistance	speed	velocity

You may use each word once, more than once or not at all.

The Moon's ..... is constant but its ..... changes because its ..... changes.

(2 marks)

(c) When any object moves in a circular, or nearly circular, path a force must act towards the centre of the circle.

(i) What word is used to describe this force?

.....

(1 mark)

(ii) The Moon orbits the Earth. What provides the force towards the Earth?

.....

(1 mark)

(iii) In an atom, name the particles which are moving in circular paths around the nucleus.

.....

(1 mark)

(iv) In the case of an atom, what word describes the forces which keep these particles moving in circular paths around the nucleus?

.....

(1 mark)

10

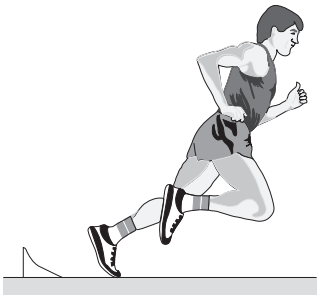
TURN OVER FOR THE NEXT QUESTION

4.5.6.1.3 Velocity

Question 02

January 2009 | PHY2H | Original Q2 | Legacy

2 (a) The diagram shows an athlete at the start of a race. The race is along a straight track.



In the first 2 seconds, the athlete accelerates constantly and reaches a speed of 9 m/s.

2 (a) (i) Use the equation in the box to calculate the acceleration of the athlete.

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken for change}}$$

Show clearly how you work out your answer.

.....

.....

.....

Acceleration = ...

(2 marks)

2 (a) (ii) Which **one** of the following is the unit for acceleration?

Draw a ring around your answer.

J/s **m/s** **m/s^2** **Nm**

(1 mark)

4.5.6.1.3 Velocity

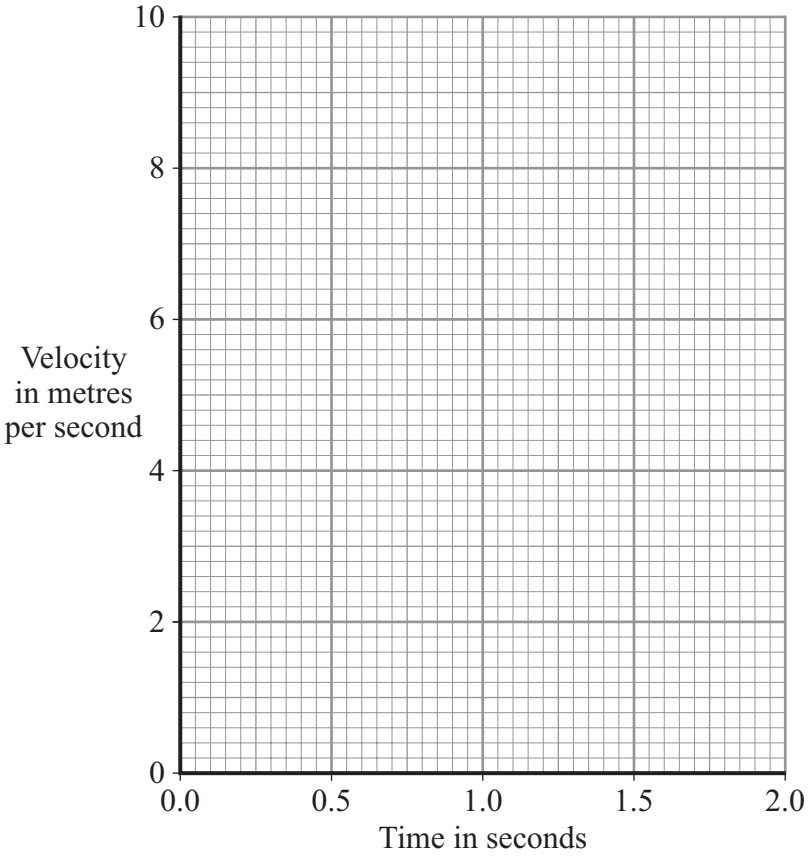
Question 02 · continued

for mark

2 (a) (iii) Complete the following sentence.

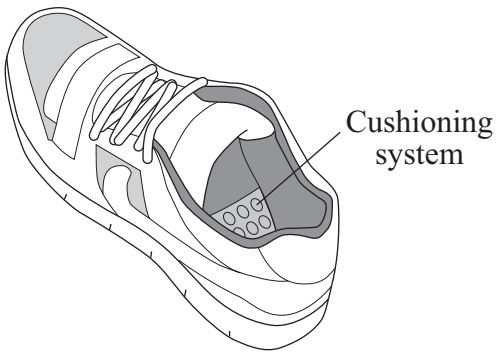
The velocity of the athlete is the ..... of the athlete in a given direction. *(1 mark)*

2 (a) (iv) Complete the graph to show how the velocity of the athlete changes during the first 2 seconds of the race.



(2 marks)

2 (b) Many running shoes have a cushioning system. This reduces the impact force on the athlete as the heel of the running shoe hits the ground.



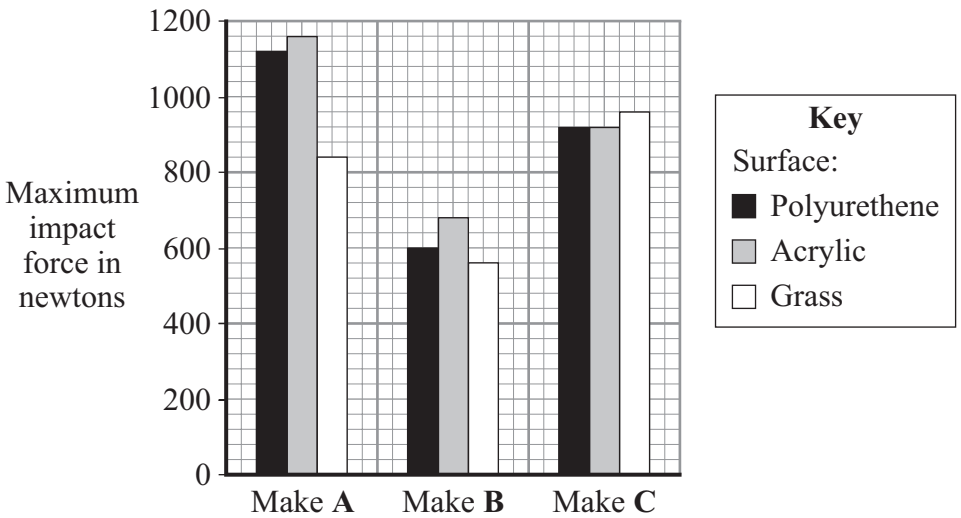
Question 2 continues on the next page

4.5.6.1.3 Velocity

Question 02 · continued

for mark

The bar chart shows the maximum impact force for three different makes of running shoe used on three different types of surface.



2 (b) (i) Which **one** of the three makes of running shoe, **A**, **B** or **C**, has the best cushioning system?

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Explain the reason for your answer.

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.....

(3 marks)

2 (b) (ii) The data needed to draw the bar chart was obtained using a robotic athlete fitted with electronic sensors.

Why is this data likely to be more reliable than data obtained using human athletes?

.....

.....

(1 mark)

10

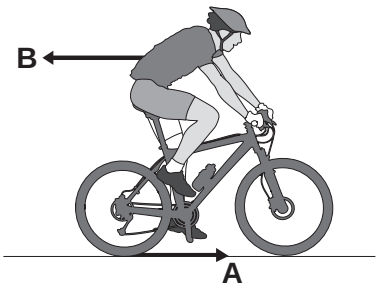
4.5.6.1.3 Velocity

Question 03

June 2014 | PH2HP | Original Q3 | Legacy

3 (a) **Figure 2** shows the horizontal forces acting on a moving bicycle and cyclist.

Figure 2



3 (a) (i) What causes force **A**?

Draw a ring around the correct answer.

[1 mark]

friction **gravity** **weight**

3 (a) (ii) What causes force **B**?

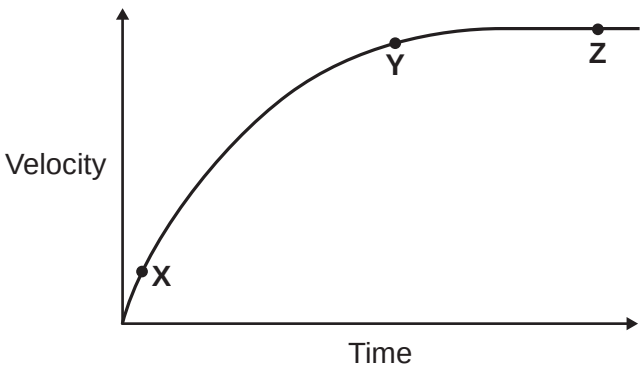
[1 mark]

.....

3 (a) (iii) **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

Figure 3 shows how the velocity of the cyclist changes during the first part of a journey along a straight and level road. During this part of the journey the force applied by the cyclist to the bicycle pedals is constant.

Figure 3



4.5.6.1.3 Velocity

Question 03 · continued

Describe how **and** explain, in terms of the forces **A** and **B**, why the velocity of the cyclist changes:

- between the points **X** and **Y**
- and between the points **Y** and **Z**, marked on the graph in **Figure 3**.

[6 marks]

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Extra space .....

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4.5.6.1.3 Velocity

Question 03 · continued

3 (b) (i) The cyclist used the brakes to slow down and stop the bicycle.

A constant braking force of 140 N stopped the bicycle in a distance of 24 m.

Calculate the work done by the braking force to stop the bicycle. Give the unit.

Use the correct equation from the Physics Equations Sheet.

[3 marks]

.....

.....

.....

Work done = ...

3 (b) (ii) Complete the following sentences.

[2 marks]

When the brakes are used, the bicycle slows down. The kinetic energy of the bicycle ..... .

At the same time, the ..... of the brakes increases.

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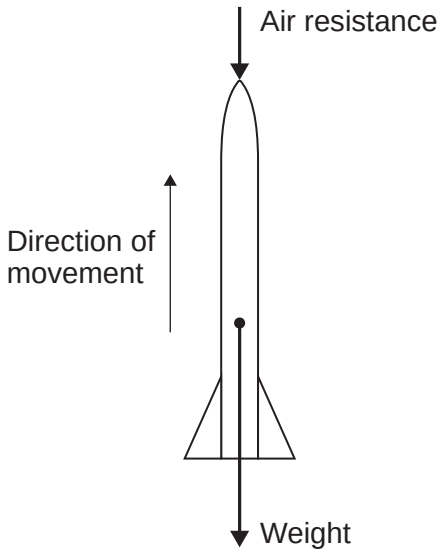
4.5.6.1.3 Velocity

Question 04

June 2015 | PH2HP | Original Q6 | Legacy

6 (a) **Figure 7** shows the forces acting on a model air-powered rocket just after it has been launched vertically upwards.

Figure 7



6 (a) (i) How does the velocity of the rocket change as the rocket moves **upwards**?

[2 marks]

.....

Give a reason for your answer.

.....

.....

6 (a) (ii) The velocity of the rocket is not the same as the speed of the rocket.

What is the difference between the velocity of an object and the speed of an object?

[1 mark]

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4.5.6.1.3 Velocity

Question 04 · continued

6 (b) The speed of the rocket just after being launched is 12 m/s.
The mass of the rocket is 0.05 kg.

6 (b) (i) Calculate the kinetic energy of the rocket just after being launched.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

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Kinetic energy = ... J

6 (b) (ii) As the rocket moves upwards, it gains gravitational potential energy.

State the maximum gravitational potential energy gained by the rocket.

Ignore the effect of air resistance.

[1 mark]

Maximum gravitational potential energy = ... J

6 (b) (iii) Calculate the maximum height the rocket will reach.

Ignore the effect of air resistance.

Gravitational field strength = 10 N/kg.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

Maximum height = ... m

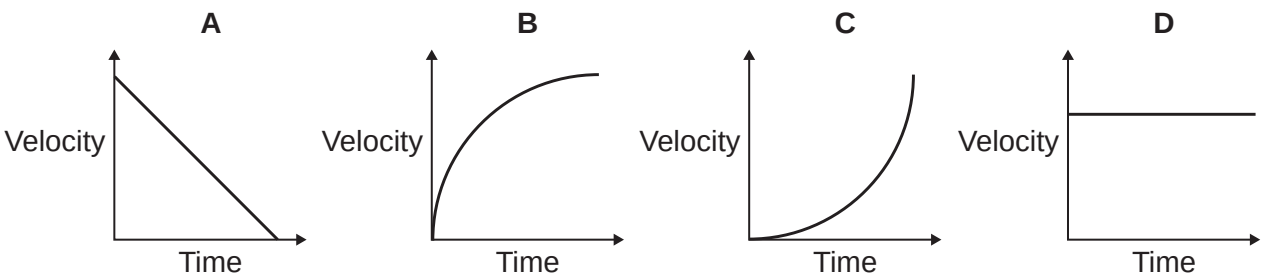
Question 6 continues on the next page

4.5.6.1.3 Velocity

Question 04 · continued

6 (b) (iv) **Figure 8** shows four velocity–time graphs.

Figure 8



Taking air resistance into account, which graph, **A**, **B**, **C** or **D**, shows how the velocity of the rocket changes as it **falls** from the maximum height it reached until it just hits the ground?

[1 mark]

Write the correct answer in the box.

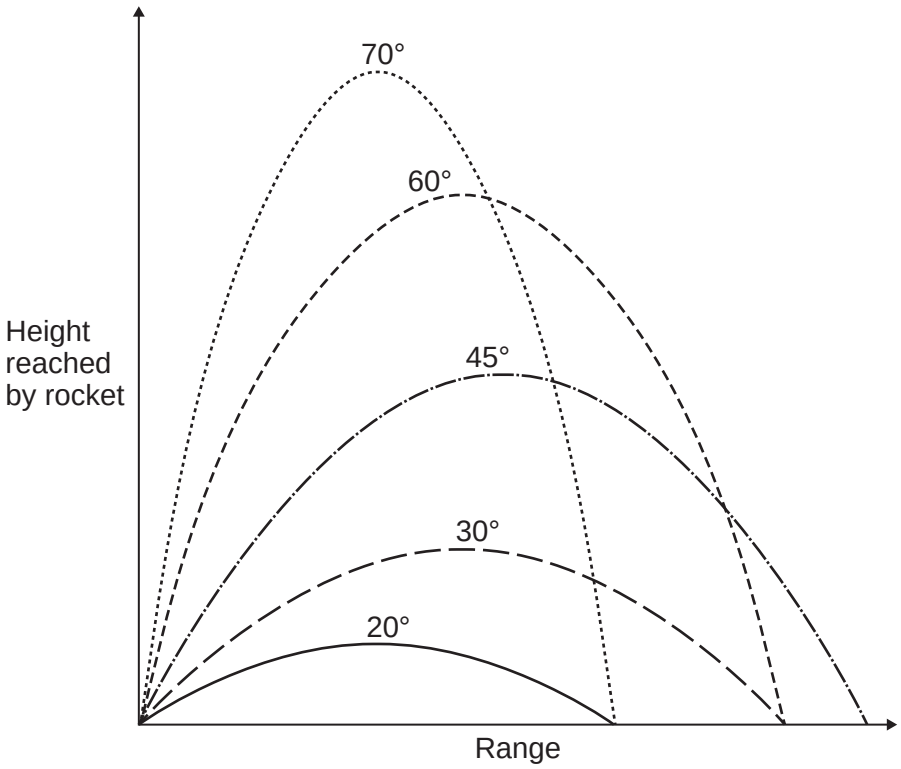
4.5.6.1.3 Velocity

Question 04 · continued

6 (c) The rocket can be launched at different angles to the horizontal.
The horizontal distance the rocket travels is called the range.

Figure 9 shows the paths taken by the rocket when launched at different angles.
Air resistance has been ignored.

Figure 9



What pattern links the angle at which the rocket is launched and the range of the rocket?

[2 marks]

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