



Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

GCSE

COMBINED SCIENCE: SYNERGY

Higher Tier

Paper 3 Physical sciences

H

8465/3H

Monday 11 June 2018

Morning

Time allowed: 1 hour 45 minutes

At the top of the page, write your surname and other names, your centre number, your candidate number and add your signature.

[Turn over]



For this paper you must have:

- **a ruler**
- **a scientific calculator**
- **the periodic table (enclosed)**
- **the Physics Equations Sheet (enclosed).**

INSTRUCTIONS

- **Use black ink or black ball-point pen.**
- **Answer ALL questions in the spaces provided. Do not write on blank pages.**
- **Do all rough work in this book. Cross through any work you do not want to be marked.**
- **In all calculations, show clearly how you work out your answer.**

INFORMATION

- **The maximum mark for this paper is 100.**
- **The marks for questions are shown in brackets.**
- **You are expected to use a calculator where appropriate.**
- **You are reminded of the need for good English and clear presentation in your answers.**

DO NOT TURN OVER UNTIL TOLD TO DO SO



4

0	1
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This question is about hydrogen chloride.

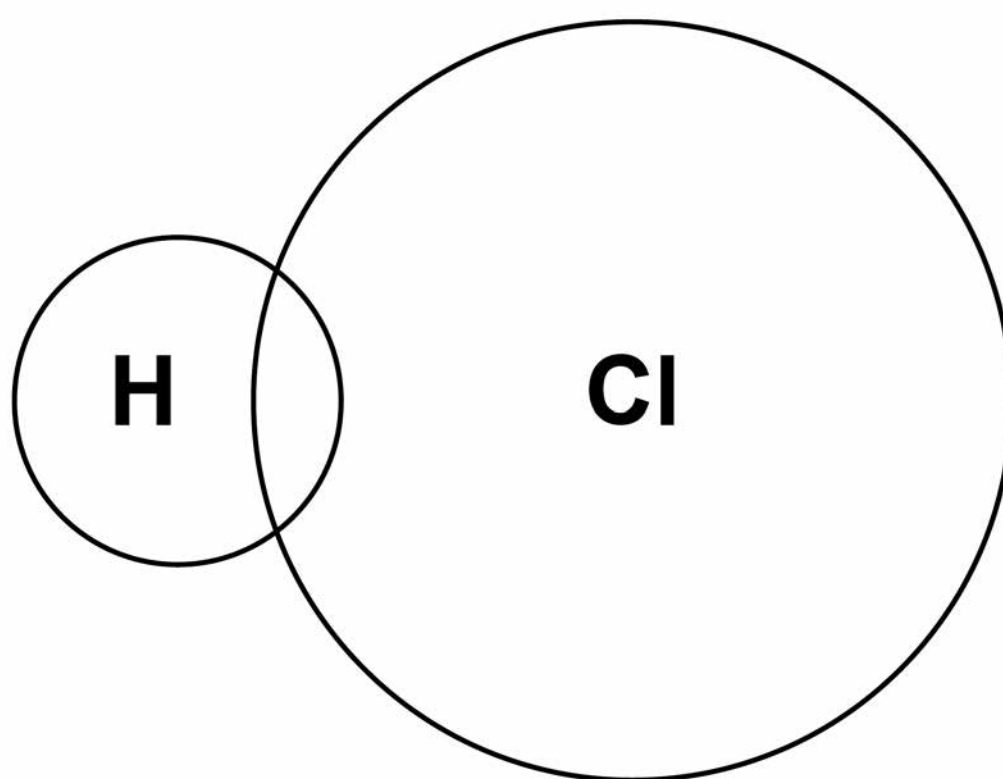
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A hydrogen atom contains 1 electron and a chlorine atom contains 17 electrons.

Complete FIGURE 1 to show a dot and cross diagram for a hydrogen chloride molecule.

Show the outer electrons only.
[2 marks]

FIGURE 1



5

Hydrogen gas (H₂) reacts with chlorine gas to produce hydrogen chloride.

0 1 . 2 Complete the balanced chemical equation for the reaction between hydrogen and chlorine.
[2 marks]



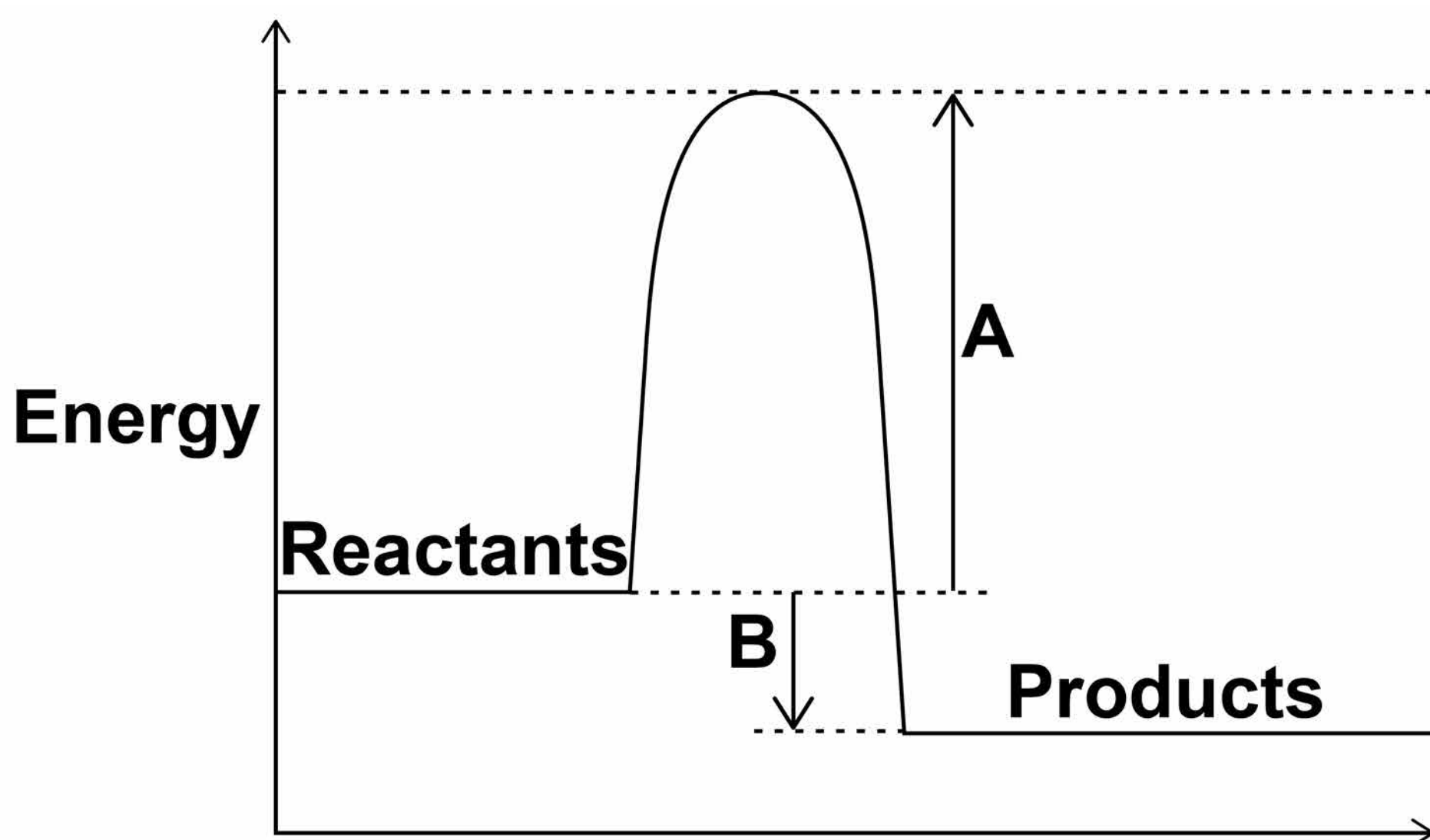
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6

FIGURE 2 shows the reaction profile diagram for the reaction between hydrogen and chlorine.

FIGURE 2



0 1 . 3 What do A and B represent on FIGURE 2? [2 marks]

A _____

B _____

0 1 . 4 How does the reaction profile diagram show that the reaction is exothermic? [1 mark]

[Turn over]



01.5

Hydrogen chloride gas dissolves in water to form hydrochloric acid.

Hydrochloric acid contains hydrogen ions and chloride ions.

Explain why hydrogen chloride gas does NOT conduct electricity but hydrochloric acid is able to conduct electricity. [3 marks]

[Turn over]

10



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0 2

When a metal carbonate reacts with an acid, a salt, carbon dioxide and water are produced.

0 2 . 1

Describe how you would test for carbon dioxide gas.

**Give the result of the test.
[2 marks]**

Test _____

Result _____

[Turn over]



0 3

An energy input of 1.3×10^{18} J is supplied each year by power stations to the National Grid.

Not all of this energy is supplied to consumers. Some of the energy is wasted in the distribution process.

0 3 . 1

Write the equation which links efficiency, total input energy transfer and useful output energy transfer. [1 mark]

15

03.2 The energy supplied each year to consumers is 1.2×10^{18} J

Calculate the efficiency of the distribution process. [2 marks]

Efficiency = _____

[Turn over]



03.3 How is electrical power transmitted across the National Grid to make the process as efficient as possible?
[1 mark]

Tick ONE box.

At a high potential difference and a high current

At a high potential difference and a low current

At a low potential difference and a high current

At a low potential difference and a low current



0 3 . 4 Write the equation which links energy transferred, power and time. [1 mark]

[Turn over]



18

03.5

A wind turbine supplies a power output of 8000 kW for 1200 seconds.

Calculate the energy transferred by the wind turbine in kJ [3 marks]

Energy transferred =

kJ



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[Turn over]



0 3 . 6

Describe the environmental advantages and disadvantages of using wind turbines to generate electricity in the UK. [4 marks]

[Turn over]

12



0 4**FIGURE 3 shows a bar magnet.****0 4 . 1****Complete the diagram to show the magnetic field lines around a bar magnet. [2 marks]****FIGURE 3**

0 4 . 3

**Explain why a compass
needle moves when placed
near the bar magnet.
[2 marks]**

04.4 Iron is a magnetic element.

Which of the following is also a magnetic ELEMENT? [1 mark]

Tick ONE box.

Cobalt

Copper

Steel

Zinc

[Turn over]



0 4 . 5

Give TWO pieces of evidence that show the Earth's magnetic field is changing. [2 marks]

1

2

0 4 . 6 Describe the most likely cause of the changes in the Earth's magnetic field. [2 marks]

[Turn over]

13



0	5
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A teacher demonstrated the extraction of copper from copper oxide.

This is the method used.

- 1. Mix 1.30 g of zinc and 1.59 g of copper oxide.**
- 2. Heat the mixture strongly.**
- 3. When the mixture starts to glow, stop heating.**
- 4. Let the glow spread through the mixture.**
- 5. Leave the mixture to cool.**
- 6. Add hydrochloric acid to the cooled mixture.**
- 7. Filter the mixture obtained in step 6.**



0 5 . 1

A student concluded that an exothermic reaction had taken place.

**Explain how an observation made during the demonstration shows this.
[2 marks]**

[Turn over]



30

0 5 . 2 The equation for the reaction between zinc and copper oxide is:



1.59 g of copper oxide reacted.

Calculate the mass of copper produced.

Relative atomic masses (A_r):

Cu = 63.5 O = 16 Zn = 65

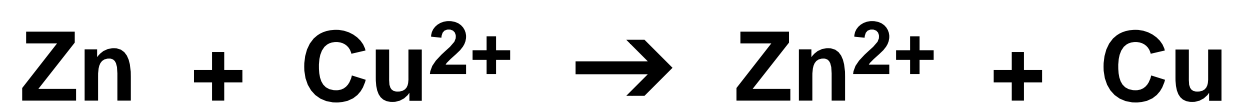
[3 marks]

Mass of copper produced =

_____ g



05.4 The ionic equation for the reaction is:



Which statement about the reaction between zinc and copper ions is correct?
[1 mark]



33

Tick ONE box.

Copper ions have been oxidised because the copper ions have gained electrons.

Copper ions have been oxidised because the copper ions have lost electrons.

Zinc has been oxidised because the zinc atoms have gained electrons.

Zinc has been oxidised because the zinc atoms have lost electrons.

[Turn over]

10



0	6
---	---

Copper can be extracted using biological methods.

0	6	.	1
---	---	---	---

Name TWO biological methods used to extract copper from copper ores.

For each method, name the type of organism used in the process. [4 marks]

Method 1 _____

Type of organism _____

Method 2 _____

Type of organism _____

0 6 . 2

Give THREE reasons why biological methods are being introduced to extract copper. [3 marks]

1

2

3

[Turn over]



36

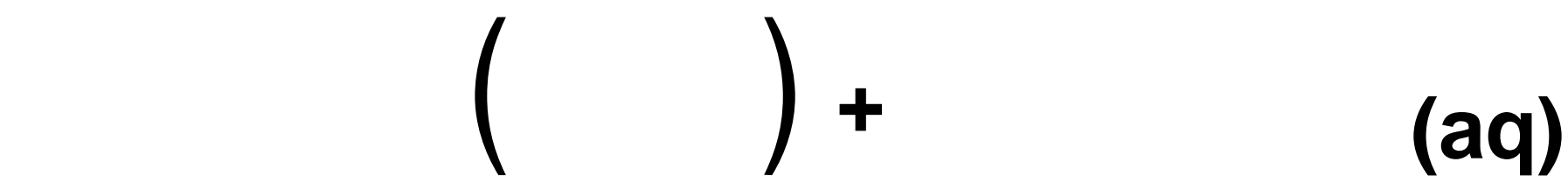
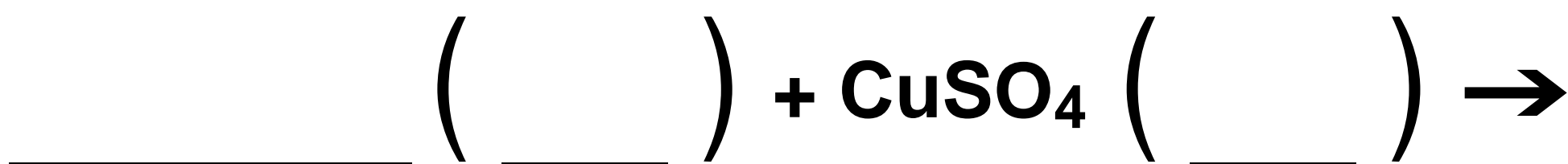
The biological methods produce copper compounds such as copper sulfate.

0 6 . 3 **Copper can be extracted from copper sulfate solution by adding scrap iron.**

Explain why. [2 marks]

06.4 Complete the chemical equation for the reaction between iron and copper sulfate solution. [2 marks]

Include state symbols.



[Turn over]



38

06.5

A solution of copper sulfate contains 3.175 g of copper ions.

Calculate the number of copper ions in the solution.

Give your answer in standard form.

Relative atomic mass (A_r):

Cu = 63.5

The Avogadro constant is 6.02×10^{23} per mole. [4 marks]

Number of copper ions =

[Turn over]

15



0	7
---	---

A teacher demonstrated the temperature change when hydrochloric acid is added to sodium hydroxide solution.

This is the method used.

- 1. Measure 25 cm³ of sodium hydroxide solution using a measuring cylinder.**
- 2. Add the sodium hydroxide solution to a polystyrene cup.**
- 3. Record the temperature of the sodium hydroxide solution.**
- 4. Add 5 cm³ of hydrochloric acid from a burette to the sodium hydroxide solution.**



5. **Stir the solution.**
6. **Record the temperature of the solution.**
7. **Repeat steps 4–6 until 50 cm³ of hydrochloric acid in total is added.**

[Turn over]

TABLE 1 shows some of the teacher's results.

TABLE 1

Volume of hydrochloric acid added in cm³	Temperature in °C
0	21.30
5	24.25
10	26.15
15	27.05
20	27.70

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[Turn over]



07.1

FIGURE 4 shows the results when 30 cm³ to 50 cm³ of hydrochloric acid was added to sodium hydroxide solution.

A line of best fit has been drawn through these results.

Complete FIGURE 4.

You should:

- **plot the data from TABLE 1, on page 42, on FIGURE 4**
- **draw a line of best fit through these results**
- **continue both lines of best fit until the lines meet.**

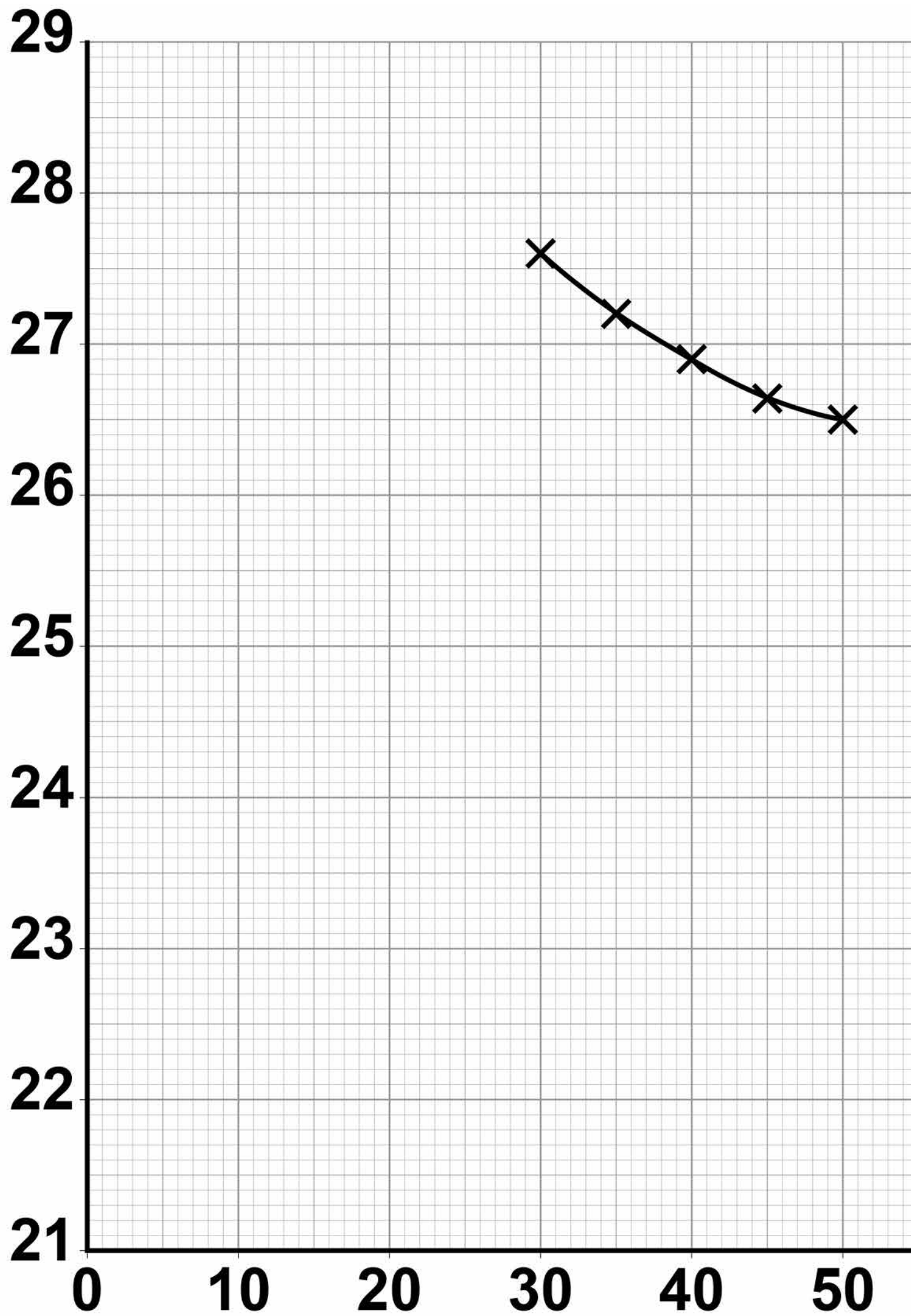
[4 marks]



45

FIGURE 4

Temperature in °C

Volume of hydrochloric acid
added in cm³

[Turn over]



46

07.2 Estimate the maximum temperature reached in the reaction.

**Use FIGURE 4, on page 45.
[1 mark]**

Maximum temperature =
_____ °C

07.3 The teacher used a temperature sensor to measure the temperature of the reaction mixture.

What is the resolution of the temperature sensor? [1 mark]

Tick ONE box.

$$1 \times 10^{-1} \text{ } ^\circ\text{C}$$

$$1 \times 10^{-2} \text{ } ^\circ\text{C}$$

$$1 \times 10^{-3} \text{ } ^\circ\text{C}$$

$$1 \times 10^{-4} \text{ } ^\circ\text{C}$$

[Turn over]



07.4

Suggest TWO ways of improving the accuracy of the results. [2 marks]

1

2

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[Turn over]



50

07.5 The pH of the solution changes as hydrochloric acid is gradually added to sodium hydroxide solution, until hydrochloric acid is in excess.

Describe how the pH of the solution changes.

Give reasons for these changes.

**You should refer to the pH value of the solution at different stages in the procedure.
[6 marks]**

53

07.6 In a different demonstration the teacher used a 25 cm^3 solution containing 1.4 g of sodium hydroxide.

Calculate the concentration of the sodium hydroxide solution in g/dm^3 [2 marks]

Concentration of sodium hydroxide solution =

_____ g/dm^3

[Turn over]

16

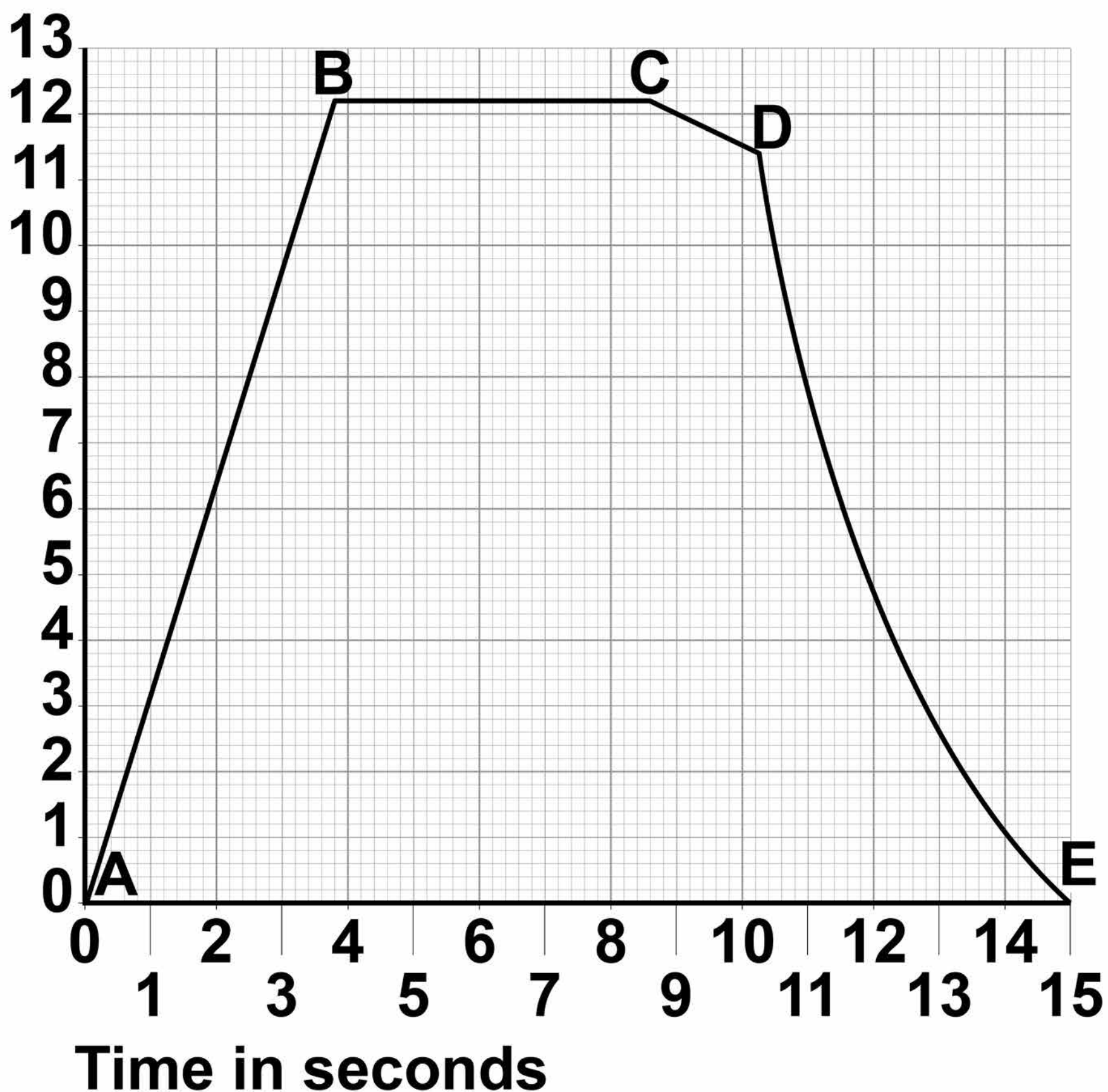


08 An athlete takes part in a race on a straight, horizontal running track.

FIGURE 5 shows the velocity-time graph for the athlete during the race.

FIGURE 5

Velocity
in m/s



0 8 . 1 What is the main force that opposes the athlete's forward motion? [1 mark]

0 8 . 2 Which section of the graph represents a part of the race where the resultant force on the athlete is zero? [1 mark]

Tick ONE box.

A–B

B–C

C–D

D–E



[Turn over]

56

0 8 . 3 The athlete has a mass of
94.8 kg

**Calculate the momentum of the
athlete at a time of 6.0 s**

**Use FIGURE 5, on page 54.
[3 marks]**

Momentum = _____ kg m/s



57

08.4 The acceleration is NOT constant from D to E.

Determine the acceleration at a time of 12.0 s

Use FIGURE 5.

Give the unit. [5 marks]

Acceleration = _____

Unit = _____

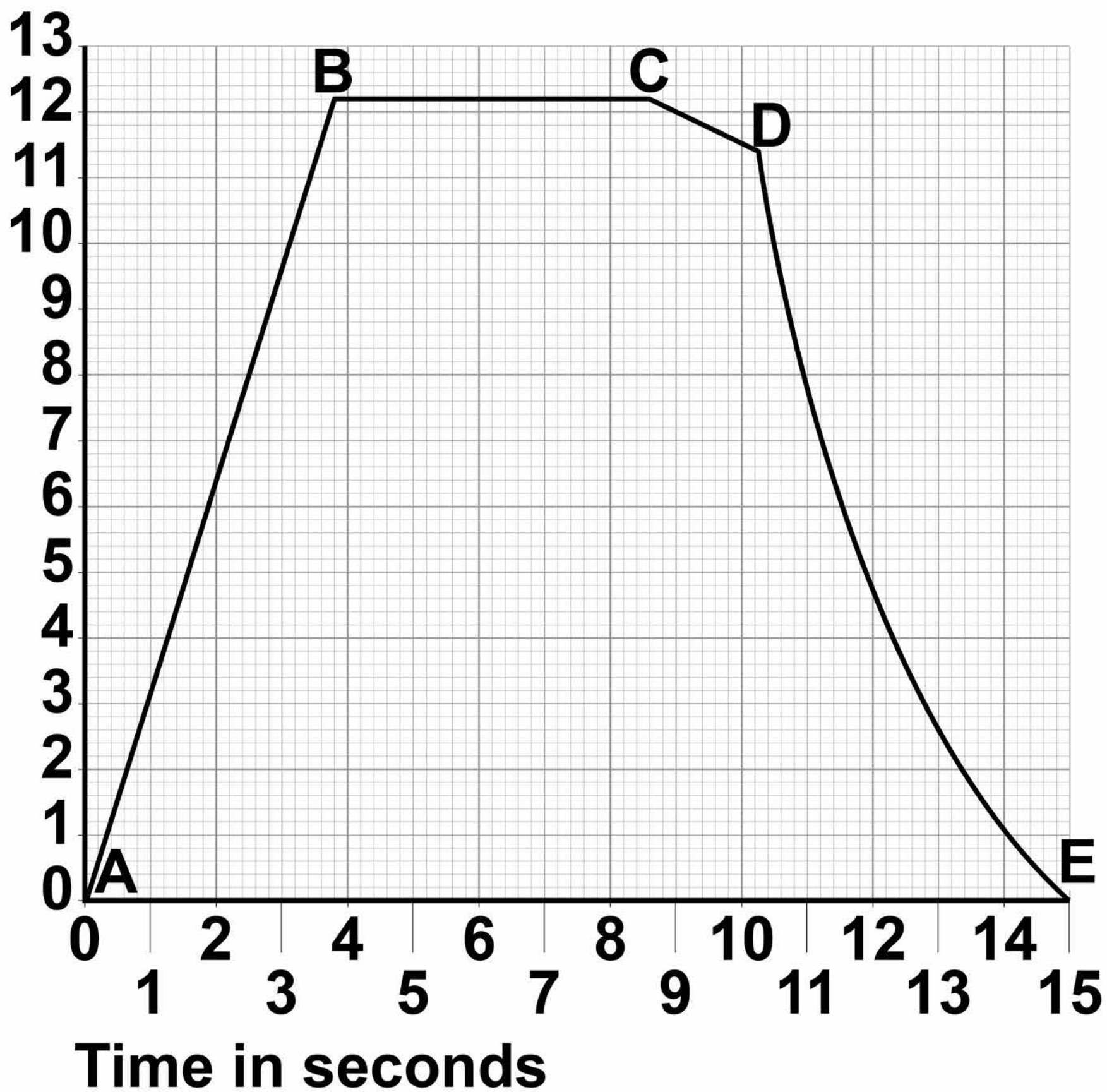
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FIGURE 6 is a copy of **FIGURE 5** to help you answer the following questions.

FIGURE 6

Velocity
in m/s



59

A second athlete starts the race at the same time as the first athlete.

The second athlete moves with a constant acceleration of 1.6 m/s^2 for the first 6.0 seconds of the race.

The first athlete travels further than the second athlete during the first 6.0 seconds.

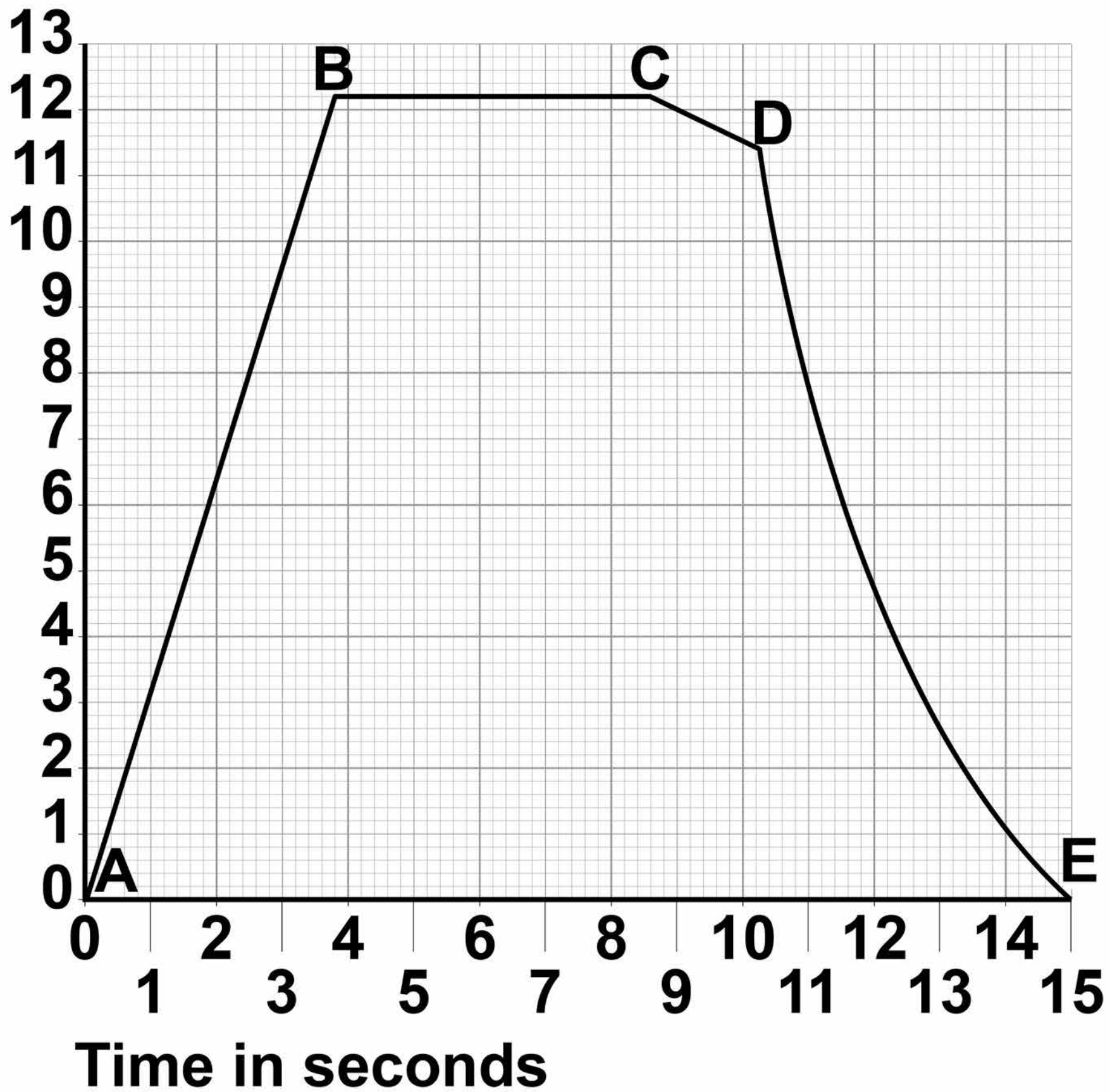
08.5 Draw a line on FIGURE 6 to represent the motion of the second athlete for the first 6.0 seconds of the race.
[2 marks]

[Turn over]



60

Repeat of FIGURE 6

Velocity
in m/s

There are no questions printed on this page

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Question	Mark
1	
2	
3	
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6	
7	
8	
TOTAL	

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