

Thursday 26 January 2012 – Morning

**GCSE GATEWAY SCIENCE
ADDITIONAL SCIENCE B**

B623/02 Unit 1 Modules B3 C3 P3 (Higher Tier)

Candidates answer on the Question Paper.
A calculator may be used for this paper.

OCR supplied materials:
None

Other materials required:

- Pencil
- Ruler (cm/mm)

Duration: 1 hour



Candidate forename		Candidate surname	
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Centre number						Candidate number				
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INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- A list of physics equations is printed on page two.
- The Periodic Table is printed on the back page.
- The total number of marks for this paper is **60**.
- This document consists of **24** pages. Any blank pages are indicated.

EQUATIONS

$$\text{speed} = \frac{\text{distance}}{\text{time taken}}$$

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

$$\text{force} = \text{mass} \times \text{acceleration}$$

$$\text{work done} = \text{force} \times \text{distance}$$

$$\text{power} = \frac{\text{work done}}{\text{time}}$$

$$\text{kinetic energy} = \frac{1}{2} mv^2$$

$$\text{potential energy} = mgh$$

$$\text{weight} = \text{mass} \times \text{gravitational field strength}$$

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

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Question 1 begins on page 4.

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Answer **all** the questions.

Section A – Module B3

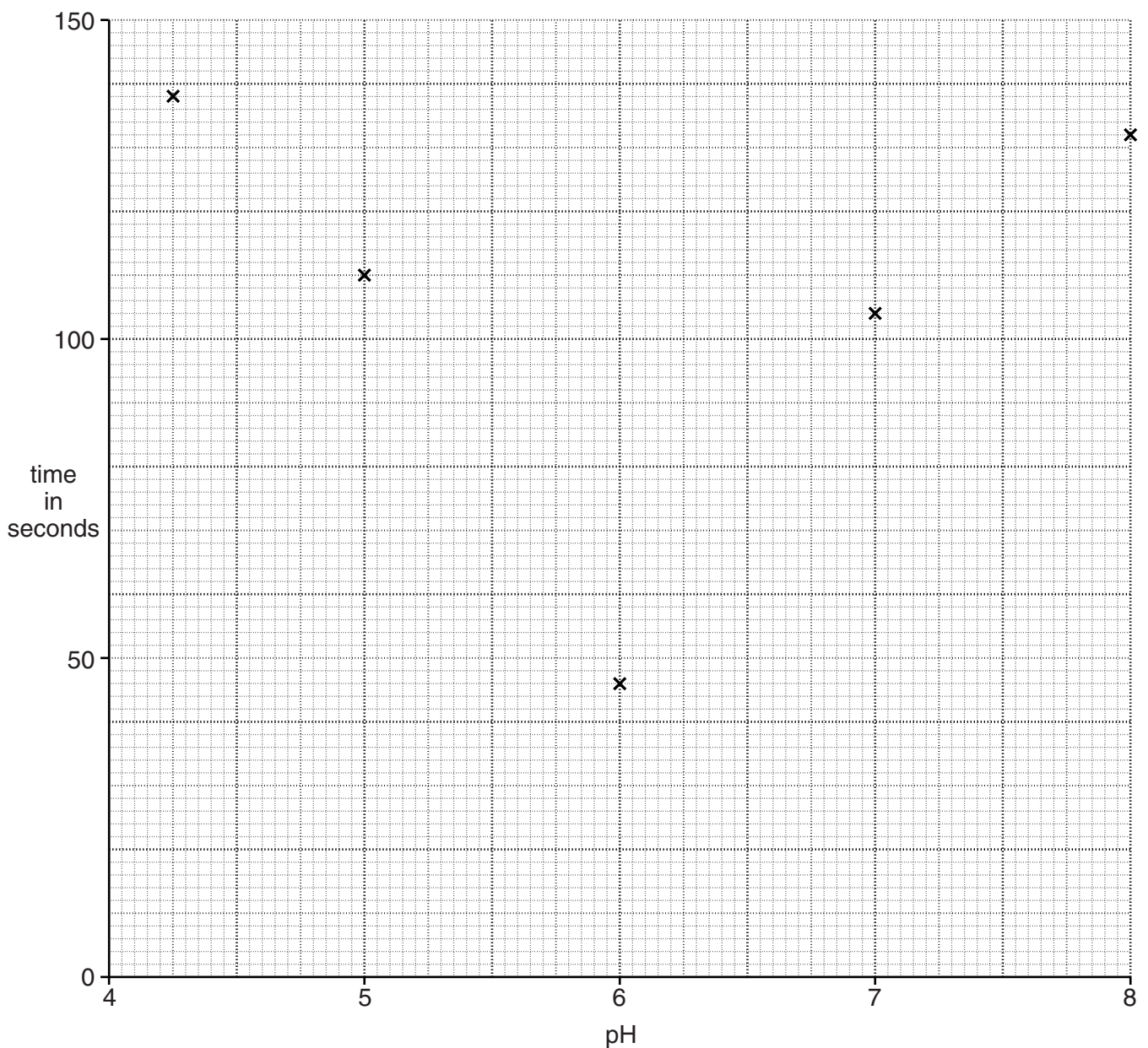
1 Rennin is an enzyme that is used to make cheese.

When added to milk, it makes the milk curdle and form a solid.

It does this by making a protein called casein.

(a) Bob and Jane investigate how long it takes rennin to curdle milk at different pHs.

They plot their results on a graph.



(i) Finish the graph by drawing the best curve.

[1]

(ii) Bob says that the results prove that pH 6 is the optimum pH for rennin.

Is Bob correct?

Explain your answer.

.....
 [1]

(b) An enzyme called pepsin breaks down casein.

Casein is broken down into smaller molecules called amino acids.

This happens in the stomach.

(i) Describe what happens to the amino acids next.

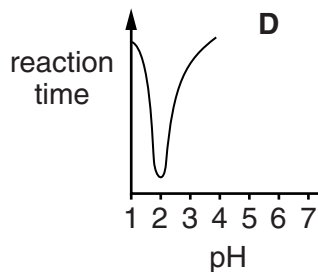
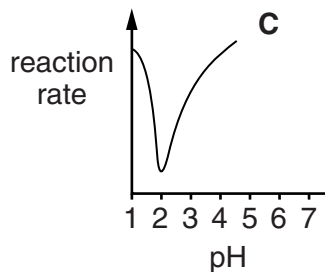
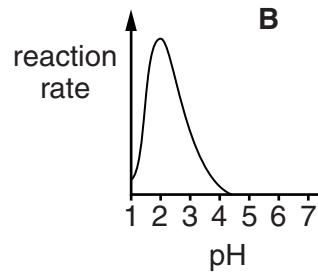
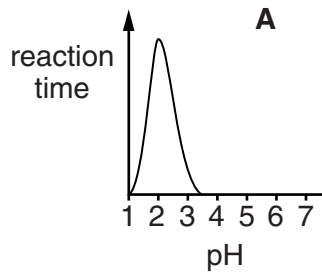
.....

 [2]

(ii) Pepsin has an optimum pH of 2.

Look at the graphs.

Which **graph** or **graphs** are correct?



answer

[1]

(c) Rennin is made by cells in the stomach lining of cows.

The **structure** of rennin is determined by DNA.

Explain how.

.....

.....

.....

.....

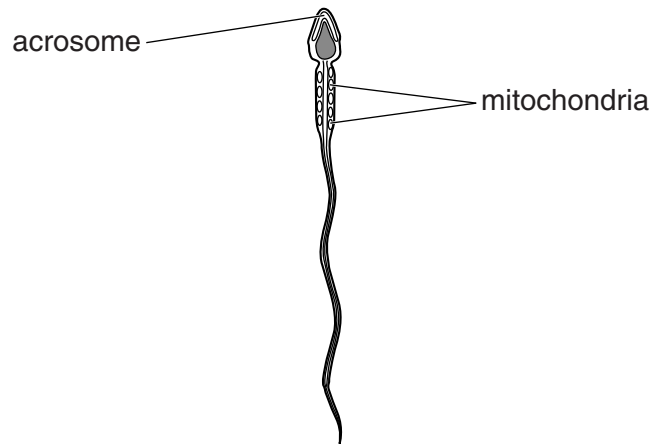
..... [3]

[Total: 8]

7
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2 (a) The diagram shows a sperm cell.



(i) Explain why a sperm cell needs a large number of mitochondria.

.....
..... [1]

(ii) Explain why a sperm cell needs an acrosome.

.....
..... [1]

(b) Some sperm cells may carry mutated genes.

Write down **one** factor that can increase the chance of mutation.

..... [1]

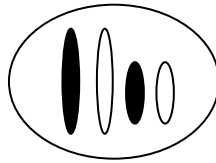
(c) Sperm cells and egg cells are haploid because of meiosis.

(i) Why is it important that they are haploid?

.....
..... [1]

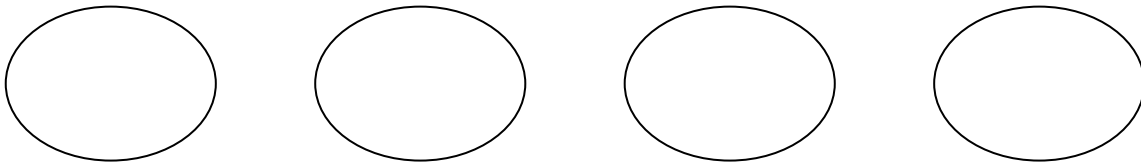
(ii) The diagram represents a cell before meiosis.

It contains four chromosomes.



This cell could produce four different cells as a result of meiosis.

Complete the diagrams to show the four possible combinations of chromosomes.



[1]

(d) When a sperm cell fertilises an egg cell, the new zygote divides.

New types of cells are formed by differentiation.

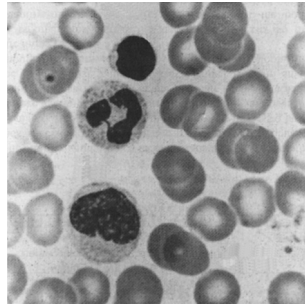
Some cells remain undifferentiated.

What name is given to these cells?

..... [1]

[Total: 6]

3 The photograph shows some blood cells.



(a) Red blood cells are adapted to carry oxygen.

One way they are adapted is their small size.

This allows them to pass through very small capillaries.

(i) Explain **one other** reason why their small size is an adaptation to carry oxygen.

.....
..... [1]

(ii) Describe **one other** way red blood cells are adapted to carry oxygen.

.....
..... [1]

(b) Some people have heart disease because the blood flow in the coronary arteries supplying blood to the heart muscle becomes restricted.

Explain how the blood flow becomes restricted.

.....
..... [1]

(c) Some people with heart disease need heart transplants.

Scientists have cloned genetically engineered pigs.

The pigs contain some human genes.

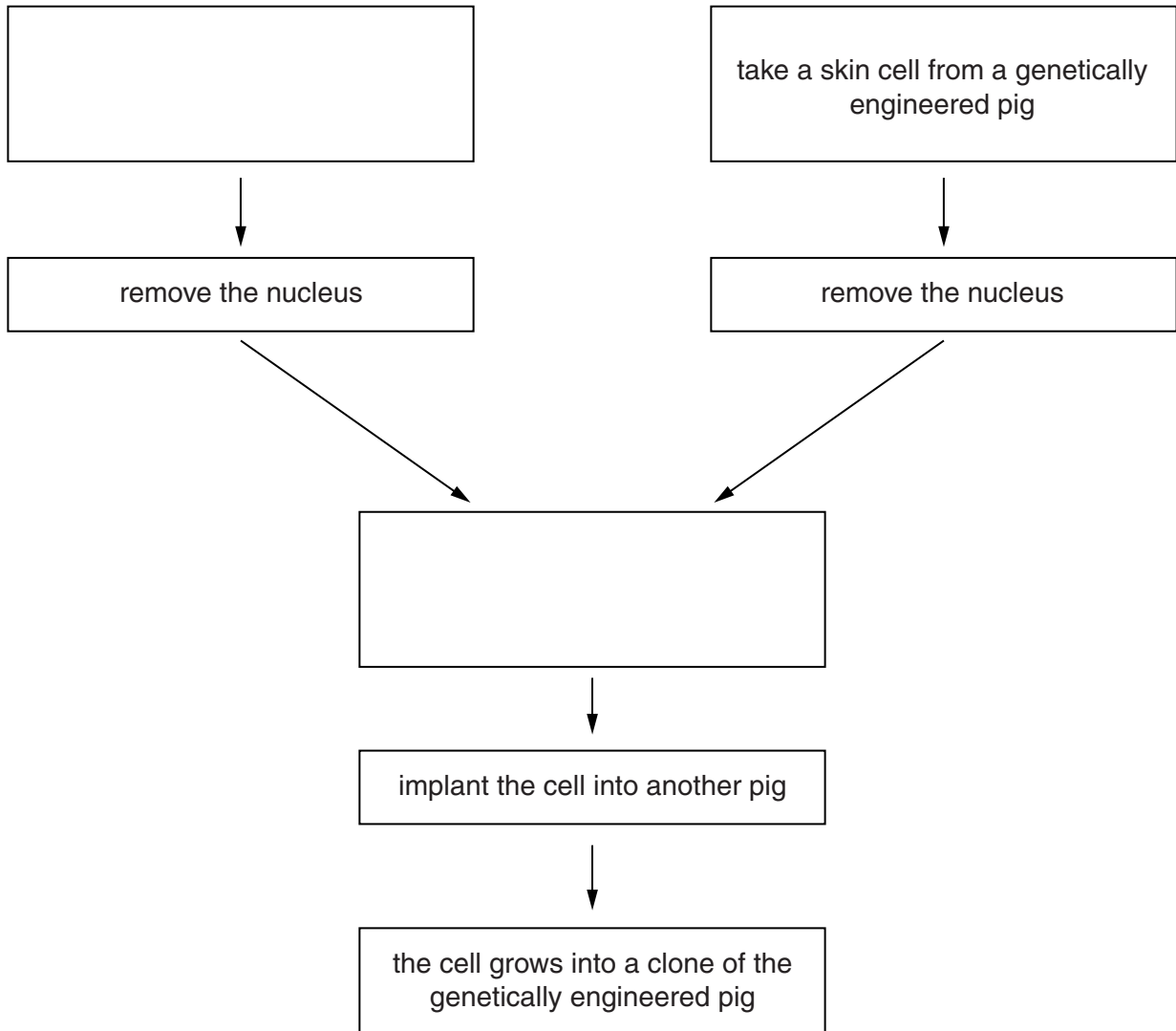
If their hearts are given to humans as transplants there is less risk of these being rejected.

(i) Suggest **one other advantage** of getting hearts from cloned pigs.

.....
..... [1]

(ii) How can a genetically engineered pig be cloned?

Complete the flow chart to show your answer.



[2]

[Total: 6]

Section B – Module C3

4 Look at the table. It shows the properties of some Group 7 elements.

element	molecular formula	atomic number	colour	state at room temperature	melting point in °C	boiling point in °C
fluorine	F ₂	9	pale yellow	gas	-188
chlorine	Cl ₂	17	pale green	-101	-35
bromine	Br ₂	35	red/brown	liquid	-7	59
iodine	I ₂	53	dark grey	solid	114	184
astatine	At ₂	85	black	solid	302

(a) (i) Complete the table to show the state of chlorine at room temperature. [1]

(ii) Complete the table to estimate the melting point of fluorine and the boiling point of astatine.

Use ideas about trends down a group. [2]

(b) Sodium reacts with fluorine to make sodium fluoride, NaF.

Write a **balanced symbol** equation for this reaction.

..... [2]

[Total: 5]

5 (a) Jane carries out some flame tests.

Describe how she does a flame test.

You may wish to draw a diagram to help your answer.

.....
.....
.....
..... [3]

(b) Jane's teacher reacts sodium with water.

A gas is made which gives a squeaky pop with a lighted splint.

An alkaline solution is also made.

(i) Write a **word** equation for this reaction.

..... [2]

(ii) Sodium loses electrons to make sodium ions, Na⁺.

What is the name of this type of reaction?

Choose from this list.

displacement

precipitation

oxidation

reduction

answer [1]

[Total: 6]

6 This question is about sulfur.

Use the Periodic Table on the back page to help you to answer these questions.

Find sulfur in the Periodic Table.

(a) To which **period** in the Periodic Table does sulfur belong?

..... [1]

(b) The **atomic number** of sulfur is 16.

What is meant by atomic number?

..... [1]

(c) Draw the electronic structure of a sulfur atom.

[1]

[Total: 3]

7 Iron is a transition element.

(a) Iron(II) sulfate solution reacts with sodium hydroxide solution to make an insoluble solid called iron(II) hydroxide.

Complete the sentences.

Two solutions are mixed. An insoluble solid is made.

This type of solid is called a [1]

(b) What is the colour of iron(II) hydroxide?

..... [1]

(c) In this reaction iron(II) ions, Fe^{2+} , react with hydroxide ions, OH^- .

Iron(II) hydroxide, $\text{Fe}(\text{OH})_2$, is made.

Write the **balanced ionic** equation for this reaction.

..... [2]

[Total: 4]

8 This question is about the elements in the Periodic Table.

Look at this list of elements.

- | | |
|------------------|-----------------|
| aluminium | argon |
| calcium | chlorine |
| gold | helium |
| lithium | oxygen |

Answer the questions.

Choose your answers from the list.

Each element may be used **once, more than once** or **not at all**.

The Periodic Table on the back page may help you.

(a) Which element has an atom with only one electron in its outer shell?

..... [1]

(b) Which element has an electronic structure of 2.8.8.2?

..... [1]

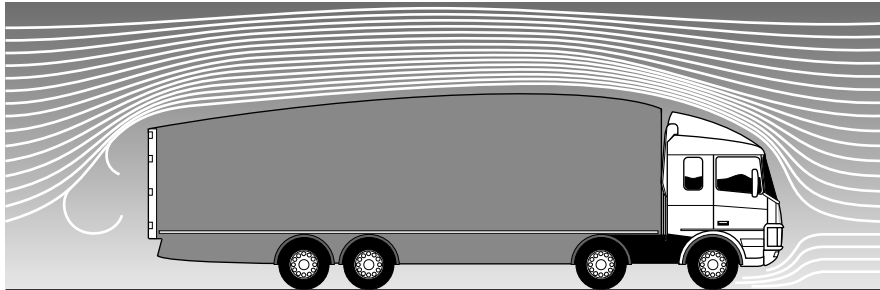
[Total: 2]

Turn over

Section C – Module P3

9 Cliff is a lorry driver.

(a) The diagram shows how air flows around his lorry.



The lorry is a new design called a teardrop.

It uses 10% less fuel than a normally-shaped lorry.

(i) Cliff drives his lorry at a **constant** speed.

The two horizontal forces acting on the lorry are the **thrust** (driving force) and the **drag** force.

Describe the relationship between these two forces.

..... [1]

(ii) The shape of the lorry reduces the drag force.

Explain how this affects the **maximum** possible speed of the lorry.

Use ideas about **forces**.

.....
.....
..... [2]

(b) Cliff is driving the lorry on a motorway.

He sees the traffic in front is **not** moving. He starts to brake.

Which two factors will affect Cliff's **thinking** distance?

Put ticks (✓) in the boxes next to the **two** correct answers.

the speed of the lorry

the road conditions

the condition of the brakes

the condition of the tyres

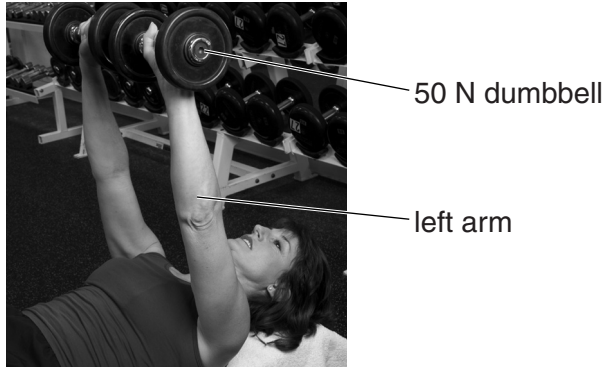
how tired Cliff is

[2]

[Total: 5]

10 Sandy is working out at the health club.

She is lifting dumbbell weights as fast as she can.



Each arm lifts a 50 N dumbbell 0.6 m.

This lift takes 0.9 s.

(a) Calculate the **work done** by Sandy's left arm every time she lifts the dumbbell.

The equations on page 2 may help you.

.....

.....

.....

answer [2]

(b) Calculate the average **power** developed in Sandy's left arm.

The equations on page 2 may help you.

.....

.....

.....

answerW [2]

[Total: 4]

11 Ray fastens his seat belt every time he travels in a car.



The seat belt will absorb energy if the car stops suddenly.

(a) Explain how a seat belt reduces the **forces** on Ray if the car crashes.

.....

.....

..... [2]

(b) Ray leans forward in his seat.

He exerts a force of 20 N on his seat belt.

What force does the seat belt exert on Ray?

Put a **ring** around the correct answer.

0 N

10 N

20 N

40 N

[1]

[Total: 3]

12 Electric cars have batteries that must be recharged.

Westminster Council has introduced the largest on-street car recharging service in the UK.



(a) Dave says, “electric cars are better because they do not pollute the environment”.

Marina says, “they do pollute, but not at the point of use”.

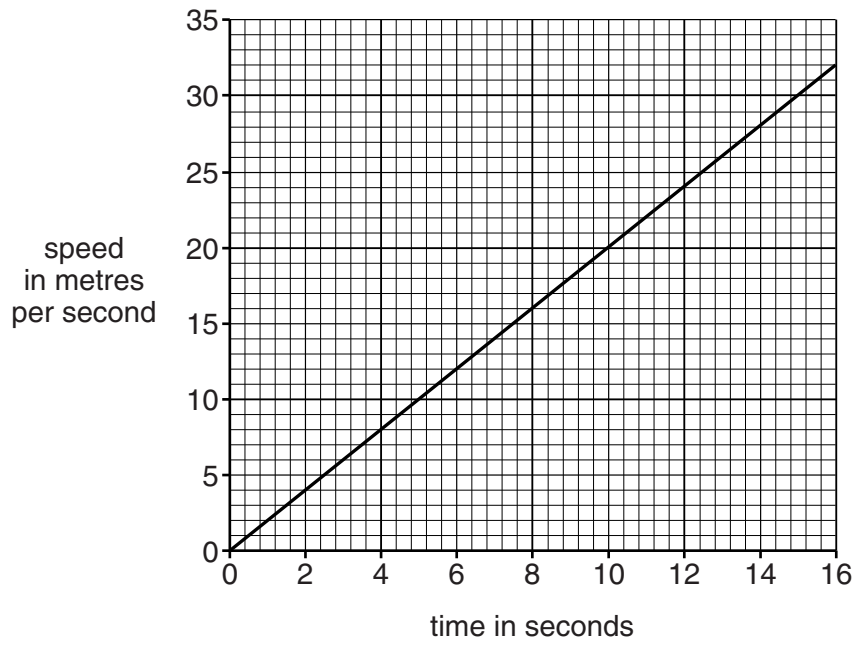
Explain what **Marina** means.

.....

.....

..... [2]

(b) The graph shows how an electric car accelerates from rest.



Calculate the **acceleration** of the car.

The equations on page 2 may help you.

.....
.....

answerm/s²

[2]

[Total: 4]

13 Aisha steps out of an aeroplane.



She weighs 600 N and has 2 700 000 J of gravitational potential energy.

(a) Calculate the **height** of the aeroplane.

The equations on page 2 may help you.

.....
.....
.....

answerm [2]

(b) As she falls, Aisha **loses** gravitational potential energy and **gains** kinetic energy.

When she reaches terminal speed, she is travelling at 55 m/s.

(i) Explain what happens to her kinetic energy **at terminal speed**.

Finish the sentence.

Her **kinetic** energy

because [1]

(ii) Explain what happens to her **gravitational potential** energy at terminal speed.

.....
..... [1]

[Total: 4]

END OF QUESTION PAPER

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