

GENERAL CERTIFICATE OF SECONDARY EDUCATION

GATEWAY SCIENCE

B623/02

ADDITIONAL SCIENCE B

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)

Wednesday 25 May 2011
Morning

Duration: 1 hour



Candidate forename		Candidate surname	
Centre number		Candidate number	

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. Pencil may be used for graphs and diagrams only.
- 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).
- Answer **all** the questions.
- 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 **28** pages. Any blank pages are indicated.

2

EQUATIONS

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

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

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

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

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

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

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

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

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

3

Answer **all** the questions.**Section A – Module B3**

1 Ethan is two years old.

His body mass has been measured every three months.

The table shows his results.

age in months	0	3	6	9	12	15	18	21	24
mass in kg	2.4	5.0	6.3	7.6	8.8	9.6	9.9	10.1	10.2

(a) Look at the table.

(i) In which three month period did Ethan's mass increase the **most**?

answer: from age months to age months [1]

(ii) In which three month period did Ethan's mass increase the **least**?

answer: from age months to age months [1]

(b) It is important to collect data on how the mass of a baby changes.

Why is it important?

.....

..... [1]

(c) Ethan started life when a sperm cell from his father fertilised an egg cell from his mother.

The fertilised egg cell then divided to form new cells.

(i) What type of cell division formed the new cells?

..... [1]

(ii) Put ticks (✓) in the table to show whether each type of cell is haploid or diploid.

	haploid	diploid
egg cell		
muscle cell		
skin cell		
sperm cell		

[1]

[Total: 5]

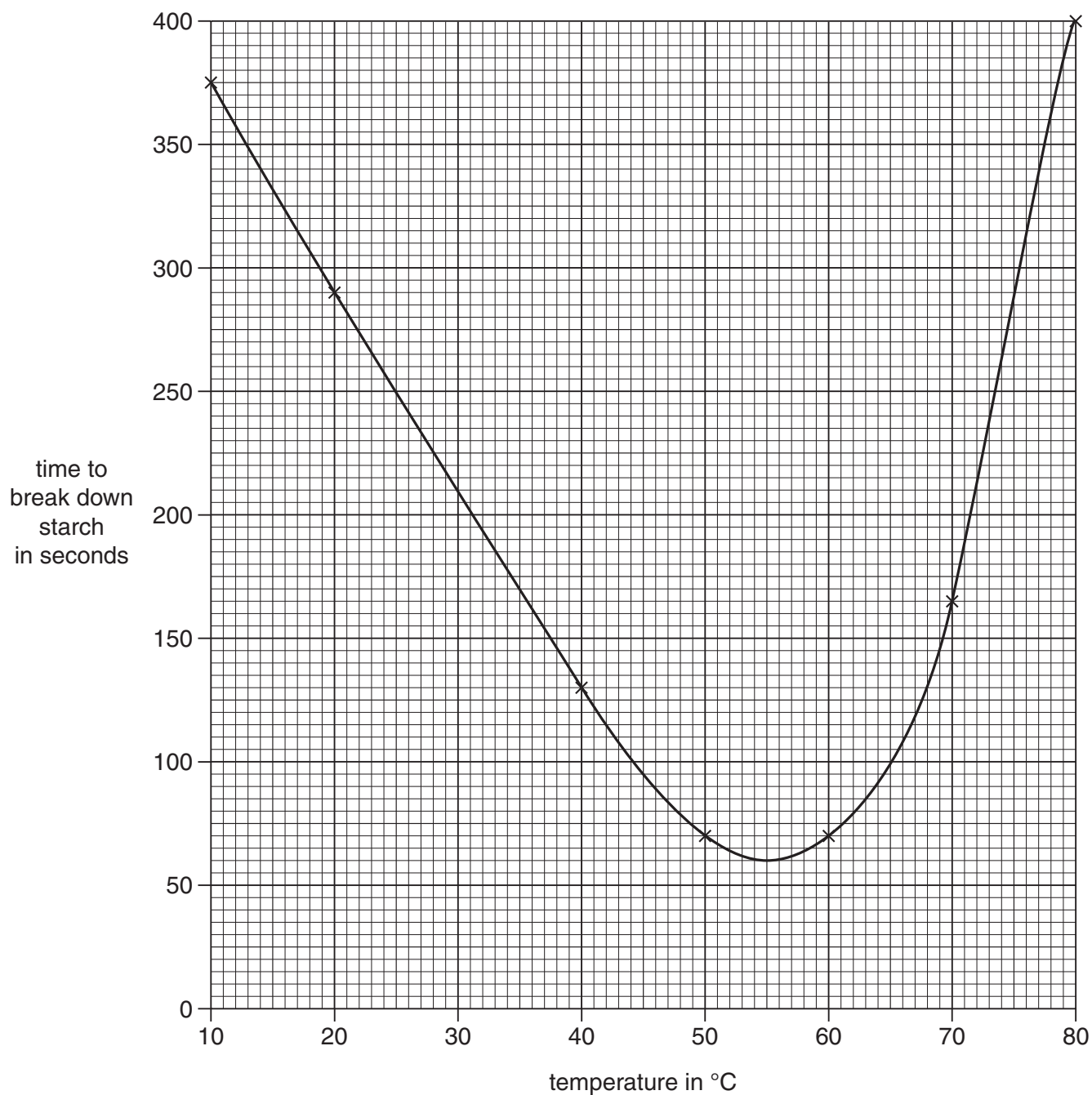
Turn over

4

2 Amylase is an enzyme that breaks down starch.

- (a) Ann investigates how quickly one type of amylase breaks down starch at different temperatures.

The graph shows her results.



- (i) Look at the graph. What is the optimum temperature of this amylase?

answer..... °C

[1]

5

- (ii) Explain what happens to the amylase at 70 °C.

.....

.....

.....

..... [3]

- (b) In the digestive system, amylase helps break down starch molecules into glucose molecules.

The glucose molecules are absorbed into the blood.

- (i) By what process are glucose molecules absorbed into the blood?

..... [1]

- (ii) Starch has to be broken down into glucose before it can be absorbed into the blood.

Suggest why starch has to be broken down before it can be absorbed.

.....

..... [1]

- (c) Glucose is absorbed into the blood in the small intestine.

Describe **two** ways the small intestine is adapted for the absorption of food.

1

.....

2

..... [2]

- (d) Glucose is absorbed into the blood so it can be transported around the body.

Which part of the blood transports glucose?

..... [1]

[Total: 9]

- 3 (a) Many zoos have breeding programmes for endangered species.

This may involve breeding together animals from different zoos, and even from different countries.

One example of this is with cheetahs.



The breeding programmes are planned to avoid problems from **inbreeding**.

- (i) What is inbreeding?

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

- (ii) Suggest why inbreeding might cause problems.

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

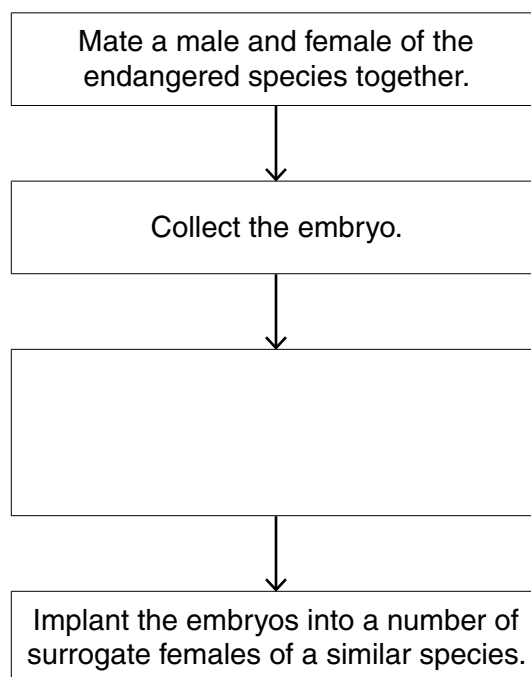
7

- (b) Another way to help endangered species is to clone their embryos.

The embryos can be transplanted into surrogates of a similar species to grow.

One example of this is the gaur, an ox-like animal, whose embryos have been transplanted into cows.

- (i) Complete the flow diagram to show how cloning by embryo transplant works.



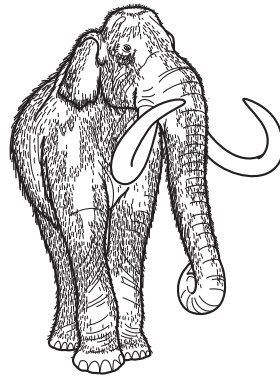
[1]

- (ii) Suggest **one** advantage of reproducing endangered species by cloning and transplanting embryos rather than breeding them normally.

.....

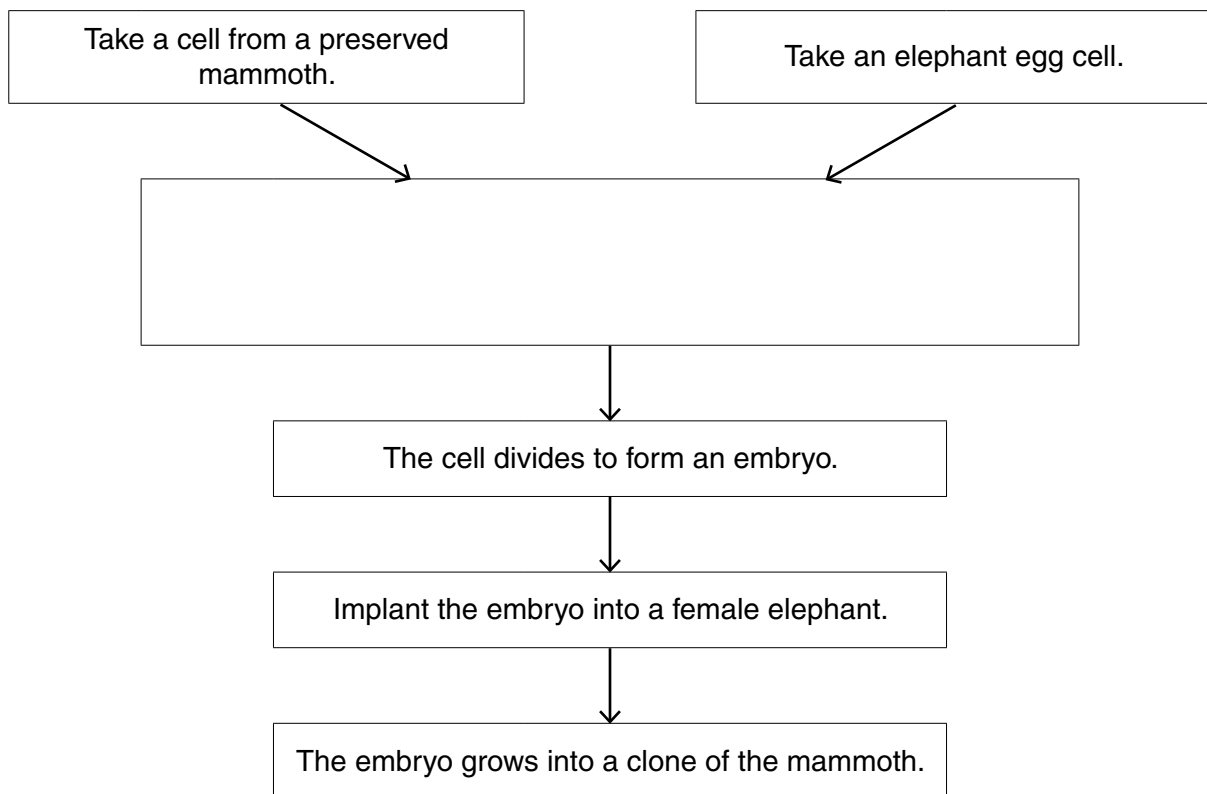
..... [1]

- (c) Some scientists are trying to recreate extinct animal species, such as mammoths.



They are using a similar cloning technique to the one that was used to produce Dolly the sheep.

- (i) Complete the diagram to show how this would work.



[1]

- (ii) The scientists **cannot** use just any cell from the preserved mammoth.

Suggest why a red blood cell would **not** be suitable.

..... [1]

[Total: 6]

- 5 Jenny investigates the use of different metals for electrical wiring.

The table below shows information about four different metals.

metal	density in g/cm ³	relative electrical conductivity	melting point in °C	relative thermal conductivity
iron	8	10	1536	80
aluminium	3	38	660	237
copper	9	60	1084	401
magnesium	2	23	650	156

- (a) (i) Iron is the cheapest of the four metals.

Iron is **not** used for electrical wiring in houses.

Explain why. Use information from the table.

.....
 [1]

- (ii) The picture shows some overhead power cables.



power cables

Aluminium is used for making overhead power cables instead of copper.

Aluminium is cheaper than copper.

Suggest one **other** reason why aluminium is used. Use information from the table.

.....
 [1]

- (b) Some metals can be used to make **superconductors**.

Superconductors are used in the Japanese MAGLEV train. The train floats above the track.



- (i) What is meant by a superconductor?

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

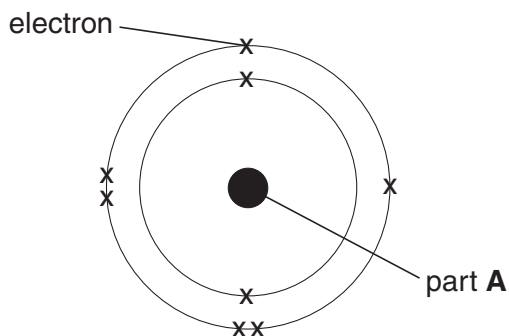
- (ii) Write about **one** disadvantage of superconductors.

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

[Total: 4]

- 6 This question is about atomic structure.

The diagram shows the structure of an oxygen atom.



Complete the crossword puzzle using the clues given. One has been done for you.

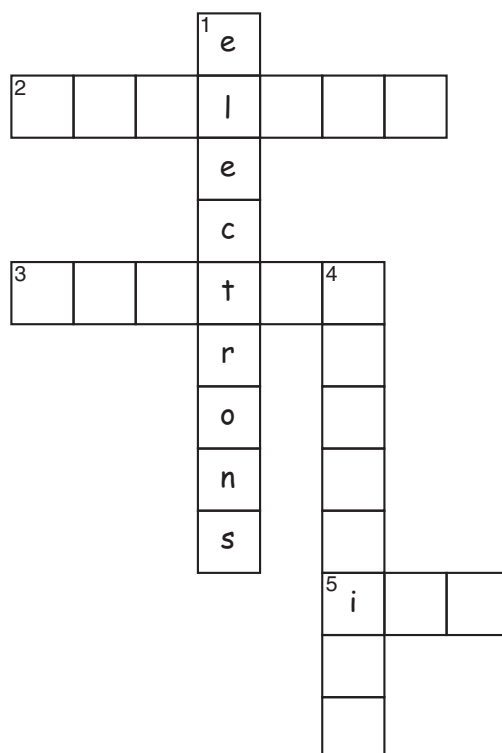
clues across

- 2 Protons and neutrons are found in the _____.
- 3 A particle with a relative mass of 1 is called a _____.
- 5 A particle made by the loss or gain of electrons is called an ____.

clues down

- 1 The space around part A is occupied by e l e c t r o n s.
- 4 The electrical charge on an electron is _____.

clues across →



↓ clues down

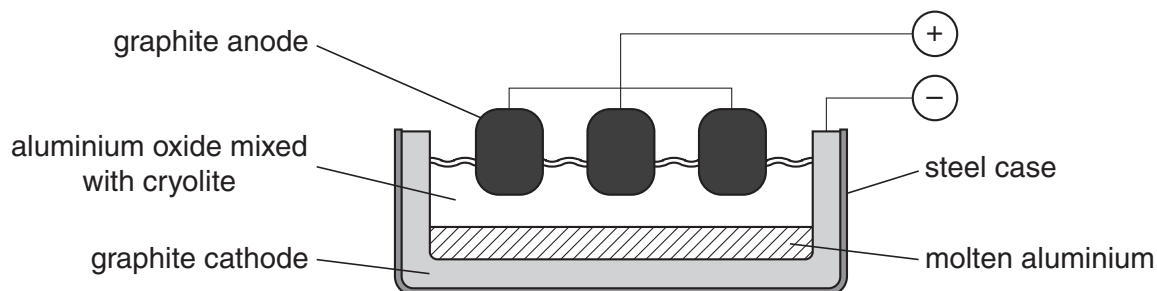
[4]

[Total: 4]

13

7 This question is about electrolysis.

(a) Aluminium is extracted by the electrolysis of aluminium oxide.



Write about how aluminium is extracted.

Your answer should include

- the name of the substance made at each electrode
- the reason why the aluminium oxide is mixed with cryolite
- the reason why the extraction of aluminium is expensive.

.....

.....

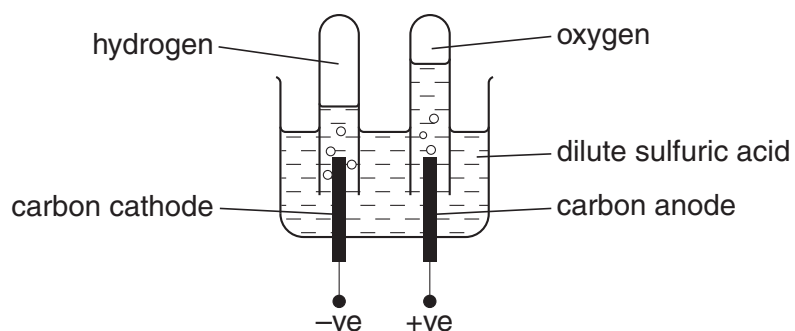
.....

.....

..... [3]

(b) Look at the diagram.

It shows the electrolysis of dilute sulfuric acid.



Hydroxide ions, OH^- , move to the positive electrode.

The hydroxide ions lose electrons. Oxygen, O_2 , and water are made.

Write a **balanced symbol** equation for this reaction. Use e^- to represent an electron.

..... [2]

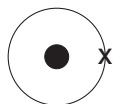
15

(c) Water is a molecule containing hydrogen – oxygen covalent bonds.

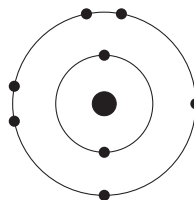
A covalent bond is a shared pair of electrons.

Look at the diagrams.

They show the electronic structures of hydrogen and oxygen.



hydrogen



oxygen

Draw a 'dot and cross' diagram to show the bonding in water, H_2O .

[2]

[Total: 7]

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- 8** This question is about the Group 1 elements.

Lithium, sodium and potassium are Group 1 elements.

- (a)** Sodium reacts with water.

A gas that burns with a squeaky 'pop' is made.

Write down the name of this gas.

..... [1]

- (b)** Atoms of Group 1 elements all have one electron in their outer shell.

When they react, they lose this outer electron.

Potassium is more reactive than sodium.

Explain why.

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

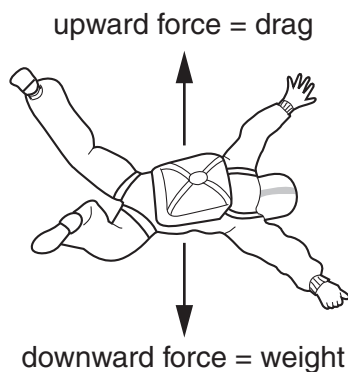
[Total: 2]

Section C – Module P3

- 9 (a) Patrick is a parachutist.

He jumps out of an aeroplane.

At first his speed increases.



- (i) Why does his speed **increase**?

Choose from

- A drag is greater than weight
- B drag and weight are equal
- C weight is increasing
- D weight is greater than drag

answer

[1]

- (ii) What happens to the drag as Patrick's speed increases?

Choose from

- A drag becomes less
- B drag increases
- C drag becomes greater than weight
- D drag stays the same

answer

[1]

- (iii) Patrick reaches his **terminal speed** before he opens his parachute.

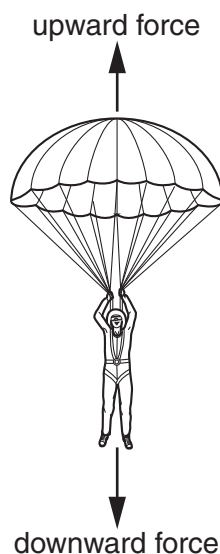
Why does Patrick travel at his terminal speed?

.....
 [1]

19

(b) After falling 500 m at **this** terminal speed Patrick opens his parachute.

He then falls at a **different** terminal speed.



What happens to the time to fall 500 m at the new terminal speed?

Complete the sentences.

When Patrick's parachute is fully open he takes a time to fall 500 m.

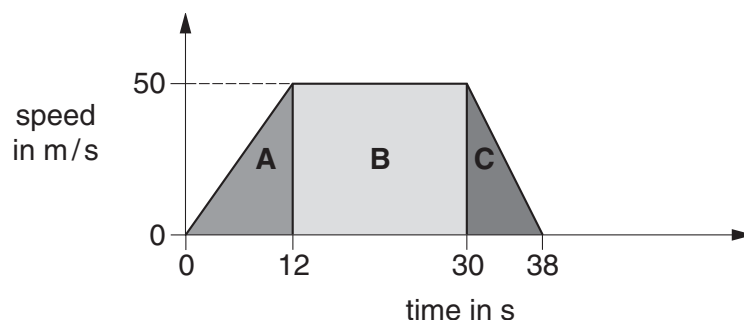
This is because he is falling at a terminal speed.

[2]

[Total: 5]

10 Fernando is a racing driver.

Look at the graph. It shows the speed of his car during part of a race.



(a) (i) Calculate the **distance** travelled in part **A** of the graph.

.....

.....

.....

answer m [2]

(ii) The kinetic energy of the car remains constant in part **B** of the graph.

Explain why.

.....

..... [1]

(iii) The graph shows the following features:

- Part **A** is an acceleration, part **C** is a deceleration.
- The value of the deceleration in **C** is **greater** than the value of the acceleration in **A**.

Describe how the **graph** shows these two features.

.....

.....

..... [1]

21

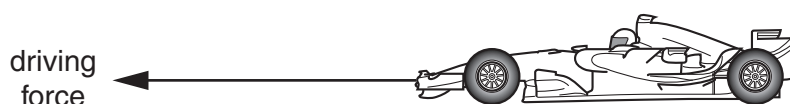
(b) In a different part of the race Fernando makes the car **accelerate** quickly.

(i) Complete the sentence.

Acceleration is the in speed per unit [1]

(ii) The acceleration of the car is 5 m/s^2 .

The total mass of the car and driver is 1200 kg.



Calculate the **driving force**.

The equations on page 2 may help you.

.....

answer N [2]

(iii) Fernando drives the car along a **straight** part of the racing circuit.

The length of the straight part of the racing circuit is 200 m.

The driving force is now 8000 N.

The driving force stays the same along the straight part of the racing circuit.

Calculate the **work done** by the car's engine.

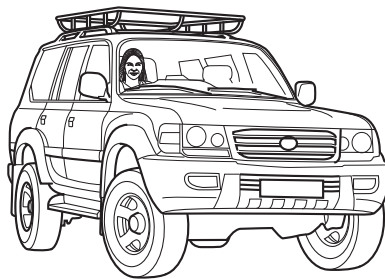
The equations on page 2 may help you.

.....

answer J [2]

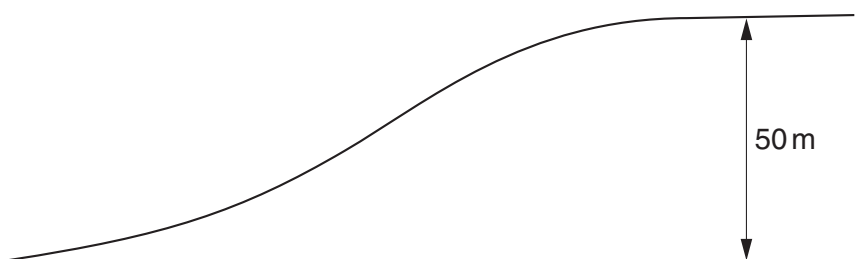
[Total: 9]

11 Amelia drives a car.

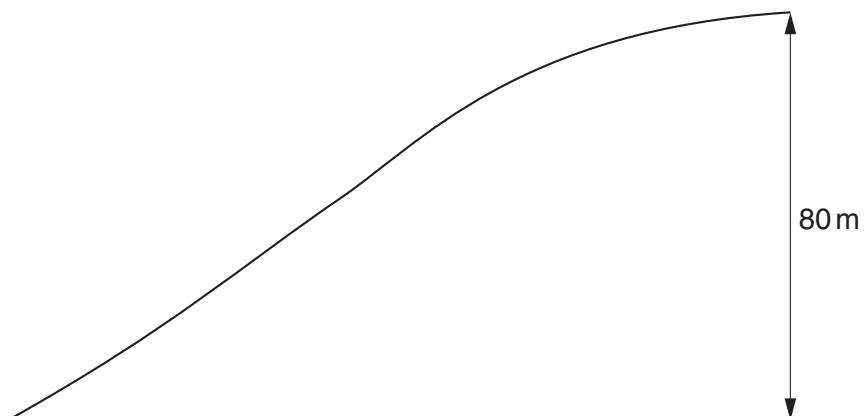


four wheel drive SUV
mass = 2000 kg

(a) She drives the car up a hill.



Leon then drives the **same** car up a different hill.



23

The fuel consumption is **higher** when Leon drives the car.

Suggest why the fuel consumption increases when Leon drives the car.

In your answer write about

- where the car was driven
- gravitational potential energy
- how Amelia and Leon drive the car.

.....

.....

.....

.....

..... [3]

(b) The car then travels down the hill.

The car travels at **twice** the speed that it did on the way up.

Complete the sentence to show how much the kinetic energy (KE) of the car changes.

When the **speed** of the car doubles, the KE of the car..... [1]

[Total: 4]

12 This question is about a car braking.

A car can have a normal braking system or an anti-lock braking system (**ABS**).

Look at the table.

type of brakes	braking distance in m		
	on a dry road when braking from 15 m/s to 0 m/s	on a dry road when braking from 30 m/s to 0 m/s	on an icy road when braking from 15 m/s to 0 m/s
ABS	10	40	60
normal	12	48	80

Finish the sentences about braking by choosing the **best** words from this list.

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

brake friction higher increase
 improves locking lower maximum
 the same thrust turning

Braking distance is when the car travels at a greater speed
or if there is a frictional force.

On icy roads there is less between the road and the tyres.

The braking distance is with ABS brakes.

This is because the brakes are constantly going on and off.

This provides a intermittent braking force which prevents skidding.

ABS brakes stop the wheels from so that the driver can
keep control of the car.

[2]

[Total: 2]

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The Periodic Table of the Elements

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1	2	Key										3	4	5	6	7	0		
		relative atomic mass atomic symbol name atomic (proton) number																	
7 Li lithium 3	9 Be beryllium 4	23 Na sodium 11	24 Mg magnesium 12	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	63.5 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	[98] Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54	[222] Rn radon 86	
133 Cs caesium 55	137 Ba barium 56	139 La* lanthanum 57	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	[209] Po polonium 84	[210] At astatine 85	[222] Rn radon 86		
[223] Fr francium 87	[226] Ra radium 88	[227] Ac* actinium 89	[261] Rf rutherfordium 104	[262] Db dubnium 105	[266] Sg seaborgium 106	[264] Bh bohrium 107	[277] Hs hassium 108	[268] Mt meitnerium 109	[271] Ds darmstadtium 110	[272] Rg roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated								

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

* The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.