

Wednesday 30 May 2012 – Afternoon**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 **20** pages. Any blank pages are indicated.

2

EQUATIONS

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

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

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

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

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

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

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

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

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

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Question 1 starts on page 4.

PLEASE DO NOT WRITE ON THIS PAGE

Answer **all** the questions.

Section A – Module B3

1 This question is about growth.

(a) Human growth occurs because new cells are produced by cell division.

Name the type of cell produced and this type of cell division.

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

diploid ☐

haploid ☐

meiosis ☐

mitosis ☐

multiplication ☐

[2]

(b) How does growth in humans differ from growth in plants?

.....
 [1]

(c) Look at the table.

It shows the gestation period (length of pregnancy) of different mammals.

mammal	gestation period in days
dog	61
hamster	16
human	266
rhino	480
sea lion	360

Suggest why the gestation periods for different mammals are **not** the same.

.....
 [1]

- (d) Stem cells are **undifferentiated**.

What is meant by undifferentiated?

..... [1]

- (e) Some microorganisms are multi-cellular. Other microorganisms are the same size but are single-celled.

Explain why being multi-cellular allows easier movement of materials into and out of the cells.

.....

..... [1]

[Total: 6]

2 Ranjit has poor circulation.

His doctor says that Ranjit has a very high cholesterol level in his blood.

(a) Describe how cholesterol can damage Ranjit's circulation.

.....

.....

..... [2]

(b) In the UK, the average cholesterol level is 5.7 mmol per litre of blood.

Statins are drugs that lower cholesterol levels in the blood.

Ranjit has a cholesterol level of 8.5 mmol per litre of blood.

He takes a statin that lowers his blood cholesterol level by 40%.

Calculate how much lower his blood cholesterol will be than the UK average.

.....

.....

answer mmol per litre of blood [3]

(c) Statins are taken as tablets that are swallowed.

Statins are absorbed in the small intestine by diffusion.

Describe what is meant by diffusion.

.....

..... [1]

(d) The small intestine is adapted for absorption of food.

Write down **two** adaptations that help the small intestine to absorb food efficiently.

1.....

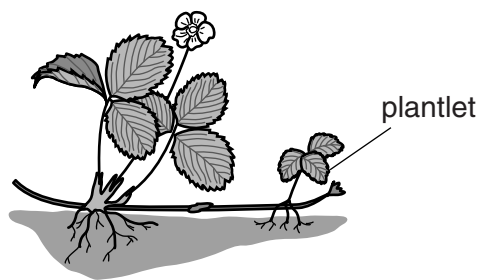
.....

2.....

..... [2]

[Total: 8]

- 3 Look at the drawing of a strawberry plant.



- (a) (i) Scientists can produce strawberry plants that survive freezing temperatures.

Strawberries can now be grown in parts of the world where they could not be grown before.

Finish these sentences about the process the scientists use.

Choose words from this list.

breed insert modification mutate resistance sensitivity

Scientists select the desired antifreeze characteristic from an arctic fish and isolate that gene. The scientists then the antifreeze gene into the cells of the strawberry plant.

The strawberry plant can now make the antifreeze protein that increases its

..... to frost. [2]

- (ii) This new type of strawberry plant can be cloned to produce large numbers of plants.

Cloning plants is easier than cloning animals.

Explain why.

.....

 [2]

- (b) The antifreeze gene in arctic fish codes for a protein.

Explain how the DNA base code in genes determines the structure of proteins.

.....

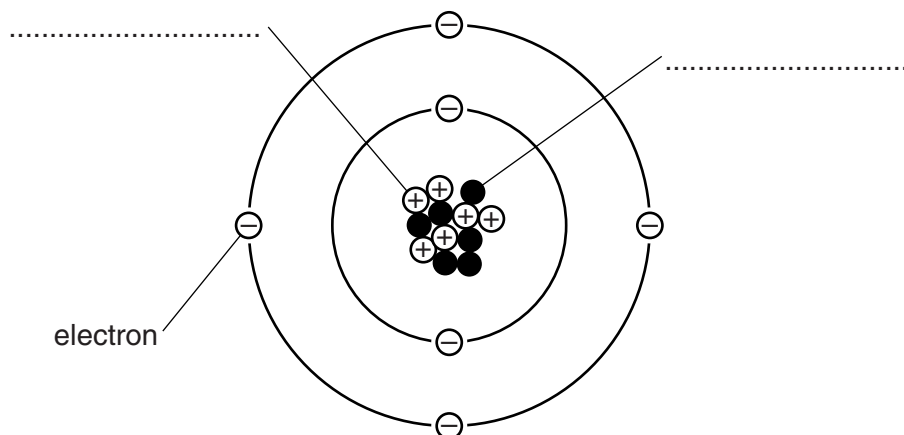
 [2]

[Total: 6]

Section B – Module C3

4 This question is about atoms.

(a) The diagram shows the particles in a carbon atom and their charges.



(i) Complete the labels on the diagram.

[1]

(ii) Write down the **mass number** of this carbon atom.

..... [1]

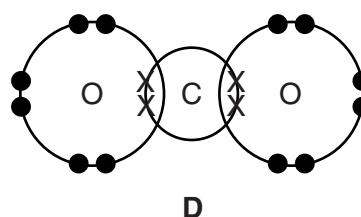
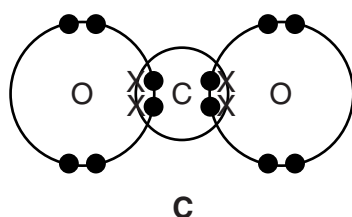
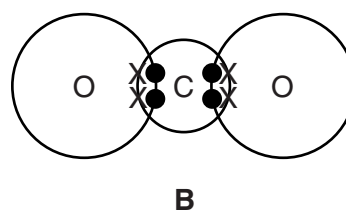
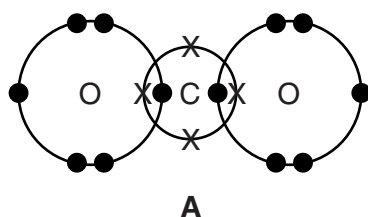
(b) Carbon reacts with oxygen to form carbon dioxide, CO_2 .

The atoms join together by sharing electrons.

Look at the dot and cross diagrams. Only the electrons in the outer shell of each atom are drawn.

(i) Which diagram shows the bonding in carbon dioxide?

Choose **A**, **B**, **C** or **D**.



answer

[1]

(ii) What is the **type of bonding** that holds the atoms together in carbon dioxide?

..... [1]

(c) Carbon dioxide

- has a low melting point
- does not conduct electricity.

Explain why.

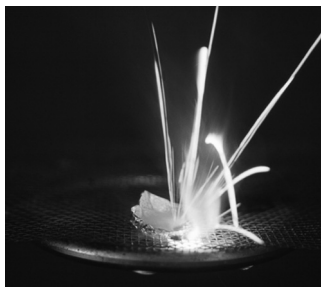
Use ideas about the structure of carbon dioxide and the forces between the molecules.

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

[Total: 6]

- 5 This question is about Group 1 metals.

Read the following newspaper article.



Sodium blaze at factory

A large drum containing sodium metal burst into flames when it reacted with rainwater at a factory. The factory owner believes that the sodium, which is normally stored under oil, had been left uncovered outside by accident.

A fireman who put out the fire said, "These Group 1 metals are very dangerous."

- (a) The Group 1 metals all react with water in a similar way.

Explain why.

Use ideas about electrons.

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

- (b) In the accident at the factory, sodium reacted with water.

Sodium hydroxide, NaOH, and hydrogen, H₂, were made.

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

..... [2]

- (c) Potassium reacts more violently than sodium.

Explain why.

Use ideas about electrons.

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

[Total: 4]

6 Look at the table.

It shows some properties of Group 7 elements.

element	molecular formula	state at room temperature	colour	radius of an atom in nm	order of reactivity
fluorine	F ₂	gas	pale yellow	0.072	most reactive ↓ least reactive
chlorine	Cl ₂		pale green	0.099	
bromine	Br ₂	liquid		0.114	
iodine	I ₂	solid	grey	0.150	
astatine	At ₂	solid	black		

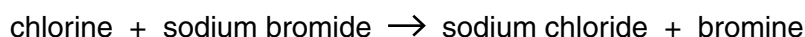
(a) Complete the table.

Use ideas about trends down a group.

[3]

(b) In the table, the Group 7 elements are listed in order of their reactivity.

Look at the equation. It shows a displacement reaction of a Group 7 element.



(i) Write a **word equation** for the reaction between bromine and sodium iodide.

..... [1]

(ii) When chlorine, Cl₂, reacts with sodium bromide, chloride ions, Cl⁻, are made.

Write an **ionic equation** to show how chloride ions are made from a chlorine molecule.

Use e⁻ to represent an electron.

..... [2]

[Total: 6]

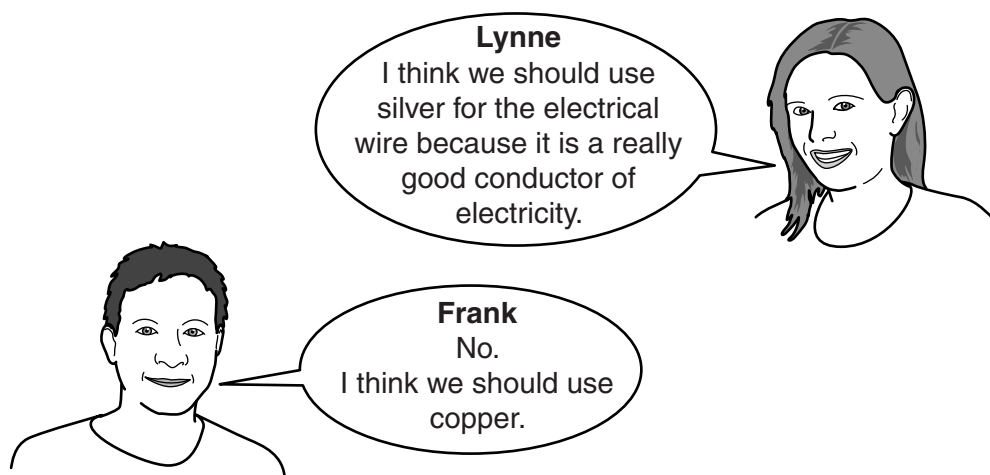
7 This question is about metals.

Look at the table. It shows the properties of some metals.

metal	melting point in °C	density in g/cm ³	relative electrical conductivity	cost per tonne in £
aluminium	660	2.7	40	1350
copper	1083	8.9	64	3800
iron	1535	7.9	11	400
silver	962	10.5	67	20 000

(a) Lynne and Frank are making a string of lights to hang on the outside of their house.

Look at what they say about the wire for the lights.



Suggest why Frank thinks they should use copper.

Use the table to help you.

.....

.....

..... [2]

13

- (b) Saucepans made from iron often have copper bases.



Suggest a property of copper, **not given in the table**, that makes it useful for the base of a saucepan.

..... [1]

- (c) Metals have **high melting points**.

Put a tick (✓) next to the statement which explains why metals have high melting points.

Metals have electrons that can move.

☐

Metals have particles in a regular arrangement.

☐

Metals have strong metallic bonds.

☐

Metals are superconductors.

☐

[1]

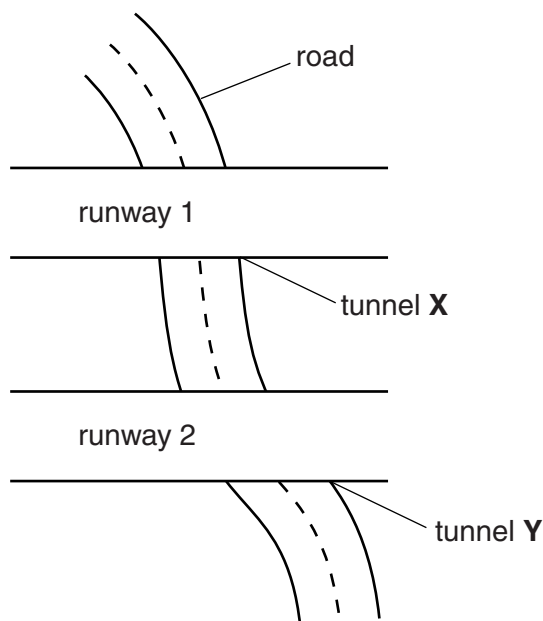
[Total: 4]

Section C – Module P3

- 8 This question is about speed and acceleration.

Look at the drawing. It shows the two runways at Manchester Airport. A road passes through tunnels underneath the runways.

The tunnels are of equal length.



- (a) Look at the information Katy collects about five cars passing through tunnel X and then through tunnel Y.

car	time taken to drive through tunnel X in seconds	time taken to drive through tunnel Y in seconds
A	20	22
B	25	24
C	27	27
D	27	21
E	23	26

In the tunnels, each car travels at a steady speed.

Between the tunnels, the cars change speed uniformly.

Which car **decelerates** the most between tunnel X and tunnel Y?

Choose from **A** **B** **C** **D** **E**

answer

[1]

15

- (b) Car **A** is travelling at 30 m/s through tunnel **X**.

Calculate the **length** of tunnel **X**.

The equations on page 2 may help you.

.....

answer m [1]

- (c) Katy buys a new car.

It has a mass of 900 kg.

The car can accelerate from 0 to 20 m/s in 4 seconds.

Calculate the accelerating **force**.

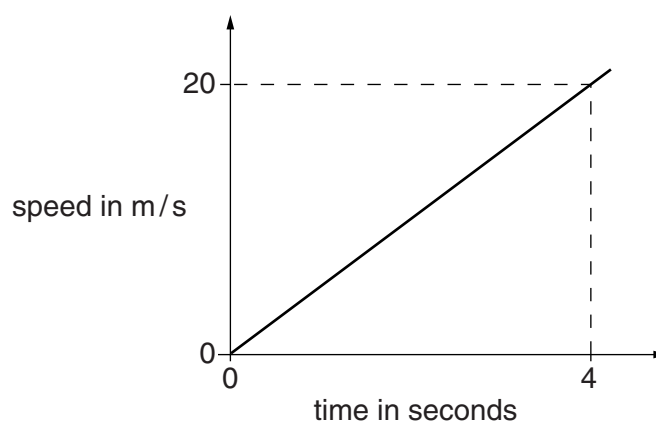
The equations on page 2 may help you.

.....

answer N [3]

- (d) The graph shows how the speed of Katy's car changes with time.

Look at the graph.



How can she use the graph to find the **distance** travelled in the first four seconds?

.....
 [1]

[Total: 6]

16

9 This question is about thinking, braking and stopping distances.

(a) Look at the table.

Put ticks (✓) in the boxes to show which distance is affected by each condition in the table.

The first one has been done for you.

condition	thinking distance	braking distance
increased speed	✓	✓
icy road		
bald tyres		
tired driver		
driver has drunk alcohol		

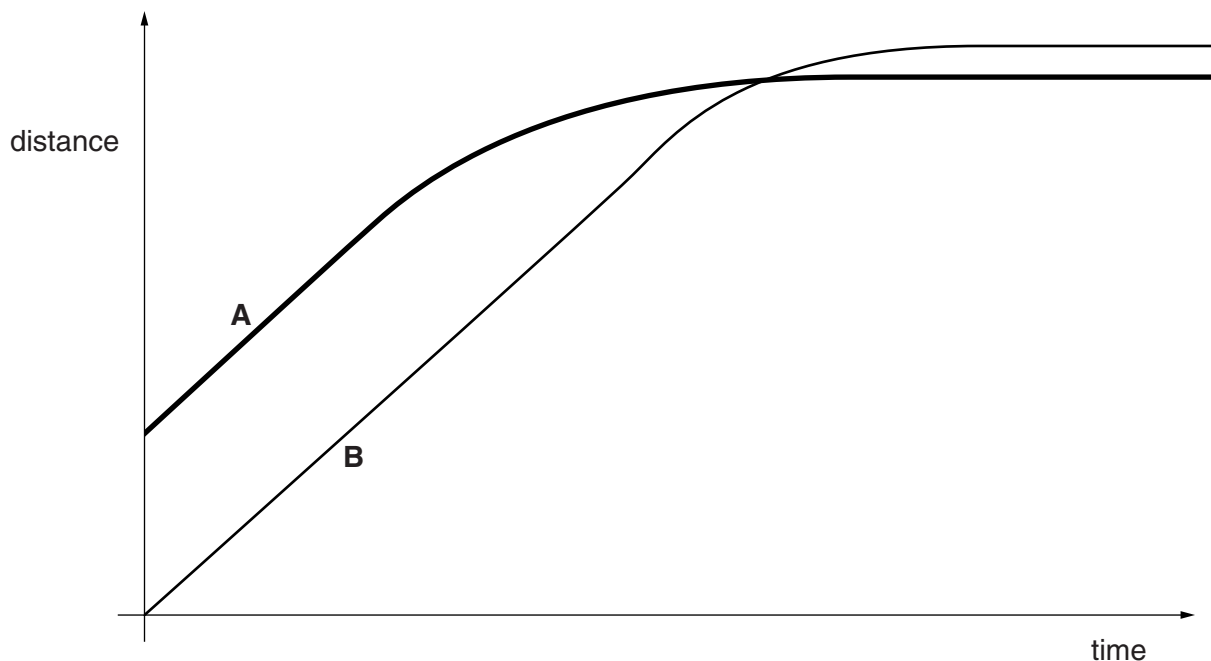
[2]

17

(b) Two cars travel at the same speed in the same lane of a motorway.

Car **B** is behind car **A**.

Look at the sketch graph.



When the driver of car **A** brakes, the driver of car **B** sees the brake lights and also brakes.

Use information in the graph to explain why car **B** was too close to car **A**, and needed to swerve to avoid car **A**.

.....

.....

.....

.....

..... [2]

[Total: 4]

10 (a) Lucy investigates road safety.

She collects data for three different road safety features.

Look at the data.

safety feature	initial car speed in m/s	stopping distance in metres	time for car to stop in seconds
escape lane	30	20	1.30
metal crash barrier	30	4.5	0.30
concrete barrier	30	0.5	0.03

Use the data in the table to explain which safety feature is likely to result in **most** injury.

Use ideas about forces and acceleration in your answer.

.....

.....

.....

.....

..... [3]

(b) The braking distance depends on the deceleration of the car.

The frictional force between the tyres and the road is reduced by slippery road conditions.

Explain why braking distance is increased by slippery road conditions.

The equations on page 2 may help you explain your answer.

.....

.....

..... [2]

[Total: 5]

11 Jenny drops a ball from a cliff.



(a) Draw **labelled** arrows to show the forces acting on the ball as it falls. [2]

(b) The speed of the ball increases until it reaches terminal velocity.

(i) Explain in terms of the forces acting on the ball what happens at terminal velocity.

.....
 [1]

(ii) The gravitational potential energy and the kinetic energy of the ball change during the fall.

Describe these changes from the moment the ball is dropped until just before it hits the ground.

gravitational potential energy

 kinetic energy

 [2]

[Total: 5]

END OF QUESTION PAPER

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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																1 H hydrogen 1		4 He helium 2			
7 Li lithium 3	9 Be beryllium 4																	11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
23 Na sodium 11	24 Mg magnesium 12																	27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	40 Ar argon 18
39 K potassium 19	40 Ca calcium 20	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						
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.