

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.

Duration: 1 hour

OCR supplied materials:
None

Other materials required:

- Pencil
- Ruler (cm/mm)



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.

EQUATIONS

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

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

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

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

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

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

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

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

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

BLANK PAGE

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 | <input type="checkbox"/> |
| haploid | <input type="checkbox"/> |
| meiosis | <input type="checkbox"/> |
| mitosis | <input type="checkbox"/> |
| multiplication | <input type="checkbox"/> |

[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]

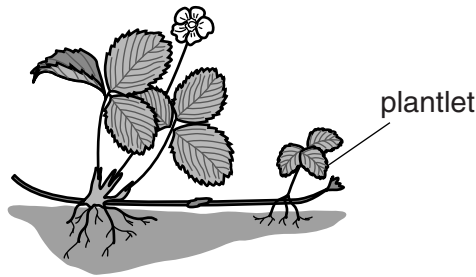
(d) The small intestine is adapted for absorption of food.

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]

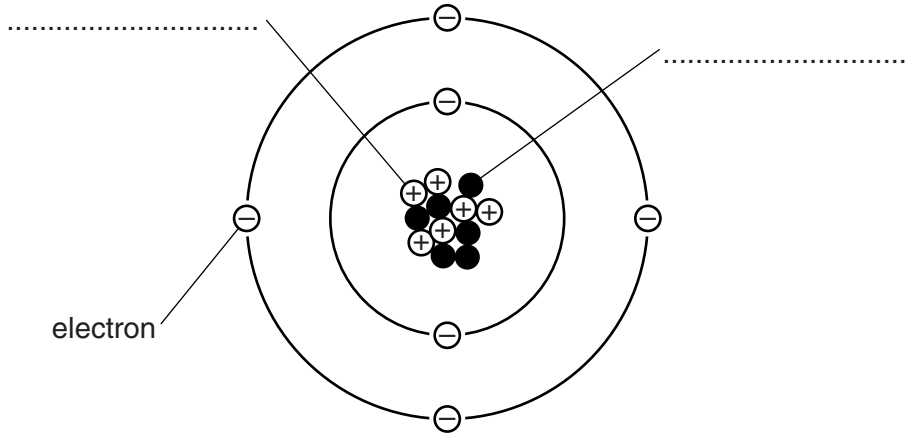
[Total: 6]

Turn over

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]

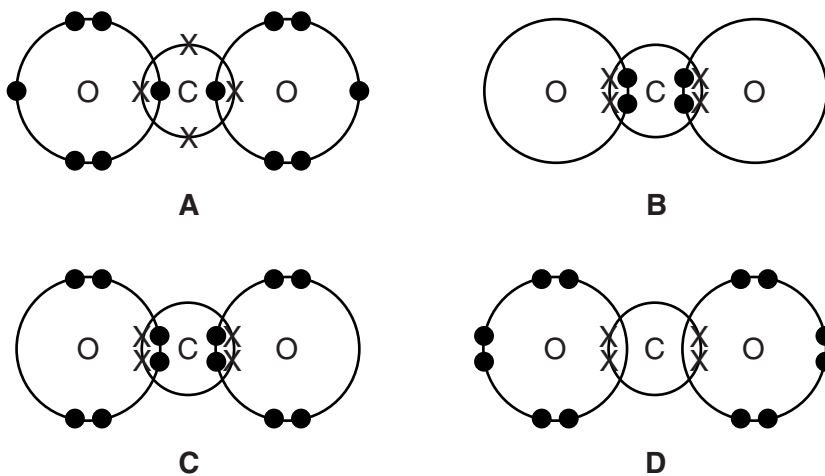
(b) Carbon reacts with oxygen to form carbon dioxide, CO₂.

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.

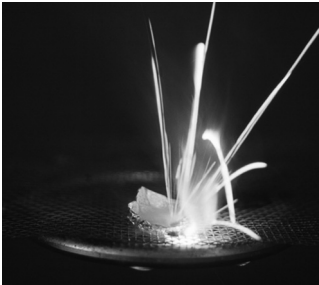
Use ideas about the structure of carbon dioxide and the forces between the molecules.

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

[Total: 6]

- 5 This question is about Group 1 metals.

Read the following newspaper article.

	<p style="text-align: center;">Sodium blaze at factory</p> <p>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.</p> <p>A fireman who put out the fire said, "These Group 1 metals are very dangerous."</p>
---	--

- (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	

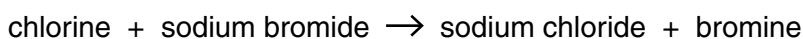
(a) Complete the table.

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]

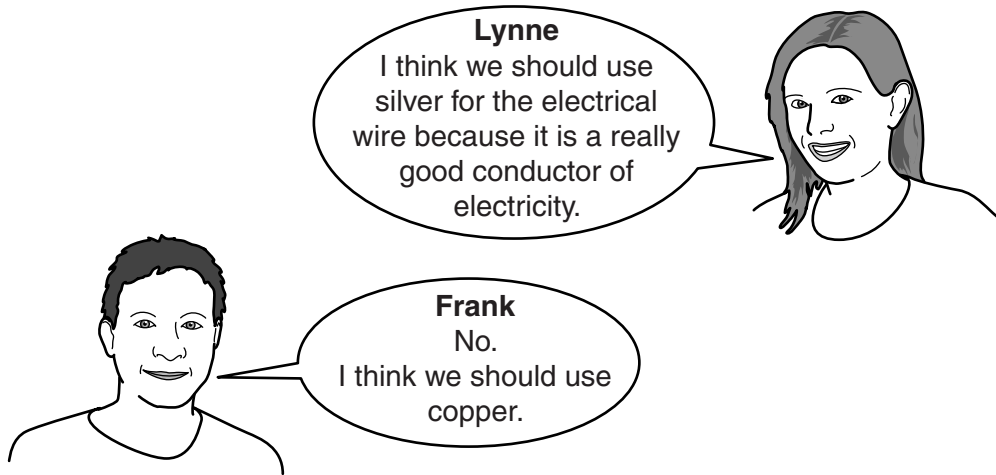
7 This question is about metals.

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]

- (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]

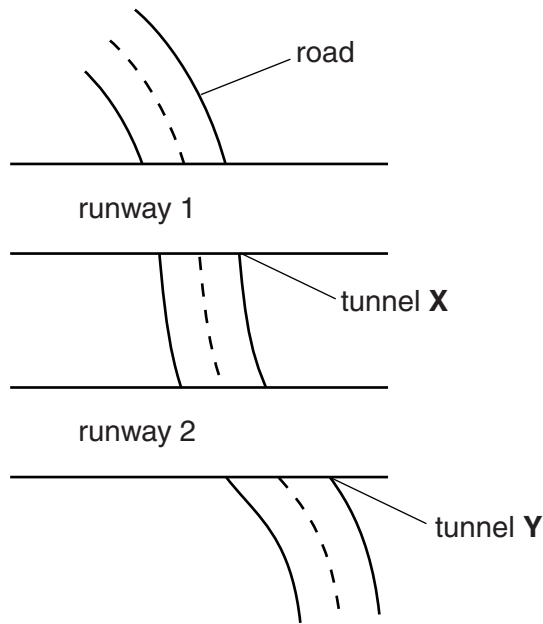
[Total: 4]

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]

(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**.

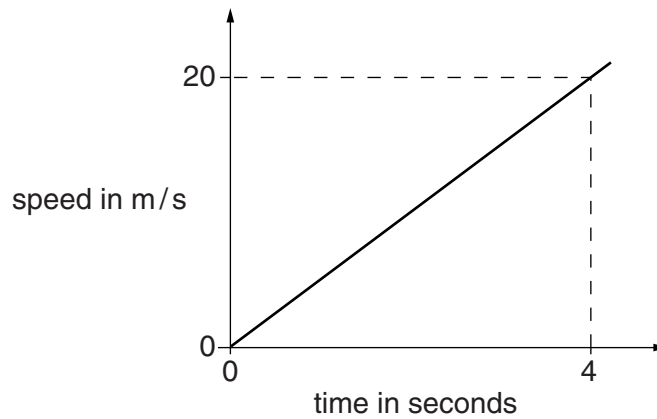
The equations on page 2 may help you.

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

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]

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.

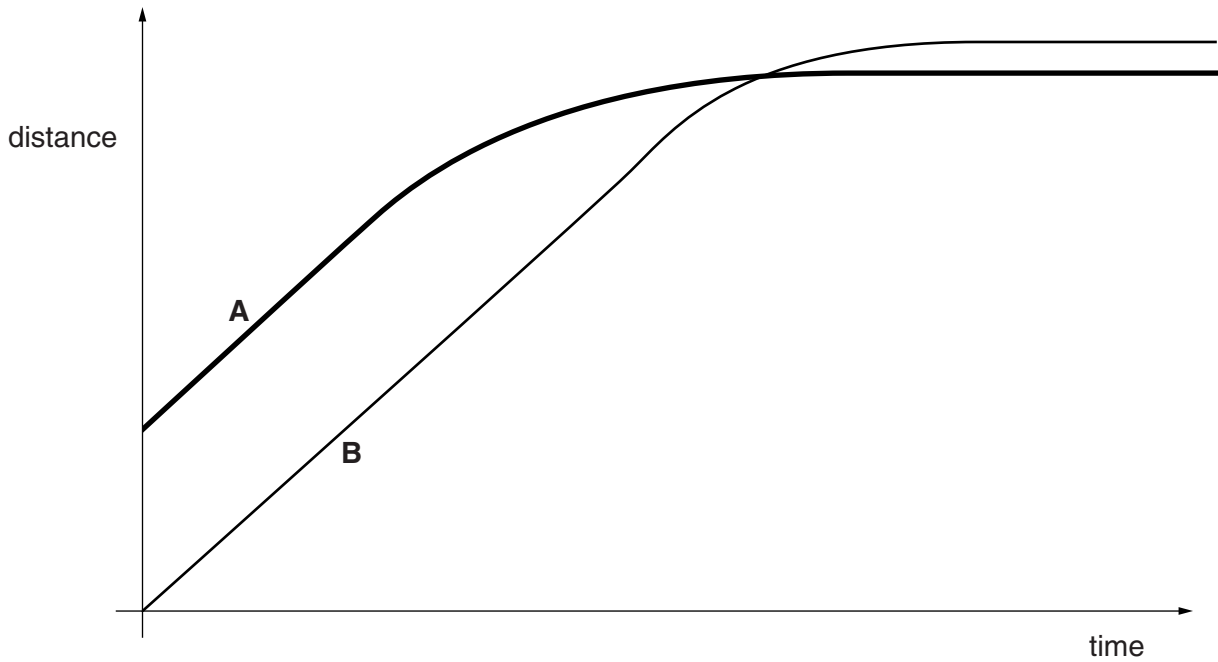
condition	thinking distance	braking distance
increased speed	✓	✓
icy road		
bald tyres		
tired driver		
driver has drunk alcohol		

[2]

(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

[Total: 5]

END OF QUESTION PAPER



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