OCR
RECOGNISING ACHIEVEMENT

GENERAL CERTIFICATE OF SECONDARY EDUCATION

GATEWAY SCIENCE
ADDITIONAL SCIENCE B
Unit 1 Modules B3 C3 P3
HIGHER TIER
THURSDAY 14 JUNE 2007

H B623/02

Afternoon
Time: 1 hour

Calculators may be used.
Additional materials: Pencil
                        Ruler (cm/mm)

Candidate
Name

Centre
Number

Candidate
Number

INSTRUCTIONS TO CANDIDATES

- Write your name, Centre Number and Candidate Number in the boxes above.
- Answer **all** the questions.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- Do **not** write in the bar code.
- Do **not** write outside the box bordering each page.
- WRITE YOUR ANSWER TO EACH QUESTION IN THE SPACE PROVIDED. ANSWERS WRITTEN ELSEWHERE WILL NOT BE MARKED.

INFORMATION FOR CANDIDATES

- The number of marks for each question 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.

FOR EXAMINER'S USE		
Section	Max.	Mark
A	20	
B	20	
C	20	
TOTAL	60	

This document consists of **23** printed pages and **1** blank page.

SP (SLM/CGW) T30056/4   © OCR 2007 [Y/103/4529]   OCR is an exempt Charity   **[Turn over**

EQUATIONS

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

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

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

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

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

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

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

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

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

Answer **all** the questions.

Section A – Module B3

1 This question is about growth.

(a) Kate and Steve are twins.

The graph shows how their mass changes as they grow.

(i) For how many years was Kate heavier than Steve?

.... [1]

(ii) Between which ages was Steve growing at the fastest rate?

.... [1]

[Turn over for the remainder of question 1

4

(b) **(i)** Kate and Steve's dad planted a tree in the garden when they were born.

As the tree has grown, its mass has changed in a different way from Kate and Steve's masses.

Draw a line on the graph to show how the mass of the tree has changed.

It has not been trimmed and the growing conditions have been good.

mass in kilograms

0   2   4   6   8   10   12   14   16   18   20

age in years
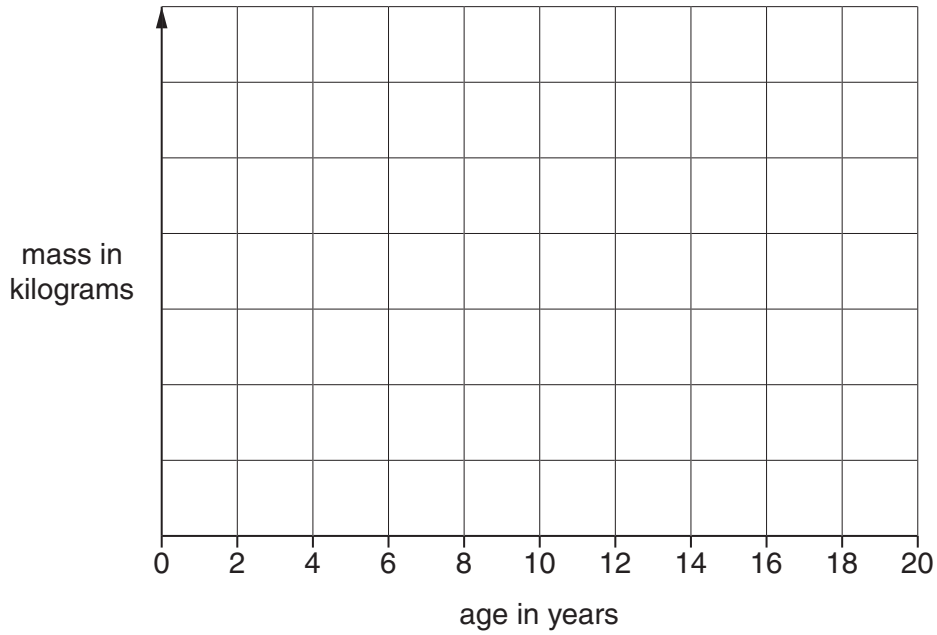
[1]

(ii) Growth involves cell division.

Where in the tree does cell division mainly happen?

.... [1]

[Total: 4]

2 **(a)** Harry grows apple trees.

He has grown his apple trees from seeds. His trees are **not** genetically identical.

Describe **one** advantage of Harry's apple trees **not** being genetically identical.

....

.... [1]

(b) Harry's friend Ed grows cauliflower plants by tissue culture.

The new cauliflower plants are genetically identical.

Describe how to grow new cauliflower plants by tissue culture.

....

....

....

....

....

.... [3]

[Total: 4]

[Turn over

3 This question is about genes.

(a) Many genes tell cells to make enzymes.

Enzymes control different chemical processes in living things.

Look at the list.

diffusion

photosynthesis

protein synthesis

respiration

Write down **one** process that is **not** controlled by enzymes.

Choose your answer from the list.

.... [1]
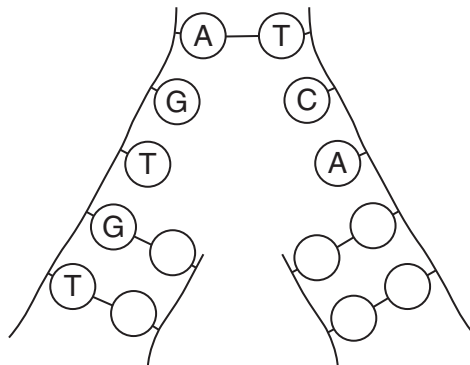
(b) (i) Genes are made from DNA.

The diagram shows DNA copying itself (replication) by 'unzipping' to form two new double strands.

Complete the diagram.

Write either **A**, **C**, **G**, or **T** in each ◯.

[2]

(ii) Look at the list.

before cell division
during cell division
just after cell division

When does DNA copy itself?

Choose your answer from the list.

.... [1]
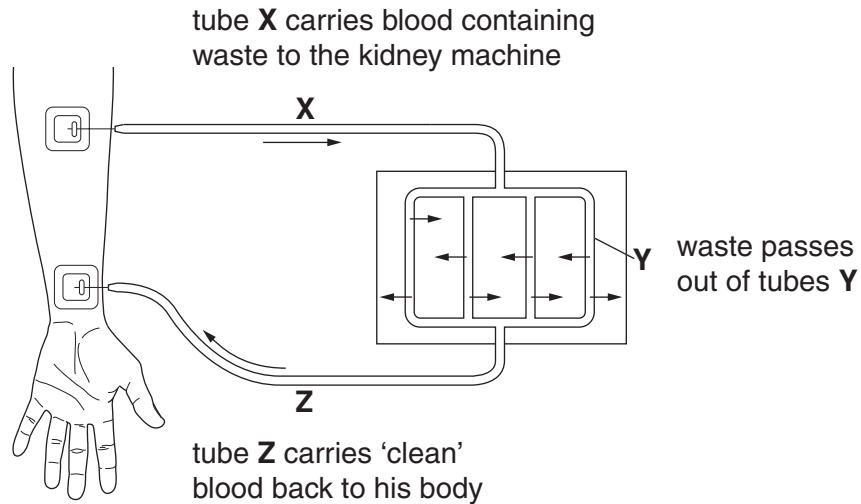
[Total: 4]

4 This question is about the blood system.

John's kidneys are not working properly.

His blood system has to be connected to a kidney (dialysis) machine two or three times a week.

The kidney machine does the job of John's kidneys. It removes waste substances from John's blood.

The diagram shows how the kidney machine works.

tube **X** carries blood containing waste to the kidney machine

waste passes out of tubes **Y**

tube **Z** carries 'clean' blood back to his body

(a) Look at the diagram of the kidney machine.

The tubes **X**, **Y** and **Z** do the same jobs as the kidneys' blood vessels.

Draw lines to join each **tube** with the **vessel** it does the same job as.

Draw only **three** lines.

tube	blood vessel
X	artery
Y	vein
Z	capillary

[2]

(b) The blood from John's arm contains waste substances.

Which part of the blood contains waste substances?

.... [1]

[Turn over for the remainder of question 4

(c) When a doctor checks on John, she listens to his heart beat.

His heart is in the centre of his chest.

However, she listens to the left side of John's chest, where the heart beat is louder.

Why is the heart beat louder on the left side?

.... [1]

[Total: 4]

5 This question is about plant growth.

   (a) The boxes show some uses of plant hormones and the effects of these hormones.

   Draw lines to join each **use of hormone** with the **effect of the hormone**.

   Draw only **three** lines.

use of hormone	**effect of hormone**
used to grow new begonia plants from cuttings	makes some plants grow very quickly and then die
used to remove weeds from a lawn	makes roots grow more quickly
used after transporting green tomatoes from Spain	makes fruit ripen quickly

[2]

[Turn over for the remainder of question 5

(b) The diagram shows some cress seedlings growing inside a box.

The box has a hole in one side to let in light.

The seedlings start to grow towards the light because the plant hormone auxin collects on the shaded side of their shoots.
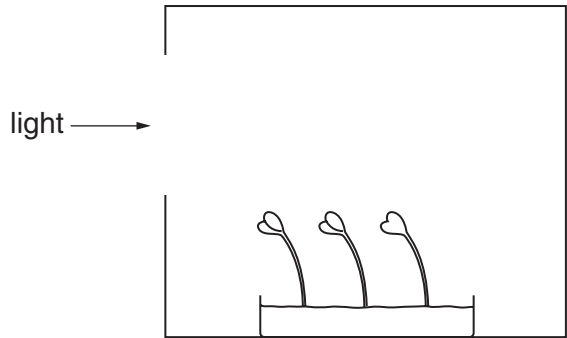
The seedlings are then put on a motorised turntable which turns around slowly once every hour.

The diagram below shows the seedlings when the motor is first switched on.
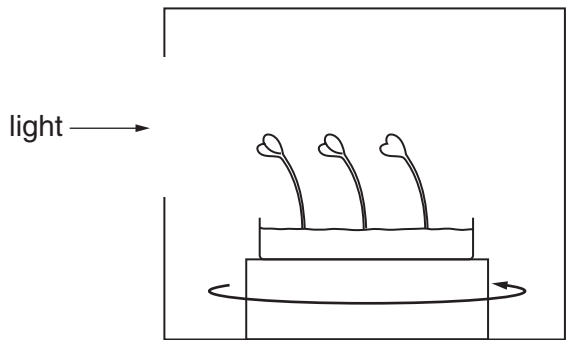
(i) In which direction will the seedlings grow now?

.... [1]

(ii) Explain your answer.

....

.... [1]

[Total: 4]

Section B – Module C3

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

Look at the list of elements.

boron

chlorine

copper

fluorine

magnesium

nickel

nitrogen

phosphorus

Answer the questions.

Choose **all** your answers from the list.

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

The Periodic Table on the back page may help you.

(a) Write down the **name** of a pale green gas.

....[1]

(b) Write down the **name** of an element that forms compounds that are blue in colour.

....[1]

(c) Write down the **name** of the element which has an atom that contains 15 protons.

....[1]

(d) Write down the **name** of the element that has an electronic structure of 2.5.

....[1]

[Total: 4]

[Turn over

7 Look at the diagram.

It shows the electrolysis of dilute sulfuric acid.
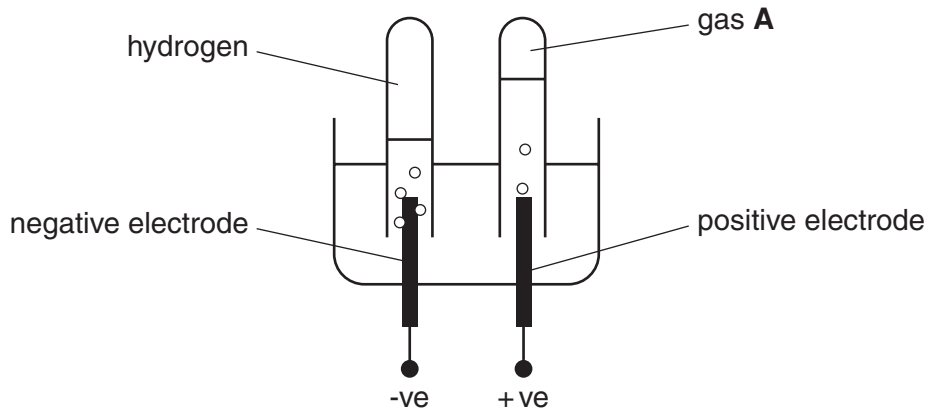
Hydrogen is made at the negative electrode.

(a) Gas **A** is made at the positive electrode.

What is the name of gas **A**?

....[1]

(b) At the negative electrode hydrogen ions, H^+, gain electrons to make hydrogen molecules, H_2.

Write down the balanced symbol equation for this reaction.

Use e^- to represent an electron.

....[2]

[Total: 3]

8   Most metals are good conductors of heat and electricity.

   (a) Describe how metals conduct electricity.

   Use ideas about metallic bonding.

   ....

   ....[1]

   (b) Look at this electrical wire.

plastic coating

copper wire
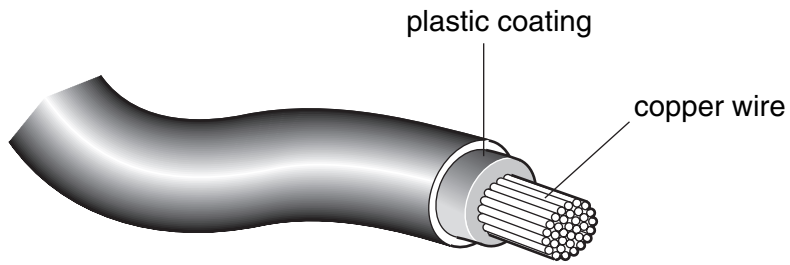
   Copper is used to make the electrical wire.

   Explain why copper is chosen to make electrical wires.

   ....

   ....

   ....[2]

   (c) At very low temperatures, some metals are **superconductors**.

   What is meant by a superconductor?

   ....

   ....[1]

   [Total: 4]

[Turn over

9 Magnesium oxide is an ionic compound.

(a) Magnesium, Mg, reacts with oxygen, O_2.

Magnesium oxide, MgO, is made.

Write a balanced symbol equation for this reaction.

....[2]

(b) Magnesium has an electronic structure of 2.8.2.

Oxygen has an electronic structure of 2.6.

Draw a 'dot and cross' diagram to show the bonding in magnesium oxide, MgO.

Show the charges on the ions formed.

[2]

[Total: 4]

10 Sodium and potassium are both alkali metals.

They are in Group 1 of the Periodic Table.

The word equation for the reaction between sodium and cold water is shown below.

$$sodium \ + \ water \ \longrightarrow \ sodium \ hydroxide \ + \ hydrogen$$

(a) Potassium also reacts with cold water.

A small piece of potassium is dropped into a bowl of cold water.

What would you **see**?

....

....

....[2]

(b) Potassium reacts with water much faster than sodium reacts with water.

Explain why.

Use ideas about the loss of electrons from atoms.

....

....[1]

(c) Rubidium, Rb, is also an alkali metal.

It reacts with cold water.

Write down the **names** of the **two** products of this reaction.

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

[Total: 5]

[Turn over

11 Look at the information on the **stopping** distance for a car.

stopping distance

thinking distance	braking distance
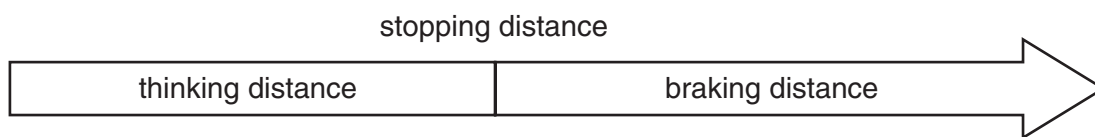
(a) Write down two different factors that can increase **thinking** distance.

....

....[2]

(b) ABS brakes can make driving safer.

Suggest how.

....

....[1]

(c) Look at the information on stopping distances for a car travelling at different speeds.

speed of car in m/s	thinking distance in m	braking distance in m
8	6	7
16	12	28
32	24	112

(i) Calculate the **stopping distance** at a speed of 8 m/s.

....m [1]

(ii) Calculate the **thinking time** of this driver.

....

....

answer ....s [2]

(iii) A car and a van travel at 32 m/s (80 mph) on the motorway.

The van drives only 15 m behind the car in front.

This is dangerous.

Use the information in the table to explain why.

....

....[2]

(iv) Look at the table.

Explain the relationship between speed and braking distance.

In your answer, use ideas about

- kinetic energy

- speed

- braking distance.

....

....

....

....[2]

[Total: 10]

[Turn over

12 Seat belts are useful in a crash.
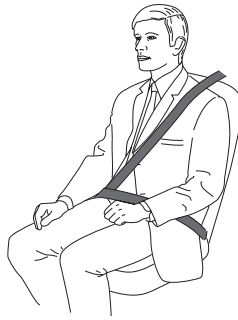
They help keep passengers in their seats.

This can reduce their injuries.

(a) What happens to the length of a driver's seat belt in a crash?

....[1]

(b) How can the seat belt help reduce injuries in a crash?

Use ideas about energy in your answer.

....

....[1]

[Total: 2]

13 Look at the information on the fuel consumption of some vehicles.

vehicle	fuel consumption in kilometres per litre
car	15
minibus	10
motorbike	25
van	8

(a) The car uses 30 litres of fuel.

Look at the table.

Suggest how many kilometres it travelled using 30 litres of fuel.

....[1]

(b) The fuel consumption for the van is not always the same.

It can be anything from 5 km / l to 12 km / l.

Suggest why the fuel consumption is not always the same.

....

....

....[2]

[Total: 3]

[Turn over

14 Mike does weight training. He lifts the weights from the floor to above his head.

Look at the diagram.

Mike does work when he lifts the weights.

He pushes up with a force of 500 N.

He lifts the weights 2 m.

Calculate the **work done** on the weights.

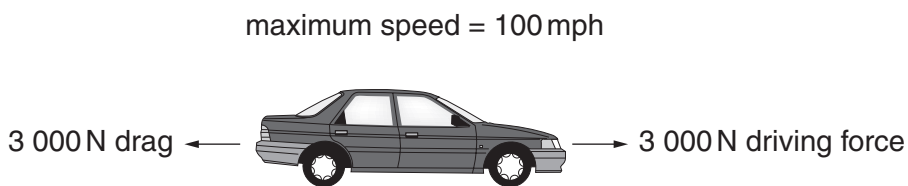Select the correct equation from the list on page 2.

....

....

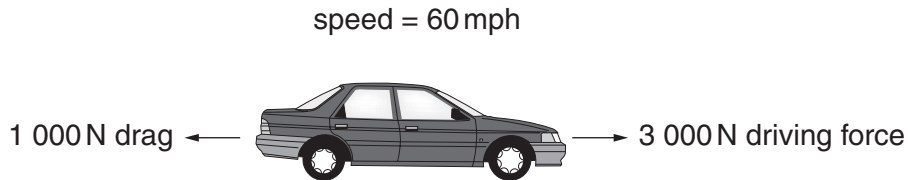answer .... J [2]

[Total: 2]

15 Steph's car has a maximum driving force of 3 000 N.

Its top speed is 100 mph.

She puts a roof box on the car. This affects the maximum speed.

Look at the diagram of the car and its forces at different speeds.

speed = 60 mph

1 000 N drag ← → 3 000 N driving force

maximum speed = 100 mph

3 000 N drag ← → 3 000 N driving force

maximum speed with roof box = 80 mph

3 000 N drag ← → 3 000 N driving force

The maximum (terminal) speed is different when Steph uses the roof box.

Explain why.

In your answer, use ideas about

- terminal speed

- drag forces

- driving forces.

....

....

....

....[3]

[Total: 3]

END OF QUESTION PAPER

22

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The Periodic Table of the Elements

Key

| relative atomic mass |
| **atomic symbol** |
| name |
| atomic (proton) number |

Group 1	2											3	4	5	6	7	0
					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

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.