

**GENERAL CERTIFICATE OF SECONDARY EDUCATION
TWENTY FIRST CENTURY SCIENCE
ADDITIONAL SCIENCE A**

A216/02

Unit 2: Modules B5 C5 P5 (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)

**Monday 28 June 2010
Morning**

Duration: 40 minutes



| | | | |
|--------------------|--|-------------------|--|
| Candidate Forename | | Candidate Surname | |
|--------------------|--|-------------------|--|

| | | | | | | | | | | |
|---------------|--|--|--|--|--|------------------|--|--|--|--|
| Centre Number | | | | | | Candidate Number | | | | |
|---------------|--|--|--|--|--|------------------|--|--|--|--|

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- 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).

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **42**.
- A list of physics equations is printed on page 2.
- The Periodic Table is printed on the back page.
- This document consists of **20** pages. Any blank pages are indicated.

TWENTY FIRST CENTURY SCIENCE EQUATIONS

Useful Relationships

Explaining Motion

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

$$\text{momentum} = \text{mass} \times \text{velocity}$$

$$\text{change of momentum} = \text{resultant force} \times \text{time for which it acts}$$

$$\text{work done by a force} = \text{force} \times \text{distance moved in the direction of the force}$$

$$\text{change in energy} = \text{work done}$$

$$\text{change in GPE} = \text{weight} \times \text{vertical height difference}$$

$$\text{kinetic energy} = \frac{1}{2} \times \text{mass} \times [\text{velocity}]^2$$

Electric Circuits

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

$$\frac{\text{voltage across primary coil}}{\text{voltage across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$$

$$\text{energy transferred} = \text{power} \times \text{time}$$

$$\text{power} = \text{potential difference} \times \text{current}$$

$$\text{efficiency} = \frac{\text{energy usefully transferred}}{\text{total energy supplied}} \times 100\%$$

The Wave Model of Radiation

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

BLANK PAGE

Question 1 starts on page 4

PLEASE DO NOT WRITE ON THIS PAGE

Answer **all** the questions.

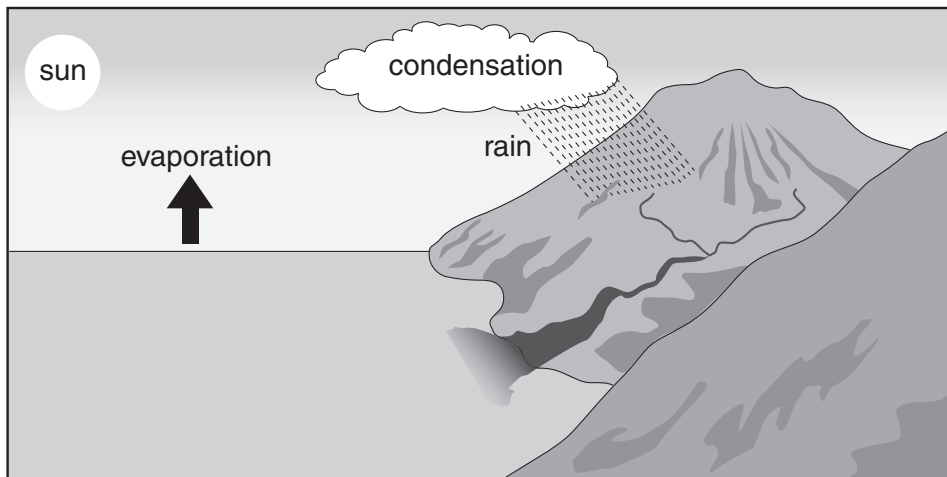
1 Chemicals such as water are vital for life.

Most of our planet is covered by water.

(a) Sea water is too salty for us to use.

The concentration of salt in the sea has increased over millions of years.

The amount of sea water has not changed much over millions of years.



Use ideas from the diagram to explain how salt gets into the sea, and why the seas have become saltier.

.....

.....

.....

.....

[3]

(b) Water easily evaporates into the air.

What does this tell you about water?

Draw **one** straight line to join the **two** correct boxes.

water is made of

small molecules

or

large molecules

or

a giant structure of ions

or

a giant structure of atoms

forces between water particles

strong forces of repulsion

or

weak forces of repulsion

or

strong forces of attraction

or

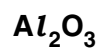
weak forces of attraction

[2]

(c) Astronomers look for signs of life on other planets.

They look for water and also for other chemicals.

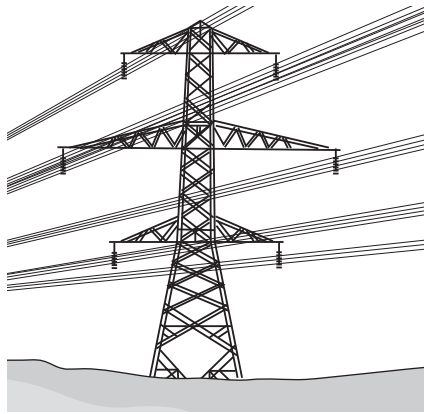
Put a (ring) around the chemical most likely to show that life is present.



[1]

[Total: 6]

2 The electric cables carried on pylons are made from aluminium.



(a) Aluminium cables are good electrical conductors.

Some students try to explain how a solid metal conducts electricity.

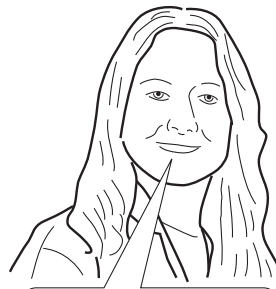
Which two students make correct statements that are part of the true explanation?



Carolyn
Metals contain
negative ions.



Mary
Metals don't
contain ions.



Judith
Metals contain
small molecules.



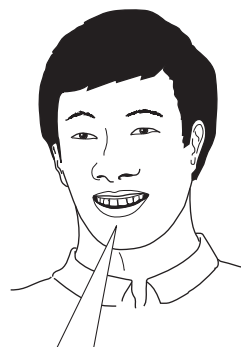
Danielle
Metals contain
electrons.



Alistair
Heat can move
through a
metal.



Andy
Charge can
move through
a metal.



Stan
Nothing can
move through a
metal.



Ryan
Neutral particles
can move
through a metal.

answer and [2]

- (b) The cables are suspended from tall pylons.

The cables are made of aluminium rather than copper.

Volume for volume, aluminium has 65% of the electrical conductivity of copper.

Weight for weight, aluminium has twice the electrical conductivity of copper.

Use this information to explain why aluminium is used instead of copper.

.....

.....

..... [1]

- (c) The aluminium used to make the cables is extracted from aluminium oxide.

Aluminium oxide is the mineral in aluminium ore.

Some ores produce 2 tonnes of aluminium oxide from 5 tonnes of ore.

Put a **ring** around the percentage of aluminium oxide in these ores.

10% 20% 25% 40% 50% [1]

- (d) To make aluminium, melted aluminium oxide is electrolysed.

Put a tick (✓) in the box next to the **best** description of electrolysis.

using an electric current to melt a compound

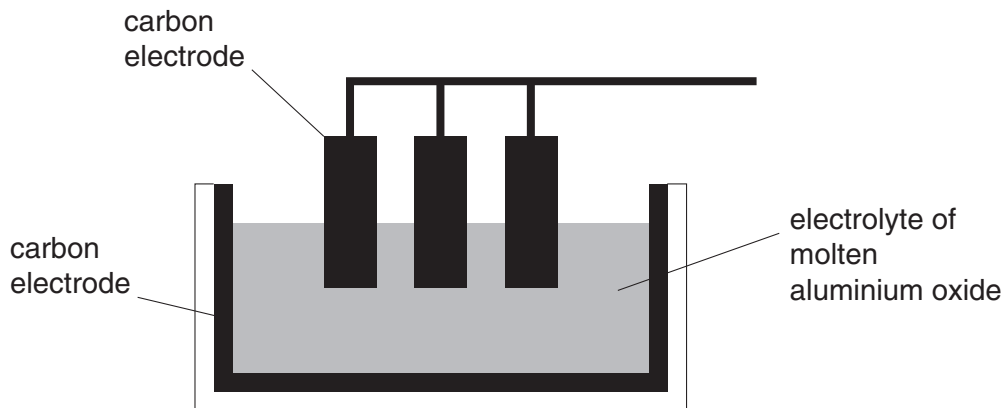
using an electric current to purify a compound

using an electric current to make a compound

using an electric current to decompose a compound

[1]

(e) Carbon dioxide gas is produced when aluminium oxide is electrolysed.



Draw a straight line to link **one** statement from **column 1** with **one** statement from **column 2** to explain why carbon dioxide is produced.

column 1

Oxygen is bubbled into the cell.

or

Oxygen is not formed in the process.

or

Oxygen is dissolved in the electrolyte.

or

Oxygen is formed at the positive electrode.

or

Oxygen is formed at the negative electrode.

column 2

Oxygen reacts with the electrolyte.

or

Oxygen reacts with the positive electrode.

or

Oxygen reacts with the negative electrode.

or

Electrolyte reacts with the positive electrode.

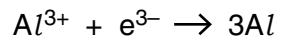
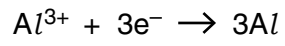
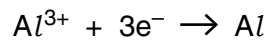
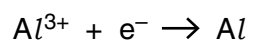
or

Electrolyte reacts with the negative electrode.

[2]

(f) What is the electrode reaction that produces the aluminium?

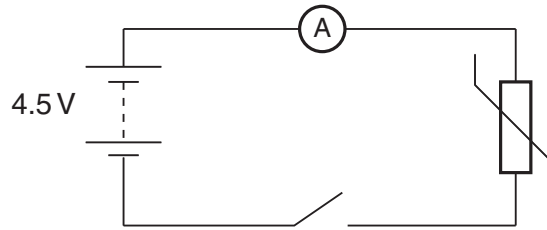
Put a tick (✓) in the box next to the correct answer.



[1]

[Total: 8]

3 The circuit below contains a thermistor.



(a) Complete the sentence for a thermistor.

Choose words from this list.

- current light level pressure resistance temperature voltage**

The of the thermistor increases with decreasing [2]

(b) When the switch is closed, the ammeter reads 0.5 A.

Put a **ring** around the **correct** value for the thermistor resistance.

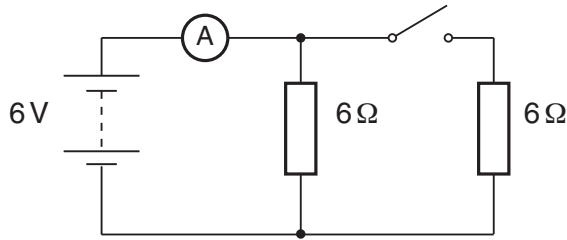
- 0.1 Ω 2.3 Ω 5 Ω 9 Ω [1]**

(c) A voltmeter can be used to measure the potential difference across the thermistor.

Draw the voltmeter **on the circuit diagram** and show how it should be connected. [1]

[Total: 4]

4 Both resistors in this circuit have the same value.



(a) Complete the sentences. Choose words from this list.

charge current resistance voltage

The energy transferred by each unit of charge as it goes around the circuit is equal to the of the battery.

Closing the switch increases the battery

[2]

(b) Complete the table.

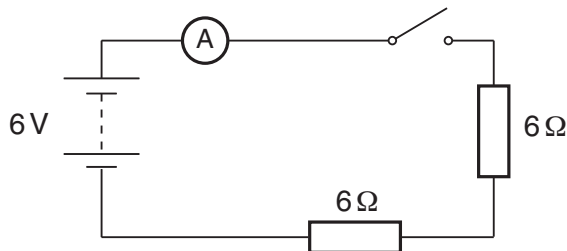
Choose numbers from the list.

0 0.5 1 2

| state of the switch | ammeter reading in amps |
|---------------------|-------------------------|
| open | |
| closed | |

[1]

(c) The two resistors are now connected in series with the switch.



Explain why the current in each resistor is 0.5 A when the switch is closed.

Show a calculation in your answer.

.....

.....

.....

.....

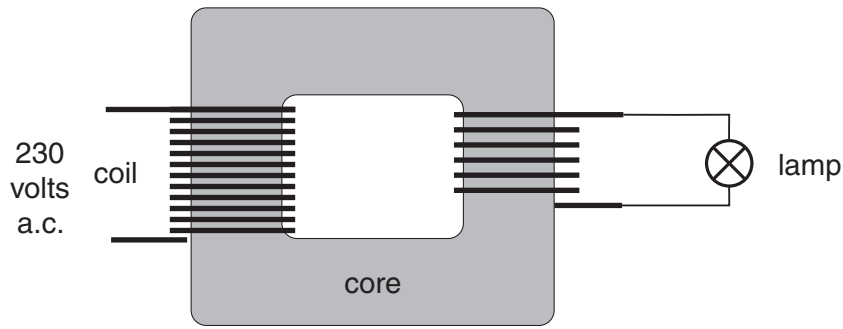
.....

..... [2]

[Total: 5]

Turn over

5 This transformer has two coils wound on a core.



The left-hand coil of the transformer is connected to the 230 V a.c. mains supply.

(a) Explain why there is an a.c. voltage across the right-hand coil.

.....

.....

.....

..... [3]

(b) The left-hand coil has 180 turns and the right-hand coil has 90 turns.

What is the voltage across the lamp?

Put a (ring) around the correct answer.

- 90 V 115 V 230 V 460 V [1]

(c) The lamp has a power of 0.1 kW.

It is left on for a week.

How much electrical energy does it use?

Put a (ring) around the correct answer.

- 0.7 kWh 2.4 kWh 8.4 kWh 16.8 kWh [1]

[Total: 5]

6 Harry takes a cutting of a plant.

He wants to know what happens to the cutting as it grows into a plant.



(a) Explain how a new plant grows from a cutting.

Your explanation should include these terms:

clone
hormone
xylem cells
unspecialised cells

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

(b) Harry's new plant shows a positive phototropic response.

How does this increase the plant's chance of survival?

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

[Total: 4]

7 The cell cycle is made up of **cell growth** and **mitosis**.

During mitosis a number of processes take place.

(a) Put ticks (✓) in the boxes next to the **two** processes that occur only during mitosis.

- | | | |
|---------------------------------|--------------------------|-----|
| cells divide | <input type="checkbox"/> | |
| chromosomes are copied | <input type="checkbox"/> | |
| number of organelles increases | <input type="checkbox"/> | |
| number of nuclei stays the same | <input type="checkbox"/> | |
| copies of chromosomes separate | <input type="checkbox"/> | [2] |

(b) Another type of cell division is meiosis.

(i) What **type** of cell is formed by meiosis?

..... [1]

(ii) The cells made in meiosis may not all be the same size.

If one of the new cells is larger than another, what can you say about the number of chromosomes in each?

Put a tick (✓) in the box next to the correct statement.

- | | | |
|----------------------------------------------|--------------------------|-----|
| The larger cell has more chromosomes. | <input type="checkbox"/> | |
| The smaller cell has more chromosomes. | <input type="checkbox"/> | |
| They have the same number of chromosomes. | <input type="checkbox"/> | |
| The first cell to form has more chromosomes. | <input type="checkbox"/> | [1] |

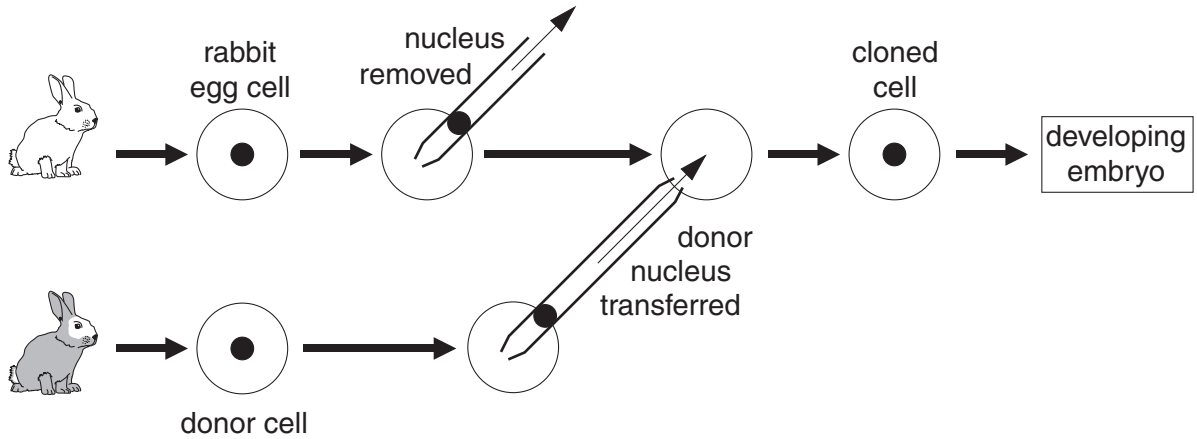
(c) Animal cells can now be made by cloning.

Paul is a scientist working in a laboratory cloning rabbits.

He removes the nucleus from an egg cell of one rabbit.

He then inserts a nucleus from a donor cell taken from another rabbit.

An embryo then develops.



(i) Which statement best describes what is happening to the genes from the **donor** cell in this process?

Put a tick (✓) in the box next to the correct answer.

- All genes are activated.
- All genes are inactivated.
- All active genes are inactivated.
- Some inactive genes are reactivated.

[1]

(ii) In the early stages of embryo growth, only stem cells are present.

How do these cells differ from normal body cells?

Put a tick (✓) in the box next to the correct answer.

- Stem cells have twice the usual number of chromosomes.
- Stem cells are specialised.
- Stem cells are unspecialised.
- Stem cells have half the usual number of chromosomes.

[1]

[Total: 6]

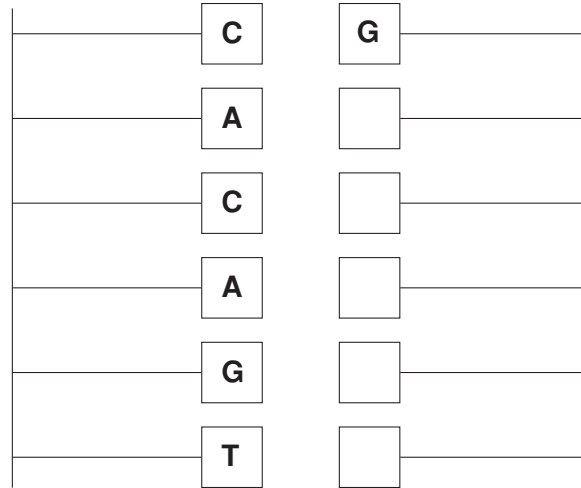
Turn over

8 A length of DNA is made up of two strands.

(a) Some of the bases on the strands are shown.

Complete the diagram to show the pairing of the bases.

The first pair has been done for you.



[1]

(b) Why is the **pairing** of the bases significant?

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

to make all DNA molecules different

to hold the strands of DNA together

to allow exact copies of DNA to be made

to allow proteins to join DNA in chromosomes

to allow each base pair to code for a different amino acid

[1]

- (c) DNA contains the genetic code to make proteins.

DNA molecules stay in one place, so a copy of the gene carries the information to where the protein is actually made.

There are several stages in the process of making protein.

Select the four correct statements from the list and place them in the correct order. One has been done for you.

- A A copy of the gene moves from the nucleus to the cytoplasm.
- B Fatty acid molecules join together.
- C A copy of the gene moves from the cytoplasm to the nucleus.
- D A copy of the information in the DNA base sequence is made.
- E Amino acid molecules join together.
- F The order of these determines the protein structure.

| | | | |
|--|--|--|---|
| | | | F |
|--|--|--|---|

[2]

[Total: 4]

END OF QUESTION PAPER

18
BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE

PLEASE DO NOT WRITE ON THIS PAGE



Copyright Information

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations, is given to all schools that receive assessment material and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1GE.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

