

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

A216/01

Unit 2: Modules B5 C5 P5 (Foundation Tier)

**Wednesday 27 January 2010
Afternoon**

Duration: 40 minutes

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)



Candidate Forename		Candidate Surname	
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Centre Number						Candidate Number				
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MODIFIED LANGUAGE

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, however additional paper may be used if necessary.

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 **16** pages. Any blank pages are indicated.

TWENTY FIRST CENTURY SCIENCE EQUATIONS

Useful Relationships

Explaining Motion

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

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

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

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

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

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

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

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

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

2 We use millions of tonnes of iron every year.

It is used to make an enormous number of things such as girders, chains and bridges.



(a) Iron is important because it is comparatively cheap and its properties are useful.

Draw straight lines to link each **property** to **why it is useful**.

You should draw four lines.

property

good electrical conductor

high melting point

malleable

strong

why it is useful

can be used to make roof supports

can be hammered into different shapes

can be used to make lightning conductors

can be used to make barbecues

can be used to make magnets

[3]

(b) Iron is extracted from iron ore.

Iron ore contains iron oxide.

There are different types of iron oxide.

Which of these formulae corresponds to the oxide with the highest **proportion** of iron atoms?

Put a **ring** around the correct answer.

FeO

Fe₂O₃

Fe₃O₄

[1]

(c) To get iron, machines dig iron ore out of the ground.

What is iron ore made of?

A the pure element

B the element mixed with other minerals

C a pure iron compound

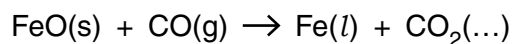
D an iron compound mixed with other minerals

answer [1]

(d) Iron can be extracted from iron oxide by heating it in a blast furnace.

(i) A blast furnace produces melted iron and carbon dioxide.

The equation for one reaction in the blast furnace is



Carbon dioxide is a gas.

Write the state symbol, **s**, **l**, or **g**, in the bracket after the carbon dioxide.

[1]

(ii) Carbon cannot extract some metals from their oxides.

Give a reason why.

.....

.....

..... [1]

(iii) Put a **ring** around the metal that cannot be extracted from its oxide using carbon.

iron

copper

aluminium

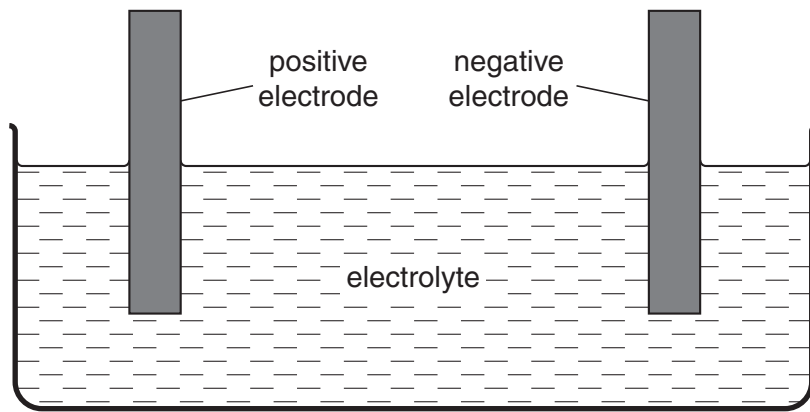
zinc

[1]

[Total: 8]

Turn over

3 Some metals are extracted using electrolysis in apparatus like this.



Electrolysis only works for liquids that contain ions.

Use your understanding of ions to explain how electricity can flow through a liquid. State where the metal will appear.

.....

.....

.....

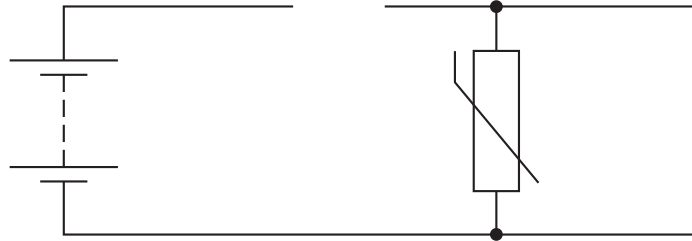
..... [3]

[Total: 3]

- 4 A student investigates the effect of temperature change on a thermistor.

The circuit diagram shows a battery and a thermistor.

The circuit diagram is not finished.



- (a) A voltmeter and ammeter are missing from the diagram.

Draw them in the correct places. Use the correct circuit symbols.

[2]

- (b) Complete the sentence. Choose words from this list.

decreases

increases

stays the same

When the temperature of the thermistor is **increased**

the resistance of the thermistor

and the reading of the ammeter

[1]

- (c) Put a **ring** around the words that correctly complete the sentence.

The ammeter measures the flow of **charge** / **power** in the thermistor

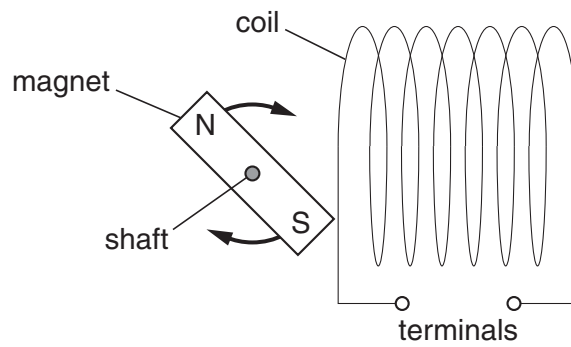
in units of **amperes** / **joules** / **volts**.

[1]

[Total: 4]

5 The diagram shows a magnet close to a coil of wire.

The magnet can spin on the shaft so that it moves in and out of the coil.



(a) What is the name of this arrangement?

Put a **(ring)** around the answer.

electromagnet

generator

transformer

[1]

(b) A voltage appears across the terminals of the coil when the magnet spins on the shaft.

Describe **two** things that you could do to increase the voltage.

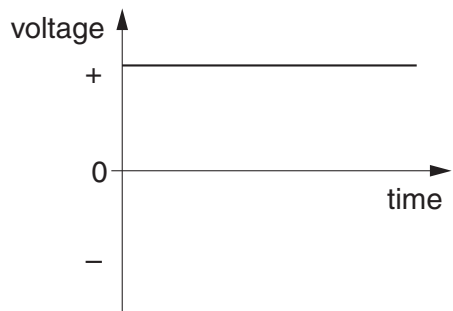
.....

.....

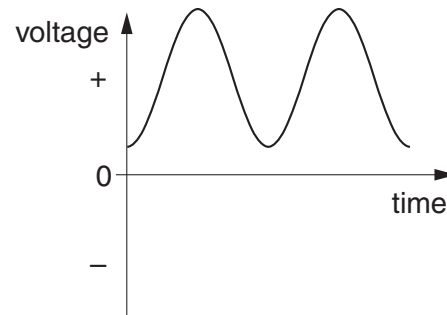
..... [2]

(c) The magnet spins round.

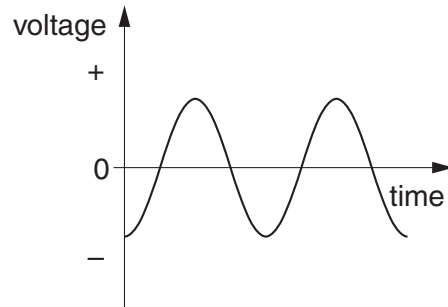
Which of these voltage-time graphs, **A**, **B** or **C**, is correct for the coil?



A



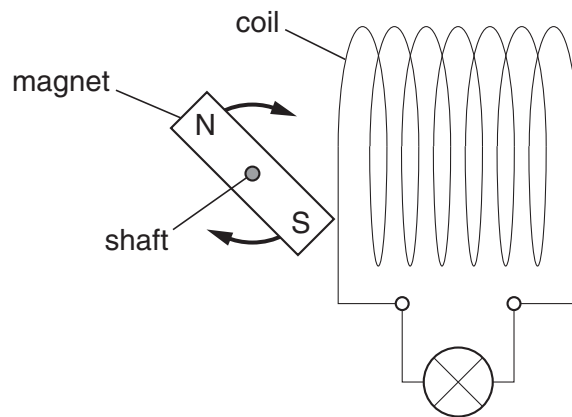
B



C

answer [1]

(d) A lamp is connected to the terminals of the coil.



What effect does this have on the coil of wire?

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

There is now a current in the coil.

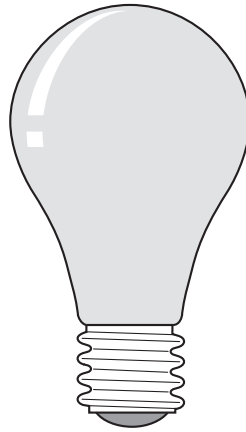
There is no voltage across the coil.

There is no magnetic field in the coil.

[1]

[Total: 5]

6 A mains lamp connected to a 230V supply has a current of 0.5 A.



(a) Calculate the power of the lamp.

power = W [1]

(b) Draw straight lines to join each **electrical quantity** with its correct **description**.

electrical quantity	description
power	the push on the electrons in the lamp
voltage	the rate of energy transfer to the lamp
current	the amount of charge moving through the lamp every second

[2]

(c) Another lamp is left on for 10 hours. Its power is 0.12 kW. How much energy is transferred to the lamp?

energy transferred = kWh [1]

(d) A domestic electricity meter measures energy transfer in units of kilowatt-hours instead of joules.

Which person has the **best** reason for this?

Alan
The joule is a very small unit of energy.

Bess
A kilowatt is a hundred watts.

Carlos
The joule is not a unit of energy transfer.

Davina
Few appliances stay switched on for more than an hour.

answer [1]

[Total: 5]

7 (a) Cells can divide by mitosis or by meiosis.

Here are some statements about cell division.

Put a tick (✓) in the correct box for each statement.

Meiosis produces cells with the same number of chromosomes as the parent cell.

Meiosis is used in sexual reproduction to produce gametes (sex cells).

Mitosis produces cells that are identical to the parent cell.

Mitosis produces cells that have different numbers of chromosomes.

true	false

[2]

(b) (i) Neil and Julie want to have children.

One of Neil's sperm fertilises one of Julie's eggs.

This makes a zygote.

The sentences explain how the cells develop after fertilisation.

Complete the sentences. Use words from this list.

body cell embryo egg fusion meiosis mitosis implant

Each sperm and egg cell has half the number of chromosomes of a

A zygote divides by

This forms an

[3]

(ii) After the zygote divides a number of times, the cells start to specialise.

At what stage does this happen?

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

- after the two cell stage
- after the four cell stage
- after the eight cell stage
- after the sixteen cell stage

[1]

**[Total: 6]
Turn over**

8 (a) All cells in a plant originate from the same cell.

Leaf cells contain chlorophyll, but root cells do not.

Explain why leaf and root cells in the same plant can develop differently.

Use ideas about genes in your answer.

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

(b) New plants can be made by taking cuttings.

Andrew takes a cutting of a plant stem.

There are no roots on the cutting.

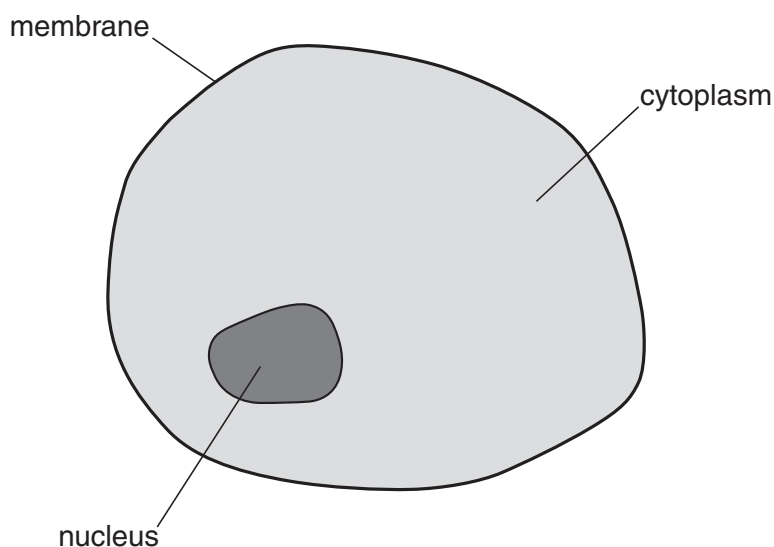
State

- how to make a cutting produce roots
- which cells of the cutting develop into roots.

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

[Total: 4]

9 This is a diagram of an animal cell.



(a) Where in the cell is the genetic code stored?

..... [1]

(b) Where in the cell are proteins produced?

..... [1]

(c) Put a **ring** around the correct word to complete these sentences.

The structure of DNA is a **single** / **double** / **triple** helix.

The DNA molecule is made up of **two** / **four** / **eight** strands.

The DNA molecule contains up to **two** / **three** / **four** different bases.

[2]

[Total: 4]

END OF QUESTION PAPER

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The Periodic Table of the Elements

1 2 3 4 5 6 7 0

7 Li lithium 3	9 Be beryllium 4	11 Na sodium 11	12 C carbon 6	13 Al aluminium 13	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	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	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	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	[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					

1 H hydrogen 1

relative atomic mass atomic symbol name atomic (proton) number

Key

* 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.