

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

**A216/01**

Unit 2: Modules B5 C5 P5 (Foundation 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 24 January 2011  
Afternoon**

**Duration: 40 minutes**



Candidate forename		Candidate surname	
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Centre number						Candidate number				
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**MODIFIED LANGUAGE**

**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. Pencil may be used for graphs and diagrams only.
- 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).
- Answer **all** the questions.
- 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.
- 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

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

Answer **all** the questions.

1 Air is a mixture of different gases.

Each year we extract thousands of tonnes of gases from the air.

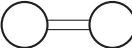


Many of these gases are very useful.

(a) Draw a straight line from the **name** of each gas to its **formula**.

name	formula
argon	H <sub>2</sub> O
carbon dioxide	Ar
oxygen	CO <sub>2</sub>
water vapour	O <sub>2</sub>

[2]

(b) Draw a straight line from the **formula** of each gas to its **structure**.

formula	structure
Ar	
CO <sub>2</sub>	
O <sub>2</sub>	

[2]

(c) Oxygen is a gas at room temperature.

What does this tell you about

- the size of the molecules
- the forces between the molecules?

.....

.....

..... [2]

[Total: 6]

Turn over

2 We have extracted iron since the Iron Age.

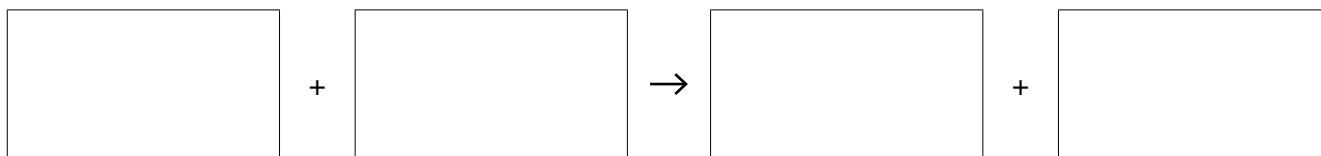
We still use the same method.

We extract the iron by heating iron oxide with carbon in a furnace.

Different reactions take place in the furnace.

In one reaction, carbon takes the oxygen away from iron oxide.

(a) Fill in the boxes to write a word equation for this reaction.



[2]

(b) Use words from this list to complete the sentences below.

**combined      electrolysed      melted      oxidised      precipitated      reduced**

When carbon gains oxygen we say that the carbon has been .....

When a metal oxide loses oxygen we say that the metal has been .....

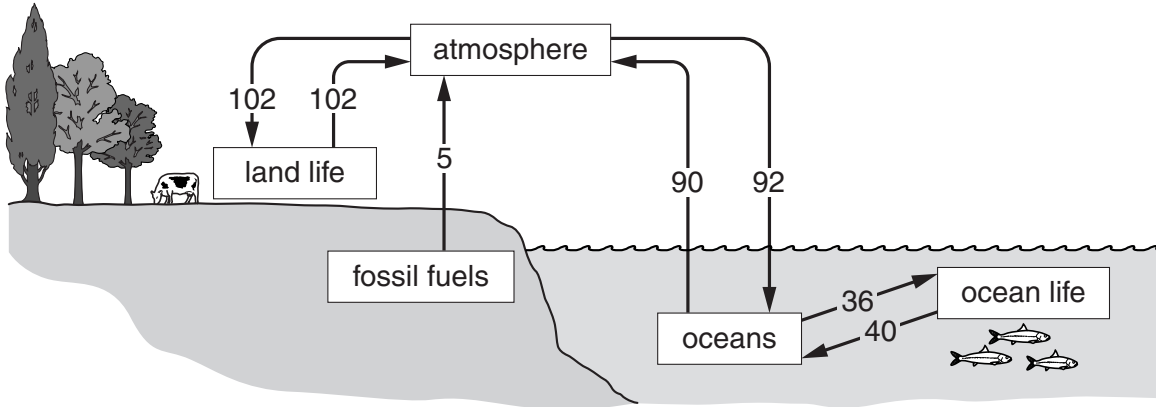
[1]

[Total: 3]

3 Scientists are worried about the increasing amounts of carbon in our atmosphere.

Look at the diagram of the carbon cycle.

The numbers show how many gigatonnes of carbon move in each direction every year.



(a) Put a **ring** around the **best** term to complete these sentences.

Carbon enters the atmosphere when fossil fuels are **burned** / **discovered** / **sold**.

Most carbon in the atmosphere is in the form of **carbon dioxide** / **ozone** / **soot**.  
[2]

(b) The amount of carbon in the atmosphere is increasing.

By how many gigatonnes does it increase every year?

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

- 2            3            5            90            102

[1]

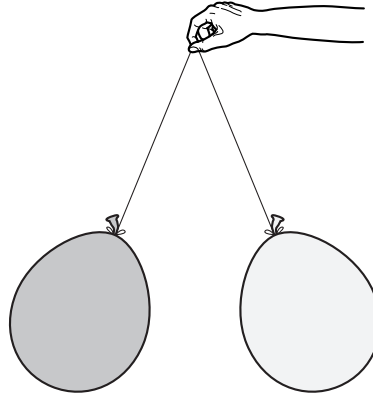
(c) Land life does not change the overall amount of carbon in the atmosphere.

Explain how you can tell this from the diagram.

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

[Total: 5]

- 4 Zara does an experiment with a pair of balloons on strings.  
She rubs each balloon against her clothing.  
Zara then holds the balloons up by their strings.

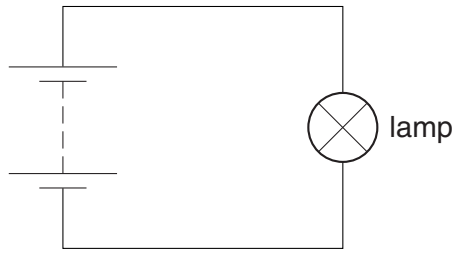


Explain why the balloons do not touch each other.

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

[Total: 3]

5 Charles puts this circuit together.



(a) There is not enough current in the circuit to make the lamp glow brightly.

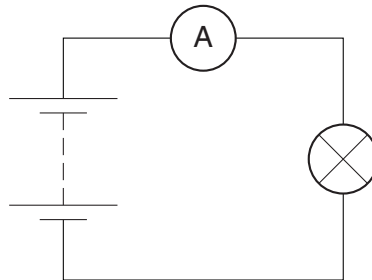
How can Charles make the lamp glow more brightly?

Put a tick (✓) in the box next to the change that **increases** the current.

- |                                      |                          |
|--------------------------------------|--------------------------|
| Put a switch after the lamp.         | <input type="checkbox"/> |
| Use longer connecting wires.         | <input type="checkbox"/> |
| Put a resistor before the lamp.      | <input type="checkbox"/> |
| Increase the voltage of the battery. | <input type="checkbox"/> |

[1]

(b) Charles adds an ammeter to measure the current in the lamp.



Complete each sentence by putting a **ring** around the correct option.

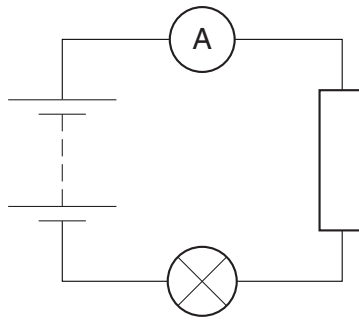
The ammeter reads 0.69 **amps** / **volts** / **watts**.

The current in the lamp is caused by a flow of **atoms** / **electrons** / **water**.

The lamp glows because its filament **cools down** / **heats up** / **reacts**. [2]

[Total: 3]

6 Fleur puts this circuit together.



(a) The resistor, ammeter and lamp are in series.

All three components have the same current.

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

More charge flows into a component than flows out of it.

Less charge flows into a component than flows out of it.

All parts of the circuit contain charges that are free to move.

Only the connecting wires contain charges that are free to move.

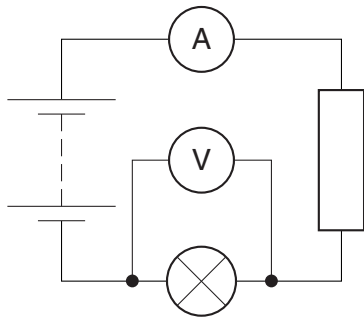
The same amount of charge flows into a component as flows out of it.

[2]

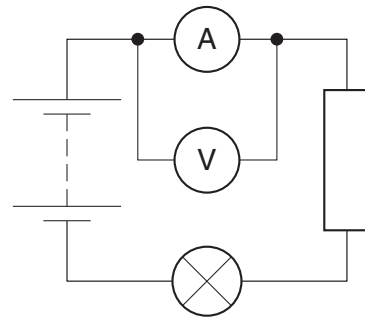


(b) Fleur wants to add a voltmeter to measure the potential difference across the resistor.

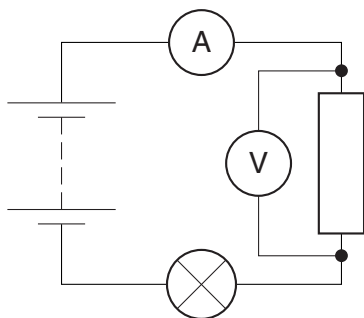
(i) Here are four ways of connecting the voltmeter.



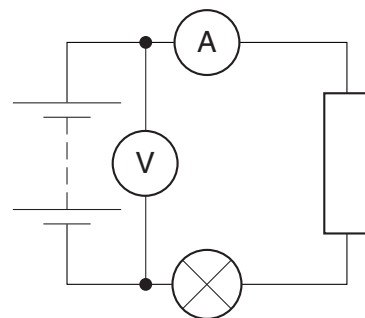
circuit A



circuit B



circuit C

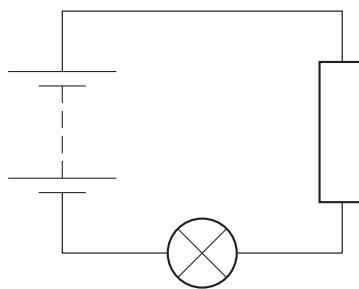


circuit D

Which circuit, **A**, **B**, **C** or **D**, shows the correct way of measuring the potential difference across the resistor?

answer ..... [1]

(ii) Fleur finds that the potential difference across the resistor in the circuit below is 6V.



The potential difference across the battery is 9V.

What is the potential difference across the lamp?

Put a ring around the correct answer.

- 3V      6V      9V      15V

[1]

[Total: 4]

Turn over

7 Mains electricity is produced by generators in power stations.



Each generator contains a magnet and a coil of wire.

(a) Describe how the magnet and the coil of wire are used to make electricity.

Include the name of the process.

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

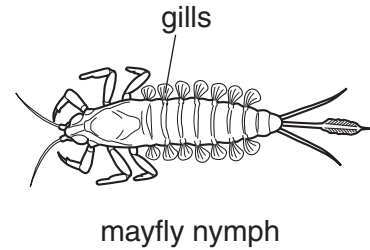
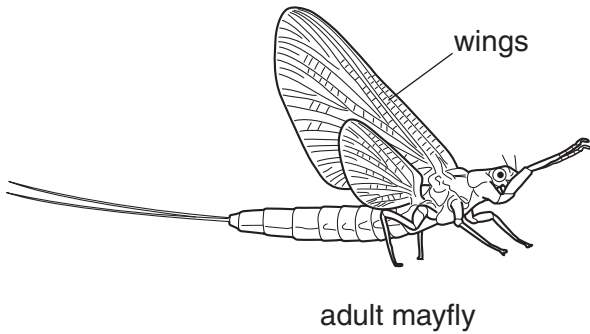
(b) State **two** ways of increasing the voltage of the electricity produced by a generator.

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

[Total: 4]

8 Martin is studying mayflies.

He looks at an adult mayfly and a mayfly nymph.



(a) The adult mayfly lays eggs in the water.

The eggs hatch into nymphs.

The nymphs grow bigger by producing more cells.

Which type of cell division is responsible for the nymphs growing bigger?

..... [1]

(b) (i) Mayfly cells contain genes.

In which part of the cell are the genes?

Put a (ring) around the correct answer.

**cell membrane      cytoplasm      nucleus** [1]

(ii) Genes carry the instructions for making a particular type of molecule.

Which type of molecule?

Put a (ring) around the correct answer.

**carbohydrates      fats      minerals      proteins** [1]

(c) The adult mayfly has wings but no gills, while the mayfly nymph has gills but no wings.

The adult mayfly and the mayfly nymph both have the same genes.

They both have the same genes, but only the adult has wings and only the nymph has gills. Explain how this can happen.

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

[Total: 6]  
Turn over

9 Susie sees a plant she likes in a friend's garden.

She asks if she can take a cutting.

(a) Which part of her friend's plant should Susie use to grow an identical plant?

Put a ring around the correct answer.

**flower**      **fruit**      **seed**      **stem**

[1]

(b) Susie dips the bottom of her cutting in some rooting powder.

She then puts the cutting into a pot of soil.

What does the rooting powder contain that helps the cutting grow roots?

..... [1]

(c) Susie's cutting grows into a new plant.

Which statements explain how this is possible?

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

Some unspecialised cells develop into other tissues.

Some unspecialised cells develop into organs.

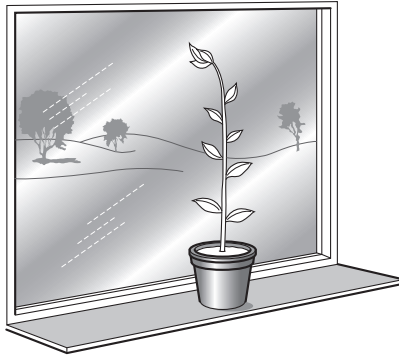
Some xylem cells become phloem cells.

Some plant cells become unspecialised.

Some leaf cells become root cells.

[2]

- (d) Susie leaves her new plant next to a window.



The plant stem grows towards the light.

- (i) What is the name for growth towards the light?

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

**photography**

**photosynthesis**

**phototropism**

[1]

- (ii) How does this response help the plant?

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

the plant gets more carbon dioxide

the plant gets more oxygen

the plant gets more water

the plant gets more light

[1]

[Total: 6]

10 DNA is the molecule that carries genetic information.

(a) What shape is a DNA molecule?

Put a ring around the correct answer.

**single helix**

**double helix**

**triple helix**

[1]

(b) Here are some statements about DNA.

Use numbers from the list to complete the statements.

- 1      2      3      4      5

DNA is made up of ..... strand(s).

DNA is made up of ..... different bases.

[1]

[Total: 2]

**END OF QUESTION PAPER**

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# The Periodic Table of the Elements

1	2						3	4	5	6	7	0										
7 <b>Li</b> lithium 3	9 <b>Be</b> beryllium 4						11 <b>B</b> boron 5	12 <b>C</b> carbon 6	14 <b>N</b> nitrogen 7	16 <b>O</b> oxygen 8	19 <b>F</b> fluorine 9	4 <b>He</b> helium 2										
23 <b>Na</b> sodium 11	24 <b>Mg</b> magnesium 12						27 <b>Al</b> aluminium 13	28 <b>Si</b> silicon 14	31 <b>P</b> phosphorus 15	32 <b>S</b> sulfur 16	35.5 <b>Cl</b> chlorine 17	40 <b>Ar</b> argon 18										
39 <b>K</b> potassium 19	40 <b>Ca</b> calcium 20						45 <b>Sc</b> scandium 21	48 <b>Ti</b> titanium 22	51 <b>V</b> vanadium 23	52 <b>Cr</b> chromium 24	55 <b>Mn</b> manganese 25	56 <b>Fe</b> iron 26	59 <b>Co</b> cobalt 27	59 <b>Ni</b> nickel 28	63.5 <b>Cu</b> copper 29	65 <b>Zn</b> zinc 30	70 <b>Ga</b> gallium 31	73 <b>Ge</b> germanium 32	75 <b>As</b> arsenic 33	79 <b>Se</b> selenium 34	80 <b>Br</b> bromine 35	84 <b>Kr</b> krypton 36
85 <b>Rb</b> rubidium 37	88 <b>Sr</b> strontium 38						89 <b>Y</b> yttrium 39	91 <b>Zr</b> zirconium 40	93 <b>Nb</b> niobium 41	96 <b>Mo</b> molybdenum 42	[98] <b>Tc</b> technetium 43	101 <b>Ru</b> ruthenium 44	103 <b>Rh</b> rhodium 45	106 <b>Pd</b> palladium 46	108 <b>Ag</b> silver 47	112 <b>Cd</b> cadmium 48	115 <b>In</b> indium 49	119 <b>Sn</b> tin 50	122 <b>Sb</b> antimony 51	127 <b>I</b> iodine 53	131 <b>Xe</b> xenon 54	
133 <b>Cs</b> caesium 55	137 <b>Ba</b> barium 56						139 <b>La*</b> lanthanum 57	178 <b>Hf</b> hafnium 72	181 <b>Ta</b> tantalum 73	184 <b>W</b> tungsten 74	186 <b>Re</b> rhenium 75	190 <b>Os</b> osmium 76	192 <b>Ir</b> iridium 77	195 <b>Pt</b> platinum 78	197 <b>Au</b> gold 79	201 <b>Hg</b> mercury 80	204 <b>Tl</b> thallium 81	207 <b>Pb</b> lead 82	209 <b>Bi</b> bismuth 83	[209] <b>Po</b> polonium 84	[210] <b>At</b> astatine 85	[222] <b>Rn</b> radon 86
[223] <b>Fr</b> francium 87	[226] <b>Ra</b> radium 88						[227] <b>Ac*</b> actinium 89	[261] <b>Rf</b> rutherfordium 104	[262] <b>Db</b> dubnium 105	[266] <b>Sg</b> seaborgium 106	[264] <b>Bh</b> bohrium 107	[277] <b>Hs</b> hassium 108	[268] <b>Mt</b> meitnerium 109	[271] <b>Ds</b> darmstadtium 110	[272] <b>Rg</b> 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.