OCR
RECOGNISING ACHIEVEMENT

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GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE ADDITIONAL SCIENCE A

A216/02

Unit 2: Modules B5 C5 P5 (Higher Tier)

OCE/25635

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

A216/02

Candidate forename		Candidate surname	

Centre number						Candidate number				

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 **20** pages. Any blank pages are indicated.

DC (SHW 00562 12/09) 25635/4

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) We extract each gas by cooling the air until the gas turns into a liquid.

Different gases turn into liquids at different temperatures.

Here is some information about the gases.

gas	melting point in K	boiling point in K
argon	84	87
nitrogen	63	77
oxygen	55	90
water vapour	273	373

Which gas turns from a gas into a liquid at the **lowest** temperature?

answer ..... **[1]**

(b) Oxygen is made of molecules.

Liquid oxygen turns into a gas at extremely low temperatures.

Explain why.

Use your understanding of forces and molecules in your answer.

.....

.....

.....

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

[Total: 4]

2 We have extracted iron since the Iron Age.

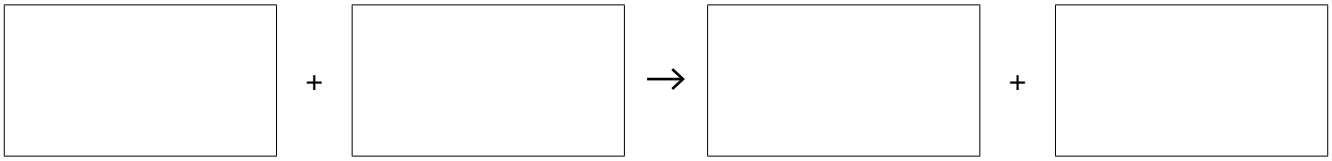
We still use the same method.

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

Different reactions take place in the furnace.

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

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



[2]

(ii) 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]

(iii) Another reaction for making iron is between iron oxide and carbon monoxide gas.

Put numbers in the boxes to balance the equation for this reaction.

$$Fe_2O_3 + \square\ CO \rightarrow \square\ Fe + 3CO_2$$

[2]

(b) Not all metals are extracted by heating their ores with carbon.

Some metals are extracted by electrolysis.

metal	extracted by	melting point of the metal in K
lead	heating with carbon	601
magnesium	electrolysis	922
aluminium	electrolysis	933
calcium	electrolysis	1112
cobalt	heating with carbon	1768
iron	heating with carbon	1808

Use the table to decide which three metals are likely to be more reactive than the others.

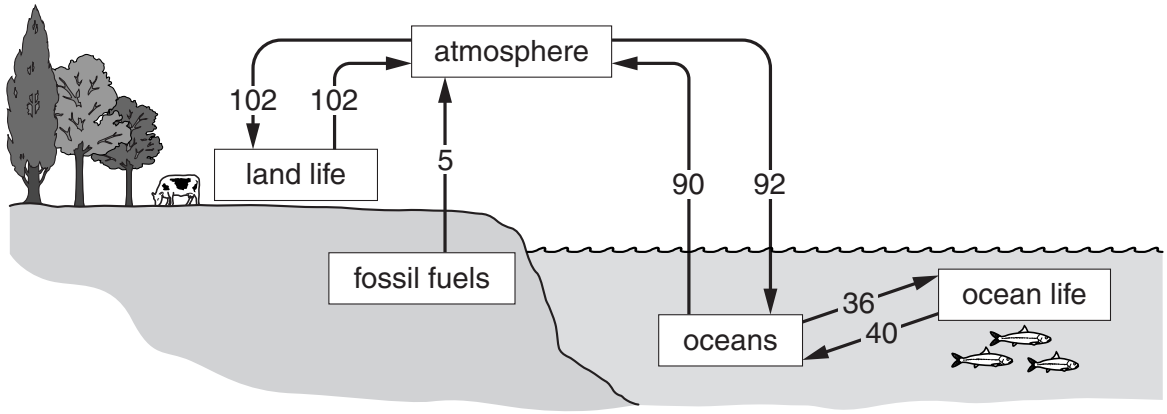
answer ..... and ..... and ..... **[1]**

[Total: 6]

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) 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]**

(b) Most of the carbon in the atmosphere is in the form of carbon dioxide.

The diagram shows that 92 gigatonnes of carbon dissolve in the oceans every year.

How many gigatonnes of carbon dioxide does this represent?

Put a (ring) around the answer.

$\frac{12}{44} \times 92$ $\frac{12}{32} \times 92$ $\frac{32}{12} \times 92$ $\frac{44}{12} \times 92$ **[1]**

(c) Carbon dioxide dissolves in seawater.

Carbon dioxide in solution reacts with water to form ions.

(i) Put **state symbols** in the boxes to complete the equation for this reaction.

$$CO_2(aq) + H_2O \square \rightarrow H^+ \square + HCO_3^- \square$$ **[1]**

(ii) Mary wants to see if sea water really is an ionic solution.

What could she measure to show that it contains ions?

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

[Total: 4]

4 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 that you could increase the voltage of the electricity produced by a generator.

.....

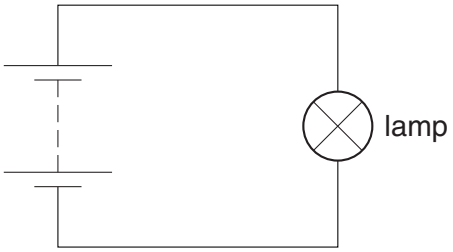
.....

.....

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

[Total: 4]

5 Charles puts this circuit together.



(a) The lamp glows.

Here are some statements about the circuit.

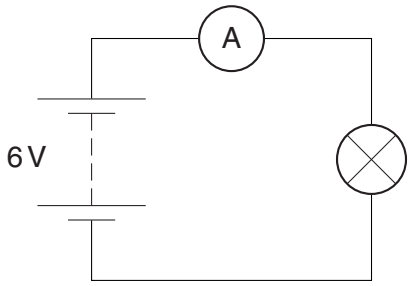
Which **two** statements, when taken together, explain why the lamp glows?

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

The wires have some resistance.	☐
The current in the lamp heats it up.	☐
The battery pushes charges through the lamp.	☐
The wires have charges that are free to move.	☐
Only the lamp has charges that are free to move.	☐

[2]

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



The lamp has a power of 3 W.

What does the ammeter read?

Put a (ring) around the correct answer.

0.5 A **2.0 A** **6.0 A** **18 A**

[1]

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

Charles adds another battery and the lamp glows brightly.

Complete the sentences. Choose words from this list.

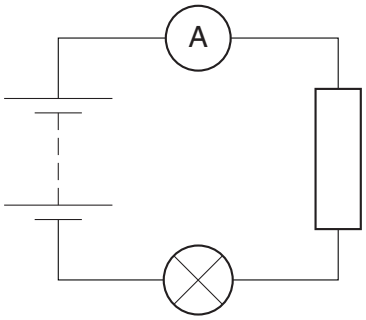
decreases **increases** **parallel** **series**

Charles adds the second battery in …… to the first one.

This …… the potential difference across the lamp. **[1]**

[Total: 4]

6 Fleur assembles this circuit.



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

Explain why all three components have exactly the same current.

.....

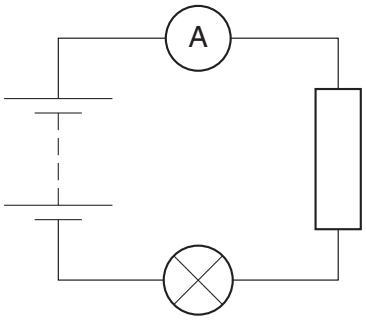
.....

.....

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

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

(i) Draw on this circuit diagram to show how Fleur should connect the voltmeter.



[1]

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

The potential difference across the battery is 9 V.

The ammeter reads 0.5 A.

What is the resistance of the **lamp**?

Put a (ring) around the correct answer.

6 Ω **12 Ω** **18 Ω** **30 Ω**

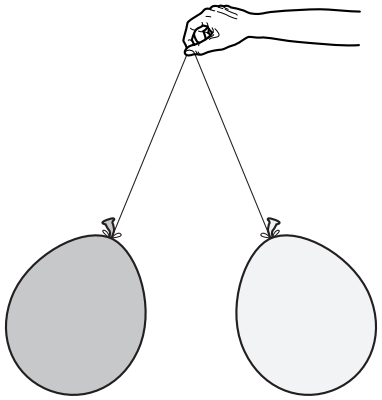
[1]

[Total: 4]

7 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.



Complete this explanation of why the balloons hang like this.

Choose the best words from the list.

atoms **attract** **different** **electrons** **identical**

shield **negative** **neutral** **positive** **protons** **repel**

The rubbing transfers some …… from each balloon to Zara's clothing so,

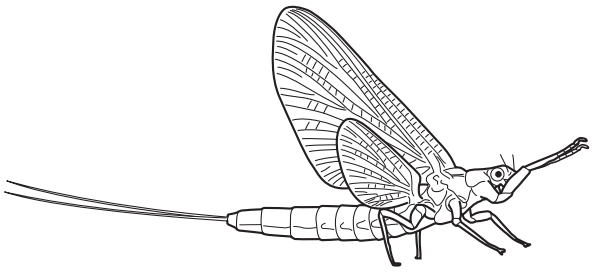
this leaves each balloon with a …… charge.

The reason the balloons …… each other is because they have …… kinds of charge. **[2]**

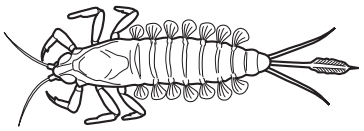
[Total: 2]

8 Martin is studying mayflies.

He looks at an adult mayfly and a mayfly nymph.



adult mayfly

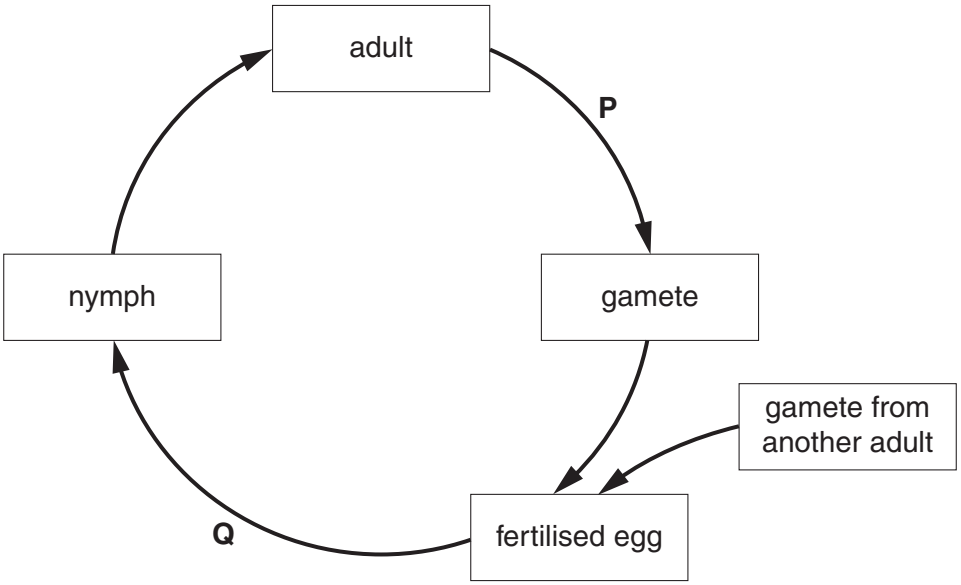


mayfly nymph

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

The eggs hatch into nymphs.

The nymphs grow bigger.



Complete the sentences.

The type of cell division at **P** is …… , which makes cells that have

…… number of chromosomes as the adult cells.

The type of cell division at **Q** is …… , which makes cells that have

…… number of chromosomes as the fertilised egg. **[2]**

(ii) The statements **A** to **D** are about processes of the cell cycle.

Put the letters **A**, **B**, **C** and **D** in the correct column of the table to show whether the processes occur during **cell growth** or **cell division**.

A the numbers of organelles increase

B copies of the chromosomes separate

C new strands of DNA form

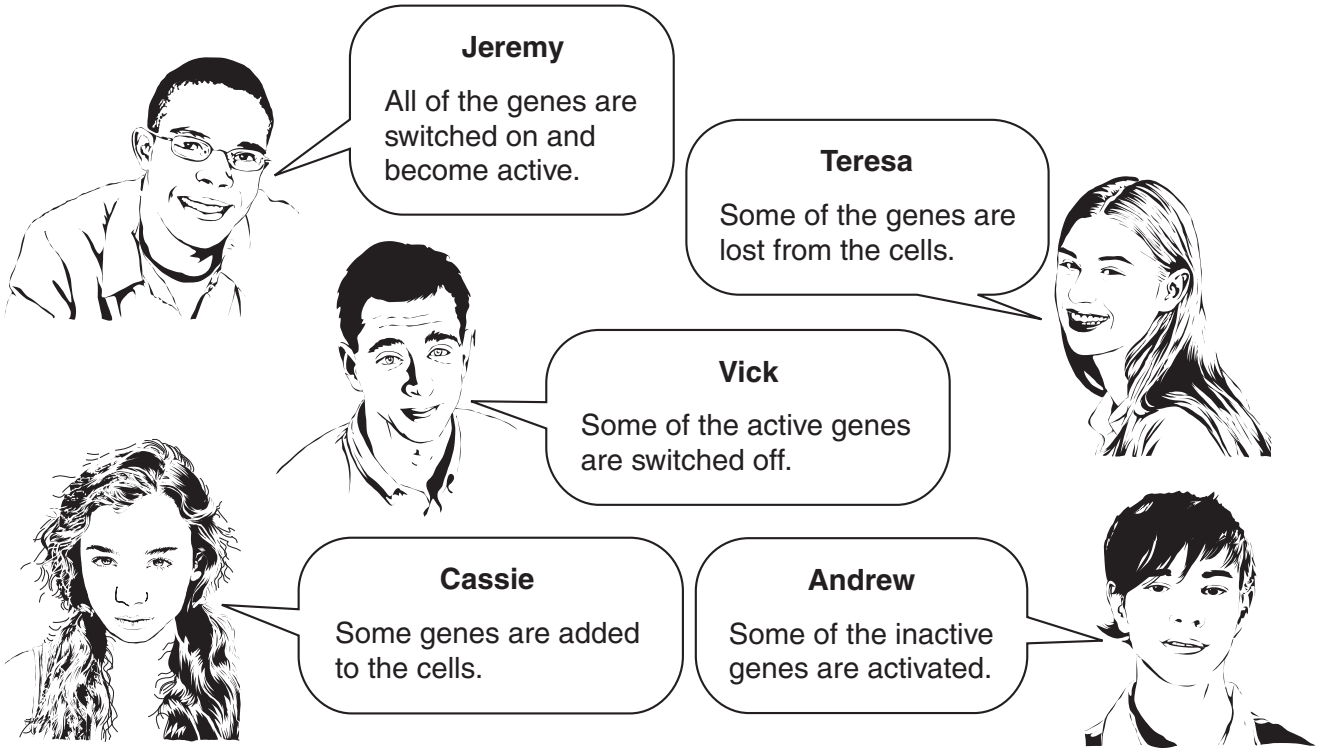
D strands of each DNA molecule separate

cell growth	cell division

[2]

(b) Once a nymph grows into an adult, it has different specialised tissues.

Five people are asked to explain this.



Which **two** people give the best explanations?

answer ..... and ..... **[1]**

[Total: 5]

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. ☐

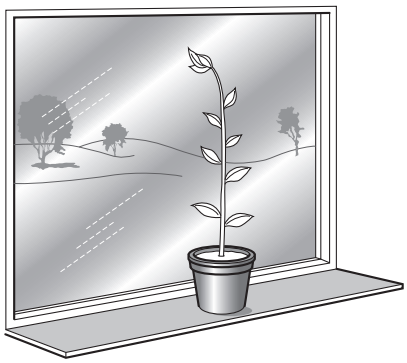
Some plant cells become unspecialised. ☐

Some leaf cells become root cells. ☐

[2]

(d) Susie keeps her new plant in a pot near a window.

The shoot grows towards the light.



Draw **one** line to join the **effect of light** on the distribution of auxin to its **effect on the cells** in the shoot.

effect of light		**effect on the cells**
more auxin on lit side		makes these cells grow more slowly
or		**or**
more auxin on shaded side		makes these cells grow more quickly

[1]

[Total: 5]

10 DNA carries genetic information.

(a) What is the name given to the shape of DNA?

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

(b) DNA in one part of the cell codes for the production of molecules in another part of the cell.

Explain how this happens.

In your answer write about

- the code in DNA
- different sites in the cell
- the type of molecule produced.

.....

.....

.....

.....

.....

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

[Total: 4]

END OF QUESTION PAPER

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The Periodic Table of the Elements

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						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** 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.