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Tuesday 31 January 2012 – Morning

GCSE TWENTY FIRST CENTURY SCIENCE ADDITIONAL SCIENCE A

A216/01 Unit 2: Modules B5 C5 P5 (Foundation Tier)

A213490112

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)

Duration: 40 minutes

A216 01

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

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

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

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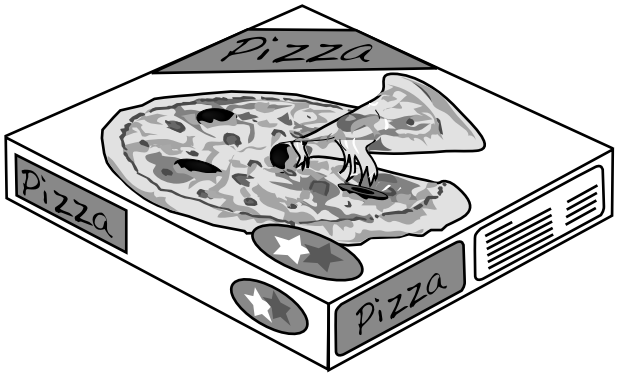
Question 1 begins on page 4

PLEASE DO NOT WRITE ON THIS PAGE

Answer **all** the questions.

1 George buys a pizza from the shop.



He looks at the food label on his pizza.

	per 100 g
energy	981 kJ
protein	9.5 g
carbohydrate	29.7 g
of which sugars	3.9 g
fat	8.5 g
of which saturates	3.9 g

(a) What is the total percentage of carbohydrate in the pizza?

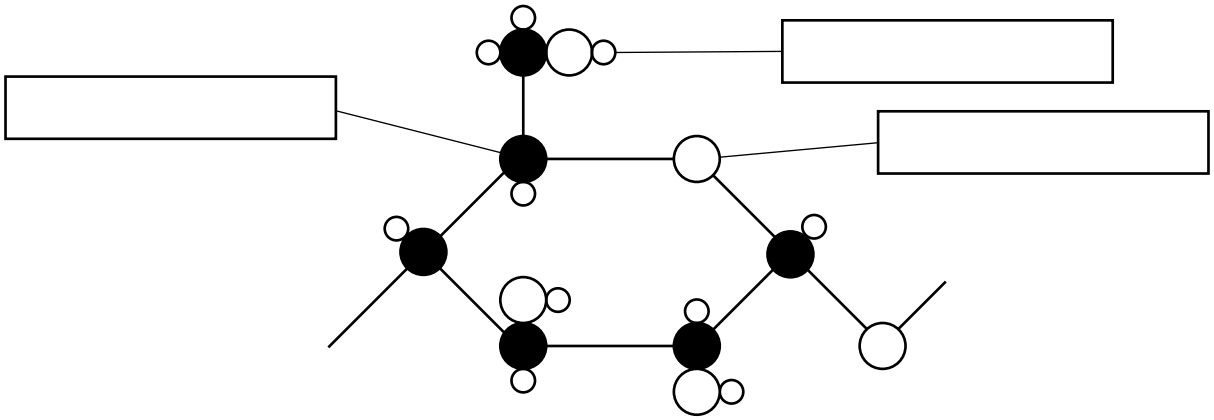
Put a (ring) around the correct answer.

2.6% **3.9%** **25.8%** **29.7%** **33.6%**

[1]

(b) The diagram shows part of a carbohydrate. The formula of this part is $C_6H_{10}O_5$.

Label the diagram with the name of each element.



[2]

[Total: 3]

2 In 2010 a volcano in Iceland erupted.

It sent clouds of sulfur dioxide gas and volcanic ash into the atmosphere.

Airports closed because planes could not fly through the ash from the volcano.

(a) The fumes from the volcano also contained argon, carbon dioxide and nitrogen.

Put ticks (✓) in the boxes next to each gas to show if it is an **element** or a **compound**.

gas	element	compound
argon		
carbon dioxide		
nitrogen		

[1]

(b) The formula of sulfur dioxide gas is SO_2.

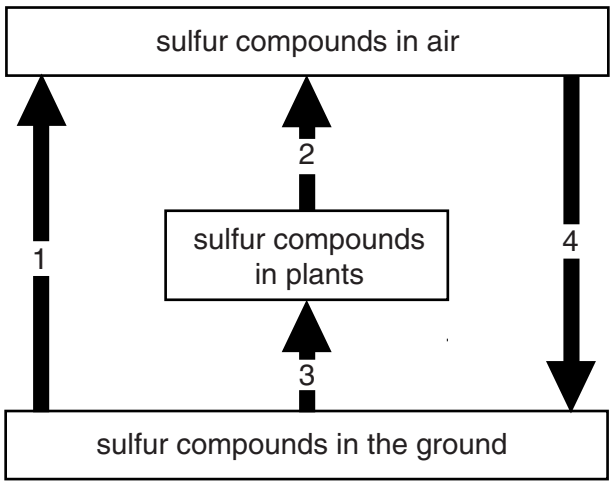
Which of the diagrams could show a sulfur dioxide molecule?

Put a (ring) around the best answer.

[1]

(c) Volcanic eruptions are not the only way that sulfur compounds get into the air.

Mary draws a diagram to show how some sulfur compounds move in and out of the air.



Put the **numbers** in the boxes to match each statement to its arrow on the diagram.

Sulfur compounds get into the air when volcanoes erupt.	
Sulfur compounds in the air form acid rain, which ends up in the ground.	
Some sulfur compounds get into the air when plants rot.	
Plants take in some sulfur compounds from the soil.	

[2]

(d) The volcanic ash also contained silicon dioxide.

Silicon dioxide has a high melting point.

Explain why silicon dioxide has a high melting point.

Use your understanding of the structure and bonding of silicon dioxide in your answer.

.....

.....

.....

.....

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

[Total: 7]

3 Aluminium is extracted by electrolysis of melted aluminium oxide.

Iron is extracted by heating iron oxide with carbon.

(a) Why is aluminium **not** extracted by heating aluminium oxide with carbon?

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

Aluminium is too reactive. ☐

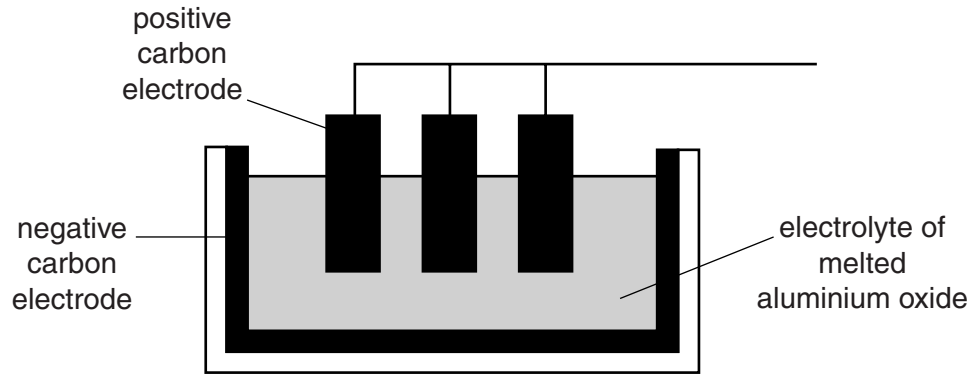
It would take too much carbon. ☐

Aluminium is not dense enough. ☐

It is less polluting to use electrolysis. ☐

[1]

(b) An electric current is passed through melted aluminium oxide.



(i) The aluminium oxide breaks down into aluminium and oxygen.

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

☐ → ☐ + ☐

[1]

(ii) Where are the aluminium and the oxygen made during electrolysis?

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

aluminium at the positive electrode, oxygen at the negative electrode	☐
aluminium at the negative electrode, oxygen at the positive electrode	☐
both at the positive electrode	☐
both at the negative electrode	☐

[1]

(iii) What do we call a reaction in which a metal oxide loses oxygen?

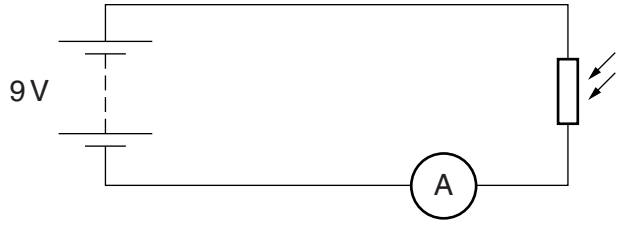
Put a (ring) around the correct answer.

electrolysis **extraction** **oxidation** **reduction**

[1]

[Total: 4]

4 Alan builds this circuit.

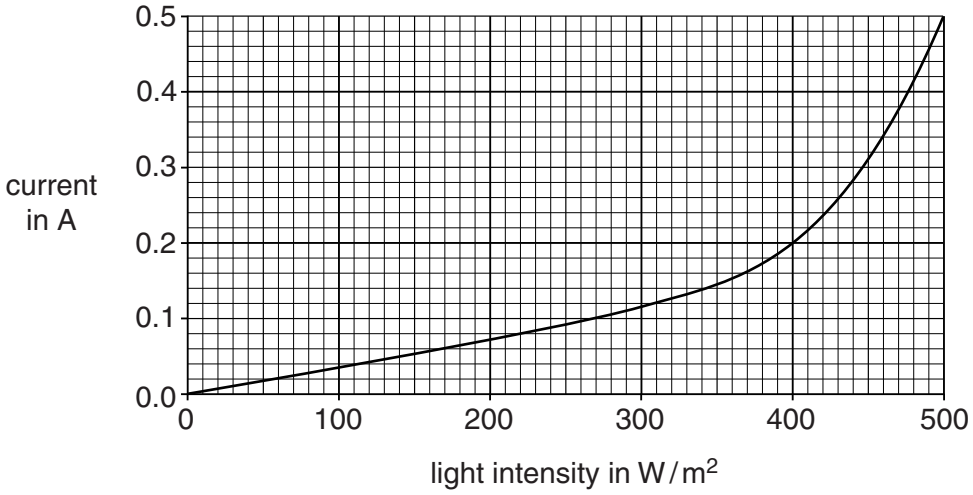


(a) Alan uses a voltmeter to check that the potential difference across the battery is 9 V.

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

(b) Alan measures the current in the LDR at different light intensities.

Here is a graph of his results.



(i) Use data from the graph to calculate the resistance of the LDR at a light intensity of 400 W / m^2. The potential difference across the LDR is 9 V.

resistance = ... Ω **[1]**

(ii) The pattern of the graph can be explained by the sentences below.

Complete the sentences. Choose words from this list.

You may use each word once, more than once, or not at all.

decreases **increases** **stays the same**

As the light intensity increases, the current ..... .

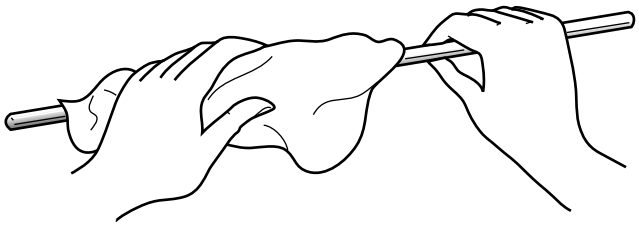
This is because the number of charges that are free to move ..... .

Therefore the resistance of the LDR ..... .

[2]

[Total: 4]

5 Sal rubs a glass rod with a silk cloth. This gives the rod a negative charge.



(a) What is transferred between the glass rod and the silk cloth when Sal rubs them together?

Put a (ring) around the correct answer.

atoms **electrons** **resistance** **voltage**

[1]

(b) The glass rod gains a negative charge. What type of charge does the silk cloth gain?

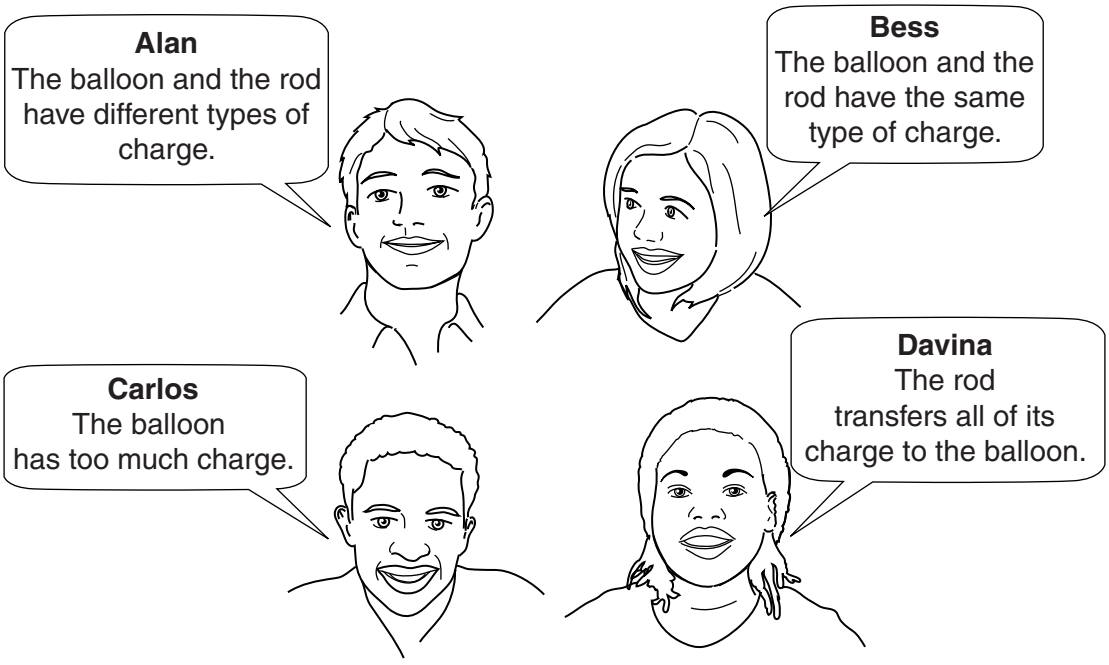
Put a (ring) around the correct answer.

magnetic **negative** **none** **positive**

[1]

(c) Sal holds the charged rod near to a balloon. The rod **repels** the balloon.

Her friends discuss why this happens.

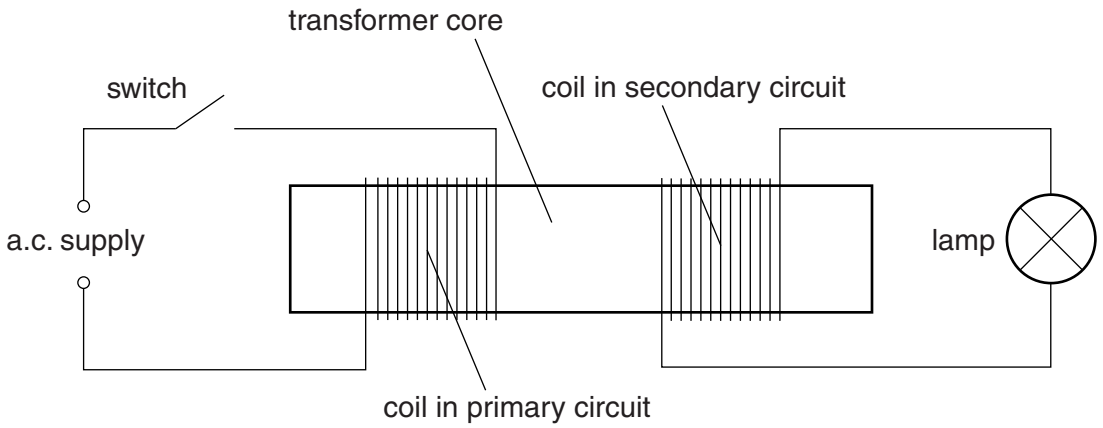


Who correctly explains why the rod repels the balloon?

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

[Total: 3]

6 Zabu builds a transformer.



(a) What is the best material to use for the core of a transformer?

Put a (ring) around the correct answer.

copper **iron** **plastic** **wood**

[1]

(b) She closes the switch in the primary circuit.

The lamp in the secondary circuit glows.

Explain why this happens.

Your answer should include what happens

- in the primary circuit
- in the transformer core
- in the secondary circuit.

.....

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.....

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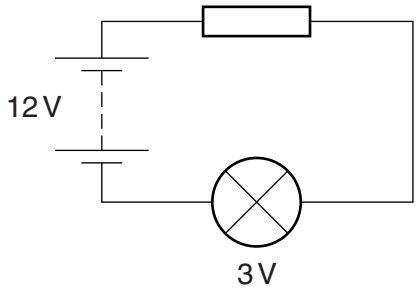
..... **[3]**

[Total: 4]

7 Celina builds this circuit.

She uses a battery, wires, a resistor and a lamp.



(a) Draw straight lines below to link each **component** to its **function**.

One line has been drawn for you.

component	function
wire	reduces electron flow
lamp	glows when electrons flow through
battery	supplies the energy for electron flow
resistor	allows electrons to flow from one component to another

[2]

(b) The potential difference across the lamp is 3 V.

The potential difference across the battery is 12 V.

What is the potential difference across the resistor?

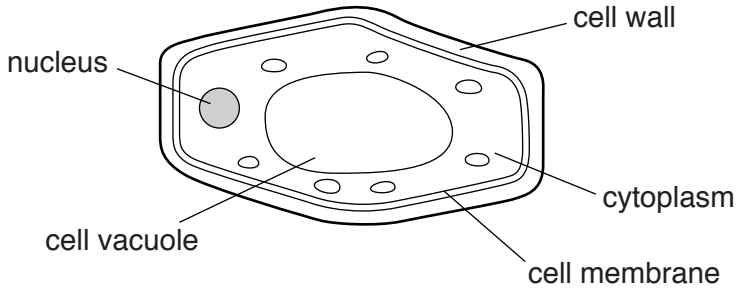
Put a (ring) around the correct answer.

3V **9V** **12V** **15V**

[1]

[Total: 3]

8 The diagram shows parts of a plant cell.



(a) The genetic code is in the DNA molecule.

DNA carries the code to make proteins.

Complete the table using labels from the diagram.

	part of cell
where DNA is found	
where proteins are produced	

[2]

(b) DNA has a number of important features.

Put a tick (✓) in the box next to the correct word to complete each sentence about DNA.

The DNA molecule is a

double	
single	
triple	

helix.

Each DNA molecule contains four different

acids.	
genes.	
bases.	

Each DNA molecule is made up of

one	
two	
three	

strands.

[2]

[Total: 4]

9 Barry works in a garden centre.

He wants to make many identical copies of a particular plant.

He takes a cutting from the plant.

How does the cutting turn into a new plant?

Use ideas about unspecialised cells in your answer.

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.....

.....

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

[Total: 3]

10 Roy is a farmer.

He breeds pigs.

The sperm from his male pig is used to fertilise a female pig.

(a) Each sperm cell from the male pig contains 19 chromosomes.

How many chromosomes are in each unfertilised egg cell of the female pig?

Put a (ring) around the correct answer.

9 **19** **36** **38** **54**

[1]

(b) Once the sperm fertilises the egg, a zygote is formed.

How many chromosomes are in the zygote nucleus?

Put a (ring) around the correct answer.

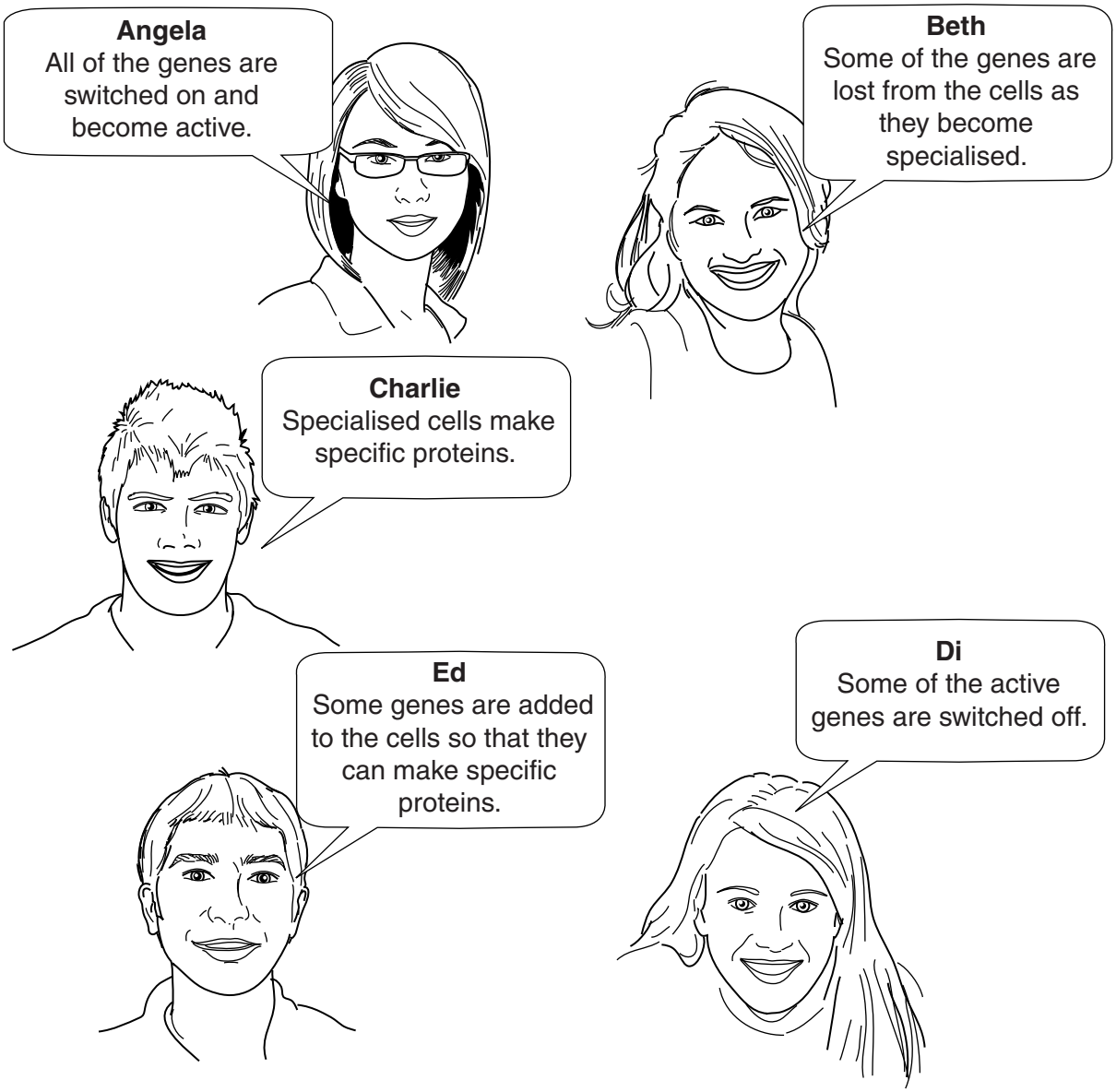
9 **19** **36** **38** **54**

[1]

(c) The zygote develops into an embryo.

As the embryo develops, the cells become specialised and form different tissues.

Five people suggest how this can happen.



Which **two** people give correct explanations?

answer ..... and ..... **[2]**

[Total: 4]

11 Cells formed by **mitosis** are different from cells formed by **meiosis**.

Write about these differences.

.....

.....

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.....

.....

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

[Total: 3]

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.