OCR
RECOGNISING ACHIEVEMENT

GENERAL CERTIFICATE OF SECONDARY EDUCATION
TWENTY FIRST CENTURY SCIENCE
ADDITIONAL SCIENCE A
Unit 2 Modules B5 C5 P5
HIGHER TIER
THURSDAY 21 JUNE 2007

H

A216/02

Afternoon
Time: 40 minutes

Calculators may be used.
Additional materials: Pencil
Ruler (cm/mm)

CUP/T43343

Candidate Name

Centre Number

Candidate Number

INSTRUCTIONS TO CANDIDATES

- Write your name, Centre Number and Candidate Number in the boxes above.
- Answer **all** the questions.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- Do **not** write in the bar code.
- Do **not** write outside the box bordering each page.
- WRITE YOUR ANSWER TO EACH QUESTION IN THE SPACE PROVIDED. ANSWERS WRITTEN ELSEWHERE WILL NOT BE MARKED.

INFORMATION FOR CANDIDATES

- The number of marks for each question is given in brackets [ ] at the end of each question or part question.
- A list of physics equations is printed on page 2.
- The Periodic Table is printed on the back page.

FOR EXAMINER'S USE		
Qu.	**Max.**	**Mark**
1	5	
2	4	
3	5	
4	4	
5	6	
6	4	
7	5	
8	4	
9	5	
TOTAL	42	

This document consists of **19** printed pages and **5** blank pages.

[Turn over

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

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

$$\frac{V_\text{p}}{V_\text{s}} = \frac{N_\text{p}}{N_\text{s}}$$

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

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

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

The Wave Motion of Radiation

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

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Question 1 starts on page 4

PLEASE DO NOT WRITE ON THIS PAGE

Answer **all** the questions.

1 This question is about growth in plants and animals.

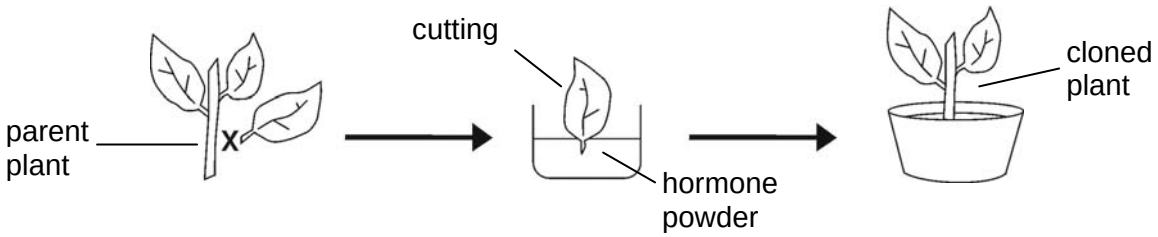
(a) Complete the following table about growth in plants and animals.

Put a tick (✓) in the correct box in **each** row.

feature	true for both plants and animals	only plants	only animals
most continue to grow in height and width **throughout** their lives			
different types of tissue contain **specialised** cells			
some cells are still **unspecialised** even in adults			

[3]

(b) For many years, cuttings have been used to produce clones of plants.



The cut surface is dipped into a hormone powder before planting.

Why is hormone powder used?

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

to stop water loss ☐

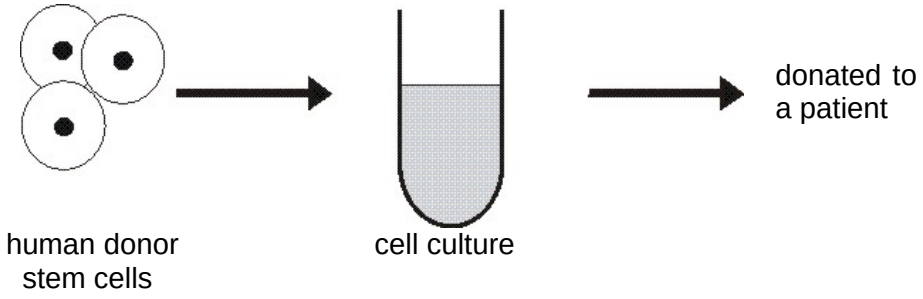
to help root growth ☐

to make the plant flower ☐

to stop disease spreading ☐

[1]

(c) Animal cells can also be cloned.
David is a member of a stem cell research team.
He removes stem cells from human tissue.
He cultures the cells and uses them to treat a patient.



Complete the sentences by choosing the best word from each pair.

Put a (ring) around the correct answer for each sentence.

Some of the genes in the donor stem cells are active and some are inactive.

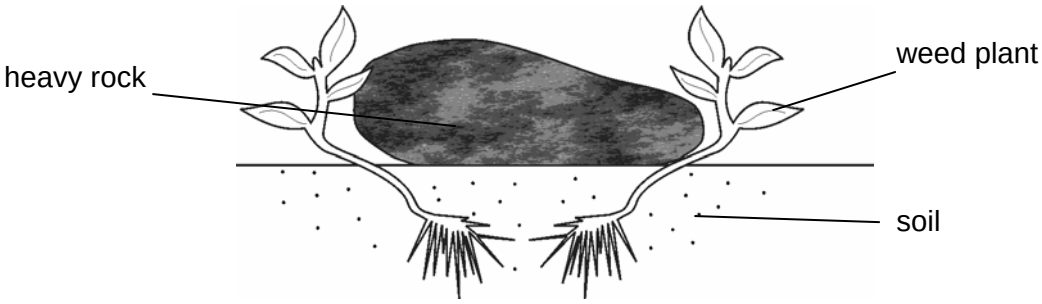
Under special culture conditions genes can be…… **inactivated / reactivated**.

This treats patients because the cells…… **repair / replace** damaged tissues.

[1]

[Total: 5]

2 **(a)** Robyn is trying to remove weeds from her garden.
She finds it difficult because some have their roots under a heavy rock.



The weeds are showing the result of phototropism.

What is the advantage of phototropism for plants?

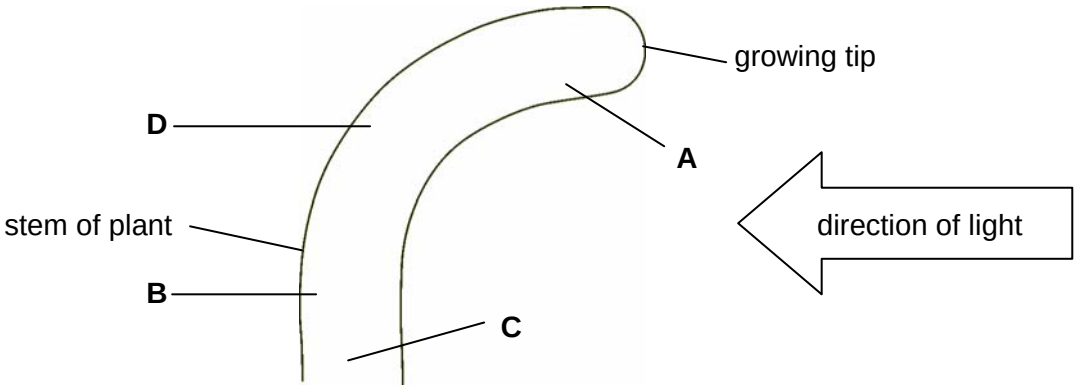
A They are able to take in more water.

B They can compete better for light.

C They grow faster.

answer ..... [1]

(b) Robyn draws a model to show the action of auxin during phototropism in a growing plant stem.



(i) In which area, **A**, **B**, **C** or **D**, is the auxin **produced**?

answer ..... [1]

(ii) In which area, **A**, **B**, **C** or **D**, is there **increased** cell expansion as a result of auxin action?

answer ..... [1]

(c) Light affects the concentration of auxin on the light and shaded parts of the stem.

Which of the following is the **best** explanation for the unequal distribution of auxin?

Put a tick (✓) in the correct box.

More auxin is made in the light.	☐
More auxin is made in the shade.	☐
Auxin moves across the stem to the light.	☐
Auxin moves across the stem towards the shady side.	☐

[1]

[Total: 4]

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3 **(a)** There is a clear link between genes and protein synthesis.

Complete the sentences by choosing the best word from each pair.

Put a (ring) around the correct answer for each sentence.

The genetic code is stored in the…… **cytoplasm / nucleus**.

Proteins are made in the…… **cytoplasm / nucleus**.

The genes are portions of the molecule…… **DNA / RNA**.

Genes are made from combinations of different bases arranged in groups of…… **two / three**.

[2]

(b) The control of protein synthesis follows a number of steps.

(i) Here are four of the steps in protein synthesis. They are in the wrong order.

A Protein is synthesised.

B The genetic code is copied.

C The code is read by a ribosome.

D Amino acids are put into a specific order.

Fill in the boxes to show the right order. The first one has been done for you.

B			

[2]

(ii) There is an error in the genetic code.

Which of these statements may be a consequence of this?

A The code cannot be read.

B The code cannot be copied.

C The wrong protein is synthesised.

answer ..... [1]

[Total: 5]

4 Titan is a moon near the planet Saturn.
In 2004, a space probe landed on Titan and found out what gases are in its atmosphere.

This table shows the main gases in the atmosphere of Titan.

gas		percentage in Titan atmosphere
name	**formula**	
nitrogen		95%
methane	CH_4	3%
argon	Ar	1%
other gases		

(a) Complete the table by filling in the formula for **nitrogen gas**.

[1]

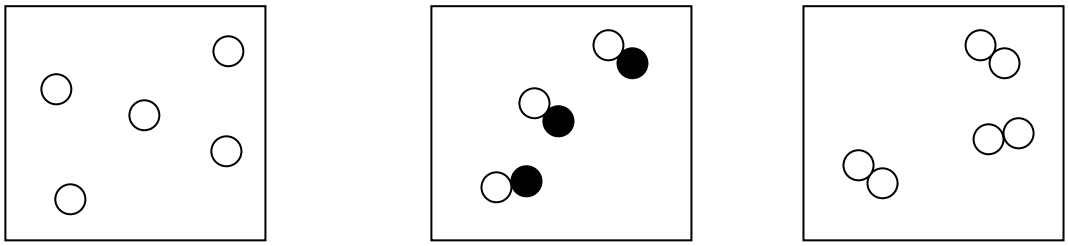
(b) Which of the following statements are **true** and which are **false**?

Put ticks (✓) in the correct boxes.

	true	**false**
The gases on Titan are all ionically bonded.		
1% of the atmosphere of Titan is other gases.		
All the gases named in the table are present on Earth.		
All the gases present on Earth are named in the table.		
The data shows that there is no carbon dioxide on Titan.		

[2]

(c) Which diagram, **A**, **B** or **C**, shows the arrangement of atoms in argon gas?



A **B** **C**

answer ..... [1]

[Total: 4]

5 In 2003, there was a tsunami (tidal wave) in Indonesia.

Sea water flooded large areas of farmland.

(a) After the tsunami, sea water left on the farmland evaporated.

This equation shows what happens to water when it evaporates.

$$H_2O(l) \rightarrow H_2O(g)$$

(i) What do the state symbols (l) and (g) mean?

(l) .....

(g) ..... [1]

(ii) The sea water contains large amounts of sodium chloride.
When the water evaporates, the dissolved sodium chloride forms solid crystals.

Complete the equation for this change by filling in the missing **state symbols**.

sodium chloride dissolved in water	→	solid sodium chloride
NaC*l* (……..)	→	NaC*l* (……..)

[1]

(b) Scientists tested the water in the soil to see if it contained dissolved sodium chloride.

They used an electrical conductivity tester.

Why does water that contains dissolved sodium chloride conduct electricity?

Put a tick (✓) in the box next to the **best** explanation.

The ions are strongly attracted together.	☐
The water contains free moving ions.	☐
The ions have opposite charges.	☐
Electrons move between ions.	☐

[1]

(c) Sea water contains many different salts.

The table shows some information about some salts in sea water.

name of salt	ions in salt		formula of salt
	name	formula	
potassium chloride	potassium		KCl
	chloride	Cl^-	
magnesium chloride	magnesium	Mg^{2+}	
	chloride	Cl^-	
magnesium sulfate	magnesium	Mg^{2+}	$MgSO_4$
	sulfate		

Complete the table by filling in the **three empty boxes**.

[3]

[Total: 6]

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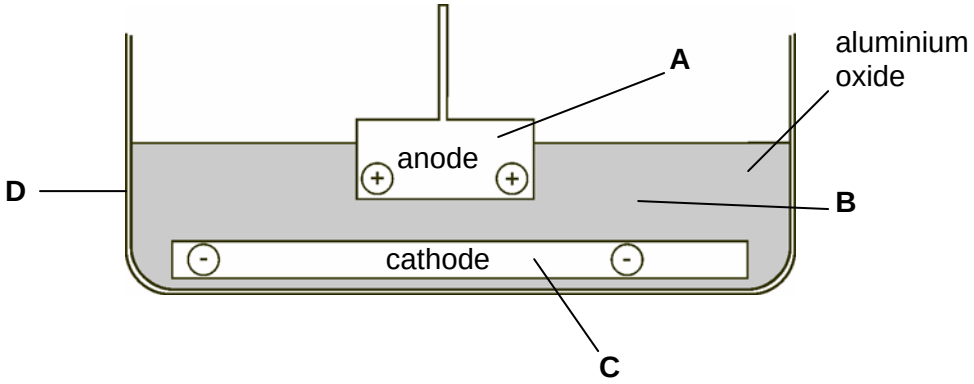
6 This diagram shows an electrolysis cell for extracting aluminium from aluminium oxide.



(a) In which area, **A**, **B**, **C** or **D**, will aluminium form?

answer ..... [1]

(b) Complete the equation to show what happens when aluminium ions form aluminium.

Al^{3+} + ☐ → Al

[2]

(c) The electrolysis is carried out at 900 ^{o}C.

Why does the electrolysis not work at room temperature?

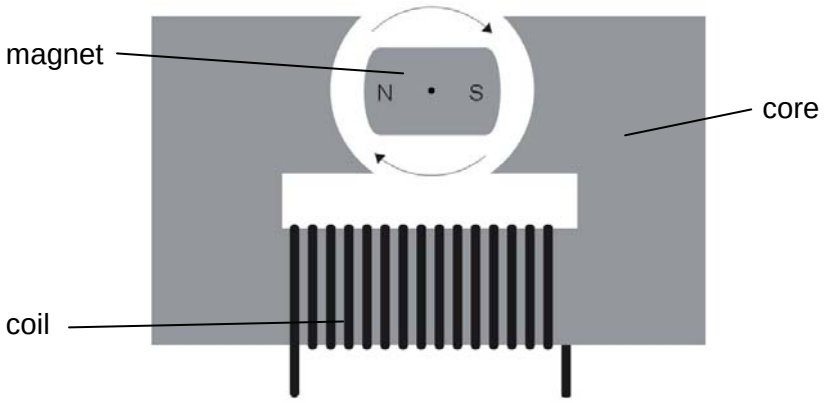
Put ticks (✓) in the boxes next to the correct statements.

Aluminium oxide only conducts electricity when molten.	☐
There are no free electrons in aluminium oxide at room temperature.	☐
At room temperature, the ions in aluminium oxide do not move.	☐
At room temperature, aluminium oxide does not contain ions.	☐

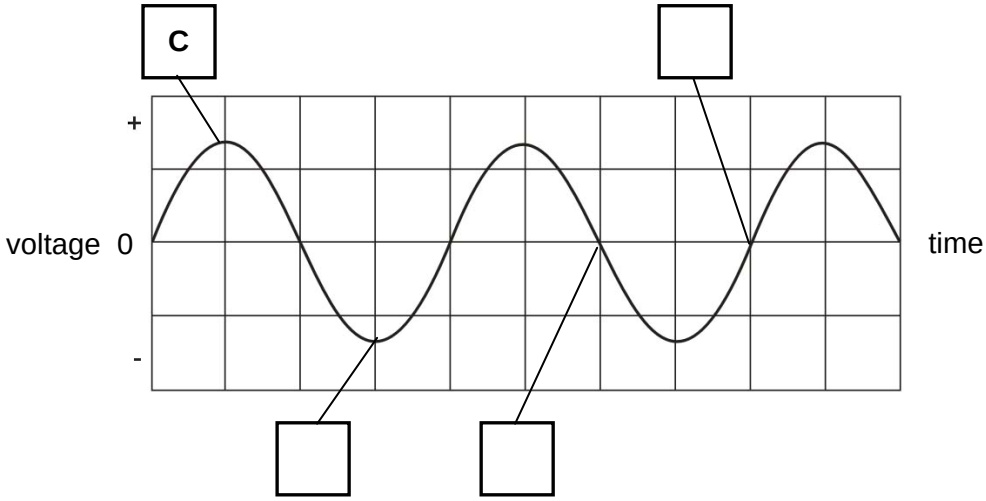
[1]

[Total: 4]

7 This question is about generating mains electricity by rotating magnets.



(a) Here is a voltage-time graph for the coil when the magnet is rotating.



Add these labels to the graph. One has been done for you.

A lowest magnetic field in the coil

B highest magnetic field in the coil

C increasing magnetic field in the coil

D decreasing magnetic field in the coil

[2]

(b) How could you make the output voltage smaller?

Which of the statements **A**, **B**, **C** or **D** is correct?

A use a stronger magnet

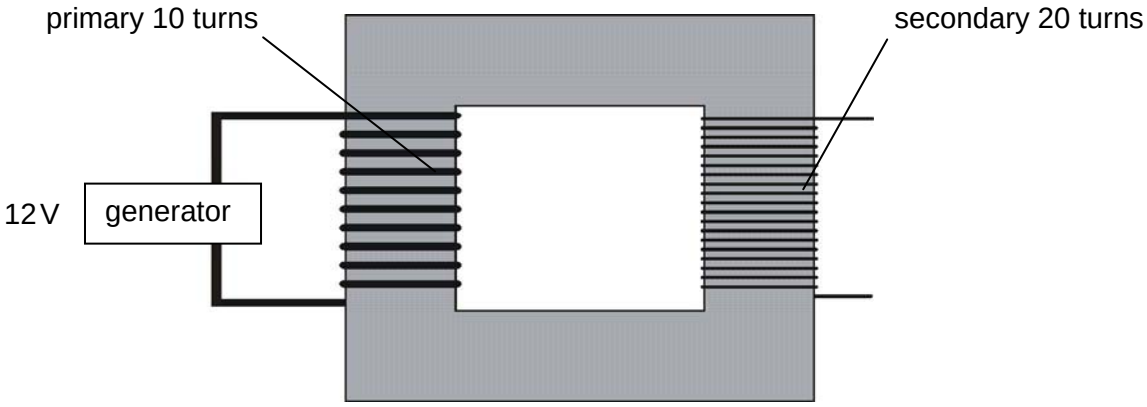
B rotate the magnet faster

C have more turns of wire in the coil

D use copper instead of iron for the core

answer ..... [1]

(c) The output of the generator is connected to a transformer.



The primary coil has 10 turns and is connected to the generator.
The secondary coil has 20 turns.

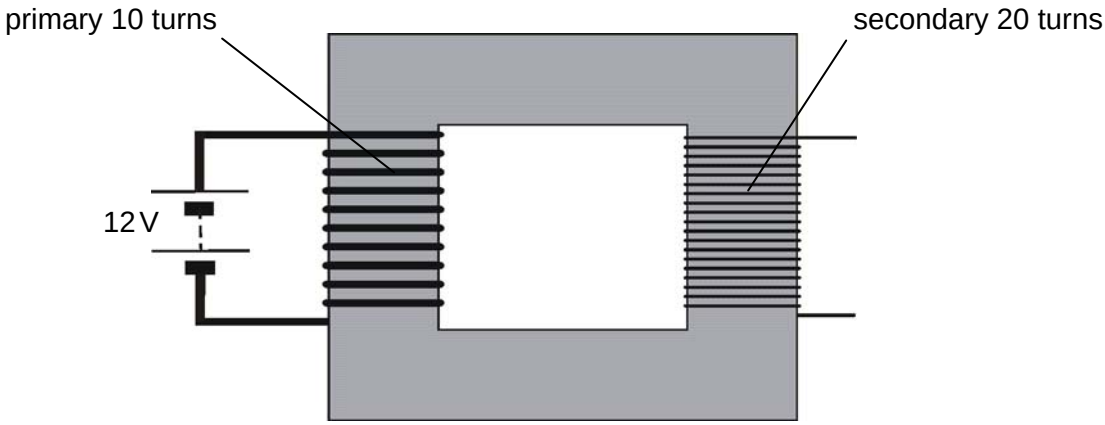
What is the voltage across the secondary coil when the generator voltage is 12 V?

Put a ring around the correct answer.

0 V **6 V** **12 V** **24 V**

[1]

(d) The generator is replaced with a 12 V battery.



What is the voltage across the secondary coil now?

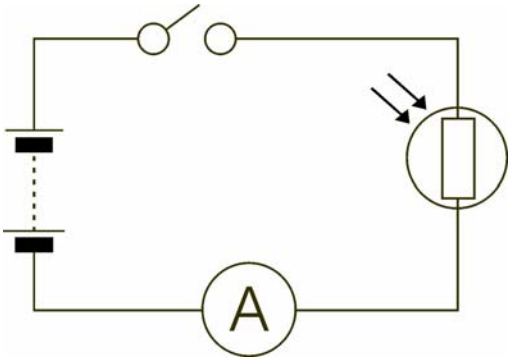
Put a ring around the correct answer.

0 V **6 V** **12 V** **24 V**

[1]

[Total: 5]

8 Ann builds this electric circuit.



(a) Add a **voltmeter** to the circuit to measure the battery voltage.

Use the correct symbol.

[1]

(b) Here are some statements about Ann's circuit.

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

The battery is a source of direct current.	☐
There is only a voltage across the battery when the switch is closed.	☐
The ammeter measures the energy of the charge moving in the circuit.	☐
The current in the circuit depends on the amount of light shining on the LDR.	☐

[2]

(c) Ann closes the switch.

The current in the circuit = 0.12 A.
The voltage across the LDR = 9 V.

Here are some calculations for the resistance of the LDR.

Put a (ring) around the correct calculation.

$\frac{9}{0.12} = 75\,\Omega$ $\qquad$ $9 \times 0.12 = 1.1\,\Omega$ $\qquad$ $\frac{0.12}{9}$ $0.013\,\Omega$

[1]

[Total: 4]

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Question 9 starts on page 20

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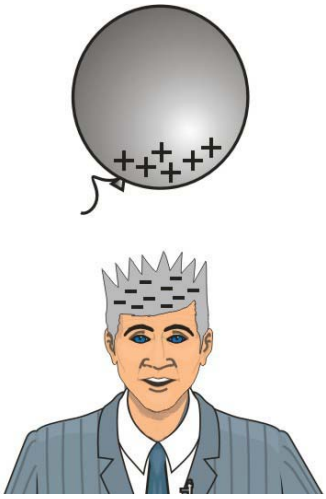
9 Dan has a favourite party trick.



He rubs a balloon on his head.

When he removes the balloon, his hair stands on end.

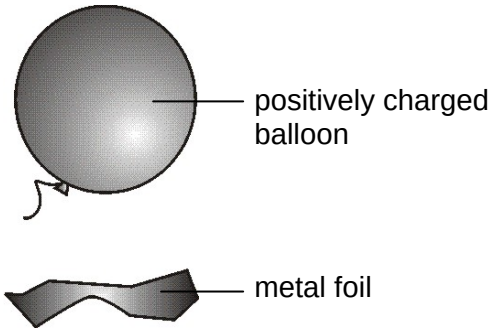
(a) Draw a straight line from each **observation** to its best **explanation**.

observation	**explanation**
The hair is attracted to the balloon.	It gains electrons.
The hair becomes negatively charged.	Electrons are removed from it.
Each hair is repelled by the other hairs.	They have the same type of charge.
The balloon becomes positively charged.	They have the opposite type of charge.

[2]

(b) Dan now holds the positively charged balloon above a thin piece of metal foil.

The foil moves up and sticks to the balloon.



The sentences explain why this happens. They are in the wrong order.

A Electrons move to the top of the foil.

B The foil moves up towards the balloon.

C Electrons in the foil are attracted to the balloon.

D The top of the foil becomes negatively charged.

E The force between the foil and the balloon is now more than the weight of the foil.

Fill in the boxes to show the correct order. The first one has been done for you.

C				

[3]

[Total: 5]

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.