

Candidate forename						Candidate surname					
Centre number						Candidate number					

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS**  
**GCSE**

**A152/01**

**TWENTY FIRST CENTURY SCIENCE**  
**ADDITIONAL SCIENCE A**

**Modules B5 C5 P5 (Foundation Tier)**

**MONDAY 25 JUNE 2012: Afternoon**

**DURATION: 1 hour**  
**plus your additional time allowance**

**MODIFIED ENLARGED**

**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)**  
**Calculator**

**READ INSTRUCTIONS OVERLEAF**

## **INSTRUCTIONS TO CANDIDATES**

- Write your name, centre number and candidate number in the boxes on the first page. 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).

## **INFORMATION FOR CANDIDATES**

- Your quality of written communication is assessed in questions marked with a pencil (.
- The number of marks is given in brackets [ ] at the end of each question or part question.
- A list of physics equations is printed on pages 4–5.
- A list of qualitative tests for ions is printed on pages 6–7.
- An enlarged copy of the Periodic Table will be provided.
- The total number of marks for this paper is 60.

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# **TWENTY FIRST CENTURY SCIENCE EQUATIONS**

## **USEFUL RELATIONSHIPS**

### **THE EARTH IN THE UNIVERSE**

$$\text{distance} = \text{wave speed} \times \text{time}$$

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

### **SUSTAINABLE ENERGY**

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

$$\text{power} = \text{voltage} \times \text{current}$$

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

## **EXPLAINING MOTION**

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

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}}$$

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

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

$$\frac{\text{work done by a force}}{\text{force}} = \frac{\text{distance moved in the direction of the force}}{\text{direction of the force}}$$

$$\text{amount of energy transferred} = \text{work done}$$

$$\frac{\text{change in gravitational potential energy}}{\text{weight}} = \frac{\text{vertical height difference}}{\text{vertical height difference}}$$

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

## **ELECTRIC CIRCUITS**

$$\text{power} = \text{voltage} \times \text{current}$$

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

$$\frac{\text{voltage across primary coil}}{\text{voltage across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$$

## **RADIOACTIVE MATERIALS**

$$\text{energy} = \text{mass} \times [\text{speed of light in a vacuum}]^2$$

# TWENTY FIRST CENTURY SCIENCE DATA SHEET

## QUALITATIVE ANALYSIS

### TESTS FOR IONS WITH A POSITIVE CHARGE

ION	TEST	OBSERVATION
calcium $\text{Ca}^{2+}$	add dilute sodium hydroxide	a white precipitate forms; the precipitate does not dissolve in excess sodium hydroxide
copper $\text{Cu}^{2+}$	add dilute sodium hydroxide	a light blue precipitate forms; the precipitate does not dissolve in excess sodium hydroxide
iron(II) $\text{Fe}^{2+}$	add dilute sodium hydroxide	a green precipitate forms; the precipitate does not dissolve in excess sodium hydroxide
iron(III) $\text{Fe}^{3+}$	add dilute sodium hydroxide	a red-brown precipitate forms; the precipitate does not dissolve in excess sodium hydroxide
zinc $\text{Zn}^{2+}$	add dilute sodium hydroxide	a white precipitate forms; the precipitate dissolves in excess sodium hydroxide

## TESTS FOR IONS WITH A NEGATIVE CHARGE

ION	TEST	OBSERVATION
carbonate $\text{CO}_3^{2-}$	add dilute acid	the solution effervesces; carbon dioxide gas is produced (the gas turns lime water from colourless to milky)
chloride $\text{Cl}^-$	add dilute nitric acid, then add silver nitrate	a white precipitate forms
bromide $\text{Br}^-$	add dilute nitric acid, then add silver nitrate	a cream precipitate forms
iodide $\text{I}^-$	add dilute nitric acid, then add silver nitrate	a yellow precipitate forms
sulfate $\text{SO}_4^{2-}$	add dilute acid, then add barium chloride or barium nitrate	a white precipitate forms

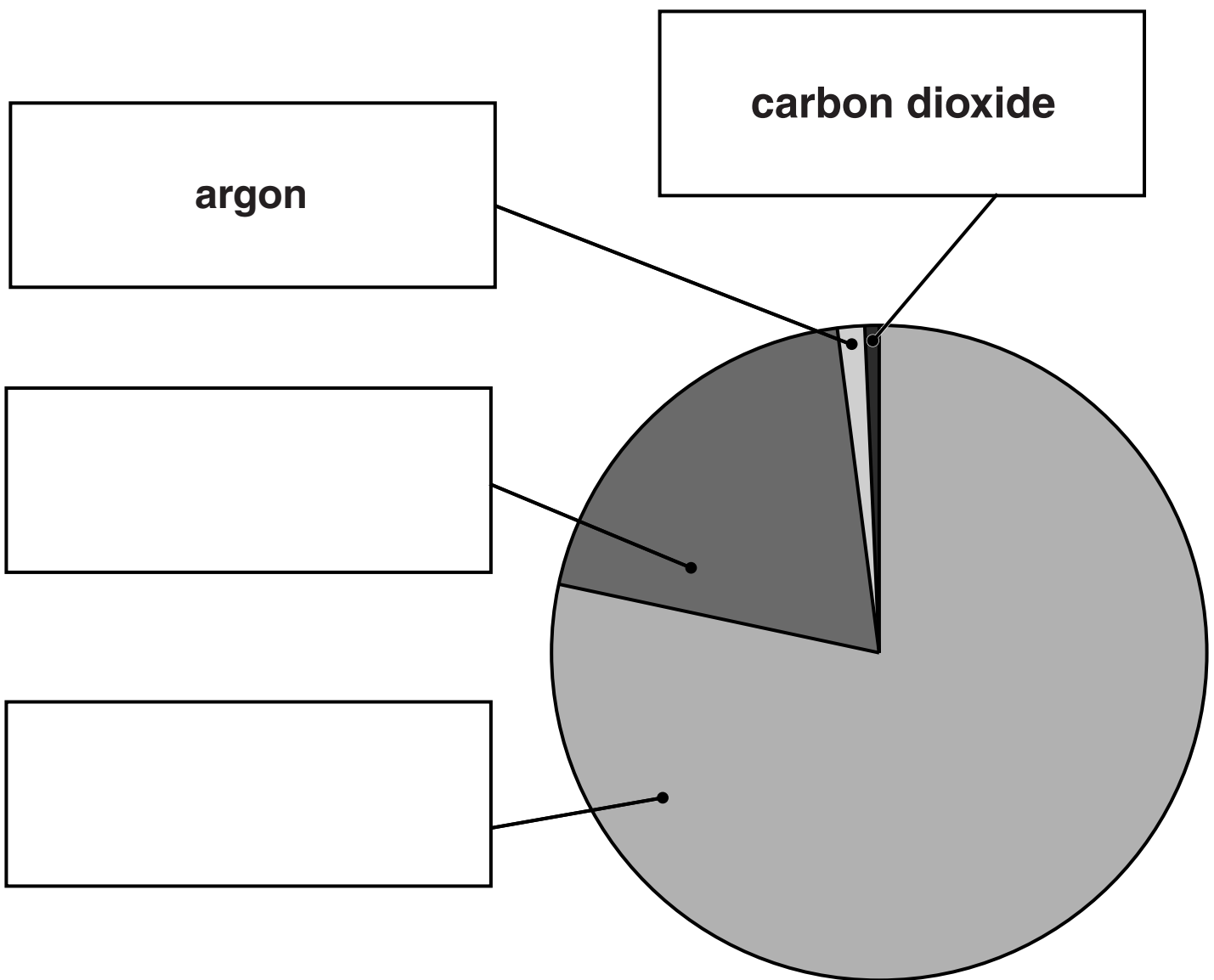
**Answer ALL the questions.**

**1 Industry in Britain uses thousands of tonnes of gases from the air every year.**

**(a) The pie chart shows the amounts of the four main gases in dry air.**

**Write the names of the gases in the boxes.**

**Two have been done for you.**



**[1]**



**(b) Complete the table to show the chemical symbol for argon and the formula for carbon dioxide.**

	<b>ARGON</b>	<b>CARBON DIOXIDE</b>
<b>SYMBOL OR FORMULA</b>		

**[2]**

**(c) When air is cooled to a very low temperature it turns into a liquid.**

**Oxygen and nitrogen can then be separated by warming the liquid.**

**Gases in the air have low boiling points.**

**Explain why.**

**Use ideas about**

- size of molecules**
- forces between molecules.**

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**[3]**

**(d) (i) The relative atomic mass of nitrogen = 14.**

**What is the relative formula mass of a nitrogen molecule, N<sub>2</sub>?**

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

**2**

**7**

**14**

**28**

**[1]**

**(ii) A gas cylinder contains 40 formula masses (in grams) of nitrogen molecules.**

**What mass in grams of nitrogen gas is in the cylinder?**

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

**80 g**

**280 g**

**560 g**

**1120 g**

**[1]**

**[Total: 8]**

**2 Mary says that tap water contains chloride ions.**

**Jo says that it contains iodide ions.**

**How can you show who is correct?**

**Describe the test you would use, and say how the results show who is correct.**

**Use the data sheet to help you.**

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**[3]**

**[Total: 3]**

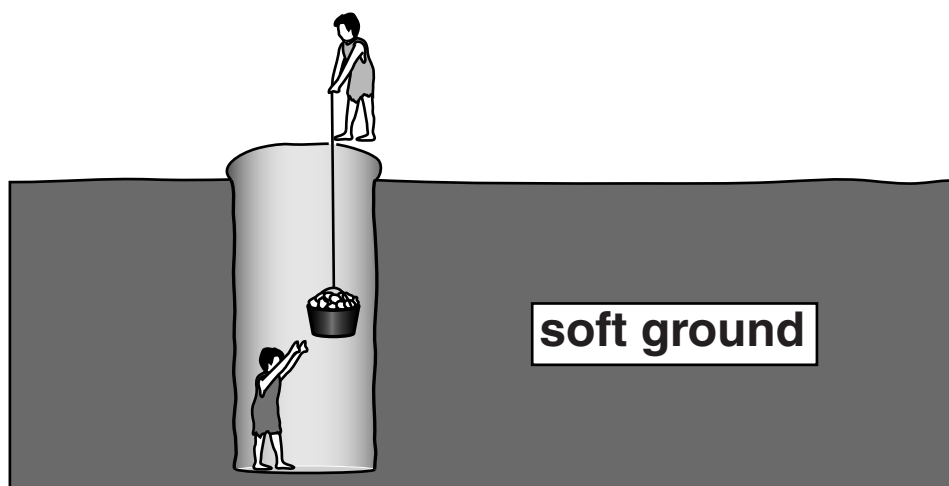
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### 3 Read this article about lead mining.

Archaeologists have discovered a small lead mine that was used 4000 years ago.

The miners made a deep hole through soft ground until they reached the lead ore. They then dug out the ore and loaded it into baskets.

A second group of people lifted the ore out of the mine and put it into a wood fire. In the fire the ore reacted to make sulfur dioxide, carbon dioxide and melted lead. The melted lead was run into moulds dug in the ground and allowed to solidify.



(a) Here is some information about three of the substances involved in the process.

	LEAD	LEAD ORE	SULFUR DIOXIDE
MELTING POINT IN °C	327	1114	-73
BOILING POINT IN °C	1744	1281	-10
HAZARD	prolonged exposure to dust or fumes is harmful	prolonged exposure to dust or fumes is harmful	acidic gas

**Use the information in the article and table on the previous page to suggest and describe at least four likely risks to people. Explain how each risk is created and who would be affected.**



**The quality of written communication will be assessed in your answer.**

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**[6]**

**(b) Two reactions take place when lead ore is heated in the fire.**



**(i) What is the total number of ATOMS in one molecule of  $\text{SO}_2$ ?**

**answer = \_\_\_\_\_ atoms [1]**

**(ii) How many different ELEMENTS are in  $2\text{PbO}$ ?**

**answer = \_\_\_\_\_ elements [1]**

**(iii) In reaction 2 the lead oxide loses oxygen.**

**What do we call this type of reaction?**

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

**EXTRACTION**

**NEUTRALISATION**

**OXIDATION**

**REDUCTION**

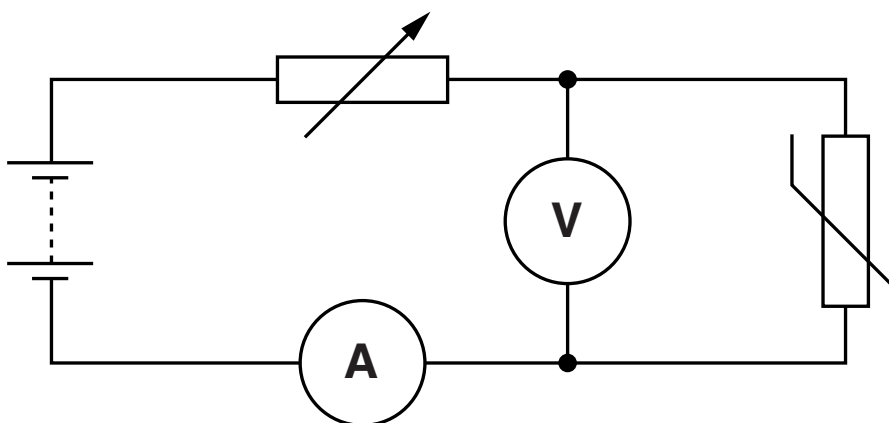
**[1]**

**[Total: 9]**



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- 4 Anna uses this circuit to find out how the resistance of a thermistor depends on the power delivered to it.



Here are her results.

POWER DELIVERED IN W	RESISTANCE OF THERMISTOR IN $\Omega$
0.10	10.0
0.50	8.0
3.20	5.0

- (a) What is the correlation between the resistance and the power?

Use ideas about thermistors to explain the correlation.

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[3]

**(b) Anna takes this pair of readings to check the correlation.**

**voltage = 3.0V**

**current = 0.50 A**

**Calculate the resistance and power of the thermistor for these readings.**

**How do these results affect your confidence in the correlation shown in the table?**

**resistance = \_\_\_\_\_  $\Omega$**

**power = \_\_\_\_\_ W**

\_\_\_\_\_

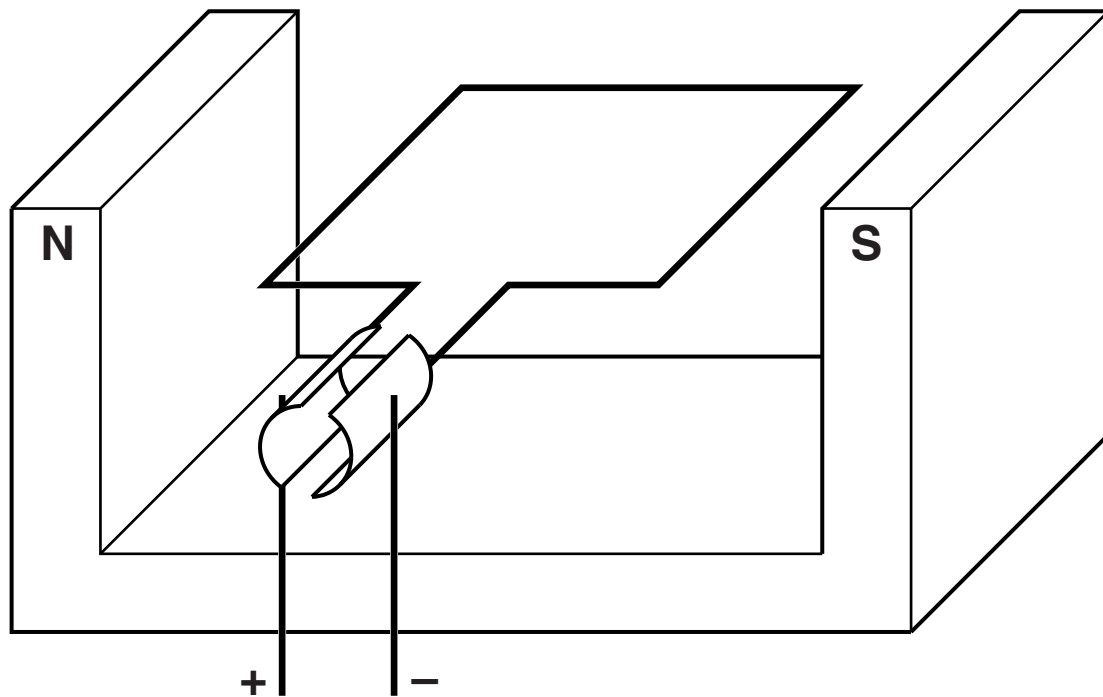
\_\_\_\_\_

\_\_\_\_\_

**[3]**

**[Total: 6]**

**5 The diagram shows a simple electric motor.**



**Add labels to the diagram and use them to explain how this simple electric motor operates.**



**The quality of written communication will be assessed in your answer.**

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**[6]**

**[Total: 6]**

- 6 Sanjay has a lamp which has the following information printed on its box.

frequency	50 Hz
power	20W
voltage	12V

- (a) Which piece of information tells Sanjay that the lamp can operate from an a.c. supply?

Put a ring around the correct answer.

**FREQUENCY**

**POWER**

**VOLTAGE**

[1]

- (b) Sanjay uses a transformer to step down the 230V mains supply for the 12V lamp.

- (i) Complete the sentence.

Choose a word from this list.

**TWO**

**THREE**

**FOUR**

To make a simple transformer you need

\_\_\_\_\_ coils of wire on an iron core.  
[1]

**(ii) Transformers use electromagnetic induction.**

**Here are some descriptions of electromagnetic induction in a transformer.**

**Put a tick (✓) in the box next to the ONE correct description.**

**A coil of wire is charged when it is rubbed by a magnet.**

☐

**Changing the magnetic field in a coil of wire makes a voltage.**

☐

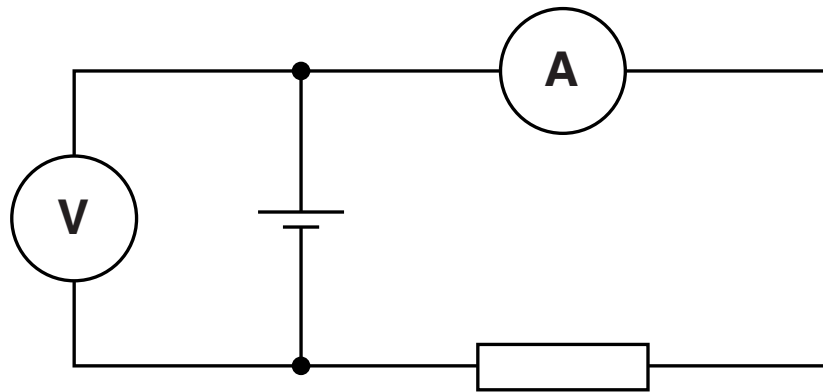
**Leaving a magnet in a coil of wire results in an electric current.**

☐

**[1]**

**[Total: 3]**

**7 Bill assembles this circuit.**



**(a) Draw straight lines to link the START of each sentence to its correct END.**

**START**

**END**

**The battery ...**

**... measures the rate at which charge flows in the circuit.**

**The resistor ...**

**... measures the potential difference across the battery.**

**The ammeter ...**

**... pushes charges around the circuit.**

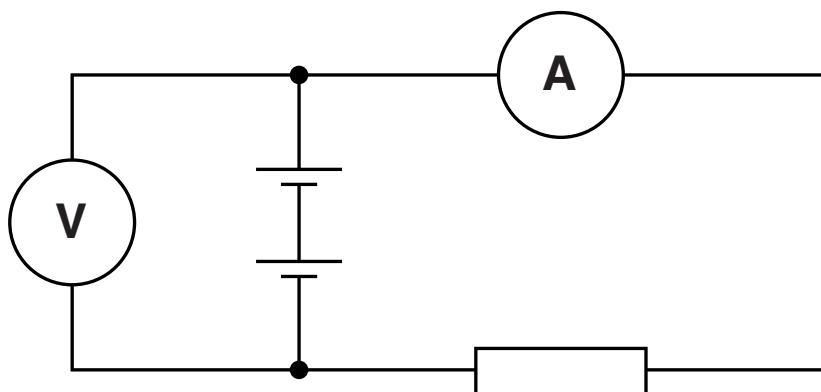
**The voltmeter ...**

**... has a value measured in ohms.**

**[3]**



**(b) Bill adds a second identical battery to his circuit.**



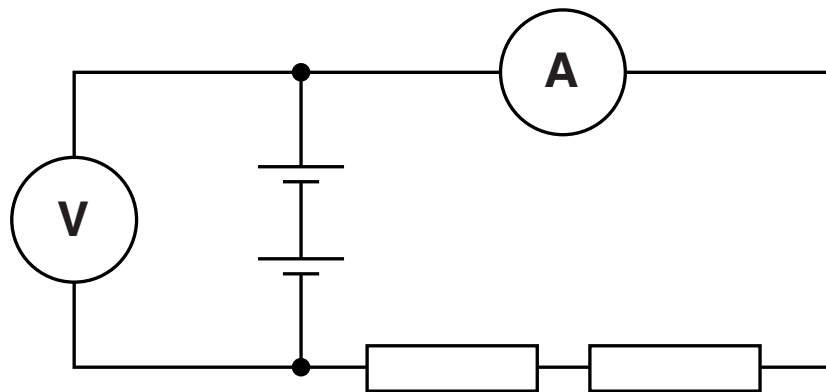
**What effect does this have on the meter readings?**

**Put a tick (✓) in the box next to the correct row of the table.**

<b>VOLTMETER READING</b>	<b>AMMETER READING</b>	<b>(✓)</b>
<b>doubles</b>	<b>doubles</b>	
<b>doubles</b>	<b>no change</b>	
<b>no change</b>	<b>doubles</b>	
<b>no change</b>	<b>no change</b>	

**[1]**

(c) Bill now adds another identical resistor to the circuit.



Complete each sentence by putting a **ring** around the correct word in CAPITAL LETTERS.

The extra resistor    **DOUBLES / HALVES / DOES NOT CHANGE**    the resistance of the circuit.

This means that the current **DOUBLES / HALVES / DOES NOT CHANGE**.

[1]

[Total: 5]

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**8 Tony is a forestry worker.**

**Each year he keeps records of the width of four tree trunks.**

<b>TREE</b>	<b>WIDTH OF TREE IN EACH YEAR IN cm</b>			
	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>
<b>A</b>	<b>21</b>	<b>23</b>	<b>25</b>	<b>27</b>
<b>B</b>	<b>20</b>	<b>22</b>	<b>24</b>	<b>25</b>
<b>C</b>	<b>21</b>	<b>23</b>	<b>24</b>	<b>25</b>
<b>D</b>	<b>23</b>	<b>25</b>	<b>26</b>	<b>28</b>

**(a) Tony thinks that tree A has had the most cell divisions in its trunk.**

**Do you agree?**

**Use information from the table to support your answer.**

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**[2]**

**(b) Tony takes a cutting from one of the trees.**

**He dips the cutting into a powder.**

**Describe the processes that will help the cutting develop into a new, identical tree.**



**The quality of written communication will be assessed in your answer.**

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**[6]**

**[Total: 8]**

- 9 Scientists analysed a sample of DNA from a muscle cell.

DNA is made up of four different bases, A, T, C and G.

The bases always pair up in the same way.

- (a) Complete the table to show the percentage of each base present in the muscle cell.

BASE	PERCENTAGE PRESENT
A	21
T	21
C	
G	

[2]

- (b) The order of the four bases is the genetic code.

This is the code to make proteins.

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

The proteins are made in the

CYTOPLASM	<input type="checkbox"/>
MEMBRANE	<input type="checkbox"/>
NUCLEUS	<input type="checkbox"/>

of the cells.

[1]

**(c) A scientist claims to have found a gene that makes stronger muscles.**

**The stronger muscle cells have a particular protein.**

**He tested 23 young men who had strong muscles to find out if they had the gene.**

**Suggest THREE ways the scientist could improve his investigation.**

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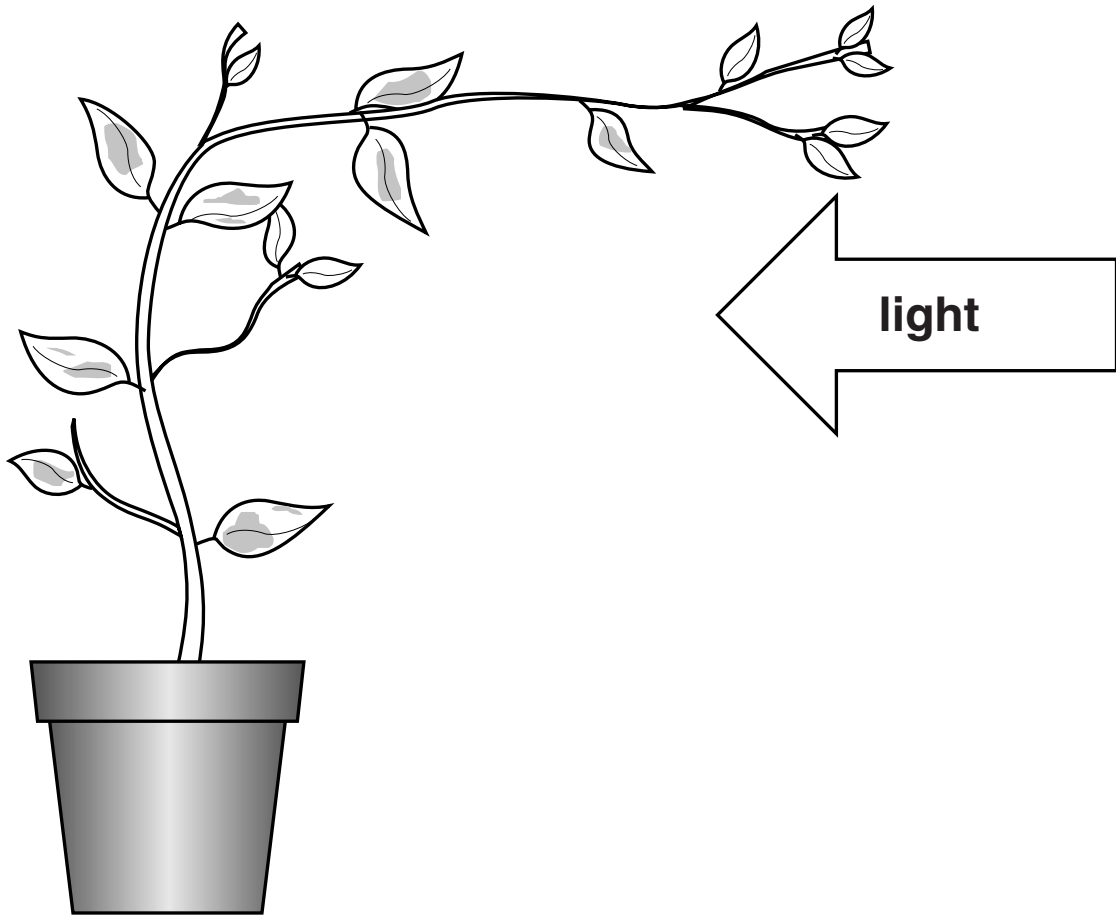
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**[3]**

**[Total: 6]**

**10 Trudy puts a plant in the middle of a room.**



**The plant stem grows towards the light.**

**(a) What is the name of this process?**

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

**CLONING**

**MEIOSIS**

**PHOTOTROPISM**

**[1]**



**(b) Explain how growing towards the light helps plants.**

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[3]

**[Total: 4]**

**11 Mary studies the development of human embryos.**

**(a) Mary knows that a fertilised egg cell (zygote) develops into an embryo.**

**There are 46 chromosomes in the fertilised egg cell.**

**How many chromosomes are there in each cell of the embryo?**

**answer \_\_\_\_\_ [1]**

- (b) Mary hopes that her research will lead to embryonic stem cells being available to replace damaged tissues in accident victims.

Four of her friends discuss her work with her.

**CAMERON SAYS:**

**“It’s worth the risk because thousands of people could benefit.”**

**FIONA SAYS:**

**“You should stop work on embryos, there are too many risks.”**

**LIZA SAYS:**

**“You shouldn’t try this on patients until you know it’s completely risk free.”**

**JEFF SAYS:**

**“This risky treatment should be kept for special cases.”**

**Which person wants something which is NOT possible to achieve?**

**answer \_\_\_\_\_ [1]**

**[Total: 2]**

**END OF QUESTION PAPER**

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