

THIS IS A NEW SPECIFICATION

**H****Monday 25 June 2012 – Afternoon****GCSE TWENTY FIRST CENTURY SCIENCE
ADDITIONAL SCIENCE A****A152/02** Modules B5 C5 P5 (Higher 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)
- Calculator

Duration: 1 hour

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

- 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 page 2.
- A list for qualitative tests for ions is printed on page 3.
- A Periodic Table is printed on the back page.
- The total number of marks for this paper is **60**.
- This document consists of **20** pages. Any blank pages are indicated.

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

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

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

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

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

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

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

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

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

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 Ca^{2+}	add dilute sodium hydroxide	a white precipitate forms; the precipitate does not dissolve in excess sodium hydroxide
copper Cu^{2+}	add dilute sodium hydroxide	a light blue precipitate forms; the precipitate does not dissolve in excess sodium hydroxide
iron(II) Fe^{2+}	add dilute sodium hydroxide	a green precipitate forms; the precipitate does not dissolve in excess sodium hydroxide
iron(III) Fe^{3+}	add dilute sodium hydroxide	a red-brown precipitate forms; the precipitate does not dissolve in excess sodium hydroxide
zinc 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 CO_3^{2-}	add dilute acid	the solution effervesces; carbon dioxide gas is produced (the gas turns lime water from colourless to milky)
chloride Cl^-	add dilute nitric acid, then add silver nitrate	a white precipitate forms
bromide Br^-	add dilute nitric acid, then add silver nitrate	a cream precipitate forms
iodide I^-	add dilute nitric acid, then add silver nitrate	a yellow precipitate forms
sulfate SO_4^{2-}	add dilute acid, then add barium chloride or barium nitrate	a white precipitate forms

4

Answer **all** the questions.

1 The way that atoms are held together in a substance affect its properties.

(a) Here are some properties of five substances.

Substance	Melting point	Boiling point	Electrical conductivity of solid	Hardness at room temperature
1	high	high	poor	very hard
2	high	high	good	soft
3	high	high	good	hard
4	high	high	poor	hard
5	low	low	poor	not applicable

Fill in the boxes with the numbers **1, 2, 3, 4** or **5**, to show which number represents ...

... iron.

... graphite.

... diamond.

... a compound of chlorine and oxygen.

... sodium chloride crystal.

[3]

(b) Nitrogen and oxygen have very low boiling points.

Explain why.

.....

.....

.....

..... [3]

5

- (c) Sodium chloride solution conducts electricity when electrodes are placed in the solution.

Explain what happens.

.....

.....

.....

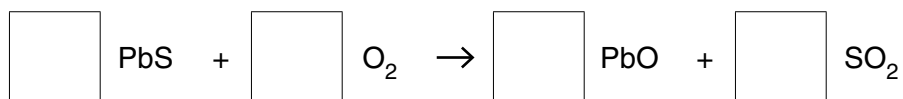
..... [3]

[Total: 9]

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

In reaction 1, lead sulfide reacts with oxygen to make lead oxide and sulfur dioxide.

- (i) Balance the equation for this reaction.



[2]

- (ii) In reaction 2, the oxygen is removed from the lead oxide.

What do we call a reaction in which oxygen is removed?

..... [1]

- (iii) What is the relative formula mass of lead oxide, PbO?

Use the Periodic Table to help you.

..... [1]

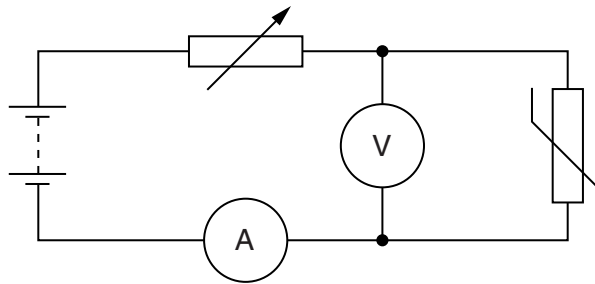
- (iv) Calculate the percentage mass of Pb in the PbO.

..... [1]

[Total: 11]

8

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



- (a) (i) Put a ring around the component which allows Anna to vary the current in the circuit. [1]

- (ii) State the property of that component which allows Anna to vary the current.

..... [1]

- (b) Here are her results.

Power delivered in W	Resistance of thermistor in Ω
0.10	10
0.50	8.0
3.20	5.0

What is the correlation between the resistance and the power?

Use ideas about thermistors to explain the correlation.

.....

.....

.....

.....

..... [3]

9

- (c) Anna takes an extra pair of readings to provide more evidence for the correlation.

She finds that when the voltage is 3.0V, the resistance is 6.0 Ω .

Does this support the correlation shown in the table?

Justify your answer with calculations.

..... [2]

[Total: 7]

- 4** Sanjay wants to run a low voltage lamp off the mains supply.

He decides to use a step-down transformer to reduce the mains voltage to a lower voltage supply.

- (a)** Describe the structure of a step-down transformer and explain how it works.



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

..... [6]

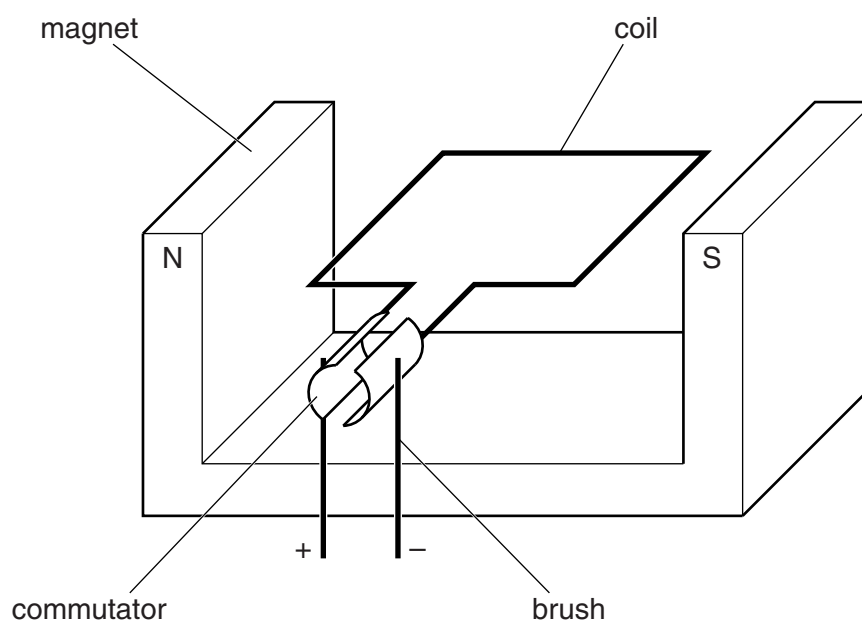
- (b)** Sanjay's transformer has 20 000 turns in its primary coil, but only 1000 turns in its secondary coil. Show that he can use it to run a 12V lamp safely off the 230V mains supply.

..... [2]

[Total: 8]

11

5 The diagram shows a simple electric motor.



Here are some statements about the simple electric motor.

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

The magnet exerts a force on all parts of the coil.

☐

The commutator converts the d.c. from the supply into a.c. for the brushes.

☐

The wires next to the poles of the magnet are pushed in opposite directions.

☐

The forces on the coil are caused by the p.d. induced by its motion in the field.

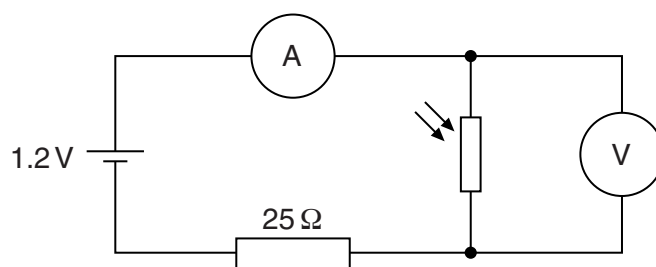
☐

[1]

[Total: 1]

12

- 6 Bill assembles this circuit.



The current in the circuit depends on the lighting level of the room.

- (a) At one instant the current in the ammeter is 0.04 A.

What is the reading of the voltmeter?

Put a ring around the correct answer.

0.20V 1.0V 1.2V 2.2V

[1]

- (b) Complete the sentences. Choose words from this list.

decreases increases stays the same

When the amount of light increases, the resistance of the LDR

The potential difference across the battery

The current in the battery

The potential difference across the 25Ω resistor

[3]

[Total: 4]

13

BLANK PAGE

Question 7 begins on page 14

PLEASE DO NOT WRITE ON THIS PAGE

14

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

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

- (a) It is found that 21% of the bases are A.

Calculate the percentage of bases that are G.

answer = % [1]

- (b) The genetic code uses the four different bases.

Calculating the percentage of each base present is not enough to determine the genetic code for a particular protein.

Explain why.

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

- (c) Myosin is a protein which is found in muscle cells, but not in nerve cells.

Explain the processes which lead to myosin being made and why it is only produced in muscle cells.



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

.....
.....
.....
.....
.....
.....
.....
.....
.....
..... [6]

15

(d) 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.

.....

.....

.....

..... [3]

[Total: 11]

8 Mary studies the development of human embryos.

(a) Complete the table to compare two differences between the 4 cell stage and 32 cell stage.

	4 cell stage	32 cell stage
Difference 1		
Difference 2		

[1]

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

There are 46 chromosomes in the fertilised egg cell.

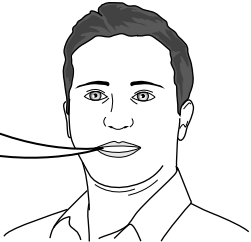
How many chromosomes are there in each cell of the embryo?

answer [1]

(c) 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
It's worth the risk because thousands of people could benefit.



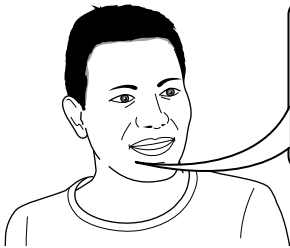
Fiona
You should stop work on embryos, there are too many risks.



Liza
You shouldn't try this on patients until you know it's completely risk free.



Jeff
This risky treatment should be kept for special cases.



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

answer [1]

[Total: 3]

17

BLANK PAGE

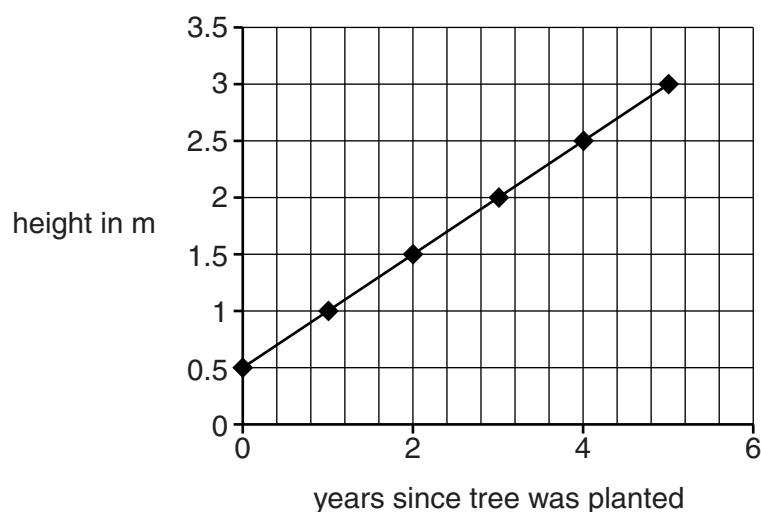
Question 9 begins on page 18

PLEASE DO NOT WRITE ON THIS PAGE

- 9 Tony works on a tree plantation.

Each tree is grown for forty years, then it is cut down for timber.

He records the height of one tree every year for its first five years after planting.



- (a) (i) The tree is under telephone cables.

The cables are 15m above the ground.

Tony predicts that the tree will have to be cut down 28 years after planting to avoid damaging the cables.

Explain how he made this prediction.

.....

 [2]

- (ii) Use your knowledge of plant growth to explain why this prediction may not be accurate.

.....

 [2]

19

- (b) Tony finds a bush growing in the plantation.

He takes a cutting of the bush to grow in his garden.

As the cutting grows it develops tissues and organs.

Explain the difference between a tissue and an organ.

.....

.....

..... [2]

[Total: 6]

END OF QUESTION PAPER



Copyright Information

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1GE.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

The Periodic Table of the Elements

1	2	3	4	5	6	7	0

* 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.