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OCR
RECOGNISING ACHIEVEMENT

Wednesday 30 May 2012 – Afternoon

GCSE TWENTY FIRST CENTURY SCIENCE
ADDITIONAL SCIENCE A

A218/02   Unit 4: Ideas in Context (Higher Tier)

Candidates answer on the Question Paper. A calculator may be used for this paper.	
OCR supplied materials: • Insert (inserted) **Other materials required:** • Pencil • Ruler (cm/mm)	**Duration:** 45 minutes

Candidate forename		Candidate surname	

Centre number						Candidate number					

MODIFIED LANGUAGE

INSTRUCTIONS TO CANDIDATES

* The Insert will be found in the centre of this document.
* 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 **40**.
* A list of physics equations is printed on page 2.
* The Periodic Table is printed on the back page.
* ✎ Where you see this icon you will be awarded marks for the quality of written communication in your answer.
* This document consists of **12** pages. Any blank pages are indicated.

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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

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

3

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Question 1 starts on page 4

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Answer **all** the questions.

1 **This question is based on the article 'Hypothermia – a hazard for mountaineers'.**

(a) Temperature regulation is an example of homeostasis.

(i) Name two **effectors** involved in the process of temperature regulation in humans.

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

(ii) Describe the function of the **hypothalamus** in temperature regulation.

One mark will be for writing in sentences with correct spelling, punctuation and grammar.

....

....

....

.... **[2+1]**

(iii) Homeostasis involves negative feedback.

What is negative feedback?

....

....

....

.... **[2]**

(b) The article gives a list of symptoms for hypothermia.

Fingers and toes can look pale when a person suffers from moderate hypothermia.

Use your knowledge of temperature regulation to explain how this happens.

....

....

....

.... **[2]**

(c) The core body temperatures of twenty mountaineers are recorded.

The temperatures (°C) are shown below.

33.5	33.7	33.9	34.2	34.5
34.9	35.1	35.6	35.8	36.0
36.1	36.8	36.9	37.0	37.2
37.4	37.4	37.8	37.9	38.0

(i) What percentage of the group of mountaineers have core body temperatures within the **normal** range stated in the article?

Show your working.

percentage = ... % **[1]**

(ii) The information in the article suggests that some of the mountaineers suffer from **hypothermia**.

What is the **mean** core body temperature of the mountaineers with hypothermia?

Show your working.

mean = ... °C **[1]**

(d) The article gives advice to help avoid hypothermia.

Explain why wearing wet clothes increases the risk of getting hypothermia.

....

....

....

.... **[2]**

(e) Respiration is a chemical reaction.

This reaction is controlled by enzymes.

Explain why severe hypothermia is so dangerous to the body.

....

....

....

.... **[2]**

[Total: 14]

Turn over

2 **This question is based on the article 'The dangers and delights of chlorine and bromine'.**

(a) Chlorine is extracted by passing electricity through a solution of sodium chloride dissolved in water.

Sodium chloride is an ionic compound.

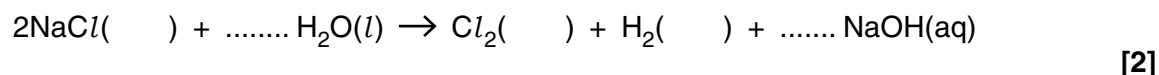**(i)** Explain how sodium chloride solution conducts electricity.

....

....

.... **[2]**

(ii) The equation shows what happens when electricity passes through the solution.

Complete the equation by

- adding numbers to balance the equation
- adding the missing state symbols.

$2NaCl(\quad) + ... H_2O(l) \rightarrow Cl_2(\quad) + H_2(\quad) + ... NaOH(aq)$

[2]

(iii) One of the products of the reaction is chlorine.

What are the names of the **other** two products of the reaction?

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

(b) At room temperature, iodine is a grey element in the solid state.

(i) Describe the **colour** and **state** of chlorine and bromine at room temperature.

....

.... **[2]**

(ii) The article explains why a large spillage of chlorine is more hazardous than a large spillage of bromine.

Suggest **two** reasons why.

....

....

.... **[2]**

(c) Chlorine, bromine and iodine all form ions with a single negative charge.

Use ideas about electron arrangements to explain why.

....

....

.... **[2]**

(d) Iodine is extracted from sodium iodide in sea water.

Sodium bromide and sodium iodide react in a similar way with chlorine.

(i) Explain why chlorine can be used to extract iodine from sodium iodide.

Use information from the article to help you.

....

....

.... **[1]**

(ii) The table shows some information about the physical properties of group 7 elements.

element	melting point in °C	boiling point in °C	density in g/cm³
chlorine	−101	−34	0.003
bromine	−7	59	3.1
iodine	114	184	4.9

How do these properties of group 7 elements change down the group?

....

.... **[1]**
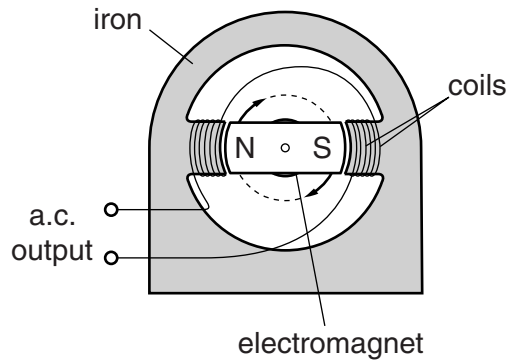
[Total: 13]

3 **This question is based on the article 'The National Grid'.**

(a) Describe and explain how this generator produces electricity.
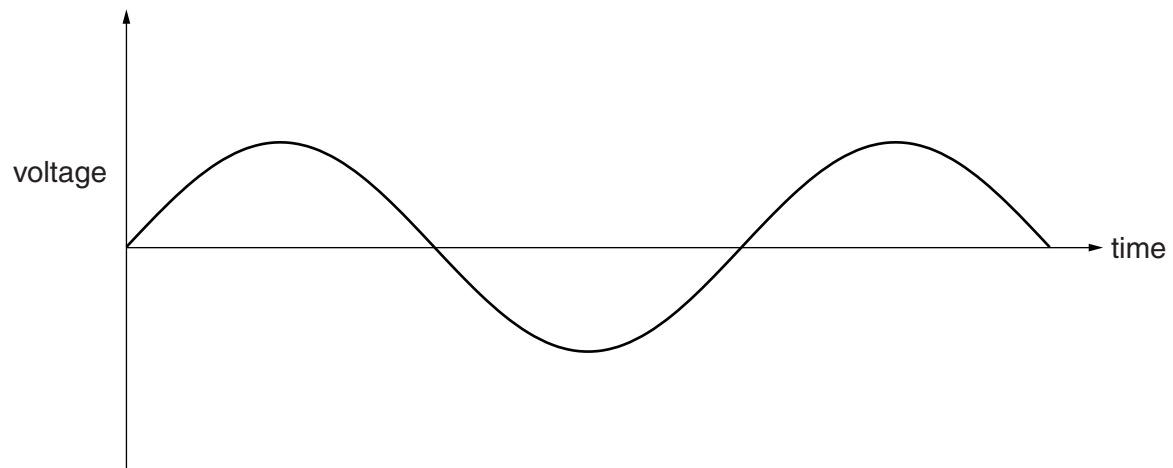
Use the diagram to help you.

iron

coils

N ∘ S

a.c.
output

electromagnet

....

....

....

....

.... **[4]**

(b) The graph shows how the output of the generator changes with time.

voltage

time

The magnet is now rotated twice as fast.

Draw the new output on the graph. **[2]**

(c) Energy is lost from the cables of the National Grid.

   (i) Explain how energy is lost from the cables.

   Your answer should include what happens inside the cables.

   ....

   ....

   ....

   .... **[3]**

   (ii) Why would it be a good idea to build new power stations in the south of the UK?

   ....

   ....

   ....

   .... **[2]**

(d) A particular transformer joins two parts of the National Grid.

The ratio of the number of turns in its primary coil to the number of turns in its secondary coil is 11 to 16.

Different parts of the National Grid operate at different voltages.

Between which two voltages quoted in the article, is the transformer working?

Show a calculation that supports your answer.

   the transformer converts .... kV into .... kV **[2]**

[Total: 13]

END OF QUESTION PAPER

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The Periodic Table of the Elements

Key

| relative atomic mass |
| atomic **symbol** |
| name |
| atomic (proton) number |

Example:
| 1 |
| **H** |
| hydrogen |
| 1 |

1	2											3	4	5	6	7	0
																	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

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.