Candidate forename		Candidate surname	

Centre number						Candidate number				

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GENERAL CERTIFICATE OF SECONDARY EDUCATION

A218/02

TWENTY FIRST CENTURY SCIENCE
ADDITIONAL SCIENCE A

Unit 4: Ideas in Context (Higher Tier)

TUESDAY 7 JUNE 2011: Afternoon
DURATION: 45 minutes

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

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)

READ INSTRUCTIONS OVERLEAF

DC (NF/SW) 11MEP06015 45411

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. Pencil may be used for graphs and diagrams only.**
- **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).**
- **Answer ALL the questions.**

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 three.**
- **The Periodic Table is provided.**
-  **Where you see this icon you will be awarded marks for the quality of written communication in your answer.**

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

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

Answer ALL the questions.

1 THIS QUESTION IS BASED ON THE ARTICLE 'ROCKET SCIENCE'.

(a) (i) Explain how the rocket engine makes the rocket move.

Your answer should include

- **the role of the exhaust gases**
- **the sizes and directions of the forces involved.**

_____

_____

_____

_____

_____ **[3]**

(ii) The rocket flies straight up.

At its highest point the rocket stops rising. It then falls.

What is the momentum of the rocket at its highest point?

momentum = _____ kg m/s [1]

(b) During which time period was the velocity of the rocket at its greatest?

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

0 to 2.5 seconds ☐

2.5 to 5 seconds ☐

5 to 7.5 seconds ☐

7.5 to 10 seconds ☐

10 to 15 seconds ☐

[1]

(c) As the rocket burns fuel, the total mass of the rocket changes.

Explain why this means that the rocket reaches a greater velocity than if its mass did not change.

_____

_____

_____ **[2]**

(d) The potential energy of the rocket at its highest point is 112 500 J.

(i) Show that the weight of the rocket at THE HIGHEST POINT is about 30 N.

You must show your calculation.

[2]

(ii) After reaching its highest point the rocket falls to the ground.

Once all the fuel has been used the rocket's mass is 3 kg.

Use ideas about energy to calculate the maximum possible speed of the rocket, when it hits the ground.

speed = _____ m/s [3]

(e) The rocket falls back to the ground due to the pull of gravity acting on it.

This force is one of a pair of interaction forces.

What does the other force of the interaction pair act on?

Put a (ring) around the correct answer.

AIR THE EARTH EXHAUST

GASES ROCKET SPACE

[1]

[Total: 13]

2 THIS QUESTION IS BASED ON THE ARTICLE 'BRAIN POWER – THE FRONTIER OF MEDICAL RESEARCH INTO AGEING'.

(a) The CENTRAL NERVOUS SYSTEM has two main parts.

One part is the brain.

What is the name of the other part?

_____ **[1]**

(b) Name TWO types of neuron.

answer _____ **and** _____ **[1]**

(c) The microscopic gap between two neurons is called a synapse.

Explain how a nerve impulse is transmitted across a synapse.

_____

_____

_____

_____

_____

_____ **[3]**

(d) Professor Yankner studied the brains of thirty people.

The people were aged between 26 and 106 years.

Two people were over 100 years old.

What PERCENTAGE of the group of people was over 100 years old?

Show your working.

answer = _____ % [2]

(e) Scientists are doing research into memory.

(i) What is MEMORY?

_____

_____ **[2]**

(ii) Some people are more likely to experience loss of MEMORY than loss of BALANCE as they get older.

What information in the article can be used to explain this?

_____

_____

_____ **[2]**

(iii) Older people may lose their SHORT-TERM memory but keep their LONG-TERM memory.

Use the INFORMATION PROCESSING MODEL to explain why.

One mark is awarded for writing in sentences with correct spelling, punctuation and grammar.

_____

_____

_____

_____

_____

_____ **[2+1]**

[Total: 14]

3 THIS QUESTION IS BASED ON THE ARTICLE 'COPPER – NOT JUST IN MOBILE PHONES'.

(a) Some of the metals used in mobile phones must be extracted using electrolysis rather than by heating with carbon.

Explain why.

_____ **[1]**

(b) Copper mines produce large amounts of waste rock.

The amount of waste rock is much larger than the amount of copper produced.

Explain why.

_____ **[1]**

(c) The 'electrolysis' process produces sulfuric acid.

Suggest how this sulfuric acid could be recycled in the process.

_____ **[1]**

(d) Both the 'blister' process and the 'electrolysis' process use large amounts of energy.

Each process uses the energy in different ways.

Use information from the flow diagrams to say how the energy is used in each process.

_____

_____ **[2]**

(e) (i) During the 'blister' process, sulfur is OXIDISED.

Explain what this means.

_____

_____ **[1]**

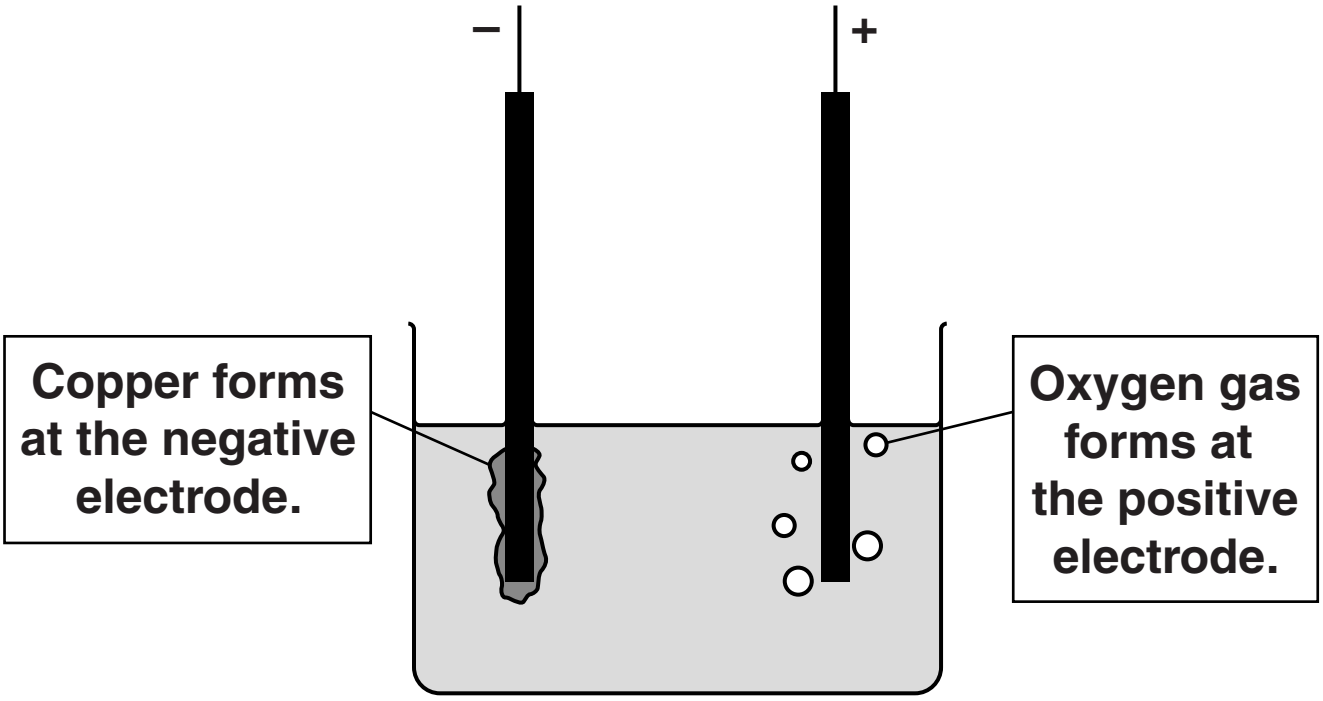
(ii) In the 'BLISTERING' step of the 'blister' process, copper sulfide reacts with oxygen.

Fill in the boxes to show the word equation and the balanced symbol equation for this reaction.

copper sulfide	**+**	**oxygen**	**→**		**+**	
Cu_2S	+	O_2	→		+	

[2]

(f) The diagram shows the products of the electrolysis of dilute copper sulfate solution.



During the electrolysis process, copper ions (Cu^{2+}) change to copper atoms.

Explain how this happens.

_____

_____

_____ **[2]**

(g) Copper sulfate is an ionic compound.

Copper sulfate solution and copper metal both conduct electricity.

Outline the differences between the ways that solutions and metals conduct electricity.

_____

_____

_____

_____

_____ **[3]**

[Total: 13]

END OF QUESTION PAPER

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.