| Candidate forename | | | | | Candidate surname | | | | |
|---|---|---|---|---|---|---|---|---|---|

| Centre number | | | | | Candidate number | | | | |
|---|---|---|---|---|---|---|---|---|---|

# OXFORD CAMBRIDGE AND RSA EXAMINATIONS
## GENERAL CERTIFICATE OF SECONDARY EDUCATION

# A218/01

# TWENTY FIRST CENTURY SCIENCE
# ADDITIONAL SCIENCE A

## Unit 4: Ideas in Context (Foundation 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**

## 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 <u>40</u>.

- 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

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

momentum = mass × velocity

change of momentum = resultant force × time for which it acts

work done by a force = force × distance moved in the direction of the force

change in energy = work done

change in GPE = weight × vertical height difference

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

## ELECTRIC CIRCUITS

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

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

energy transferred = power × time

power = potential difference × current

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

## THE WAVE MODEL OF RADIATION

wave speed = frequency × wavelength

**Answer ALL the questions.**

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

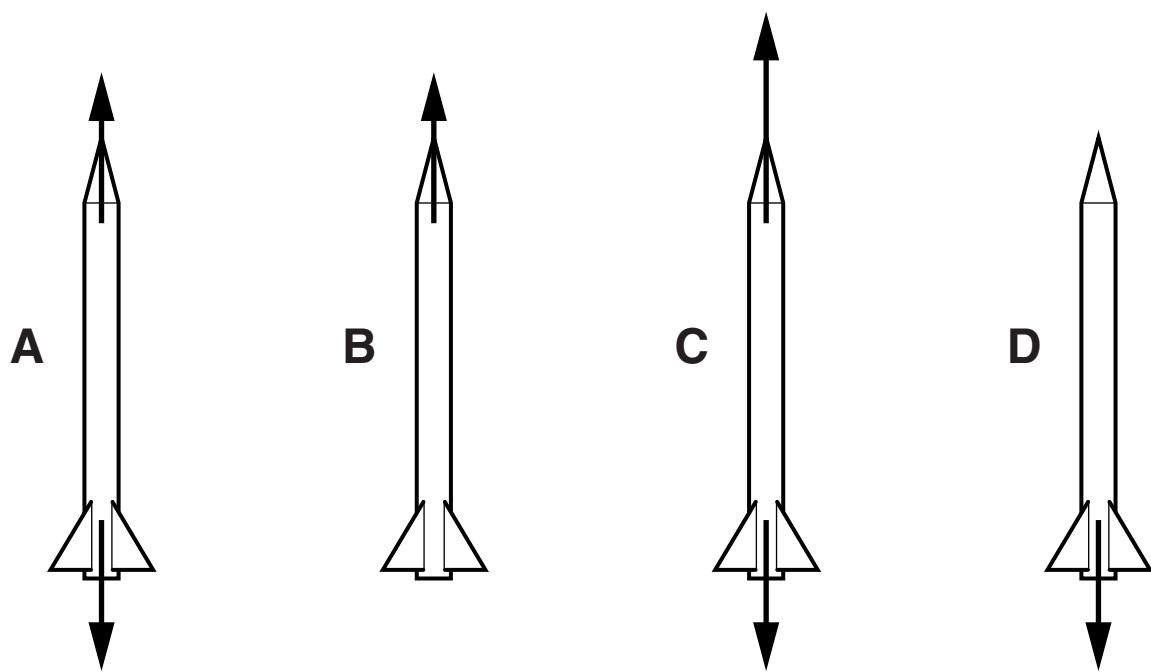   (a) **Use the graphs in the article to answer the following questions.**

      (i)  **How high does the rocket go?**

                              **answer = _____ m  [1]**

      (ii)  **At what time is the thrust biggest?**

                        **answer = _____ seconds  [1]**

**(b)** These diagrams show thrust and weight forces acting on the rocket.



Which diagram, A, B, C or D, shows the forces on the rocket …

… before the rocket engine starts?

answer _____

… when the rocket is increasing its speed going up?

answer _____

[2]

**(c)** The thrust from the rocket engine is the driving force.

Which TWO forces together act as the counter force, as the rocket goes up?

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

**(d)** When the rocket engine is firing, the average upwards force on the rocket is 1800 N.

The rocket engine works for 7 seconds.

What is the change in momentum of the rocket during this time?

You must show your working.

change in momentum = _____ Ns **[2]**

**(e)** After reaching its highest point the rocket falls back to the ground.

Complete the sentences about the energy changes as the rocket falls to the ground.

Use words from the list.

CHEMICAL

FORCE

GRAVITATIONAL POTENTIAL

KINETIC

As the rocket falls back to the ground, its

_____

energy increases.

As the rocket falls back to the ground, its

_____

energy decreases. [2]

**(f)** **(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]**

**[Total: 13]**

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

(a) **The CEREBRAL CORTEX is part of the human brain.**

(i) **Look at the article.**

**State TWO things that the cerebral cortex is involved in.**

1 _____

2 _____ **[1]**

(ii) **The cerebral cortex contains nerve cells called neurons.**

**What is the name of the GAP between two neurons?**

answer _____ **[1]**

(b) (i) **Which of the following are part of a neuron (nerve cell)?**

**Put a ⬭ring around the TWO correct answers.**

**CYTOPLASM**

**EFFECTOR**

**GLAND**

**MEMBRANE**

**[1]**

(ii) Name TWO types of neuron.

answer _____ and _____ [1]

(iii) Complete the sentences about neurons.

Use correct words from the list.

CHEMICAL

ELECTRICAL

IMPULSES

LIGHT

RESTING

STIMULATED

TURNED OFF

Neurons transmit _____ when

they are _____ .

These are _____ signals.    [3]

**(c)** The CENTRAL NERVOUS SYSTEM has two main parts.

One part is the brain.

What is the name of the other part?

_____ **[1]**

**(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)** People do not remember all of their experiences.

Use the INFORMATION PROCESSING MODEL, including the diagram, to suggest why.

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

_____

_____

_____

_____

_____ **[2+1]**

**(f)** What may happen to NEURON PATHWAYS in the brain when people become older?

_____

_____ **[1]**

**[Total: 14]**

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

(a) **The article mentions several metals that are used to make mobile phones.**

**Some of the metals are extracted from their compounds by heating with carbon and some are extracted by electrolysis.**

**Complete the table to show which method is used for each metal.**

**Use these metals.**

**ALUMINIUM**

**IRON**

**LITHIUM**

**ZINC**

| EXTRACTED BY HEATING WITH CARBON | EXTRACTED USING ELECTROLYSIS |
|---|---|
|  |  |

[2]

**(b)** From the article, give ONE EXAMPLE of an environmental problem caused by mining copper ore.

Give one method used by the mining industry to solve THIS problem.

environmental problem _____

_____

method to solve this problem _____

_____

[2]

**(c)** 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]

**(d)** The 'electrolysis' process produces sulfuric acid.

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

_____ [1]

(e) 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]

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

Complete the labels on the diagram.
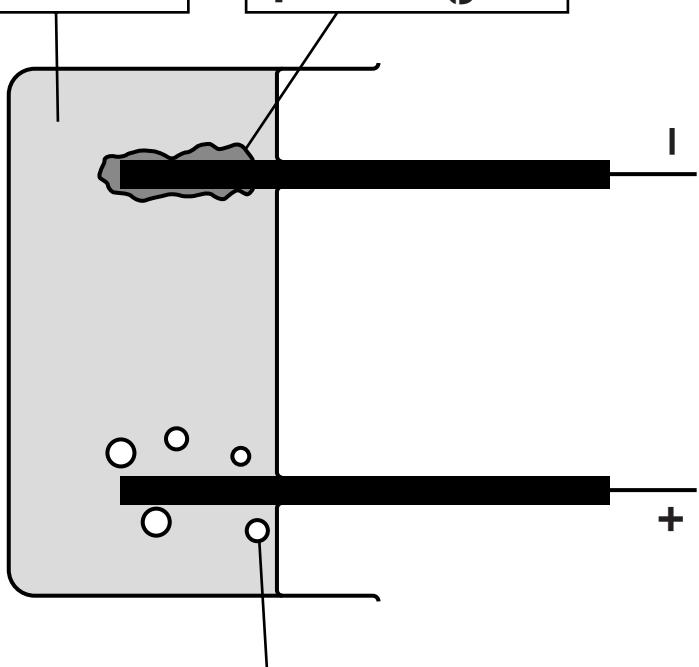
Use words from the list.

**ELECTRON**

**ELECTROLYTE**

**INDICATOR**

**NEGATIVE**

**NEUTRAL**

**POSITIVE**

Copper forms at the negative electrode because copper ions have a .................... charge.

A solution that conducts electricity is called an .......................... .

A gas forms at the positive electrode.

|

+

[2]

**(g)** The table in the article shows some properties of copper.

Copper is easily bent into shape when making jewellery.

Which property in the table shows this?

Put a ⟨ring⟩ around the correct answer.

**ELECTRICAL CONDUCTIVITY**

**MALLEABILITY**

**MELTING POINT**

**THERMAL CONDUCTIVITY**

[1]

**(h)** It is important that we recycle as much copper as possible rather than extract it from fresh ores.

Use information from the article to explain why.

_____

_____

_____

_____ [2]

[Total: 13]

**END OF QUESTION PAPER**

# The Periodic Table of the Elements

**Key**

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

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

| Group 1 | Group 2 | | | | | | | | | | | Group 3 | Group 4 | Group 5 | Group 6 | Group 7 | Group 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.