OCR
RECOGNISING ACHIEVEMENT

H

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE ADDITIONAL SCIENCE A

A218/02

Unit 4: Ideas in Context
(Higher Tier)

OCE/T76007

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)

Thursday 4 June 2009
Morning

Duration: 45 minutes

A218/02

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

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 two.
- The Periodic Table is printed on the back page.
- Where you see this icon you will be awarded a mark for the quality of written communication in your answer.
- This document consists of **12** pages. Any blank pages are indicated.

TWENTY FIRST CENTURY SCIENCE EQUATIONS

Useful Relationships

Explaining Motion

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

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

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

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

$$\text{change in energy} = \text{work done}$$

$$\text{change in GPE} = \text{weight} \times \text{vertical height difference}$$

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

Electric Circuits

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

$$\frac{V_p}{V_s} = \frac{N_p}{N_s}$$

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

$$\text{power} = \text{potential difference} \times \text{current}$$

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

The Wave Model of Radiation

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

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Question 1 starts on page 4.

Answer **all** the questions.

This question is based on the article 'Acids in the body'.

1 **(a)** Look at the results of the student's investigation.

(i) What happens to the rate of the reaction when the concentration changes?

.....

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

(ii) Use ideas about particles colliding to explain how changing the concentration affects the rate of reaction.

.....

.....

..... **[2]**

(iii) Why is it important to measure the **temperature** when the experiment is carried out?

.....

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

(b) Eve carries out an experiment to investigate how carbonates react with acid.
She adds some solid calcium carbonate to dilute hydrochloric acid in a beaker.

Complete the word and symbol equations for the reaction.
Balance the symbol equation.

calcium carbonate + hydrochloric acid → [ ] + [ ] + [ ]

$CaCO_3$ + [ ] → $CaCl_2$ + [ ] + [ ]

[3]

(c) The general equation for a neutralisation reaction is

$$H^+ + OH^- \longrightarrow H_2O$$

Use the equation to describe what happens during a neutralisation reaction.

.....

..... **[2]**

(d) The table shows some information about some compounds used in medicines.

Complete the table to show the **two** missing formulae.

name of compound	**formula**	**ions in compound**	
		names	**formula of ion**
magnesium carbonate	$MgCO_3$	magnesium ion carbonate ion	Mg^{2+} .....
sodium hydrogencarbonate	.....	sodium ion hydrogencarbonate ion	Na^+ HCO_3^-

[2]

(e) Calcium carbonate and sodium hydrogencarbonate are both used in medicines.
Sodium hydrogencarbonate works much better than calcium carbonate at neutralising acids in the **blood**.
Explain why.

.....

..... **[2]**

[Total: 13]

This question is based on the article 'Help for patients with kidney failure'.

2 **(a)** During dialysis, **urea** passes out of the blood into the dialysis fluid by diffusion.

(i) Explain why urea diffuses out of the blood into the dialysis fluid.

In your answer you should write about

- what happens during diffusion
- the concentration of urea.

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

.....

.....

.....

.....

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

(ii) How does a **partially permeable membrane** work?

.....

..... **[2]**

(iii) In a dialysis machine, the blood and the dialysis fluid flow in opposite directions.

How does this affect the diffusion of urea out of the blood?

.....

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

(b) Using the information provided, determine the percentage of the UK population likely to become patients with chronic kidney failure each year.

Show your calculations.

..... % **[2]**

(c) Why is it important to maintain balanced water levels in cells in the human body?

.....

.....

..... **[2]**

(d) Drinking alcohol affects the water balance in the human body.

What effect does alcohol have on the production of urine?

In your answer you should

- consider the volume and concentration of urine produced under these conditions
- describe how the production of ADH is affected by drinking alcohol.

.....

.....

.....

..... **[3]**

(e) The kidney is one of the organs in the human body involved in **homeostasis**.

What is homeostasis?

.....

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

[Total: 14]

This question is based on the article 'A time-line of scientific discoveries about light'.

3 **(a)** In 1817, Thomas Young showed that light is a transverse wave.

Describe the differences between a transverse wave and a longitudinal wave.

Your answer should include

- a labelled diagram of each type of wave
- the differences between them.

.....

.....

..... **[3]**

(b) In 1865, James Clerk Maxwell said that light was an electromagnetic wave.

State **two** ways in which electromagnetic waves are different from sound waves.

1 .....

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

(c) In 1861, Maxwell took the first colour photograph. He used red, yellow and blue filters and then recombined the images.

Give **two** differences, other than colour, between red, yellow and blue light waves.

.....

..... **[2]**

(d) In 1900, Max Planck suggested that light could be made up of packets of energy. These are now called photons.

In 1905, Albert Einstein showed that the intensity of a beam of light could be explained by thinking of light as a stream of photons.

Use ideas about light as a stream of photons to explain how light beams can have different intensities.

.....

..... **[2]**

(e) Einstein also proposed a theory that the speed of light in a vacuum is constant.
The speed of light is 300 000 000 m / s.

Calculate the frequency of an electromagnetic wave with a wavelength of 1.5 m.

frequency = ... unit ..... **[3]**

(f) Isaac Newton looked at the refraction of light through a prism.
Refraction is caused by waves changing speed.
Describe what happens to the wavelength **and** the frequency as a wave refracts.

.....

.....

..... **[2]**

[Total: 13]

END OF QUESTION PAPER

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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.