OCR
RECOGNISING ACHIEVEMENT

F

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE ADDITIONAL SCIENCE A

A218/01

Unit 4: Ideas in Context
(Foundation Tier)

OCE/T76000

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

A218801

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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PLEASE DO NOT WRITE ON THIS PAGE

Question 1 starts on page 4.

Answer **all** the questions.

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

1 **(a)** The article talks about how excess acid can cause problems in the body.

Give **two** examples, taken from the article, of problems that acids cause in the body.

.....

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

(b) Look at the results of the student's investigation.

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

.....

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

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

.....

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

(iii) Why is it important that the **volume of acid** is kept the same when the experiment is carried out?

.....

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

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

(i) Eve uses a pH meter to measure the pH of the acid at the start of the reaction.
It has a pH of 3.
What will happen to the pH of the acid as it is neutralised by the calcium carbonate?

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

(ii) What else could Eve use, other than a pH meter, to measure pH?

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

(iii) Eve writes a word and a symbol equation for the reaction.
Complete the equations by filling in the boxes.

calcium carbonate + hydrochloric acid → calcium chloride + [ ] + carbon dioxide

$CaCO_3$ + 2HCl → $CaCl_2$ + H_2O + [ ]

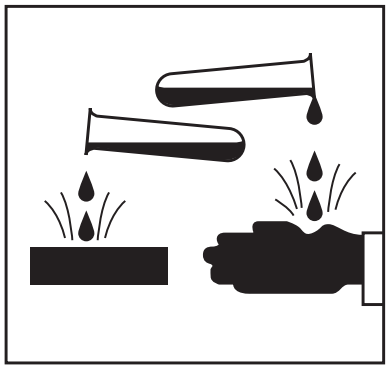
[2]

(iv) Eve notices that bubbles form around the calcium carbonate.
Why do bubbles form?

.....

[1]

(d) Eve sees this hazard symbol on the container for the acid.



(i) What does this symbol mean?

.....

[1]

(ii) What precautions should Eve take when handling an acid?

.....

.....

[1]

(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)** A healthy kidney balances water levels. This process is affected by **alcohol**.

Name **two** other factors, from the article, that affect this process in healthy kidneys.

1 .....

2 .....

[2]

(b) Drinking **alcohol** causes the body to produce a greater volume of urine.

The urine is more dilute than normal.

What effect does drinking alcohol have on the level of water in the body?

.....

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

(c) **(i)** Small molecules, such as water, are filtered out of the blood plasma by the kidneys.

Name **two** other substances that kidneys filter **out** of the blood plasma.

1 .....

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

(ii) Explain why red blood cells are **not** filtered out of the blood.

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

(iii) Why is sugar **not** normally found in the urine produced by healthy kidneys?

.....

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

(d) 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]**

(e) Look at the figures given in the section **'Some more facts about dialysis'**.

Calculate the **maximum number of hours** spent by a patient using the dialysis machine **each week**.

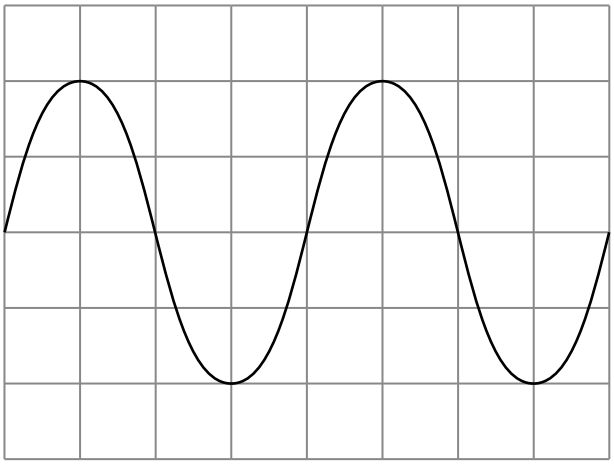
Show your calculations.

..... hours per week **[2]**

[Total: 14]

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

3 **(a)** In 1690 Christiaan Huygens described light as a wave.
The diagram shows the side view of a wave.



On the diagram, label the

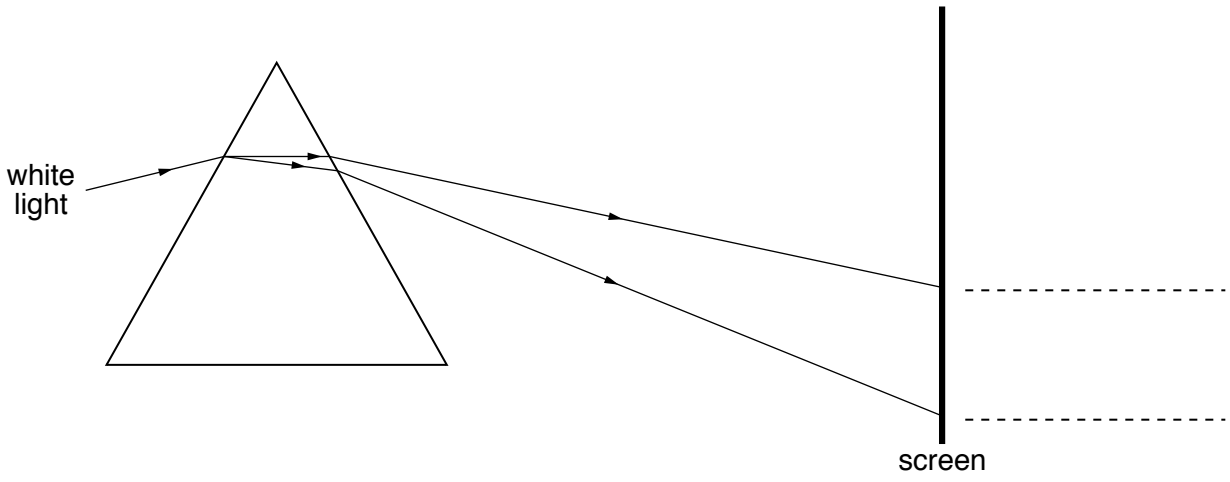
(i) amplitude

(ii) wavelength.

[2]

(b) Isaac Newton showed that white light is made of many colours by refracting it through a prism.
Blue light is refracted more than red light.

(i) The diagram shows refraction through a prism.
Label the diagram to show where these colours are on the screen.



[1]

(ii) What happens to the waves that makes them change direction as they enter the glass prism?

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

(c) Newton and Huygens disagreed about whether light is made of particles or waves.

Which of the following could **only** be explained by thinking about light as a wave?
Put a ring around the correct answer.

interference **reflection** **refraction** **energy transfer**

[1]

(d) 240 years after Newton, Albert Einstein used the idea that all types of electromagnetic radiation could be packets of energy.

(i) What is the modern name for a packet of energy?

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

(ii) What feature is the same for all types of electromagnetic radiation?

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

(iii) Light is one type of electromagnetic radiation.
Write down the names of **two** other types.

1 .....

2 .....

[2]

(e) 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]**

Turn over for the remainder of question 3

(f) In 1865, James Clerk Maxwell said that light is an electromagnetic wave.

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

1 .....

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

[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.