

<b>Candidate Forename</b>		<b>Candidate Surname</b>	
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<b>Centre Number</b>						<b>Candidate Number</b>				
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**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)**

**THURSDAY 4 JUNE 2009: Morning  
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 clearly in capital letters, your Centre Number and Candidate Number in the boxes on the first page.
- 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.
- 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 three.
- 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.

## 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

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

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]

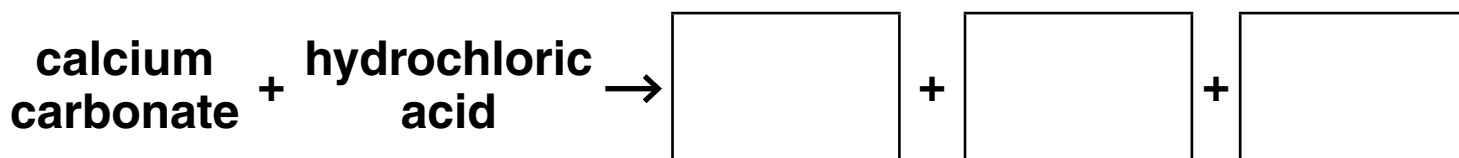
(iii) Why is it important to measure the TEMPERATURE when the experiment is carried out?

\_\_\_\_\_  
\_\_\_\_\_ [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.

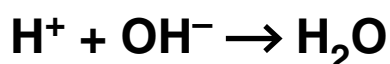
Complete the word and symbol equations for the reaction.

Balance the symbol equation.



[3]

- (c) The general equation for a neutralisation reaction is



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

\_\_\_\_\_

\_\_\_\_\_ [2]

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

**Complete the table opposite to show the TWO missing formulae.**

**(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]**

<u>NAME OF COMPOUND</u>	<u>FORMULA</u>	<u>IONS IN COMPOUND</u>	
		<u>NAMES</u>	<u>FORMULA OF ION</u>
magnesium carbonate	MgCO <sub>3</sub>	magnesium ion carbonate ion	Mg <sup>2+</sup> _____
sodium hydrogencarbonate	_____	sodium ion hydrogencarbonate ion	Na <sup>+</sup> HCO <sub>3</sub> <sup>-</sup>

[2]

**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.**

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**[2+1]**

**(ii) How does a PARTIALLY PERMEABLE MEMBRANE work?**

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**[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?**

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**[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.**

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**[3]**

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

**What is homeostasis?**

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[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.**

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**[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, green and blue filters and then recombined the images.**

**Give TWO differences, other than colour, between red, green 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.

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[2]

[Total: 13]

**END OF QUESTION PAPER**

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