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)

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

DC (LEO) OV90857 11369/1

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.

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

$CaCO_3$ + [ ] → $CaCl_2$ + [ ] + [ ]

[3]

(c) The general equation for a neutralisation reaction is

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

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]

7

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]

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, 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.

_____

_____

_____ [2]

[Total: 13]

END OF QUESTION PAPER

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