Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
TOTAL	

General Certificate of Education
Advanced Level Examination
June 2012

Physics A PHYA5/2B

Unit 5B Medical Physics
Section B

Monday 18 June 2012 9.00 am to 10.45 am

For this paper you must have:
- a calculator
- a ruler
- a Data and Formulae Booklet (enclosed).

Time allowed
- The total time for both sections of this paper is 1 hour 45 minutes. You are advised to spend approximately 50 minutes on this section.

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.
- Show all your working.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this section is 35.
- You are expected to use a calculator where appropriate.
- A *Data and Formulae Booklet* is provided as a loose insert.
- You will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.

Section B

The maximum mark for this section is 35. You are advised to spend approximately 50 minutes on this section.

1 (a) State the changes which occur in a normal eye when

1 (a) (i) the eye changes from focussing on a distant object to focussing on a near object, both objects being viewed in bright light

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(2 marks)

1 (a) (ii) the eye changes from viewing an object in very dim light to viewing the same object in bright light.

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(2 marks)

1 (b) State **two** differences in the perceived image of a coloured object viewed in bright white light compared to the perceived image of the same object viewed in very dim white light.

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(2 marks)

1 (c) (i) A patient's eye is astigmatic. State the effect of astigmatism on the image produced by the defective eye.

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(1 mark)

1 (c) (ii) State the usual cause of astigmatism.

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(1 mark)

1 (c) (iii) State the shape of lens used to correct astigmatism.

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(1 mark)

9

Turn over for the next question

2 (a) A sound source of constant output power is used to generate a sound which is measured using a sound meter. When set to the dB scale, the sound meter displayed 60 dB as the reading when the frequency of the sound was 1 kHz.

2 (a) (i) State and explain what the reading would be for a sound of frequency 1 kHz if the meter was changed to the dBA scale.

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(1 mark)

2 (a) (ii) State and explain what would happen to the reading on **each** scale if the frequency of the sound was changed to 500 Hz.

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(2 marks)

2 (b) A drill is operated in an otherwise silent room. The drill produces sound of power 2.0 W which is given out equally in all directions. A sound meter is placed 5.0 m from the drill and is set to the dB scale.
Calculate the reading on the sound meter.

$I_0 = 1.0 \times 10^{-12}$ W m^{-2}

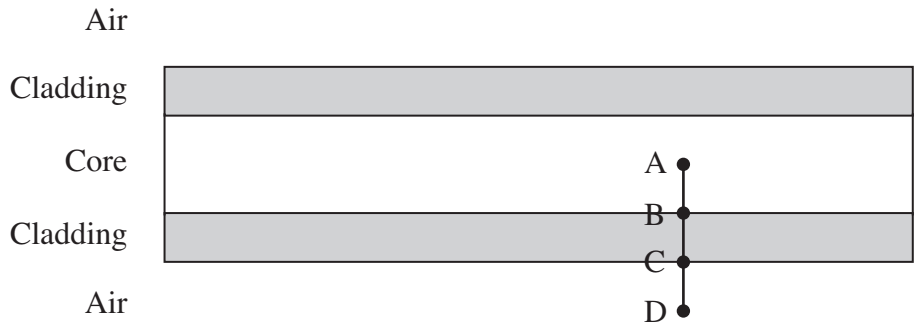
answer = ... dB

(3 marks)

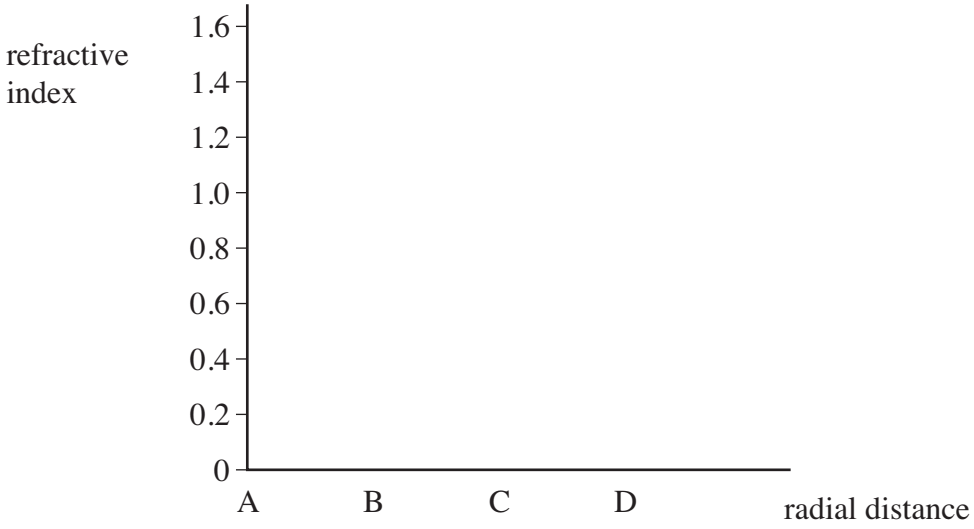
6

3 (a) **Figure 1** shows the cross-section through a clad optical fibre which has a core of refractive index 1.50.

Figure 1



Complete the graph below to show how the refractive index changes with the radial distance along the line ABCD in **Figure 1**.



(3 marks)

3 (b) In the optical system of a flexible endoscope there are two types of fibre bundles, coherent and non-coherent. Explain the purpose of each of these two types of bundle.

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(2 marks)

5

4 (a) Explain how and why ultrasound is used to obtain an image of an unborn foetus.
You might consider the following points in your answer

- the method of obtaining the image
- practical considerations for the scan
- safety issues.

The quality of your written communication will be assessed in this question.

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(6 marks)

4 (b) Explain why the pulses of ultrasound used in medical imaging must be of short duration.

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(2 marks)

8

Turn over for the next question

5 (a) In an X-ray tube, electrons are accelerated from rest through a pd of 72.4 kV before they hit the target anode.

5 (a) (i) Calculate the kinetic energy of an electron as it reaches the anode. Give your answer to an appropriate number of significant figures.

answer = ... J

(2 marks)

5 (a) (ii) Assuming that the electron gives up all this energy to form an X-ray photon, calculate the wavelength of the photon.

answer = ... m

(2 marks)

5 (b) X-rays are used in a CT scanner. Describe briefly how a CT scanner produces an image.

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(3 marks)

7

END OF QUESTIONS

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