

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.



J U N 1 2 P H Y A 5 2 B 0 1

**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
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**Turn over for the next question**

**Turn over ►**



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.

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

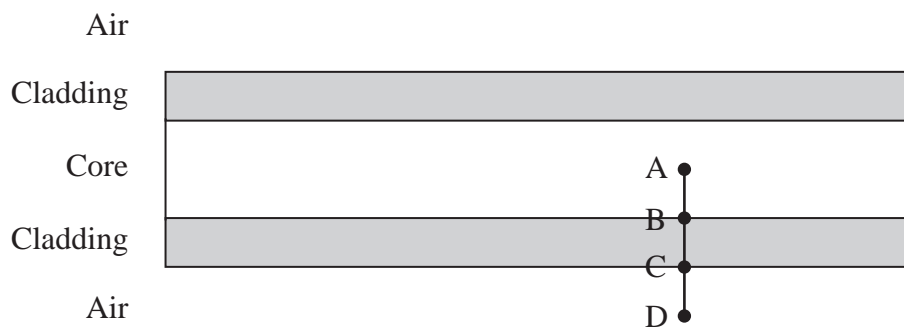
answer = ..... dB  
(3 marks)

6

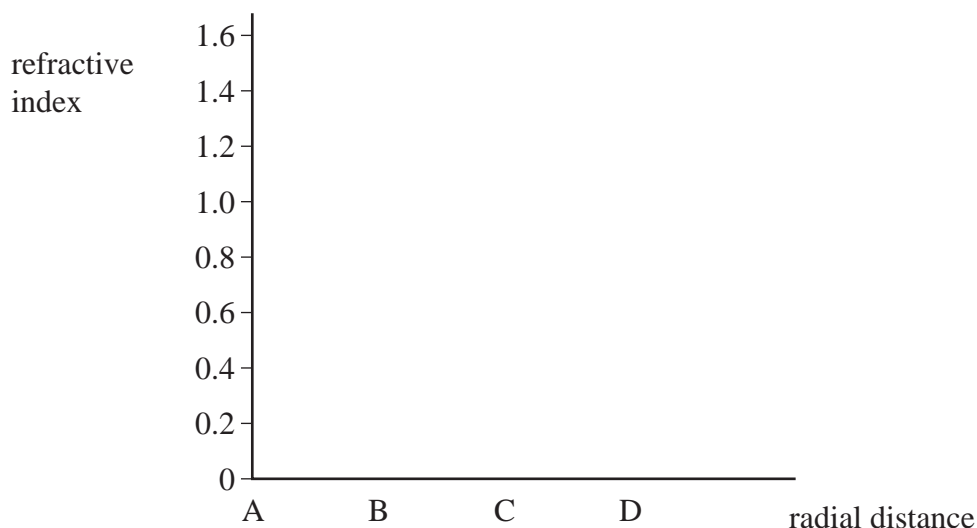


3 (a) **Figure 1** shows the cross-section through a clad optical fibre which has a core of refractive index 1.50.

**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)

Turn over ►





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

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*(2 marks)*

8
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**Turn over for the next question**

**Turn over ►**



- 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
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**END OF QUESTIONS**



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