

|                     |  |  |  |  |  |                  |  |  |  |  |
|---------------------|--|--|--|--|--|------------------|--|--|--|--|
| 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

WMP/Jun12/PHYA5/2B

**PHYA5/2B**

**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

.....

.....

.....

.....

.....

(2 marks)

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

.....

.....

.....

.....

.....

(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.

.....

.....

.....

.....

.....

.....

(2 marks)



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

.....

.....

.....

(1 mark)

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

.....

.....

(1 mark)

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

.....

(1 mark)

9

**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.

.....

.....

.....

(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.

.....

.....

.....

.....

.....

.....

(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.

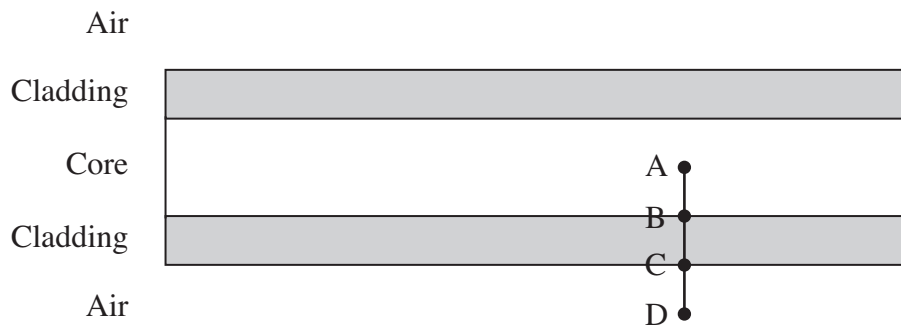
$$I_0 = 1.0 \times 10^{-12} \text{ W m}^{-2}$$

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

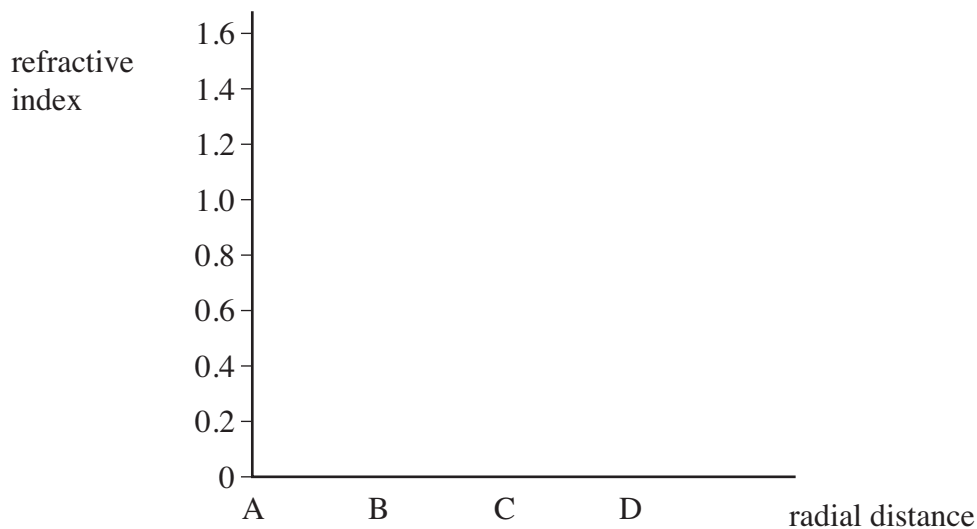


- 3 (a)** **Figure 1** shows the cross-section through a clad optical fibre which has a core of refractive index 1.50.

**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.

.....

.....

.....

.....

.....

.....

(2 marks)



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

[illegible]

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

.....

.....

.....

.....

.....

.....

(2 marks)

8

**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.

.....

.....

.....

.....

.....

.....

.....

.....

.....

(3 marks)

7

**END OF QUESTIONS**



**There are no questions printed on this page**

**DO NOT WRITE ON THIS PAGE  
ANSWER IN THE SPACES PROVIDED**



**There are no questions printed on this page**

**DO NOT WRITE ON THIS PAGE  
ANSWER IN THE SPACES PROVIDED**



**There are no questions printed on this page**

**DO NOT WRITE ON THIS PAGE  
ANSWER IN THE SPACES PROVIDED**

