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.

Do not write outside the box

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)

Do not write outside the box

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

Do not write outside the box

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

answer = ... dB

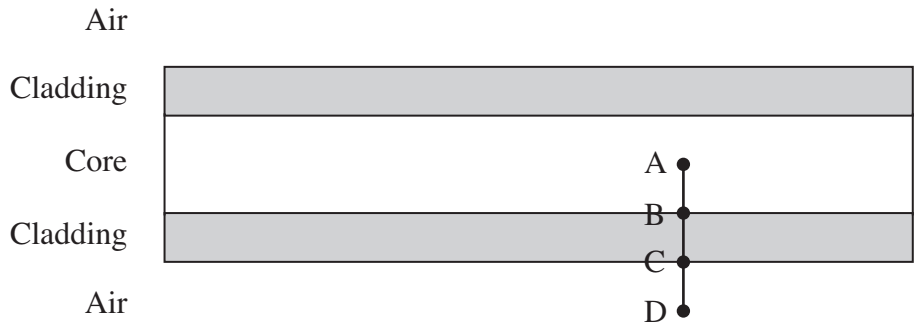
(3 marks)

6

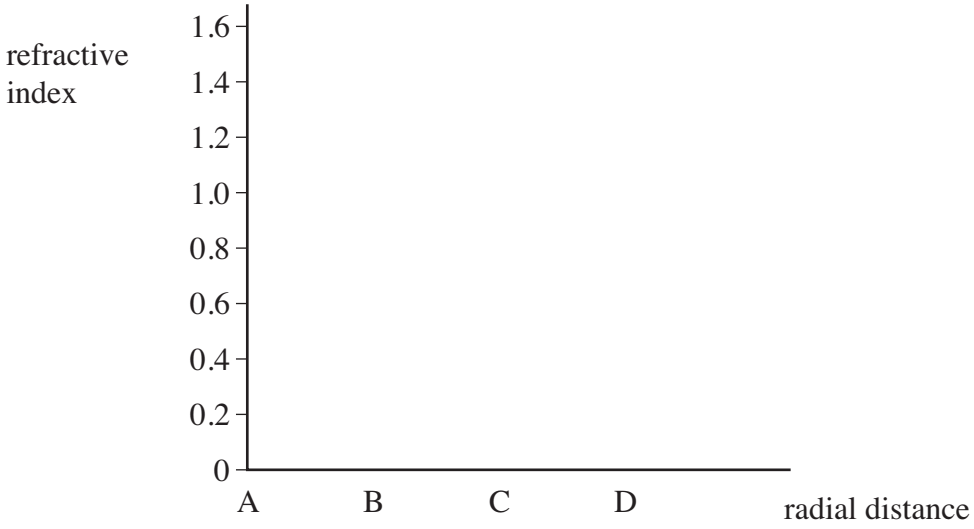
Do not write outside the box

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)

5

Turn over ▶

Do not write outside the box

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.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(6 marks)

Do not write outside the box

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

Do not write outside the box

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)

Do not write outside the box

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

Copyright © 2012 AQA and its licensors. All rights reserved.