Centre Number						Candidate Number				
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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 2011

Physics A PHYA5/2B

Unit 5B Medical Physics
Section B

Monday 27 June 2011 9.00am to 10.45am

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

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.

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.

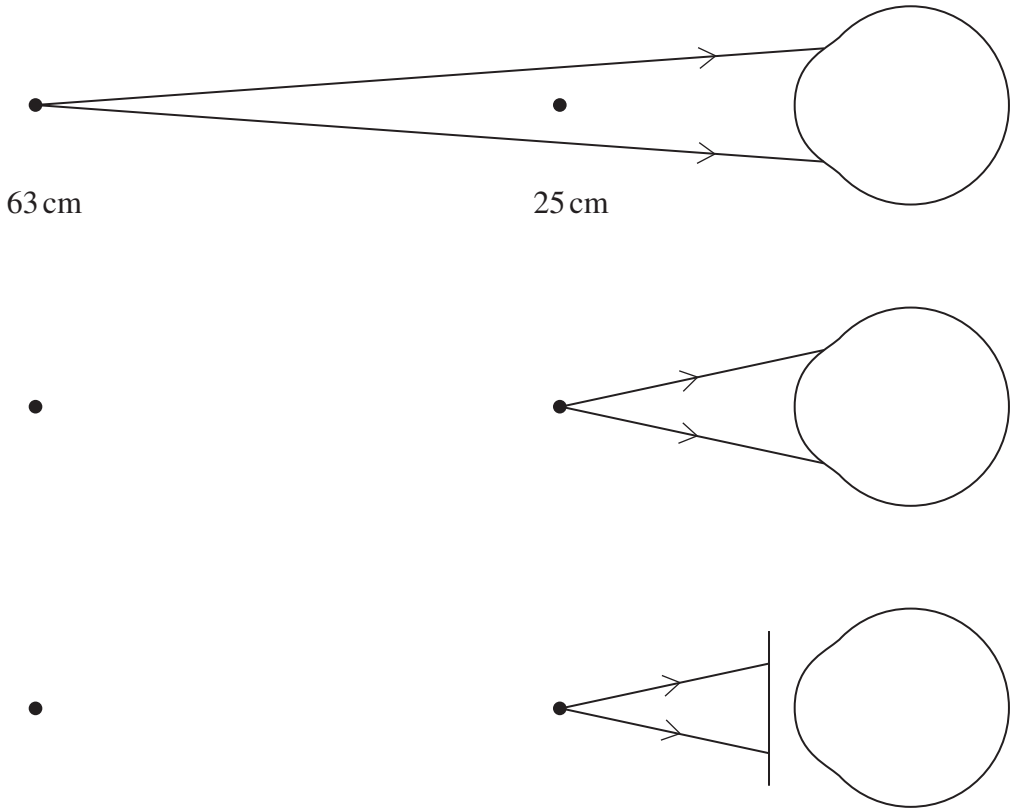
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Section B

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

1 (a) A person suffering from long sight has an unaided near point 63 cm from the eye. **Figure 1** shows three diagrams not drawn to scale. The first two diagrams show rays incident on the unaided eye. The third diagram shows rays incident on the correcting lens which will allow the person to have an aided near point 25 cm from the eye. Complete the diagrams to show the passage of the rays to the retina. You may assume that for the eye there is only a single refraction at the cornea of the eye.

Figure 1



(2 marks)

1 (b) Calculate the focal length of the correcting lens, stating the answer to the appropriate number of significant figures.

answer = ... m

(3 marks)

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1 (c) Explain what is meant by persistence of vision and state a practical situation where it is important.

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(2 marks)

7

Turn over for the next question

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2 (a) Define the threshold of hearing, I_0.

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(2 marks)

2 (b) A hearing test was used to obtain threshold hearing audiograms for several people. The audiogram shown in **Figure 2** was obtained for a person with normal hearing.

On the same axes:

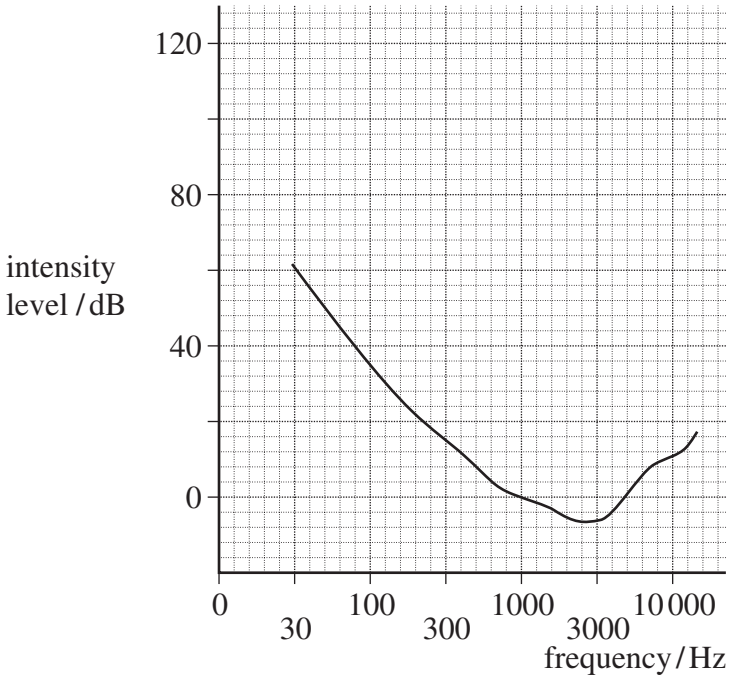
2 (b) (i) sketch a curve, labelled **A**, for a person suffering hearing loss due to old age

(1 mark)

2 (b) (ii) sketch a curve, labelled **B**, for a person suffering hearing loss due to excessive noise.

(2 marks)

Figure 2



5

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3 An endoscope contains two bundles of optical fibres.

3 (a) Name the two bundles. For each bundle state clearly the arrangement of the fibres and explain its purpose in the operation of the endoscope.

Bundle 1 .....

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Bundle 2 .....

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(4 marks)

3 (b) Each fibre has a core surrounded by cladding.
Calculate the critical angle at the core – cladding interface of a fibre.

refractive index of core = 1.60
refractive index of cladding = 1.55

answer = ... degree
(1 mark)

5

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4 (a) An ECG trace is to be obtained for a patient. State and explain the procedure and some design features of the equipment needed to ensure a good trace is obtained.

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

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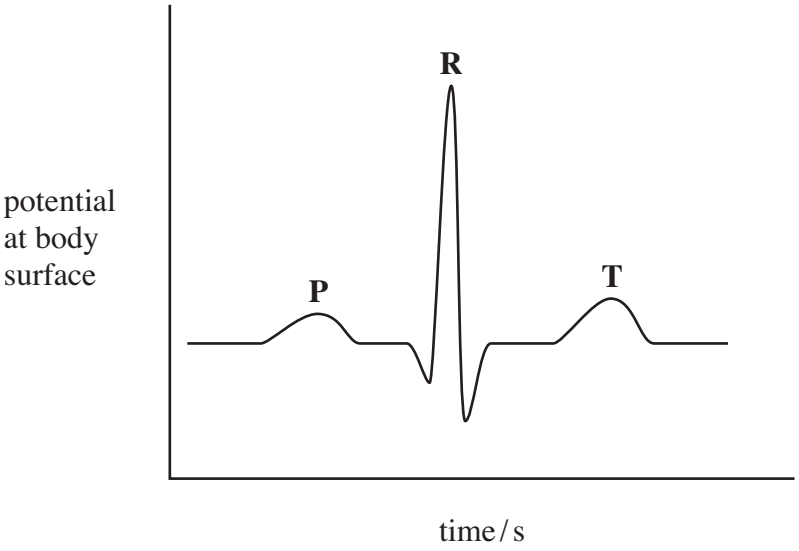
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(6 marks)

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4 (b) **Figure 3** shows an ECG trace for a healthy person.

Figure 3



4 (b) (i) Add a suitable scale and unit to the potential axis.

(2 marks)

4 (b) (ii) Add a suitable scale to the time axis.

(1 mark)

4 (b) (iii) State the electrical events which give rise to the points:

P .....

R .....

T .....

(3 marks)

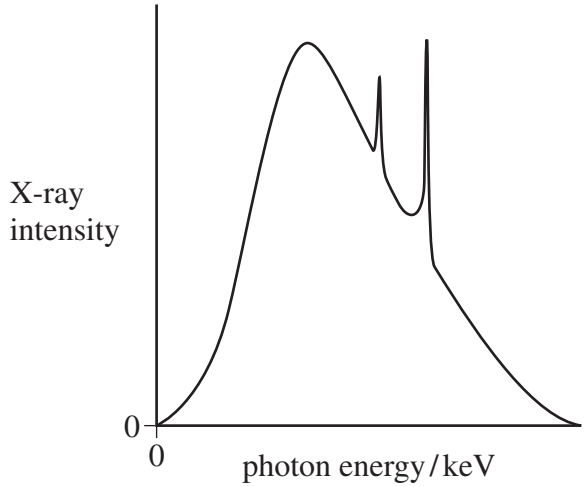
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Turn over for the next question

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5 (a) The X-ray spectrum for a certain X-ray tube target is shown in **Figure 4**. Explain the process which gives rise to spikes at certain photon energies.

Figure 4



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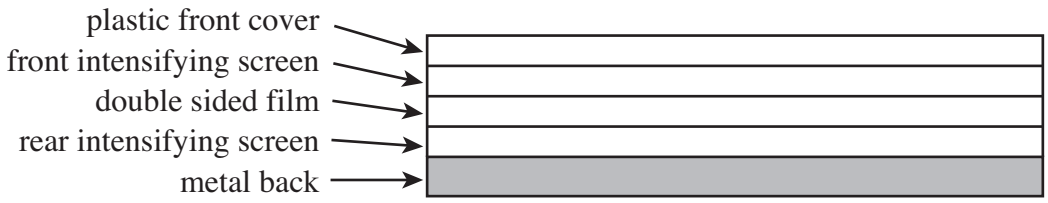
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(3 marks)

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5 (b) A film cassette, placed under a patient being X-rayed, is shown in **Figure 5**.

Figure 5



5 (b) Explain how the intensifying screens in the film cassette achieve their purpose and state their benefit to the patient.

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(3 marks)

6

END OF QUESTIONS

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