| Centre Number | | | | | | Candidate Number | | | | |
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| 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 2015

# Physics A PHYA5/2B

**Unit 5B Medical Physics**
**Section B**

Thursday 18 June 2015 9.00 am to 10.45 am

**For this paper you must have:**
- a calculator
- a pencil and 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.

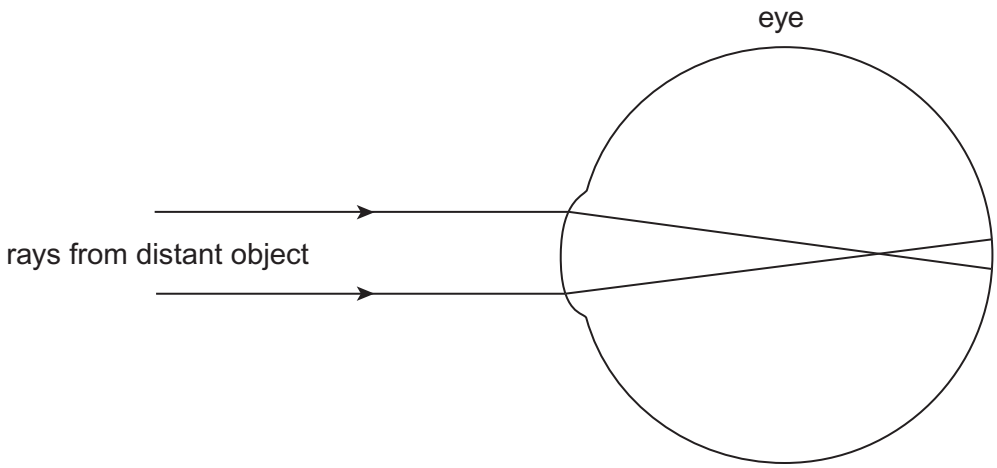
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## Section B

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

**1 (a)** **Figure 1** is a simplified ray diagram which shows light rays from a distant object being focused at a point in front of the retina.

**Figure 1**




**1 (a) (i)** What is this defect of vision?
Tick (✓) the correct answer.

**[1 mark]**

| | |
|---|---|
| astigmatism | |
| hypermetropia / long sight | |
| myopia / short sight | |

**1 (a) (ii)** On **Figure 1**, draw in front of the eye a suitable lens to correct this type of defect of vision.

**[1 mark]**

**1 (a) (iii)** Complete the new diagram by drawing the path of the two rays from the distant object as they pass through the correcting lens and the eye.

**[2 marks]**

Do not write outside the box

**1 (b)** The unaided far point of the defective eye is $0.75$ m.

**1 (b) (i)** Explain why the focal length of the correcting lens used should be $-0.75$ m.

**[1 mark]**

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**1 (b) (ii)** Calculate the power of this correcting lens.

**[1 mark]**

power = ..... D

**1 (b) (iii)** The unaided near point of the defective eye is $0.15$ m.

Calculate the distance of the aided near point from the eye when the lens of focal length $-0.75$ m is used. Give your answer to a suitable number of significant figures.

**[3 marks]**

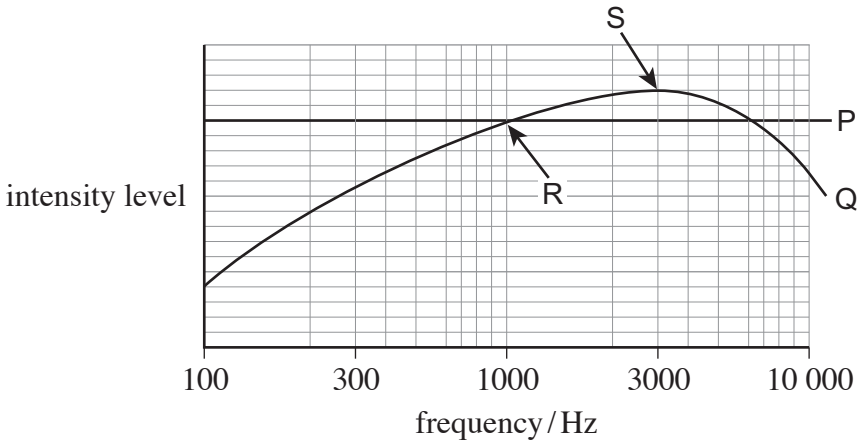
aided near point distance = ..... m

9

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**2 (a)** A variable-frequency sound source produces sound of equal intensity at all frequencies. Two sound meters are placed at equal distances from the source. The two meters are set on different scales. Lines P and Q on **Figure 2** show how the intensity level indicated by each meter varies with frequency.

**Figure 2**




**2 (a) (i)** State and explain which sound meter scale is used for line P.

**[2 marks]**

.....

.....

.....

**2 (a) (ii)** State and explain which sound meter scale is used for line Q.

**[2 marks]**

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**2 (b) (i)** Explain the significance of the point R.

**[1 mark]**

.....

.....

**2 (b) (ii)** Explain the significance of the point S.

**[1 mark]**

.....

.....

**2 (c)** A sound of intensity level 95 dB is incident on a human ear.
Calculate the intensity incident on the ear drum.

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

**[2 marks]**

intensity = ..... W m$^{-2}$

8

**Turn over for the next question**

*Do not write outside the box*

**3** An ECG trace is to be obtained for a healthy patient. Describe the procedure involved to ensure that a good trace is obtained. Your answer should include reference to:

- connections to the body
- how unwanted signals are avoided
- some properties of the amplifier used.

The quality of your written communication will be assessed in your answer.

**[6 marks]**

*Do not write outside the box*

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**Turn over for the next question**

Do not write outside the box

**4 (a)** An endoscope uses **coherent** and **non-coherent** fibre bundles.

**4 (a) (i)** State the use of the **coherent** bundle and describe its arrangement of fibres.

**[2 marks]**

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**4 (a) (ii)** State the use of the **non-coherent** bundle and describe its arrangement of fibres.

**[2 marks]**

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

refractive index of core = 1.52
refractive index of cladding = 1.49

**[1 mark]**

critical angle = ..... degree

5

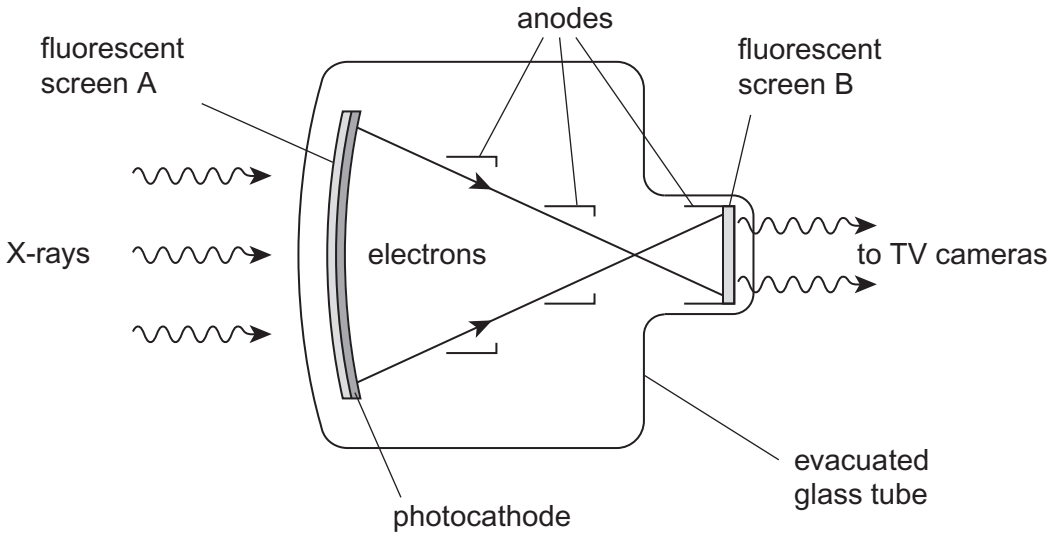
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**ANSWER IN THE SPACES PROVIDED**

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**5 (a)** **Figure 3** shows a fluoroscopic image intensifier.

**Figure 3**




State the purpose of each of the following components of the intensifier.

**5 (a) (i)** fluorescent screen A,

**[1 mark]**

.....

.....

**5 (a) (ii)** photocathode,

**[1 mark]**

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**5 (a) (iii)** anodes,

**[2 marks]**

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**5 (a) (iv)** fluorescent screen B.

**[1 mark]**

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**5 (b)** A patient is asked to swallow a suspension of barium sulfate before X-ray images are to be obtained. This is known as a barium meal technique.
Explain why the patient needs to swallow the barium sulfate.

**[2 marks]**

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7

**END OF QUESTIONS**

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