

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

A-level PHYSICS

Paper 3

Section B Medical physics

Thursday 14 June 2018

Morning

Time allowed: The total time for both sections of this paper is 2 hours. You are advised to spend approximately 50 minutes on this section.

Materials

For this paper you must have:

- a pencil and a ruler
- a scientific calculator
- a Data and Formulae Booklet.

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 paper is 35.
- You are expected to use a scientific calculator where appropriate.
- A Data and Formulae Booklet is provided as a loose insert.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
TOTAL	



Section B

Answer **all** questions in this section.

0 1 . 1

An endoscope is used to view an area inside the body. The endoscope contains two bundles of optical fibres.

Name each bundle and explain its use in the process.

[4 marks]

Bundle 1 _____

Bundle 2 _____



0 1 . 2

A single optical fibre is placed in air. The optical fibre has a core surrounded by cladding. The critical angle is 75° at the core-cladding boundary.

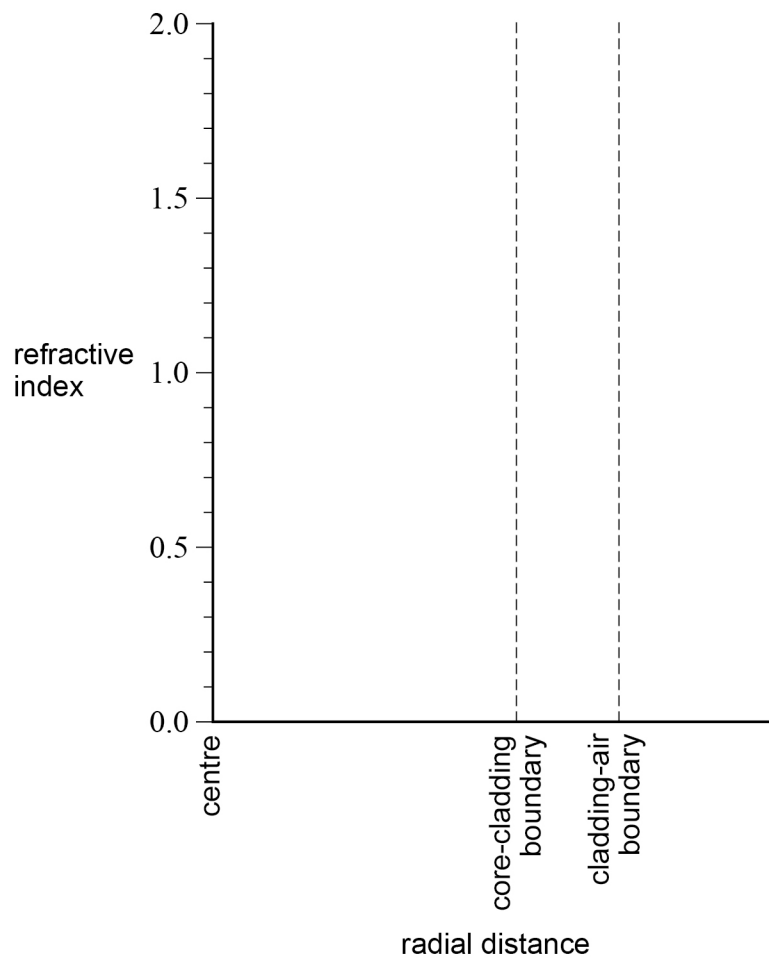
Complete **Figure 1** to show how the refractive index varies with radial distance from the centre of the core to the air surrounding the fibre.

Your answer should be supported by a suitable calculation.

refractive index of core = 1.6

[2 marks]

Figure 1



6

Turn over ►



0 2 . 1

The fovea in a typical human eye consists of cones which have an average diameter of 1.5×10^{-6} m

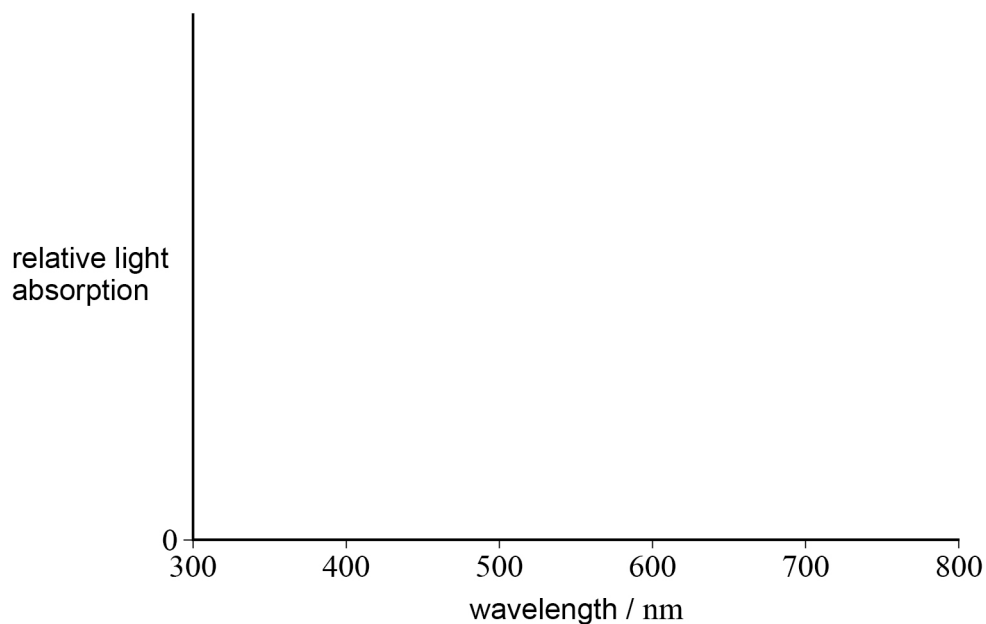
An eye looks directly at two point sources of light which are 12 mm apart at a distance of 61 m from the centre of the eye lens. The fovea is at the centre of the retina a distance of 21 mm behind the centre of the eye lens.

Deduce whether the eye would be able to resolve the two images formed at the fovea. **[4 marks]**

0 2 . 2

Three types of cone are present at the fovea.

On **Figure 2** sketch and clearly label **three** curves to show how the relative light absorption of each type of cone varies with wavelength.

[3 marks]**Figure 2**

7



Turn over for the next question

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

Turn over ►



0 4 . 2

Mesh barriers are set up to keep pedestrians at a safe distance from a noisy drill. The maximum noise level which pedestrians should be subjected to is 110 dB. The drill emits sound with a power of 7.8 W and acts as a point source. The mesh barriers are set up a distance of 2.0 m from the drill.

Discuss whether this will keep pedestrians at a safe distance from the sound source.

[4 marks]

8

Turn over for the next question

Turn over ►



0 5 . 3 The half-value thickness of lead for 500 keV X-rays is 4.2×10^{-3} m

Calculate the mass attenuation coefficient of lead for 500 keV X-rays.

State an appropriate unit for your answer.

$$\text{density of lead} = 1.1 \times 10^4 \text{ kg m}^{-3}$$

[4 marks]

mass attenuation coefficient = _____ unit _____

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END OF QUESTIONS



There are no questions printed on this page

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