AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

A-level PHYSICS A

Unit 5B Medical Physics
Section B

Wednesday 21 June 2017 Morning

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.

Materials

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

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.

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

Section B

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

1 (a) A person views a flashing white light source in a darkened room. Each flash lasts for $0.01\,\text{s}$ and initially the light is flashing at a frequency of $1\,\text{Hz}$.

1 (a) (i) Describe how the person's perception of the light source changes as the frequency of the flashing light source is slowly increased from $1\,\text{Hz}$ to $40\,\text{Hz}$.

[2 marks]

1 (a) (ii) State the physiological process involved.

[1 mark]

1 (b) A person with a defective eye wears spectacles to see clearly a small real object. The object is placed at the aided near point of the eye, $25.0\ \text{cm}$ from the correcting lens. The power of the correcting lens is $+2.10\ \text{D}$.

1 (b) (i) Calculate, in cm, the image distance of the image formed by the correcting lens. Give your answer to an appropriate number of significant figures.

[3 marks]

image distance = _____ cm

1 (b) (ii) What does the image distance represent, with reference to the defective eye? Tick (✓) the correct box.

[1 mark]

- aided far point ☐
- focal length of correcting lens ☐
- unaided far point ☐
- unaided near point ☐

Question 1 continues on the next page

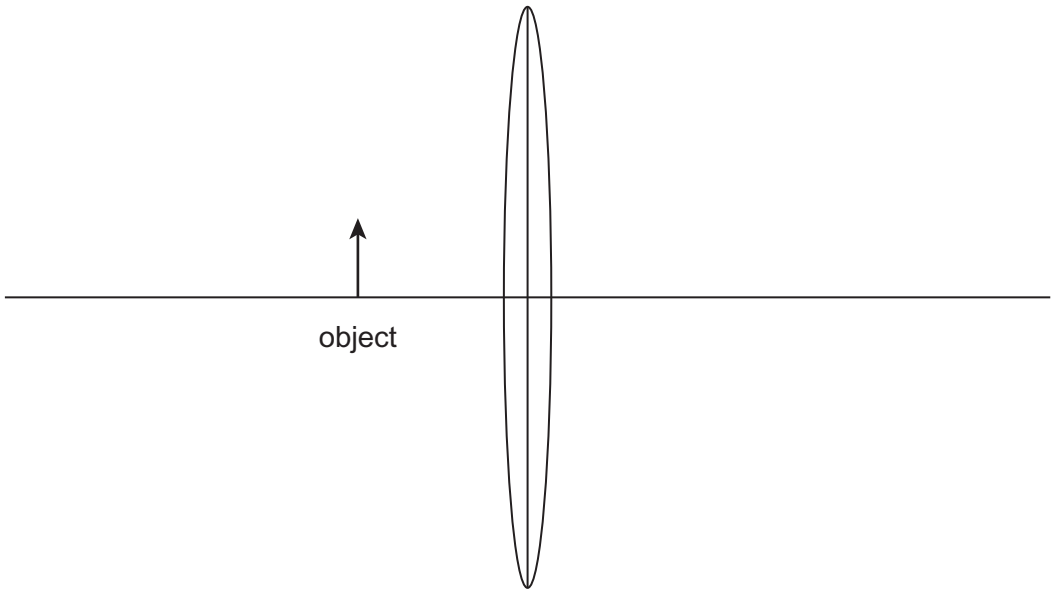
1 (c) State the defect of vision which is corrected using a converging lens.

[1 mark]

_____

1 (d) Draw a labelled ray diagram below to show how the lens in **part (b)** forms the image of the small real object.
Clearly label the image and principal foci of the lens.
Your diagram does not have to be to scale.

[2 marks]



10

2 (a) Sound waves are incident on the ear canal of a normal human ear.

Describe the physical processes involved in the transmission of the energy from the air through to the inner ear.

Outline, in your answer, how the variations in air pressure in the ear canal are amplified to produce greater pressure variations in the inner ear.

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

[6 marks]

Extra space is available on the next page if needed

2 (b) Define intensity of sound.

[2 marks]

2 (c) A human ear has a threshold of hearing of $45\ \text{dB}$ at a given frequency.

Calculate the intensity of sound incident on the ear at this frequency.

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

[2 marks]

intensity of sound = _____ W m^{-2}

10

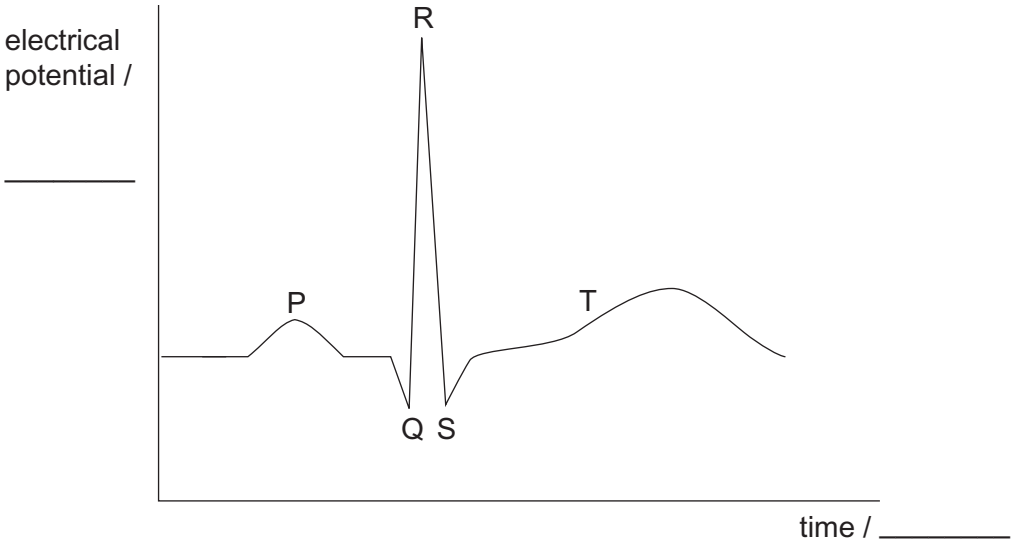
Turn over for the next question

3 (a) **Figure 1** shows the ECG waveform produced when electrodes are attached to the chest of a healthy person.

Label the axes with suitable scales and units.

[2 marks]

Figure 1



3 (b) State what is meant by depolarisation and repolarisation.
Go on to explain, in terms of ion movement, how each effect is caused.

[3 marks]

depolarisation: _____

repolarisation: _____

3 (c) State how the actions of the atria and ventricles correspond to the waveform PQRST shown in **Figure 1**.

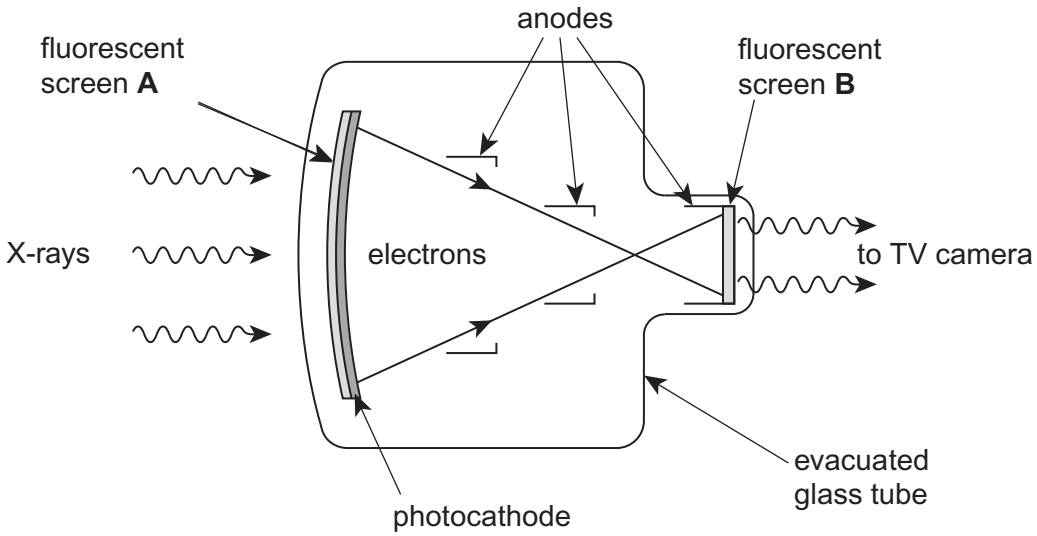
[3 marks]

8

Turn over for the next question

4 (a) **Figure 2** shows a fluoroscopic image intensifier.

Figure 2



4 (a) (i) State the purpose of the fluorescent screen **A** in **Figure 2**.

[1 mark]

4 (a) (ii) State the purpose of the photocathode in **Figure 2**.

[1 mark]

4 (a) (iii) State **two** purposes of the anodes in **Figure 2**.

[2 marks]

1. _____

_____

2. _____

_____

4 (a) (iv) State the purpose of the fluorescent screen **B** in **Figure 2**.

[1 mark]

_____

_____

4 (b) A patient is asked to swallow a suspension of barium sulfate before X-ray images are obtained. This is known as a barium-meal technique.

Explain why the patient needs to swallow the barium sulfate.

[2 marks]

_____

_____

_____

_____

_____

_____

7

END OF QUESTIONS

There are no questions printed on this page

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