



Rewarding Learning

ADVANCED

General Certificate of Education

2023

Centre Number

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Candidate Number

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Life and Health Sciences

Assessment Unit A2 3

assessing

Medical Physics

[AZ031]

MONDAY 19 JUNE, MORNING



AZ031

TIME

1 hour 45 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

Write your answers in the spaces provided in this question paper.

Answer **all eight** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 100.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

You may use an electronic calculator.

Quality of written communication will be assessed in question **6**.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	

Total Marks	
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3 (a) A physiological measurement taken by a medical practitioner, to indicate how well the body is functioning, is body temperature.

(i) Compare and contrast the use of a **contactless thermometer** and a **tympanic thermometer** to measure body temperature.

Include the following information in your answer:

- how each thermometer works; and
- how each thermometer is used to measure body temperature accurately.

How a contactless and a tympanic thermometer work:

[2]

How a contactless and a tympanic thermometer are used to measure body temperature:

[2]

(ii) State **two** advantages of using both contactless and tympanic thermometers compared to using an oral digital thermometer.

[2]

(b) Although more expensive, the contactless thermometer is the most useful thermometer to use in a busy accident and emergency department.

Suggest two reasons why the **contactless** thermometer is preferred over all other types of thermometer in this situation.

1. _____

2. _____

[2]

Examiner Only	
Marks	Remark

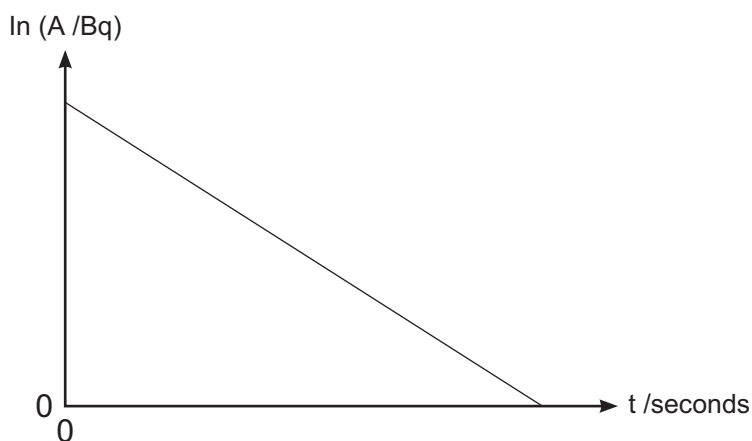
- (v) Calculate the percentage decrease in the value of activity after 6 weeks have passed.

You are advised to show your working.

Percentage decrease = _____ % [4]

- (b) Another equation used to describe the decay of a radioactive isotope is $\ln A = \ln A_0 - \lambda t$.

A graph of $\ln A$ against t is shown below.



- (i) How can the initial activity be determined from the graph of $\ln A$ against t ?

_____ [2]

Examiner Only

Marks Remark

- (ii) The equation of the straight line representing the graph of $\ln A$ against t is:

$$\ln A = -0.037t + 11$$

Use this information to show the initial activity of the radioactive source is approximately 60 kBq.

[1]

- (iii) Calculate the value of the activity after 60 seconds.

You are advised to show your working.

Activity after 60 seconds = _____ Bq [2]

Examiner Only	
Marks	Remark

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(Questions continue overleaf)

Physical principle

Burning the cancer cells

Advantages

[8]

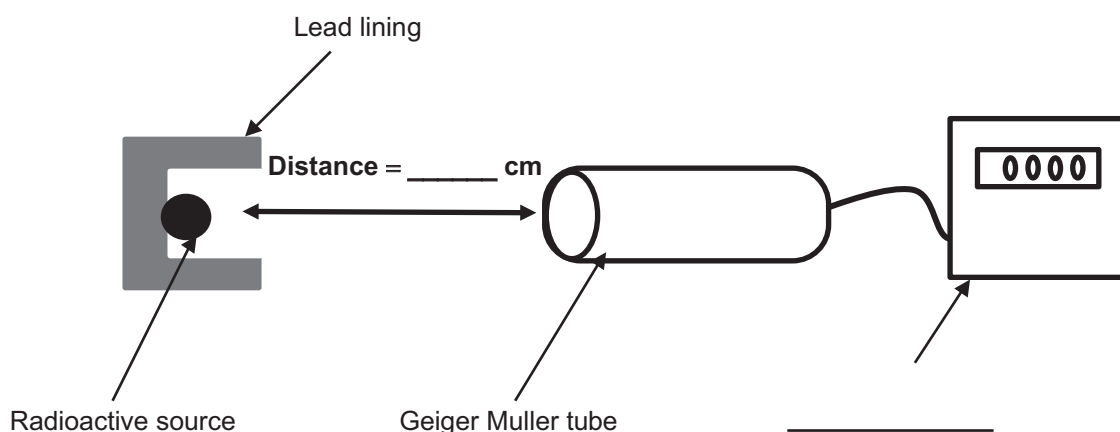
Examiner Only	
Marks	Remark

7 A radioactive source in a school laboratory emits **more than one type** of radiation.

You are asked to describe an experiment which could be carried out in the laboratory to investigate which types of radiation are emitted from the source.

(i) Complete the diagram by labelling the apparatus that would be used for this experiment.

On the diagram, suggest a suitable distance between the radioactive source and the Geiger Muller tube that would allow all types of radiation to be detected.



Source: Principal Examiner

Diagram not drawn to scale

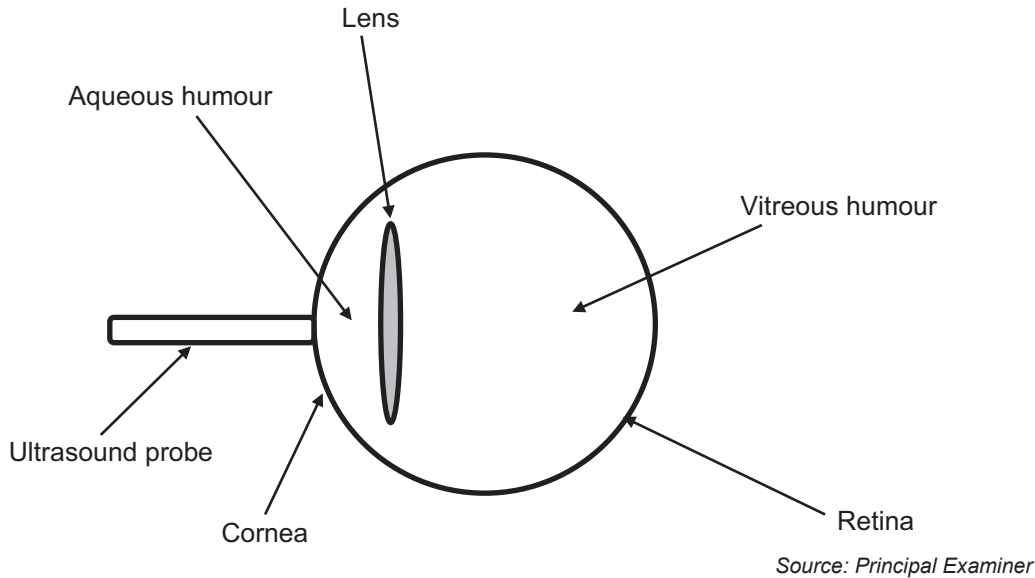
[2]

Examiner Only	
Marks	Remark

8 Ultrasound scans can be used in ophthalmology, a branch of medicine dealing with eye disorders.

The diagram below shows a simplified sketch of the human eye.

During an ultrasound examination the ultrasound probe is placed on the cornea and the pulses of ultrasound transmitted into the eye are reflected from the various structures inside the eyeball.



An ultrasound A scan can be used to determine the length of an eyeball.
An ultrasound B scan can be used to help diagnose a detached retina.

(i) What is the difference between the images produced by an ultrasound A scan and an ultrasound B scan?

_____ [2]

(ii) Suggest the ultrasound frequency used to study the eye.

Explain your answer in detail.

Frequency _____ [1]

Explanation _____

_____ [2]

Examiner Only	
Marks	Remark

(iii) The table below shows some speeds at which the ultrasound travels through biological material of different densities in the eye.

Biological material	Speed of ultrasound /kms ⁻¹	Density /kgm ⁻³
Aqueous humour	1.50	1000
Lens	1.64	1120

By first finding the specific acoustic impedance of the materials in the aqueous humour and the lens, calculate the intensity reflection coefficient for ultrasound travelling from the aqueous humour to the lens.

You are advised to show your working.

Intensity reflection coefficient = _____ [7]

THIS IS THE END OF THE QUESTION PAPER

Examiner Only

Marks Remark

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