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Student number

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Name _____

Date _____

Attempt/Time taken _____

GCSE PHYSICS

Topic Paper: 6.2 Electromagnetic waves, lenses, sound waves (Physics only)
Part 3

Time allowed: 40 minutes

Materials

For this paper you must have:

- the Periodic Table/Data Sheet, provided as an insert (enclosed)
- a ruler with millimetre measurements
- a calculator, which you are expected to use where appropriate.

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.
- All working must be shown.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

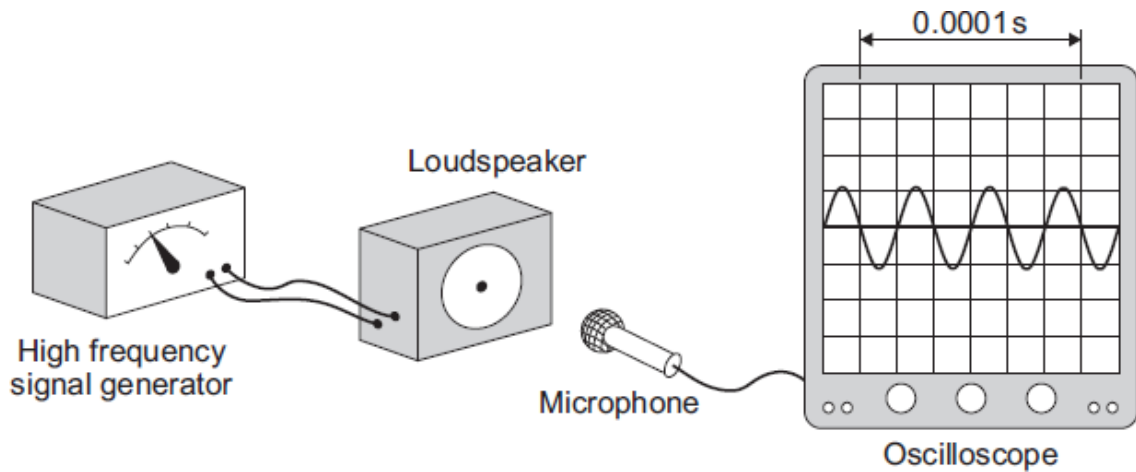
- The Periodic Table/Data Sheet is provided as in insert.
- You are reminded of the need for good English and clear presentation in your answers.
- When answering questions you need to make sure that your answer:
 - is clear, logical, sensibly structured
 - fully meets the requirements of the question
 - shows that each separate point or step supports the overall answer.



32 Marks



- Q11.** (a) The diagram shows a microphone being used to detect the output from a loudspeaker. The oscilloscope trace shows the wave pattern produced by the loudspeaker.



- (i) How many waves are produced by the loudspeaker in 0.0001 seconds?

.....

(1)

- (ii) How many waves are produced by the loudspeaker every second?
Assume the input to the loudspeaker does not change.

.....
.....

(1)

- (iii) A person with normal hearing cannot hear the sound produced by the loudspeaker.

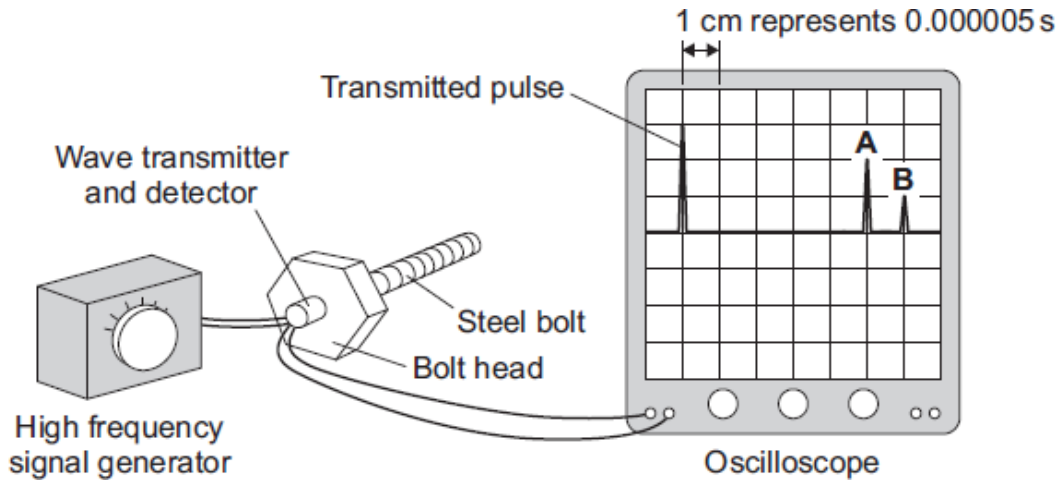
Explain why.

.....
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.....
.....

(2)



- (b) The diagram shows how a very high frequency sound wave can be used to check for internal cracks in a large steel bolt. The oscilloscope trace shows that the bolt does have an internal crack.



- (i) Explain what happens to produce pulse A and pulse B.

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.....

(2)

- (ii) Use the information in the diagram and the equation in the box to calculate the distance from the head of the bolt to the internal crack.

$$\text{distance} = \text{speed} \times \text{time}$$

Speed of sound through steel = 6000 m/s

Show clearly how you work out your answer.

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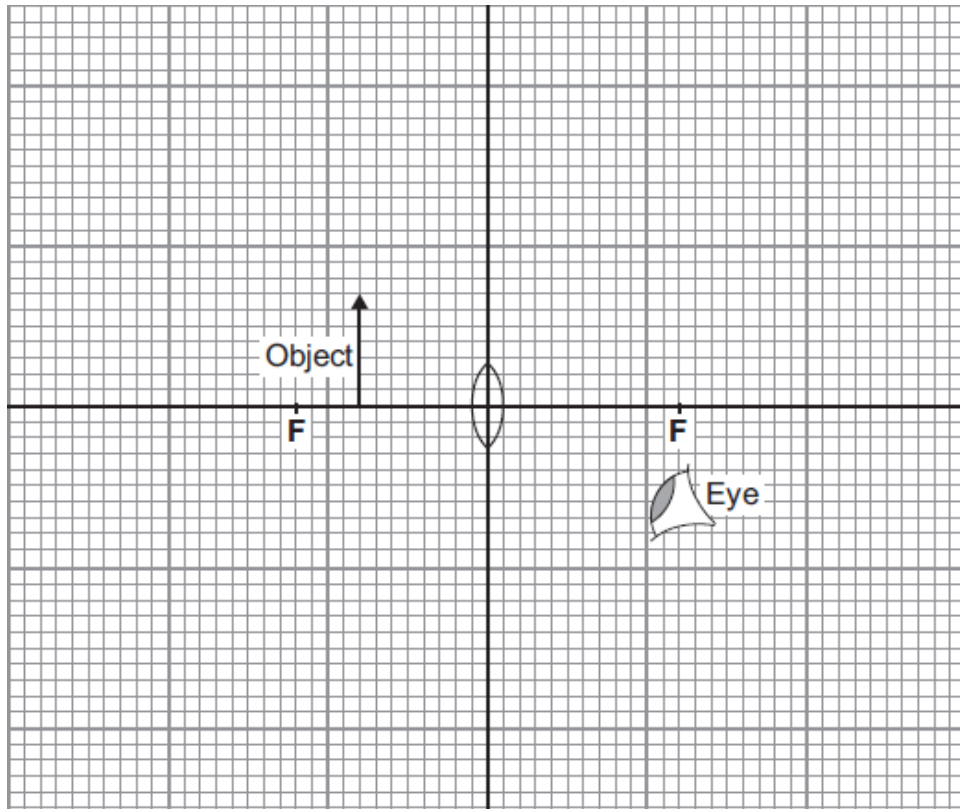
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(3)
(Total 9 marks)



- Q12.** (a) The diagram shows a converging lens being used as a magnifying glass.
- (i) On the diagram, use a ruler to draw two rays from the top of the object which show how and where the image is formed. Represent the image by an arrow drawn at the correct position.



(3)

- (ii) Use the equation in the box to calculate the magnification produced by the lens.

$$\text{magnification} = \frac{\text{image height}}{\text{object height}}$$

Show clearly how you work out your answer.

.....

.....

Magnification =

(2)



- (b) A camera also uses a converging lens to form an image.

Describe how the image formed by the lens in a camera is different from the image formed by a lens used as a magnifying glass.

.....
.....
.....
.....

(2)
(Total 7 marks)

- Q13.** Figure 1 shows how a ray of light from a laser travels along an optical fibre.

Figure 1



- (a) Why does the ray of light stay within the optical fibre?

.....
.....

(1)

- (b) The material used to make the optical fibre has a refractive index of 1.50.

Calculate the critical angle of this material.

Use the correct equation from the Physics Equations Sheet.

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.....

Critical angle = degrees

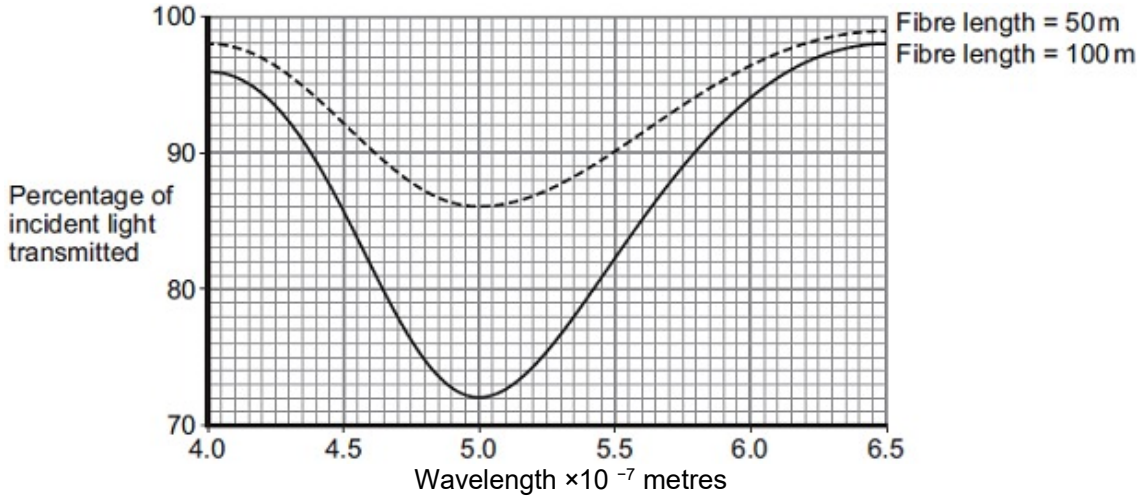
(2)



- (c) Different wavelengths of light can be used to transmit information along optical fibres.

Figure 2 shows how the percentage of incident light transmitted through a fibre varies with the wavelength of light and the length of the fibre.

Figure 2



Compare the percentages of incident light transmitted through the two different fibres over the range of wavelengths shown.

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(3)
(Total 6 marks)

- Q14.** (a) Human eyes and digital cameras both have parts with the same function.

Complete the missing parts in the table below.

Details of part	Part of eye	Part of digital camera
Refracts light to produce an image	Cornea and lens	Lens
Images are focused here	Retina
Variable opening where light enters	Aperture

(2)



(b) Long sight is a defect of the human eye.

State **two** causes of long sight.

- 1
-
- 2
-

(2)

(c) Long sight can be corrected by wearing spectacles with converging (convex) lenses.

A lens in these spectacles has a power of +3.2 dioptres.

Calculate the focal length of this lens.

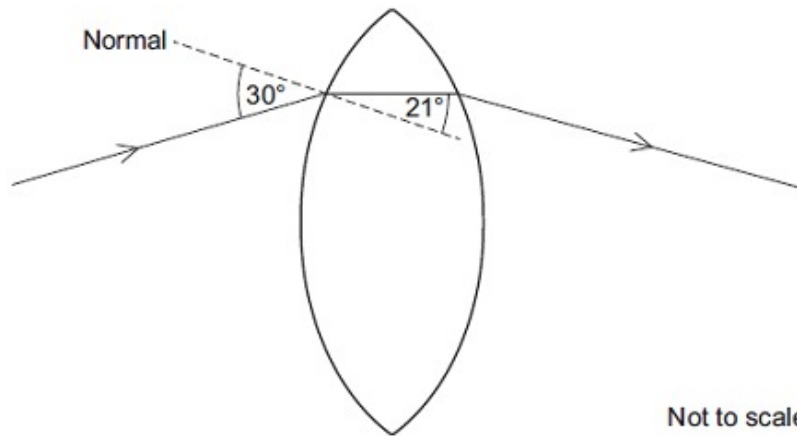
Use the correct equation from the Physics Equations Sheet.

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-
-

Focal length = metres

(2)

(d) The figure below shows a ray of light passing through a converging (convex) lens.



(i) Use the information in the figure above to calculate the refractive index of the glass used to make the lens.

Use the correct equation from the Physics Equations Sheet.

-
-
-
-

Refractive index =

(3)



- (ii) Different lenses of the same power can be made using glass of a different refractive index.

State **one** advantage of making spectacles using lenses made from glass of a higher refractive index.

.....
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(1)
(Total 10 marks)