Practice Question Set For A-Level
Subject : Physics
Paper-2 Topic : 5_Waves

Name of the Student:_____
Max. Marks : 26 Marks **Time : 26 Minutes**

Q1.

The photograph shows a child's nature observation kit used for observing small creatures such as flies.

The lid has a built-in lens and an additional optional lens to allow the magnification to be increased.

The photographs below show the appearance of a fly using no lens, a single lens and two lenses respectively.



A student reads that the power of a combination of lenses is equal to the sum of the powers of the individual lenses.

$$\text{power}_{\text{combination}} = \text{power}_{\text{lens1}} + \text{power}_{\text{lens2}}$$

The student investigates this relationship using the lenses in the observation kit.

The student records the method and measurements as shown below.

Method

Set up a bulb on one side of the laboratory.
Hold the lens near the opposite wall and vary the distance from the wall until a clear image of the bulb is seen on the wall.
With the other hand, use a ruler to measure the distance of the lens from the clear image formed.
This is the focal length.

Results

Lens	Focal length/cm
Lens in the lid	12
Optional lens	17.5
Combination of both lenses	7

The distance between the light and the opposite wall was 6 m.

(i) Explain **one** way of improving the value obtained for the focal length of the lens.

(2)

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(ii) Determine whether the data from this experiment supports the conclusion.

$$power_{combination} = power_{lens1} + power_{lens2}$$

Support your answer with a calculation.

(4)

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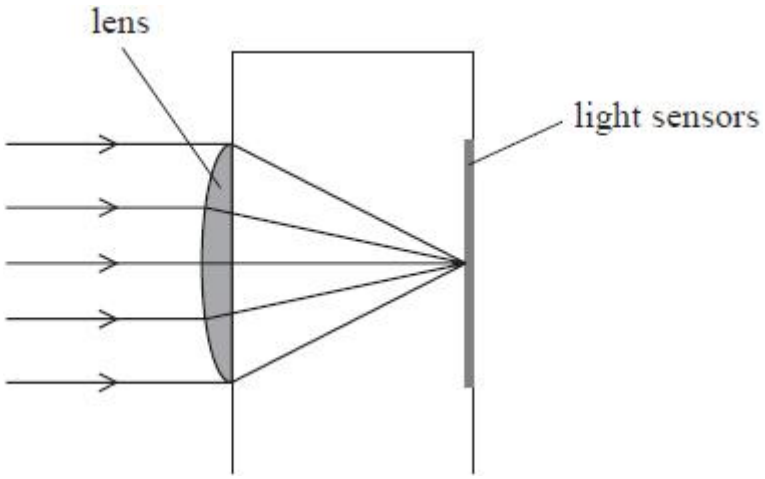
(Total for question = 6 marks)

Q2.

The lens of a mobile phone camera has a focal length of 4.25 mm. Light is focused onto light sensors at the back of the camera, as shown.



The camera is initially focused on an object in the far distance.

Calculate the displacement of the lens that would be required to focus on an object 25.0 cm from the camera.

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Displacement of lens = ...

(Total for question = 4 marks)

Q3.

The lens in the eye of an octopus focuses light onto the retina at the back of the eye.

The octopus focuses on objects at different distances from the eye by changing the shape of the eye to move the

lens closer or further from the retina.

(i) The power of an octopus lens is 118 D.

Show that the focal length of the lens is about 8.5 mm.

(2)

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(ii) Calculate the shortest distance from the eye at which an object may be focused clearly on the retina.

maximum distance from lens to retina = 2.0 cm

(2)

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Shortest distance from the eye = ...

(iii) The lens in the eye of an octopus is in contact with seawater. The refractive index of freshwater is less than the refractive index of seawater.

Deduce what would happen to the shortest distance from the eye at which an object may be focused clearly if the octopus was in freshwater.

(3)

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(iv) Calculate the speed of light in seawater.

refractive index of seawater = 1.37

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Speed of light in seawater = ...

(Total for question = 9 marks)

Q4.

A simple model of the hydrogen atom consists of an electron moving in a circular path around a proton.

(i) In this simple model it is the electrostatic force, rather than the gravitational force, that is responsible for keeping the electron in a circular path.

By means of calculations justify this statement.

radius r of the hydrogen atom = 5.3×10^{-11} m

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(ii) Ignoring the gravitational force, calculate the velocity of the electron in this simple model of the hydrogen atom.

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Velocity = ...

(Total for question = 7 marks)