Physics
Leaving Certificate
Higher Level

Past Exam Questions on
Refraction and Lenses

Q5 Part (e) Section B 2013

(*e*) If a diamond has a refractive index of 2.42, what is the speed of light in the diamond?

Q2 Section A 2012

2. In an experiment to measure the focal length of a converging lens, a student measured the image distance *v* for each of four different values of the object distance *u*.

The table shows the data recorded by the student.

u/cm	12.0	18.0	23.6	30.0
v/cm	64.5	22.1	17.9	15.4

Describe, with the aid of a labelled diagram, how the student obtained the data. (15)

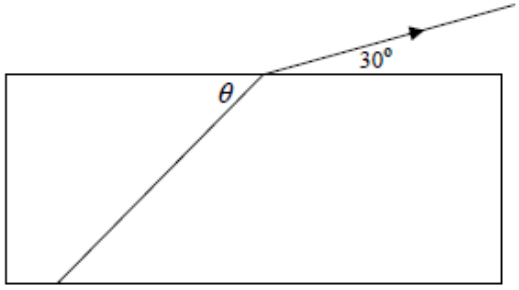
Why is it difficult to measure the image distance accurately? (4)

Using all the data in the table, find the value for the focal length of the lens. (15)

Why is it difficult to measure the image distance when the object distance is less than 10 cm? (6)

Q12 Part (b) Section B 2012

(*b*) The diagram shows a ray of light as it leaves a rectangular block of glass. As the ray of light leaves the block of glass, it makes an angle θ with the inside surface of the glass block and an angle of 30° when it is in the air, as shown.



(i) If the refractive index of the glass is 1.5, calculate the value of θ. (12)

(ii) What would be the value of the angle θ so that the ray of light emerges parallel to the side of the glass block? (9)

(iii) Calculate the speed of light as it passes through the glass. (7)

Q3 Section A 2010

3. In an experiment to verify Snell's law, a student recorded the following data.

i/°	30	40	50	55	60	65	70
r/°	19	26	30	33	36	38	40

Draw a labelled diagram of the apparatus used.
On your diagram, indicate an angle i and its corresponding angle r. (12)

Using the recorded data, draw a suitable graph and explain how your graph verifies Snell's law.

Using your graph, calculate the refractive index of the substance used in the experiment. (22)

The student did not record any values of the angle i below 30°. Give two reasons why. (6)

Q2 Section A 2009

2. A student was asked to measure the focal length of a converging lens. The student measured the image distance v for each of three different object distances u. The student recorded the following data.

u/cm	20.0	30.0	40.0
v/cm	65.2	33.3	25.1

Describe how the image distance was measured. (12)

Give two precautions that should be taken when measuring the image distance. (6)

Use all of the data to calculate the focal length of the converging lens. (15)

What difficulty would arise if the student placed the object 10 cm from the lens? (7)

Q12 Part (c) Section B 2009

(*c*) Information is transmitted over long distances using optical fibres in which a ray of light is guided along a fibre. Each fibre consists of a core of high quality glass with a refractive index of 1.55 and is coated with glass of a lower refractive index.

Explain, with the aid of a labelled diagram, how is a ray of light guided along a fibre. (9)

Why is each fibre coated with glass of lower refractive index? (6)

What is the speed of the light as it passes through the fibre? (7)

Light passing through optical fibres must travel through an enormous length of glass. Impurities in the glass reduce the power transmitted by half every 2 km. The initial power being transmitted by the light is 10 W.

What is the power being transmitted by the light after it has travelled 8 km through the fibre? (6)

(speed of light in air = 3.0×10^8 m s^{-1})

Q9 Section B 2008

9. What is meant by refraction of light?
State Snell's law of refraction. (12)

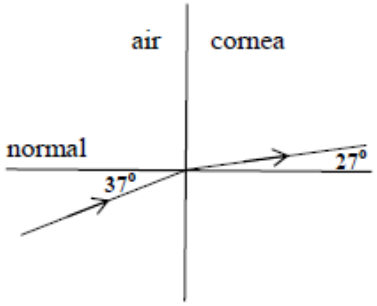
An eye contains a lens system and a retina, which is 2.0 cm from the lens system. The lens system consists of the cornea, which acts as a fixed lens of power 38 m^{-1}, and a variable internal lens just behind the cornea. The maximum power of the eye is 64 m^{-1}.

Calculate:

(i) how near an object can be placed in front of the eye and still be in focus;

(ii) the maximum power of the internal lens. (15)

Light is refracted as it enters the cornea from air as shown in the diagram.
Calculate the refractive index of the cornea. (6)



Draw a diagram to show the path of a ray of light as it passes from water of refractive index 1.33 into the cornea. (6)

Q5 Part (e) Section B 2007

(*e*) The refractive index of a liquid is 1.35, what is the critical angle of the liquid? (7)

Q7 Section B 2006

7. What is meant by the refraction of light? (6)

A converging lens is used as a magnifying glass.
Draw a ray diagram to show how an erect image is formed by a magnifying glass. (12)

A diverging lens cannot be used as a magnifying glass.
Explain why. (5)

The converging lens has a focal length of 8 cm. Determine the two positions that an object can be placed to produce an image that is four times the size of the object? (15)

The power of an eye when looking at a distant object should be 60 m^{-1}. A person with defective vision has a minimum power of 64 m^{-1}.

Calculate the focal length of the lens required to correct this defect. (12)

What type of lens is used? Name the defect. (6)

Q3 Section A 2005

3. In an experiment to verify Snell's law, a student measured the angle of incidence *i* and the angle of refraction *r* for a ray of light entering a substance. This was repeated for different values of the angle of incidence. The following data was recorded.

i/degrees	20	30	40	50	60	70
r/degrees	14	19	26	30	36	40

Describe, with the aid of a diagram, how the student obtained the angle of refraction. (9)

Draw a suitable graph on graph paper and explain how your graph verifies Snell's law. (18)

From your graph, calculate the refractive index of the substance. (9)

The smallest angle of incidence chosen was 20°. Why would smaller values lead to a less accurate result? (4)