AQA GCSE Physics | 8463

SPECIFICATION POINT 4.6.2.5

Lenses (physics only)

Past-paper questions

Tier	**Higher**
Question groups	**23**
Available paper years	**2004–2025**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.6.2.5 Lenses (physics only)

Question 01

June 2004 | 3451H | Original Q15 | Legacy

15 (a) The diagram shows a lens used as a magnifying glass. The position of the eye is shown and the size and position of an object standing at point **O**.

(i) What type of lens is shown in the diagram?

.....

(1 mark)

(ii) Two points are marked as **F**. What are these points?

.....

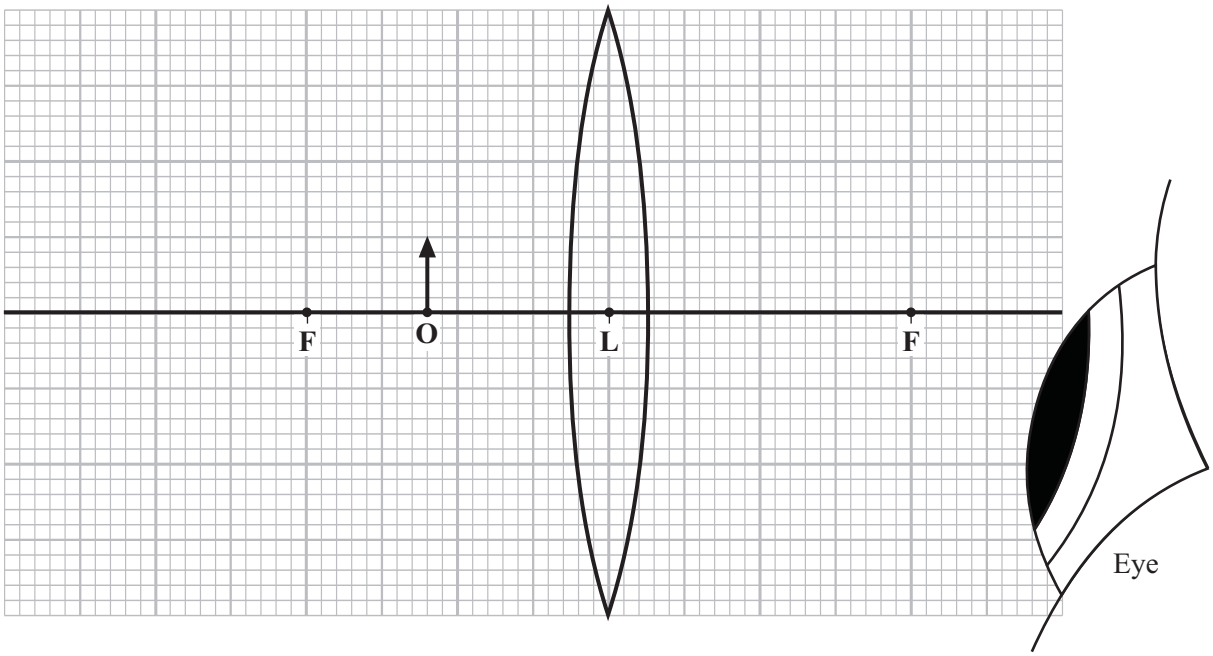
(1 mark)

(iii) What is the name of the straight line which goes through the point **F**, through the point **L** at the centre of the lens, and through the point **F** on the other side?

.....

(1 mark)

(iv) On the diagram, use a ruler to construct accurately the position of the image. You should show how you construct your ray diagram and how light appears to come from this image to enter the eye.



(5 marks)

(v) The image is *virtual*. What is a *virtual* image?

.....

.....

(1 mark)

4.6.2.5 Lenses (physics only)

Question 01 · continued

MARGIN
BLANK

(b) The lens shown in the diagram in part (a)(iv) can be used in a camera to produce a *real* image.

Explain why a *real* image must be produced in a camera and how the object and the lens are positioned to produce a *real* image which is **smaller** than the object.

Do **not** draw a ray diagram as part of your answer.

.....

.....

.....

.....

.....

.....

(3 marks)

12

4.6.2.5 Lenses (physics only)

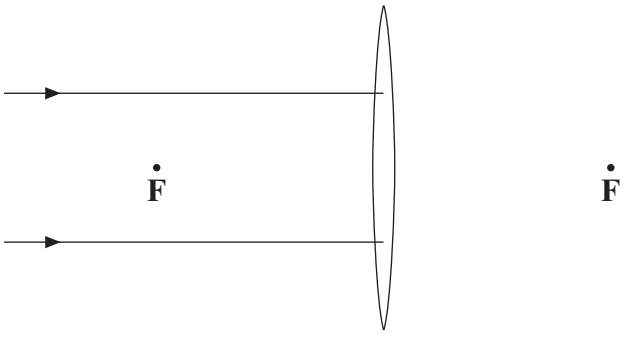
Question 02

June 2006 | 3451 | Original Q6 | Legacy

6 (a) **Diagram 1** shows parallel rays of light and a converging lens. The points, **F**, show the focus on each side of the lens.

Complete **Diagram 1** to show what happens to the rays of light. Use a ruler to do this.

Diagram 1

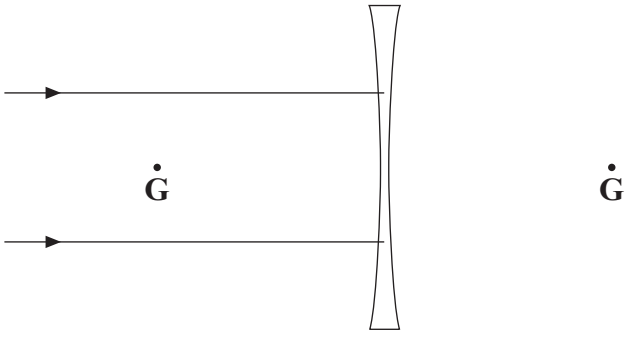


(2 marks)

(b) **Diagram 2** shows parallel rays of light and a diverging lens. The points, **G**, show the focus on each side of the lens.

Complete **Diagram 2** to show what happens to the rays of light. Use a ruler to do this.

Diagram 2



(2 marks)

(c) Use words from the box to complete the sentences.

image	**lens**	**object**

You may use each word once, more than once or not at all.

In a camera, a converging ..... is used to produce an

..... of an ..... on a film. The ..... is

smaller than the ..... and nearer to the ..... .

(3 marks)

4.6.2.5 Lenses (physics only)

Question 02 · continued

BLANK

(d) (i) What is the difference between a real image and a virtual image for a lens?

.....

.....

.....

.....

(2 marks)

(ii) Why does a real image, rather than a virtual image, need to be formed in a camera?

.....

.....

(1 mark)

10

Turn over for the next question

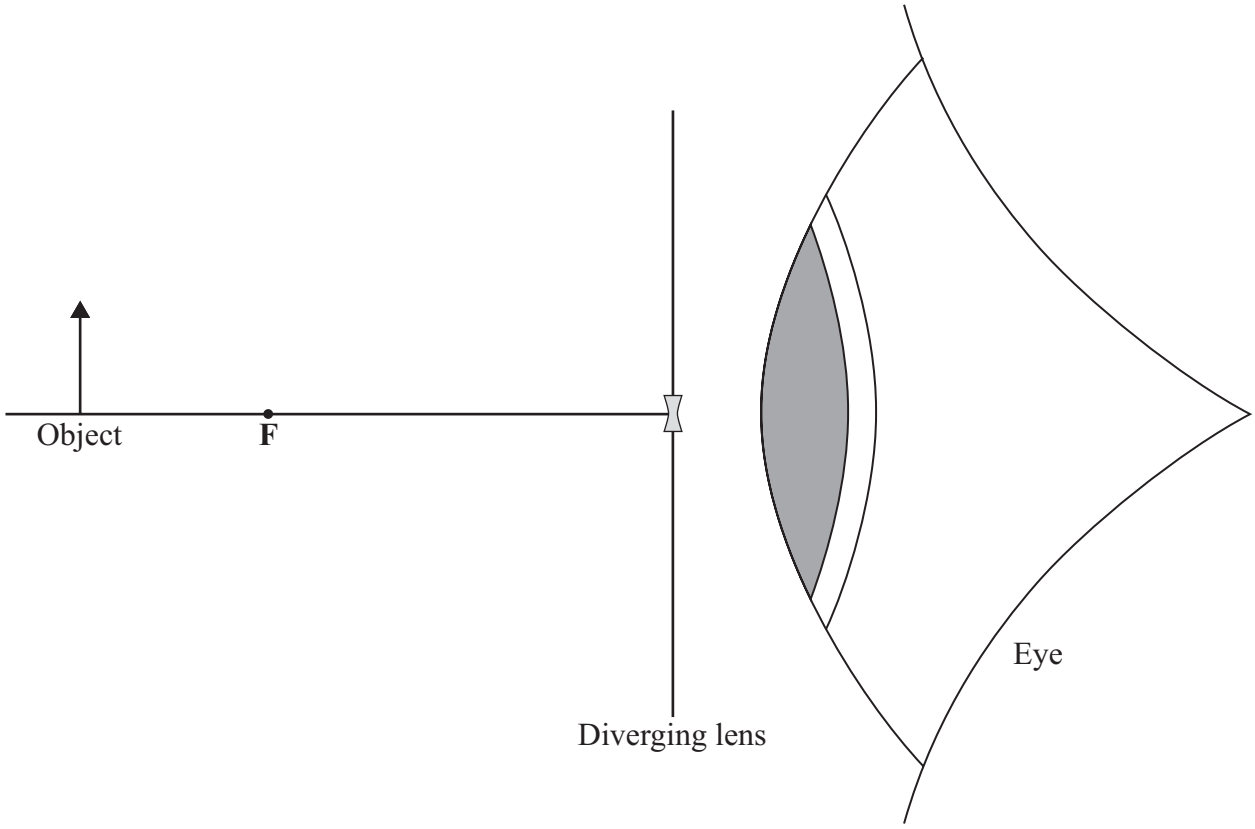
4.6.2.5 Lenses (physics only)

Question 03

January 2008 | PHY3H | Original Q4 | Legacy

4 The diagram shows an object located vertically on the principal axis of a diverging lens. A student looks through the lens and can see an image of the object.

(a) Using a pencil and ruler to draw construction lines on the diagram, show how light from the object enters the student's eye and the size and position of the image.



(3 marks)

(b) Describe the nature of the image by comparing it to the object.

.....

.....

.....

.....

(2 marks)

5

4.6.2.5 Lenses (physics only)

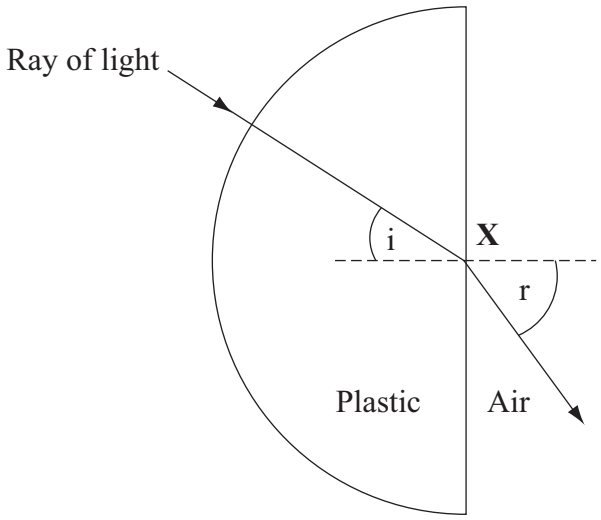
Question 04

June 2008 | PHY3H | Original Q1 | Legacy

1 (a) A student investigated the refraction of light as it passes out of a transparent plastic block.

She aimed a ray of light at point **X**. She marked the position of the ray as it passed through the transparent plastic block and into the air.

The angle ***i*** is the angle of incidence.



1 (a) (i) What is the name of angle **r**?

.....

(1 mark)

1 (a) (ii) What is the name of the dashed line?

.....

(1 mark)

4.6.2.5 Lenses (physics only)

Question 04 · continued

for mark

1 (b) A camera uses a lens to produce an image which falls on a light detector.



Name a light detecting device which may be used in a camera.

.....

(1 mark)

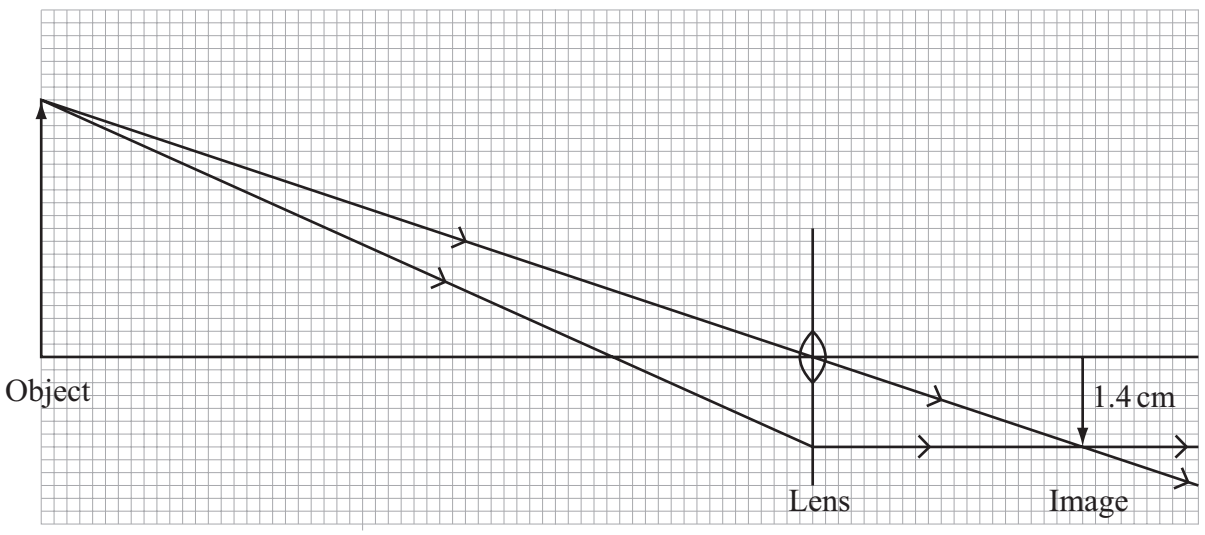
Question 1 continues on the next page

4.6.2.5 Lenses (physics only)

Question 04 · continued

for mark

1 (c) The diagram shows the position of an image formed in a camera.



1 (c) (i) What type of lens is shown in the diagram?

.....

(1 mark)

1 (c) (ii) Use the equation in the box to calculate the magnification.

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

Show clearly how you work out your answer.

.....

.....

Magnification = ... *(2 marks)*

1 (d) Why does the image formed in a camera have to be a real image?

.....

.....

(1 mark)

7

4.6.2.5 Lenses (physics only)

Question 05

January 2009 | PHY3H | Original Q4 | Legacy

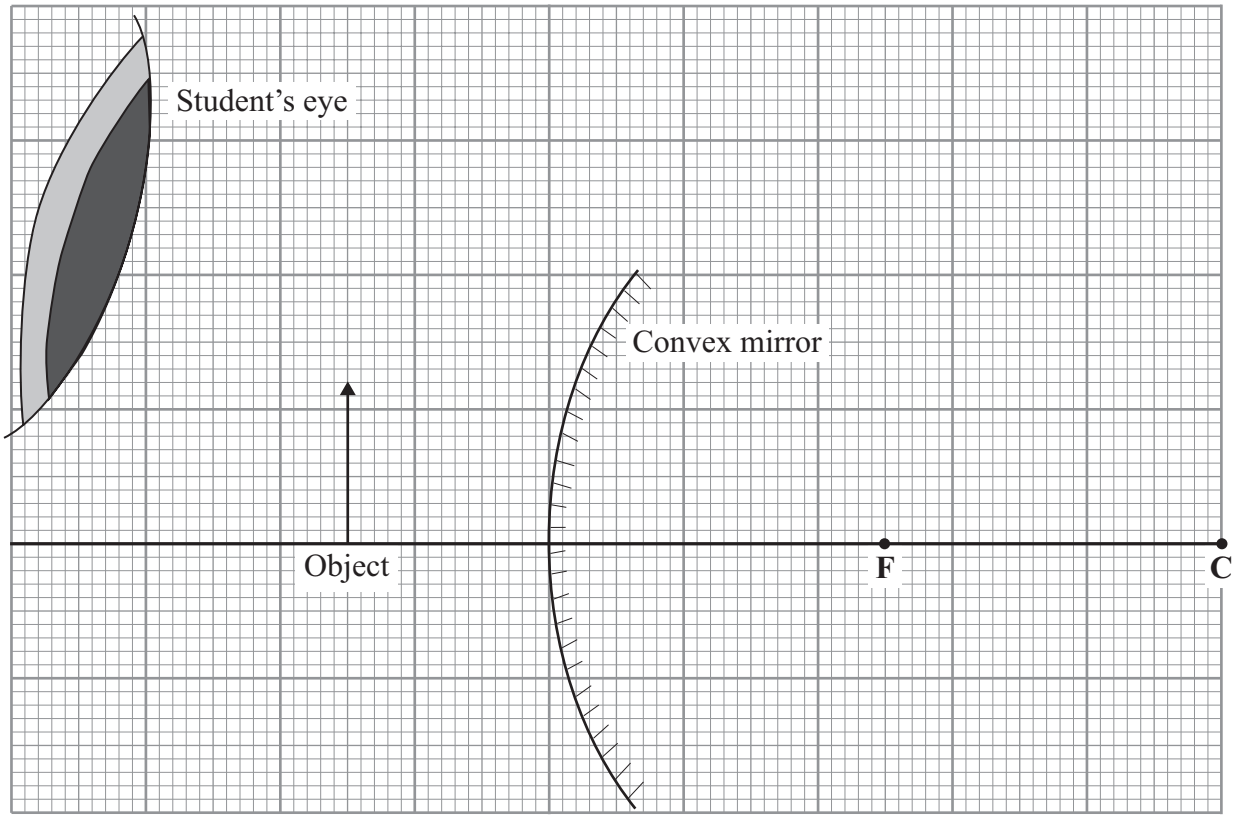
4 A student investigates the formation of images by a convex mirror.

In the mirror, she can see the image of an object placed in front of the mirror.

In the diagram, **F** is the principal focus of the mirror and **C** is the centre of curvature of the mirror.

4 (a) On the diagram, use a ruler to draw **two** rays from the top of the object which show the position of the image and how the student sees the image.

Mark the direction of the rays at each stage.



(4 marks)

4 (b) The image is a virtual image.

How can you tell from the rays you have drawn on the diagram that the image is a virtual image?

.....

.....

(1 mark)

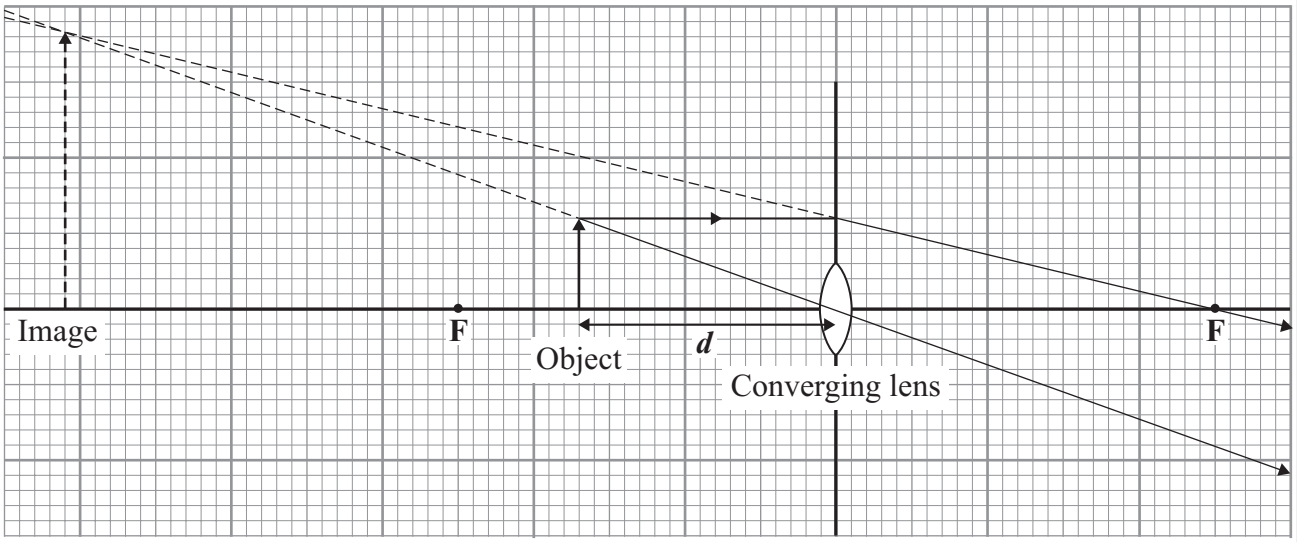
5

4.6.2.5 Lenses (physics only)

Question 06

2 A student investigates how the magnification of an object changes at different distances from a converging lens.

The diagram shows an object at distance ***d*** from a converging lens.



2 (a) (i) The height of the object and the height of its image are drawn to scale.

Use the equation in the box to calculate the magnification produced by the lens shown in the diagram.

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

Show clearly how you work out your answer.

.....

.....

.....

Magnification = ...

(2 marks)

2 (a) (ii) The points **F** are at equal distances on either side of the centre of the lens.

State the name of these points.

.....

(1 mark)

4.6.2.5 Lenses (physics only)

Question 06 · continued

for mark

2 (a) (iii) Explain how you can tell, **from the diagram**, that the image is virtual.

.....

.....

(1 mark)

Question 2 continues on the next page

4.6.2.5 Lenses (physics only)

for mark

2 (b) The student now uses a different converging lens. He places the object between the lens and point **F** on the left.

The table shows the set of results that he gets for the distance ***d*** and for the magnification produced.

Distance *d* measured in cm	Magnification
5	1.2
10	1.5
15	2.0
20	3.0
25	6.0

His friend looks at the table and observes that when the distance doubles from 10 cm to 20 cm, the magnification doubles from 1.5 to 3.0.

His friend's conclusion is that:

The magnification is directly proportional to the distance of the object from the lens.

His friend's observation is correct but his friend's conclusion is **not** correct.

2 (b) (i) Explain, with an example, why his friend's conclusion is **not** correct.

.....

.....

.....

.....

(2 marks)

2 (b) (ii) Write a correct conclusion.

.....

.....

(1 mark)

4.6.2.5 Lenses (physics only)

for mark

2 (b) (iii) The maximum range of measurements for ***d*** is from the centre of the lens to **F** on the left.

The student **cannot** make a correct conclusion outside this range.

Explain why.

.....

.....

(1 mark)

8

Turn over for the next question

4.6.2.5 Lenses (physics only)

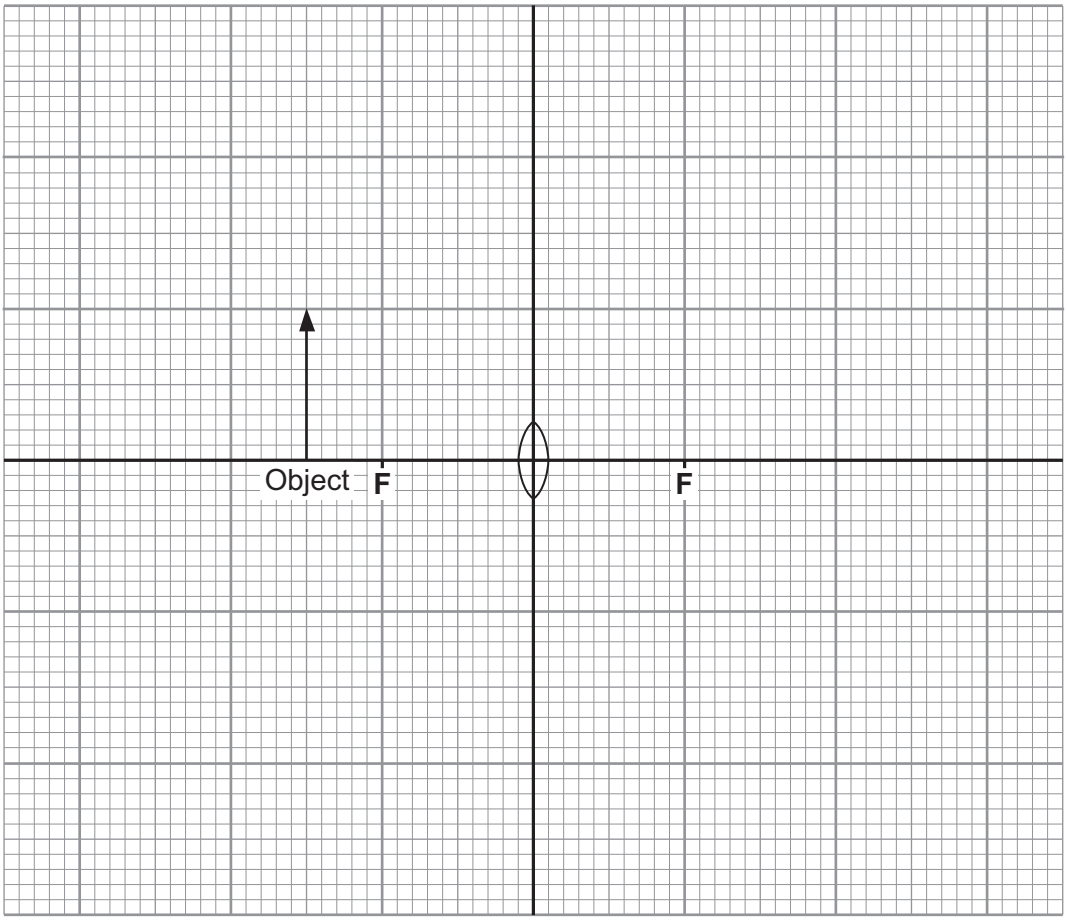
Question 07

June 2010 | PHY3H | Original Q7 | Legacy

7 A student investigated how the nature of the image depends on the position of the object in front of a large converging lens.

The diagram shows one position for the object.

7 (a) Use a ruler to complete a ray diagram to show how the image of the object is formed.



Key: **F** = principal focus

(4 marks)

7 (b) Describe the nature of this image relative to the object.

.....

.....

.....

(2 marks)

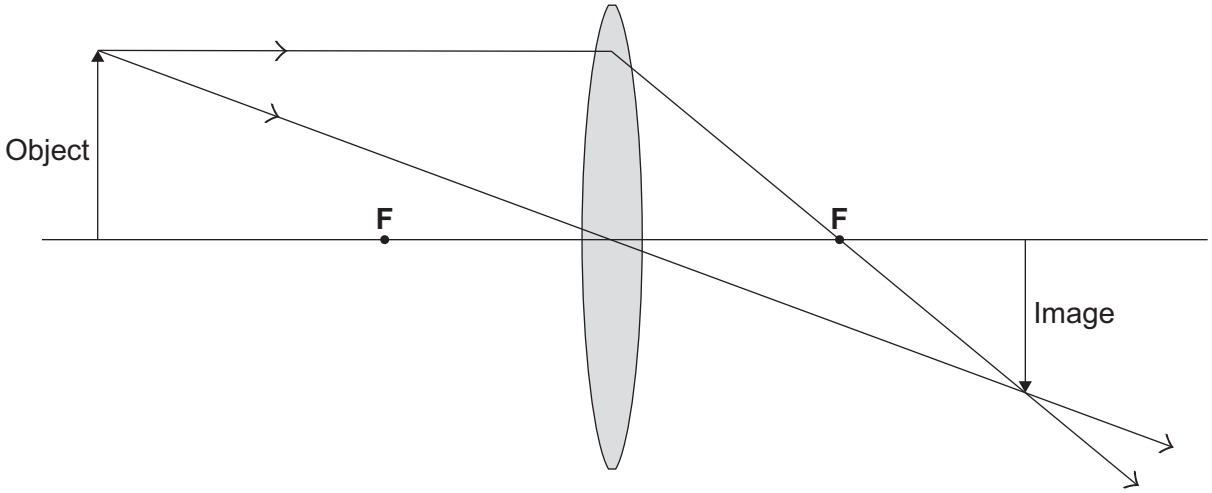
6

4.6.2.5 Lenses (physics only)

Question 08

January 2011 | PHY3H | Original Q1 | Legacy

1 The diagram shows a lens, the position of an object and the position of the image of the object.



1 (a) What type of lens is shown?

.....

(1 mark)

1 (b) What is the name of the points, **F**, shown each side of the lens?

.....

(1 mark)

1 (c) (i) The image is real and can be put on a screen.

How can you tell **from the diagram** that the image is real?

.....

.....

(1 mark)

1 (c) (ii) Draw a ring around a word in the box which describes the image produced by the lens.

inverted	**larger**	**upright**

(1 mark)

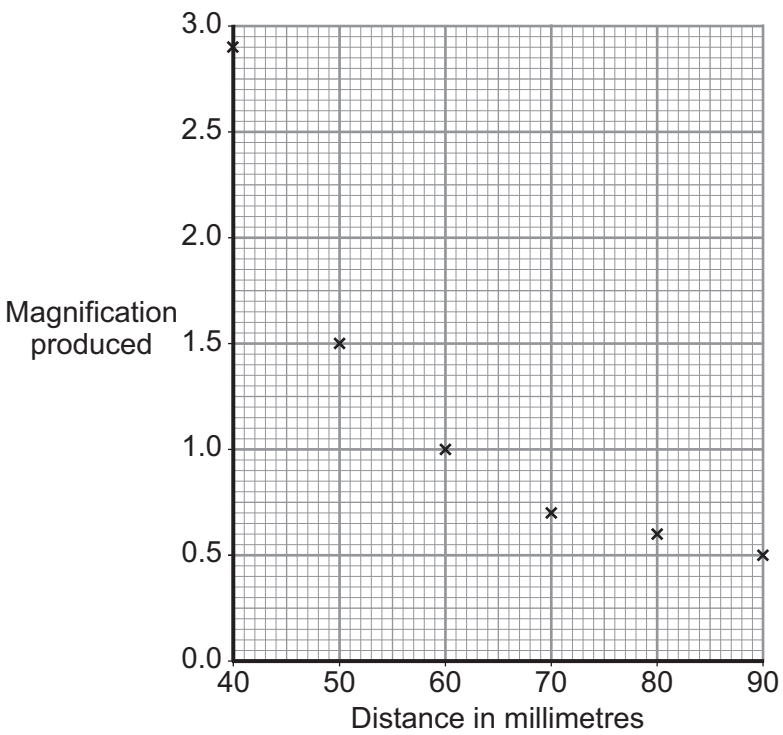
4.6.2.5 Lenses (physics only)

Question 08 · continued

1 (d) A student investigates the relationship between the distance from the object to the lens and the magnification produced by the lens.
The student's results are given in the table.
The student did not repeat any measurements.

Distance in millimetres	Height of object in millimetres	Height of image in millimetres	Magnification produced
40	20	58	2.9
50	20	30	1.5
60	20	20	1.0
70	20	14	0.7
80	20	12	0.6
90	20	10	0.5

The student plots the points for a graph of *magnification produced* against *distance*.



1 (d) (i) Draw a *line of best fit* for these points.

(1 mark)

4.6.2.5 Lenses (physics only)

Question 08 · continued

1 (d) (ii) Complete the following sentence by drawing a ring around the correct word in the box.

A line graph has been drawn because both variables are

described as being

categoric.
continuous.
discrete.

(1 mark)

1 (d) (iii) Describe the relationship between *magnification produced* and *distance*.

.....

.....

.....

(2 marks)

8

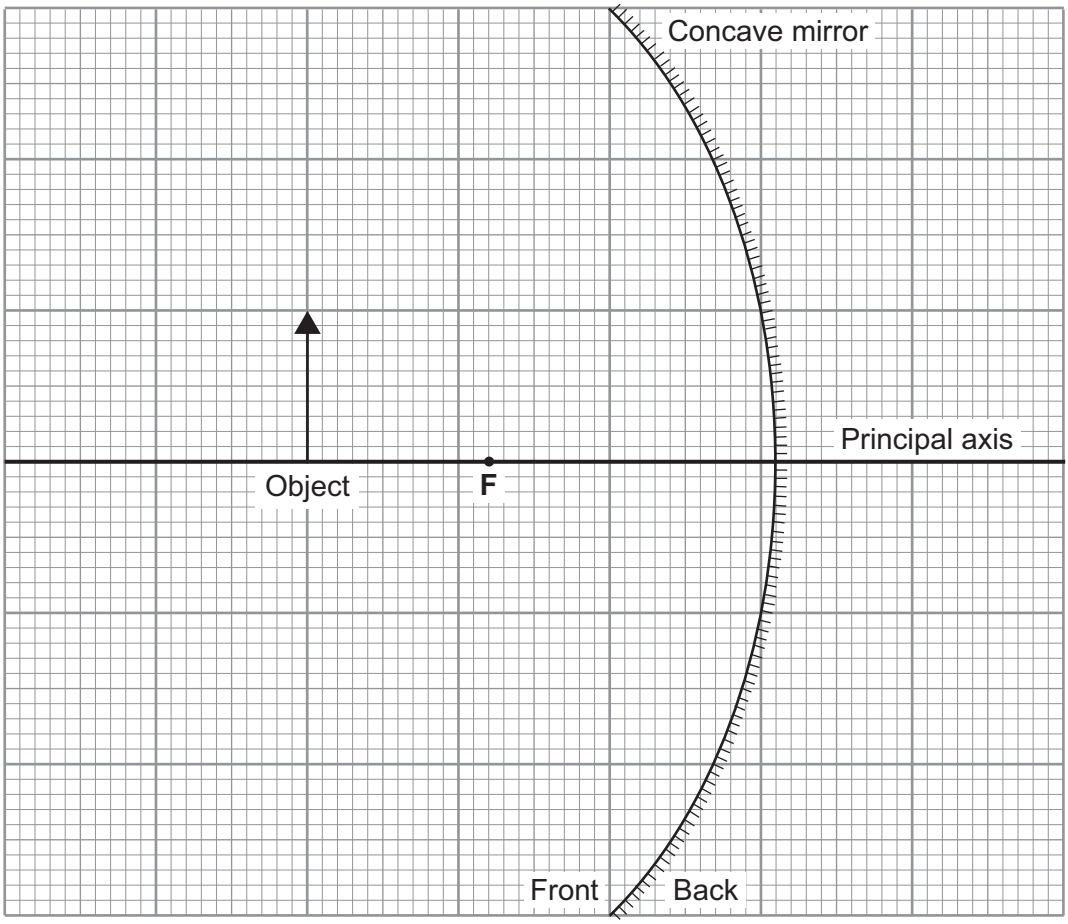
4.6.2.5 Lenses (physics only)

Question 09

January 2011 | PHY3H | Original Q6 | Legacy

6 The diagram shows an object in front of a concave mirror.

Complete the diagram to show the position of the image.



(3 marks)

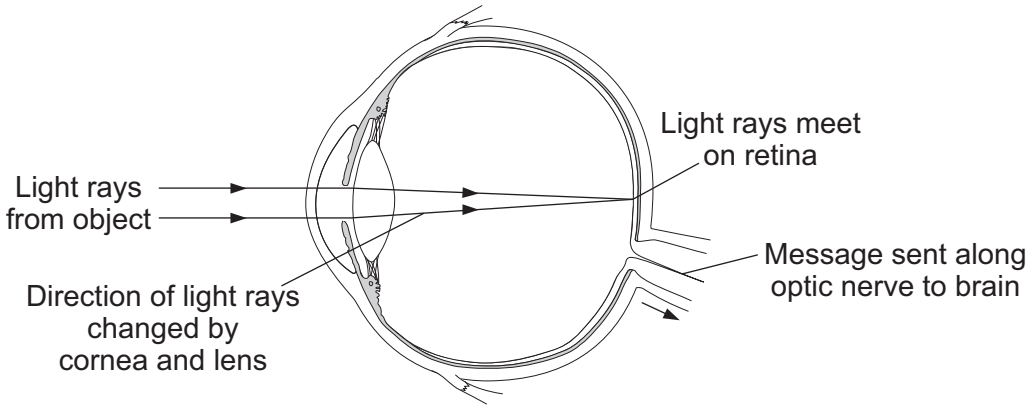
3

4.6.2.5 Lenses (physics only)

Question 10

June 2011 | PHY3H | Original Q5 | Legacy

5 (a) The diagram shows the inside of the eye of a person with perfect vision.



Complete the sentence.

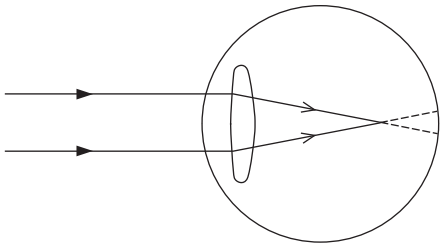
The process by which the cornea and lens change the direction of the light is called

..... .

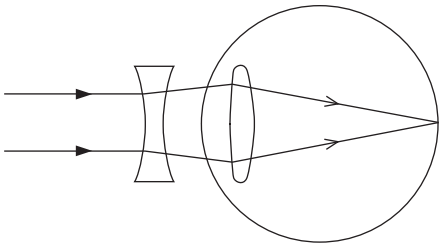
(1 mark)

5 (b) (i) Not everyone has perfect vision.
A **short-sighted** person can only clearly see objects which are close.
Light from distant objects meets in front of the retina.

The diagrams show how an additional lens will correct **short-sightedness**.

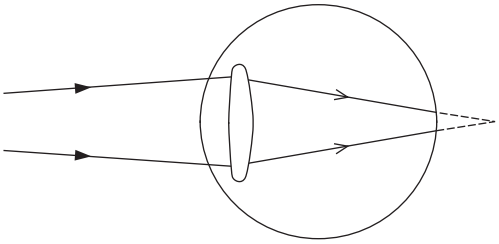


Uncorrected vision



Vision corrected with a diverging lens

The following diagram shows what happens when light from a close object enters the eye of a **long-sighted** person.



Light fails to come to focus on the retina

What type of additional lens will correct the vision of a **long-sighted** person?

.....

(1 mark)

5 (b) (ii) The additional lens changes the direction of the light before it enters the eye.

Why does this correct the person's vision?

.....

.....

(1 mark)

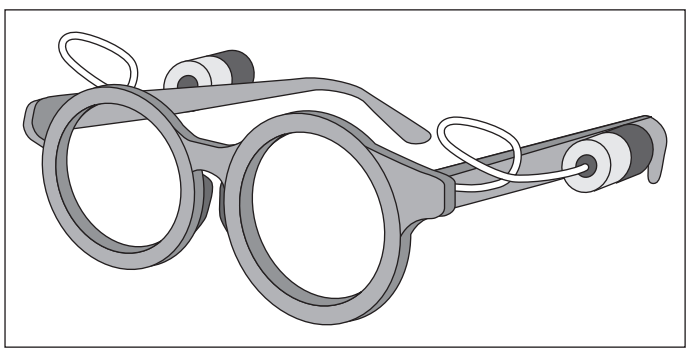
Question 5 continues on the next page

Question 10 · continued

5 (c) Read this passage from a magazine.

Professor's clear vision for the future

There are billions of poor people in the world who cannot see clearly and cannot afford the cost of having their eyesight corrected. A professor has invented adjustable glasses. They are cheap and a few minutes is all it takes for you to adjust them to suit your eyes.



When the adjusting screw is turned in one direction, silicone is pushed into the flexible lens which becomes thicker in the centre. Turning the screw in the opposite direction pulls silicone out, and the lens becomes thinner at the centre than at the edge.

Explain how these glasses are adjusted for a **short-sighted** person and how this adjustment allows the person to see distant objects clearly.

.....

.....

.....

.....

.....

(3 marks)

6

4.6.2.5 Lenses (physics only)

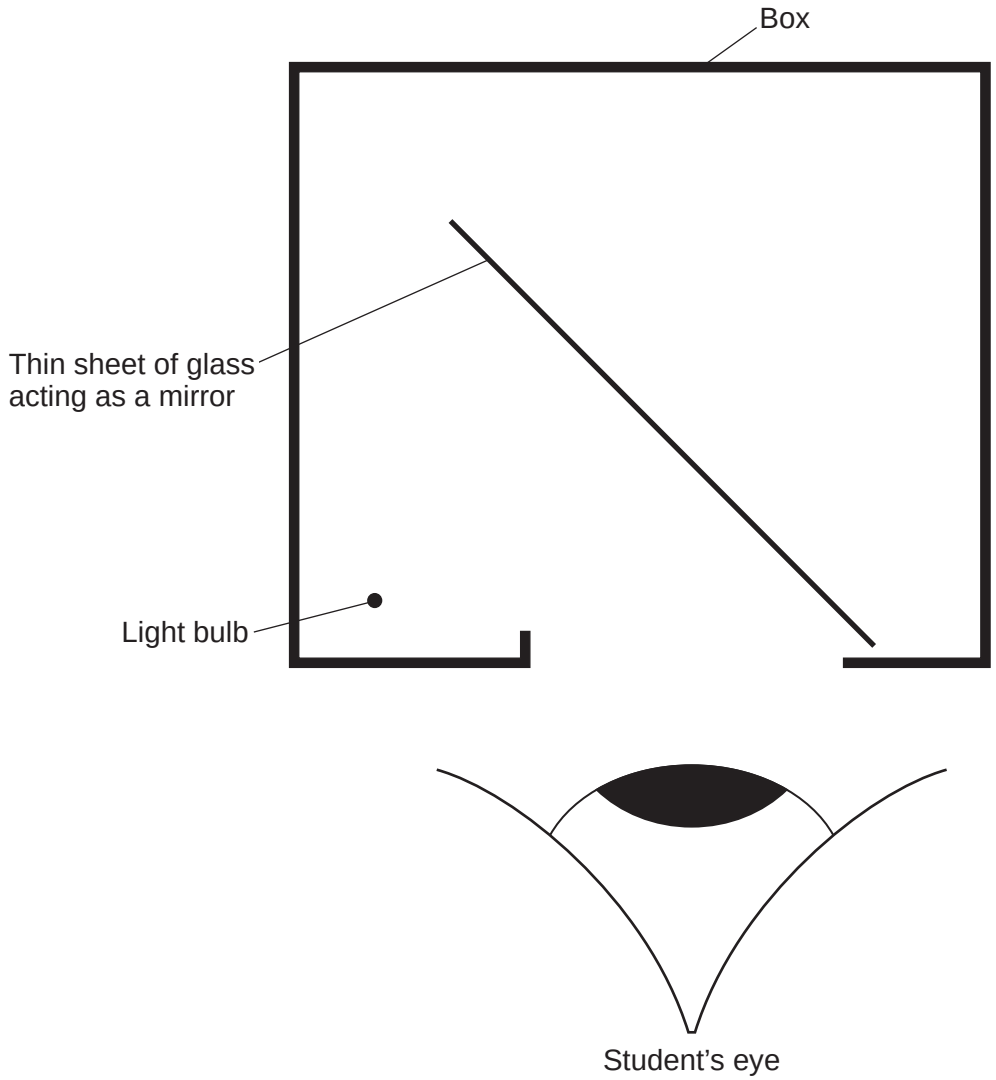
Question 11

June 2012 | PH1HP | Original Q7 | Legacy

7 The diagram shows a model used to demonstrate an illusion known as 'Pepper's Ghost'.

A small light bulb and thin sheet of glass are put inside a box. The thin sheet of glass acts as a mirror. Although the light bulb is switched on, a student looking into the box cannot see the bulb. What the student does see is a virtual image of the bulb.

View from above



7 (a) Use a ruler to complete a ray diagram to show how the image of the light bulb is formed. Mark and label the position of the image.

(4 marks)

7 (b) The image seen by the student is virtual.

Why?

.....

.....

(1 mark)

5

4.6.2.5 Lenses (physics only)

Question 12

June 2013 | PH1HP | Original Q3 | Legacy

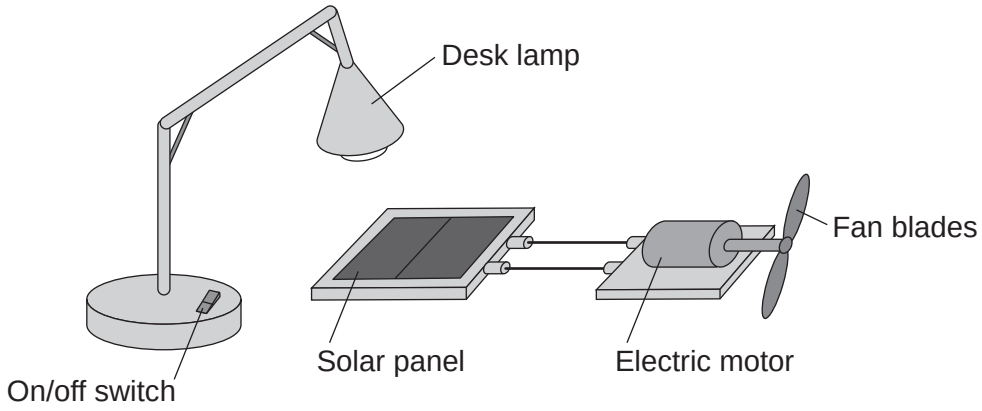
3 (a) Light waves transfer energy.

3 (a) (i) Complete the following sentence.

The oscillations producing a light wave are ..... to the direction of the energy transfer by the light wave.

(1 mark)

3 (a) (ii) The apparatus in the diagram shows that light waves transfer energy.



Describe how switching the desk lamp on and off shows that light waves transfer energy.

You do **not** need to describe the energy transfers.

.....

.....

.....

.....

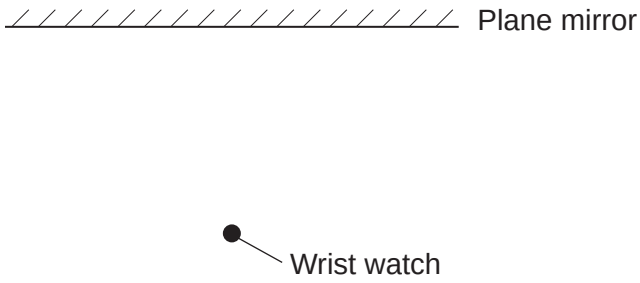
(2 marks)

4.6.2.5 Lenses (physics only)

Question 12 · continued

3 (b) A student holds a wrist watch in front of a plane mirror. The student can see an image of the wrist watch in the mirror.

The diagram shows the position of the wrist watch and the mirror.



Draw a ray diagram showing how the image of the wrist watch is formed.

Mark the position of the image.

(4 marks)

3 (c) The image of the wrist watch seen by the student is virtual.

What is a virtual image?

.....

.....

(1 mark)

8

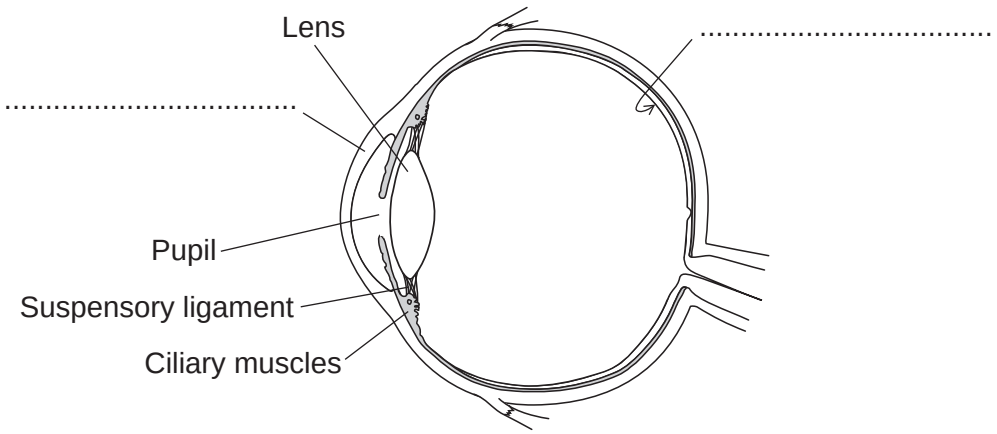
4.6.2.5 Lenses (physics only)

Question 13

June 2013 | PH3HP | Original Q1 | Legacy

1 (a) The diagram shows parts of the human eye.

Complete the missing labels.



(2 marks)

1 (b) Each part of the human eye has a function.

Complete the table below.

Part of the human eye	Function of the part
.....	Changes size to make sure the correct amount of light enters the eye.
Ciliary muscles	....
Lens	....

(3 marks)

4.6.2.5 Lenses (physics only)

Question 13 · continued

1 (c) The human eye can focus on near objects. The closest distance the eye can bring into sharp focus is called the near point.

A student measured the near point of four people of different ages. The table shows her data.

Age of human in years	Near point in millimetres
10	200
25	250
40	400
55	700

What can you conclude from the data in the table above?

.....

.....

.....

.....

(2 marks)

1 (d) Suggest how the data obtained by the student could be improved.

.....

.....

(1 mark)

1 (e) Spectacles are worn to correct vision. One of the lenses in a pair of spectacles has a focal length of 40 centimetres.

Calculate the power of the lens.

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Power of lens = ... dioptres

(2 marks)

10

4.6.2.5 Lenses (physics only)

Question 14

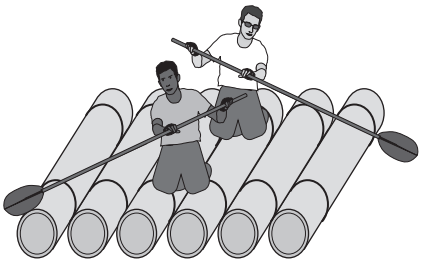
June 2013 | PH3HP | Original Q2 | Legacy

2 An event involved paddling a homemade raft down a fast-flowing river. The rafts were made using empty barrels.

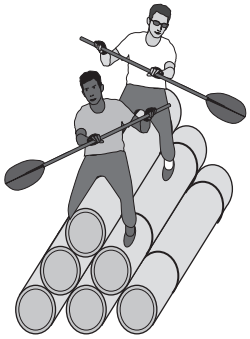


Below are the designs of two rafts.

Design **A**



Design **B**



2 (a) Compare the stability of the two raft designs. Give reasons for your answer.

.....

.....

.....

.....

.....

.....

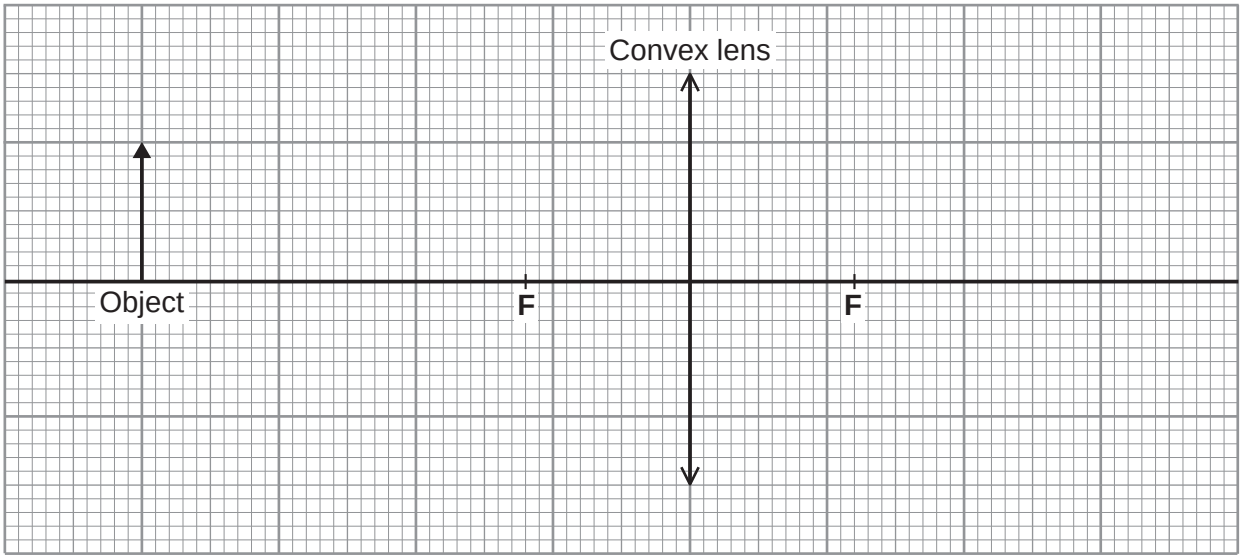
(2 marks)

4.6.2.5 Lenses (physics only)

Question 14 · continued

2 (b) A camera was used to take photographs of the rafts. The camera contains a convex (converging) lens.

Complete the ray diagram to show how the lens produces an image of the object.



F = Principal focus

(4 marks)

2 (c) State **two** words to describe the nature of the image produced by the lens in the camera.

1 .....

2 .....

(2 marks)

8

4.6.2.5 Lenses (physics only)

Question 15

June 2014 | PH3HP | Original Q5 | Legacy

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

Complete the missing parts in **Table 2**.

[2 marks]

Table 2

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

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

State **two** causes of long sight.

[2 marks]

1 .....

.....

2 .....

.....

4.6.2.5 Lenses (physics only)

Question 15 · continued

5 (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.

[2 marks]

.....

.....

.....

Focal length = ... metres

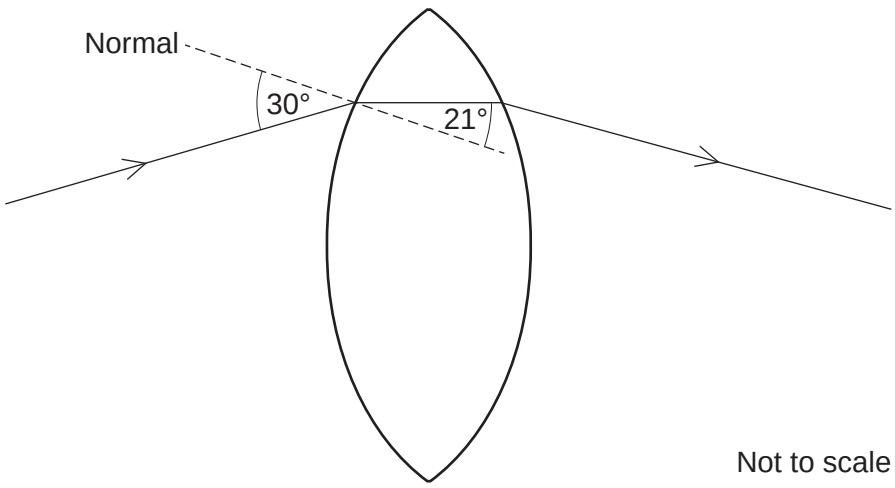
Question 5 continues on the next page

4.6.2.5 Lenses (physics only)

Question 15 · continued

5 (d) **Figure 8** shows a ray of light passing through a converging (convex) lens.

Figure 8



Not to scale

5 (d) (i) Use the information in **Figure 8** to calculate the refractive index of the glass used to make the lens.

Use the correct equation from the Physics Equations Sheet.

[3 marks]

.....

.....

.....

.....

Refractive index = ...

5 (d) (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.

[1 mark]

.....

.....

10

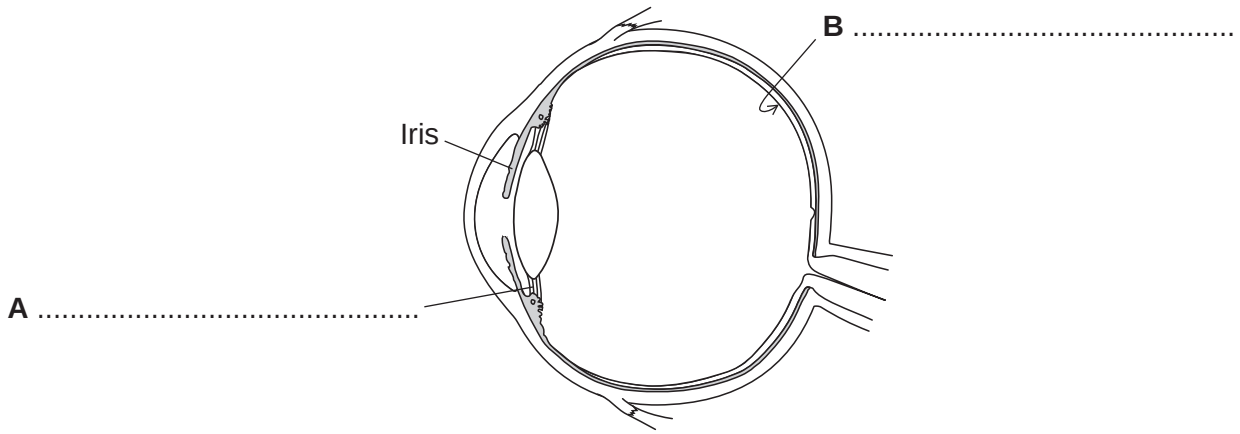
4.6.2.5 Lenses (physics only)

Question 16

June 2015 | PH3HP | Original Q4 | Legacy

4 (a) **Figure 6** shows a diagram of a human eye.

Figure 6



Label the parts **A** and **B** on **Figure 6**.

[2 marks]

4 (b) State the function of the iris.

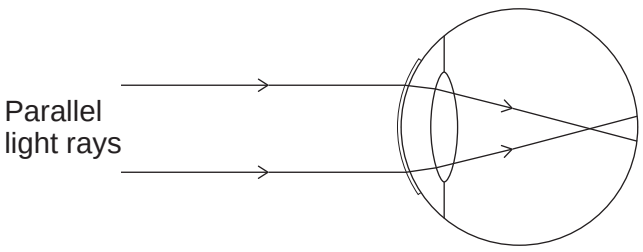
[1 mark]

.....

.....

4 (c) **Figure 7** shows light rays travelling into the human eye.

Figure 7



4 (c) (i) Give the name of the defect of vision shown in **Figure 7**.

[1 mark]

.....

4.6.2.5 Lenses (physics only)

Question 16 · continued

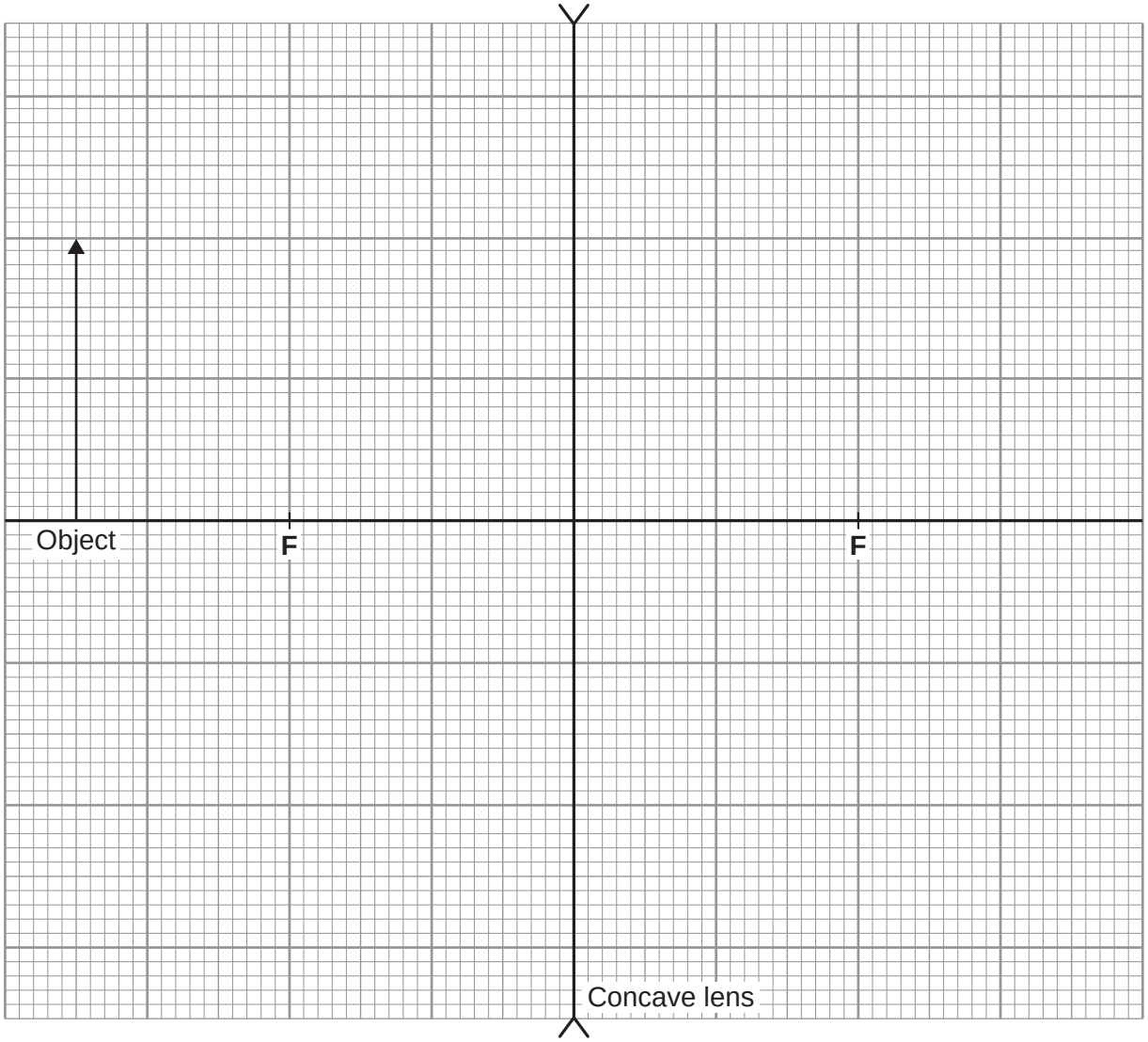
4 (c) (ii) A concave (diverging) lens can be used to correct the defect of vision shown in **Figure 7**.

Complete the ray diagram in **Figure 8** to show how a concave lens produces an image of the object.

Use an arrow to represent the image.

[3 marks]

Figure 8



4 (d) It is important that muscles can change the power of the lens in the eye.
State why.

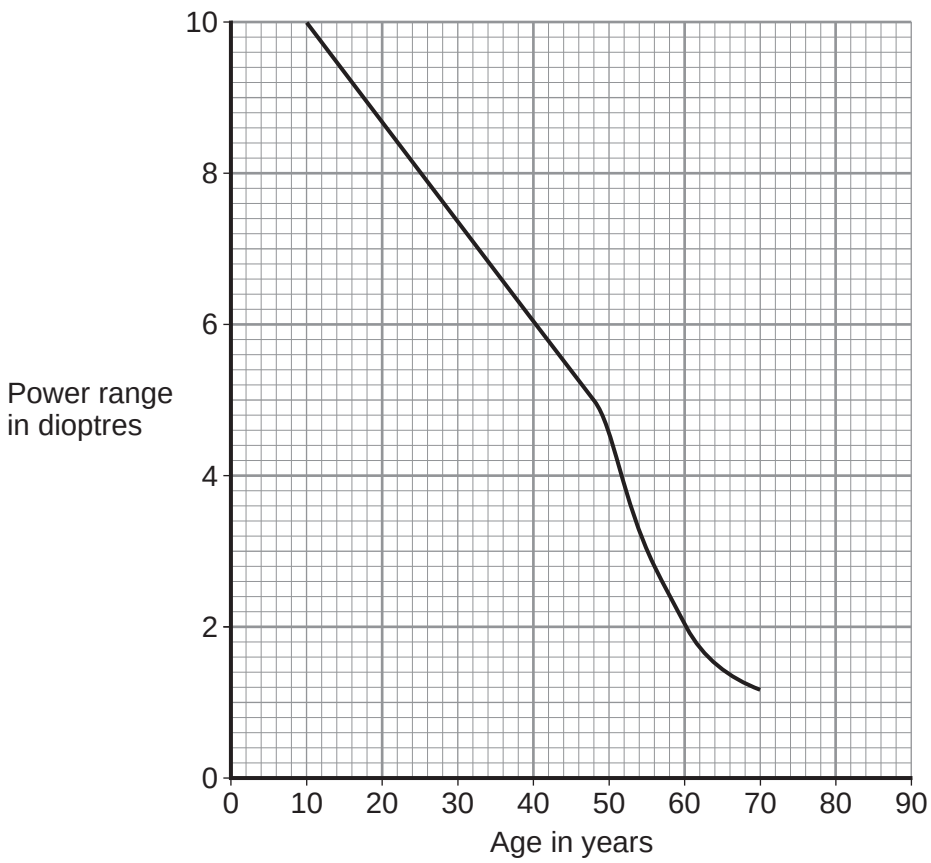
[1 mark]

.....

4 (e) The 'power range' of an eye lens is the difference between the maximum and minimum power of the lens.

Figure 9 shows how the power range of an eye lens changes with age.

Figure 9



4 (e) (i) Use data from **Figure 9** to calculate the maximum change that can happen to the **focal length** of the eye lens for a 60-year-old person.

Use the correct equation from the Physics Equations Sheet.

Give the unit.

[2 marks]

.....

.....

.....

Maximum change in focal length = ... unit .....

4.6.2.5 Lenses (physics only)

Question 16 · continued

4 (e) (ii) Compare the change in power range of the eye lens between the ages of 10 and 30 with that between the ages of 50 and 70.

[3 marks]

.....

.....

.....

.....

.....

.....

4 (e) (iii) Use **Figure 9** to suggest the power range of the eye lens for a 90-year-old person.

[1 mark]

Power range = ... dioptres

14

4.6.2.5 Lenses (physics only)

Question 17

June 2016 | PH3HP | Original Q7 | Legacy

7 (a) Some people have an eye defect called long sight.

7 (a) (i) State **one** cause of long sight.

[1 mark]

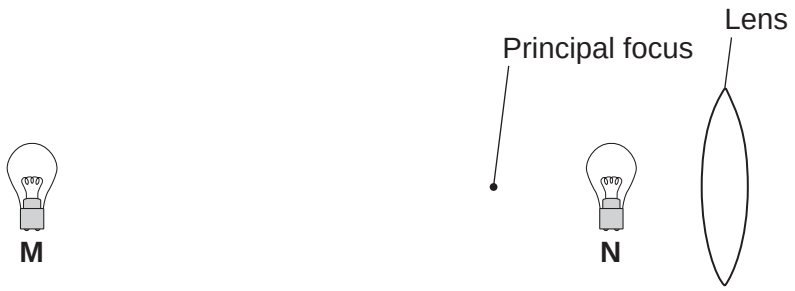
7 (a) (ii) Long sight can be corrected by surgery. During surgery, the surgeon may need to cut and heat very delicate parts of the eye.

Name the piece of equipment which provides the energy source used to do this.

[1 mark]

7 (b) A light bulb is placed between a convex lens and the principle focus of this lens, at position **N** shown in **Figure 14**. The light bulb is then moved to position **M**, a large distance from the lens.

Figure 14



Describe how the nature of the image formed changes as the light bulb is moved from position **N** to position **M**.

[3 marks]

4.6.2.5 Lenses (physics only)

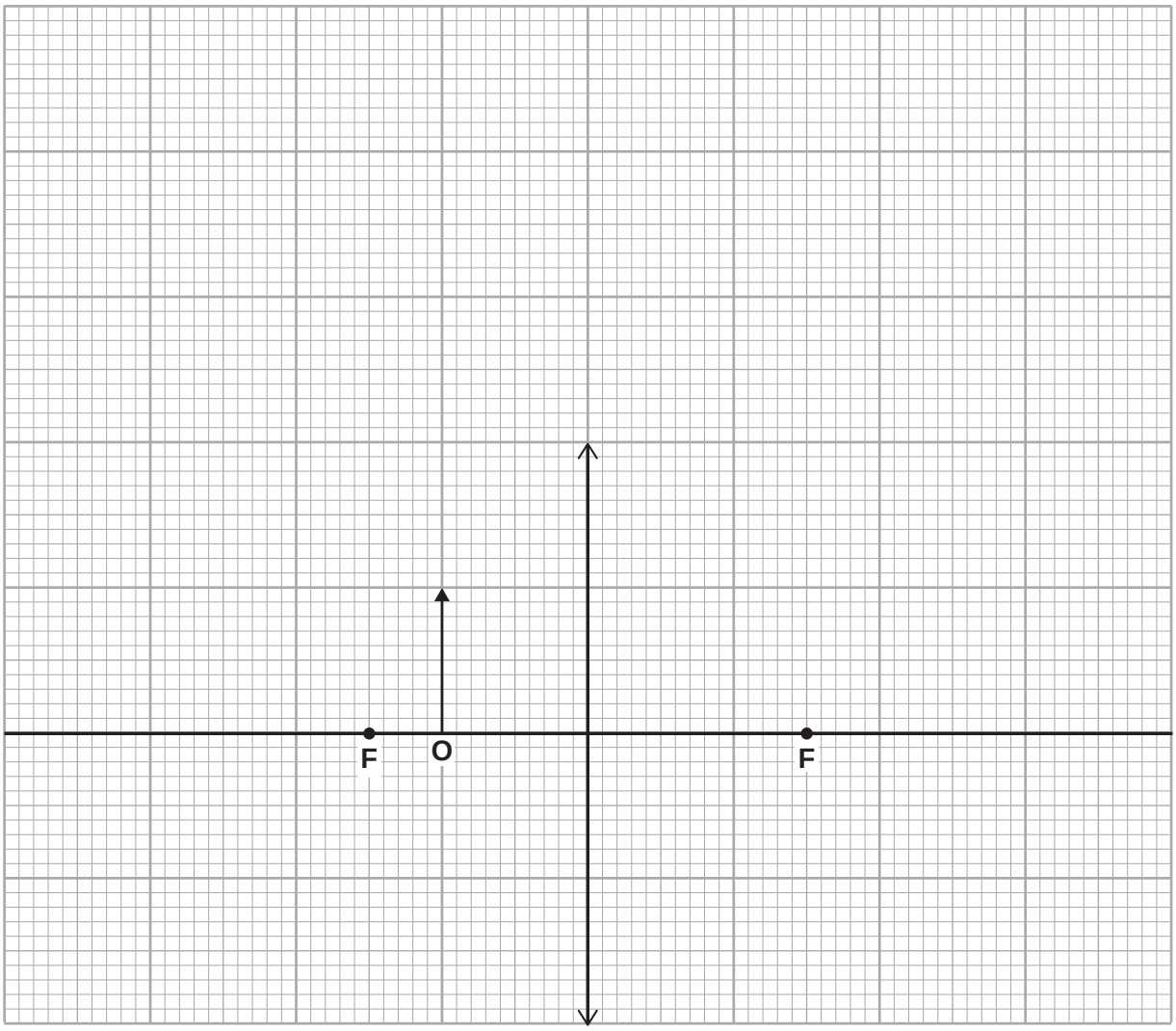
Question 17 · continued

7 (c) An object, **O**, is very near to a convex lens, as shown in **Figure 15**.

Complete **Figure 15** to show how rays of light from the object form an image.

[3 marks]

Figure 15



Question 7 continues on the next page

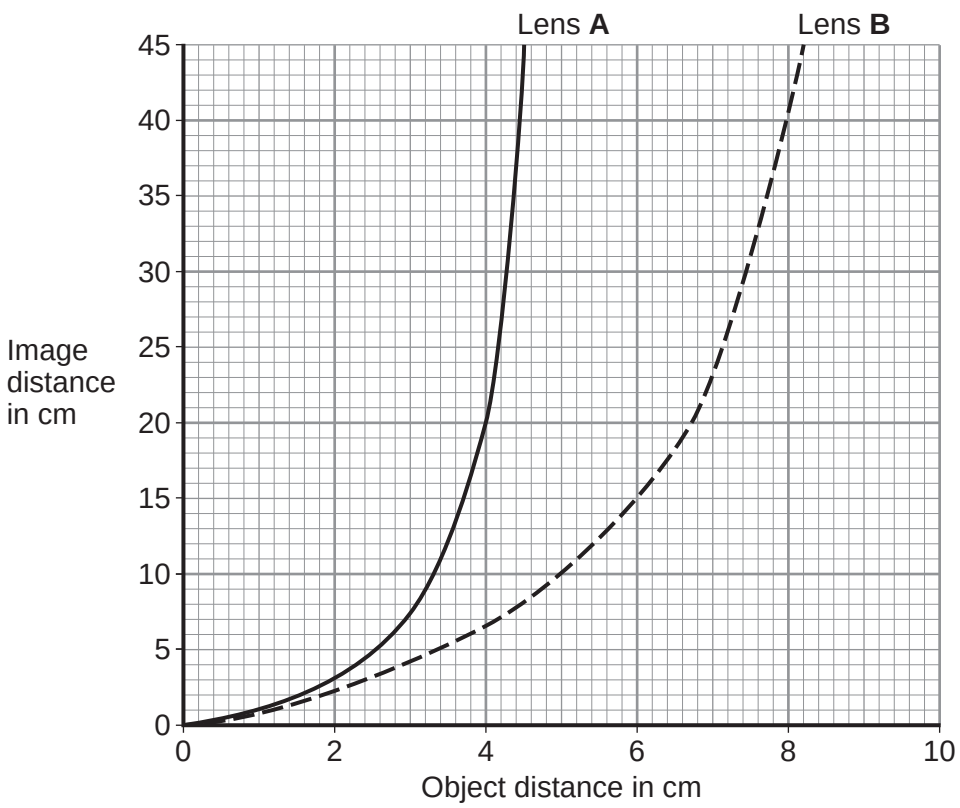
4.6.2.5 Lenses (physics only)

Question 17 · continued

7 (d) The object distance is the distance from an object to the lens. The image distance is the distance from the lens to the image.

Figure 16 shows how the image distance changes with the object distance, for two identically shaped convex lenses, **A** and **B**. Each lens is made from a different type of glass.

Figure 16



7 (d) (i) When the object distance is 4 cm, the image distance for lens **A** is longer than for lens **B**.

State why.

[1 mark]

4.6.2.5 Lenses (physics only)

Question 17 · continued

7 (d) (ii) When the object is moved between lens **B** and the principal focus, the image size changes. **Table 2** shows the magnification produced by lens **B** for different object distances.

Table 2

Object distance in cm	Magnification
0.0	1
5.0	2
6.7	3
7.5	4
8.0	5

Using information from **Figure 16** and **Table 2**, describe the relationship between the **image** distance and the magnification produced by lens **B**.

[2 marks]

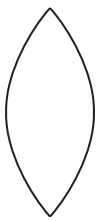
7 (d) (iii) A third convex lens, lens **C**, is made from the same type of glass as lens **B**, but has a shorter focal length than lens **B**.

Lens **B** is shown in **Figure 17**.

Complete **Figure 17** to show how lens **C** is different from lens **B.**

[1 mark]

Figure 17



Lens **B** Lens **C**

12

4.6.2.5 Lenses (physics only)

Question 18

June 2017 | PH3HP | Original Q2 | Legacy

2 (a) Glasses may be used to correct defects of vision. Some glasses have been designed with lenses that can be adjusted to give different focal lengths.

Suggest **one** advantage of using adjustable lenses in glasses.

[1 mark]

2 (b) **In this question you will gain marks for using good English, organising information clearly and using scientific words correctly.**

Explain how the human eye forms an image.

Your explanation should include:

- how a normal eye causes light from objects at different distances to form an image
- why long sight and short sight cause blurred images.

Do **not** include diagrams in your answer.

[6 marks]

Extra space

4.6.2.5 Lenses (physics only)

Question 19

June 2017 | PH3HP | Original Q4 | Legacy

4 One type of digital camera contains both a converging (convex) lens and a diverging (concave) lens.

4 (a) State the name of the light detector used in digital cameras.

[1 mark]

_____

4 (b) Converging and diverging lenses both produce images.

What type of images can be produced using converging and diverging lenses?

Tick (✓) **one** box for **each** type of lens.

[2 marks]

Converging lens

Real image only ☐

Virtual image only ☐

Both real and virtual images ☐

Diverging lens

Real image only ☐

Virtual image only ☐

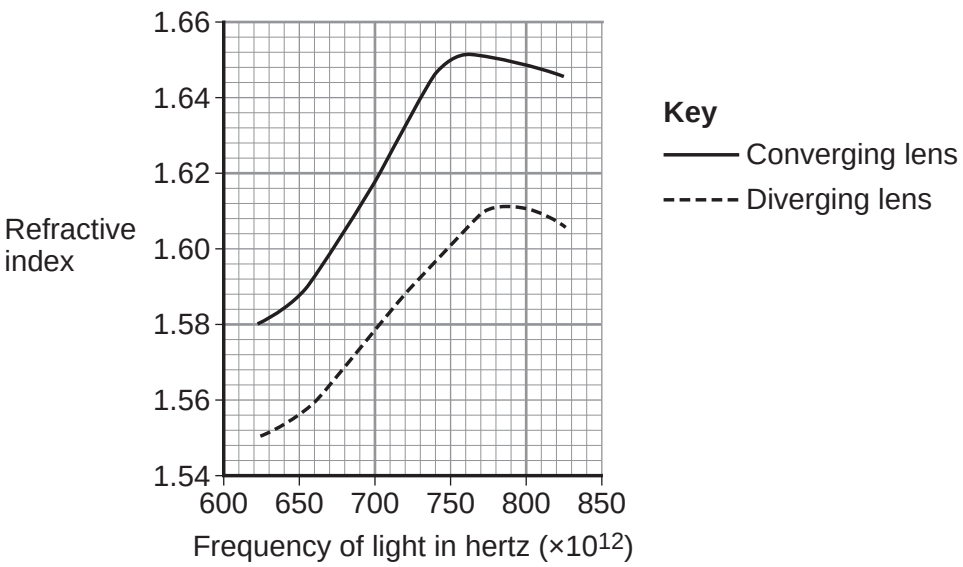
Both real and virtual images ☐

Question 4 continues on the next page

4 (c) Each lens in the digital camera is made from a different type of glass.

Figure 3 shows the relationship between the frequency of light and the refractive index of the glass used to make each lens.

Figure 3



Describe **three differences** between the refractive index of the glass used for the converging lens compared to the glass used for the diverging lens as the frequency of light increases.

[3 marks]

1 _____

_____

_____

2 _____

_____

_____

3 _____

_____

_____

4.6.2.5 Lenses (physics only)

Question 19 · continued

4 (d) At one frequency, the glass of the diverging lens has a refractive index of 1.60
The angle of incidence of a ray of this light on the diverging lens is 20°

Calculate the angle of refraction for the ray of light.

Use the correct equation from the Physics Equations Sheet.

[3 marks]

Angle of refraction = _____ degrees

4 (e) The focal length of the diverging lens is 40 cm.

Calculate the power of the diverging lens. Give the unit.

Use the correct equation from the Physics Equations Sheet.

[3 marks]

Power = _____ unit _____

4 (f) Give **two** factors that affect the power of a lens.

[2 marks]

1 _____

2 _____

14

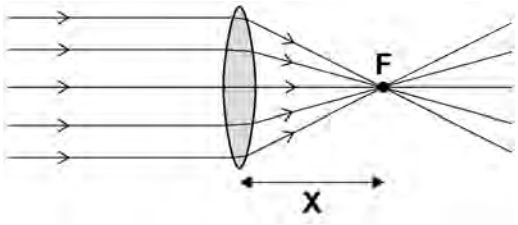
4.6.2.5 Lenses (physics only)

Question 20

June 2019 | 8463/2H | Original Q1

0 1 . 1 **Figure 1** shows parallel rays of light being refracted by a convex lens.

Figure 1



What is distance '**X**' called?

[1 mark]

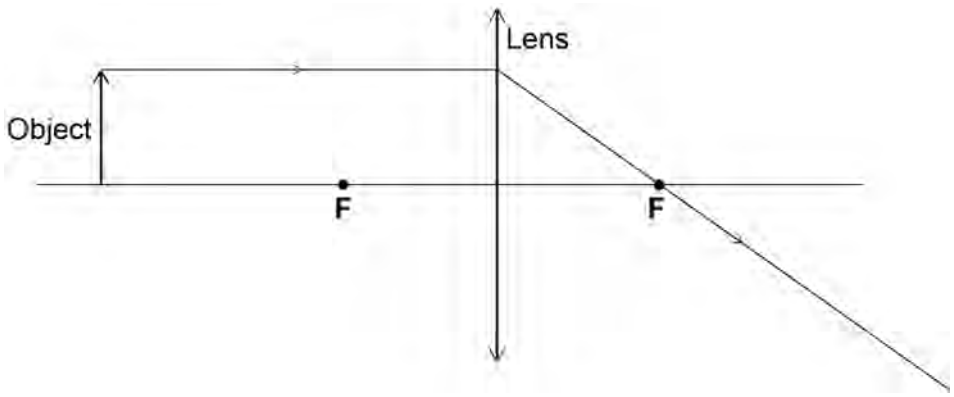
0 1 . 2 Lenses can be used to form the image of an object.

Complete the ray diagram in **Figure 2** to show how a **convex** lens forms the image of the object.

Use an arrow to represent the image.

[2 marks]

Figure 2

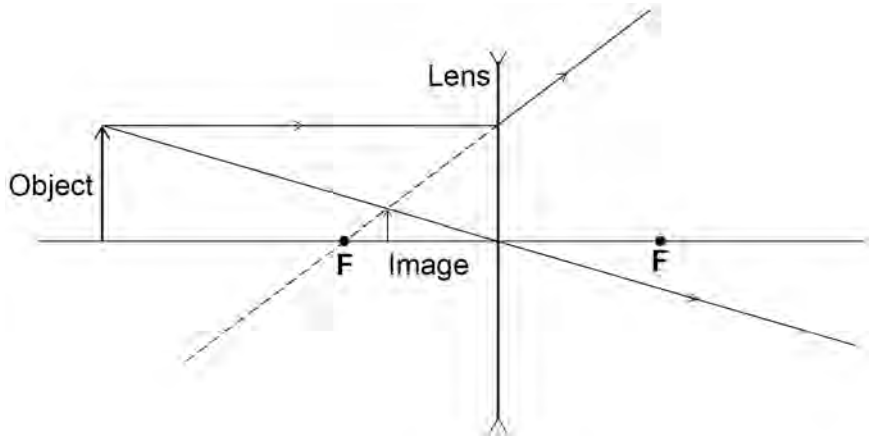


4.6.2.5 Lenses (physics only)

Question 20 · continued

Figure 3 shows how a **concave** lens forms the image of an object.

Figure 3



0 1 . 3 Give **one** similarity and **one** difference between the image formed by the convex lens and the image formed by the concave lens.

[2 marks]

Similarity _____

_____

Difference _____

_____

0 1 . 4 A person uses a lens to read the letters on the back of a coin.

The image height of the letters on the coin is 9.0 mm

The magnification produced by the lens is 6.0

Calculate the height of the letters on the coin.

Use the Physics Equations sheet.

[3 marks]

_____

_____

_____

_____

Height = _____ mm

8

4.6.2.5 Lenses (physics only)

Question 21

November 2020 | 8463/2H | Original Q4

0 4 A door is fitted with a security lens and a lock.

The security lens allows a person to see a visitor before opening the door.

The security lens is concave.

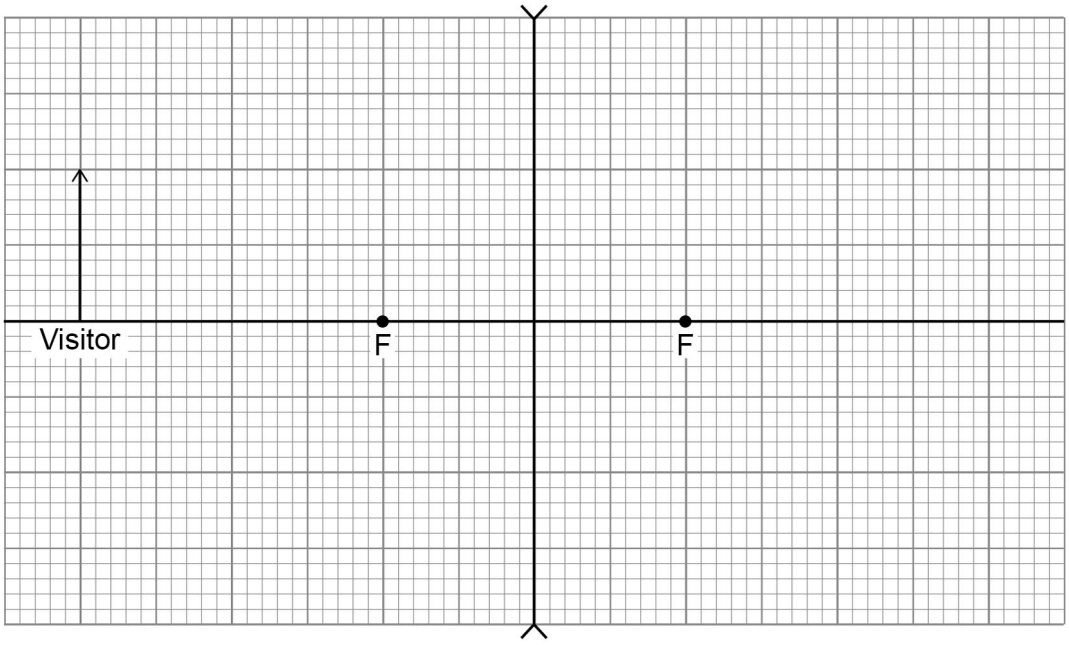
0 4 . 1 **Figure 5** is an incomplete ray diagram representing a visitor standing near the security lens.

Complete **Figure 5** to show how an image of the visitor is formed by the concave lens.

Draw an arrow to represent the image.

[3 marks]

Figure 5



0 4 . 2 The visitor moves further away from the security lens in the door.

How does the size of the image change?

[1 mark]

Tick (✓) **one** box.

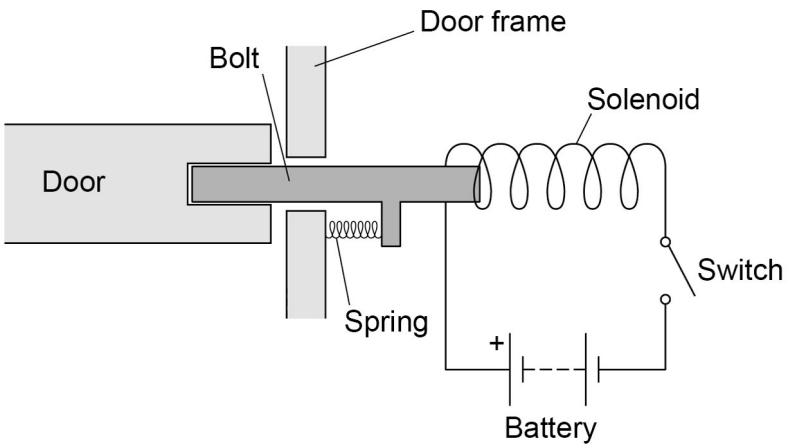
Decreases ☐

Increases ☐

Stays the same ☐

Figure 6 shows a diagram of the lock. The door unlocks when the switch is closed.

Figure 6



0 4 . 3 Which material should the bolt be made from?

[1 mark]

Tick (✓) **one** box.

Aluminium ☐

Brass ☐

Copper ☐

Iron ☐

0 4 . 4 Explain why the door unlocks when the switch is closed.

[3 marks]

4.6.2.5 Lenses (physics only)

Question 21 · continued

0 4 . 5 When the door unlocks, a force of 2.88 N is applied to the spring.

The spring extends by 1.50 cm.

Calculate the spring constant of the spring.

[4 marks]

Spring constant = _____ N/m

0 4 . 6 Give **two** ways the resultant force on the bolt could be increased.

[2 marks]

1 _____

2 _____

14

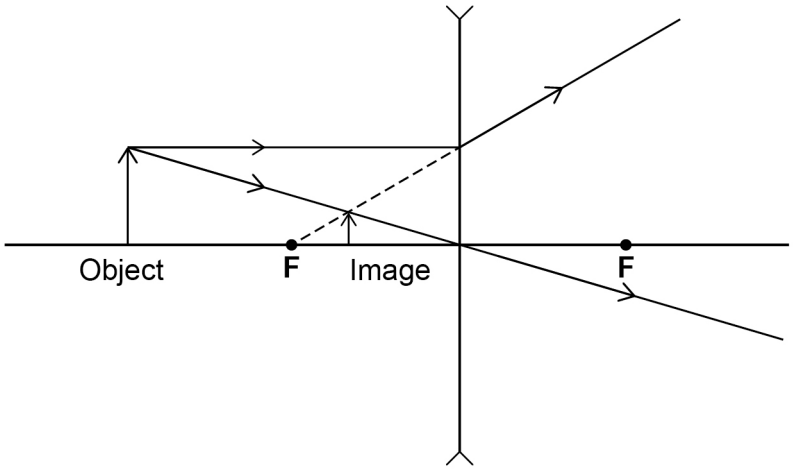
4.6.2.5 Lenses (physics only)

Question 22

0 4 Lenses are used to form images of objects.

0 4 . 1 **Figure 6** shows how a concave lens forms an image of an object.

Figure 6



The image of the object in **Figure 6** is upright.

Give **two** other words that describe the image.

[1 mark]

1 _____

2 _____

4.6.2.5 Lenses (physics only)

Question 22 · continued

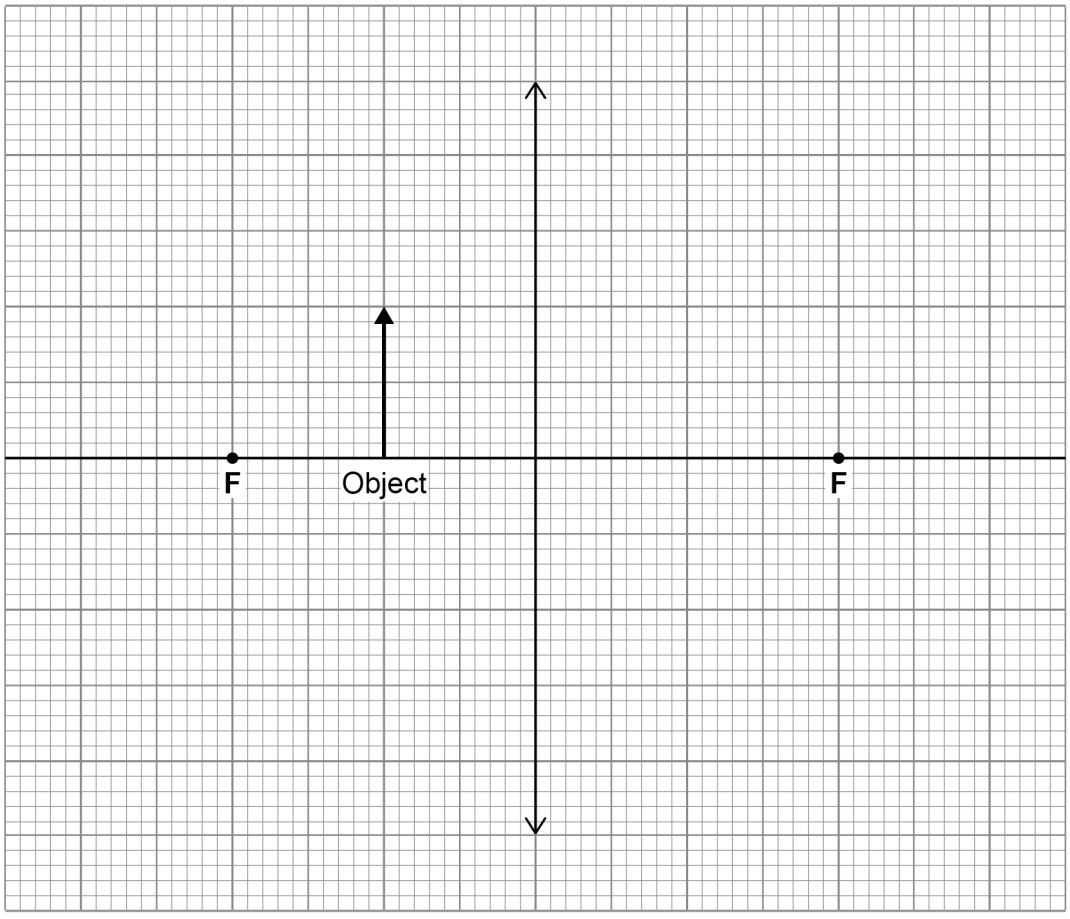
0 4 . 2 **Figure 7** shows an object near to a **convex** lens.

Complete the ray diagram to show how the image is formed.

Use an arrow to represent the image.

[3 marks]

Figure 7



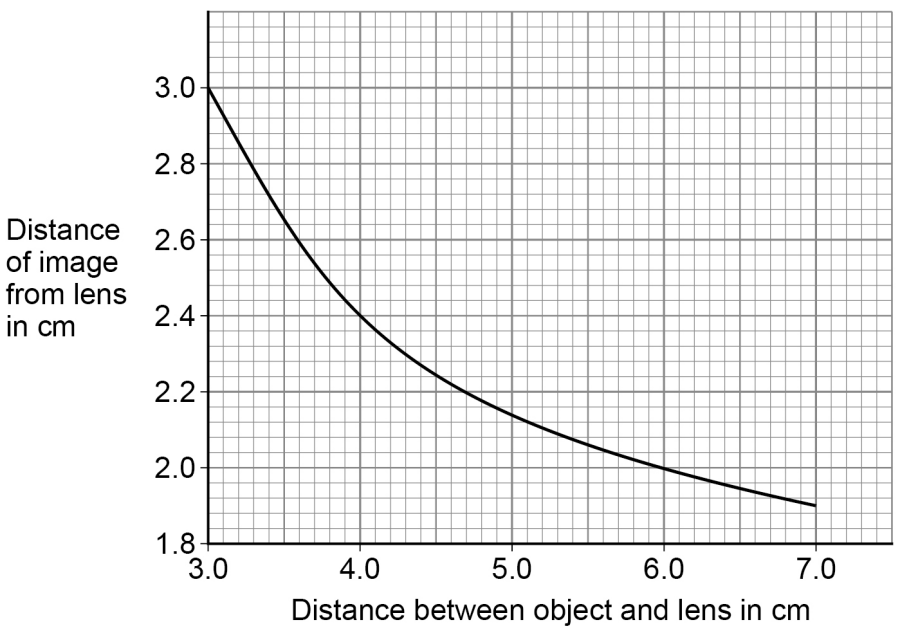
Question 4 continues on the next page

Question 22 · continued

The position of an image formed by a convex lens varies with the distance between the object and the lens.

Figure 8 shows the results of a student's investigation using a convex lens.

Figure 8



0 4 . 3 Describe how the distance of the image from the lens decreases as the distance between the object and the lens increases.

[1 mark]

4.6.2.5 Lenses (physics only)

Question 22 · continued

0 4 . 4 The student measured the distance from the image to the lens four times.

The distance between the object and the lens did not change.

The 4 measurements from the image to the lens were:

1.9 cm 1.7 cm 2.2 cm 1.4 cm

Calculate the uncertainty in the measurements.

[2 marks]

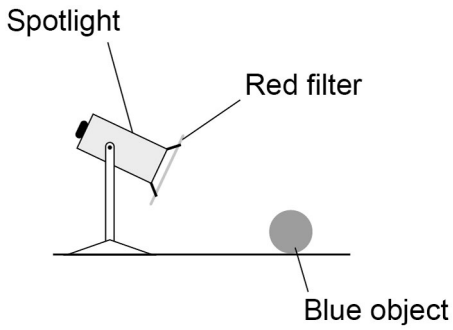
Uncertainty = ± _____ cm

0 4 . 5 **Figure 9** shows a spotlight containing a convex lens.

A red filter is placed in front of the spotlight.

The spotlight is directed at a blue object.

Figure 9



Explain why the blue object appears black.

[3 marks]

10

4.6.2.5 Lenses (physics only)

Question 23

June 2025 | 8463/2H | Original Q4

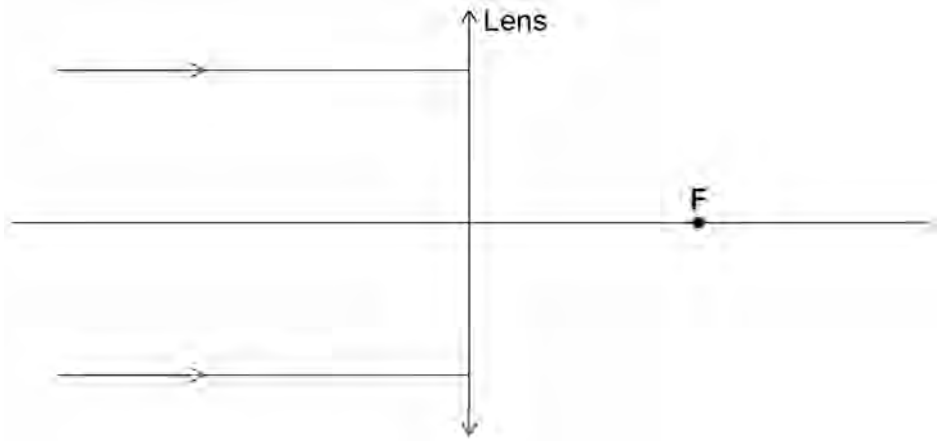
0 4 Telescopes are used to look at distant objects.

Some telescopes use lenses to form an image.

Figure 5 shows two parallel rays of light incident on a lens in a telescope.

The principal focus of the lens is labelled **F**.

Figure 5



0 4 . 1 What type of lens is shown in **Figure 5**?

[1 mark]

0 4 . 2 Complete the ray diagram in **Figure 5**.

[2 marks]

Question 4 continues on the next page

4.6.2.5 Lenses (physics only)

Question 23 · continued

The James Webb Space Telescope can detect electromagnetic radiation beyond the visible spectrum.

0 4 . 3 The shortest wavelength of electromagnetic radiation that can be detected by the James Webb Space Telescope is 0.60 μm.

speed of electromagnetic radiation = 3.0×10^8 m/s

Calculate the frequency of electromagnetic radiation that has a wavelength of 0.60 μm.

Use the Physics Equations Sheet.

[4 marks]

Frequency = _____ Hz

0 4 . 4 Complete the sentence.

[1 mark]

Electromagnetic radiation detected from distant galaxies is red-shifted.

This means that the electromagnetic radiation shows an increase in

_____.

Question 23 · continued

0 4 . 5 Why is the electromagnetic radiation from distant galaxies red-shifted?

[1 mark]

Tick (✓) **one** box.

All observed light from distant galaxies appears red. ☐

Distant galaxies are moving away from our galaxy. ☐

Distant galaxies are moving at the speed of light. ☐

0 4 . 6 The James Webb Space Telescope has detected electromagnetic radiation from many different galaxies.

Electromagnetic radiation from one of the galaxies detected shows the greatest red-shift ever observed.

What conclusion can be made about the distance to this galaxy?

[1 mark]

0 4 . 7 The James Webb Space Telescope is an artificial satellite that orbits the Sun at a constant speed.

Explain why the velocity of the satellite changes as it orbits the Sun.

[3 marks]

13