

Lenses

Question Paper

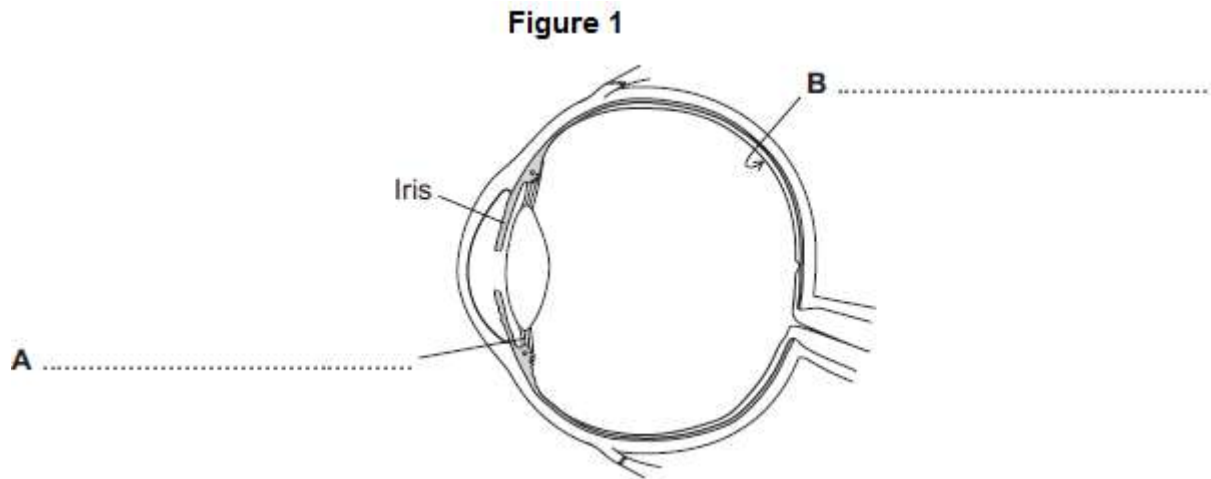
Level	GCSE
Subject	Physics
Exam Board	AQA
Unit	P3
Topic	Lenses
Difficulty Level	Silver Level
Booklet	Question Paper

Time Allowed: 71 minutes

Score: /71

Percentage: /100

Q1.(a) **Figure 1** shows a diagram of a human eye.



Label the parts **A** and **B** on **Figure 1**.

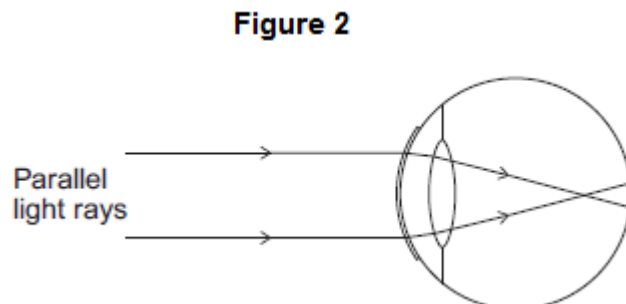
(2)

(b) State the function of the iris.

.....
.....

(1)

(c) **Figure 2** shows light rays travelling into the human eye.



(i) Give the name of the defect of vision shown in **Figure 2**.

.....

(1)

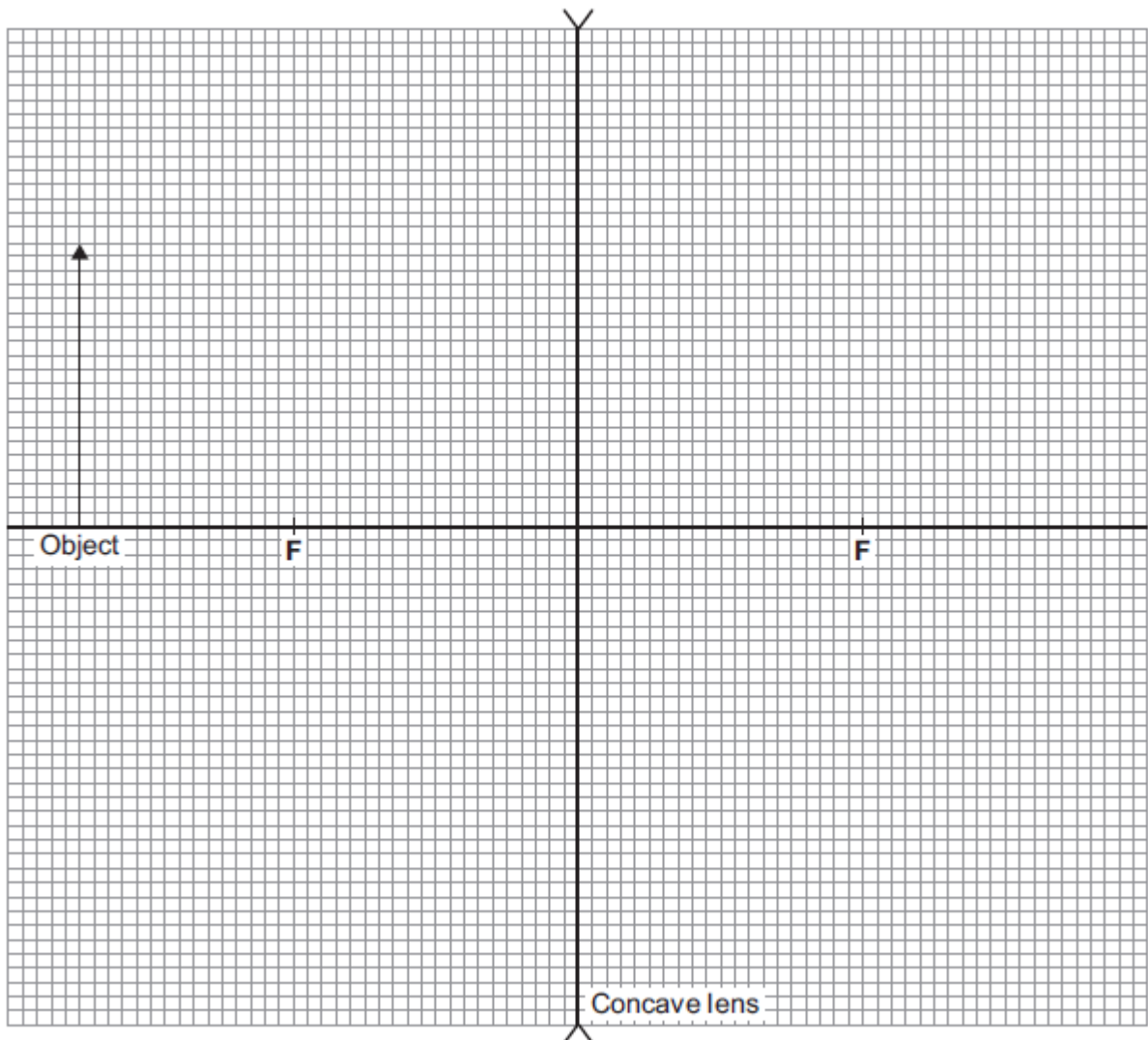
(ii) A concave (diverging) lens can be used to correct the defect of vision shown in

Figure 2.

Complete the ray diagram in **Figure 3** to show how a concave lens produces an image of the object.

Use an arrow to represent the image.

Figure 3



(3)

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

.....

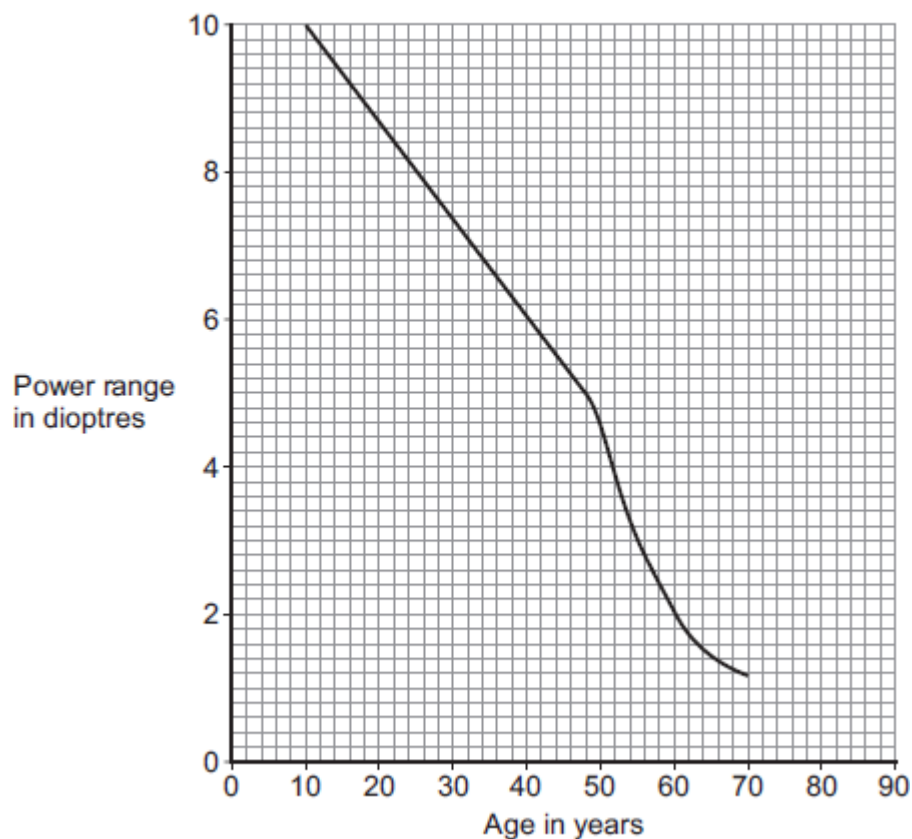
(1)

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

minimum power of the lens.

Figure 4 shows how the power range of an eye lens changes with age.

Figure 4



- (i) Use data from **Figure 4** 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.

.....

Maximum change in focal length = unit

(2)

- (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.

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(3)

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

Power range = dioptries

(1)

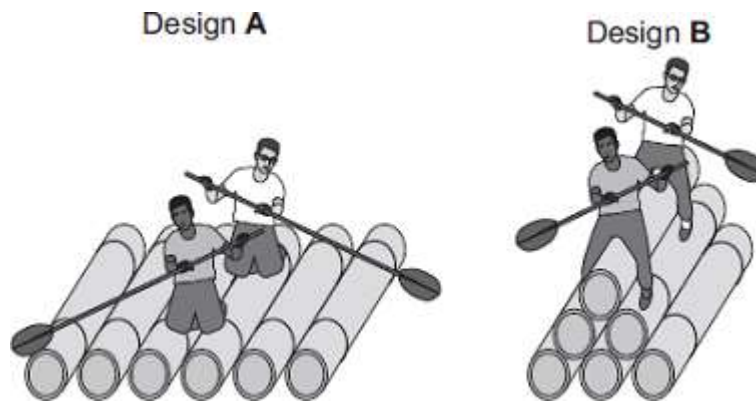
(Total 14 marks)

Q2.An event involved paddling a homemade raft down a fast-flowing river. The rafts were made using empty barrels.



By Reidrac [CC BY-SA 2.0], via Flickr

Below are the designs of two rafts.



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

.....

.....

.....

.....

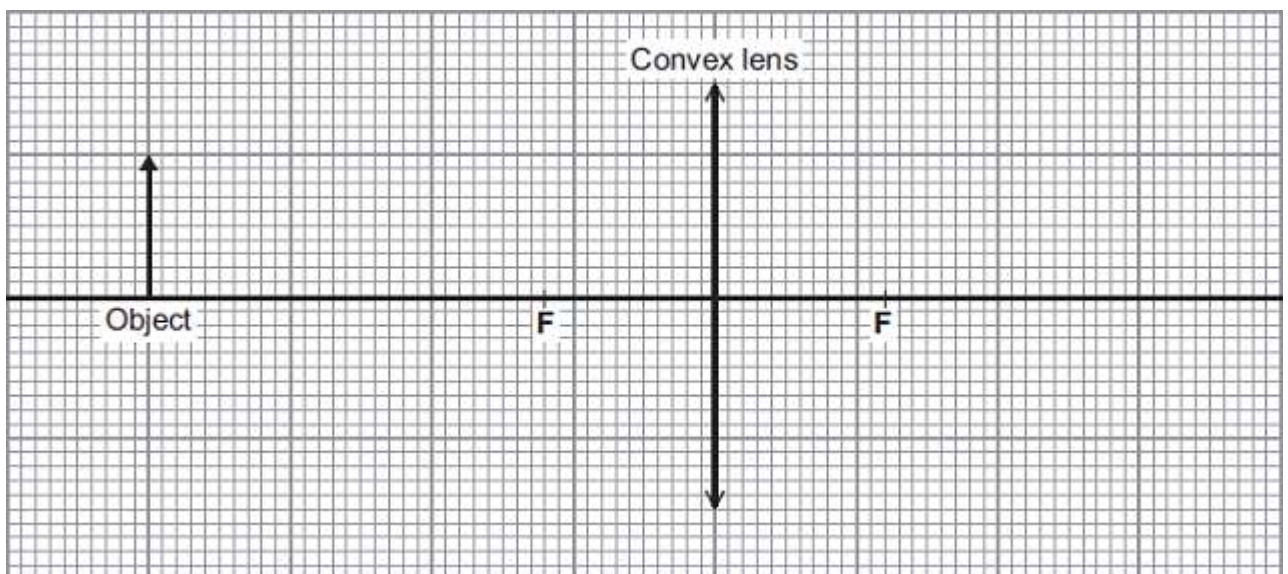
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(2)

(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)

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

1

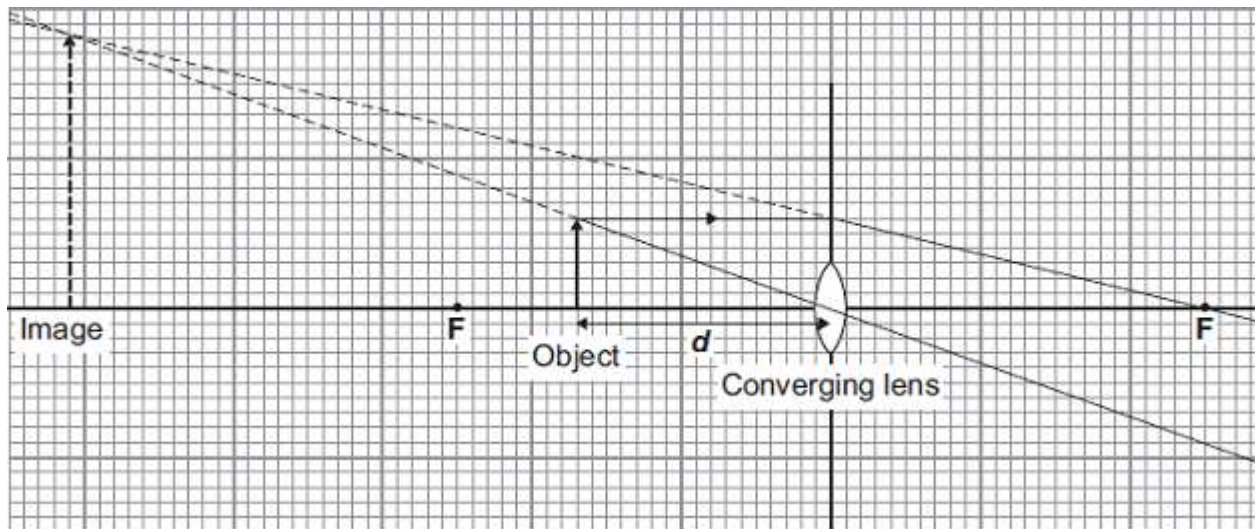
2

(2)

(Total 8 marks)

Q3. 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.



(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.

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

Show clearly how you work out your answer.

.....

.....
.....

Magnification =

(2)

- (ii) The points **F** are at equal distances on either side of the centre of the lens.
State the name of these points.

.....

(1)

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

.....
.....

(1)

- (b) The student now uses a different converging lens. He places the object between the lens and the 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 <i>d</i> 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.

His friend’s conclusion is wrong.

(i) Explain using data from the table why his friend’s conclusion is wrong.

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

(2)

(ii) Write a correct conclusion.

.....
.....

(1)

(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.

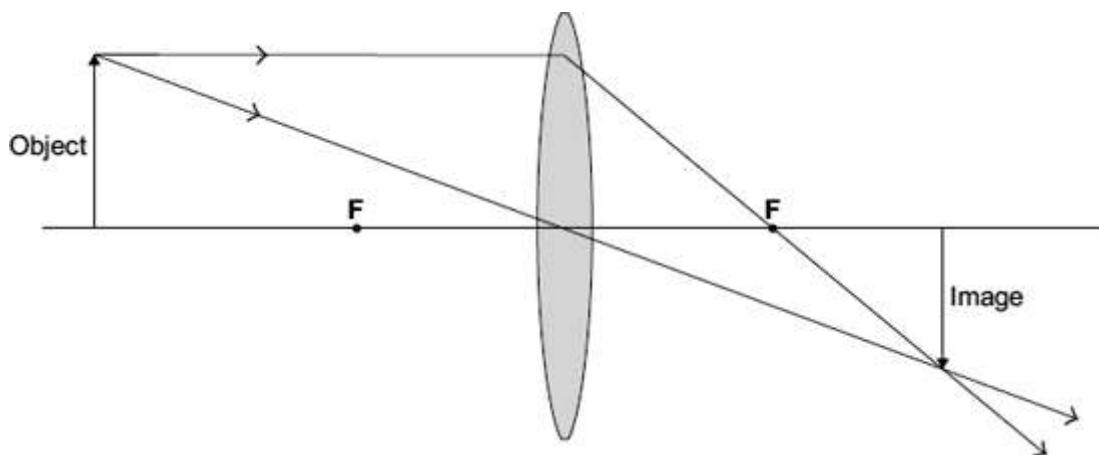
Explain why.

.....
.....

(1)

(Total 8 marks)

Q4. The diagram shows a lens, the position of an object and the position of the image of the object.



(a) What type of lens is shown?

.....

(1)

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

.....

(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)

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

inverted	larger	upright
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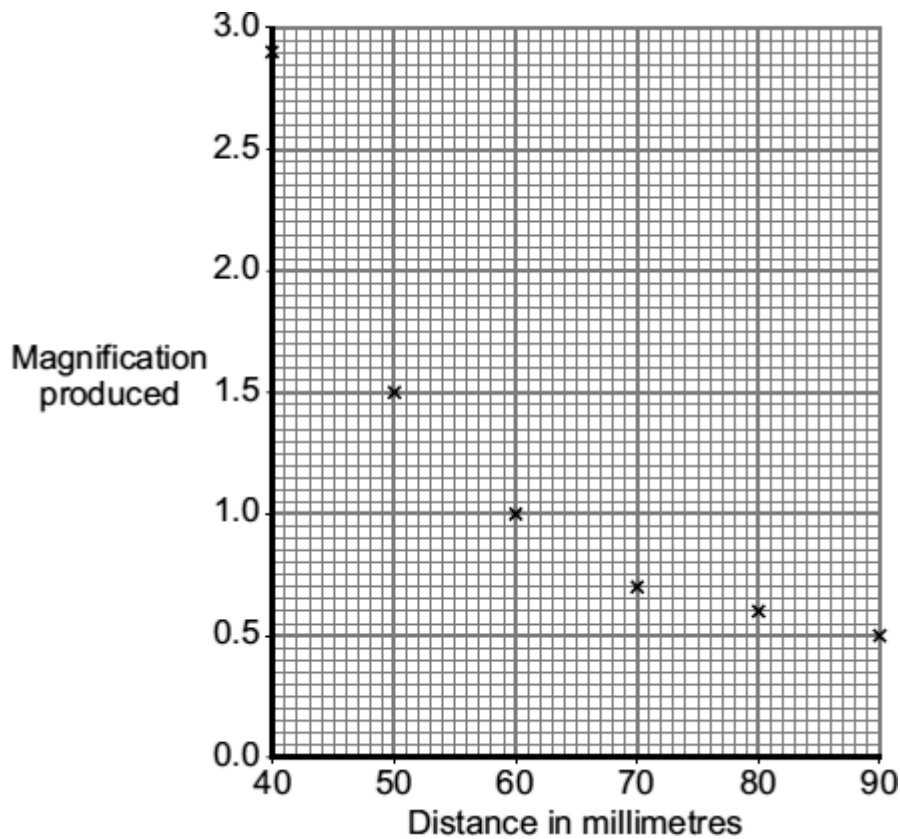
(1)

(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*.



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

(1)

- (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.
continuu s.
discrete.

(1)

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

.....

.....

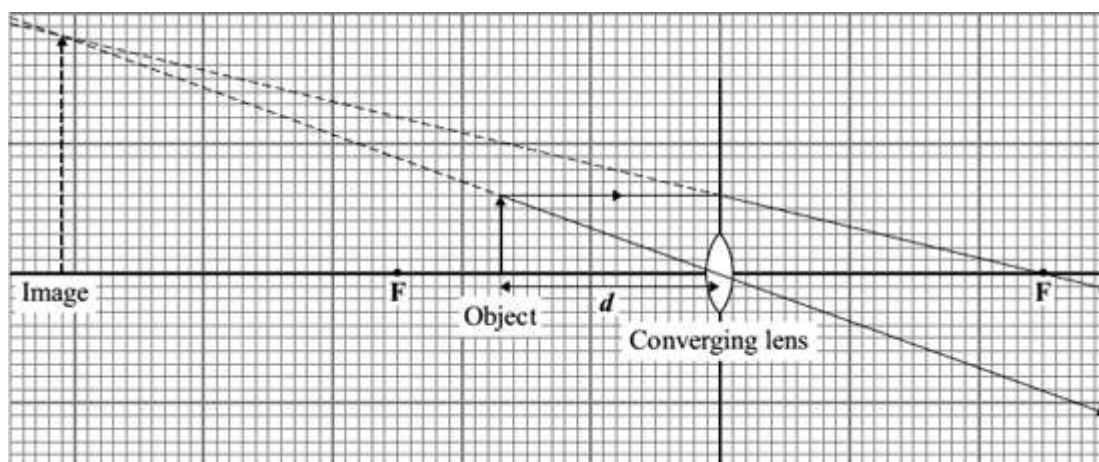
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(2)

(Total 8 marks)

- Q5.** 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.



- (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)

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

State the name of these points.

.....

(1)

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

.....

.....

(1)

- (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.

- (i) Explain, with an example, why his friend’s conclusion is **not** correct.

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

(2)

- (ii) Write a correct conclusion.

.....

.....

(1)

- (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.

.....

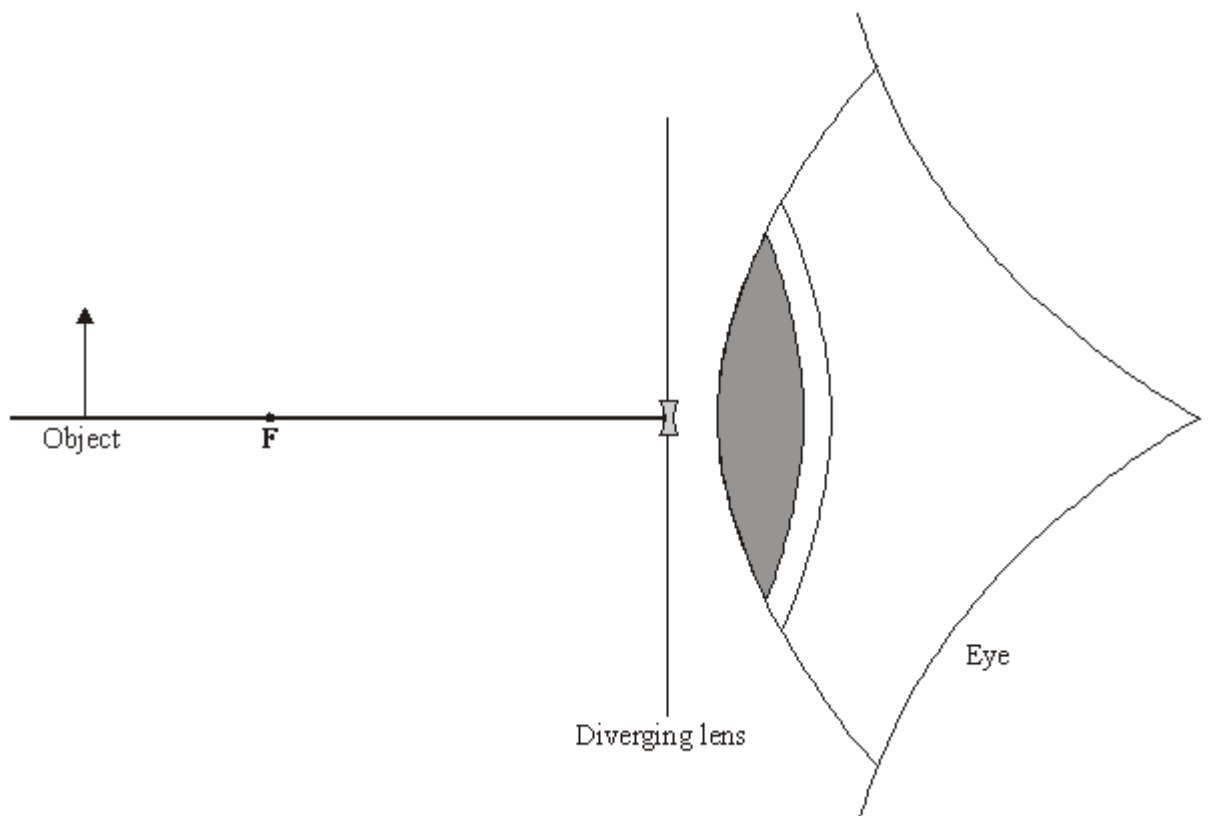
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(1)

(Total 8 marks)

Q6. 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)

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

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.....

.....

.....

(2)

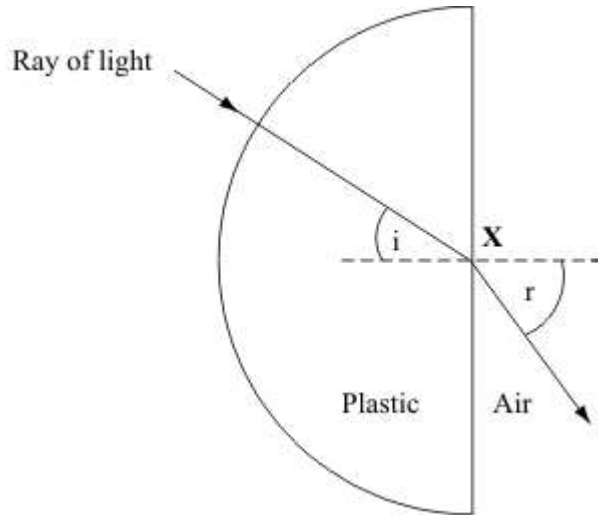
(Total 5 marks)

Q7. (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.



(i) What is the name of angle r ?

.....

(1)

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

.....

(1)

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

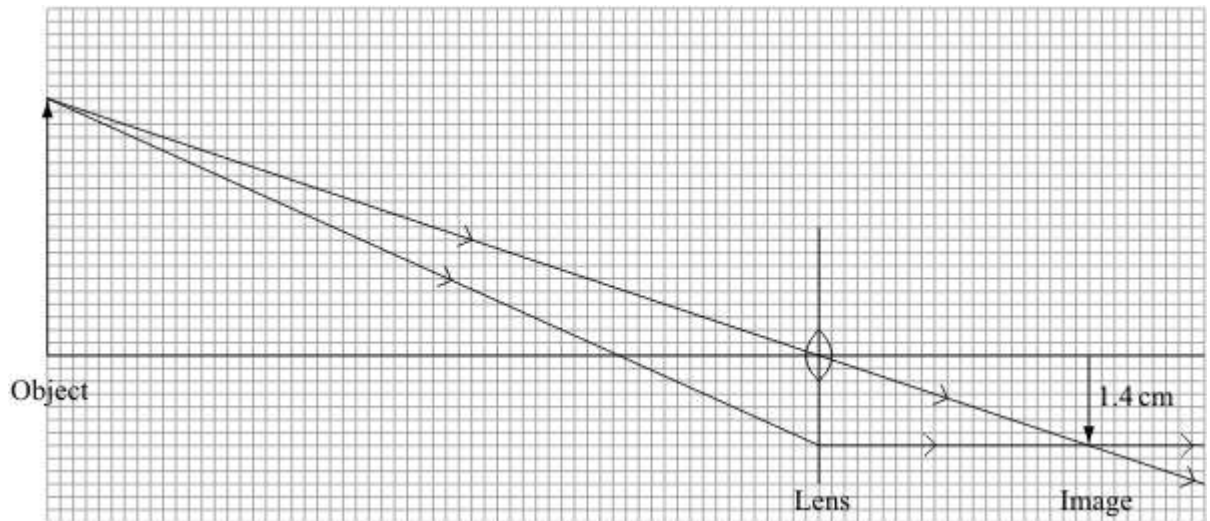


Name a light detecting device which may be used in a camera.

.....

(1)

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



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

.....

(1)

(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)

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

.....

.....
(1)
(Total 7 marks)

Q8. Lenses are used in many optical devices.

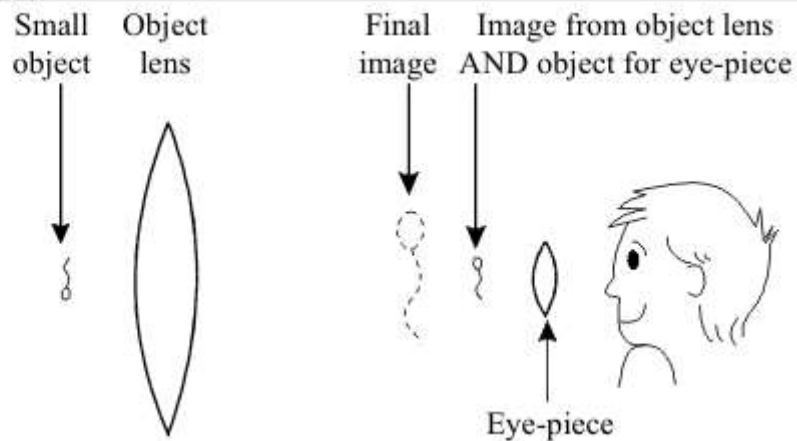
Complete the table below about the images formed by some optical devices.

OPTICAL DEVICE	NATURE OF IMAGE	SIZE OF IMAGE	POSITION OF IMAGE
Eye	real		
Projector		Magnified	
camera			Closer to lens than the object

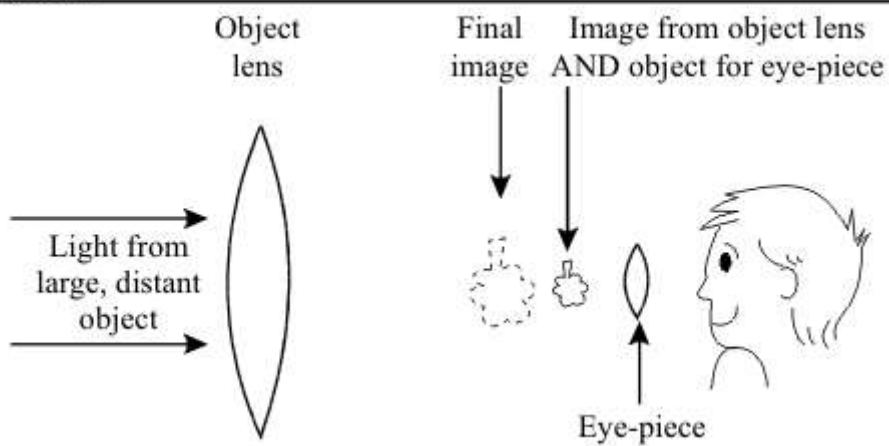
(Total 6 marks)

Q9. The diagrams show how the same two lenses can be used to make a microscope **or** a telescope.

MICROSCOPE



TELESCOPE



The microscope and the telescope made from the two lenses are similar in some ways but different in others.

Complete the table to show these **similarities** and **differences**.

	Similarities	Differences
What the microscope and telescope are used for		
The job done by the eye-piece		X
How the final image compares with the original object		

(Total 7 marks)

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