Lenses

Question Paper

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

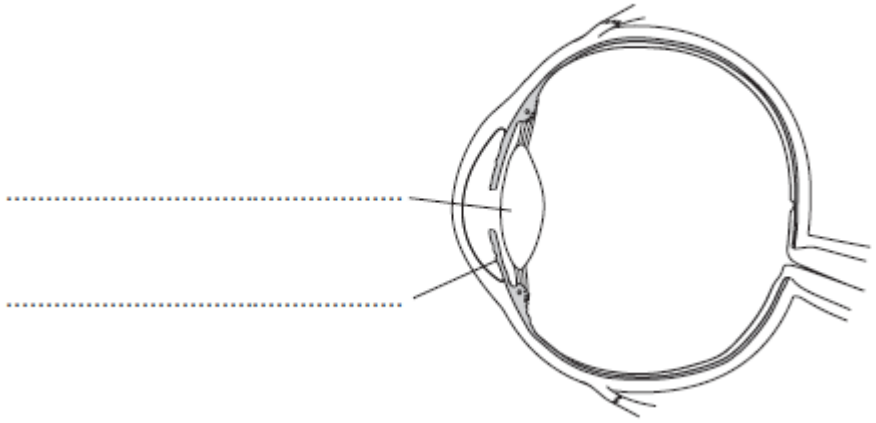
Time Allowed: **99 minutes**

Score: **/99**

Percentage: **/100**

Q1.Figure 1 shows a diagram of a human eye.

Figure 1



(a) Use words from the box to label **Figure 1**.

Cornea	**Iris**	**Lens**	**Pupil**

(2)

(b) Draw **one** line from each part of the eye to its correct function.

Part of the eye	**Function**
	Changes light into electrical signals
Cornea	
	Changes the direction of light entering the eye
Retina	
	Changes the shape of the lens

(2)

(c) Some people wear contact lenses to help them to see clearly.

A contact lens has a focal length of 0.2 metres.

Calculate the power of this contact lens.

Use the correct equation from the Physics Equations Sheet.

.....

.....

Power of the contact lens = ... dioptres

(2)

(d) Eye lens replacement is a surgical procedure that can help some people to see clearly.

In this procedure, the surgeon removes the eye lens and replaces it with an artificial lens.

Which statement gives the correct reason for carrying out the procedure?

Tick (✓) **one** box.

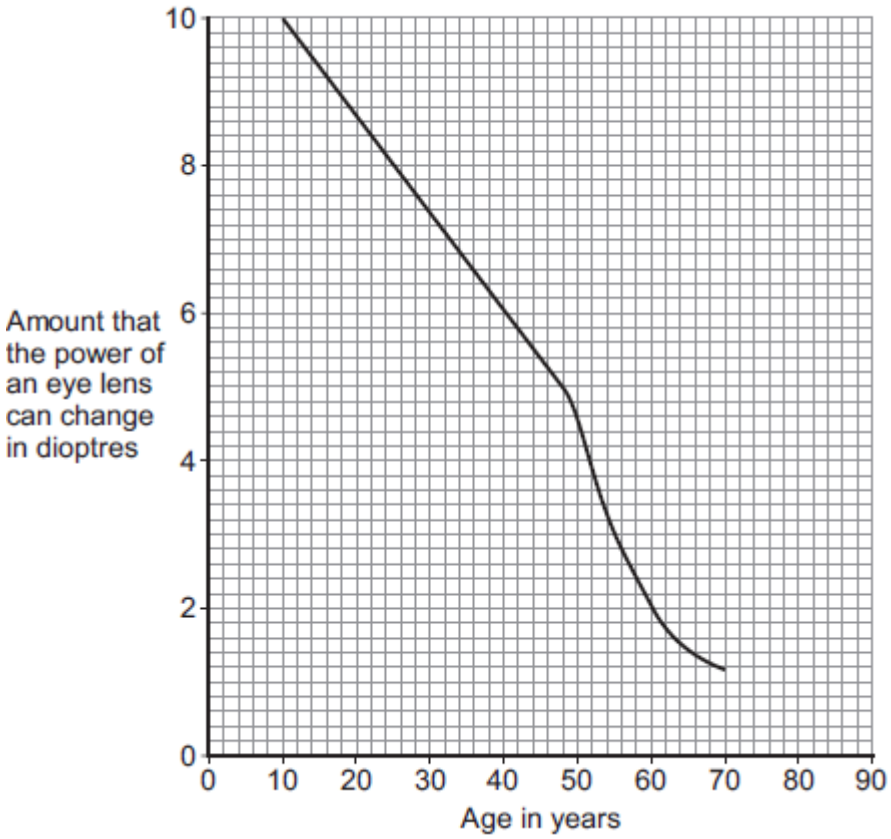
The potential benefit of the procedure is greater than the risk.	☐
The procedure involves a recent medical development.	☐
The surgical procedure is totally safe.	☐

(1)

(e) When a human eye changes focus from a distant object to a close object, the power of the eye lens changes.

Figure 2 shows how the amount that the power of an eye lens can change depends on age.

Figure 2



(i) A person is 40 years old.

State the amount that the power of this person's eye lens is able to change.

Change in power = ... dioptres

(1)

(ii) Give **one** conclusion that can be made from **Figure 2**.

.....

.....

(1)

(iii) Use **Figure 2** to estimate the amount that the power of the eye lens of an 80-year-old person is able to change.

Tick (✓) **one** box.

2 dioptres ☐

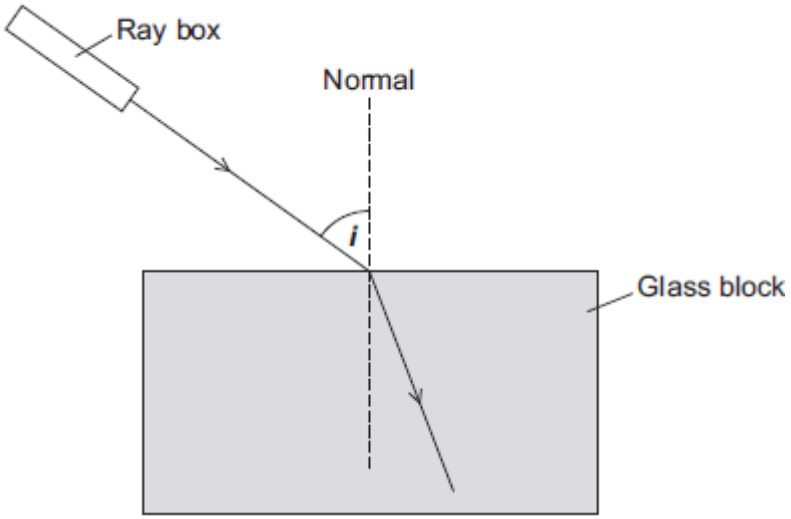
1 dioptre ☐

0 dioptres ☐

(1)
(Total 10 marks)

Q2.(a) **Figure 1** shows a ray of light entering a glass block.

Figure 1



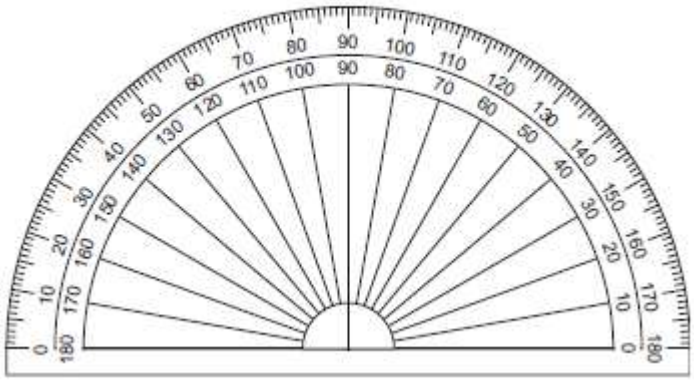
(i) The angle of incidence in **Figure 1** is labelled with the letter ***i***.

On **Figure 1**, use the letter ***r*** to label the angle of refraction.

(1)

(ii) **Figure 2** shows the protractor used to measure angles ***i*** and ***r***.

Figure 2



What is the resolution of the protractor?

Tick (✓) **one** box.

1 degree ☐ 5 degrees ☐ 10 degrees ☐

(1)

(iii) The table shows calculated values for angle ***i*** and angle ***r*** from an investigation.

Calculated values
sin ***i*** = 0.80
sin ***r*** = 0.50

Use the values from the table to calculate the refractive index of the glass.

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

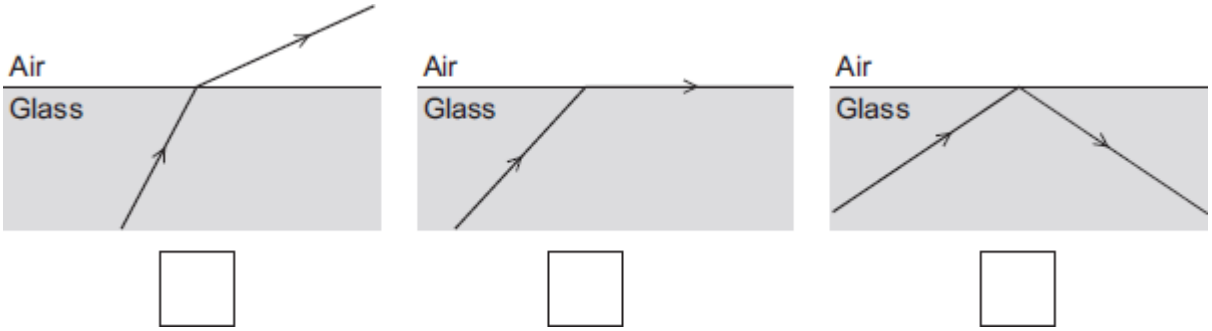
Refractive index = ...

(2)

(b) The diagrams below show a ray of light moving through glass.

Which diagram correctly shows what happens when the ray of light strikes the surface of the glass at the critical angle?

Tick (✓) **one** box.

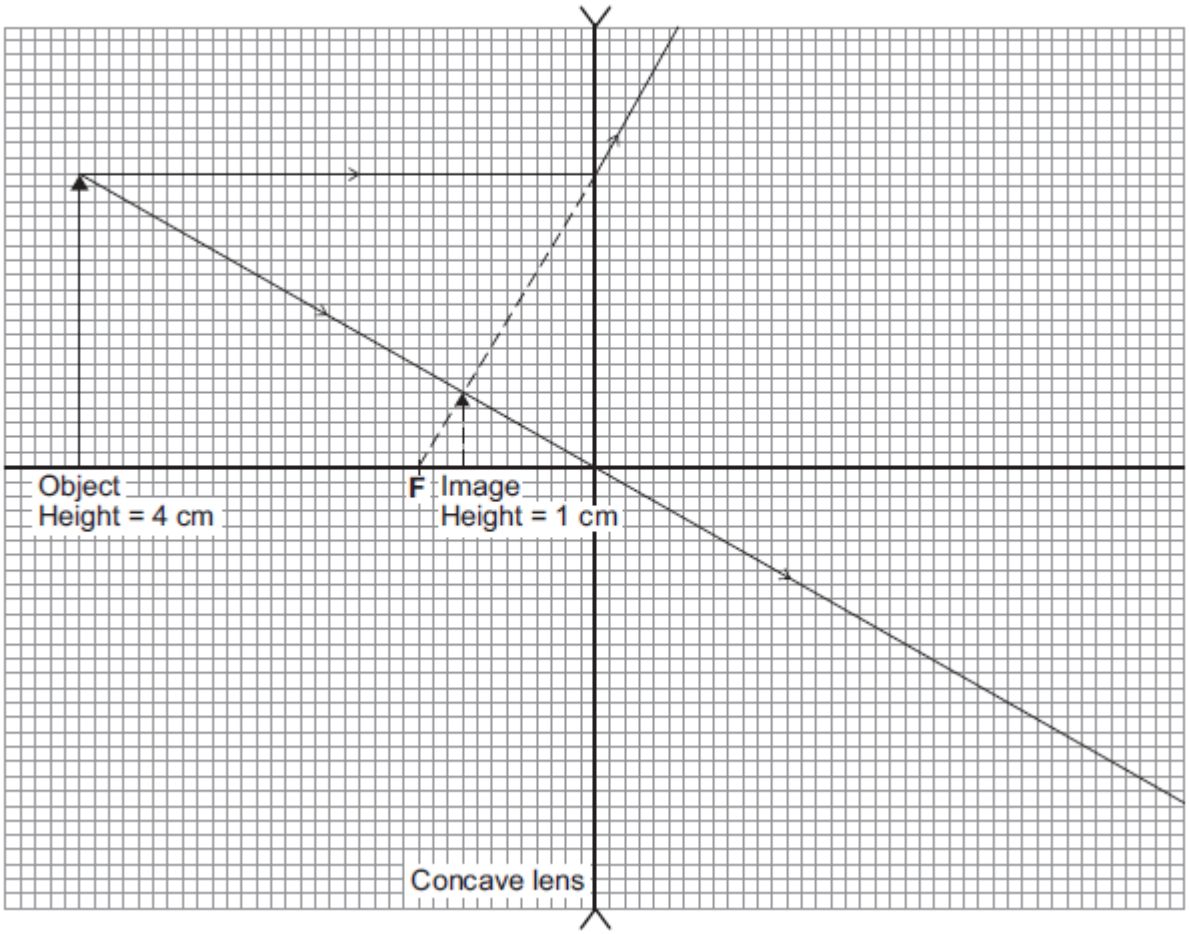


(1)

(c) A concave (diverging) lens is fitted into a door to make a security spyhole.

Figure 3 shows how this lens produces an image.

Figure 3



(i) State **one** word to describe the nature of the image in **Figure 3**.

.....

(1)

(ii) Use data from **Figure 3** to calculate the magnification of the image.

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Magnification = ...

(2)

(iii) What is another use for a concave lens?

Tick (✓) **one** box.

A magnifying glass	☐
Correcting short sight	☐
To focus an image in a camera	☐

(1)
(Total 9 marks)

Q3.(a) Digital cameras and human eyes both form images.

Complete **Table 1** by putting a tick in the correct column(s) to show if the parts are found in the digital camera or in the human eye or in both.

The first part has been completed for you.

Table 1

Part	**In a digital camera**	**In the human eye**
Cornea		✓
Lens		
Pupil		
Charge-coupled device (CCD)		

(3)

(b) Some humans are short-sighted.

Complete the following sentence.

Short sight can be caused by the eyeball being too ..... .

(1)

(c) Spectacles can be worn to correct short sight.

Table 2 gives information about three different lenses that can be used in spectacles.

Table 2

	Lens feature		
	Material	**Mass in grams**	**Type**
Lens A	Plastic	5.0	Concave (diverging)
Lens B	Glass	6.0	Convex (converging)
Lens C	Glass	5.5	Convex (converging)

Which lens from **Table 2** would be used to correct short sight?

Draw a ring around the correct answer.

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

Give the reason for your answer.

.....

.....

(2)

(d) Every lens has a focal length.

Which factor affects the focal length of a lens?

Tick (✓) **one** box.

The colour of the lens ☐

The refractive index of the lens material ☐

The size of the object being viewed ☐

(1)

(e) A lens has a focal length of 0.25 metres.

Calculate the power of the lens.

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Power of lens = ... dioptres

(2)

(f) Laser eye surgery can correct some types of eye defect.

Which of the following is another medical use for a laser?

Tick (✓) **one** box.

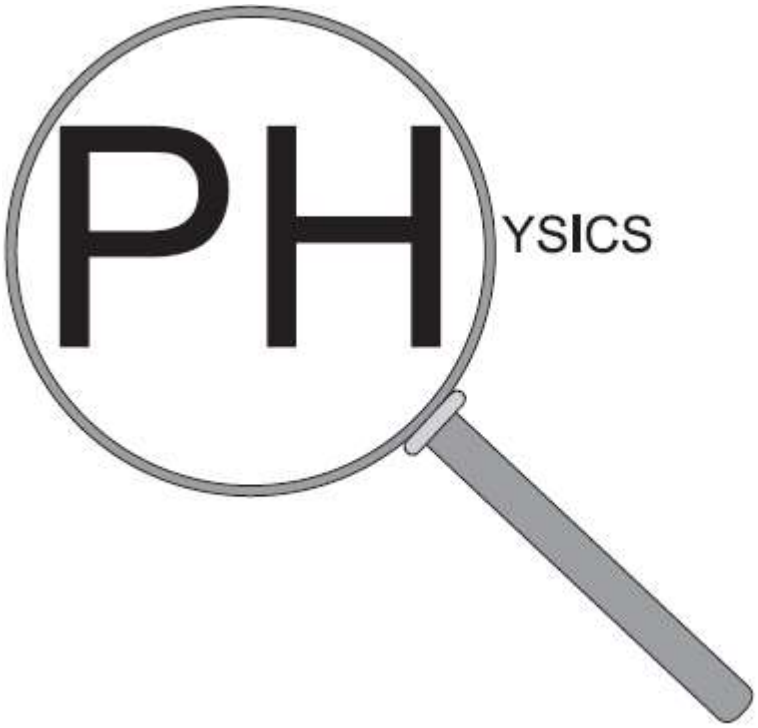
Cauterising open blood vessels ☐

Detecting broken bones ☐

Imaging the lungs ☐

(1)

(g) The figure shows a convex lens being used as a magnifying glass.



Not to scale

An object of height 14 mm is viewed through a magnifying glass.

The image height is 70 mm.

Calculate the magnification produced by the lens in the magnifying glass.

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Magnification = ...

(2)
(Total 12 marks)

Q4. 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

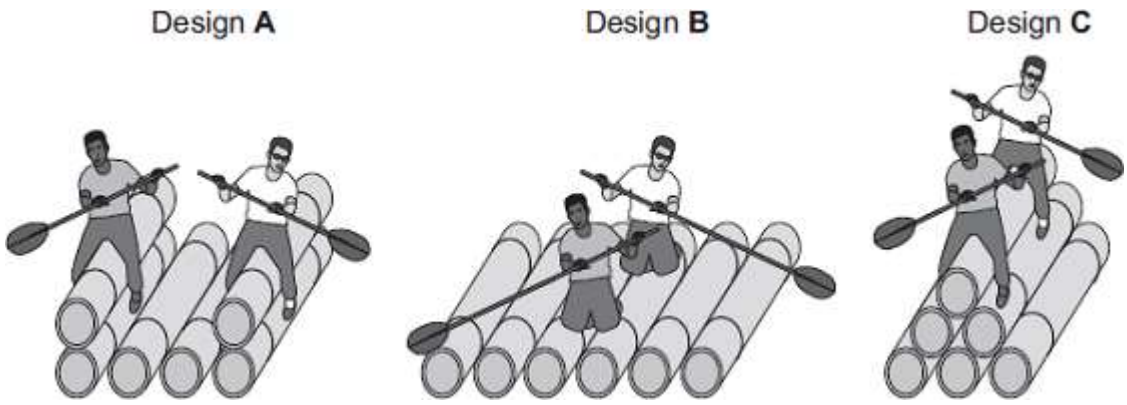
(a) (i) Which **two** factors would most affect the raft's stability?

Tick (✓) the **two** correct factors.

The cost of the raft	☐
The width of the base of the raft	☐
The position of the centre of mass of the raft	☐
How streamlined the raft is	☐

(2)

(ii) Here are three raft designs:



Which design of raft would be most stable?

Tick (✓) **one** box.

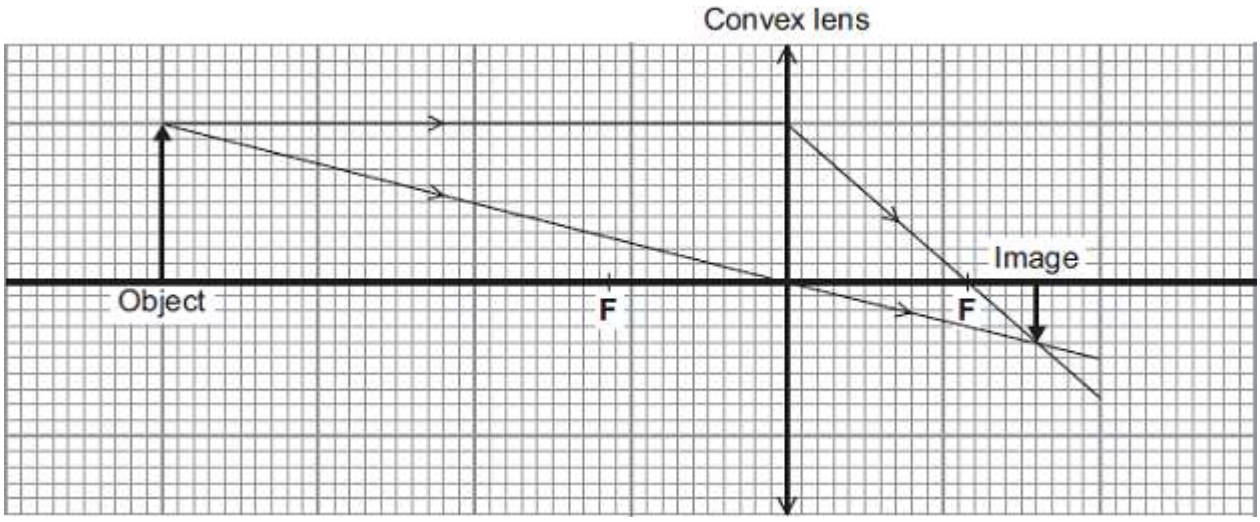
Design **A** ☐

Design **B** ☐

Design **C** ☐

(1)

(b) A camera was used to take photographs of the rafts. The camera contains a convex (converging) lens. The ray diagram shows how the lens produces an image.



F = Principal focus

(i) Which **two** words from the list describe the nature of the image?

Draw a ring around each of the **two** correct answers.

upright **magnified** **inverted** **virtual** **real**

(2)

(ii) Use information from the ray diagram to calculate the magnification of the image.

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

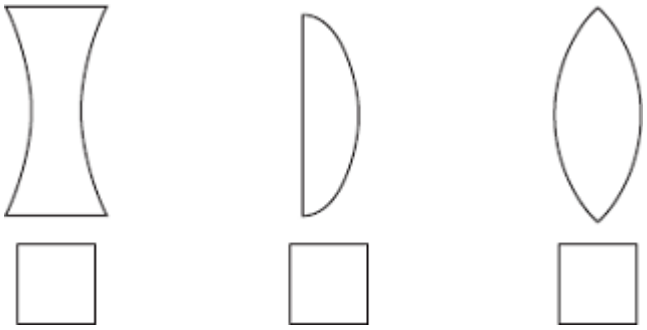
Magnification = ...

(2)

(c) A different type of lens is a concave (diverging) lens.

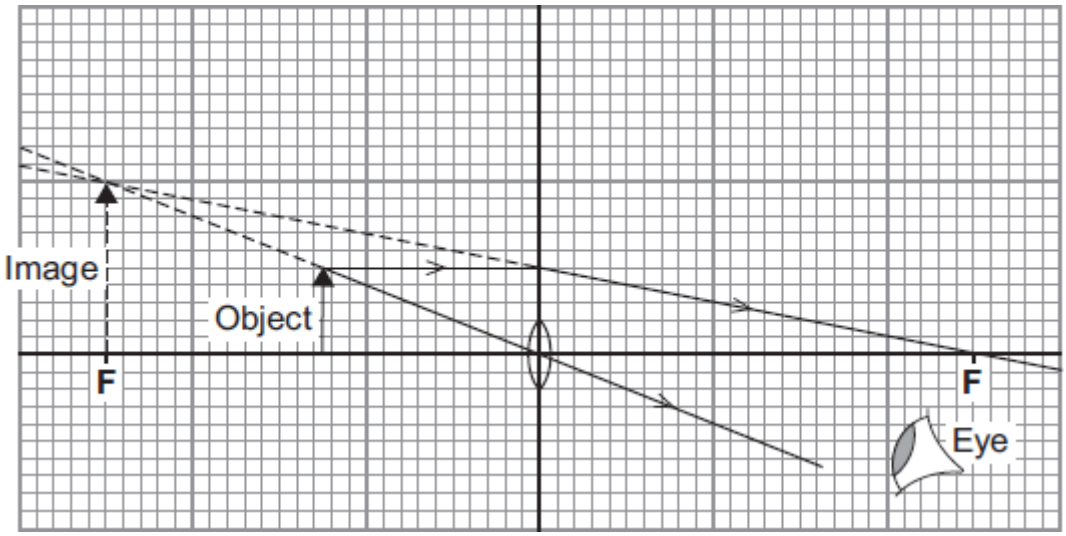
Which diagram shows a concave (diverging) lens?

Tick (✓) **one** box.



(1)
(Total 8 marks)

Q5. The diagram shows a lens being used as a magnifying glass.



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

Draw a circle around your answer.

concave **converging** **diverging**

(1)

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

The object and image in the diagram have been drawn to full size.

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

Show clearly how you work out your answer.

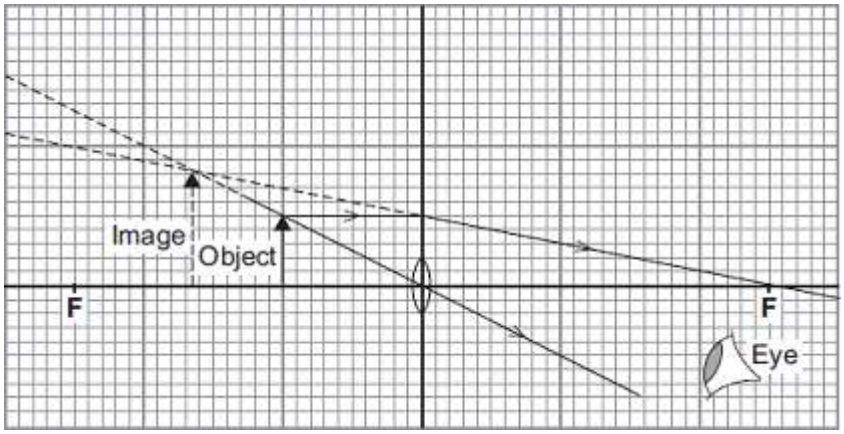
.....

.....

Magnification = ...

(2)

(b) The diagram shows how the image changes when the object has been moved closer to the lens.



Complete the following sentence by drawing a ring around the correct line in the box.

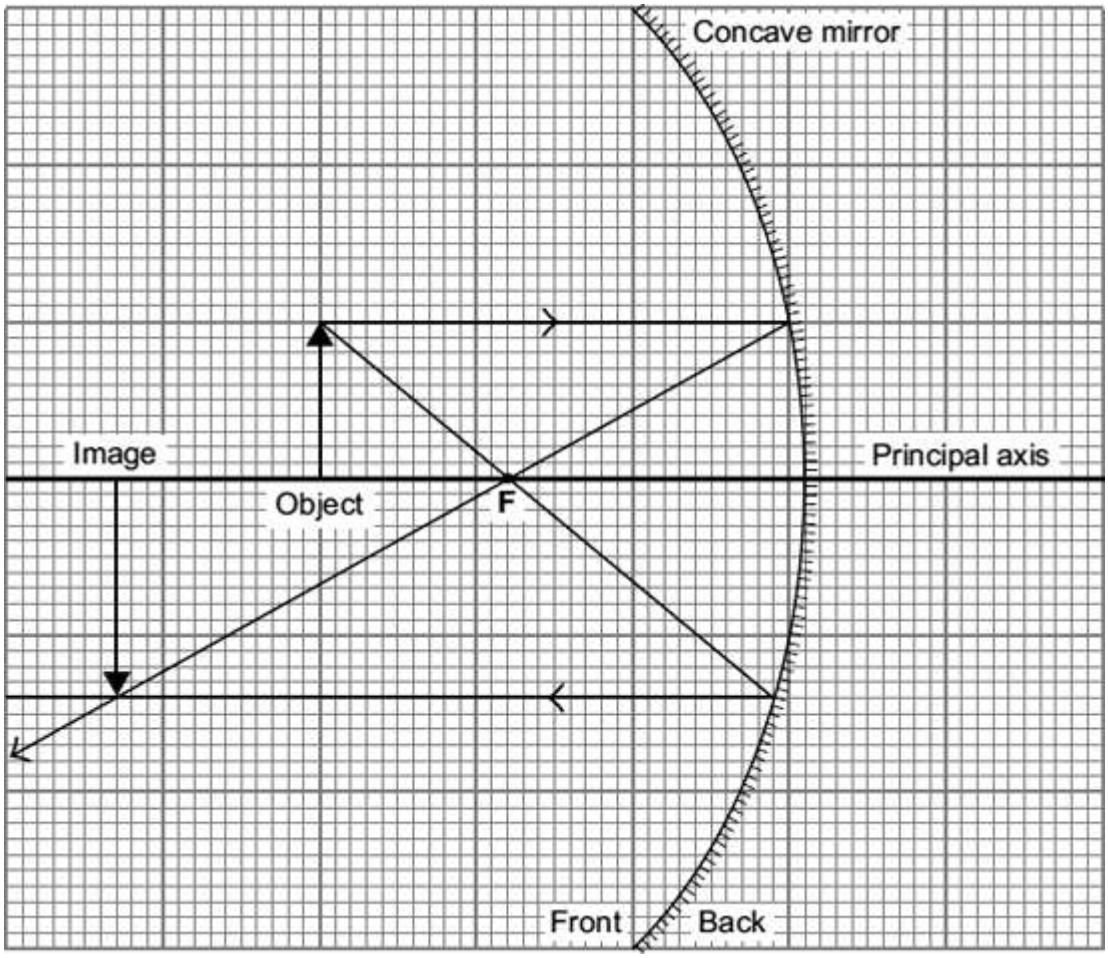
Moving the object closer to the lens

increases
does not change
decreases

the magnification produced by the lens.

(1)
(Total 4 marks)

Q6. The ray diagram shows the image formed by a concave mirror.



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.

.....

.....

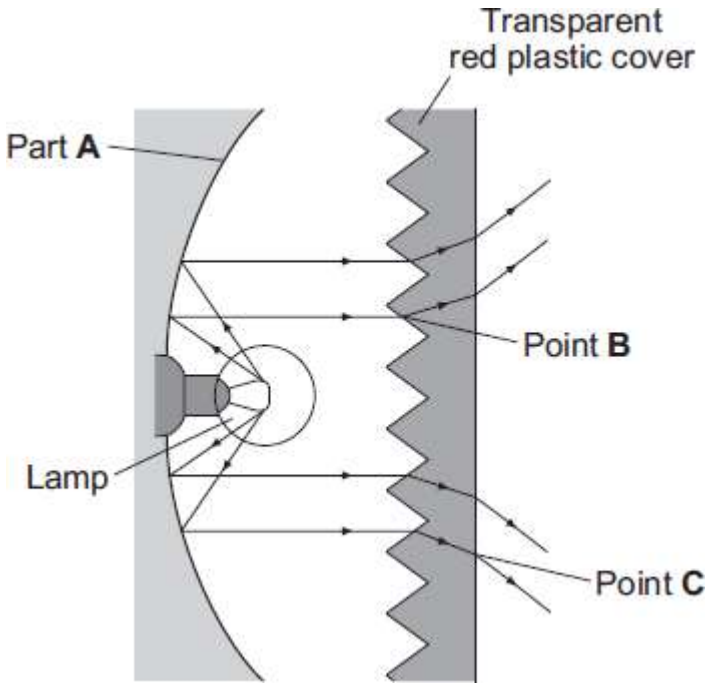
Magnification = ...

(Total 2 marks)

Q7. At night, it is important that the lights of a car can be seen by other drivers but it is

dangerous if these lights dazzle them.

The diagram shows a rear light of a car.



(a) (i) Name part **A**.

.....

(1)

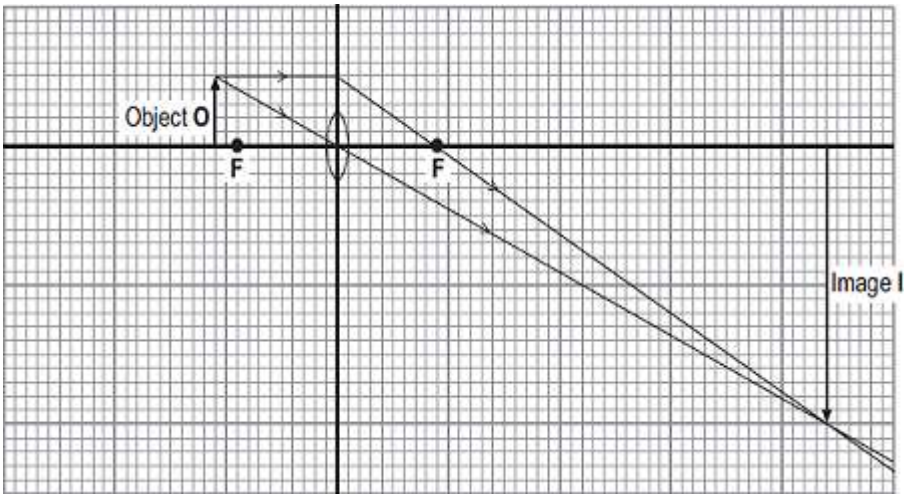
(ii) Name the process which occurs at point **B** and at point **C**.

.....

(1)

(b) A headlamp of a car contains a lens.

The ray diagram shows the position and size of the image, **I**, of an object, **O**, formed by a lens similar to the one inside a car headlamp.



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

Draw a ring around your answer.

converging **diverging** **plane**

(1)

(ii) The ray diagram is drawn to scale.

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.

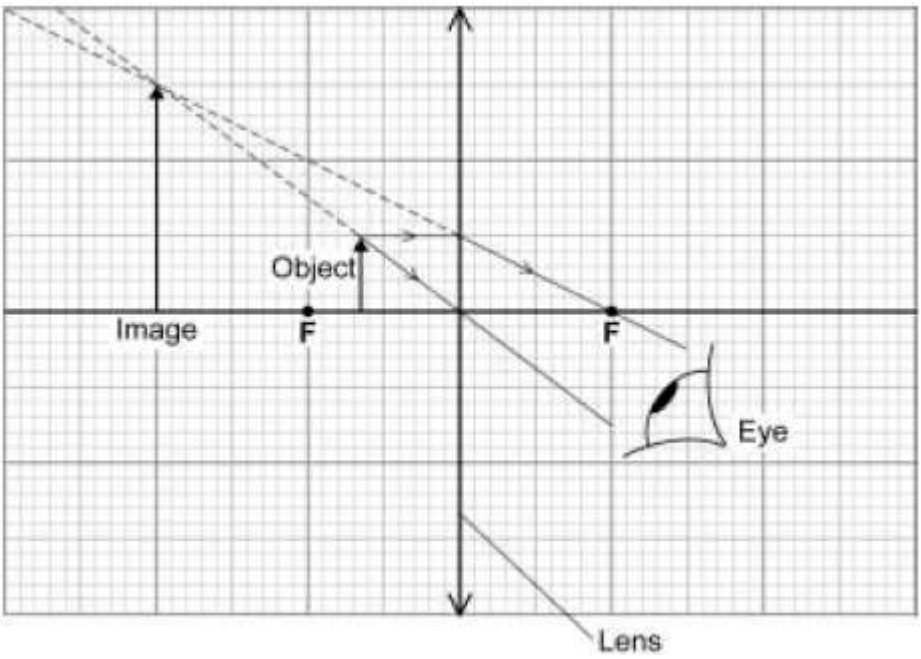
.....

.....

Magnification = ...

(2)
(Total 5 marks)

Q8. The ray diagram shows a converging lens being used as a magnifying glass. The diagram has been drawn to scale.



(a) What name is given to the type of lens used as a magnifying glass?

.....

(1)

(b) Calculate the magnification produced by the lens.

Write down the equation you use, and then show clearly how you work out your answer.

.....

.....

.....

.....

.....

.....

Magnification = ...

(2)

(c) Describe the image produced by a magnifying glass.

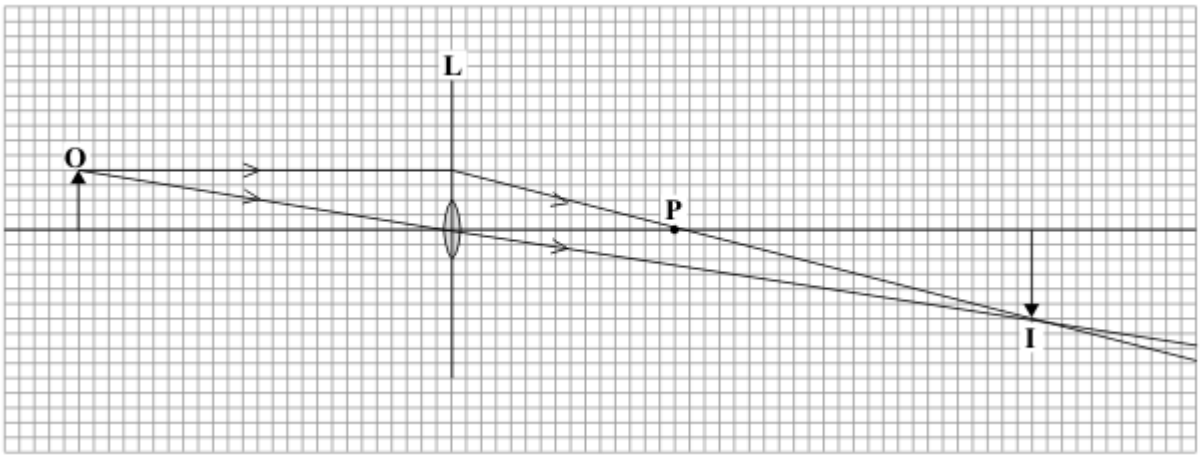
.....

.....

.....

(3)
(Total 6 marks)

Q9. The ray diagram shows the position and size of the image, **I**, of an object, **O**, formed by a lens, **L**.



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

.....

(1)

(b) Name the point labelled **P**.

.....

(1)

(c) The ray diagram has been drawn to scale.

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) How can you tell from this ray diagram that the image is a real image?

.....

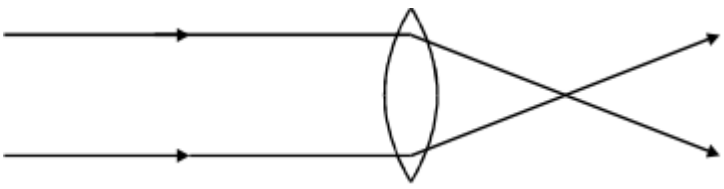
.....

(1)

(Total 5 marks)

Q10. (a) The diagram shows how parallel rays of light pass through a convex lens.

(i) Mark the position of the focus.



(1)

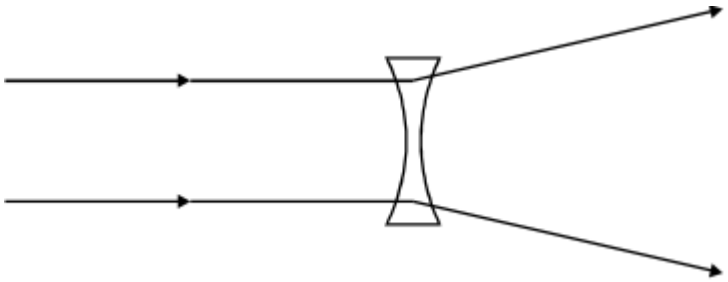
(ii) Is this a **converging** lens, a **diverging** lens, **both** or **neither**?

.....

(1)

(b) The diagram shows how parallel rays of light pass through a concave lens.

(i) Mark the position of the focus.



(1)

(ii) Is this a **converging** lens, a **diverging** lens, **both** or **neither**?

.....

(1)

(c) Complete these sentences by crossing out the **two** lines in each box that are wrong.

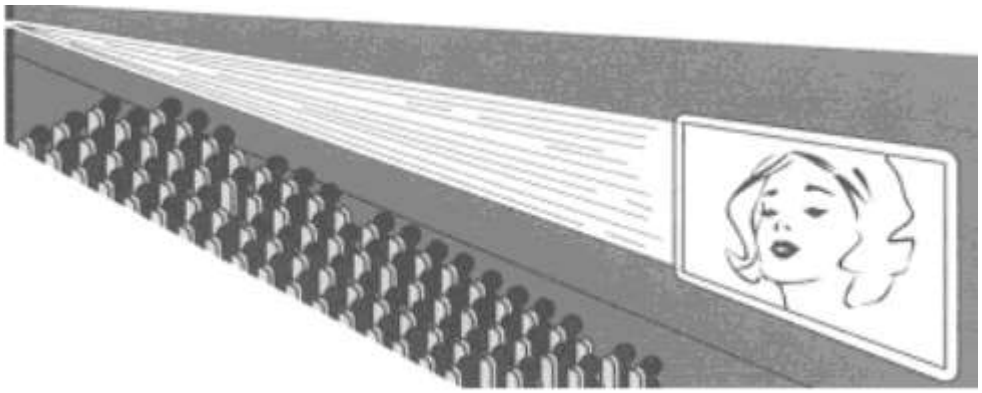
In a camera, a [converging / diverging / parallel] lens is used to produce an image of an object on a [film / lens / screen].

The image is [larger than / smaller than / the same size as] the object.

The image is [further from / nearer to / the same disrtance from] the lens, compared to the distance of the object from the lens.

(4)

(d) In a cinema projector, a convex lens is used to produce a *magnified*, *real* image.



(i) What does *magnified* mean?

.....

.....

(1)

(ii) What is a *real* image?

.....

.....

(1)

(e) You are in a dark room. You have a box containing some lenses. Only **one** of them is a converging lens.

Describe how, by just feeling the lenses, you can pick out the converging lens.

.....

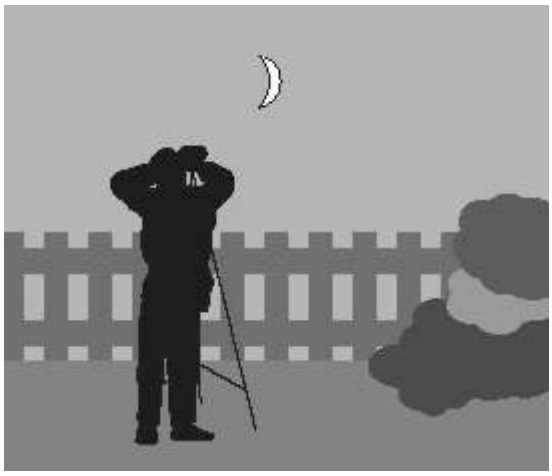
.....

.....

.....

(2)
(Total 12 marks)

Q11. Malik uses a camera to photograph the Moon.



(a) Complete each sentence by choosing the correct words from the box.

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

converging	**diverging**	**image**	**longer**
object	**real**	**shorter**	**virtual**

In a camera a ..... lens is used to produce an .....

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

the ..... and it is a ..... distance from the lens.

(6)

(b) The Moon moves in a nearly circular path around the Earth.

(i) What is the name of the force which causes the Moon to move around the Earth?

.....

(1)

(ii) In which direction does this force act?

.....

(1)

(c) A force is needed to make a car change direction when it goes round a bend.

(i) What is the name of this force and where does it act?

.....

.....

(2)

(ii) Complete the **two** spaces in the sentence.

The force needed is greater if the ..... of the car is greater and

the ..... of the bend is smaller.

(2)

(d) What word is used to describe any force which causes an object to move in a circular path?

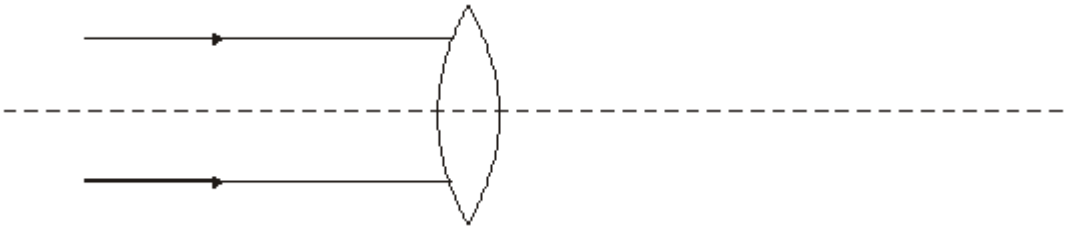
.....

(1)

(Total 13 marks)

Q12. (a) The diagram shows two parallel rays of light, a lens and its axis.

(i) Complete the diagram to show what happens to the rays.



(2)

(ii) Name the point where the rays come together.

.....

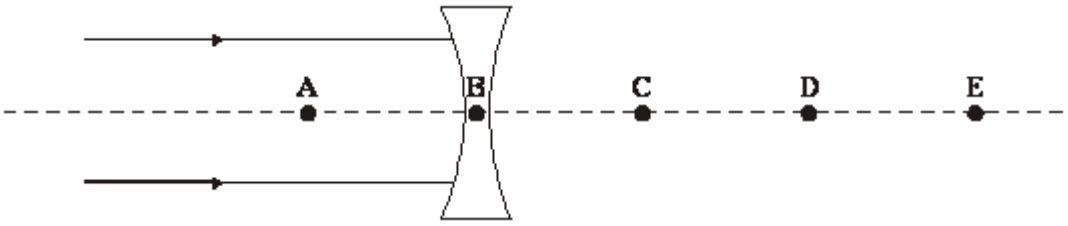
(1)

(iii) What word can be used to describe this type of lens?

.....

(1)

(b) The diagram shows two parallel rays of light, a lens and its axis.



(i) Which point **A**, **B**, **C**, **D** or **E** shows the focal point for this diagram?

Point .....

(1)

(ii) Explain your answer to part (b)(i).

.....

.....

(1)

(iii) What word can be used to describe this type of lens?

.....

(1)

(c) Complete the following **three** sentences by crossing out the **two** lines in each box which are wrong

In a camera a converging lens is used to produce an image on a

film
lens
screen

.

The image is	larger than smaller than the same size as	the object.

Compared to the distance of the image from the lens, the object is	further away from nearer to the same distance from

the lens.

(3)

(d) Explain the difference between a *real* image and a *virtual* image.

.....

.....

.....

.....

.....

.....

(3)
(Total 13 marks)