1. (a) (i) Draw a **labelled** ray diagram to show how a normal eye forms an image of a near point object on the optical axis of the eye. The diagram should show the path of two rays from the object and should indicate clearly the places where refraction occurs.

(ii) Explain why most of the refraction occurs at one of these places.

.....

.....

(4)

(b) Draw another labelled ray diagram to show where the image of the same object would be formed by an eye suffering from the defect known as hypermetropia or "long-sight". Indicate on your diagram how a suitable correcting lens could be used to bring the image in focus on the retina.

(4)

(c) A person suffering from hypermetropia has a near point at a distance of 1.25 m from her eyes.

(i) Calculate the power of the correcting lens needed to bring her near point to 0.25 m from her eyes.

.....

.....

.....

.....

(ii) State whether this power is positive or negative.

.....

(3)

(Total 11 marks)

2. (a) For the eye defect astigmatism, complete each of the following.

(i) Astigmatism is caused by .....

.....

.....

.....

(ii) The image seen by a person with astigmatism is .....

.....

.....

.....

(iii) Astigmatism is corrected using .....

.....

(3)

(b) A person has a myopic eye with a range of clear vision at distances from his eye of 0.15 m to 0.80m.

(i) Calculate the power of the correcting lens which would allow this eye to produce focused images of distant objects.

.....

.....

.....

.....

(ii) Calculate the new near point position for the eye when using the correcting lens.

.....

.....

.....

.....

(4)

(Total 7 marks)

3. (a) A lens is used as shown in figure 1 to enable a person with an eye defect to see distant objects clearly.

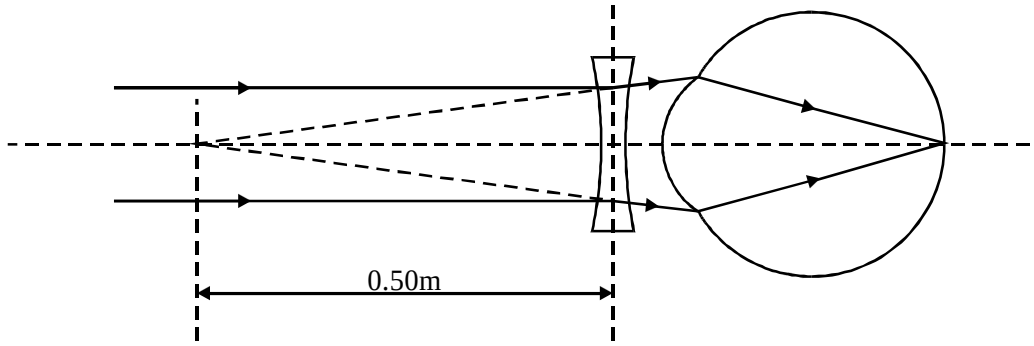


figure 1

(i) Name the defect corrected by this lens.

.....

(ii) Determine the power of the lens.

.....

.....

.....

(iii) Draw a ray diagram on figure 2 to show the path through the eye of rays from a distant object when a correcting lens is not being used.

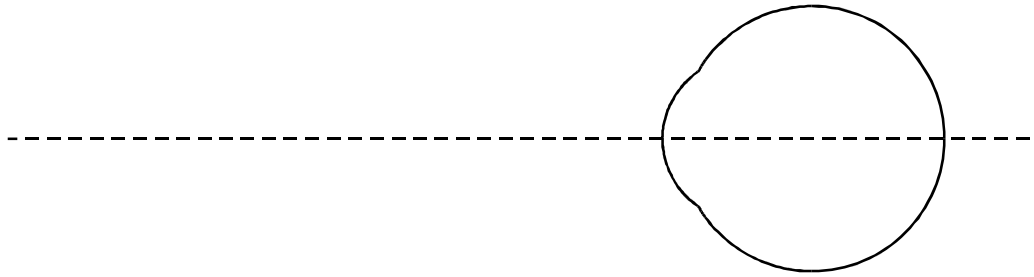


figure 2

(iv) Draw a ray diagram on figure 3 to show the path through the eye of rays from an object positioned at the uncorrected far-point.

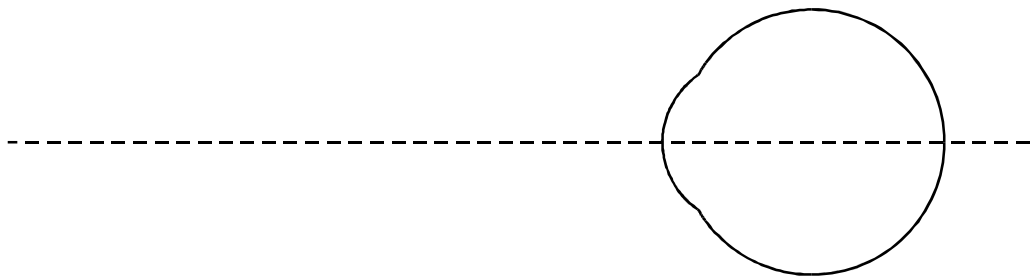


figure 3

(v) State one cause of the defect you have named in part (i).

.....

(6)

(b) When a camera is focused on a near object at a point P, the distance from lens to film is 36.4 mm. In order to refocus on a very distant object, the lens has to be moved a distance of 1.2 mm.

(i) State the direction in which the lens must be moved.

.....

(ii) Calculate the focal length of the lens.

.....

.....

(iii) Calculate the distance from the lens to P.

.....

.....

.....

(iv) One frame of the film in the camera has a height of 24mm. Determine whether or not the image of an object of height 0.60 m placed at P will fit into this frame.

.....

.....

.....

.....

(7)

(c) A photographic plate can be used with an astronomical telescope in order to photograph the night sky. State where the plate should be positioned in the telescope and give **one** advantage which photography has over direct observation when using telescopes.

.....

.....

.....

(2)

(Total 15 marks)

4. (a) State **two** applications of laser radiation in medicine.

1 .....

2 .....

(2)

(b) For **one** of the applications which you have given, describe how the laser radiation is applied and state any safety features needed.

method of application .....

.....

.....

.....

safety features .....

.....

.....

.....

(4)
(Total 6 marks)

5. An eye test shows that a person suffers from astigmatism.

(i) Give the main cause of astigmatism.

.....

.....

(ii) State the effect of astigmatism on the image seen.

.....

.....

(iii) State the type of lens needed to correct this defect of vision.

.....

(iv) Give **two** quantities which must be known in order to manufacture the correcting lens.

1 .....

2 .....

(Total 5 marks)

6. (a) Sketch, on the axes below, the response curves for the colour cones of the eye. Label the wavelength axis with a scale appropriate for your curves.

(4)

(b) In terms of receptors,

(i) give the condition for two different images to be resolved by the eye,

.....

.....

.....

.....

(ii) explain why finer detail can be seen in bright light than in dim light.

.....

.....

.....

.....

(3)

(c) (i) State what is meant by *persistence of vision.*

.....

.....

(ii) Give an example of a practical situation where persistence of vision is used to advantage.

.....

(2)
(Total 9 marks)

7. A defective eye has an unaided far point of 2.5 m and an unaided near point of 0.20 m. A correcting lens is used to produce an aided far point at infinity.

(a) (i) Name the defect of vision affecting the eye.

.....

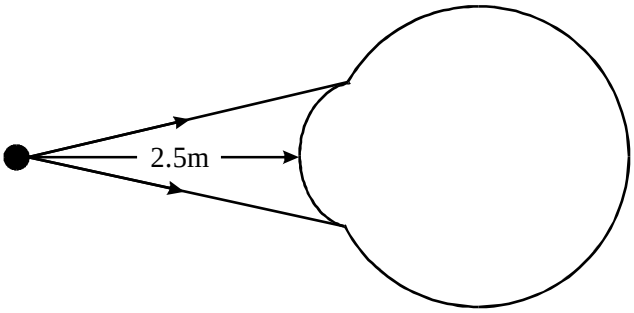
(ii) State **one** possible cause of this defect of vision.

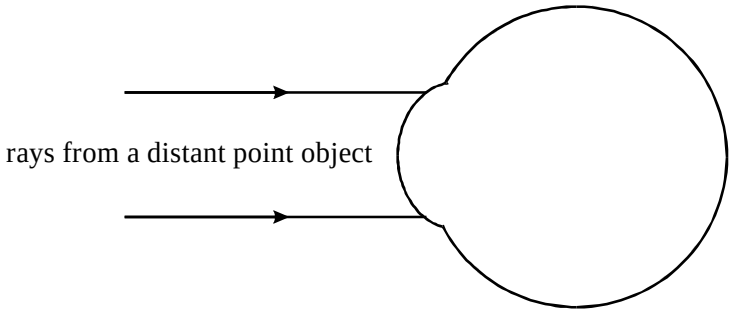
.....

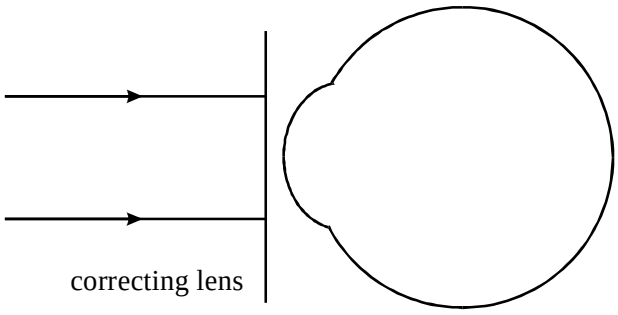
.....

(2)

(b) Complete the ray diagrams below for the defective eye.







(3)

(c) (i) Calculate the power of the correcting lens.

.....

.....

.....

(ii) Calculate the aided near point when wearing the correcting lens.

.....

.....

.....

.....

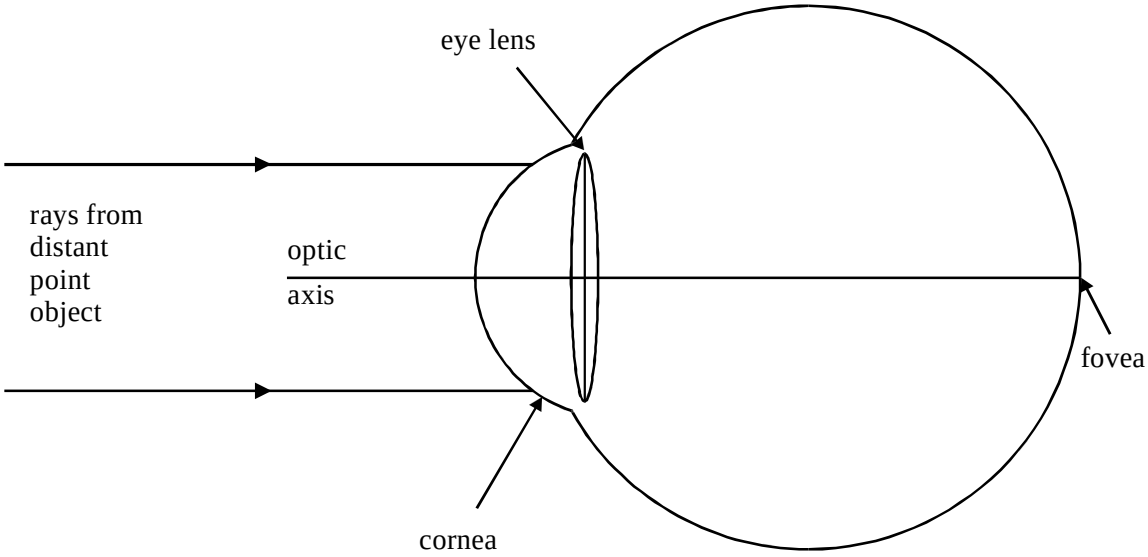
.....

.....

(4)
(Total 9 marks)

8. (a) The diagram represents a simplified version of a normal eye, with no sight defects, looking at a distant point object.

Complete the paths of the two rays.



(2)

(b) Describe the distribution of receptors over the retina.

.....

.....

.....

.....

(2)

(c) (i) State the purpose of the iris.

.....

.....

(ii) Describe how this purpose is achieved when the eye is exposed to bright light.

.....

.....

(2)

(d) (i) State what is meant by *accommodation*.

.....

.....

(ii) Describe how accommodation is achieved.

.....

.....

.....

.....

(2)
(Total 8 marks)

9. A convex lens is placed 0.25 m from an object. The focused image produced is virtual and is 0.60 m from the lens.

(a) Calculate

(i) the power of the lens,

.....

.....

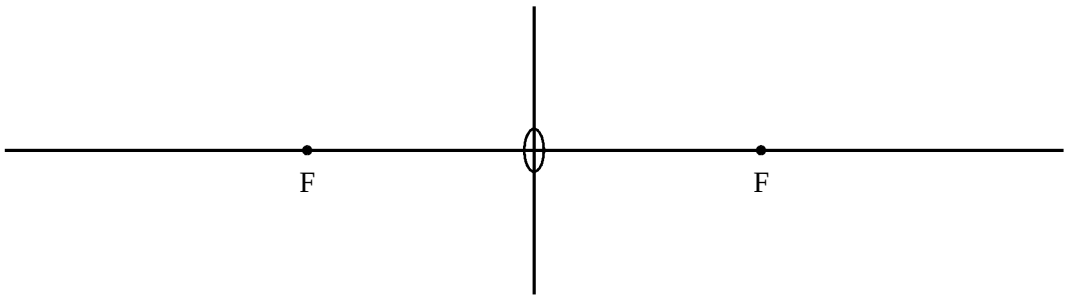
(ii) the magnification produced.

.....

.....

(3)

(b) Draw a ray diagram to show the formation of the image produced by this lens. The diagram does not have to be to scale, but relevant distances must be marked.



(3)

(c) (i) What defect of vision is this lens used to correct?

.....

(ii) A person has an unaided near point at 0.60 m and an unaided far point at infinity. Calculate the range of vision of the person when using this lens.

.....

.....

.....

.....

(4)
(Total 10 marks)

10. (a) State

(i) the cause of astigmatism,

.....

(ii) the effect of astigmatism on vision,

.....

.....

.....

(iii) the type of lens needed to correct astigmatism,

.....

(iv) **two** parameters that must be determined for the correcting lens.

.....

.....

(4)

(b) A defective eye has an unaided near point at 0.65 m and an unaided far point at infinity.

Calculate

(i) the power of the correcting lens needed to allow the eye to see clearly an object 0.25 m from the eye,

.....

.....

.....

.....

(ii) the furthest distance from the eye that an object can be seen clearly when the correcting lens is used.

.....

.....

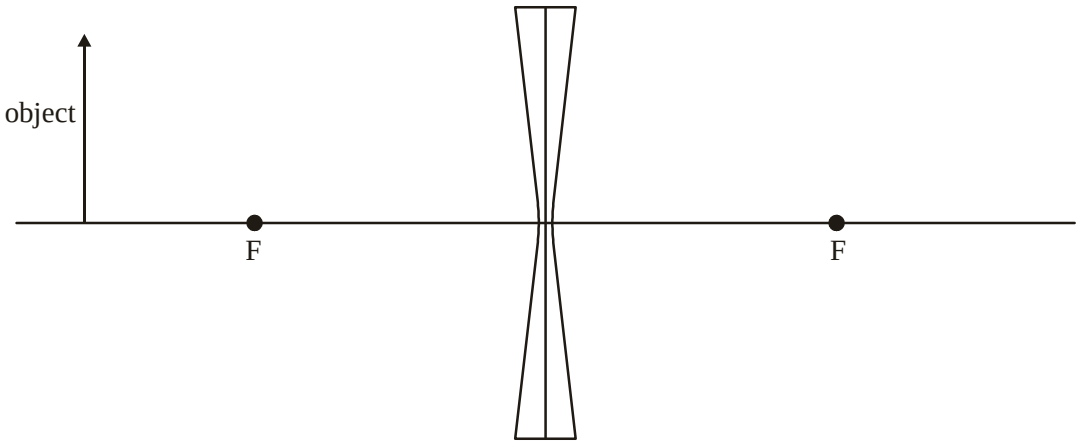
.....

.....

.....

(3)
(Total 7 marks)

11. (a) The diverging lens in the figure below forms an image of the object. Complete the figure by drawing a ray diagram to show the formation of the image. Label the image.



(2)

(b) A diverging spectacle lens of power –3.0 D is used to correct a defect of vision. When used to view a real object, the image is formed 0.21 m from the lens.

(i) State the defect of vision.

.....

(ii) Calculate the distance of the object from the lens.

.....

.....

.....

.....

.....

(3)
(Total 5 marks)

12. (a) A detailed, coloured object is illuminated by white light. Compare what is seen under high intensity light with that seen under low intensity light by an observer with normal eyesight.

Your explanation should refer to rods and cones.

You may be awarded marks for the quality of written communication in your answer.

.....

.....

.....

.....

.....

.....

.....

.....

(3)

(b) A person suffering from a defect of vision has an unaided far point of 2.0 m.

(i) Name this defect of vision. .....

(ii) Calculate the power of the correcting lens needed to allow the person to see distant objects clearly.

.....

.....

.....

(iii) The person has an unaided near point at 0.22 m. Calculate the aided near point of the person when using the correcting lens.

.....

.....

.....

.....

(4)
(Total 7 marks)