Refraction and Lenses

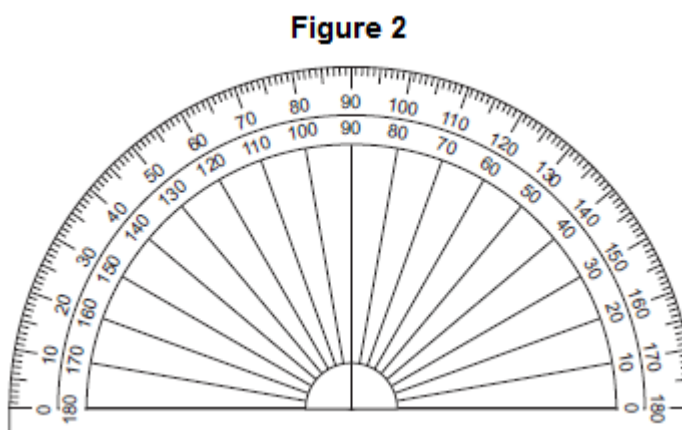Name ……………………

Q1.(a)   **Figure 1** shows a ray of light entering a glass block.
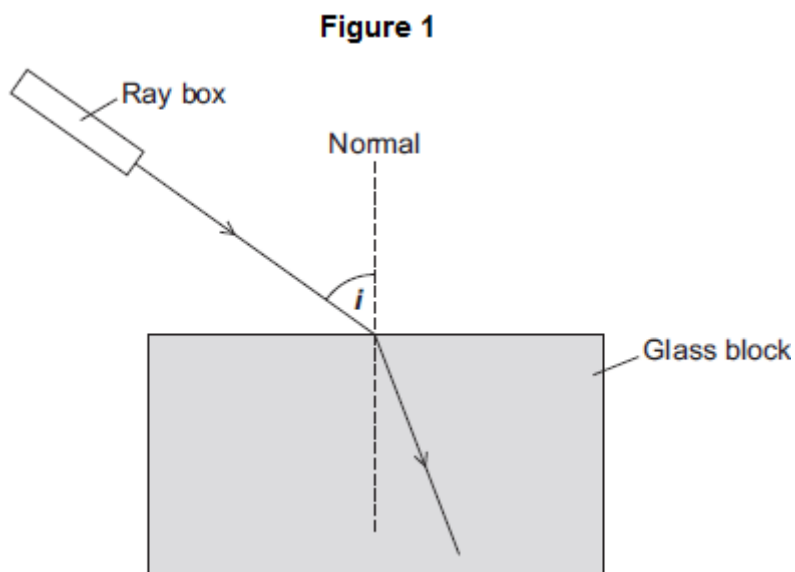
Figure 1

(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.

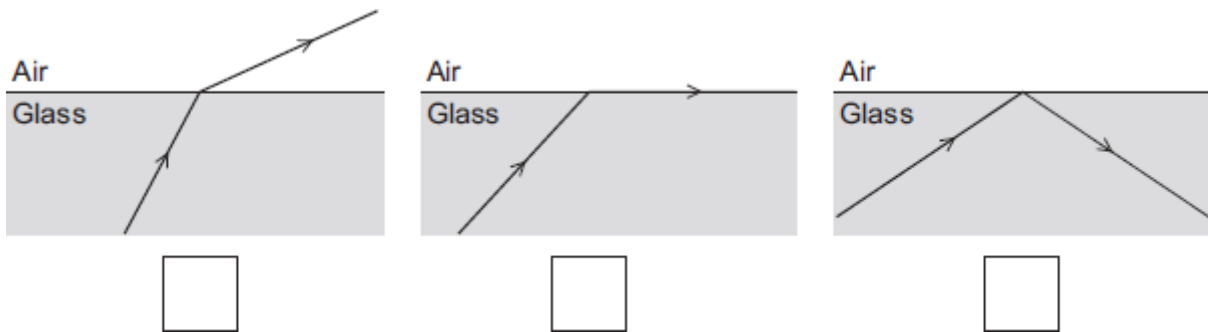Use the correct equation from the Physics Equations Sheet.

....

....

....

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.
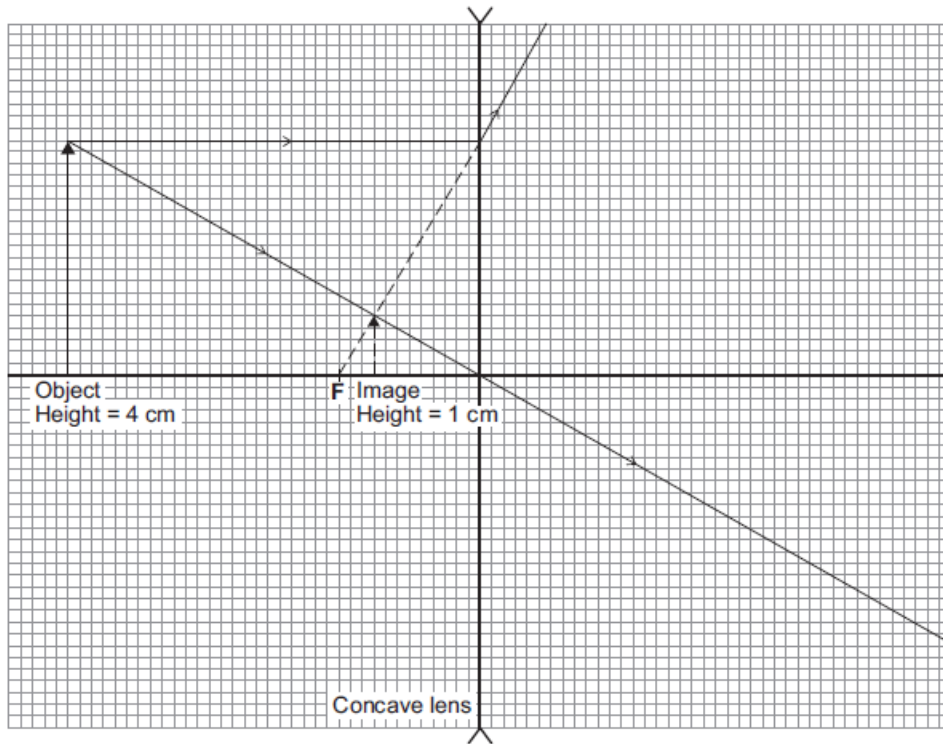
Air
Glass

Air
Glass

Air
Glass

☐   ☐   ☐

(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? **(1)**
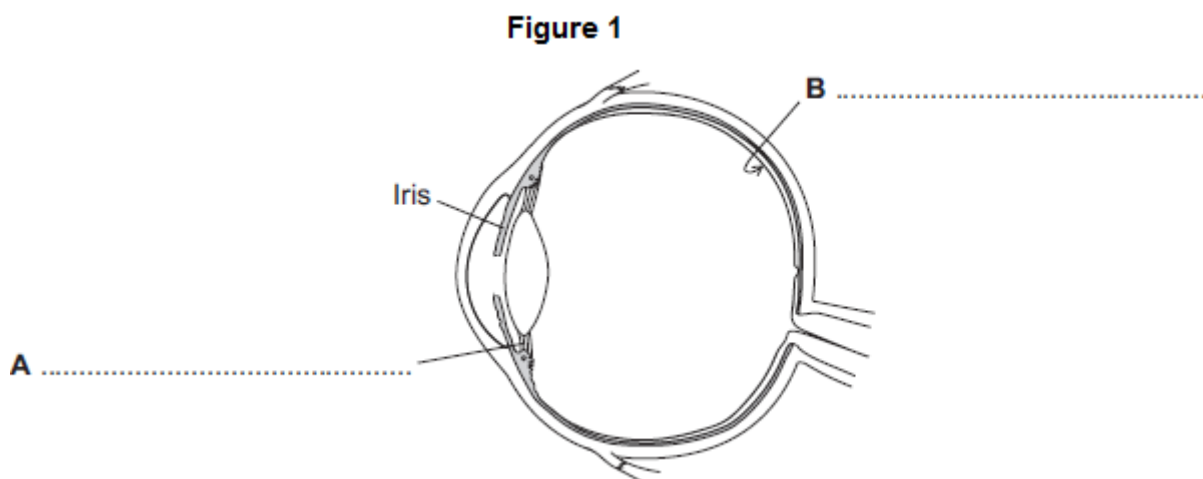
Tick (✓) **one** box.

A magnifying glass ☐

Correcting short sight ☐

To focus an image in a camera ☐

(Total 9 marks)

Q2.(a) **Figure 1** shows a diagram of a human eye.

Figure 1

B ....

Iris

A ....

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.

Figure 2

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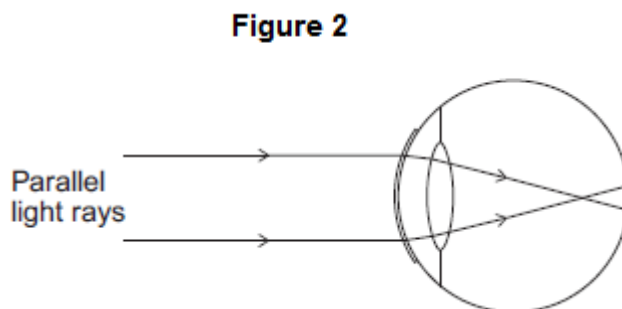
(i) Give the name of the defect of vision shown in **Figure 2**.

....
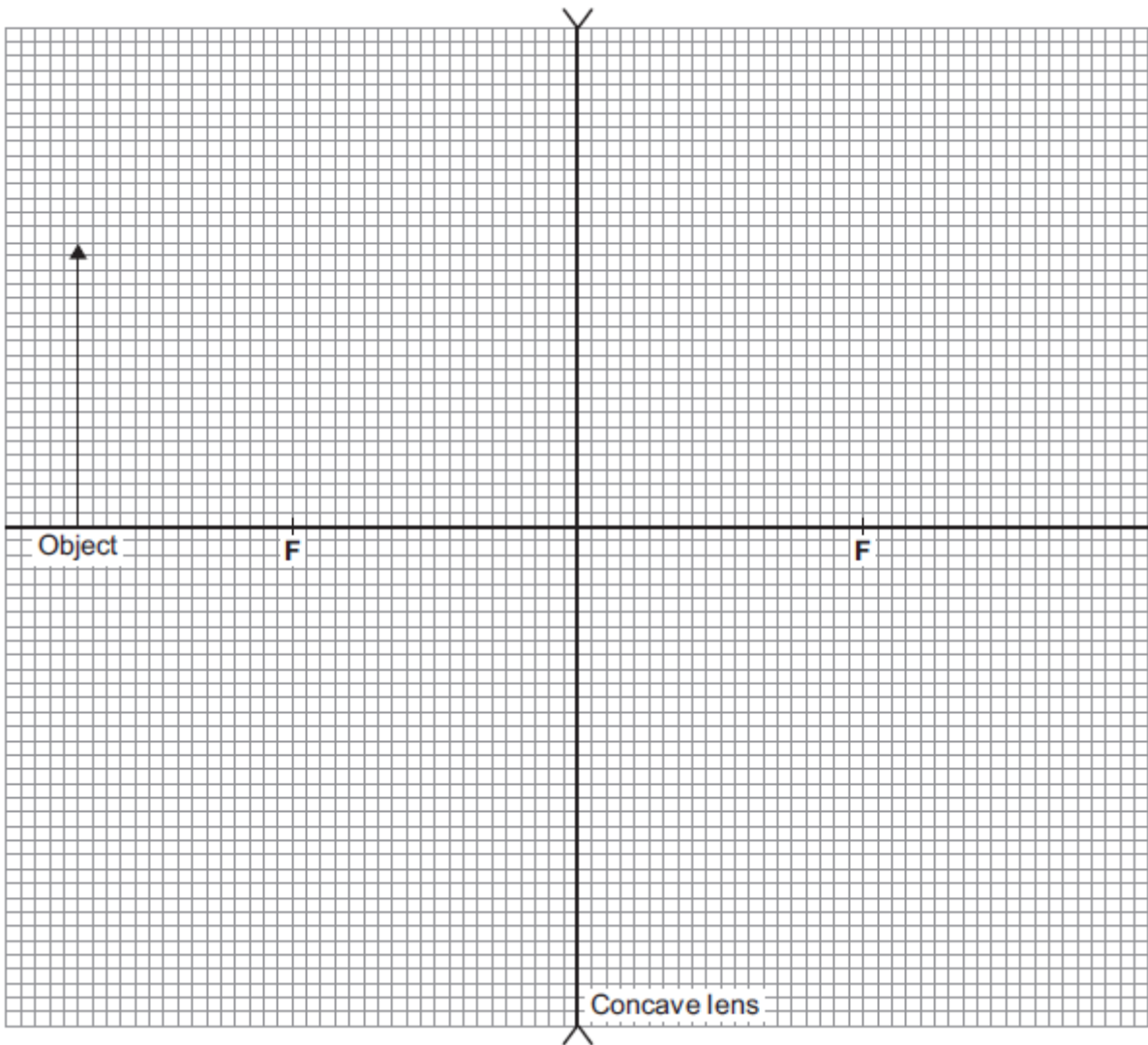
(1)

(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.

    ....
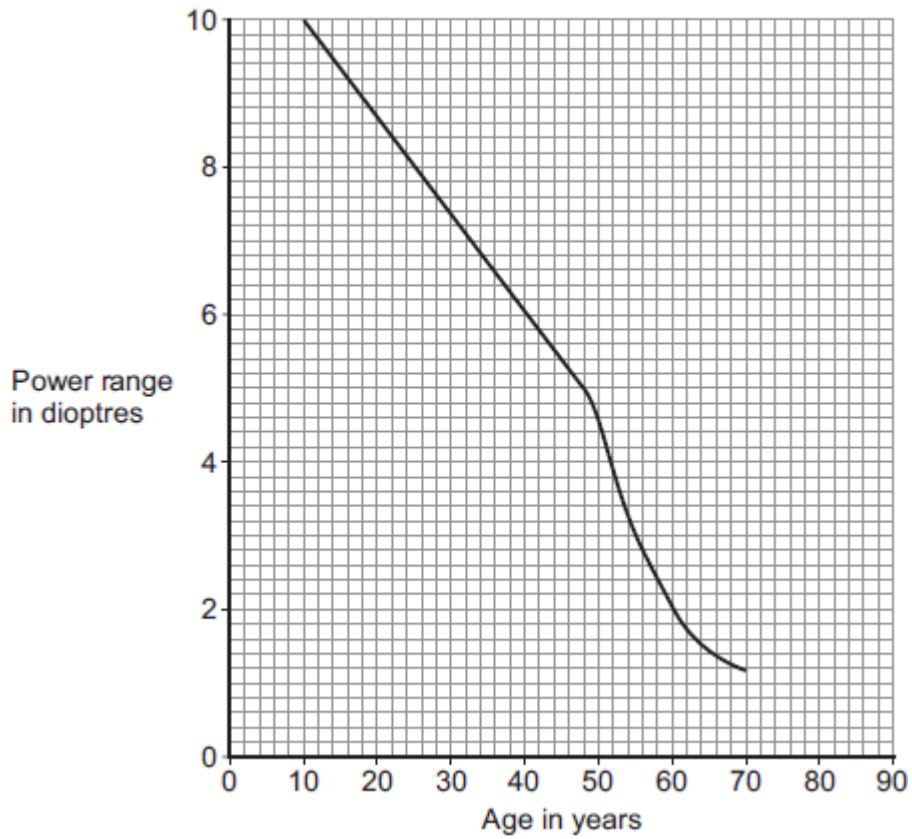
(1)

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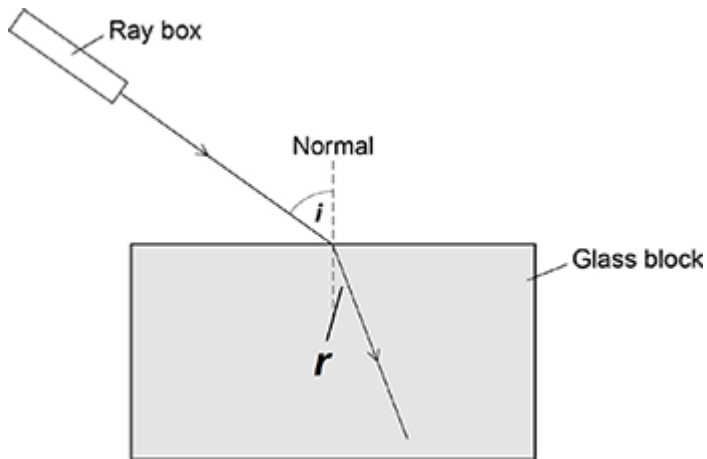
(ii) Compare the change in power range of the eye lens between the ages of 10 and 30 with that between the ages of 50 and 70.

....

....

....

....

....

....

(3)

(Total 13 marks)

M1.(a)   (i)

                                                                                      1

(ii)   1 degree

                                                                                      1

(iii)   1.6

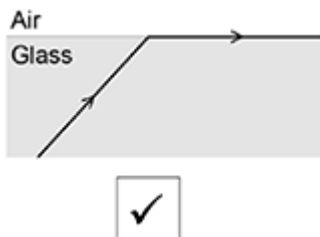   *allow **1** mark for correct substitution, ie 0.80 / 0.5 provided no*
   subsequent step shown
   working showing 1.59(9…..) scores zero

                                                                                      2

(b)   2nd diagram ticked

                                                                                      1

(c)   (i)   any **one** correct description:
   •   upright
   •   virtual
   •   diminished.
   treat multiple words as a list

                                                                                      1

(ii)   0.25

   *allow **1** mark for correct substitution, ie 1 / 4 or 5 / 20 provided no*
   subsequent step shown
   ignore any unit

                                                                                      2

(iii)   Correcting short sight

                                                                                      1

                                        [9]

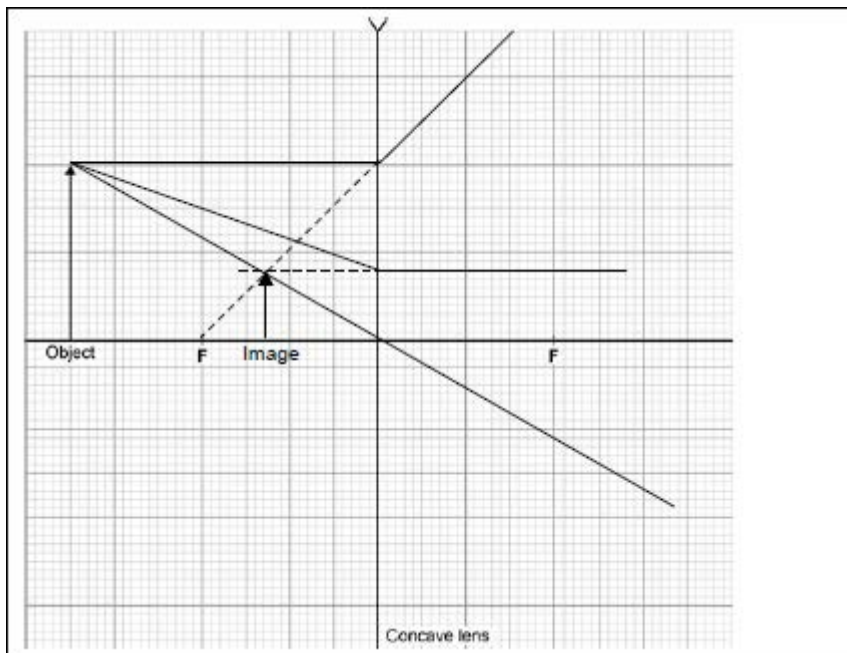**M2.**(a)   **A** = suspensory ligament

1

B = retina

1

(b)   to control the amount of light entering the eye
or
to control the amount of light incident on the retina
allow change the size of the pupil

1

(c)   (i)   short sight

or

myopia
accept near sight

1

(ii)

Concave lens

any 2 correct construction lines:
construction lines may be dotted or solid
construction lines must pass correctly through the lens
treat more than 2 construction lines as a list for marking

2

upright image drawn at correct location
image must be to the left of the lens
upright orientation of image must be clear
the image line can be   dotted or solid

(d) to focus light from objects at different distances

accept can see objects (clearly) at different distances.

to focus light on the retina is insufficient

1

(e) (i) 0.5 metre(s) / m

*the **unit** is not an independent mark*

*an answer 0.5 without a unit or with an incorrect unit scores **1** mark*

or

*a substitution 2 = 1 / f with the unit metre(s) / m scores **1** mark*

2

(ii) 10 to 30 decreases linearly or at a constant rate

accept from 10 to 30 the decrease is 2.6 / 2.7(D)

1

50 to 70 falls less rapidly after 60 years

accept it decreases at a decreasing rate

accept from 50 to 70 the decrease is 3.3 / 3.4(D)

1

10 to 30 decrease is less than 50 to 70

1