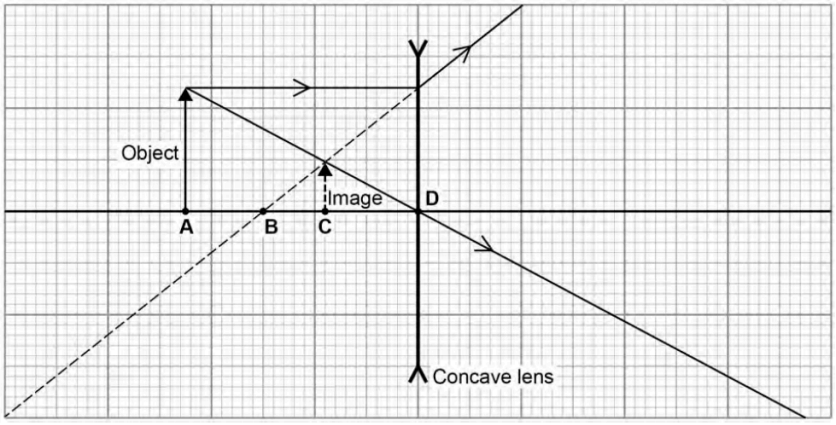
Q1.(2018)

a)

Figure 1 shows how a concave lens forms an image of an object.

Figure 1



Which point on **Figure 1** marks the position of the principal focus of the lens?

Tick **one** box.

[1 mark]

A ☐ **B** ☐ **C** ☐ **D** ☐

b)

Which **two** words describe the image?

Tick **two** boxes.

[2 marks]

Enlarged ☐

Inverted ☐

Real ☐

Upright ☐

Virtual ☐

c)

Calculate the magnification produced by the lens.

Use the equation:

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

[4 marks]

Magnification = _____

d)

Complete the sentence.

Choose an answer from the box.

[1 mark]

decrease	**increase**	**not change**

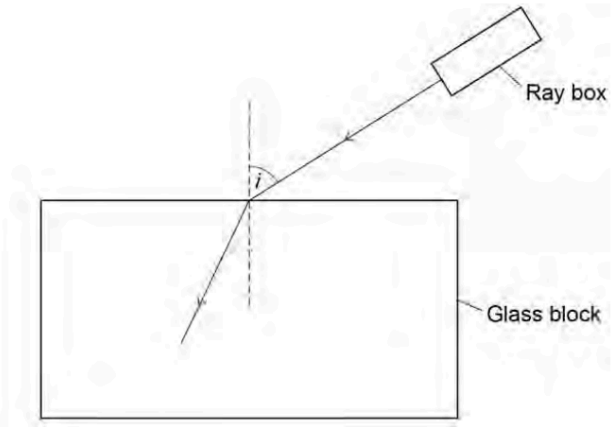
As the object is moved further away from the lens, the size of the image will _____.

Q2.(2019)

A student used a ray box and glass block to investigate refraction of light.

Figure 15 shows a ray of light entering the glass block.

Figure 15



In **Figure 15**, the angle of incidence is labelled with the letter ***i***.

Label the angle of refraction in **Figure 15** with the letter ***r***.

[1 mark]

b)

Measure the angle of incidence in **Figure 15**.

[1 mark]

Angle of incidence = _____ °

c)

Complete **Figure 15** to show the path taken by the ray of light through the glass block and out into the air.

[3 marks]

d)

Complete the sentence.

Choose an answer from the box.

[1 mark]

random	**systematic**	**zero**

The student repeated the measurement three times and calculated the mean to

reduce the effect of _____ errors.

e)

Table 2 shows the student's values for the angles of incidence and the mean angles of refraction.

Table 2

Angle of incidence in degrees	Mean angle of refraction in degrees
20	13
30	19
40	**X**
50	31

For an angle of incidence of 40° the three measurements for the angle of refraction were:

23° 27° 25°

Calculate the value of **X** in **Table 2**.

[1 mark]

X = _____ °

f)

Complete the sentence.

Choose the answer from the box.

[1 mark]

equal to	**greater than**	**less than**

The student used the data in **Table 2** and correctly concluded that the angle of refraction is _____ the angle of incidence used.

g)

Why is the student's conclusion only valid for angles of incidence between 20° and 50°?

[1 mark]

h)

The student repeated the investigation using a transparent plastic block.

Why did the student use a transparent block and not an opaque block?

[1 mark]

i)

The student wanted to compare the refraction caused by the plastic with the refraction caused by the glass.

What must the student keep the same for both the plastic block and the glass block?

[1 mark]

Tick (✓) **one** box.

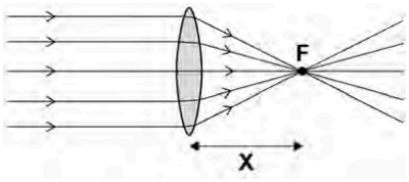
- The angles of incidence tested ☐
- The angles of refraction tested ☐
- The number of results recorded ☐
- The size of the two blocks ☐

Q3.(2019)

a)

Figure 20 shows parallel rays of light being refracted by a convex lens.

Figure 20



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

[1 mark]

b)

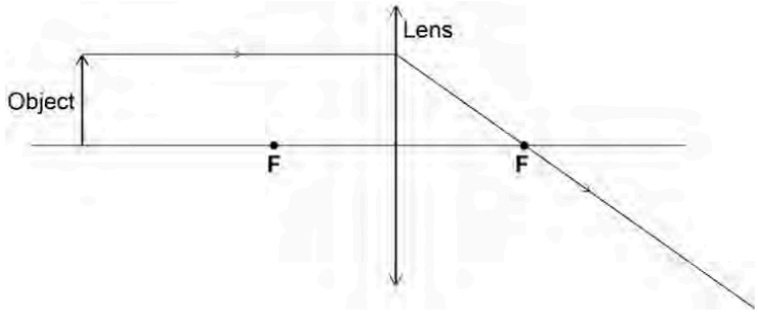
Lenses can be used to form the image of an object.

Complete the ray diagram in **Figure 21** to show how a **convex** lens forms the image of the object.

Use an arrow to represent the image.

[2 marks]

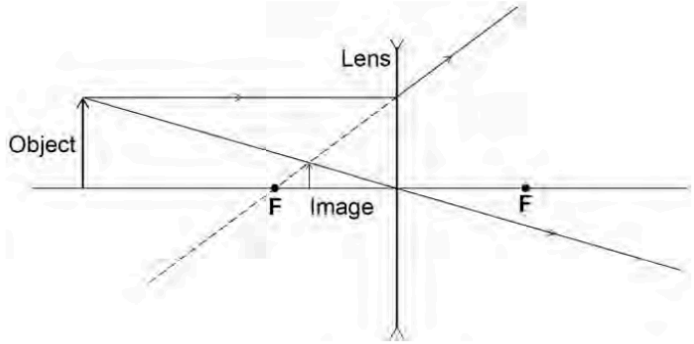
Figure 21



c)

Figure 22 shows how a **concave** lens forms the image of an object.

Figure 22



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 _____

d)

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]

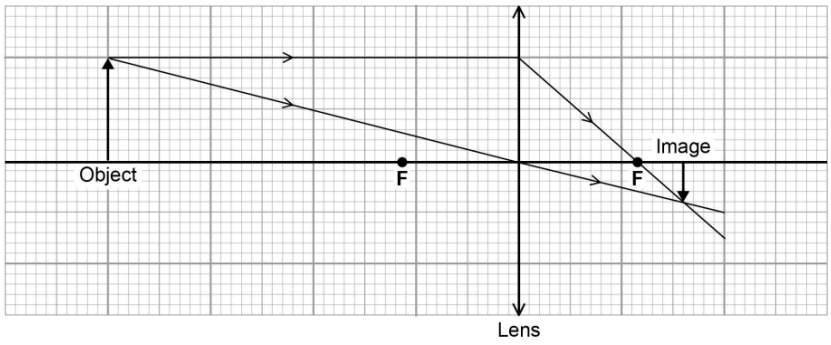
Height = _____ mm

Q4.(2021)

a)

Figure 14 shows how a lens forms an image of an object.

Figure 14



What type of lens is represented in **Figure 14**?

[1 mark]

Tick (✓) **one** box.

Concave ☐

Convex ☐

Diverging ☐

b)

Measure the image height and the object height in **Figure 14**.

[1 mark]

Image height = _____ cm

Object height = _____ cm

c)

Calculate the magnification produced by the lens.

Use the equation:

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

[2 marks]

_____

_____

_____

_____

_____

Magnification = _____

d)

Which **two** words describe the image in **Figure 14**?

[2 marks]

Tick (✓) **two** boxes.

- Enlarged ☐
- Inverted ☐
- Real ☐
- Upright ☐
- Virtual ☐

e)

The object was blue.

A student looked at the blue object through a green filter.

Complete the sentences.

Choose answers from the box.

[2 marks]

black	**blue**	**green**	**red**	**white**

Looking at the blue object through a green filter makes the object appear

_____ .

This is because the green filter only transmits the light that is _____ .

Q5.(2022)

a)

A student used a ray box to shine a ray of light through air into a glass block.

The student investigated how the angle of refraction varied with the angle of incidence.

Table 5 shows the results.

Table 5

Angle of incidence in degrees	Angle of refraction in degrees
10	5
20	10
30	14
40	19
50	23
60	26
70	28
80	29

Describe a method the student could have used to obtain the results in **Table 5**.

Your answer may include a labelled diagram.

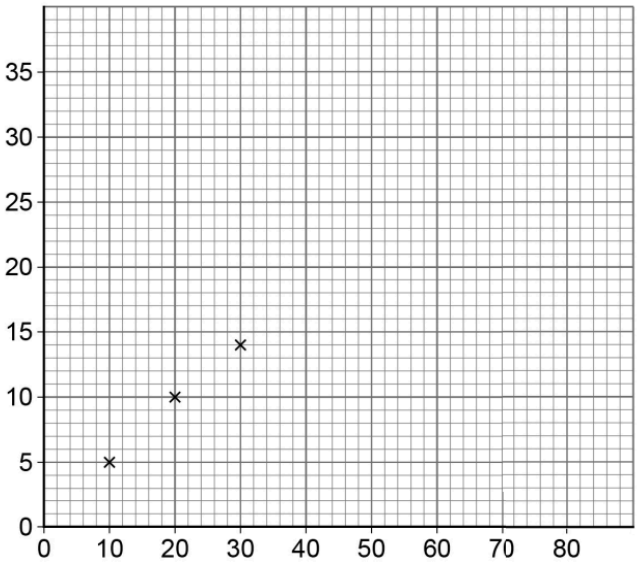
[6 marks]

---

b)

Figure 16 is an incomplete graph of the results.

Figure 16



Complete **Figure 16** using data from **Table 5**.

- Label the axes.
- Plot the remaining data.
- Draw a line of best fit.

[4 marks]

c)

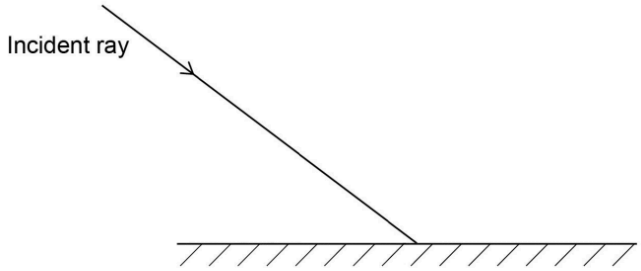
Complete the ray diagram in **Figure 17** to show the reflection of light from the surface of a plane mirror.

You should:

- draw the normal line
- draw the reflected ray.

[2 marks]

Figure 17

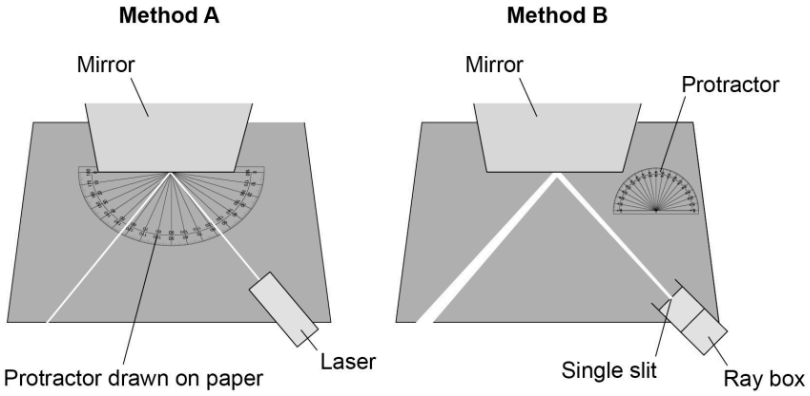


Q6.(2022)

Two students investigated the reflection of light by a plane mirror.

Figure 18 shows the different equipment the students used.

Figure 18



Explain **two** ways that **Method A** is better than **Method B**.

[4 marks]

Q7.(2023)
a)

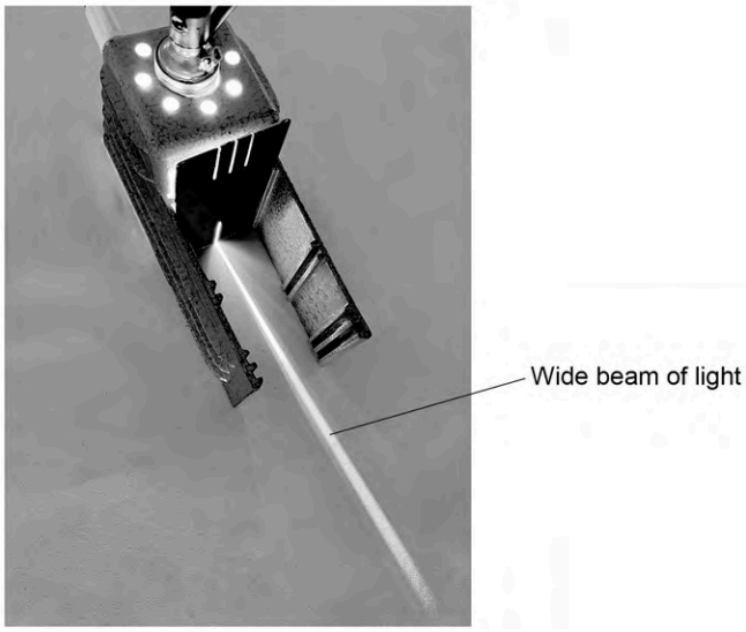
A student investigated the refraction of light through a glass block.

Figure 14 shows the ray box used.

The student aimed the beam of light from the ray box towards a glass block.

The student measured the angle of incidence at the point where the light entered the glass block.

Figure 14



Why is using a wide beam of light less likely to give accurate results than using a narrow beam?

[1 mark]

Tick (✓) **one** box.

It will be harder to judge where the centre of the beam is. ☐

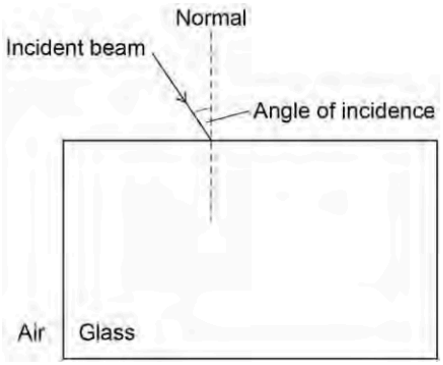
It will cause a smaller uncertainty in the measurements. ☐

The angle of refraction will be larger than it should be. ☐

b)

Figure 15 shows the beam of light incident on the glass block.

Figure 15



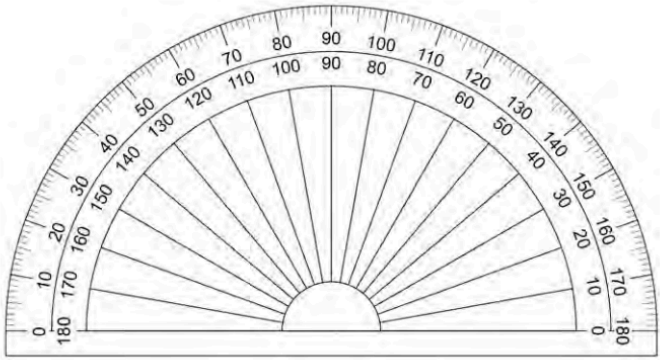
Complete **Figure 15** to show the path taken by the beam of light through the glass block and back into the air.

[3 marks]

c)

Figure 16 shows the protractor used by the student.

Figure 16



What is the resolution of the protractor?

[1 mark]

Tick (✓) **one** box.

1 degree ☐

10 degrees ☐

180 degrees ☐

d)

For one angle of incidence the student measured the angle of refraction three times.

The three measurements were:

35° 31° 33°

Calculate the mean angle of refraction.

[1 mark]

Mean angle of refraction = _____ °

e)

The student placed a red filter in front of the white beam of light.

Only red light passes through the filter.

Complete the sentence.

[1 mark]

When white light is incident on the red filter, all colours except for red are

_____ by the filter.

f)

Write down the equation which links frequency (f), wave speed (v) and wavelength (λ).

[1 mark]

g)

Light has a wave speed of 3.0×10^8 m/s in air.

The frequency of the red light is 4.0×10^{14} Hz.

Calculate the wavelength of the red light in air.

[3 marks]

Wavelength = _____ m

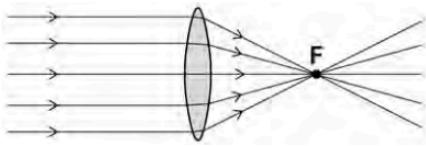
Q8.(2023)

a)

Lenses can be used to form an image of an object.

Figure 20 shows parallel rays of light being refracted by a **convex** lens.

Figure 20



What is the position marked '**F**' called?

[1 mark]

Tick (✓) **one** box.

- Focal length ☐
- Focus point ☐
- Principal focus ☐

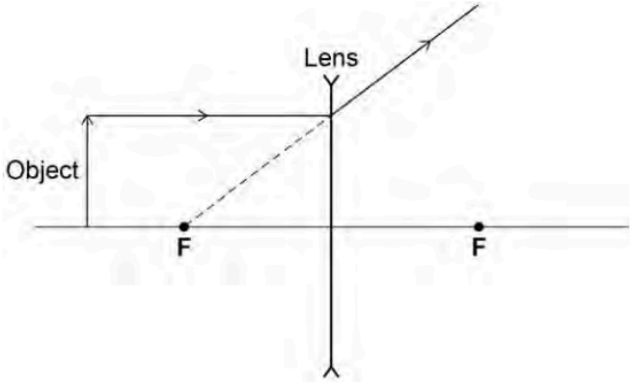
b)

Complete the ray diagram in **Figure 21** to show how a **concave** lens forms the image of the object.

Use an arrow to represent the image.

[2 marks]

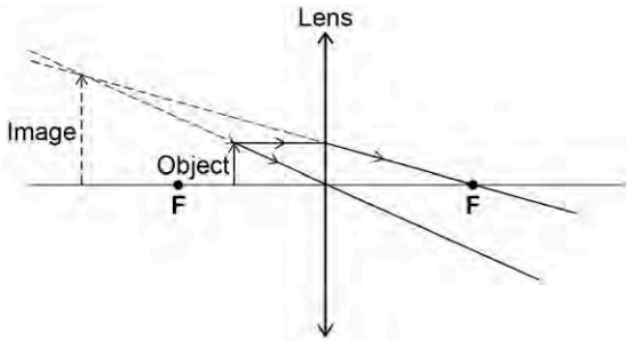
Figure 21



c)

Figure 22 shows how a **convex** lens can be used to form a magnified image of an object.

Figure 22



Give **two** ways that the image formed by the convex lens in **Figure 22** is similar to the image formed by the concave lens.

[2 marks]

1 _____

2 _____

d)

A convex lens is used as a magnifying glass to identify a symbol on the back of a silver spoon.

The symbol has an actual height of 1.6 mm.

The magnification produced by the lens is 3.5

Calculate the image height of the symbol when viewed through the magnifying glass.

Use the Physics Equations Sheet.

[3 marks]

Image height = _____ mm

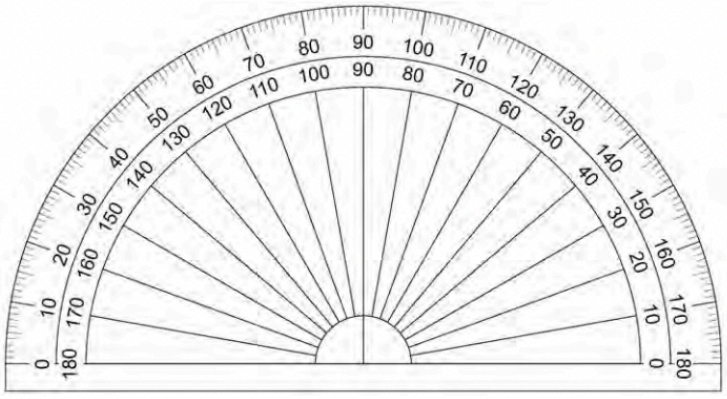
Q9.(2024)

a)

A student investigated the refraction of light by a glass block.

Figure 13 shows the protractor used to measure the angles of incidence and the angles of refraction.

Figure 13



What is the resolution of the protractor used to measure the angles?

[1 mark]

Resolution = _____ °

b)

Table 1 shows the results.

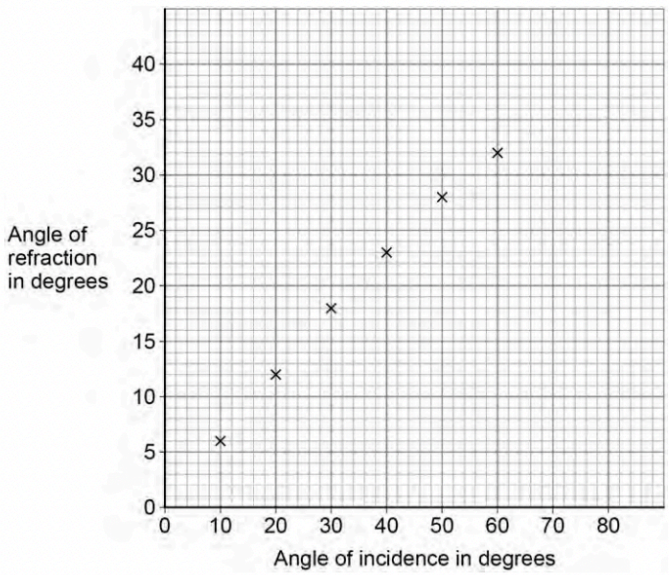
Table 1

Angle of incidence in degrees	Angle of refraction in degrees
10	6
20	12
30	18
40	23
50	28
60	32

Q9.c)(2024)

Figure 14 shows some of the results.

Figure 14



The student measured the angles of refraction for two additional angles of incidence.

Table 2 shows the additional results.

Table 2

Angle of incidence in degrees	Angle of refraction in degrees
70	35
80	37

Complete **Figure 14**.

You should:

- plot the results from **Table 2**
- draw the line of best fit.

[2 marks]

d)

How does **Figure 14** show that the angle of refraction is **not** directly proportional to the angle of incidence?

[1 mark]

Q10.(2024)

a)

Figure 15 shows a diagram of a car headlight.

The headlight has a lamp, a reflective surface and a transparent cover.

Figure 15

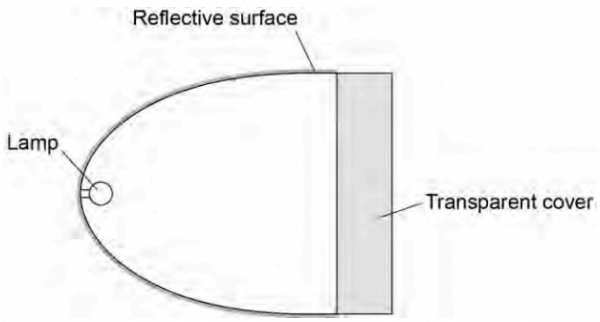
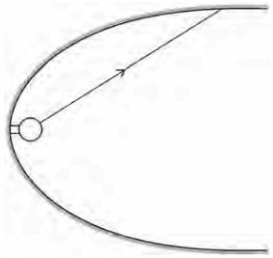


Figure 16 shows a ray of light incident on the reflective surface.

Figure 16



Complete **Figure 16** to show the reflected ray of light.

You should include the normal line at the point where the incident ray meets the reflecting surface.

[2 marks]

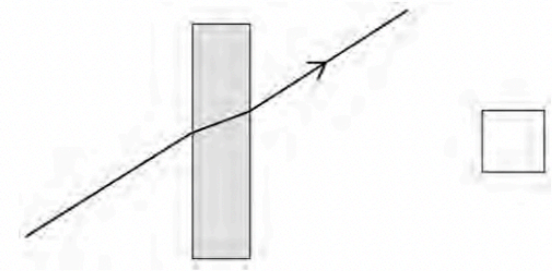
b)

Rays of light pass through the transparent cover of the headlight.

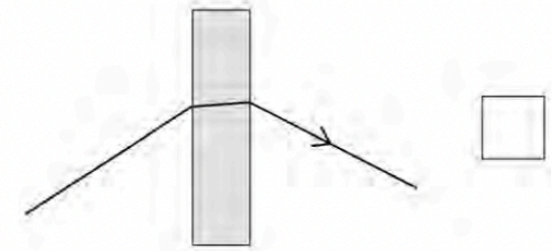
Which diagram shows how a ray of light passes through the transparent cover?

[1 mark]

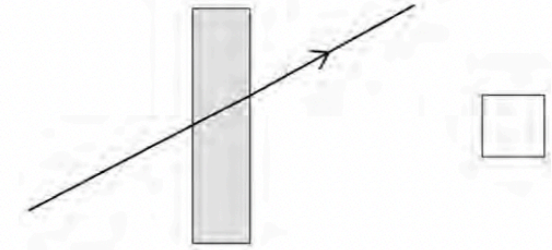
Tick (✓) **one** box.



☐



☐



☐

Describe a method the student could have used to obtain the data in **Table 1**.

You may include a labelled diagram.

[6 marks]