OCR GCSE GATEWAY PHYSICS A · J249

PHYSICS



EXAM QUESTION PACK

P5.3 WAVE INTERACTION

SCORE	PERCENTAGE
/77	%

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Gateway Physics A (9-1)

Wave interaction

Please note that you may see slight differences between this paper and the original.

Candidates answer on the Question paper.

OCR supplied materials:
Additional resources may be supplied with this paper.

Other materials required:
- Pencil
- Ruler (cm/mm)

Duration: Not set

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions, unless your teacher tells you otherwise.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Where space is provided below the question, please write your answer there.
- You may use additional paper, or a specific Answer sheet if one is provided, but you must clearly show your candidate number, centre number and question number(s).

INFORMATION FOR CANDIDATES

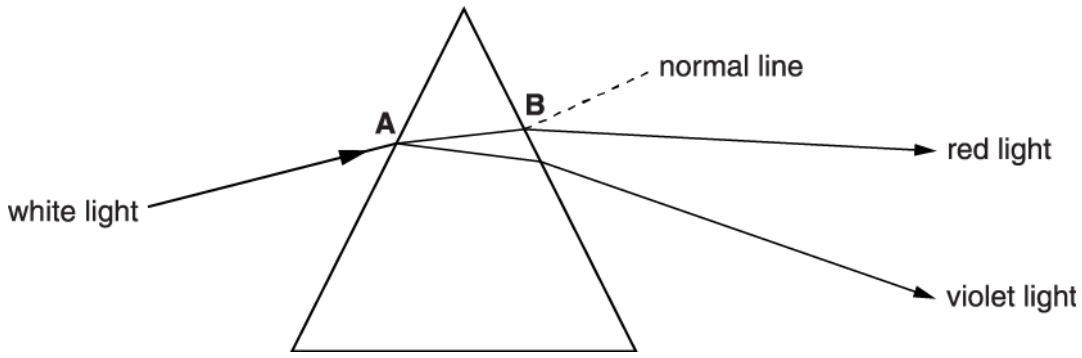
- The quality of written communication is assessed in questions marked with either a pencil or an asterisk. In History and Geography a *Quality of extended response* question is marked with an asterisk, while a pencil is used for questions in which *Spelling, punctuation and grammar and the use of specialist terminology* is assessed.
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **77**.
- The total number of marks may take into account some 'either/or' question choices.

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1 Look at the diagram. It shows white light entering a glass prism at **A**.



The red light refracts away from the normal at **B**.

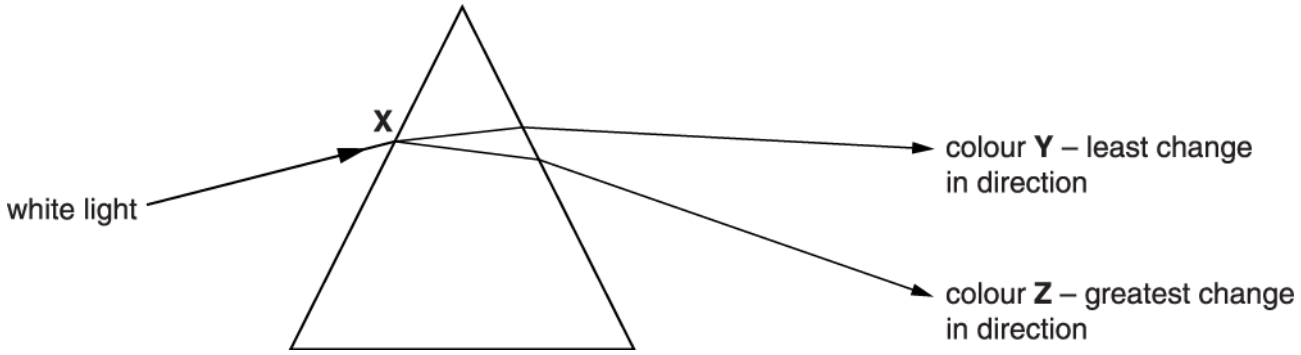
Violet light refracts **more** than red light.

Explain why.

---

[2]

2 Look at the diagram. It shows white light entering a glass prism.



Dispersion happens and different colours are produced.

Complete the sentences.

Choose from:

diffracts	longest	red
reflects	refracts	same
shortest	violet	white

When the light enters the prism at X, it _____

Colour Z is _____

Colour Z has the greatest change in direction because it has the _____ wavelength.

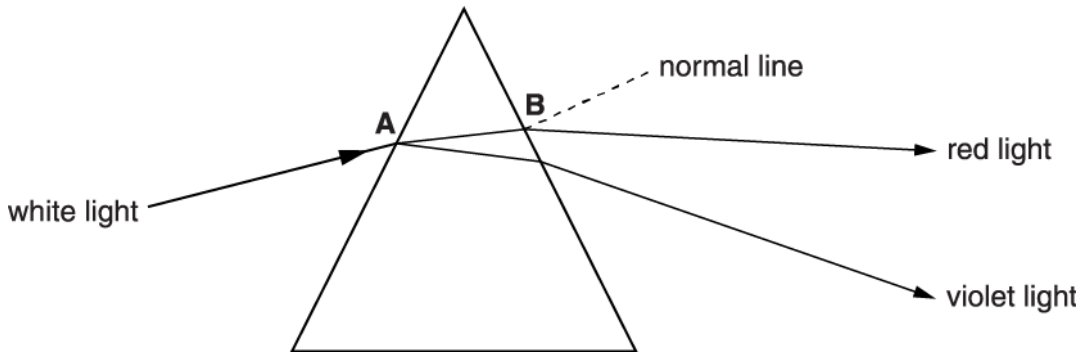
[3]

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3 Look at the diagram. It shows white light entering a glass prism at **A**.



The red light refracts away from the normal at **B**.

Use ideas about waves to explain why this happens.

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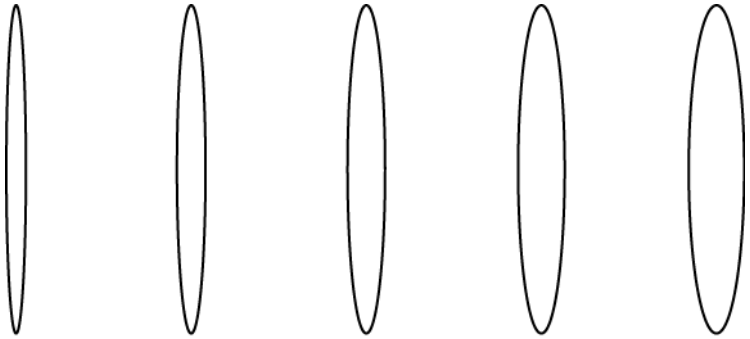
[2]

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4 Sam wants to measure the focal length of some convex (converging) lenses.

He has some equipment.

- A metre rule measuring in cm
- A small ruler measuring in mm
- A sheet of white card
- A tree outside which he can use as a distant object
- 5 lenses of different thicknesses.



Explain what is meant by focal length and describe an experiment that Sam could do to investigate how the thickness of a lens affects its focal length.

The quality of written communication will be assessed in your answer to this question.

[6]

5(a) She sends a laser beam through an optical fibre.

The laser beam is totally internally reflected as it moves along the fibre.

Describe one other use of total internal reflection.

---

[1]

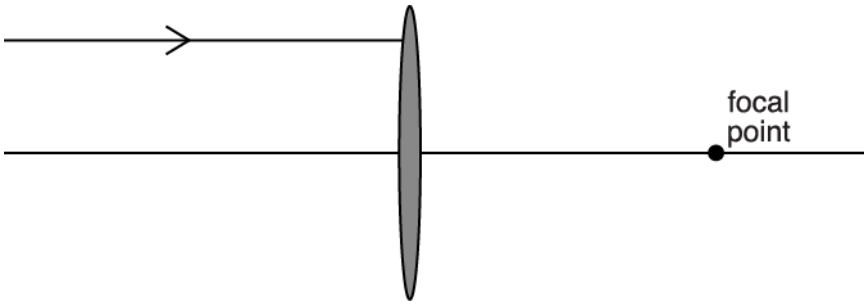
(b) Chantal experiments with converging lenses.

(i) Write down another name for a converging lens.

---

[1]

(ii) Complete the path of the light ray after it goes through the converging lens.



[1]

(c) Converging lenses are used in cameras to produce images.

Describe the **type** of image and **where** it is produced in a camera.

---

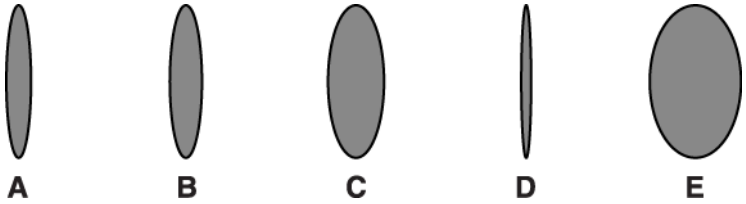
[2]

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(d) Chantal has some converging lenses with different thicknesses.



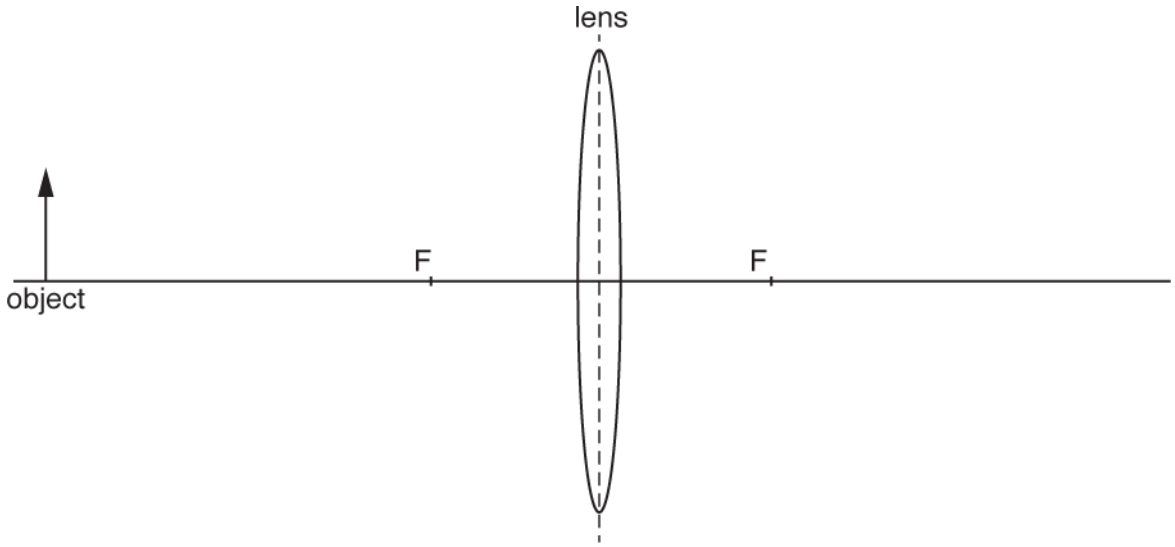
She wants to arrange the lenses in the order of their focal lengths.

Put the lenses in the correct order. Complete the table. One has been done for you.

Focal length in cm	Lens
5	
10	
15	B
20	
25	

[2]

6 Anya starts drawing a ray diagram for a convex lens.



The magnification of the lens is 0.5 and the object height is 1.5 cm.

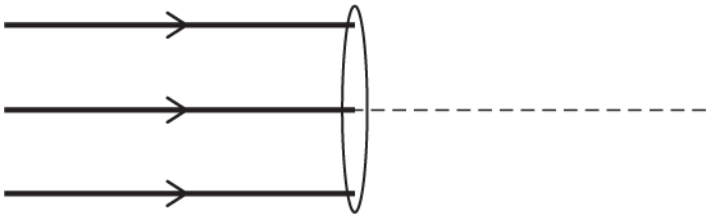
Complete the ray diagram to show the size and position of the image. Calculate the size of the image and use your diagram to explain refraction by a convex lens.

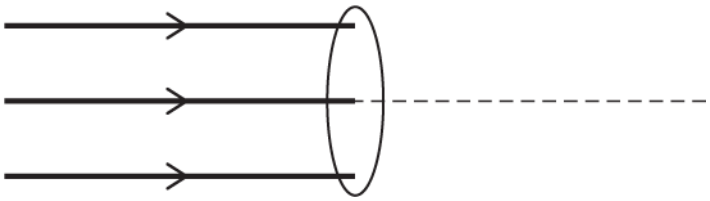
The quality of written communication will be assessed in your answer to this question.

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[6]

7 Anya compares two different convex lenses.





The light rays pass through the lenses.

Label and complete the ray diagrams to show the path the rays take.

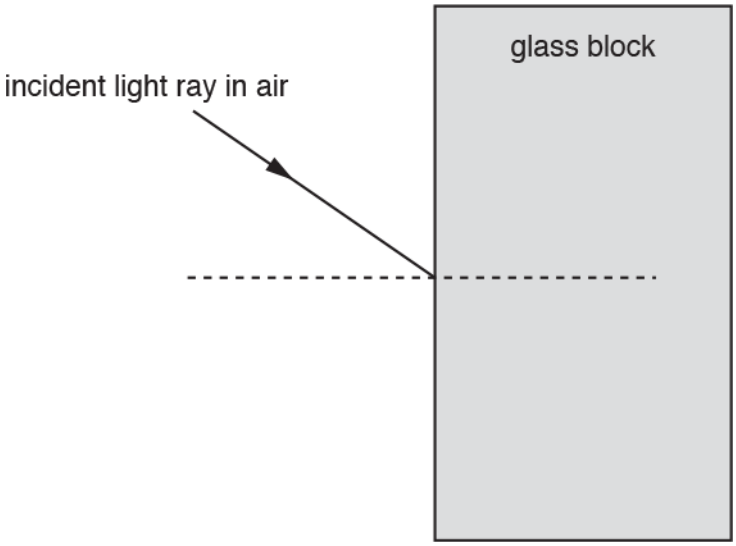
Use your completed diagrams to describe how convex lenses produce a real image.

The quality of written communication will be assessed in your answer to this question.

[6]

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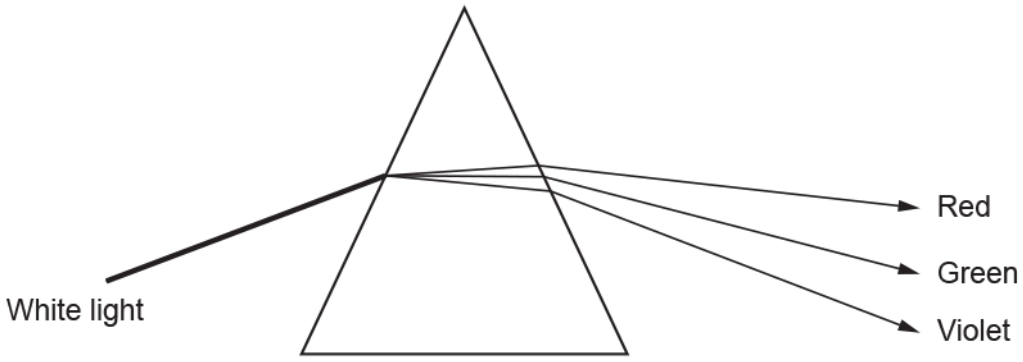
8 A light ray passes from air through a glass block.



Complete the ray diagram for this light ray as it travels into **and** out of the glass block. **[3]**

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9 Look at the diagram of white light as it passes through a prism.



A spectrum of colours is seen. It ranges from red to violet.

Why does the **violet** light refract **more** than the red light?

A Violet light changes frequency more than red light.

B Violet light has the largest change in speed.

C Violet light has the smallest change in speed.

D Violet light increases its speed in the glass prism.

Your answer [ ] **[1]**

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10(a) A student investigates reflection and refraction of light rays.

The student sends a ray of red light into a glass prism.

Fig. 18.1 shows the light ray as it leaves the glass prism.

On **Fig. 18.1** complete the ray of light as it travels towards **and** through the glass prism.

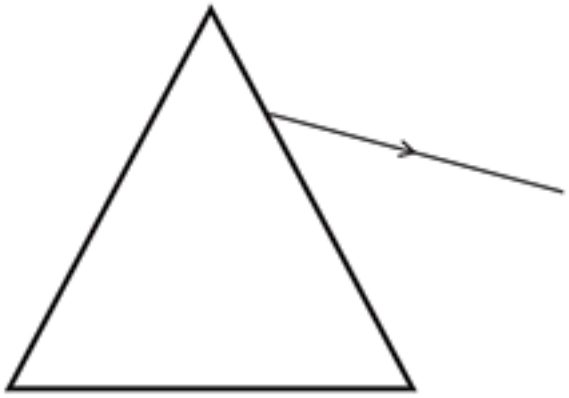


Fig. 18.1

[2]

(b) **Fig. 18.2** shows two mirrors placed at 90° to each other.

A light ray hits one of the mirrors at 45°.

On **Fig. 18.2** complete the ray of light as it reflects from both mirrors.

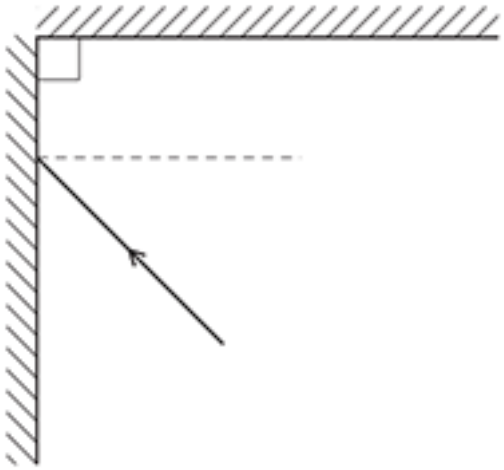


Fig. 18.2

[2]

(c) White light is made of different colours.

White light passes through a transparent filter **X**.

Filter **X** absorbs green, blue, indigo and violet light.

The light then passes through another transparent filter, **Y**, as shown in **Fig. 18.3**.

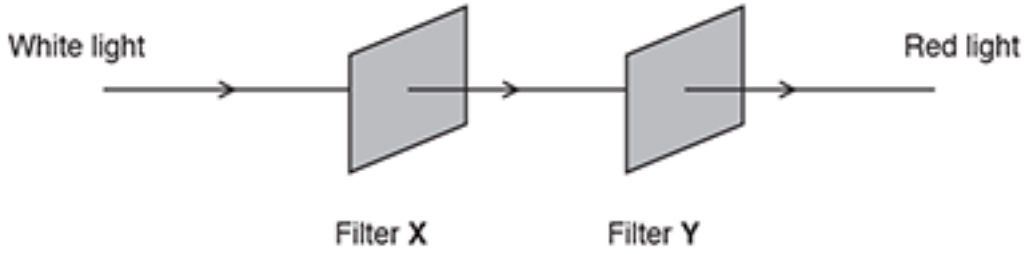


Fig. 18.3

The light that leaves filter **Y** is red.

(i) What colours are transmitted by filter **X**?

---

[1]

(ii) What colours are absorbed by filter **Y**?

---

[1]

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(d) A wall is painted red.

When some coloured lights shine on it, the wall appears black.

(i) Explain why.

---

[1]

(ii) Suggest **two** different colours of light that would cause the wall to appear black.

---------- and ----------

[1]

(e) An optician uses red and green light to test vision.

Fig. 18.4 is a ray diagram showing **red light** passing through a lens.

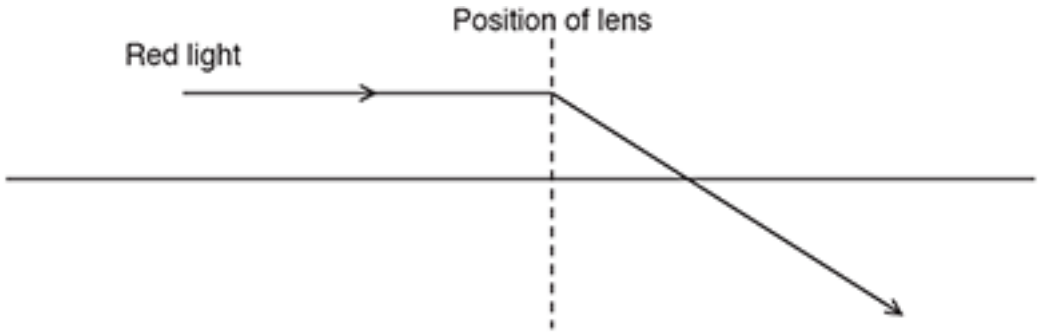


Fig. 18.4

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(i) Green light passes through the same lens as in **Fig. 18.4.**

Complete the ray diagram in **Fig. 18.5** for **green light**. The focal point for red light F_R is shown.

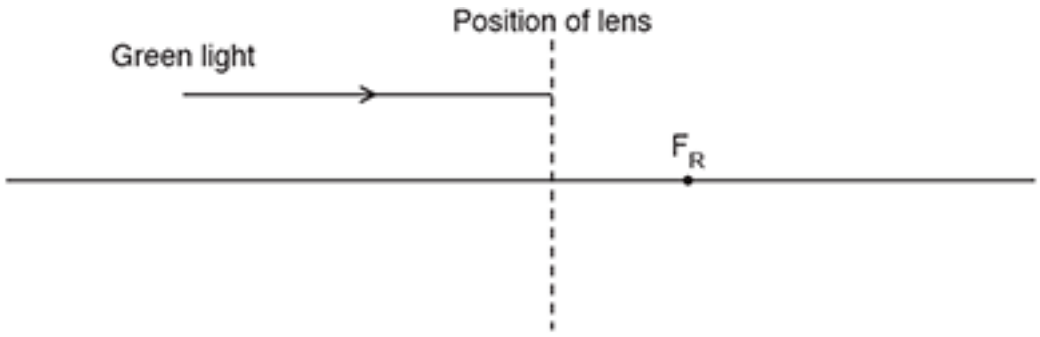


Fig. 18.5

[1]

(ii) Explain your answer to **(i)**.

---

[1]

(iii) Is the lens in **Fig. 18.4** and **18.5** suitable for correcting long-sight or short-sight?

Tick (✓) **one** box.

Long-sight ☐

Short-sight ☐

Explain your answer.

---

[2]

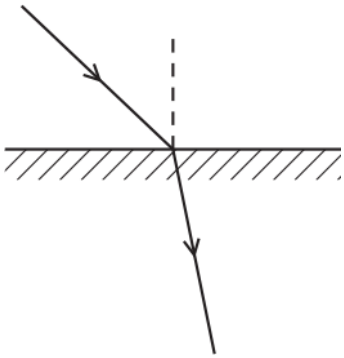
11 Which diagram shows reflection of a light ray using a plane mirror?

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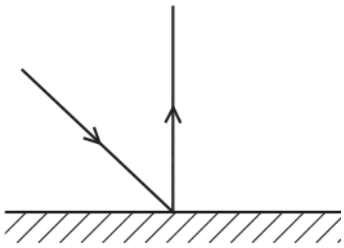
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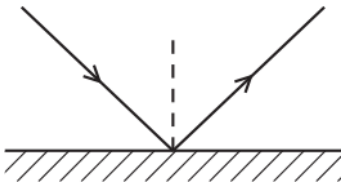
A



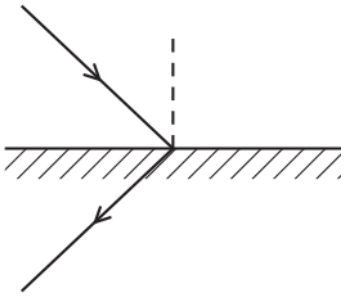
B



C



D



Your answer

[1]

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12(a) Lenses can be used to help people see clearly.

Fig. 18.1 is a diagram of a convex lens.

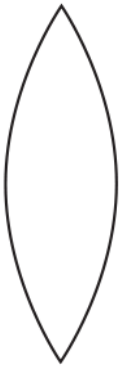


Fig. 18.1

(i) A student models the lens using two glass **prisms** and a glass **block**.

Complete the ray diagram **Fig. 18.2** to show how light rays travel through the model lens (glass prism and glass block).

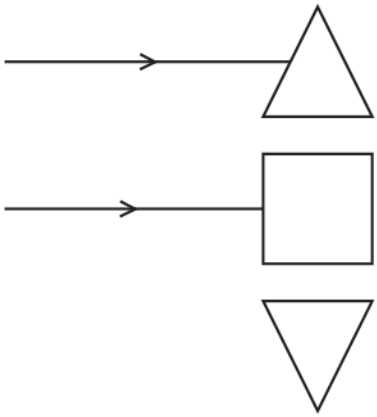


Fig. 18.2

[2]

(ii) Explain how a convex lens can correct long-sighted vision.

Use the model in **Fig. 18.2** to help you.

---

[2]

(b) A student looks at coloured paper in different coloured light.

Fig. 18.3 is a diagram of her experiment.

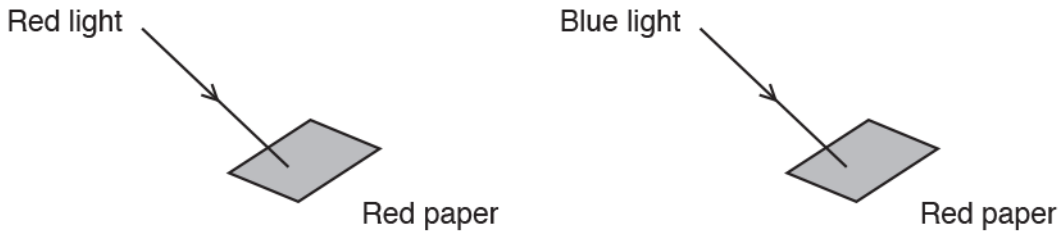


Fig. 18.3

She looks at red paper with red light. The paper appears red.

What colour does the red paper appear in blue light?

Explain your answer.

[2]

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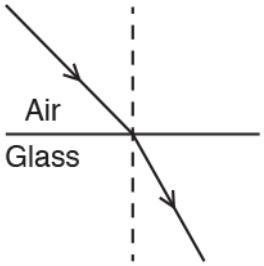
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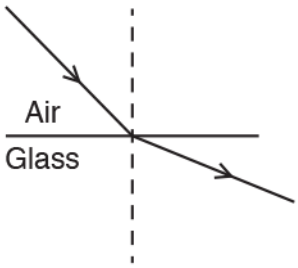
13 A light ray passes from air into glass.

Which diagram shows the **refraction** of this light ray?

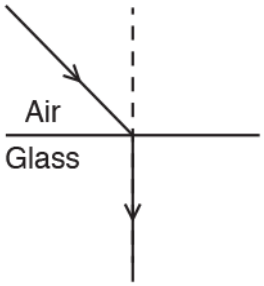
A



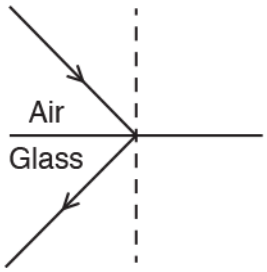
B



C



D

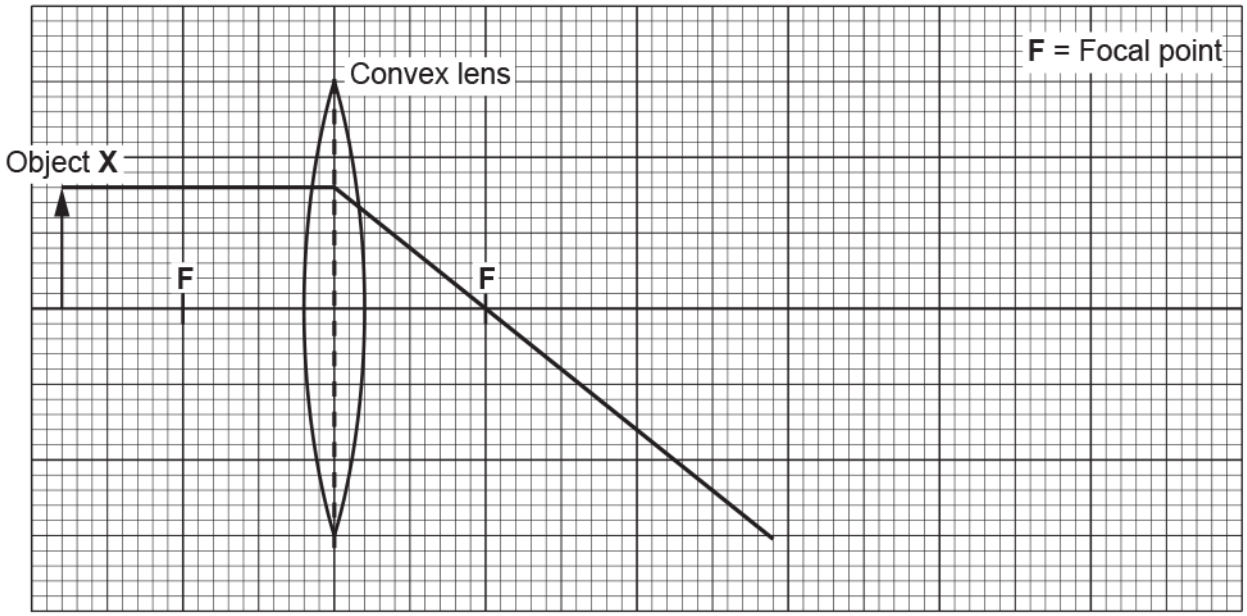


Your answer [ ] [1]

14(a) A projector is used to create a larger image of an object.

The diagram shows one light ray as it passes through the convex lens.

Draw **one** more ray on the diagram to show where the image is formed. Label the image **Y**.



[2]

(b) The projector contains a white light source.

Explain how this white light source can be used to get **red** light.

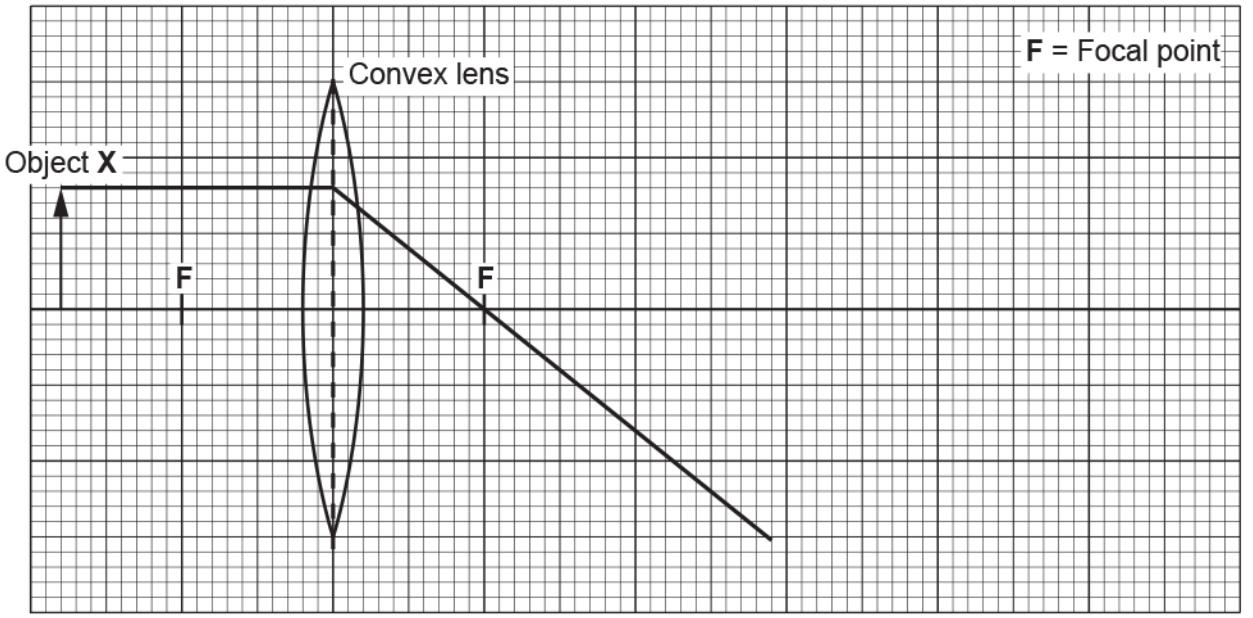
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[2]

15 A projector is used to create a larger image of an object.

The diagram shows one light ray as it passes through the convex lens.

Draw **one** more ray on the diagram to show where the image is formed. Label the image **Y**.

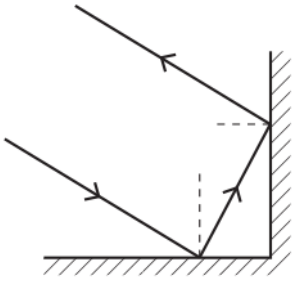


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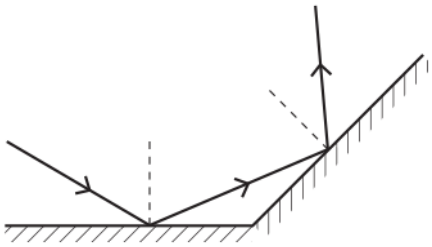
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16 Look at the diagrams of a light ray reflecting from two identical surfaces.

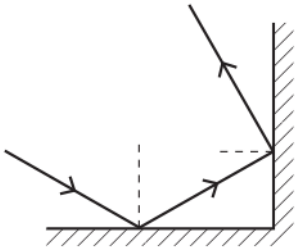
A



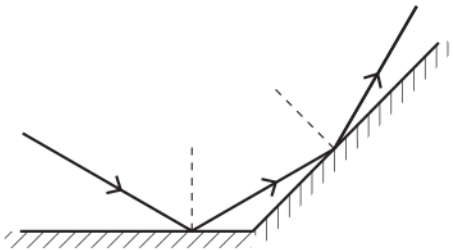
B



C



D



Which diagram is correct?

Your answer [ ] [1]

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17 A projector is used to create a larger image of an object.

The projector contains a white light source.

Explain how this white light source can be used to get **red** light.

---

[2]

18(a) The graph in **Fig. 19.1** shows how displacement of an ultrasound wave varies with distance.

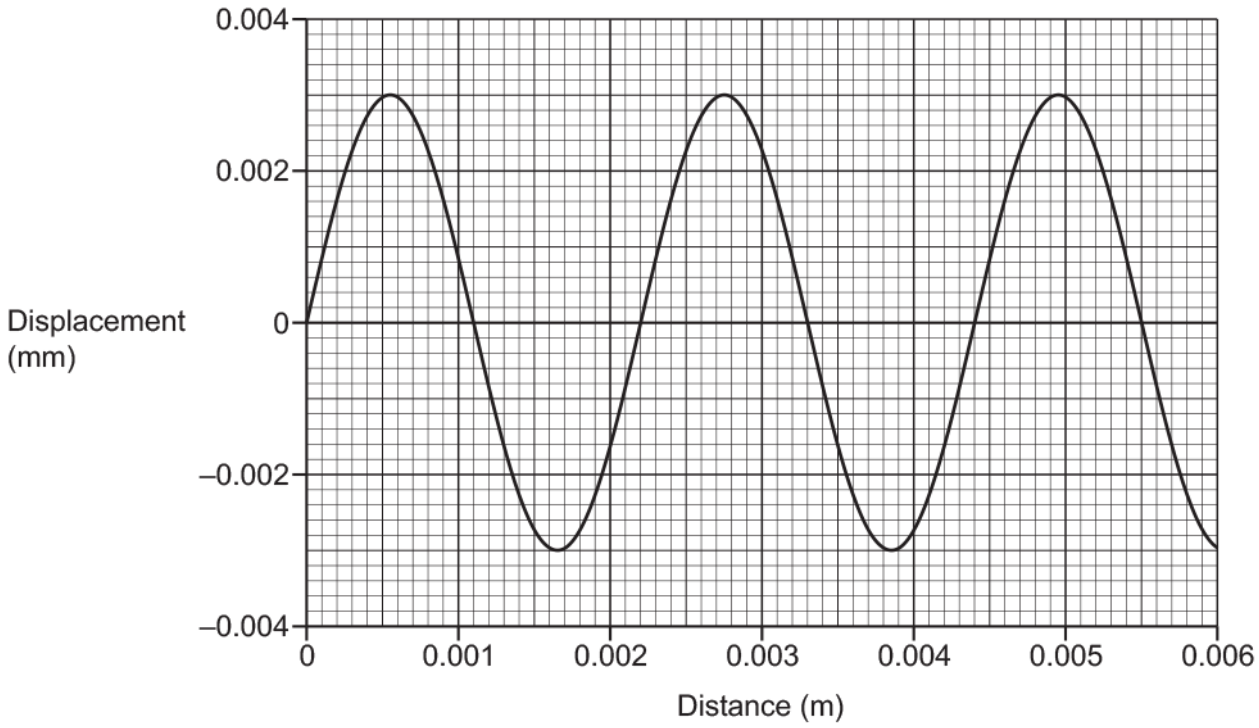


Fig. 19.1

(i) Use the graph in **Fig. 19.1** to determine the wavelength of an ultrasound wave.

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Wavelength = ... m **[1]**

(ii) The speed of ultrasound waves in **(i)** is 4500 m / s.

Calculate the frequency of the ultrasound wave in **Fig. 19.1**.

Use the equation: wave speed = frequency × wavelength

Give your answer in **standard form** and to **2** significant figures.

Frequency = ... Hz **[4]**

(b) Doctors can use an ultrasound scan to measure the size of a person's kidney.



Fig. 19.2

Complete the sentences using the words below.

Each word may be used once, more than once, or not at all.

Increases **Decreases** **Stays the same**

The ultrasound scanner is made from a solid ceramic material.

As the wave enters the body, the speed ..... .

As the wave enters the body, the frequency ..... .

[2]

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(c)

(i) Explain what happens to the ultrasound wave when it reaches the kidney.

[2]

(ii) **Fig. 19.2** shows the thickness of the kidney, **w**.

Explain how ultrasound waves are used to measure **w**.

[2]

(d) A doctor uses an ultrasound scan instead of X-rays to measure the kidneys.

Explain why.

[1]

END OF QUESTION PAPER