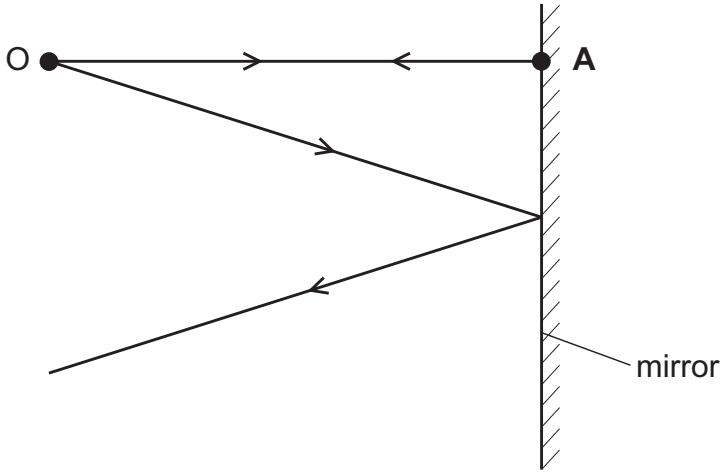
1. Question | 5054 May-June 2023 P1 V1 Q19

19 The diagram shows two divergent rays of light from an object O being reflected from a plane mirror.

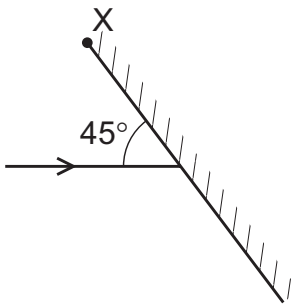
At which position is the image formed?



- **B**
- **C**
- **D**

2. Question | 5054 May-June 2023 P1 V1 Q20

20 Light is incident on a mirror at an angle of 45° as shown. The mirror can be rotated about an axis into the page through point X.



The mirror is rotated until the light is reflected back along its original path.

Through which angle is the mirror rotated?

A 22.5° clockwise

B 22.5° anticlockwise

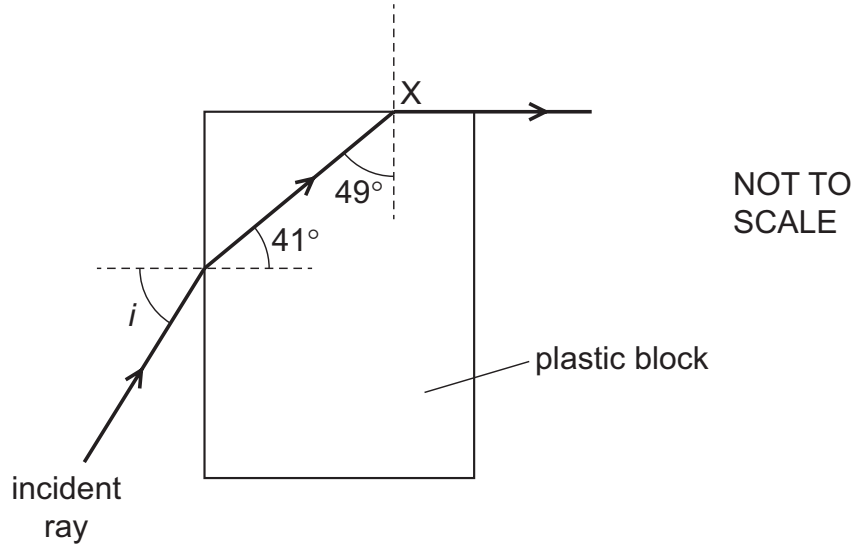
C 45° clockwise

D 45° anticlockwise

3. Question | 5054 May-June 2023 P1 V1 Q21

21 A ray of light is incident on a plastic block in air, at an angle of incidence *i*. The refractive index of the plastic is *n*.

The light ray refracts along the plastic-air boundary when it reaches X.



Which equation is correct?

A $\sin i = \frac{\sin 41°}{n}$

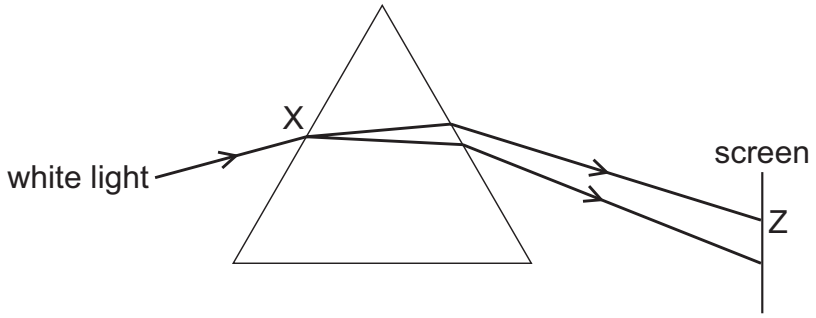
B $\sin i = \frac{n}{\sin 49°}$

C $\sin i = n \times \sin 41°$

D $\sin i = n \times \sin 49°$

4. Question | 5054 May-June 2023 P1 V1 Q22

22 The diagram shows white light entering a prism.



What happens at point X and what is the colour of the light that strikes the screen at point Z?

	at point X	at point Z
A	dispersion only	blue light
B	dispersion and refraction	blue light
C	dispersion and refraction	red light
D	refraction only	red light

5. Question | 5054 May-June 2023 P1 V1 Q23

23 Which row names a region of the electromagnetic spectrum with a wavelength longer than that of visible light and a region with a frequency that is greater than that of visible light?

	wavelength longer than visible light	frequency greater than visible light
A	infrared	ultraviolet
B	microwave	radio
C	radio	microwave
D	ultraviolet	infrared

6. Question | 5054 May-June 2023 P1 V1 Q24

24 Sound travels at different speeds in different states of matter.

Which list gives the three states of matter arranged in order of the speed of sound from slowest to fastest?

A gas → liquid → solid

B liquid → solid → gas

C solid → gas → liquid

D solid → liquid → gas

7. Question | 5054 May-June 2023 P1 V2 Q19

19 Which characteristics describe the image formed by a vertical plane mirror?

A real and upside down

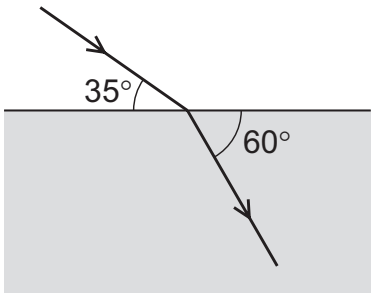
B virtual and upright

C real and larger than the object

D virtual and smaller than the object

8. Question | 5054 May-June 2023 P1 V2 Q20

20 A ray of light passes into a block of transparent material as shown.



What is the refractive index of the transparent material?

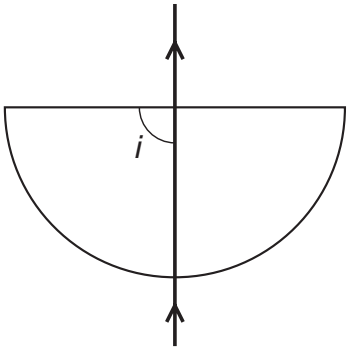
A 0.66 **B** 1.15 **C** 1.64 **D** 1.83

9. Question | 5054 May-June 2023 P1 V2 Q21

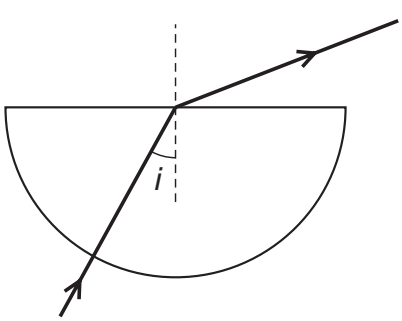
21 The diagrams show light incident on the straight edge of a semi-circular glass block after passing through it.

Which diagram shows refraction and an angle *i* equal to the critical angle of the glass?

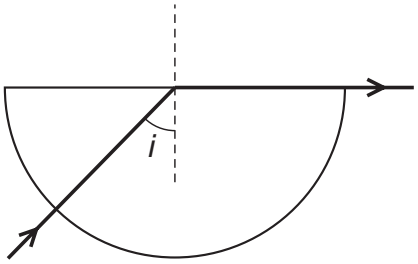
A



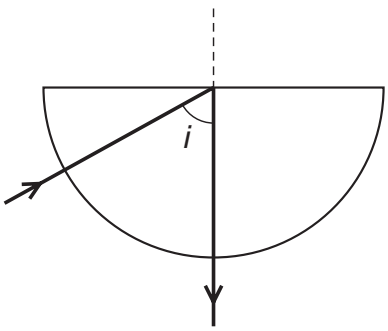
B



C



D



10. Question | 5054 May-June 2023 P1 V2 Q23

23 Ultrasound is a type of sound wave that is not audible to a healthy human ear.

Which range of frequencies contains **only** ultrasound?

A 30 Hz–3.0 kHz

B 300 Hz–30 kHz

C 3.0 kHz–3.0 MHz

D 30 kHz–30 MHz

11. Question | 5054 Oct-Nov 2023 P1 V1 Q18

18 A plane mirror on a vertical wall forms an image of an object placed in front of it.

Which characteristics describe the image?

A real and inverted

B real and upright

C virtual and inverted

D virtual and upright

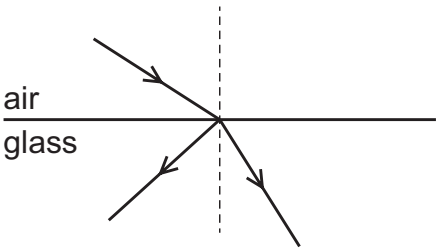
12. Question | 5054 Oct-Nov 2023 P1 V1 Q19

19 The diagrams show light travelling in air incident on the surface of a glass block.

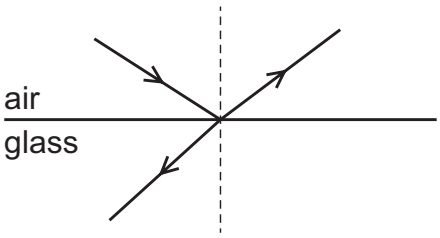
Some light is reflected and some light is refracted.

Which diagram shows the reflection and refraction of the light?

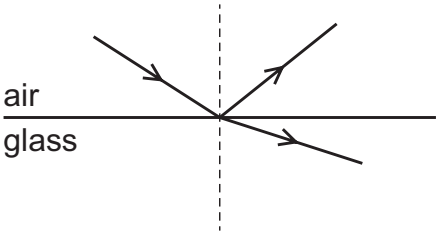
A



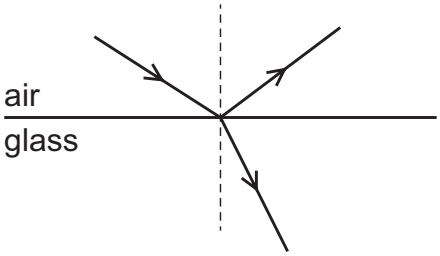
B



C



D



13. Question | 5054 Oct-Nov 2023 P1 V1 Q20

20 Which statement is correct?

A Total internal reflection only occurs when light travels from air into glass.

B The larger the refractive index of glass, the larger is the critical angle.

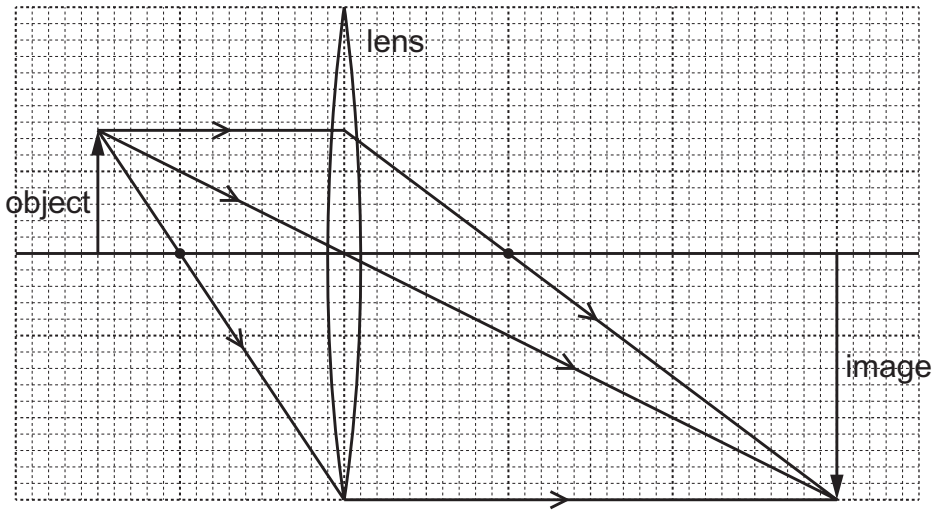
C When total internal reflection occurs, the angle of incidence is equal to the angle of reflection.

D When total internal reflection occurs, the angle of incidence is less than the critical angle.

14. Question | 5054 Oct-Nov 2023 P1 V1 Q21

21 An object is placed in front of a converging lens of focal length 4.0 cm. The height of the image is 6.0 cm.

The arrangement is shown on the scale diagram.



What is the linear magnification produced by the lens?

A 0.50 **B** 1.5 **C** 2.0 **D** 6.0

15. Question | 5054 Oct-Nov 2023 P1 V1 Q22

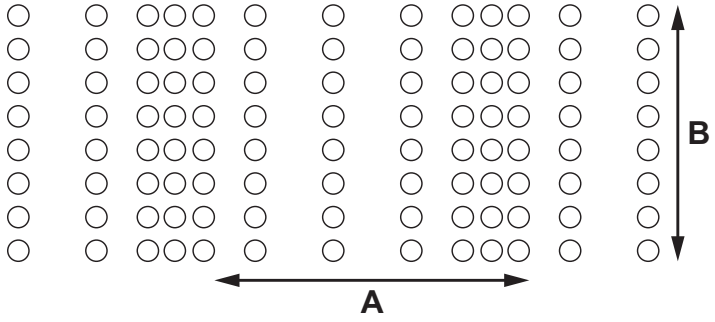
22 Which range of sound frequencies includes only frequencies of sound that can be heard by a healthy human ear?

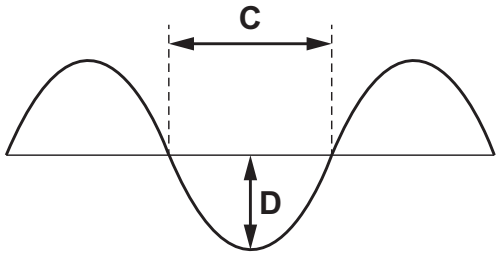
A 0.5–50 Hz **B** 5–500 Hz **C** 50–5000 Hz **D** 500–50 000 Hz

16. Question | 5054 Oct-Nov 2023 P1 V2 Q24

24 The diagram shows two waveforms.

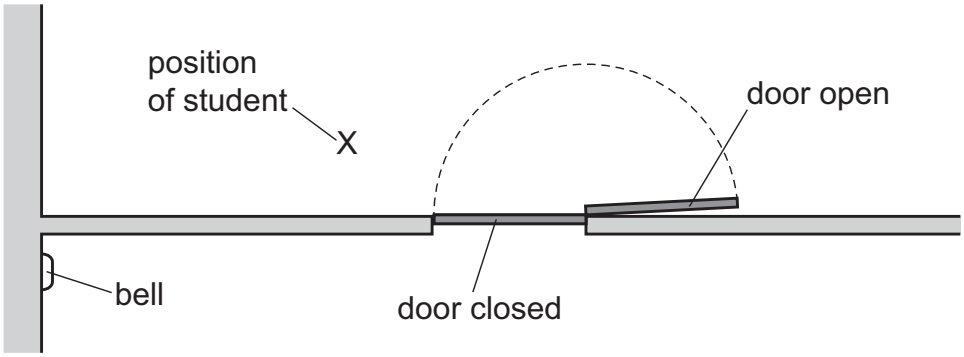
Which arrow shows the wavelength of a longitudinal wave?





17. Question | 5054 Oct-Nov 2023 P1 V2 Q25

25 A bell, on a wall outside a classroom, rings. A student is standing at point X shown on the view from above.



The door of the classroom is closed and the student in the room at X hears the bell ring.

The door is opened, and the sound heard by the student from the bell is louder.

What causes the sound reaching the student to be louder?

A diffraction

B dispersion

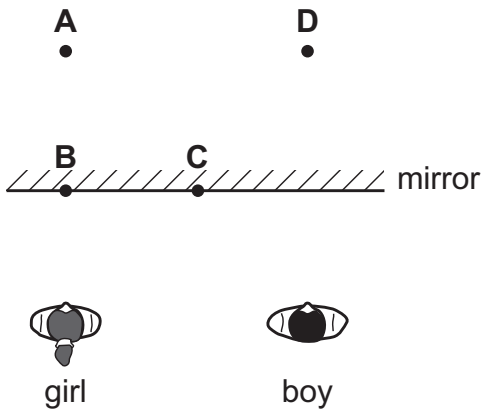
C reflection

D refraction

18. Question | 5054 Oct-Nov 2023 P1 V2 Q26

26 A boy stands beside a girl in front of a large vertical plane mirror. They are equal distances from the mirror, as shown. The boy sees an image of the girl.

Where is the girl's image?



19. Question | 5054 Oct-Nov 2023 P1 V2 Q27

27 Light travelling in air is incident on a water surface.

The refractive index of water is 1.3 and the angle of refraction in the water is 40°.

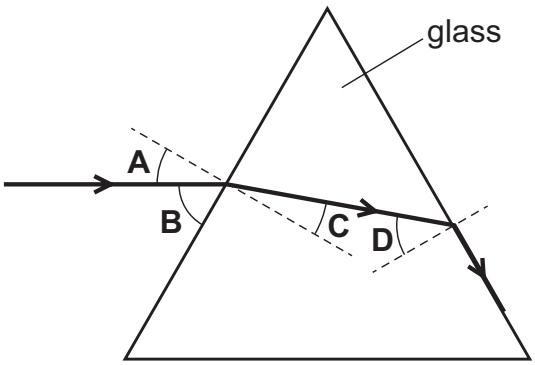
What is the angle of incidence in the air?

A 30° **B** 50° **C** 52° **D** 57°

20. Question | 5054 Oct-Nov 2023 P1 V2 Q28

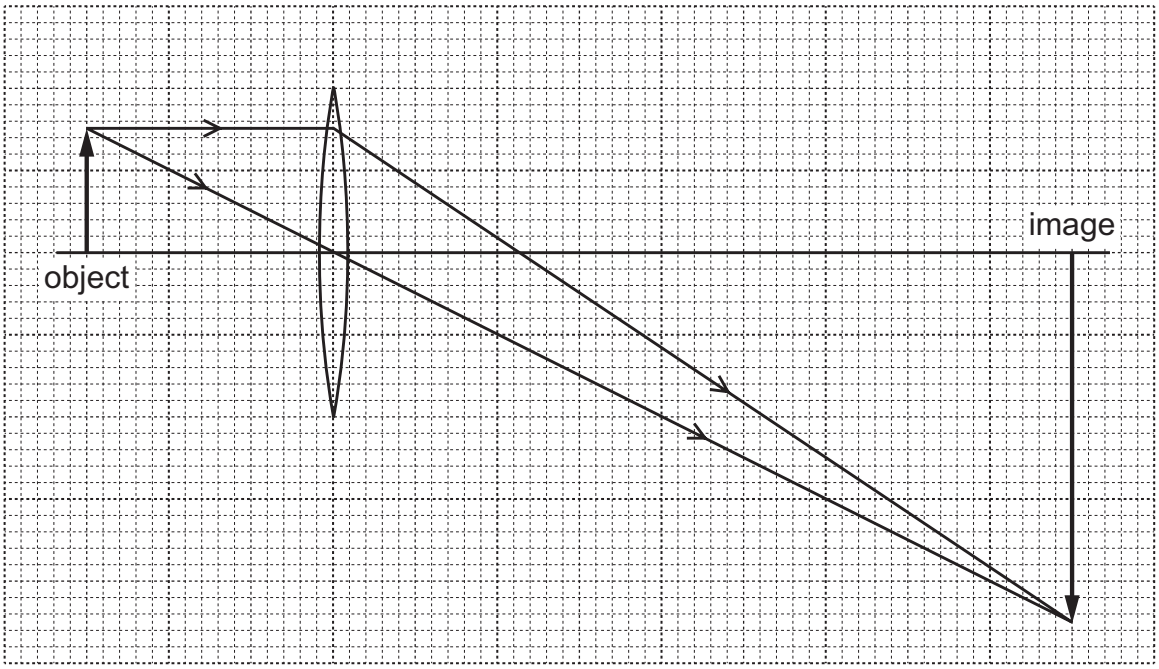
28 The diagram shows a ray of light passing through a triangular glass block.

Which angle is the critical angle of light in glass?



21. Question | 5054 Oct-Nov 2023 P1 V2 Q29

29 A lens is used to produce a magnified image, as shown in the scale diagram.



What is the linear magnification produced by the lens?

A 0.33 **B** 3.0 **C** 4.0 **D** 6.0

22. Question | 5054 Oct-Nov 2023 P1 V2 Q30

30 Ultraviolet radiation is a component of the electromagnetic spectrum.

Which application uses ultraviolet radiation?

A Bluetooth technology

B prenatal scanning

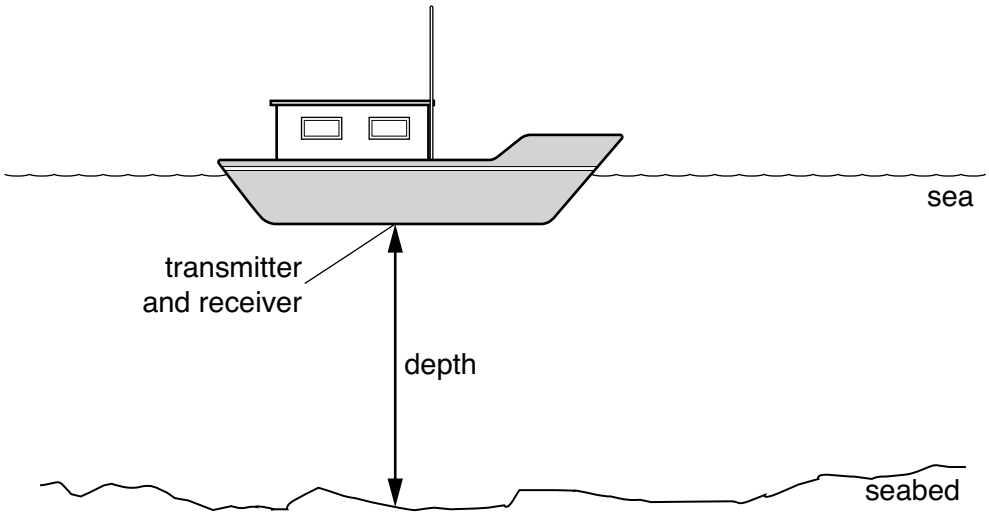
C sterilising water

D thermal imaging

23. Question | 5054 Specimen 2023 P1 Q17

17 The depth of the sea under a ship is determined by sending a pulse of sound with a frequency of 3000 Hz from a transmitter on the bottom of the ship to the seabed. The sound reflects from the seabed and returns to a receiver on the bottom of the ship.

The time between sending the pulse and receiving the reflected pulse is measured.



The depth of the sea beneath the ship is 600 m and the time measured is 0.80 s.

What is the wavelength of this sound in the sea?

A 0.25 m

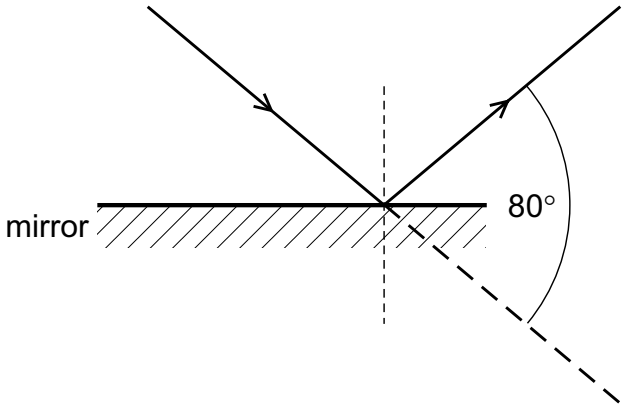
B 0.32 m

C 0.50 m

D 2.0 m

24. Question | 5054 Specimen 2023 P1 Q18

18 Light is incident on a mirror and is reflected as shown.



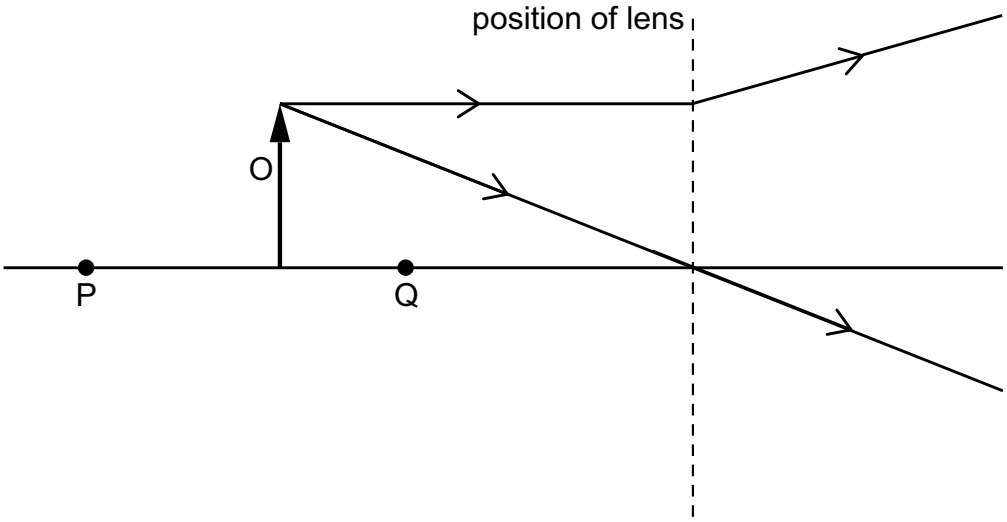
What is the angle of incidence and what is the angle of reflection?

	angle of incidence	angle of reflection
A	40°	40°
B	40°	50°
C	50°	40°
D	50°	50°

25. Question | 5054 Specimen 2023 P1 Q19

19 An object O is placed in front of a lens.

The ray diagram shows the paths of two light rays that start at the tip of the object.



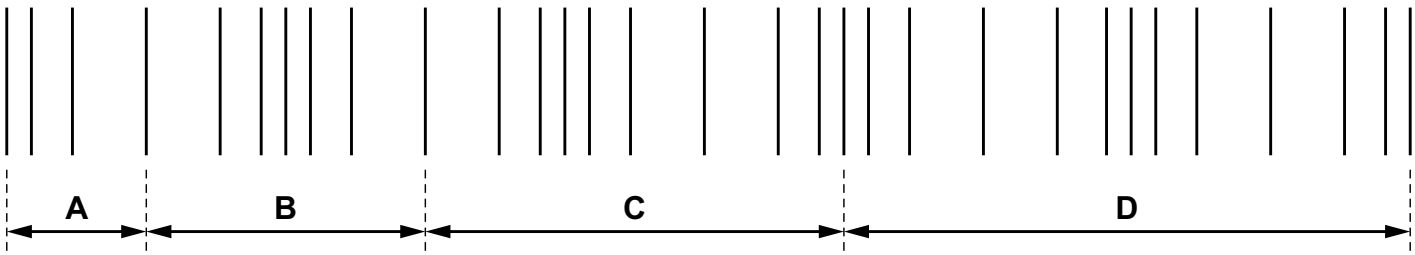
Which point P or Q is a principal focus and what type of image is formed?

	principal focus	type of image formed
A	point P	real
B	point P	virtual
C	point Q	real
D	point Q	virtual

26. Question | 5054 Specimen 2023 P1 Q20

20 A sound wave travels through air. The lines in the diagram show the positions of particles of air at one particular time.

Which distance is the wavelength of the wave?



27. Question | 5054 May-June 2024 P1 V1 Q22

22 Which quantity is defined as the number of wavelengths passing a point per second?

A amplitude

B frequency

C speed

D wavelength

28. Question | 5054 May-June 2024 P1 V1 Q23

23 A plane mirror forms the image of an object.

What are characteristics of the image formed?

	size	type
A	same as object	real
B	same as object	virtual
C	smaller than object	real
D	smaller than object	virtual

29. Question | 5054 May-June 2024 P1 V1 Q24

24 A ray of light strikes the surface of a glass block at an angle of incidence of 45°.

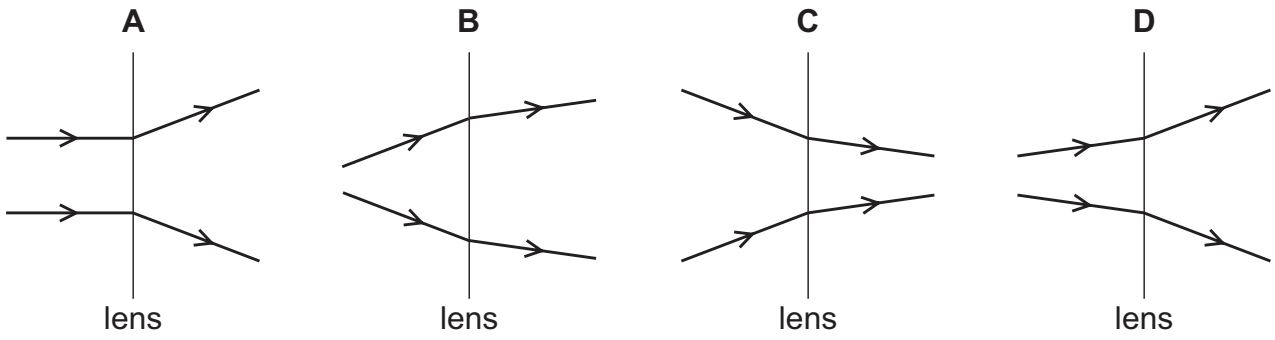
The refractive index of the glass is 1.8.

What is the angle of refraction inside the block?

A 23° **B** 25° **C** 45° **D** 81°

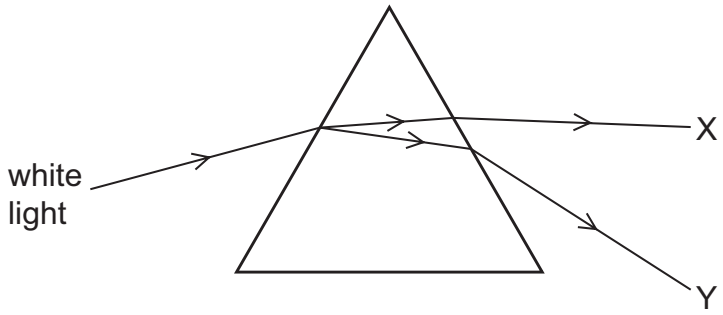
30. Question | 5054 May-June 2024 P1 V1 Q25

25 Which diagram shows rays of light passing through a converging lens?



31. Question | 5054 May-June 2024 P1 V1 Q26

26 A beam of white light is incident on a glass prism.



X and Y are the two ends of the visible spectrum.

Which statement is correct?

A All the light travels at the same speed in the prism.

B The light at X has a lower frequency than the light at Y.

C The light at X refracts more as it leaves the prism than the light at Y.

D The white light refracts away from the normal as it enters the prism.

32. Question | 5054 May-June 2024 P1 V1 Q27

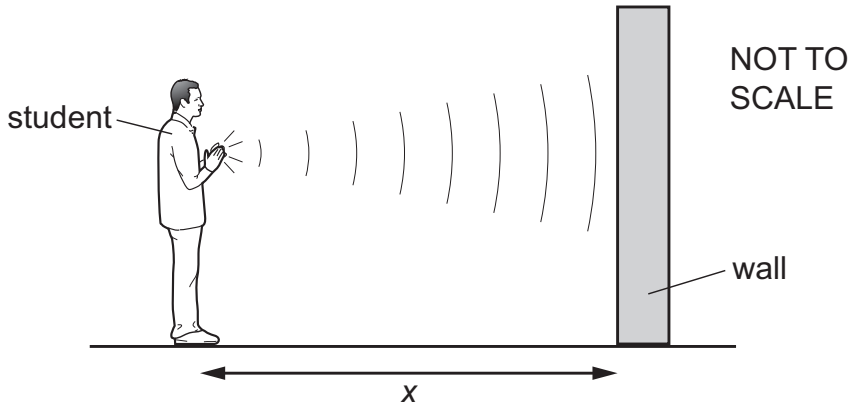
27 Which components of the electromagnetic spectrum are used to communicate from a remote controller to a television set and from the Earth to a satellite?

	remote controller to TV set	the Earth to a satellite
A	infrared	microwave
B	infrared	ultraviolet
C	light	microwave
D	light	ultraviolet

33. Question | 5054 May-June 2024 P1 V1 Q28

28 A student claps his hands in front of a wall and hears the echoes. He claps at the same moment as he hears the echo of the previous clap.

Another student starts a stop-watch on the first clap and stops it on the eleventh clap. The reading on the stop-watch is 9.4 s and the speed of sound is 320 m / s.



What is the distance *x* between the student and the wall?

A 140 m **B** 150 m **C** 270 m **D** 300 m

34. Question | 5054 May-June 2024 P1 V2 Q22

22 Which statement about infrared radiation is correct?

A In a vacuum, infrared radiation travels at the speed of light.

B Infrared radiation is a longitudinal wave.

C Infrared radiation has a higher frequency than ultraviolet radiation.

D White surfaces are better emitters of infrared radiation than black surfaces.

35. Question | 5054 May-June 2024 P1 V2 Q23

23 The speed of sound in air is 330 m / s.

Which sound is classed as ultrasound?

A a sound with a wavelength of 250 cm

B a sound with a wavelength of 25 cm

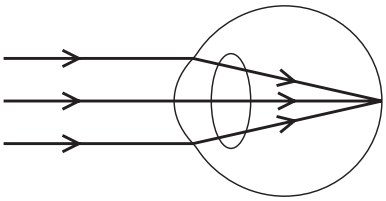
C a sound with a wavelength of 2.5 cm

D none of the above

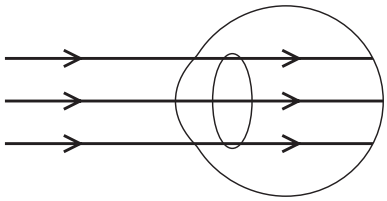
36. Question | 5054 May-June 2024 P1 V2 Q24

24 Which diagram shows how light from a distant object forms an image in a normal eye?

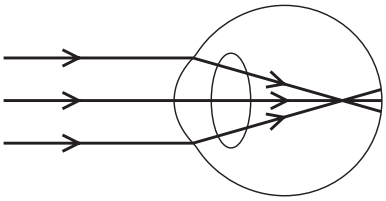
A



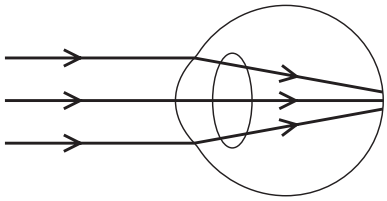
B



C



D



37. Question | 5054 May-June 2024 P1 V2 Q25

25 The colour of visible light is related to the wavelength of the light.

Which list of colours is in order of increasing wavelength?

A blue → green → yellow → red

B blue → green → red → yellow

C green → red → yellow → blue

D red → yellow → green → blue

38. Question | 5054 May-June 2024 P1 V2 Q26

26 A thin converging lens is used as a magnifying glass.

Which row gives the nature of the image produced and an expression that is the linear magnification?

	nature of image	expression for linear magnification
A	real	$\frac{\text{image length}}{\text{object length}}$
B	real	$\frac{\text{object length}}{\text{image length}}$
C	virtual	$\frac{\text{image length}}{\text{object length}}$
D	virtual	$\frac{\text{object length}}{\text{image length}}$

39. Question | 5054 May-June 2024 P1 V2 Q27

27 Which application is **not** a use for ultrasound?

A cleaning jewellery

B scanning an unborn baby

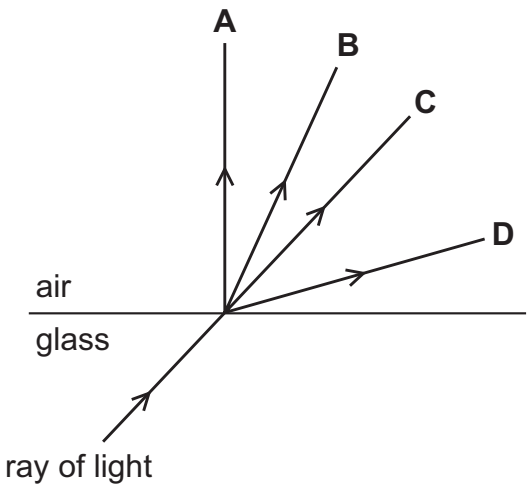
C sonar

D sterilising water

40. Question | 5054 Oct-Nov 2024 P1 V1 Q25

25 A ray of light passes from glass to air.

Which arrow shows the direction of the ray in air?



41. Question | 5054 Oct-Nov 2024 P1 V1 Q26

26 A short-sighted student looks at a distant object.

Which row shows the position of an image in a short-sighted eye and the type of lens used to correct short-sightedness?

	position of image in short-sighted eye	lens used to correct short-sightedness
A	in front of retina	diverging
B	behind retina	converging
C	on retina	converging
D	behind retina	diverging

42. Question | 5054 Oct-Nov 2024 P1 V1 Q27

27 A student makes four statements about infrared waves.

1 They can be seen by the human eye.

2 They travel at 330 m / s in air.

3 They are transverse waves.

4 They are used by intruder alarms.

Which statements are correct for infrared waves?

A 1 and 3 **B** 2, 3 and 4 **C** 2 only **D** 3 and 4 only

43. Question | 5054 Oct-Nov 2024 P1 V1 Q28

28 Which waves are longitudinal?

A sound waves in water

B ultraviolet waves in air

C waves on the surface of water

D X-rays in a vacuum

44. Question | 5054 Oct-Nov 2024 P1 V1 Q29

29 A person hears an echo after a sound hits a solid cliff face.

What causes the echo?

A absorption

B dispersion

C reflection

D refraction

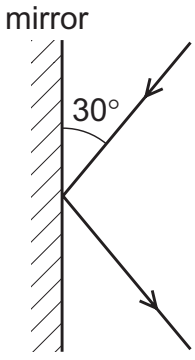
45. Question | 5054 Oct-Nov 2024 P1 V2 Q19

19 Which row gives the velocity and wavelength of a wave that is an ultrasound wave?

	velocity / m/s	wavelength / cm
A	330	6.6
B	890	89
C	1500	6.0
D	4000	25

46. Question | 5054 Oct-Nov 2024 P1 V2 Q20

20 The diagram shows a ray of light incident on a plane mirror.



NOT TO SCALE

What is the angle of reflection?

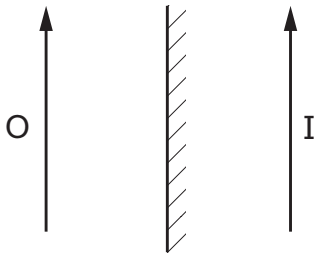
A 30° **B** 60° **C** 90° **D** 120°

47. Question | 5054 Oct-Nov 2024 P1 V2 Q21

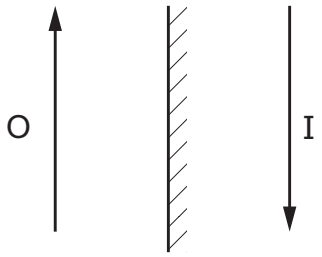
21 An object O is placed in front of a plane mirror.

Which diagram shows the image I formed by the mirror?

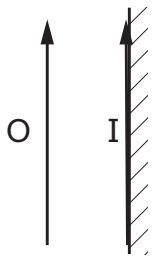
A



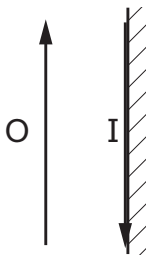
B



C

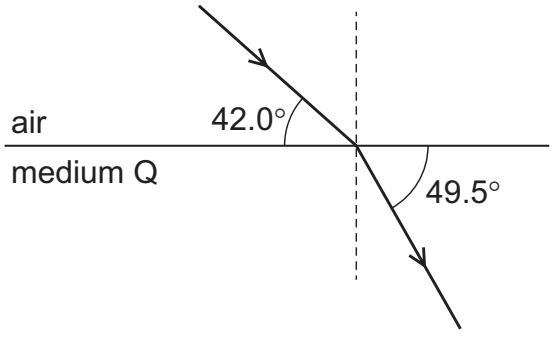


D



48. Question | 5054 Oct-Nov 2024 P1 V2 Q22

22 The diagram shows a ray of light travelling from air to medium Q.



What is the critical angle for the boundary between medium Q and air?

A 57.5° **B** 58.0° **C** 60.9° **D** 61.6°

5054 Physics Paper 1 - Waves

Topical questions | 99 questions

49. Question | 5054 Oct-Nov 2024 P1 V2 Q23

23 Which two waves are components of the electromagnetic spectrum?

A light and sound

B ultrasound and ultraviolet

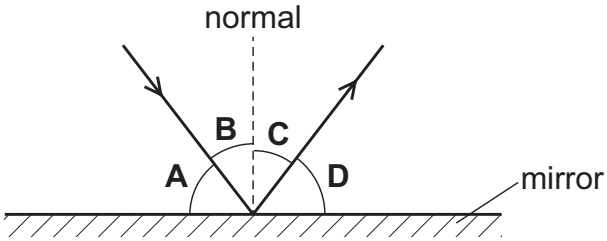
C water waves and infrared

D X-rays and microwaves

50. Question | 5054 May-June 2025 P1 V1 Q19

19 The diagram shows light striking a plane mirror and reflecting.

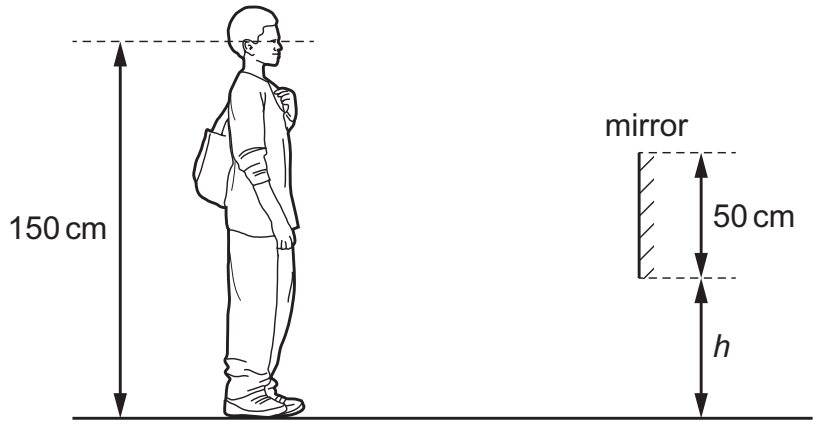
Which angle is the angle of incidence?



51. Question | 5054 May-June 2025 P1 V1 Q20

20 A shoe shop puts a mirror on the wall so that customers can look at their shoes.

The length of the mirror is 50 cm. A customer has eyes 150 cm above ground level.



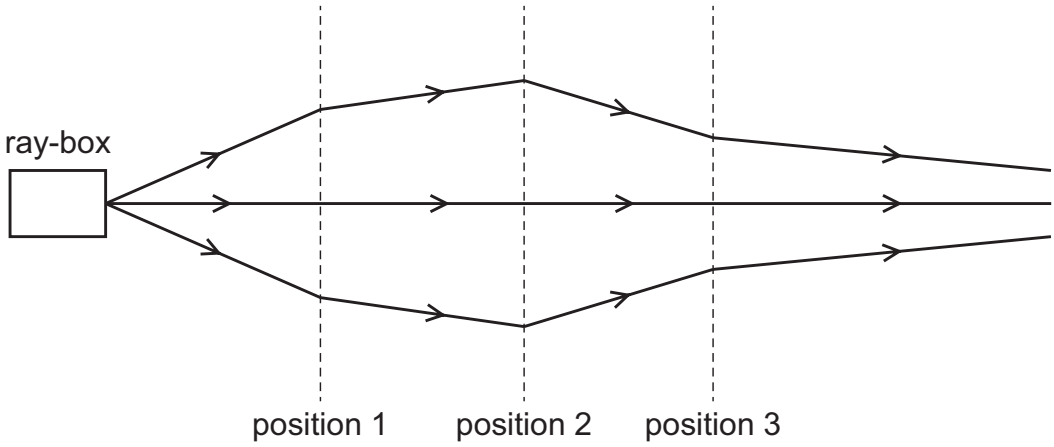
The bottom of the mirror is at height *h* above the ground.

What is the smallest value of *h* that allows the customer to see an image of his shoes in the mirror?

A 0 **B** 25 cm **C** 50 cm **D** 75 cm

52. Question | 5054 May-June 2025 P1 V1 Q22

22 The rays of light from a ray-box pass through three lenses placed at positions 1, 2 and 3.



Which type of lens is used at each position?

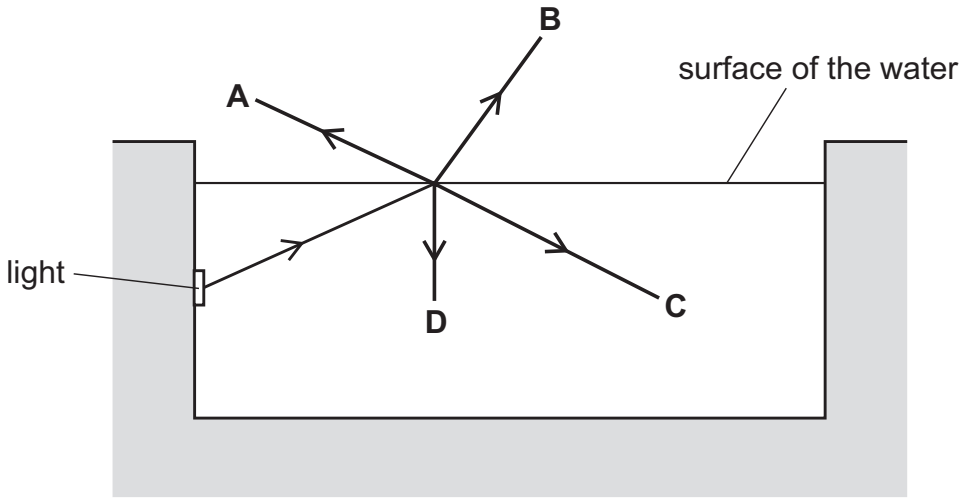
	position 1	position 2	position 3
A	converging	converging	converging
B	converging	converging	diverging
C	diverging	converging	diverging
D	diverging	diverging	converging

53. Question | 5054 May-June 2025 P1 V1 Q23

23 A swimming pool is lit by an underwater light.

A ray of light is incident on the surface of the water.

What is the path for the ray of light?



54. Question | 5054 May-June 2025 P1 V1 Q24

24 When a converging lens is used as a magnifying glass, what is the nature of the image?

A real and inverted

B real and upright

C virtual and inverted

D virtual and upright

55. Question | 5054 May-June 2025 P1 V1 Q25

25 A sound wave consists of compressions and rarefactions.

Which type of wave is sound and how does the pressure in a rarefaction compare with the pressure in a compression?

	type of wave	pressure in a rarefaction
A	longitudinal	smaller
B	longitudinal	greater
C	transverse	smaller
D	transverse	greater

56. Question | 5054 May-June 2025 P1 V1 Q26

26 What happens to a sound wave when the note heard gets louder?

A Its amplitude increases.

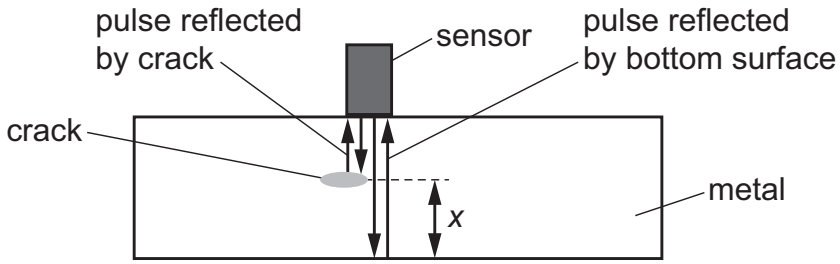
B Its frequency increases.

C Its speed increases.

D Its wavelength increases.

57. Question | 5054 May-June 2025 P1 V1 Q27

27 A pulse of ultrasound from a sensor is reflected back to the sensor by a crack in a piece of metal and by the bottom surface of the metal.



The reflection from the crack is received back at the sensor 1.0×10^{-5} s after the pulse is sent out.

The reflection from the bottom surface is received back at the sensor 1.5×10^{-5} s after the pulse is sent out.

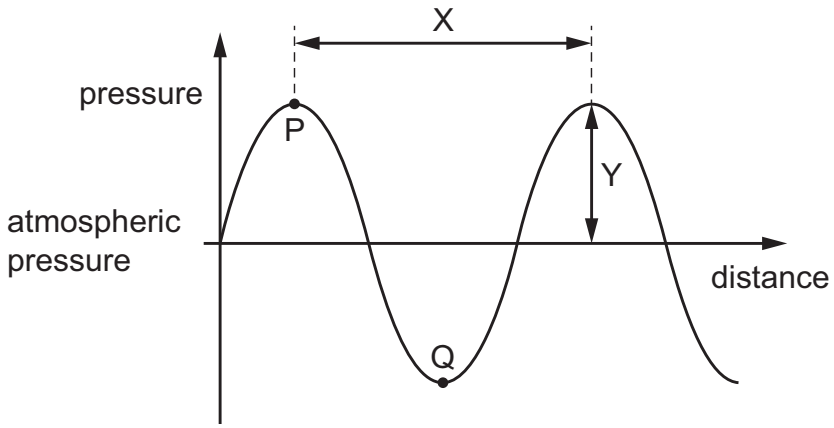
The speed of ultrasound in the metal is 5200 m / s.

What is the distance *x* between the crack and the bottom surface of the metal?

A 0.013 m **B** 0.026 m **C** 0.052 m **D** 0.078 m

58. Question | 5054 May-June 2025 P1 V2 Q18

18 The graph shows, at one instant, the pressure variation along a sound wave.



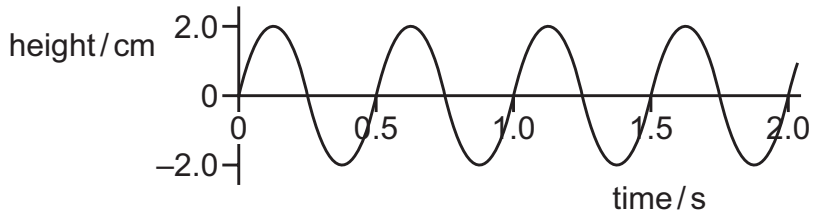
Which point on the diagram represents a rarefaction and what is the wavelength of the sound wave?

	rarefaction	wavelength
A	P	X
B	P	Y
C	Q	X
D	Q	Y

59. Question | 5054 May-June 2025 P1 V2 Q19

19 A cork on the surface of water moves up and down as a wave passes across the surface.

The diagram shows how the height of the cork above the average level of the surface varies with time.



The numerical value of the wavelength of this wave is equal to the numerical value of the amplitude of this wave.

What is the speed of the wave?

A 1.0 cm / s **B** 2.0 cm / s **C** 4.0 cm / s **D** 8.0 cm / s

60. Question | 5054 May-June 2025 P1 V2 Q20

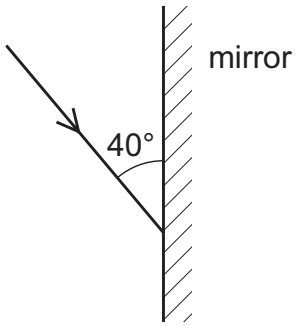
20 A water wave travels from deep water to shallow water in a ripple tank.

What happens to the speed and to the wavelength of the wave?

	speed of wave	wavelength
A	increases	increases
B	increases	decreases
C	decreases	increases
D	decreases	decreases

61. Question | 5054 May-June 2025 P1 V2 Q21

21 The diagram shows a ray of light directed at a plane mirror.



What are the angle of incidence and the angle of reflection?

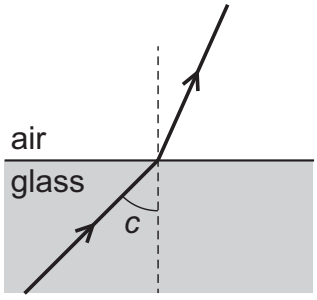
	angle of incidence / °	angle of reflection / °
A	40	40
B	40	50
C	50	40
D	50	50

62. Question | 5054 May-June 2025 P1 V2 Q22

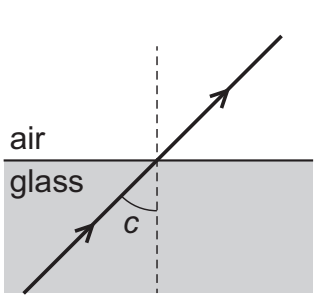
22 A ray of light in glass is incident on the surface at an angle *c*. The angle *c* is the critical angle.

Which diagram shows what happens to the light?

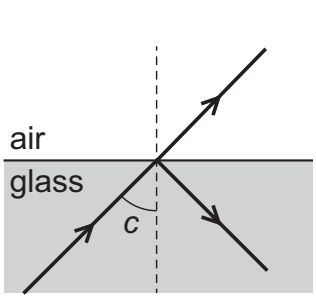
A



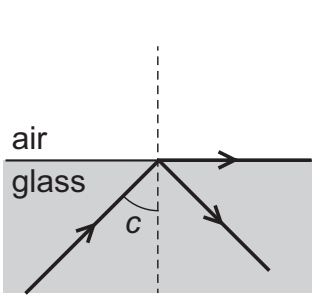
B



C

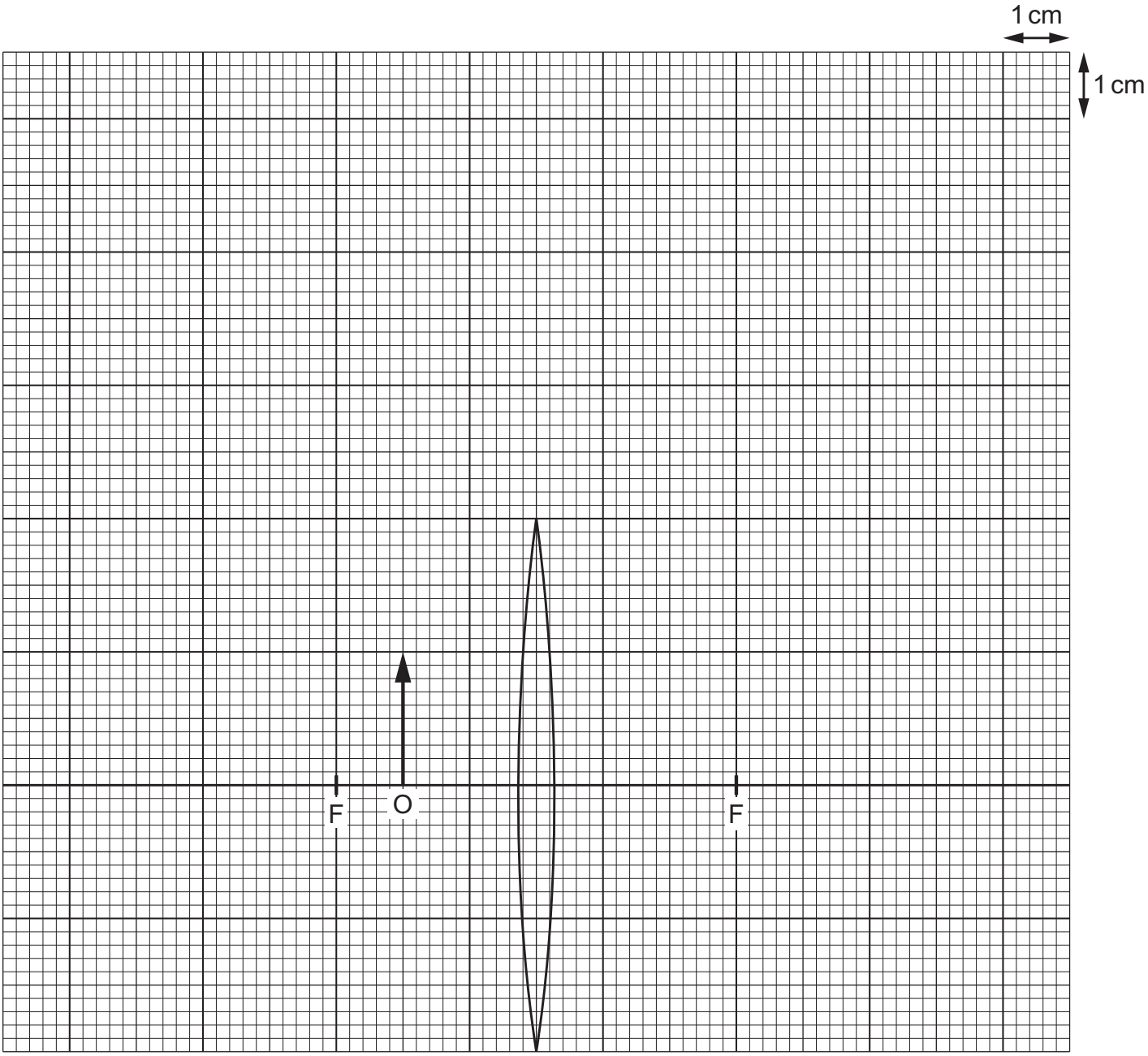


D



63. Question | 5054 May-June 2025 P1 V2 Q23

23 An object O is placed between a converging lens and one principal focus F of the lens.



What is the magnification of the image formed?

A 1.0 **B** 2.0 **C** 3.0 **D** 6.0

64. Question | 5054 May-June 2025 P1 V2 Q24

24 Which statement about red light and violet light is correct?

A A prism deviates red light more than it deviates violet light.

B Red light has a lower frequency than violet light.

C Red light has a shorter wavelength than violet light.

D The speed of red light in a vacuum is less than the speed of violet light in a vacuum.

65. Question | 5054 May-June 2025 P1 V2 Q25

25 Ultrasound is used to clean jewellery in a liquid.

What is another use of ultrasound?

A optical fibre communication

B prenatal scanning

C photography

D telephone communications

66. Question | 5054 May-June 2025 P1 V2 Q26

26 A ship that is stationary on the surface of the sea sends pulses of sound vertically downwards towards the sea bed.

Each pulse that reflects from the sea bed is received 1.0 s after it is sent out.

A whale swims under the boat and a pulse is received 0.60 s after it is sent out.

The speed of sound in sea water is 1500 m / s.

What is the distance of the whale above the sea bed?

A 300 m **B** 450 m **C** 600 m **D** 750 m

67. Question | 5054 May-June 2025 P1 V2 Q27

27 Which row describes ultrasound waves?

	type of wave	frequency
A	longitudinal	smaller than 20 kHz
B	longitudinal	greater than 20 kHz
C	transverse	smaller than 20 kHz
D	transverse	greater than 20 kHz

68. Question | 5054 Oct-Nov 2025 P1 V1 Q18

18 The sentences describe sound waves. Three words have been omitted.

Sound waves are longitudinal waves that consist of regions of higher pressure called .....1..... and regions of lower pressure called .....2..... .

An echo occurs when a sound wave is .....3..... .

Which words complete gaps 1, 2 and 3?

	1	2	3
A	compressions	rarefactions	reflected
B	compressions	rarefactions	refracted
C	rarefactions	compressions	refracted
D	rarefactions	compressions	reflected

69. Question | 5054 Oct-Nov 2025 P1 V1 Q19

19 A ray of light strikes a plane mirror at an angle of incidence of 20°.

The angle of incidence is then increased by 5°.

What is the new angle between the incident ray and the reflected ray?

A 10° **B** 25° **C** 45° **D** 50°

70. Question | 5054 Oct-Nov 2025 P1 V1 Q20

20 The following lists show colours of the spectrum.

Which list shows these colours in order of increasing frequency?

A blue → violet → red → orange → yellow → green

B green → blue → violet → red → orange → yellow

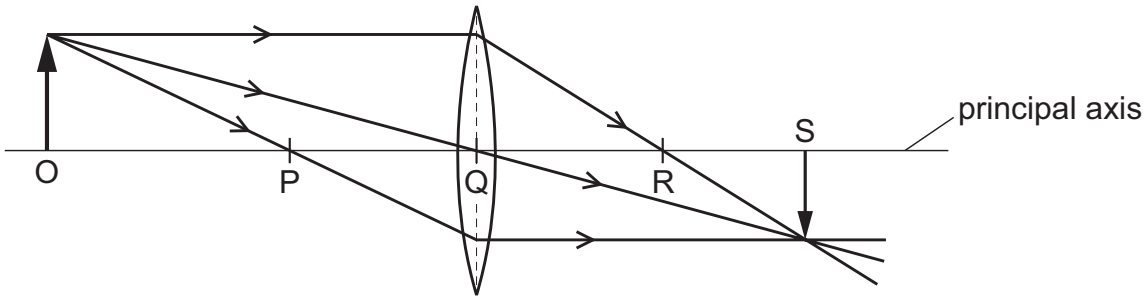
C red → orange → violet → yellow → green → blue

D red → orange → yellow → green → blue → violet

71. Question | 5054 Oct-Nov 2025 P1 V1 Q21

21 An object O is placed near to a thin converging lens.

The diagram shows three rays of light from the object passing through the lens.

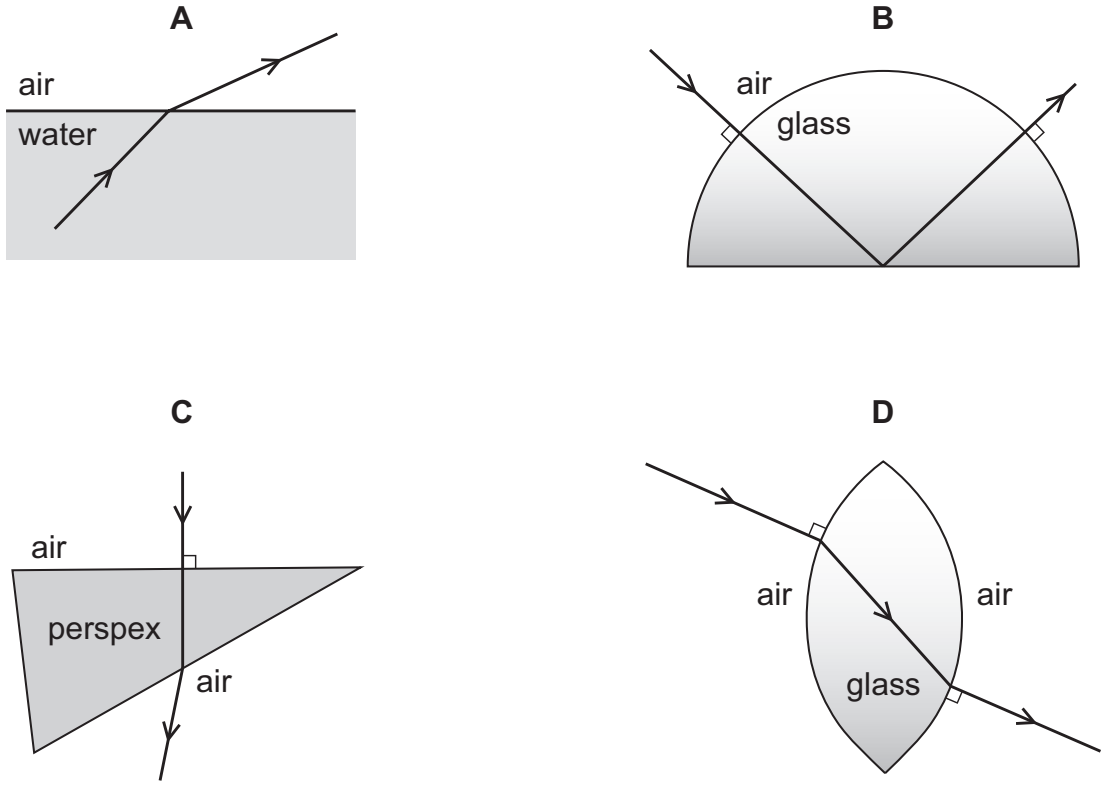


Which row describes the image formed and gives the position of a principal focus (focal point) of the lens?

	image formed	position of principal focus
A	real	R
B	real	Q
C	virtual	P
D	virtual	S

72. Question | 5054 Oct-Nov 2025 P1 V1 Q22

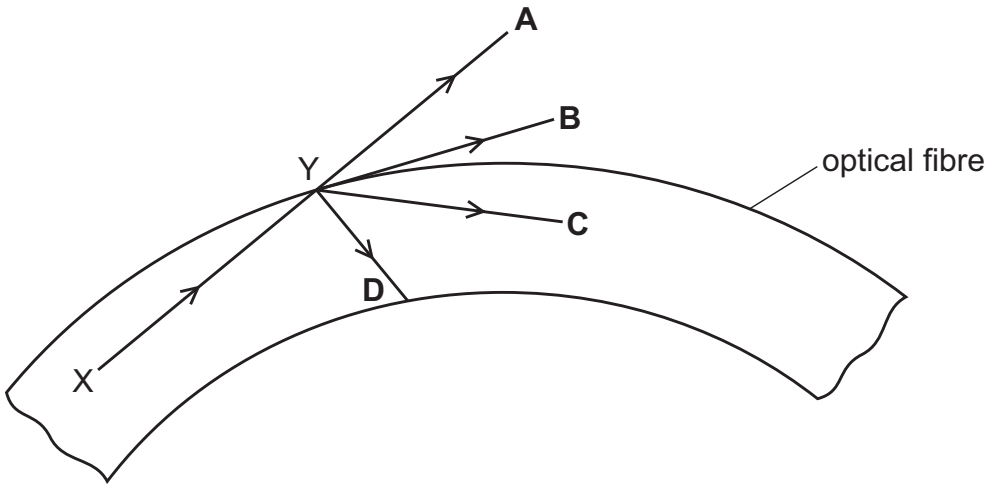
22 In which diagram is the path of the light ray **not** correct?



73. Question | 5054 Oct-Nov 2025 P1 V1 Q23

23 A ray of light travels from X to Y along an optical fibre. The angle of incidence at Y is greater than the critical angle.

In which direction does the ray of light travel after reaching point Y?



74. Question | 5054 Oct-Nov 2025 P1 V1 Q24

24 A firework is launched vertically from the ground.

When the firework reaches a height of 360 m, the firework explodes, producing coloured light.

A student on the ground below the firework incorrectly measures the time between seeing the coloured light and hearing the explosion. The student obtains a value of 1.8 s.

What is the speed of sound that the student's value suggests?

A 200 m / s **B** 360 m / s **C** 400 m / s **D** 650 m / s

75. Question | 5054 Oct-Nov 2025 P1 V1 Q25

25 A loudspeaker produces a sound wave of frequency 50 Hz.

The amplitude of the sound wave is increased.

What is heard?

A a louder sound of a higher pitch

B a louder sound of the same pitch

C a sound of higher pitch but the same loudness

D a sound of the same pitch and same loudness

76. Question | 5054 Oct-Nov 2025 P1 V2 Q5

5 A ship uses ultrasound to measure the depth of the sea.

There is a time interval of 0.52 s between transmitting and detecting a pulse of ultrasound.

The speed of ultrasound in sea water is 1500 m / s.

What is the depth of the sea?

A 390 m **B** 780 m **C** 1600 m **D** 5800 m

77. Question | 5054 Oct-Nov 2025 P1 V2 Q26

26 The table shows the speed and the wavelength for different sound waves in four different materials.

wave	$\frac{\text{speed of sound}}{\text{m/s}}$	wavelength / m
1	340	0.19
2	1500	0.050
3	4000	0.23
4	6700	0.31

Which waves are ultrasound waves?

A 1 and 3 **B** 1 only **C** 2 and 4 **D** 4 only

78. Question | 5054 Oct-Nov 2025 P1 V2 Q27

27 Light passes into a transparent material that has a refractive index n.

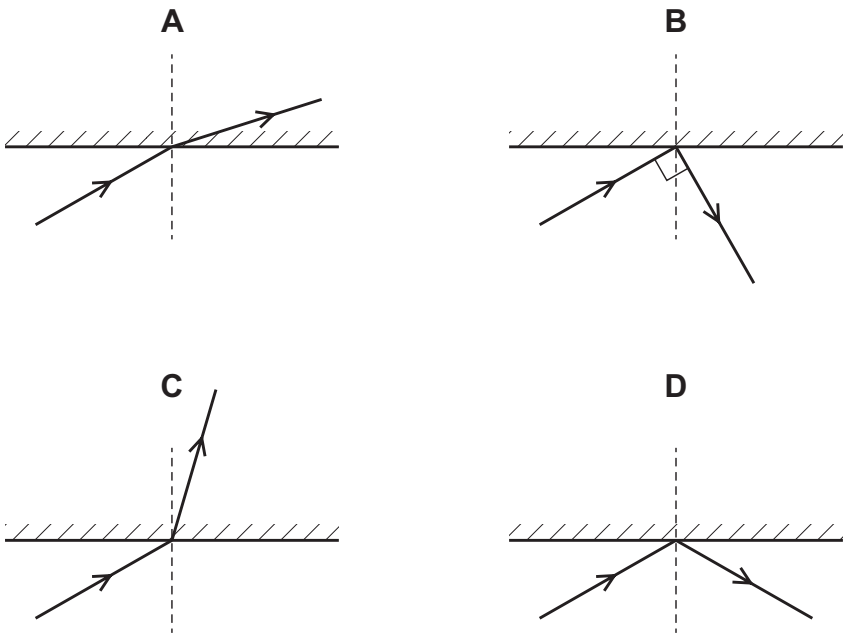
The angle of incidence at the surface of the transparent material is i.

Which equation is used to calculate the angle of refraction r?

A $r = n \sin i$ **B** $i = n \sin r$ **C** $\sin r = \frac{n}{\sin i}$ **D** $\sin r = \frac{\sin i}{n}$

79. Question | 5054 Oct-Nov 2025 P1 V2 Q28

28 Which diagram shows a ray of light that is reflected by a plane mirror?



80. Question | 5054 Oct-Nov 2025 P1 V2 Q29

29 An object is placed in front of a plane mirror.

Which statement describes the image produced?

A real and smaller than the object

B real and the same size as the object

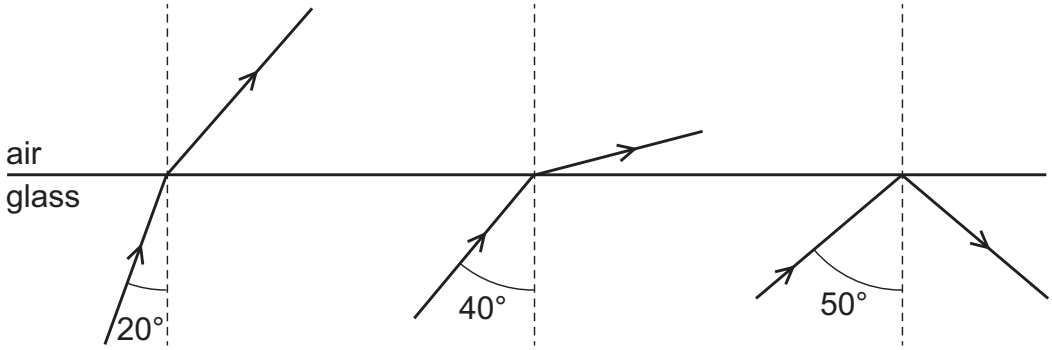
C virtual and smaller than the object

D virtual and the same size as the object

81. Question | 5054 Oct-Nov 2025 P1 V2 Q30

30 Three rays of light are incident on the boundary between a glass block and air.

The angles of incidence are different.



What is a possible critical angle for light in the glass?

A 15° **B** 30° **C** 45° **D** 60°

82. Question | 5054 Oct-Nov 2025 P1 V2 Q31

31 A student does an investigation using four thin lenses. The lenses are used to produce focused images of four different objects.

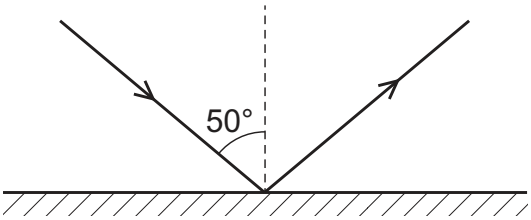
The student measures the length of the image and the length of the object. The results are shown in the table.

In which case is the magnification produced the greatest?

	image length / cm	object length / cm
A	3.5	0.80
B	4.7	0.60
C	4.8	0.70
D	5.2	0.90

83. Question | 5054 May-June 2026 P1 V1 Q21

21 The ray diagram shows light reflecting off a plane mirror.



What is the angle between the incident and reflected rays?

A 40° **B** 50° **C** 80° **D** 100°

84. Question | 5054 May-June 2026 P1 V1 Q22

22 Which equation gives the speed of a wave?

A speed = amplitude ÷ frequency

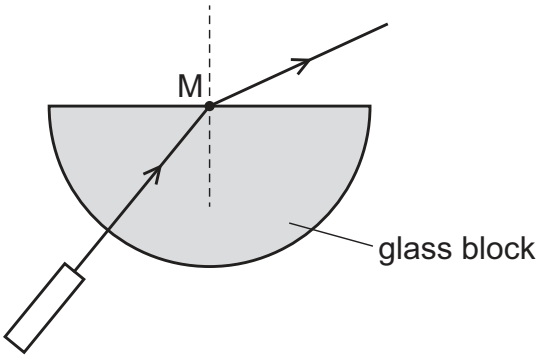
B speed = amplitude × frequency

C speed = wavelength ÷ frequency

D speed = wavelength × frequency

85. Question | 5054 May-June 2026 P1 V1 Q23

23 A ray of red light from a laser passes into a semi-circular glass block.



What is shown at M?

A dispersion

B rarefaction

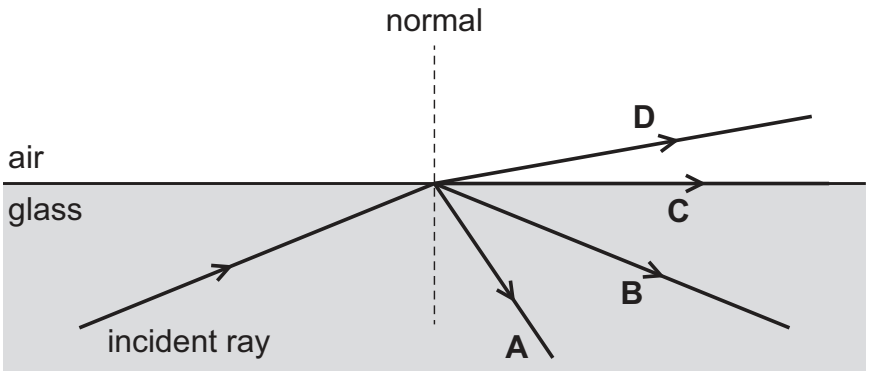
C reflection

D refraction

86. Question | 5054 May-June 2026 P1 V1 Q24

24 Light travelling in glass is incident on a glass–air boundary. The angle of incidence of the light is greater than the critical angle.

Which arrow shows the direction of the light after it is incident on the boundary?



87. Question | 5054 May-June 2026 P1 V1 Q25

25 Three students suggest an advantage of using optical fibre cables in telecommunications rather than using copper cables.

1 Optical fibre cables are more secure.

2 Optical fibre cables transmit over greater distances without boosting the signal.

3 Optical fibre cables transmit data at a greater rate.

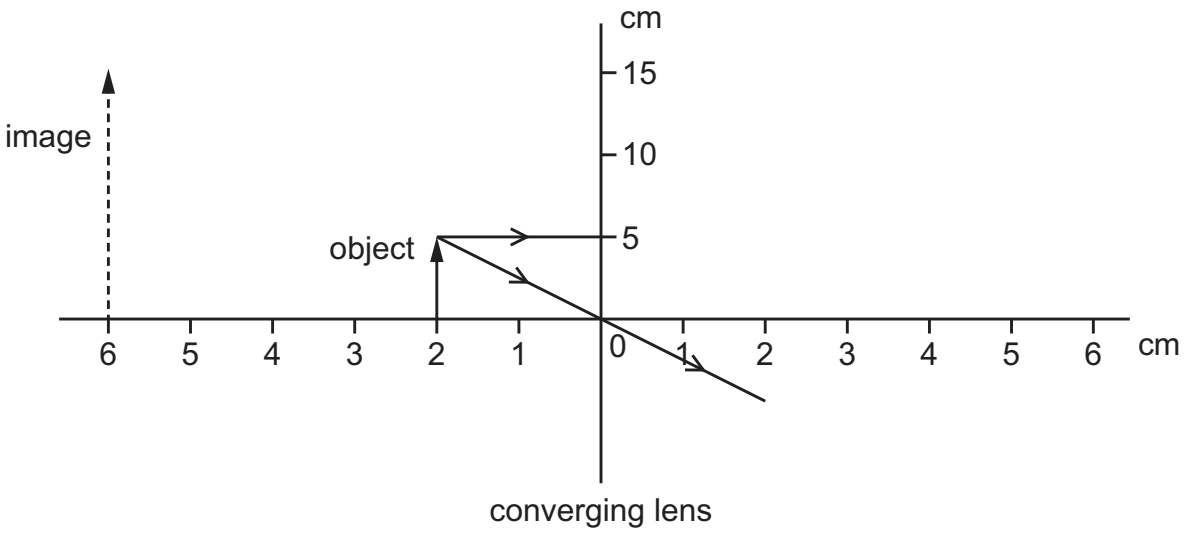
Which suggestions are correct?

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

88. Question | 5054 May-June 2026 P1 V1 Q26

26 An object of height 5.0 cm is placed 2.0 cm from a converging (convex) lens which is being used as a magnifying glass.

The image produced is 6.0 cm from the lens and has height 15.0 cm.



What is the focal length of the lens?

A 2.0 cm **B** 3.0 cm **C** 4.0 cm **D** 6.0 cm

89. Question | 5054 May-June 2026 P1 V1 Q27

27 The approximate range of audible frequencies for a sheep is 100 Hz to 30 000 Hz.

Which statement is correct?

A A human can hear sounds of higher frequencies than a sheep can hear.

B A sheep can hear sounds of lower frequencies than a human can hear.

C The highest frequency of sound that a human can hear is approximately 10 000 Hz lower than the highest frequency of sound a sheep can hear.

D The lowest frequency of sound that a human can hear is approximately 1900 Hz higher than the lowest frequency of sound a sheep can hear.

90. Question | 5054 May-June 2026 P1 V1 Q28

28 Which statement is correct?

A Gamma rays have a longer wavelength than ultraviolet waves.

B Infrared waves have a lower frequency than radio waves.

C Microwaves have a longer wavelength than visible light.

D X-rays have a higher speed in air than visible light.

91. Question | 5054 May-June 2026 P1 V2 Q20

20 A wave has a frequency of 2.0 Hz.

How many waves are produced in one minute?

A 2.0×60 **B** $\frac{60}{2.0}$ **C** 2.0 **D** $\frac{2.0}{60}$

92. Question | 5054 May-June 2026 P1 V2 Q21

21 The frequency of a wave is 0.60 MHz and the wavelength of the wave is 0.50 km.

What is the speed of this wave?

A 0.30 m / s

B 1.2 m / s

C 1200 m / s

D 300 000 000 m / s

93. Question | 5054 May-June 2026 P1 V2 Q22

22 Which list consists only of transverse waves?

A electromagnetic waves, seismic S-waves, waves on the surface of water

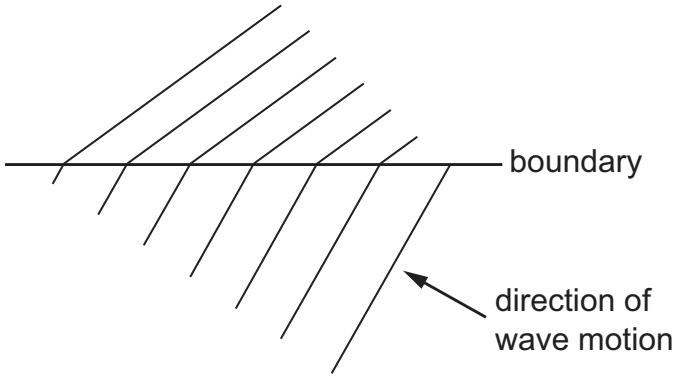
B seismic S-waves, sound waves, electromagnetic waves

C sound waves, waves on the surface of water, seismic P-waves

D waves on the surface of water, seismic P-waves, electromagnetic waves

94. Question | 5054 May-June 2026 P1 V2 Q23

23 The diagram shows the refraction of water waves as they cross a boundary in a ripple tank.



What causes this refraction?

A a change in frequency due to a change in depth

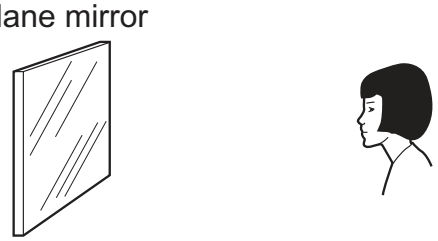
B a change in frequency due to a change in wavelength

C a change in speed due to a change in depth

D a change in speed due to a change in frequency

95. Question | 5054 May-June 2026 P1 V2 Q24

24 A woman stands in front of a plane mirror. She sees an image of herself in the mirror.



The woman moves 1.0 m further away from the mirror.

What happens to the distance between the woman and her image?

A It decreases by 1.0 m.

B It decreases by 2.0 m.

C It increases by 1.0 m.

D It increases by 2.0 m.

96. Question | 5054 May-June 2026 P1 V2 Q25

25 The refractive index of Perspex is 1.5.

What is the critical angle for light incident on the boundary between Perspex and air?

A 0.73° **B** 26° **C** 38° **D** 42°

97. Question | 5054 May-June 2026 P1 V2 Q26

26 Which statement is correct?

A Infrared radiation **cannot** travel in a vacuum.

B Infrared radiation **cannot** travel in solids or in gases.

C Infrared radiation can only travel in a vacuum.

D Infrared radiation can travel in a vacuum and in gases.

98. Question | 5054 May-June 2026 P1 V2 Q27

27 Ultraviolet waves and radio waves are both components of the electromagnetic spectrum.

Why do ultraviolet waves cause skin cancer and cataracts while radio waves do **not**?

A Ultraviolet waves have a greater speed in air than radio waves.

B Ultraviolet waves have longer wavelengths than radio waves.

C Ultraviolet waves have lower frequencies than radio waves.

D Ultraviolet waves are ionising, but radio waves are **not** ionising.

99. Question | 5054 May-June 2026 P1 V2 Q28

28 A fishing boat emits a pulse of ultrasound. The pulse is reflected from some fish underneath the boat.

The reflected pulse reaches the boat 0.32 s after it is emitted.

The speed of ultrasound in water is 1500 m / s.

What is the distance between the boat and the fish?

A 240 m **B** 480 m **C** 4700 m **D** 9400 m