

Waves

(Past Year Topical Questions 2010-2015)

May/June 2010 (11)

20 Which waves are longitudinal?



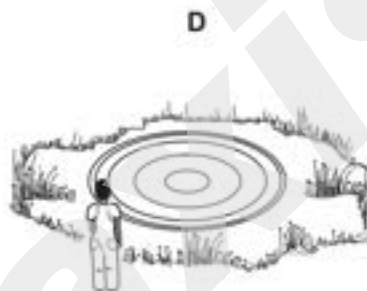
light waves
from a lamp



microwaves
in an oven



sound waves
from a trumpet



water waves
on a pond

21 A navigation buoy floating on the sea oscillates up and down as a wave passes.



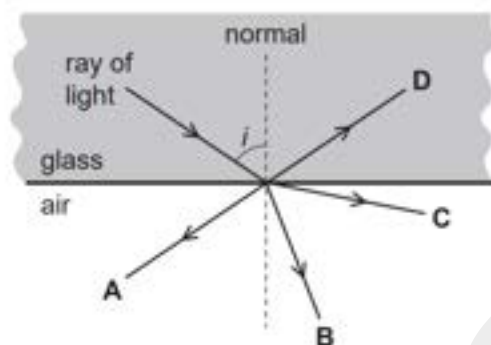
In exactly two minutes, six complete wavelengths pass the buoy.

What is the frequency of the waves?

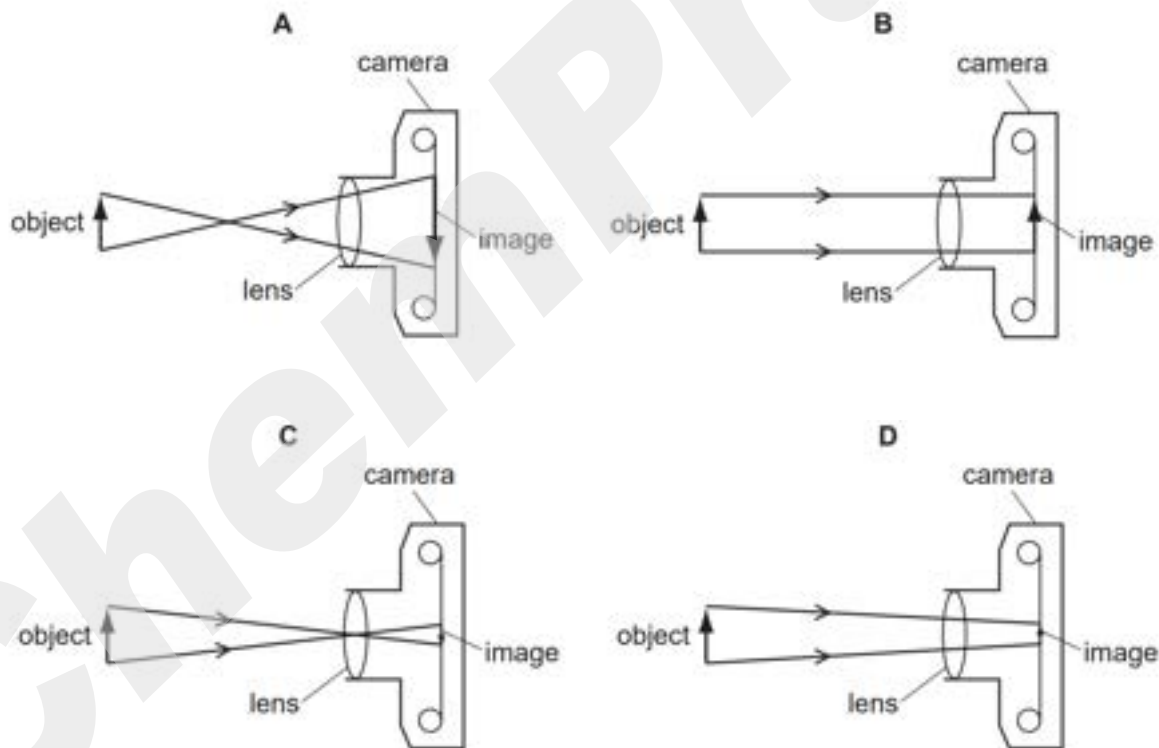
- A 0.050 Hz B 0.33 Hz C 3.0 Hz D 20 Hz

- 22 The diagram shows a ray of light incident on the edge of a piece of glass. The angle i is bigger than the critical angle.

Which arrow correctly shows the direction of the ray after it leaves the edge of the glass?



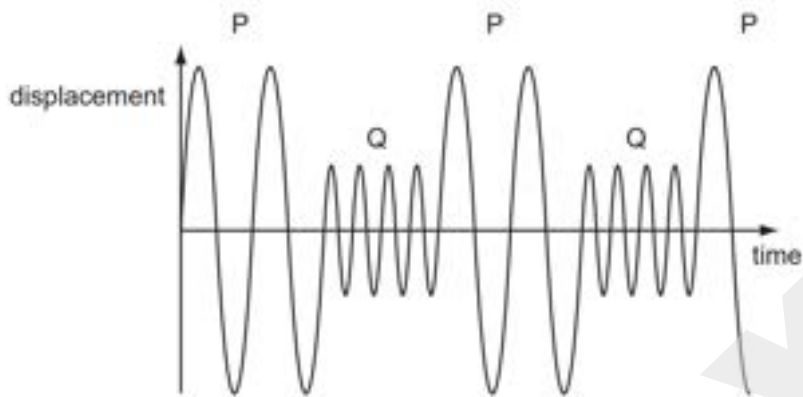
- 23 Which diagram correctly shows rays of light passing through a converging lens in a camera?



- 24 What is the approximate value of the highest frequency that can be heard by a young person?

A 20 Hz B 200 Hz C 2000 Hz D 20 000 Hz

- 25 A police car siren emits two different sounds P and Q. These are produced alternately. The diagram represents the sounds emitted.



Which sound is the louder and which has the lower pitch?

| | louder | lower pitch |
|----------|--------|-------------|
| A | P | P |
| B | P | Q |
| C | Q | P |
| D | Q | Q |

May/June 2010 (12)

- 20 Which waves are longitudinal?

A



light waves
from a lamp

B



microwaves
in an oven

C



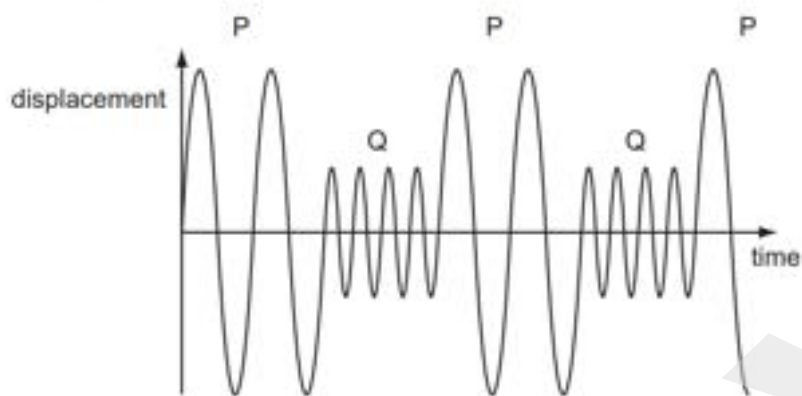
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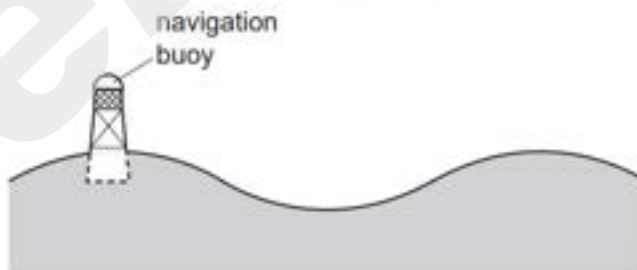
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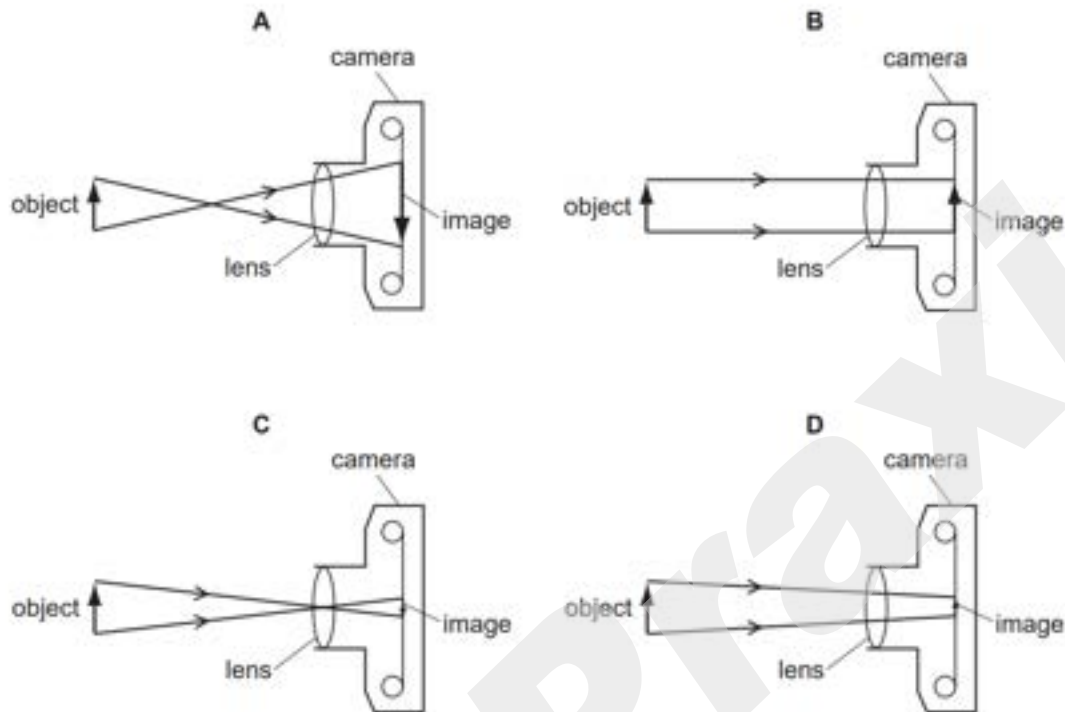


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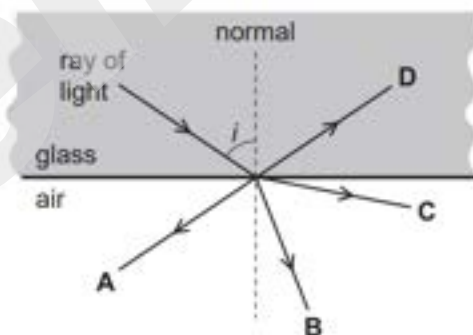
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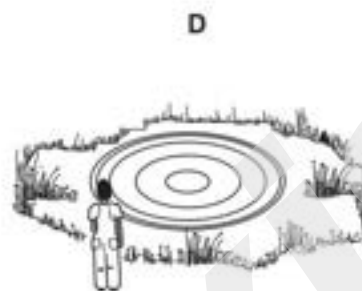


May/June 2010 (13)

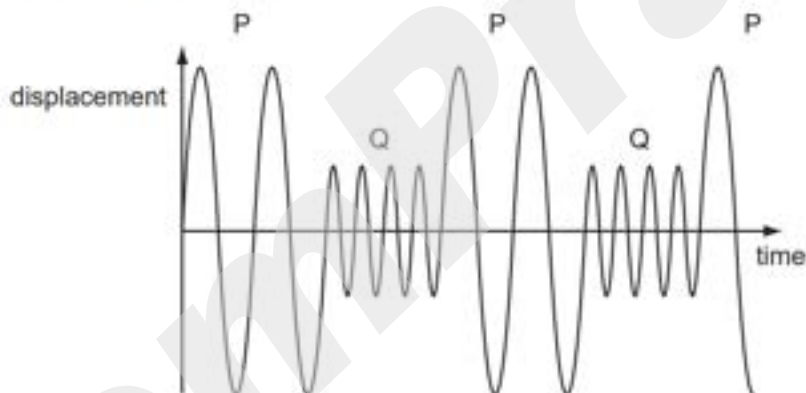
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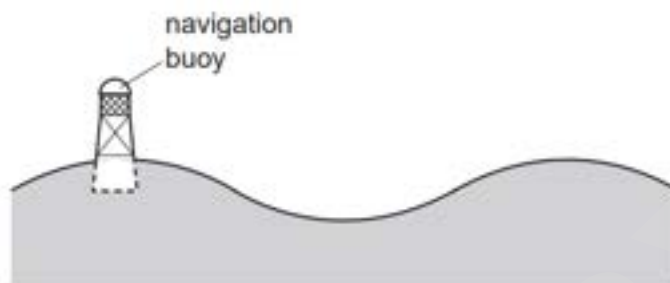
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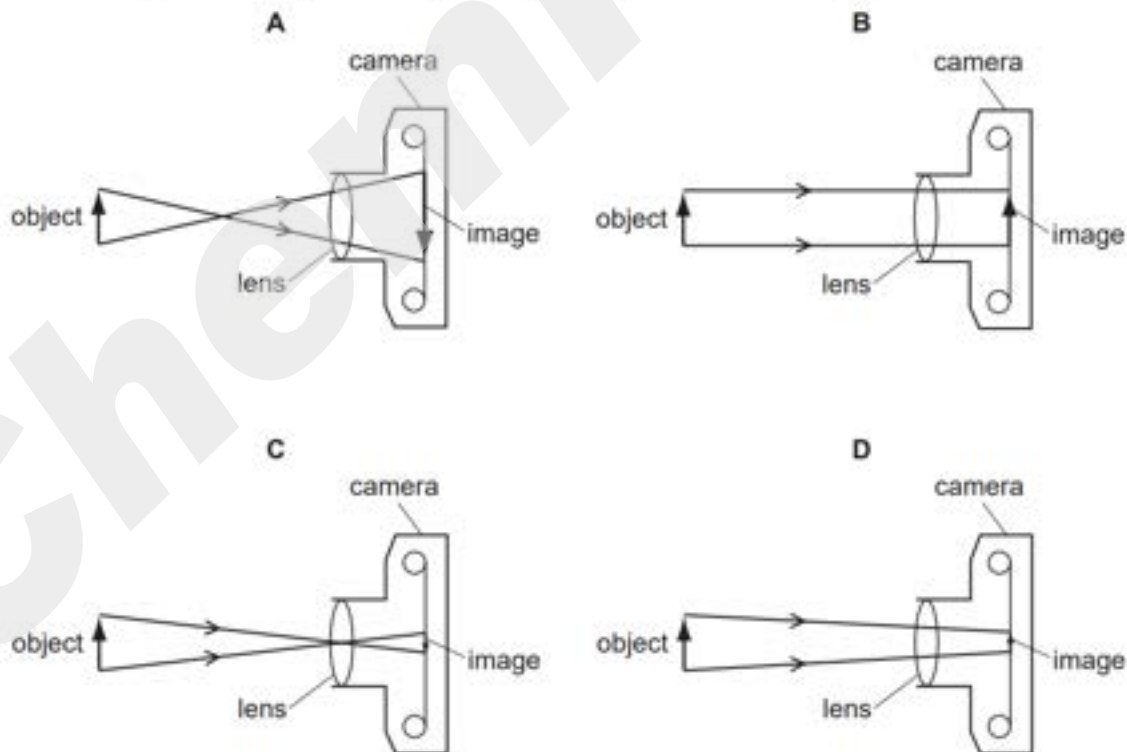


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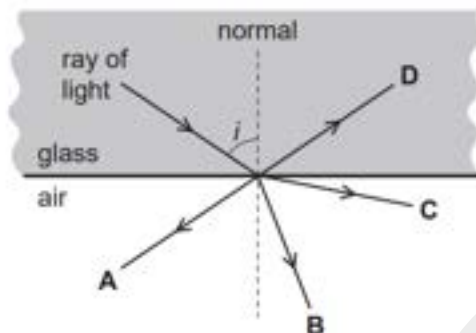
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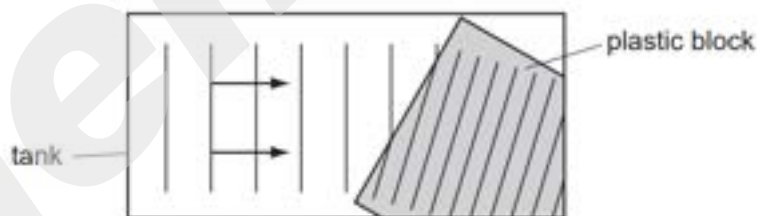


October/November 2010 (11)

- 20 Which group contains only transverse waves?

- A infra-red waves, light waves, sound waves
- B infra-red waves, light waves, ultra-violet waves
- C infra-red waves, ultra-violet waves, sound waves
- D light waves, sound waves, ultra-violet waves

- 21 Water waves in a tank pass over a thin plastic block as shown.



What happens to the waves as they reach the plastic block?

- A They are diffracted because they slow down.
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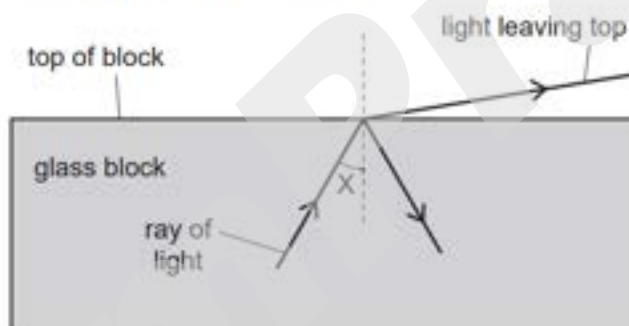
LEFT

She looks at the image of this card, made by reflection by a plane mirror.

What does she see?



23 A scientist is trying to direct a ray of light through a glass block without any light leaving the top of the block. However, some light does leave the top.

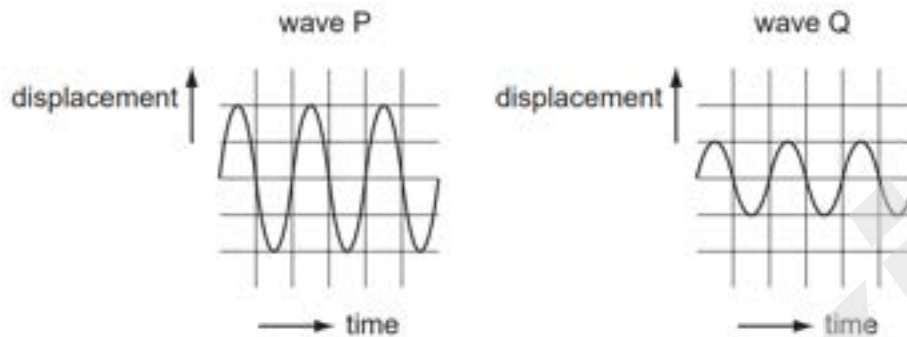


The scientist changes angle X and stops the ray of light leaving the top.

Which row in the table describes the change to angle X and the name of the effect produced?

| | change to angle X | name of effect produced |
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| A | decrease | total internal reflection |
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24 The diagrams represent two different sound waves.



How do the frequency and pitch of P compare with the frequency and pitch of Q?

| | frequency of P | pitch of P |
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| A | greater than Q | higher than Q |
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25 A ship sends a pulse of sound vertically downwards to the sea bed. An echo is heard 0.4 seconds later.

If the speed of sound in the water is 1200 m/s, how deep is the water below the ship?

- A** 240 m **B** 480 m **C** 1500 m **D** 3000 m

October/November 2010 (12)

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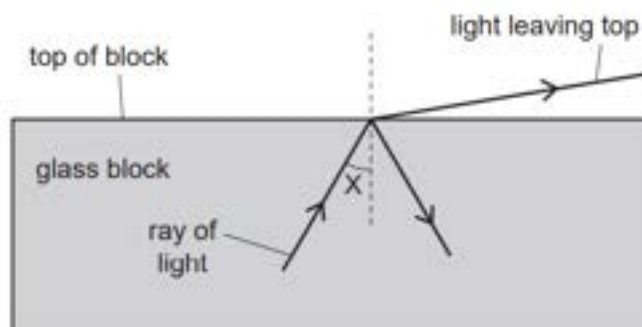
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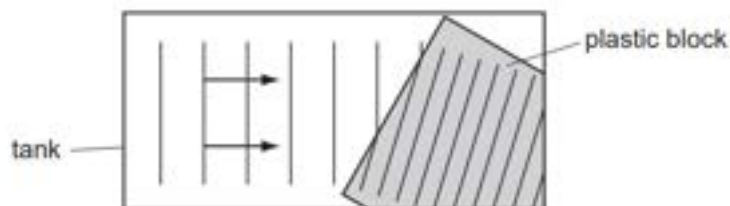


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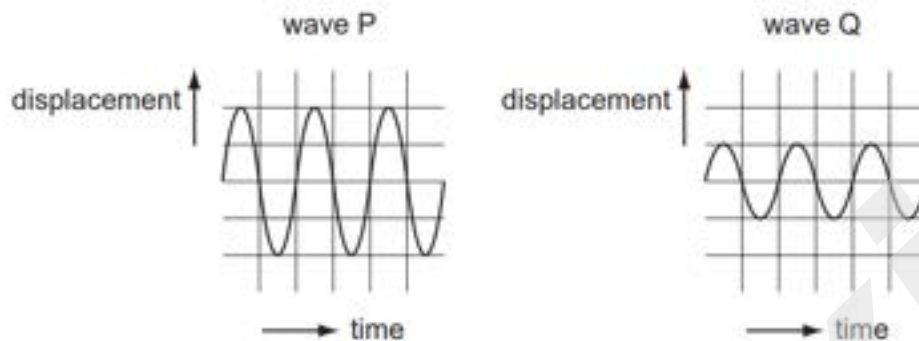
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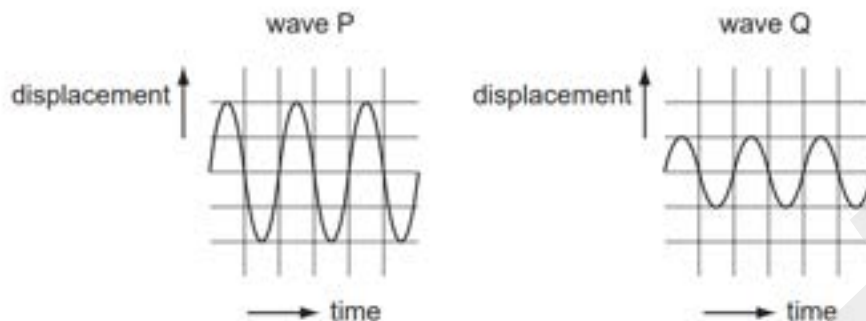
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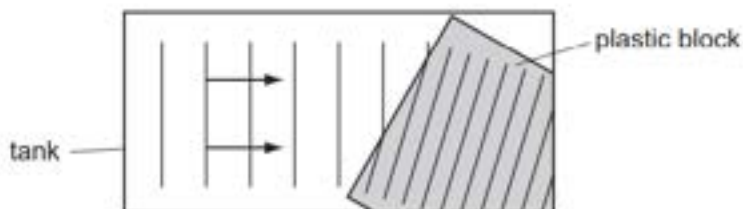


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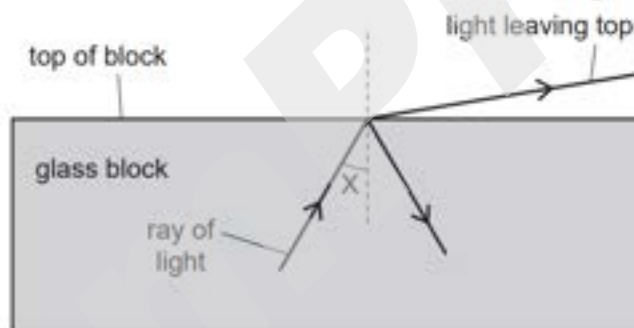
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May/June 2011 (11)

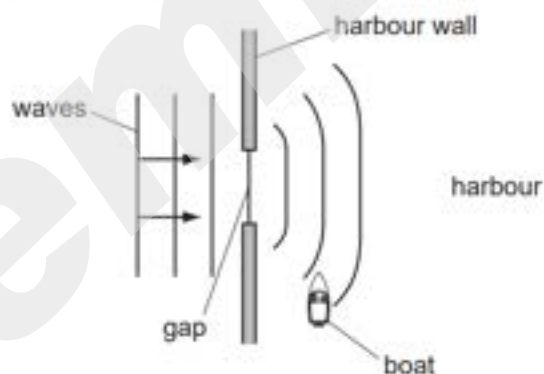
20 What is the unit of wavelength?

- A hertz
- B metre
- C metre per second
- D second

21 Which row correctly describes light waves and radio waves?

| | light waves | radio waves |
|----------|--------------|--------------|
| A | longitudinal | longitudinal |
| B | longitudinal | transverse |
| C | transverse | longitudinal |
| D | transverse | transverse |

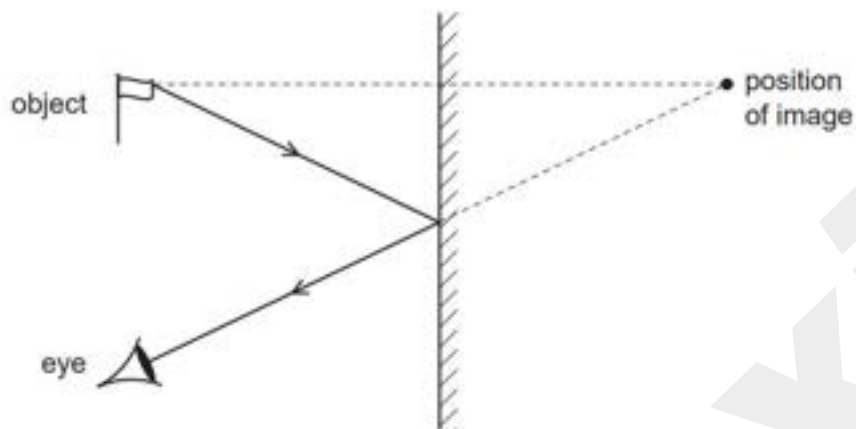
22 The diagram shows water waves passing through a gap in a harbour wall. The waves curve round the wall and reach a small boat in the harbour.



What is the name of this curving effect, and how can the gap be changed so that the waves are less likely to reach the boat?

| | name of effect | change to the gap |
|----------|----------------|-------------------------------|
| A | diffraction | make the gap slightly bigger |
| B | diffraction | make the gap slightly smaller |
| C | refraction | make the gap slightly bigger |
| D | refraction | make the gap slightly smaller |

23 The image formed by a plane mirror is upright.

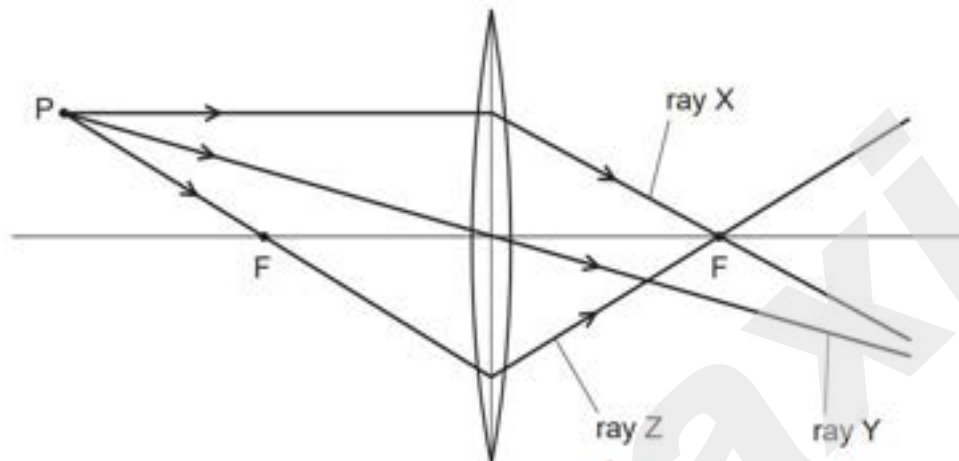


What are the other characteristics of the image?

| | laterally inverted (left to right) | magnified (larger than the object) | virtual |
|----------|---------------------------------------|---------------------------------------|---------|
| A | no | yes | yes |
| B | yes | no | no |
| C | yes | no | yes |
| D | yes | yes | no |

24 A student draws three rays of light from point P through a converging lens.

Each point labelled F is a principal focus of the lens.



Which of the rays are drawn correctly?

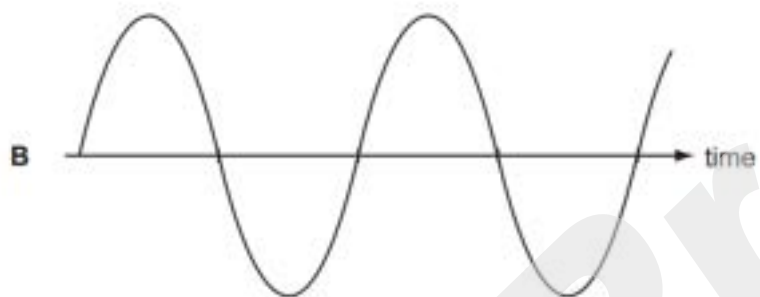
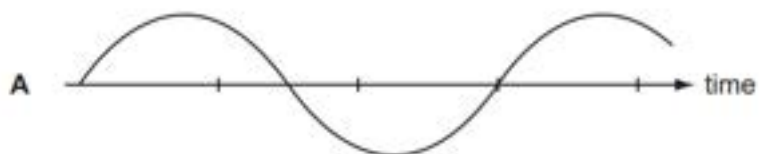
- A ray Y only
 - B ray Z only
 - C ray X and ray Y
 - D ray X and ray Z
- 25 A girl stands at a distance from a large building. She claps her hands and a short time later hears an echo.

Why is an echo produced when the sound waves hit the building?

- A The sound waves are absorbed.
- B The sound waves are diffracted.
- C The sound waves are reflected.
- D The sound waves are refracted.

26 The diagrams represent the waves produced by four sources of sound. The scales are the same for all the diagrams.

Which sound has the highest frequency?



May/June 2011 (12)

20 Which row shows the nature of light waves, sound waves and X-rays?

| | light waves | sound waves | X-rays |
|----------|--------------|--------------|--------------|
| A | longitudinal | longitudinal | transverse |
| B | longitudinal | transverse | longitudinal |
| C | transverse | longitudinal | transverse |
| D | transverse | transverse | longitudinal |

21 The diagram shows plane water waves passing through a narrow gap in a barrier.

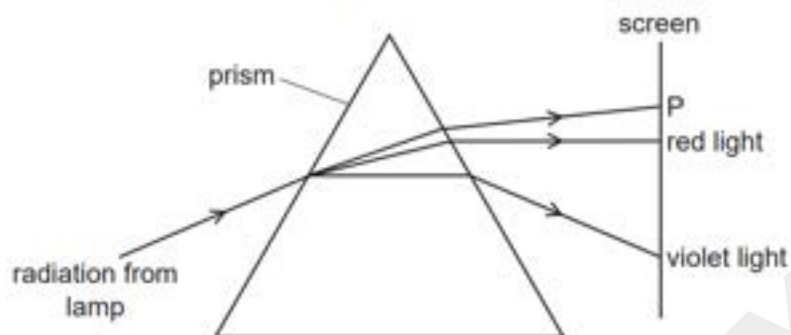


The waves spread out on the far side of the barrier.

Which property of waves does this illustrate?

- A** diffraction
- B** reflection
- C** refraction
- D** vibration

22 The diagram shows radiation from a lamp passing through a prism.

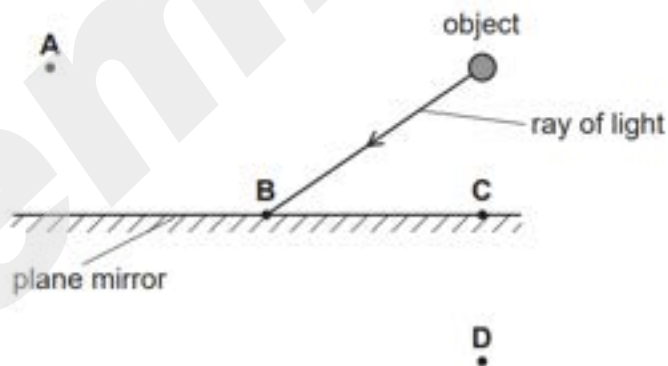


Which type of radiation is found at P?

- A γ -rays
- B infra-red
- C ultraviolet
- D X-rays

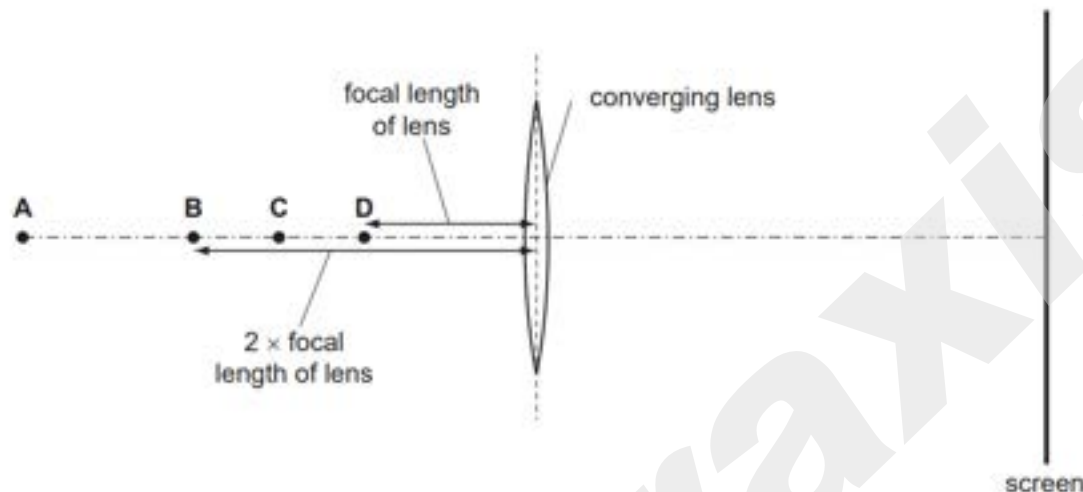
23 A plane mirror is used to form an image of an object.

At which labelled point is the image formed?



- 24 A converging lens in a projector is used to make an **enlarged** image of a small piece of film on a screen.

At which labelled point could the piece of film be placed so that the lens produces this image?

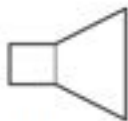


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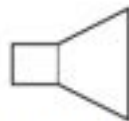
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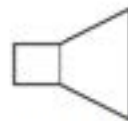
26 Three loudspeakers vibrate at different frequencies of 5 hertz, 25 kilohertz and 50 kilohertz.



5 hertz



25 kilohertz



50 kilohertz

Which row shows whether the vibrations from each loudspeaker can be heard by a human?

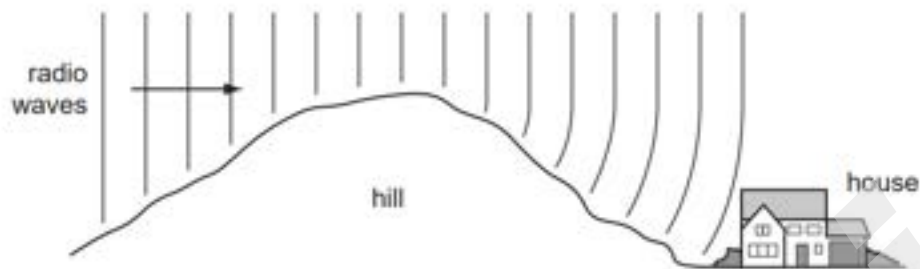
| | 5 hertz | 25 kilohertz | 50 kilohertz |
|---|---------|--------------|--------------|
| A | no | no | no |
| B | no | yes | no |
| C | yes | no | yes |
| D | yes | yes | yes |

October/November 2011 (11)

19 Which of these waves is longitudinal?

- A infra-red
- B radio
- C sound
- D water

20 Radio waves are received at a house at the bottom of a hill.

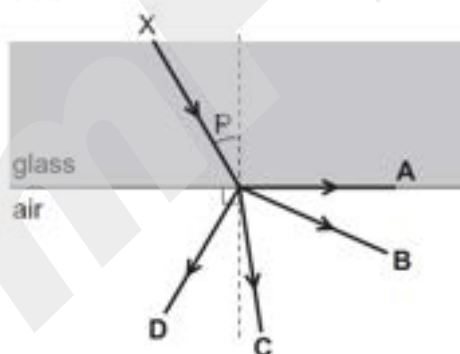


The waves reach the house because the hill has caused them to be

- A diffracted.
- B radiated.
- C reflected.
- D refracted.

21 The diagram shows a ray of light travelling from X. Angle P is less than the critical angle.

In which direction does the ray continue?



- 22 The diagram shows the image of a clock in a plane mirror.



What time is shown?

- A 02:25 B 02:35 C 09:25 D 09:35
- 23 A student wishes to measure the speed of sound in air. She plans to measure the time between making a sound and hearing the echo from a cliff.

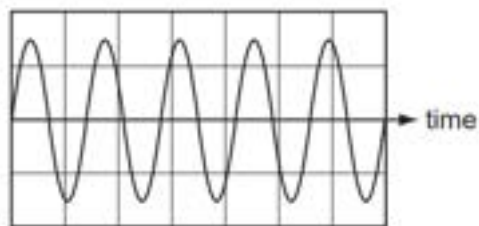


She will use the equation: $\text{speed} = \frac{\text{distance}}{\text{time}}$

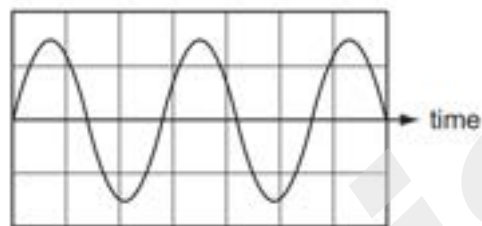
Which type of sound should she make and which distance should she use in her calculation?

| | type of sound | distance to use |
|---|--------------------|--------------------------------------|
| A | continuous sound | $\frac{\text{distance to cliff}}{2}$ |
| B | continuous sound | distance to cliff \times 2 |
| C | short, sharp sound | $\frac{\text{distance to cliff}}{2}$ |
| D | short, sharp sound | distance to cliff \times 2 |

- 24 The diagrams show the wave shapes of two different sounds. The scales are the same in each diagram.



sound 1



sound 2

How does sound 2 compare with sound 1?

- A Sound 2 is louder than sound 1.
- B Sound 2 is quieter than sound 1.
- C Sound 2 has a higher pitch than sound 1.
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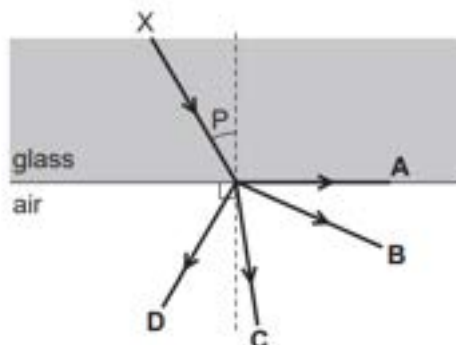


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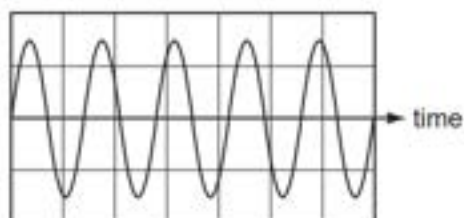
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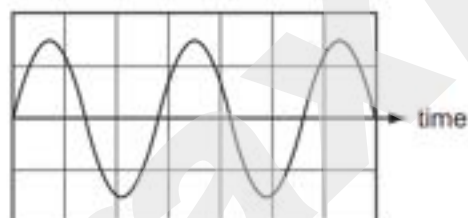
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May/June 2012 (11)

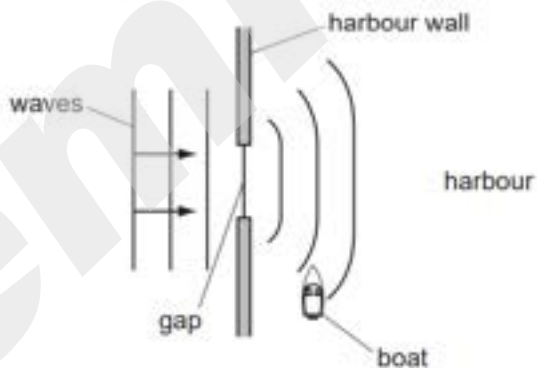
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|---|--------------|--------------|
| A | longitudinal | longitudinal |
| B | longitudinal | transverse |
| C | transverse | longitudinal |
| D | transverse | transverse |

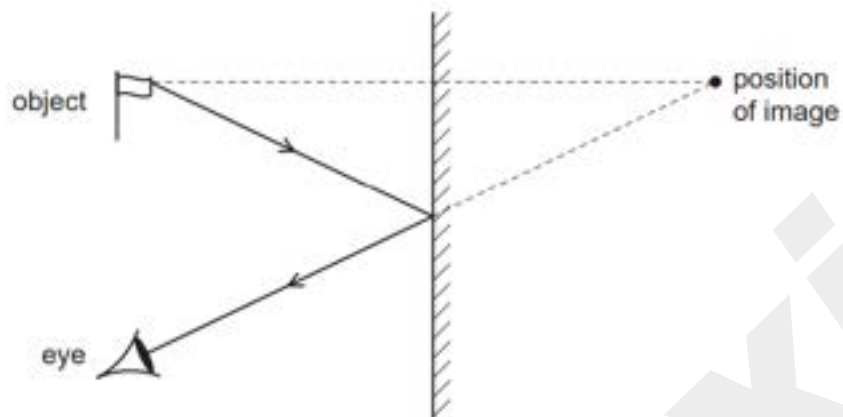
22 The diagram shows water waves passing through a gap in a harbour wall. The waves curve round the wall and reach a small boat in the harbour.



What is the name of this curving effect, and how can the gap be changed so that the waves are less likely to reach the boat?

| | name of effect | change to the gap |
|---|----------------|-------------------------------|
| A | diffraction | make the gap slightly bigger |
| B | diffraction | make the gap slightly smaller |
| C | refraction | make the gap slightly bigger |
| D | refraction | make the gap slightly smaller |

23 The image formed by a plane mirror is upright.

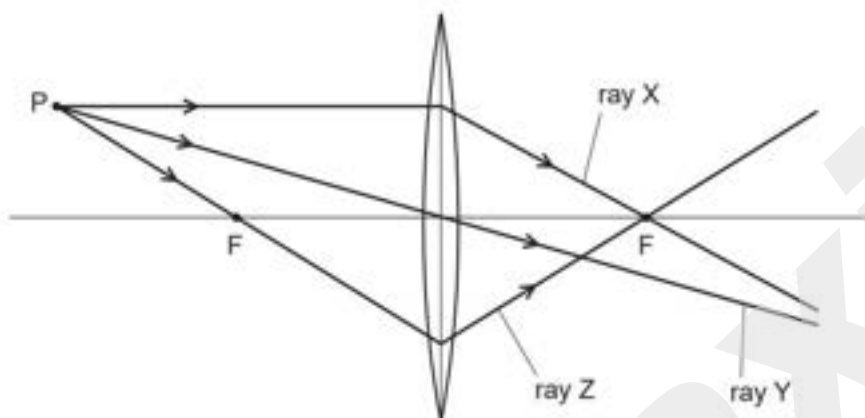


What are the other characteristics of the image?

| | laterally inverted (left to right) | magnified (larger than the object) | virtual |
|----------|---------------------------------------|---------------------------------------|---------|
| A | no | yes | yes |
| B | yes | no | no |
| C | yes | no | yes |
| D | yes | yes | no |

24 A student draws three rays of light from point P through a converging lens.

Each point labelled F is a principal focus of the lens.



Which of the rays are drawn correctly?

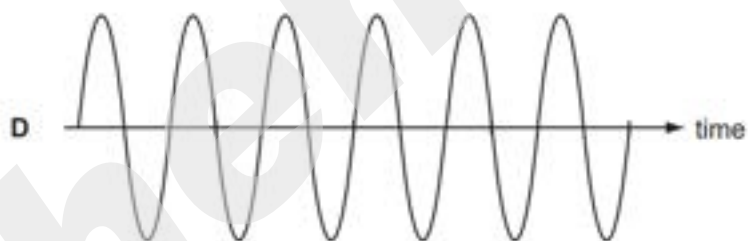
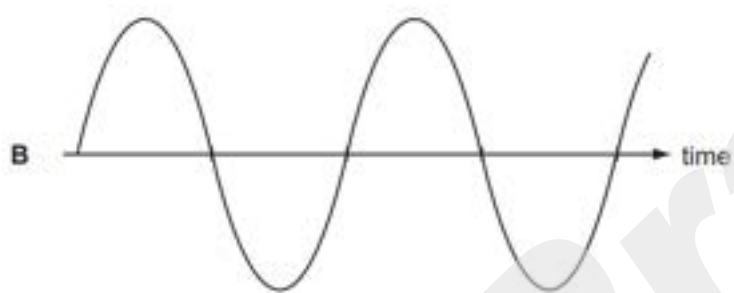
- A ray Y only
 - B ray Z only
 - C ray X and ray Y
 - D ray X and ray Z
- 25 A girl stands at a distance from a large building. She claps her hands and a short time later hears an echo.

Why is an echo produced when the sound waves hit the building?

- A The sound waves are absorbed.
- B The sound waves are diffracted.
- C The sound waves are reflected.
- D The sound waves are refracted.

- 26 The diagrams represent the waves produced by four sources of sound. The scales are the same for all the diagrams.

Which sound has the highest frequency?



May/June 2012 (12)

20 Which row shows the nature of light waves, sound waves and X-rays?

| | light waves | sound waves | X-rays |
|----------|--------------|--------------|--------------|
| A | longitudinal | longitudinal | transverse |
| B | longitudinal | transverse | longitudinal |
| C | transverse | longitudinal | transverse |
| D | transverse | transverse | longitudinal |

21 The diagram shows plane water waves passing through a narrow gap in a barrier.

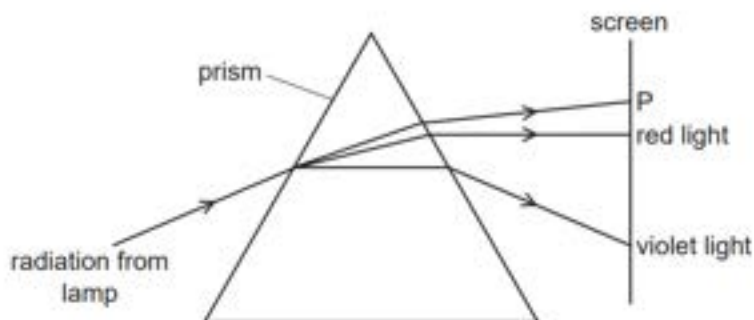


The waves spread out on the far side of the barrier.

Which property of waves does this illustrate?

- A** diffraction
- B** reflection
- C** refraction
- D** vibration

22 The diagram shows radiation from a lamp passing through a prism.

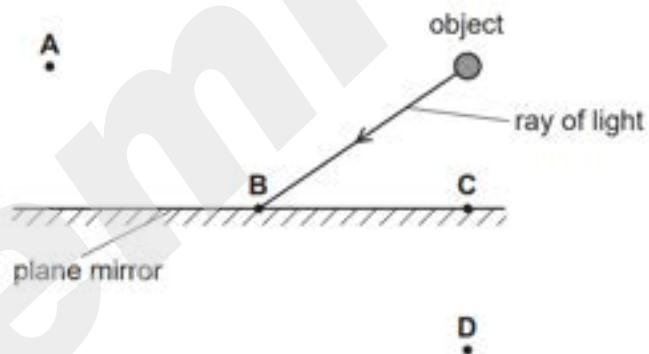


Which type of radiation is found at P?

- A γ -rays
- B infra-red
- C ultraviolet
- D X-rays

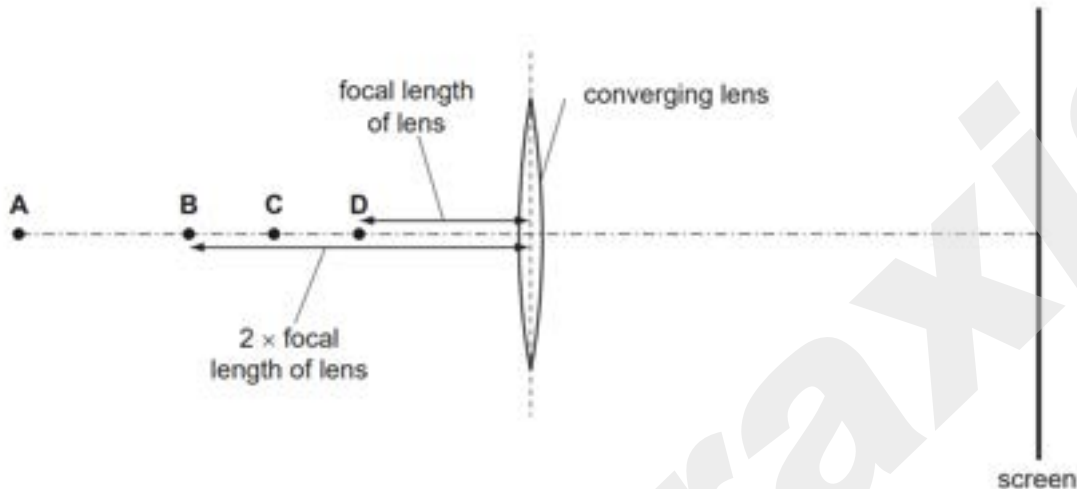
23 A plane mirror is used to form an image of an object.

At which labelled point is the image formed?



- 24 A converging lens in a projector is used to make an **enlarged** image of a small piece of film on a screen.

At which labelled point could the piece of film be placed so that the lens produces this image?

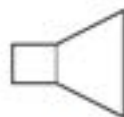


- 25 A girl stands at a distance from a large building. She claps her hands and a short time later hears an echo.

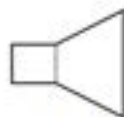
Why is an echo produced when the sound waves hit the building?

- A The sound waves are absorbed.
- B The sound waves are diffracted.
- C The sound waves are reflected.
- D The sound waves are refracted.

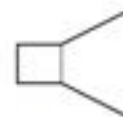
26 Three loudspeakers vibrate at different frequencies of 5 hertz, 25 kilohertz and 50 kilohertz.



5 hertz



25 kilohertz



50 kilohertz

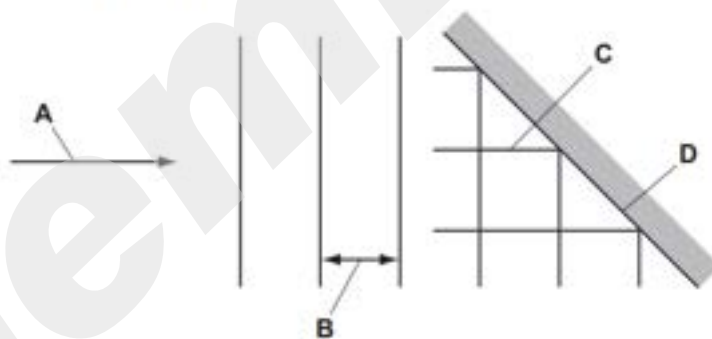
Which row shows whether the vibrations from each loudspeaker can be heard by a human?

| | 5 hertz | 25 kilohertz | 50 kilohertz |
|----------|---------|--------------|--------------|
| A | no | no | no |
| B | no | yes | no |
| C | yes | no | yes |
| D | yes | yes | yes |

October/November 2012 (11)

21 The diagram shows plane waves reflected by a plane surface.

Which line represents a wavefront?



22 A swimmer is sitting on a rock at the sea shore looking at passing waves. He notices that five complete wavelengths pass him in 20 s.

What is the frequency of this wave?

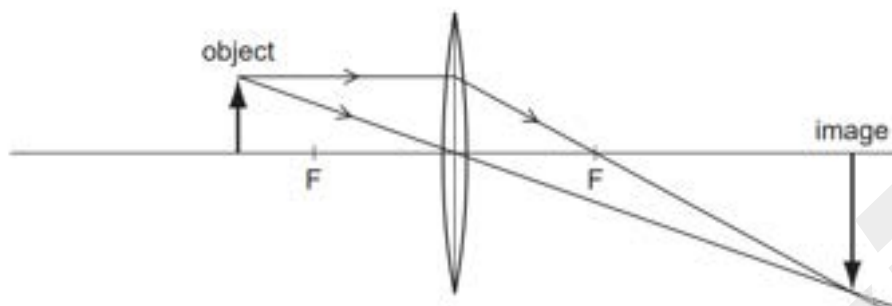
A 0.25 Hz

B 4.0 Hz

C 15 Hz

D 100 Hz

23 A thin converging lens forms an image.

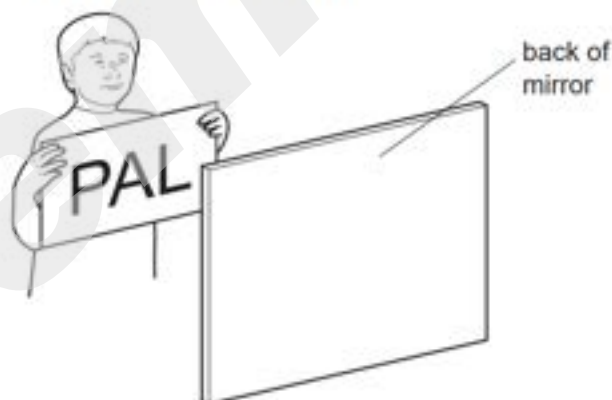


What is the nature of this image and can it be formed on a screen?

| | nature of image | can be formed on a screen? |
|----------|-----------------|----------------------------|
| A | not real | no |
| B | not real | yes |
| C | real | no |
| D | real | yes |

24 A piece of paper has 'PAL' written on it.

A student holds the paper in front of a plane mirror.



What does the student see?

A B C D

| | | | |
|-----|-----|-----|-----|
| PAL | LAP | PAL | LAP |
|-----|-----|-----|-----|

25 A girl notices that when she shouts into a cave she hears an echo.

Which wave property causes the echo?

- A diffraction
- B dispersion
- C reflection
- D refraction

26 In a test, a car horn is found to be too loud and the pitch of the note is too high.

What information does this give about the amplitude and the frequency of the sound wave produced?

| | amplitude | frequency |
|---|-----------|-----------|
| A | too large | too large |
| B | too large | too small |
| C | too small | too large |
| D | too small | too small |

October/November 2012 (12)

21 A swimmer is sitting on a rock at the sea shore looking at passing waves. He notices that five complete wavelengths pass him in 20 s.

What is the frequency of this wave?

- A 0.25 Hz
- B 4.0 Hz
- C 15 Hz
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|---|-----------|-----------|
| A | too large | too large |
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| C | too small | too large |
| D | too small | too small |

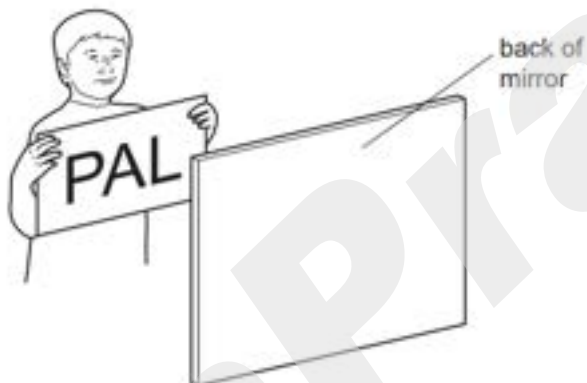
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- C reflection
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A student holds the paper in front of a plane mirror.

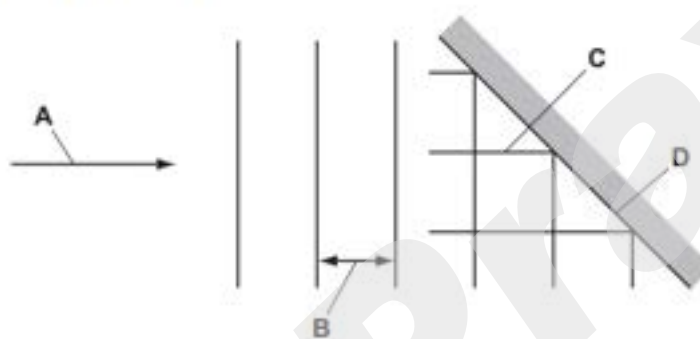


What does the student see?

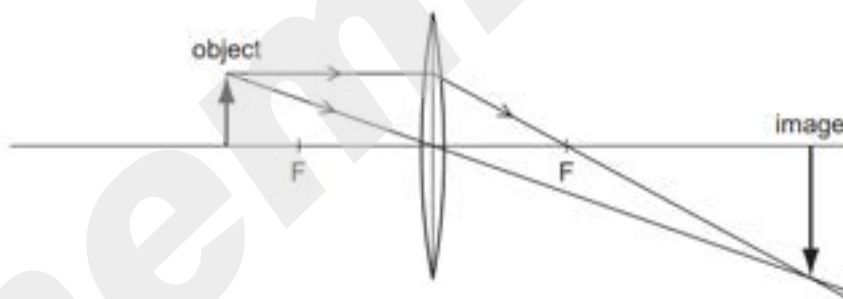


25 The diagram shows plane waves reflected by a plane surface.

Which line represents a wavefront?



26 A thin converging lens forms an image.

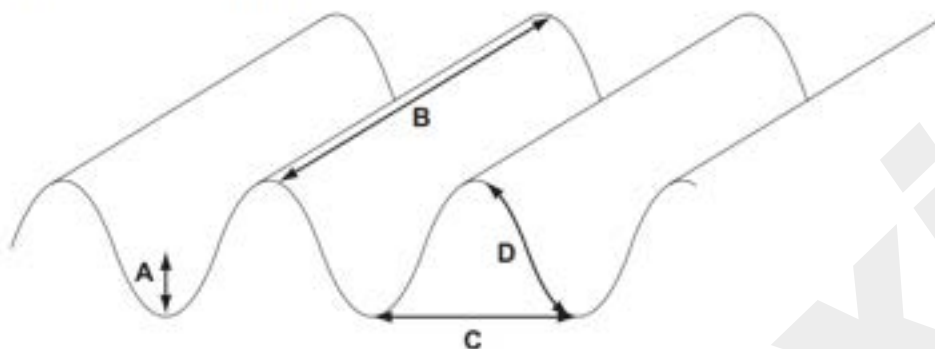


What is the nature of this image and can it be formed on a screen?

| | nature of image | can be formed on a screen? |
|---|-----------------|----------------------------|
| A | not real | no |
| B | not real | yes |
| C | real | no |
| D | real | yes |

21 The diagram shows a water wave in a ripple tank.

Which line represents a wavefront?

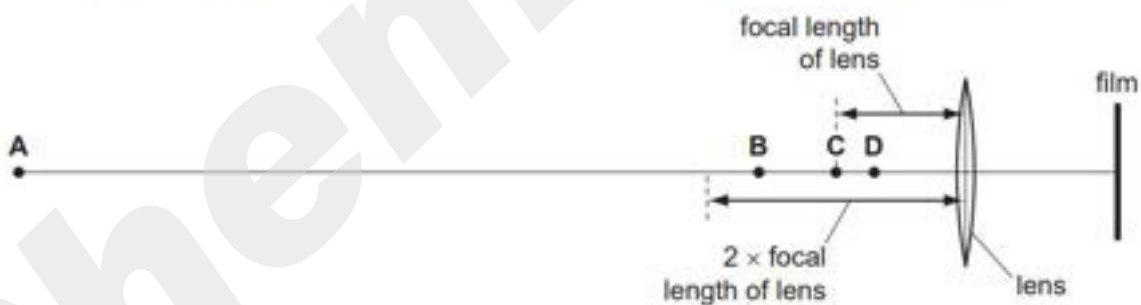


22 Which statement about radio waves is correct?

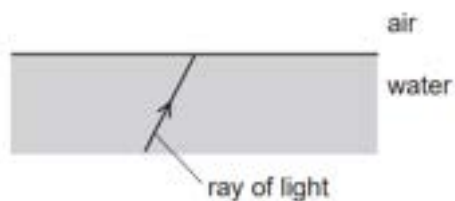
- A They travel as longitudinal waves.
- B They travel at the same speed as sound waves.
- C They travel by means of molecular vibration.
- D They can travel through a vacuum.

23 The converging lens in a camera is used to make an image on a film.

At which labelled point could a large object be placed so that it makes a smaller image?



- 24 A ray of light in water is incident on the surface. The angle of incidence is much smaller than the critical angle.



What happens to this ray?

- A It is completely reflected.
 - B It is completely refracted.
 - C It is partially reflected and partially refracted.
 - D It is refracted at an angle of refraction of 90° .
- 26 In a test, a car horn is found to be too loud and the pitch of the note is too high.

What information does this give about the amplitude and the frequency of the sound wave produced?

| | amplitude | frequency |
|----------|-----------|-----------|
| A | too large | too large |
| B | too large | too small |
| C | too small | too large |
| D | too small | too small |