Compilation trial states 2020

Chapter: 6

waves

You cant stop the waves
But you can learn to surf

John Kabat-Zinn

Smart Revisions

PHYSICS

alinaimanarif

PART 1: STRUCTURE

TRIAL TERENGGANU 2020

Diagram 2.1 shows a phenomenon occurring along the beach.
There is a difference wavelength between area P and area Q.

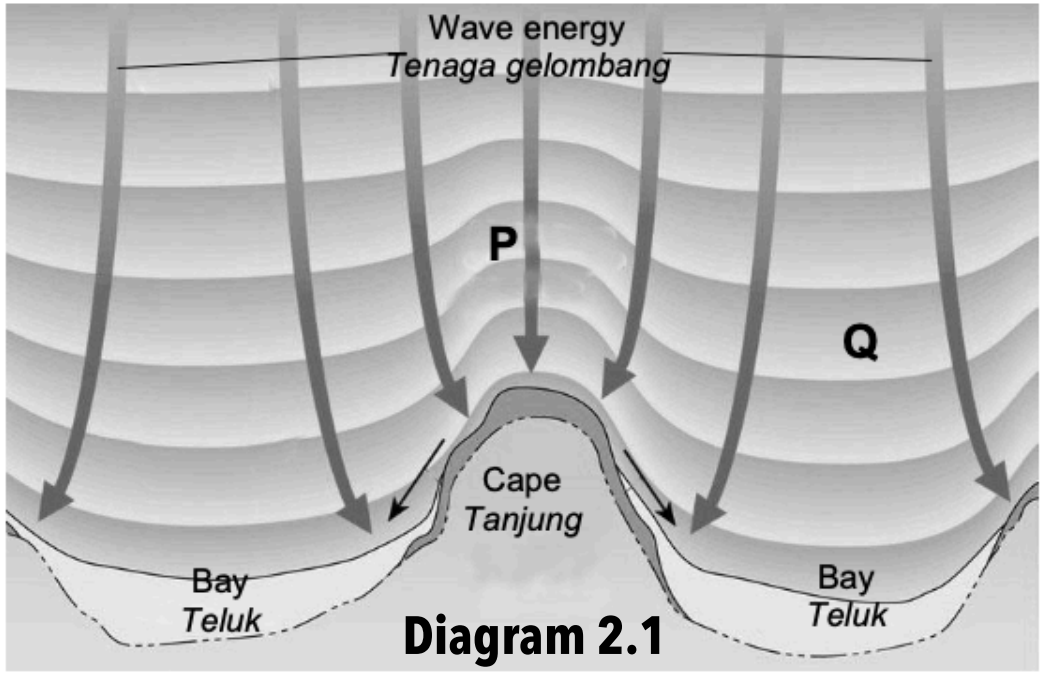

Diagram 2.1

(a) Name the wave phenomenon shown in Diagram 2.1.

REFRACTION of waves

(b) What happens to the water wave energy when it is in the cape area?

Energy INCREASES / CONVERGING

(c) Diagram 2.2 shows a plane water wave pattern.

On the Diagram 2.2, draw

(i) a line showing normal at point R.
(ii) wave pattern after crossing point R in shallow water.

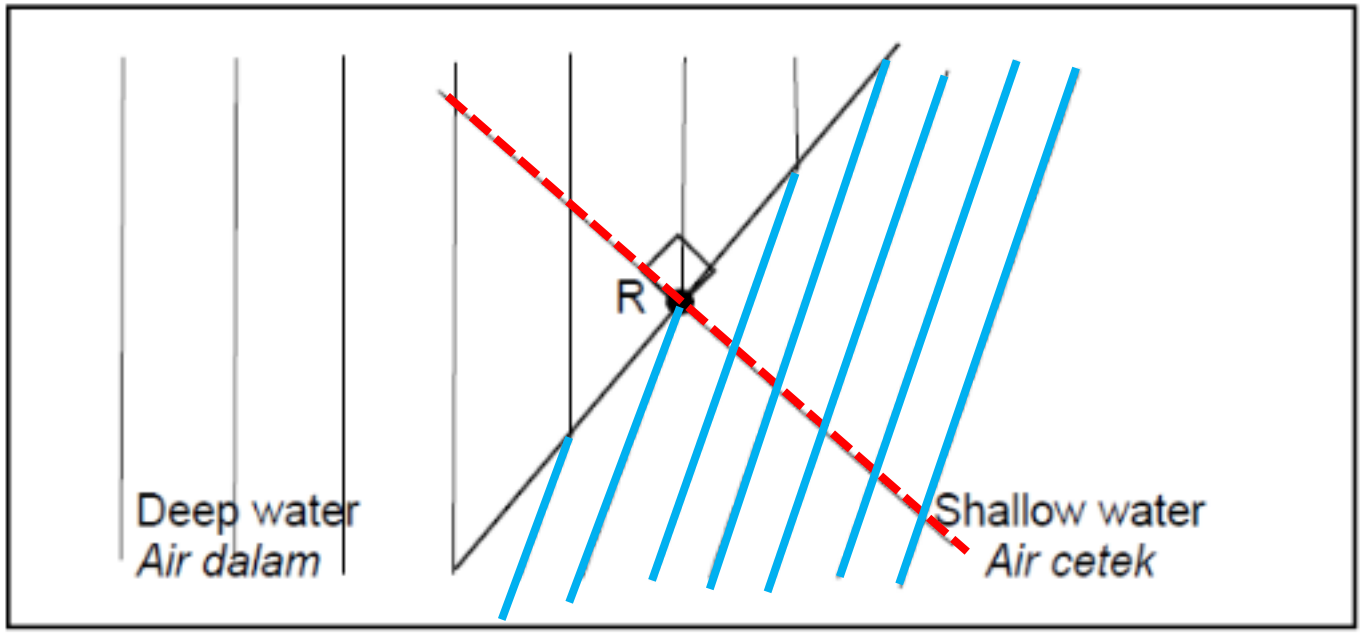

Diagram 2.2

PART 1: STRUCTURE

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Diagram 2.1 shows a buoy oscillating vertically and finally stops.

Diagram 2.1

Diagram 2.2 shows the displacement-time graph for the oscillating system.

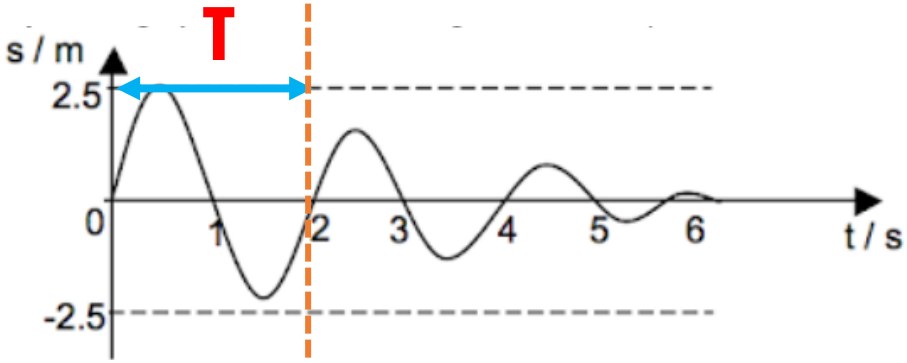


Diagram 2.2

(a) What is the phenomenon experienced by the buoy.

DAMPING

(b) State one factor that causing the phenomena.

Water friction

(c) Based on graph shown in Diagram 2.2,

(i) Determine the period of oscillation.

$T = \mathbf{2\ s}$

(ii) Calculate the frequency of the oscillation system.

$$f = \frac{1}{T} = \frac{1}{2} = \mathbf{0.5\ Hz}$$

PART 1: STRUCTURE

TRIAL KELANTAN 2020

Diagram 3.1 shows the water wave experiences diffraction after passing through a narrow gap between two concrete barriers.

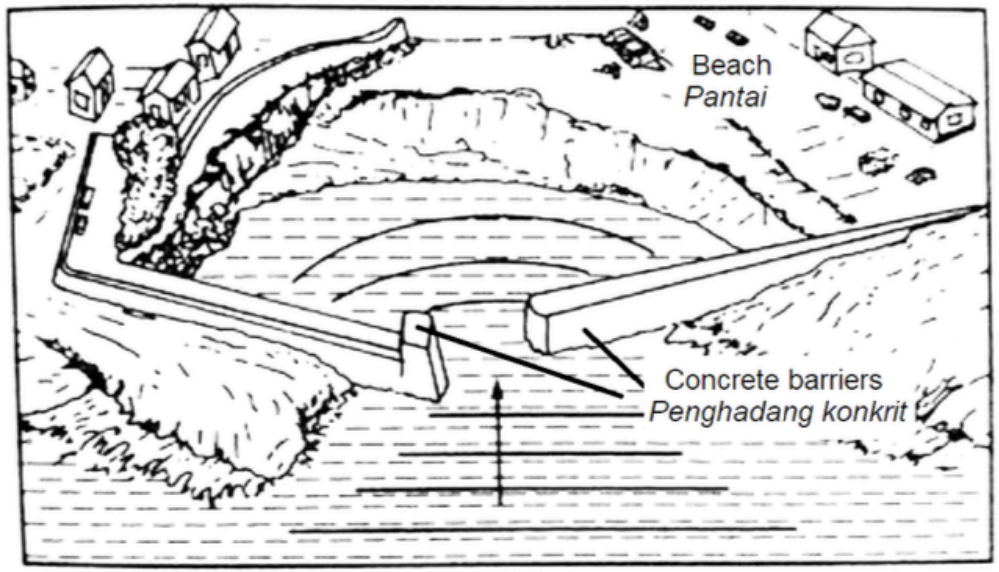


Diagram 3.1

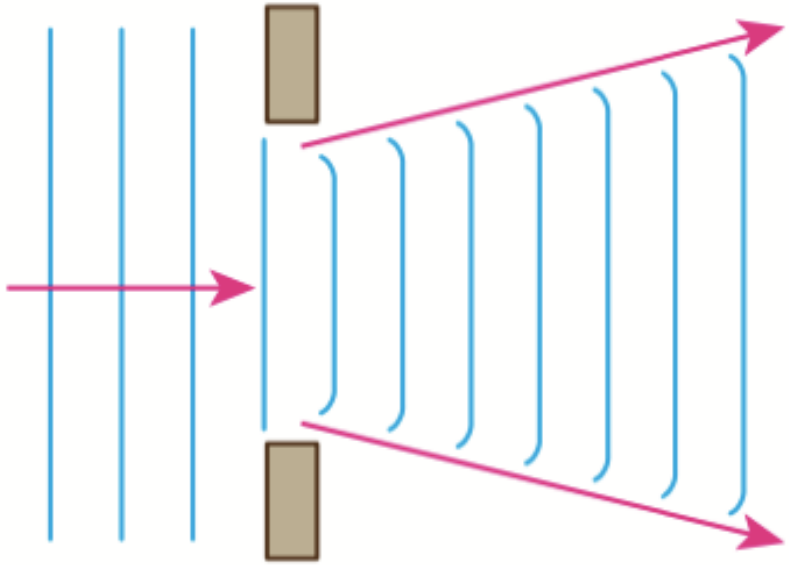
(a) What is the meaning of diffraction?

the **spreading** out of waves when they move through a **gap or round an obstacle**

(b) What happen to the wavelength of water wave after passing through the narrow gap?

Same / Unchanged

(c) On Diagram 3.2, draw the wave pattern after passing through the barriers as the size of gap is increased.



(d) Calculate the wavelength of the incoming water if the velocity of the water wave is 50 m s^{-1} and the wave frequency is 23 Hz.

$$v = f\lambda$$

$$\lambda = \frac{v}{f} = \frac{50}{23} = \mathbf{2.17\ m}$$

(a) Diagram 4.1 shows a type of wave.

Diagram 4.1

(i) Name the type of wave. **TRANSVERSE WAVE**

(ii) Underline the following statement:

Vibration of medium for the wave is **parallel /**
perpendicular to the direction of wave propagation.

(b) Diagram 4.2 shows refraction of water wave phenomenon.

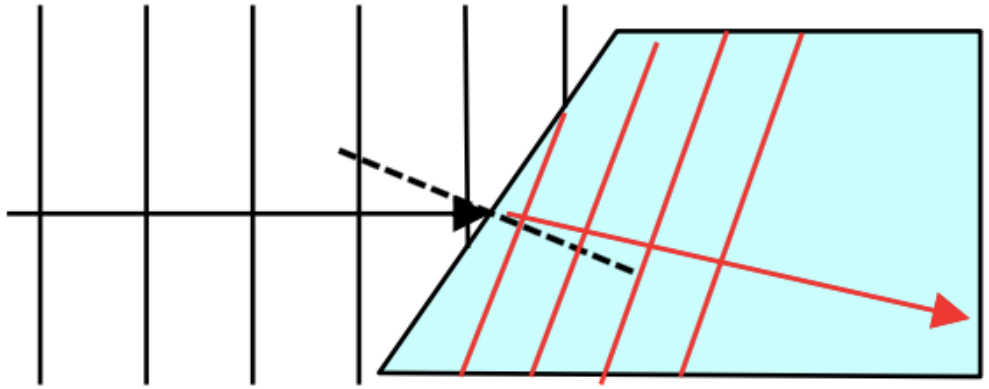


Diagram 4.2

(i) Draw the wave pattern at shallow area

(ii) What happen to the velocity of wave at the shallow region?

Decrease

(iii) Given that velocity and wavelength at deep area is 100 cm s^{-1} and 40 cm respectively.
Calculate the velocity at shallow area if the wavelength is 20 cm.

$f = \frac{v}{\lambda} = \frac{100}{40} =$ **2.5 Hz** **(Frequency unchanged)**

$V = f\lambda = 2.5(20) =$ **50 cm s^{-1}**

PART 1: STRUCTURE

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Diagram 6.1 shows a water waves passing through a log that floats in water.
Diagram 6.2 shows a student standing at one corner of a building at B who can hear the sound from a loudspeaker at A.

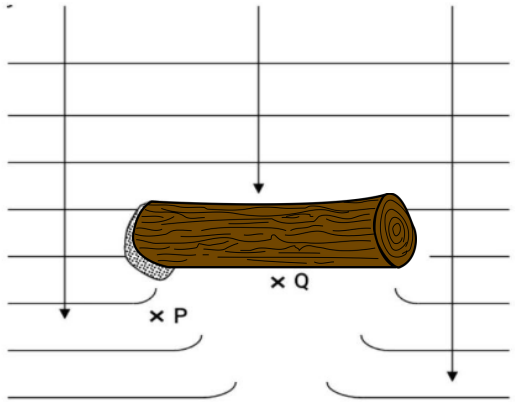

Diagram 6.1

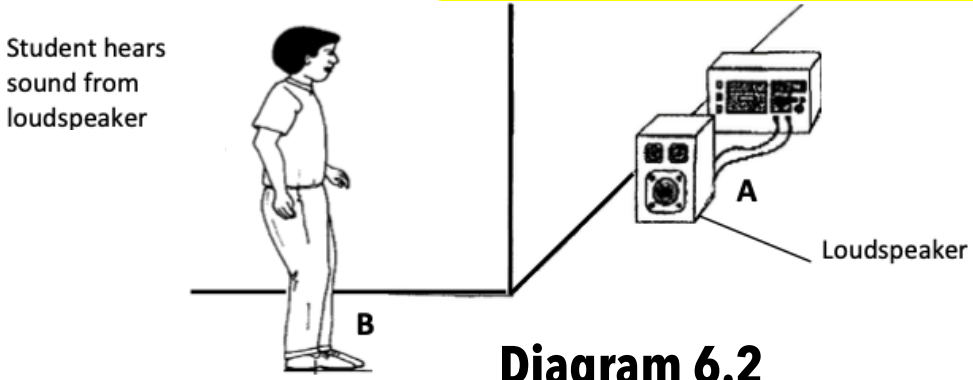

Diagram 6.2

(a) Based on Diagram 6.1 and Diagram 6.2;

(i) what happens to the wave after passing round the log and the corner of the building?

Wave diffracts / spreads to a bigger area

(ii) what happens to the amplitude of the waves after passing round the log and the corner of the building? Explain your answer.

Amplitude DECREASE
Energy DECREASE

(iii) name the wave phenomenon that is related to Diagram 6.1 and Diagram 6.2.

DIFFRACTION of waves

(iv) what will happen to the speed of the water waves after passing through the log?

UNCHANGED

(b) Referring to Diagram 6.1, what will happen to a floating object that is placed at

P : Vibrates/Oscillates
Q : Stationary

(c) Name **one** other wave phenomenon that occurs in Diagram 6.1.

REFLECTION of waves

PART 1: STRUCTURE

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Diagram 7.1 shows the wave pattern produced in a ripple tank by the vibrations of two dippers.

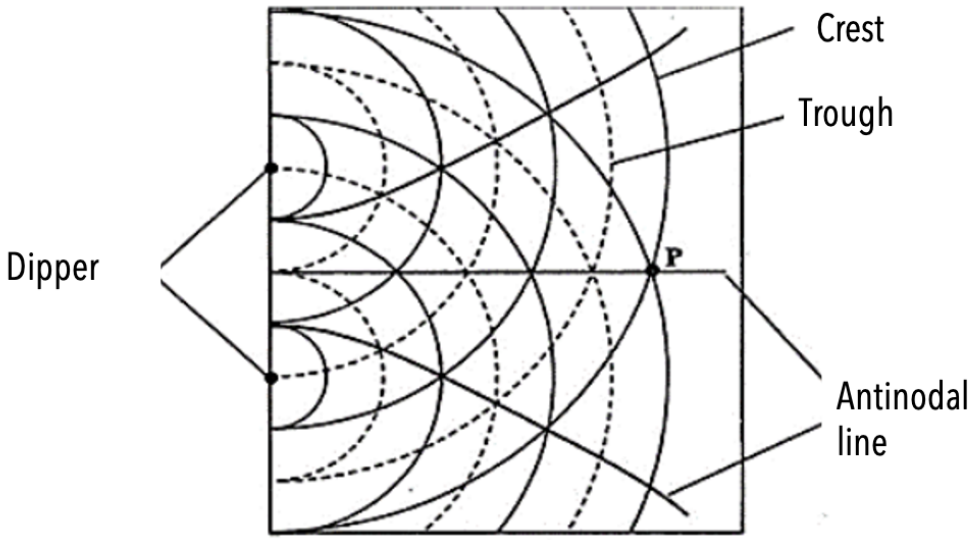


Diagram 7.1

(a) W hat is a wave phenomenon that involved in Diagram 7.1?

INTERFERENCE OF WAVE

(b) What will happen to the distance between the two consecutive antinodal lines when the distance between the dippers is decreased?

Increase

$$\lambda = \frac{ax}{D}$$

(c) A small piece of cork is placed at point P.

(i) State the motion of the cork.

Oscillate // move up and down

(ii) Explain your answer in 7 c(i).

Constructive interference occur

(d) The depth of water is increased.
What will happen to the distance between two consecutive antinodal lines? Explain your answer.

distance between two consecutive antinodal lines: **Increase**

depth **increase**, λ **increase**

(e) Diagram 7.2 shows a lecture hall at a university. Students suggest that some improvements need to be made to a sound system. Suggest a suitable arrangement of the speakers so that sound can be heard clearly throughout the hall.

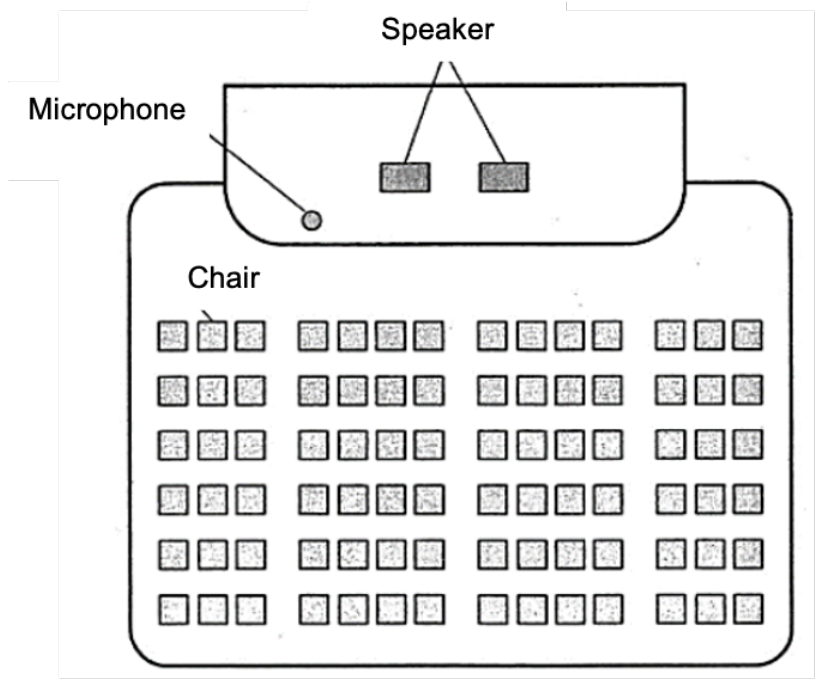


Diagram 7.2

Table 7 shows four setting of the speakers to improve the sound system in the hall.

Setting of the speakers	Position of the speakers	Distance between speakers
P	In front of the microphones	Close to each others
Q	Behind the microphones	Close to each others
R	Behind the microphones	Further from each others
S	In front of the microphones	Further from each others

Table 7

(i) Which position of the speakers is suitable?

In front of the microphones
Avoid noise or disturbance

(ii) Which distance between the speakers is suitable?

Further from each others
Distance between two loud sound is small

S

PART 1: STRUCTURE

A group of students are walking in front of two loudspeakers connected to a signal generator. They stop when they hear the loudest sound. The positions of the students when they stop are shown in Diagram 8.1

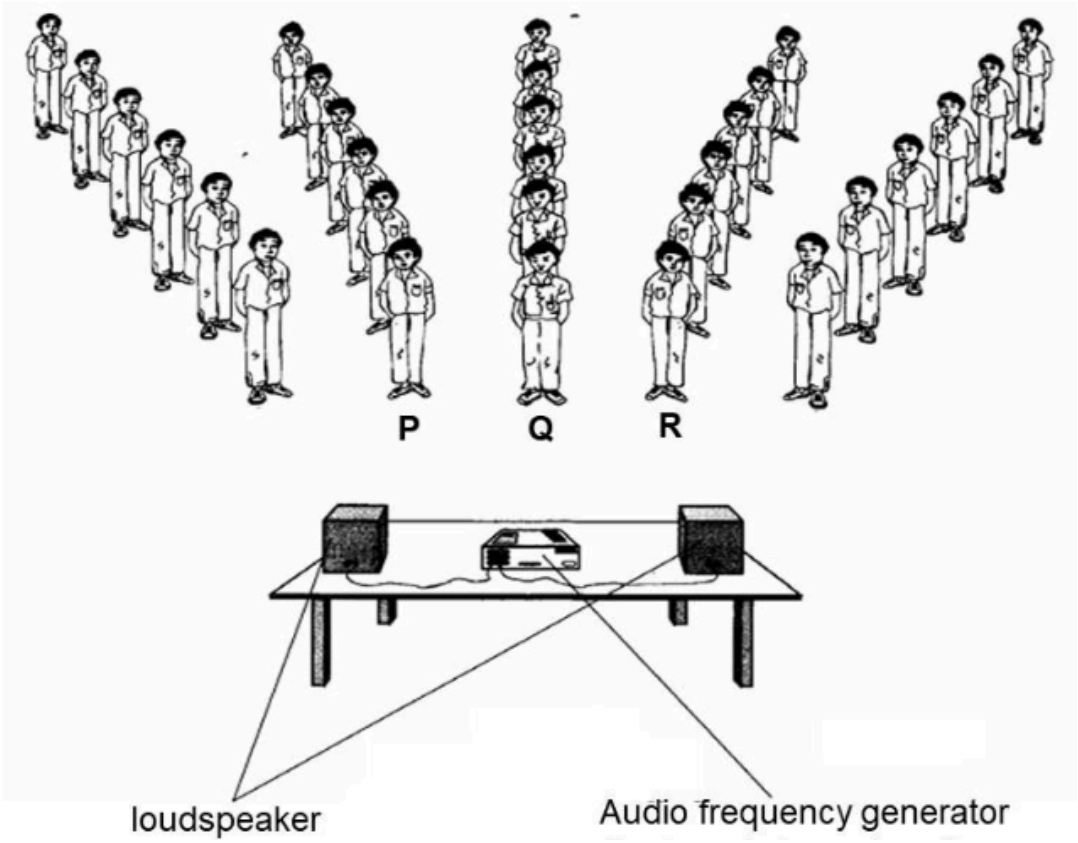


Diagram 8.1

(a) What type of sound wave?

LONGITUDINAL WAVE

(b) Given that the frequency of the sound wave is 2000 Hz, the velocity of sound in air is 340 m s^{-1} , perpendicular distance between speakers and student Q is 6 m and the two speakers are 3 m apart.

Calculate;

(i) Wavelength of sound wave

$$v = f\lambda$$

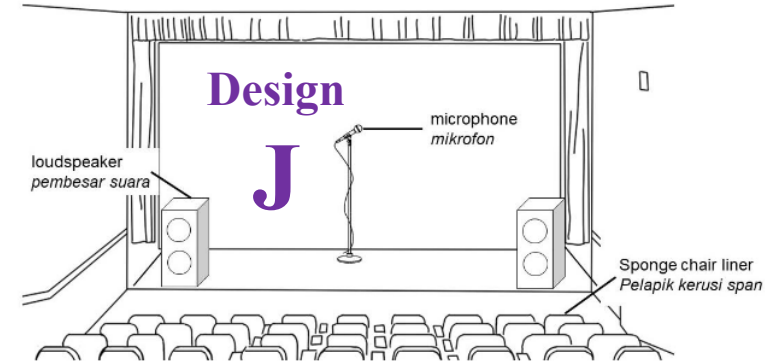
$$\lambda = \frac{v}{f} = \frac{340}{2000} = \mathbf{0.17\ m}$$

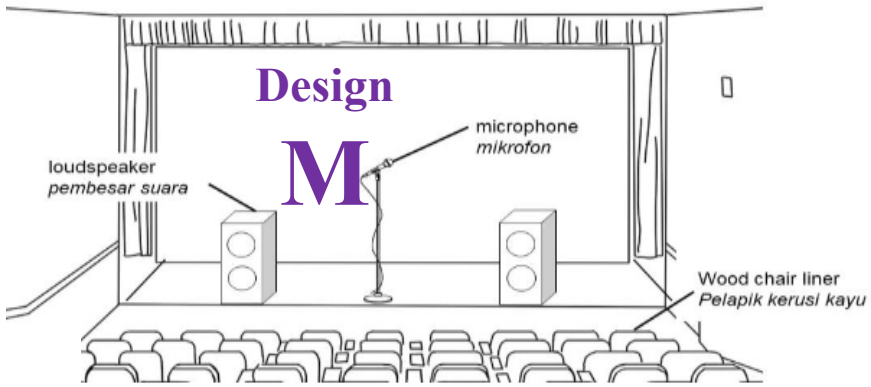
(ii) Distance between students P and Q to assure they hear loud sound.

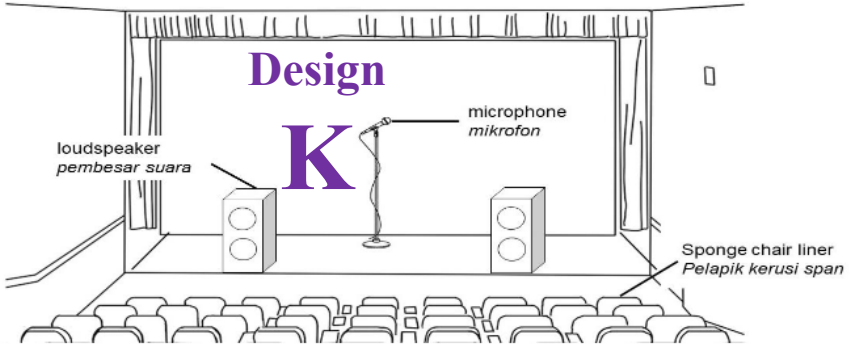
$$\lambda = \frac{ax}{D}$$

$$x = \frac{\lambda D}{a} = \frac{0.17(6)}{3} = \mathbf{0.34\ m}$$

Table 1 shows four different design of sound system to be used in a hall.







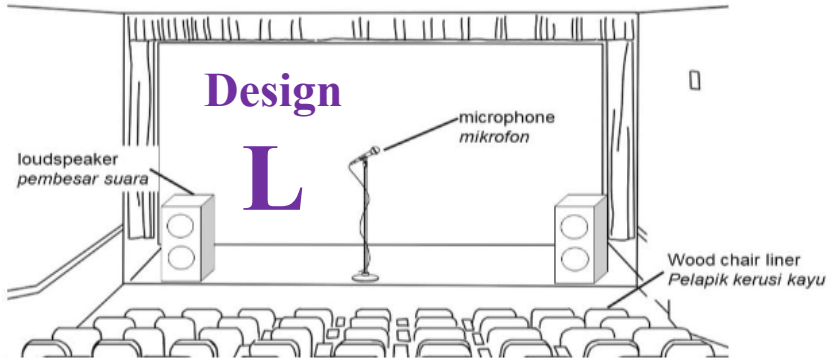


Table 1

Based on Table 1, state the suitable design to produce better sound quality. Give one reason for the suitable design.

Design **J**

(i) Distance between speaker: **large / far**
Distance between two loud sound is small

(ii) The position of the microphone: **behind speaker**
Avoid noise or disturbance

(iii) Material of chair liners: **sponge**
Reduce reflection of sound / no echo

PART 1: STRUCTURE

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Diagram 8.1 shows a remote controller.

Diagram 8.1

(a) State the waves emitted by the remote controller.

INFRA-RED

Diagram 8.2 shows a transmitting station for telecommunications.
Diagram 8.3 shows the X-ray image of chest bones.

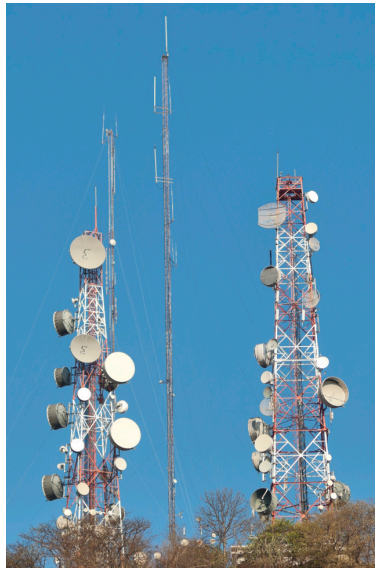

Diagram 8.2

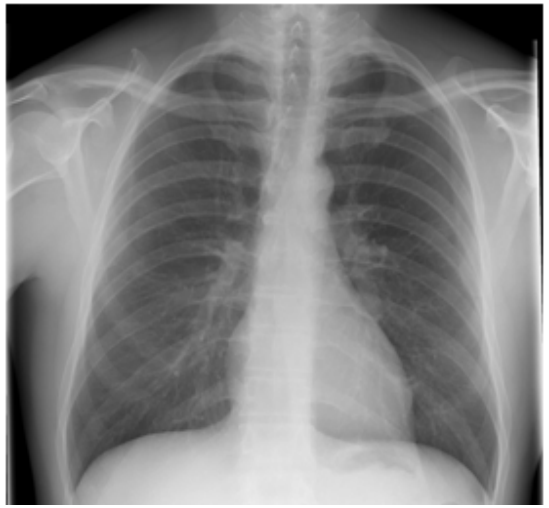

Diagram 8.3

(i) Based on Diagram 8.2 and Diagram 8.3, what is the **two** common characteristics between the wave used?

- They transfer energy from one point to another.
- They are transverse waves.
- They can travel through vacuum.
- They travel at the same speed through vacuum, i.e at the speed of light, $\mathbf{c = 3 \times 10^8\ ms^{-1}}$.
- They all show wave properties such as reflection, refraction, diffraction and interference.

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(ii) Diagram 8.4 shows a satellite disc detect a signal transmitted from a broadcasting station through a satellite that located 35 000 km from the earth.

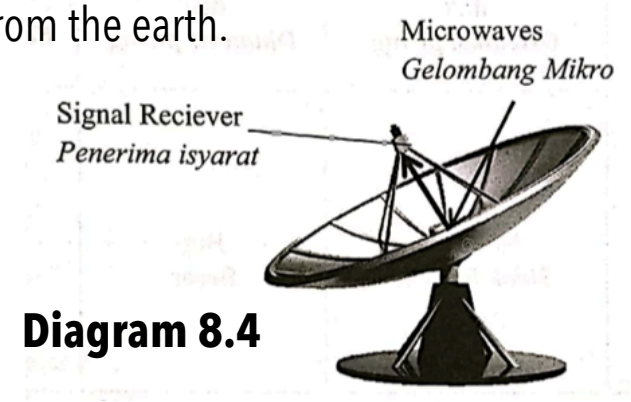

Diagram 8.4

If the time taken by the waves to be reflected back by the disc to the receiver is 2 ns, calculate the focal length of the disc.

$$v = \frac{s}{t}$$

$$s = v\,t$$

$$s = 3 \times 10^{8} (2 \times 10^{-9})$$

Focal length, s = 0.6 m

(c) Table 8 shows three Radar System disc which can be used to control aeroplanes air traffic.

Radar system disc	Orientation of the disc	Diameter of the disc	Location of the disc
J 	Not rotate	Big	High
K 	Rotate 360°	Small	Low
L 	Rotate 360°	Big	High

Table 8

Based on Table 8, state the suitable characteristic of the radar system to be used to detect movement of airplanes effectively. Give one reason for suitable characteristics.

Orientation of the disc:

Rotate 360°

sending and receiving waves from many directions

Diameter of the disc:

BIG

Receives and reflects many wave signals

Location of the disc:

HIGH

can receive wave signals without obstruction // less obstacle

L

PART 2: ESSAY B

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Diagram 10.1 and Diagram 10.2 show two transverse waveforms from two different sources of wave.

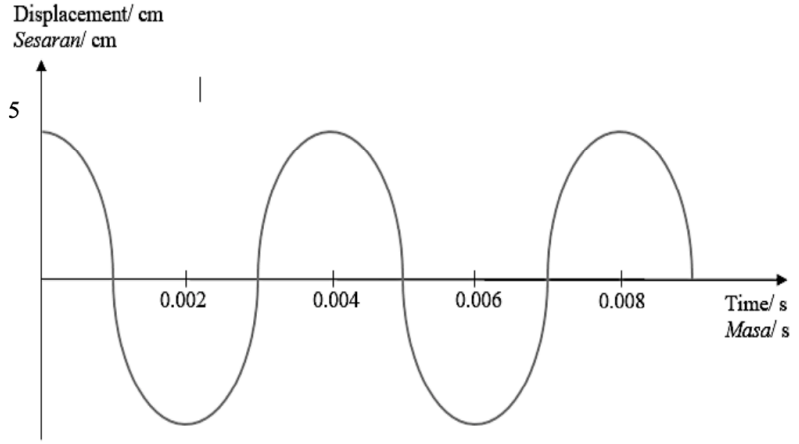

Diagram 10.1

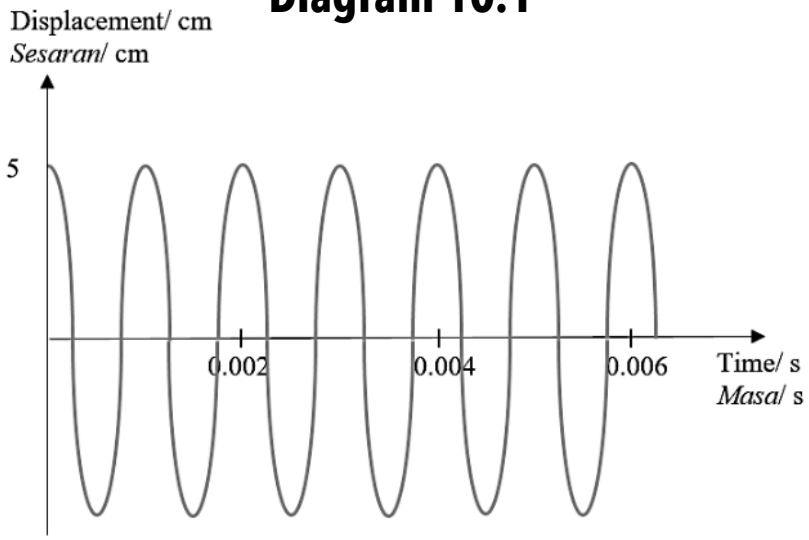

Diagram 10.2

(a) (i) State the definition of transverse wave?

A transverse wave is a wave in which matter / medium particles move **perpendicular** to the direction of wave propagation.

(ii) Using Diagram 10.1 and 10.2, compare the number of complete oscillation in one second, period and the frequency of the waves.

Characteristics	Diagram 10.1	Diagram 10.2
number of complete oscillation in one second	lower	higher
period	higher	lower
frequency	lower	higher

(iii) Relate the number of complete oscillation in one second of waves with period and the frequency of waves.

number of complete oscillation in one second **increase**, Period **decrease**

number of complete oscillation in one second **increase**, Frequency **increase**

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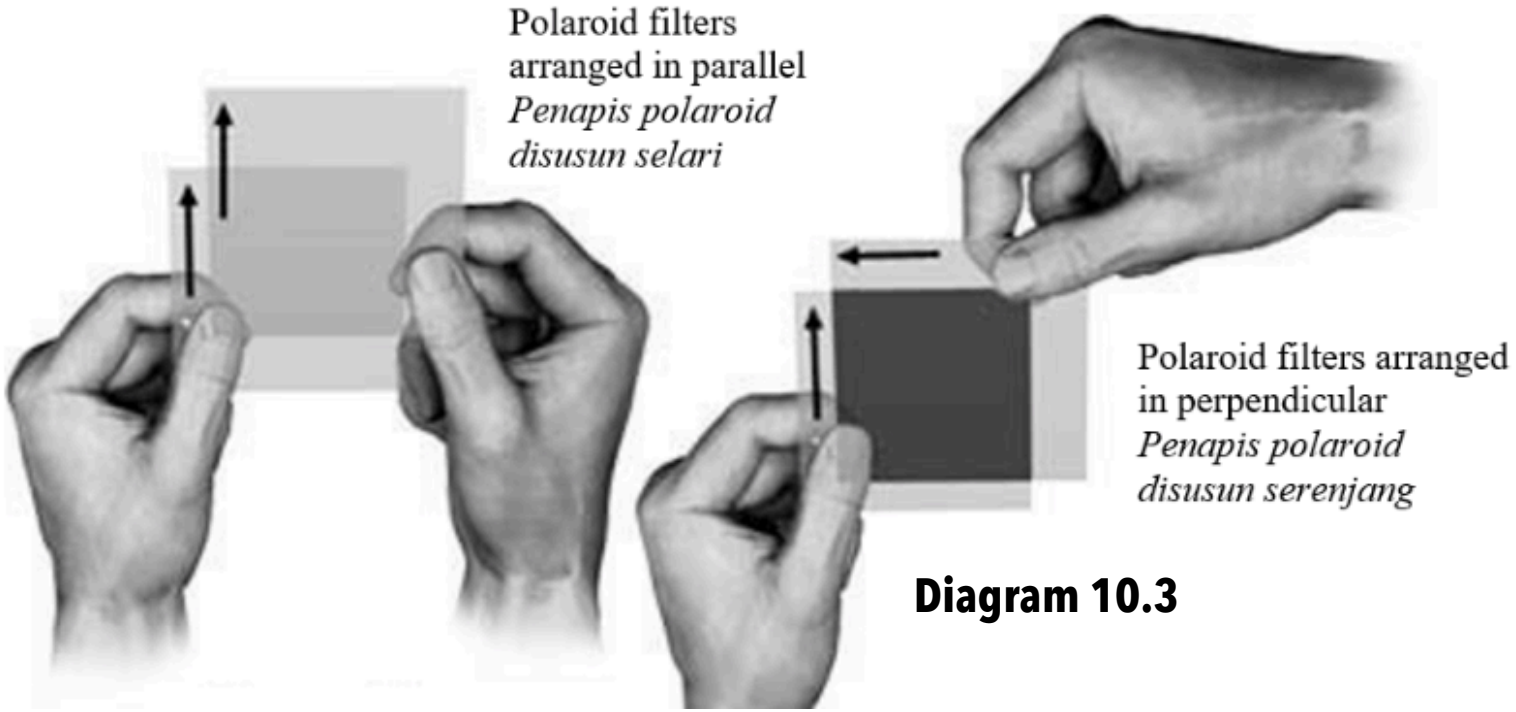

Diagram 10.3

Polaroid filter activity can prove that a wave is a transverse wave type.
Explain how polaroid filters prove that light waves are transverse waves?

- Light wave is an **electromagnetic wave**
- electromagnetic wave where **electric field** and the **magnetic fie**ld that oscillate **perpendicular** to each other
- When polaroid filters are arranged in a direction **parallel** : **One** component of the field is **allowed through the polaroid filter**.
- When two polaroid filters are arranged **perpendicular**:
  Both field components are **not allowed** through the polaroid filter.

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A plane digital TV signal receiver dish has been placed at the location as shown in Diagram 10.4. Found that the TV broadcasts are not well received.

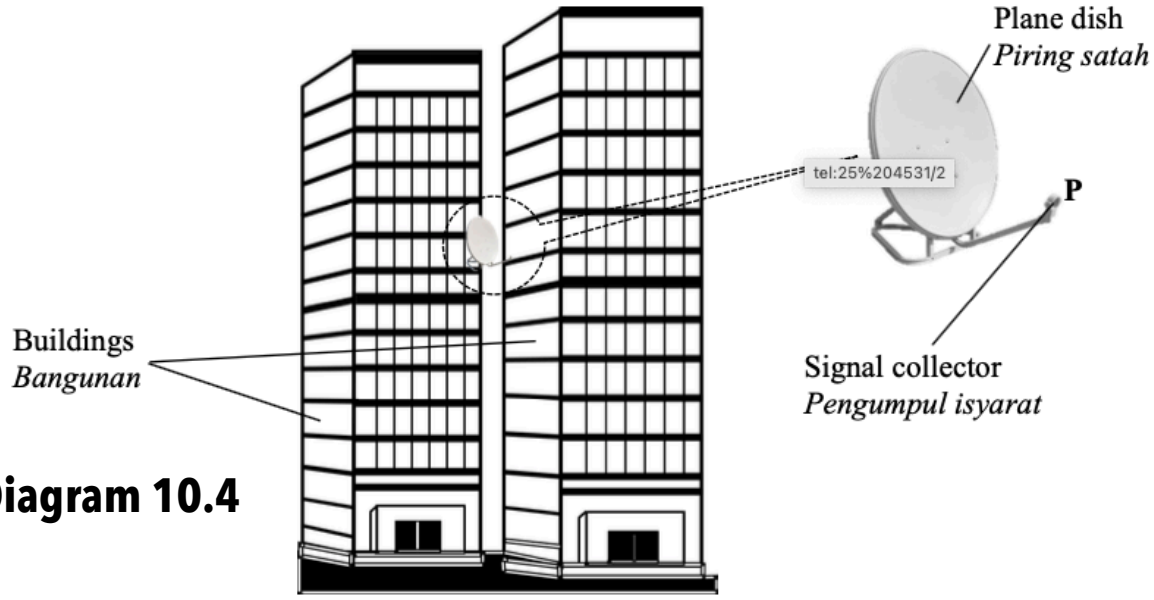

Diagram 10.4

You as a broadcasting engineer are required to modify the design of the signal receiver so that the reception of the wave signal is excellent. State and explain the modification based on the characteristics of the dish, location of the dish and position of the signal collector, **P**, as appropriate.

Characteristics	Reason
Concave dish	Reflects wave signals to a focal point
Larger diameter	Receives and reflects many wave signals
Higher location	So that the plate can receive wave signals without obstruction // Wide receiving range // less obstacle
The plate is directed towards the satellite	To overcome damping // to amplify signal // Receive wave signals abundantly and loudly
P at the focal point of the concave reflector	Receive the strongest reflected wave signal // signal will be focused

PART 2: ESSAY B

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Diagram 10.1 and Diagram 10.2 show traces of sound waves on screen of cathode ray oscilloscope (C.R.O.) when different thickness of guitar strings are plucked with same displacements. The sound waves heard has different pitch.

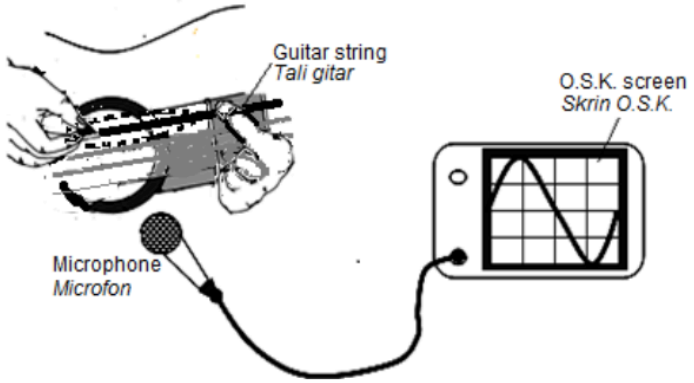


Diagram 10.1

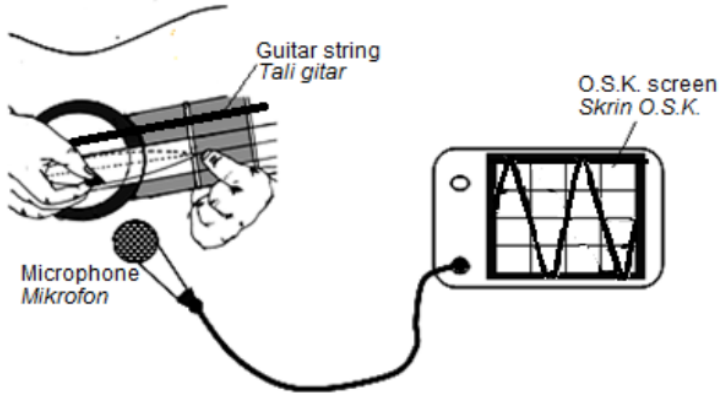


Diagram 10.2

(a) (i) State the physical quantity that affects the pitch of the sound. Frequency

(ii) By using Diagram 10.1 and Diagram 10.2, compare the thickness of the guitar strings plucked, the amplitude of traces on the C.R.O. screen produced and the frequency of traces on the C.R.O. screen produced.

Characteristics	Diagram 10.1	Diagram 10.2
Thickness of guitar string	thick	thin
period	higher	lower
frequency	lower	higher

Relate the thickness of the guitar strings plucked to the frequency of sound wave produced.

Thickness increase, Frequency decrease

Relate the frequency of sound wave produced to the pitch of sound.

Frequency increase, pitch increase

(b) Diagram 10.3 shows an audio frequency generator connected to a speaker and placed near the corner of a wall.

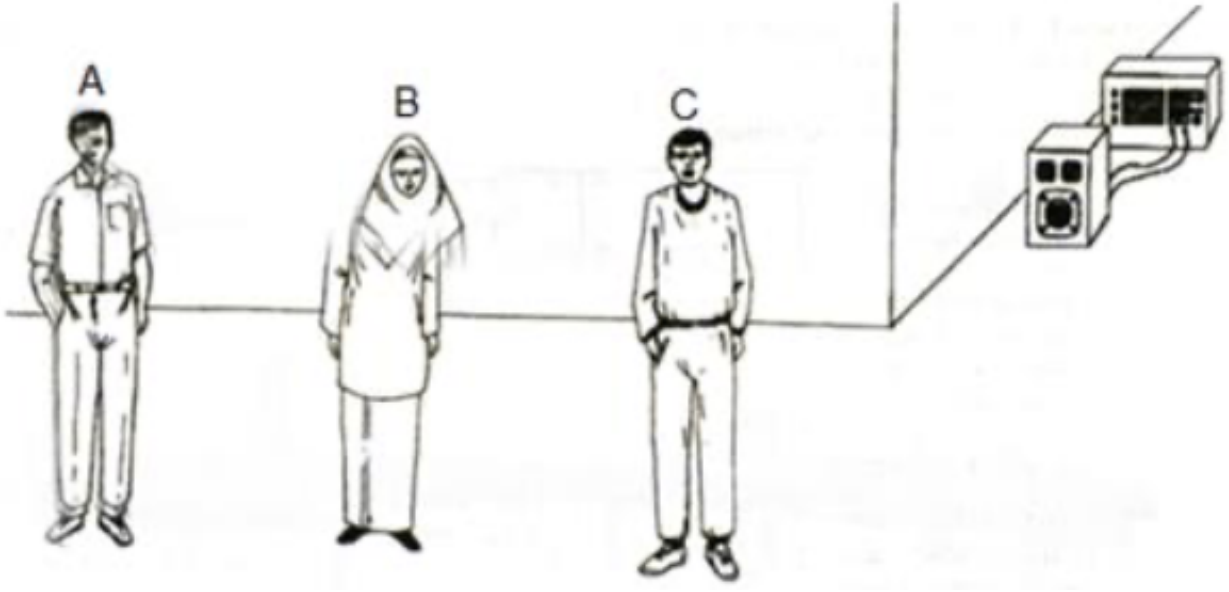


Diagram 10.3

Three students, A, B and C, are standing around the next corner. The generator and speaker can produce sound with the same speed but different pitch.

- **High pitch** sound has **high frequency** so that the **wavelength** is **shorter**.
- **Less diffraction** of sound wave occur / **sound wave spread less**
- **Low pitch** sound has **low frequency** so that the **wavelength is longer**
- **More diffraction** of sound wave occur / sound wave spread more

When a high pitch sound is generated, only student C can hear the sound clearly. When a low pitch sound is generated, all the three students can hear the sound clearly. Explain this situation.

(c) Diagram 10.4 shows a stage of your school hall that has a poor quality of sound, will be used for a singing competition.

Diagram 10.4

You are assigned to modify the school hall to be used for the singing competition. Suggest and explain how to modify the sound system of the school hall that can produce a better quality of sound based on the following aspects:

(i) the material of the wall and floor of the hall
(ii) the distance and the location of the two loudspeakers
(iii) the shape of surface of hard wall

Characteristics	Reason
Soft board to the wall	Reduce reflection of sound wave // To absorb sound
Put carpets on the floor	To absorb sound // Reduce reflection of sound wave
Longer distance of the loud speakers	More loud sounds / constructive interference points produced // Distance x shorter
High position of the loud speakers	No barrier // no obstacle / no blocking
Grooved surface of wall // acoustics wall // hollow walls	To reflects sound waves to the audiences widely

PART 2: ESSAY C

TRIAL MELAKA 2020

Diagram 12.1 shows a Barton's pendulum which consist of six pendulums tied to a horizontal string. When X is displaced and released, it will oscillate with its natural frequency.

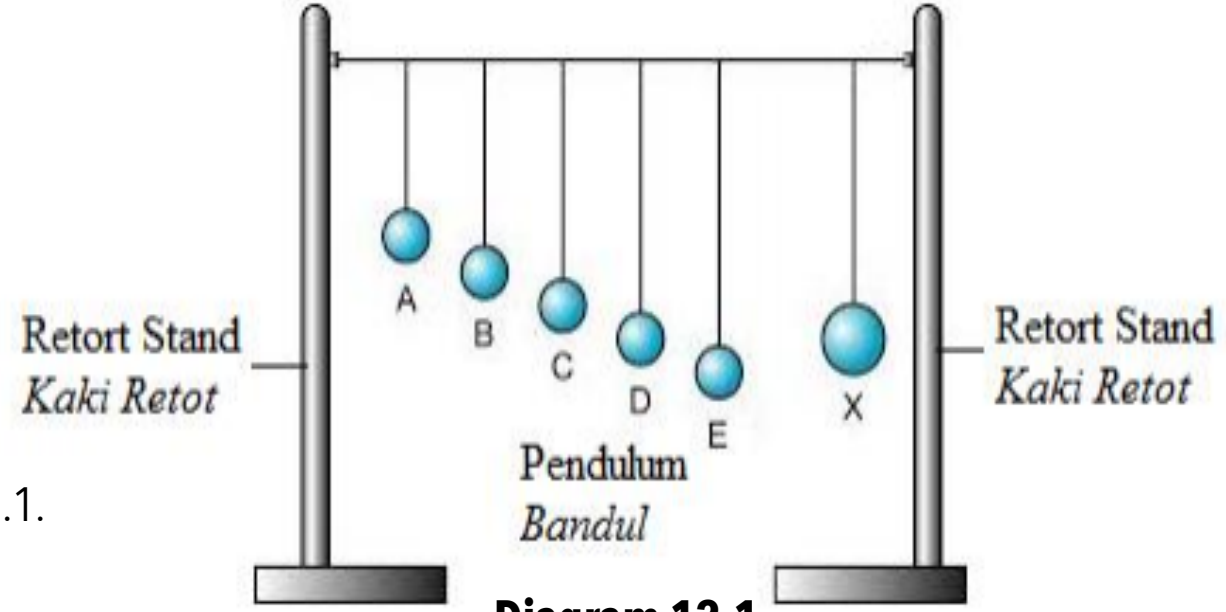


Diagram 12.1

(a) What is the meaning of frequency?

Number of oscillation / vibration made in one second

(b) Explain how the phenomenon of resonance occur in Diagram 12.1.

- Force oscillation at X
- Wave transfer energy equally through the string to all pendulum
- Pendulum B will oscillate with maximum amplitude
- Because the natural frequency of B is the same as natural frequency of X // length pendulum X is equal to the length of pendulum B
- Resonance occurred

Natural frequency: Frequency of any oscillating system in the absence of any other forces.

TRIAL MELAKA 2020

Diagram 12.2 shows a radar system at an airport. Signals are transmitted from the radar system to determine the position of an aero plane.

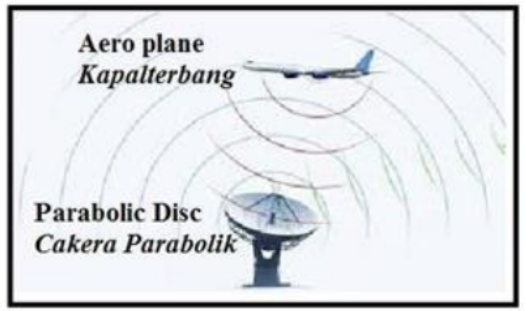


Diagram 12.2

Table 12 shows the features of four radar systems, P, Q, R and S.

Type of radar system	Diameter of parabolic disc	Type of wave transmitted	Distance of the signal receiver from the parabolic dish	Height of the parabolic dish
P	10	Radio wave	Same as focal length	Low
Q	3	Microwave	Less than focal length	High
R	9	Microwave	Same as focal length	High
S	5	Radio wave	More than focal length	Low

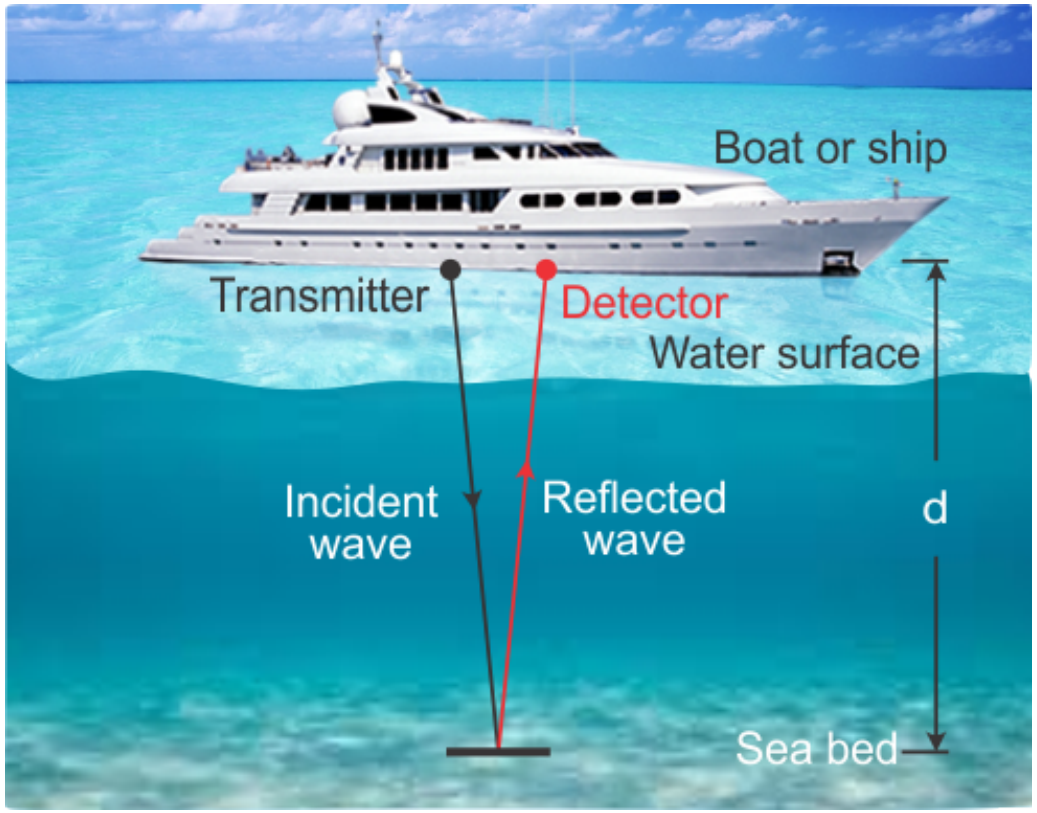
Table 12

Study the specifications of all the four radar systems.
Explain the suitability of each specification of the radar systems and determine the most suitable radar systems to be used to determine the position of an aero plane.

Characteristics	Reason
Diameter of parabolic disc BIG	Receives and reflects many wave signals
Microwave	High frequency // High energy
The distance between signal receiver and parabolic disc Same as focal length	Receive the strongest reflected wave signal // Signals are focused at the receiver
Height of the parabolic dish HIGH	No blockage
R	Diameter of parabolic disc: BIG Microwave The distance between signal receiver and parabolic disc: Same as focal length Height of the parabolic dish: HIGH

TRIAL MELAKA 2020

Ultrasonic waves are transmitted from a ship to the sea-bed to determine the depth of the sea. The frequency of the ultrasonic waves transmitted is 25 kHz. It travels at a speed of 1 500 m s^{-1} in sea water. The detector on the ship receives the echoes of the ultrasonic waves 0.12 s after the waves are transmitted



Calculate:

(i) the depth of the sea

$$s = \frac{vt}{2}$$

$$s = \frac{(1\,500)(0.12)}{2} = \mathbf{90\ m}$$

(ii) the wavelength of the ultrasonic waves in sea water

$$v = f\lambda$$

$$\lambda = \frac{v}{f} = \frac{1\,500}{25\,000} = \mathbf{0.06\ m}$$

PART 2: ESSAY C

TRIAL KELANTAN 2020

Diagram 12.1 shows a radar transmitting a microwave signal at an airport. A microwave is a type of transverse waves which emitted to determine the position of an aeroplane.

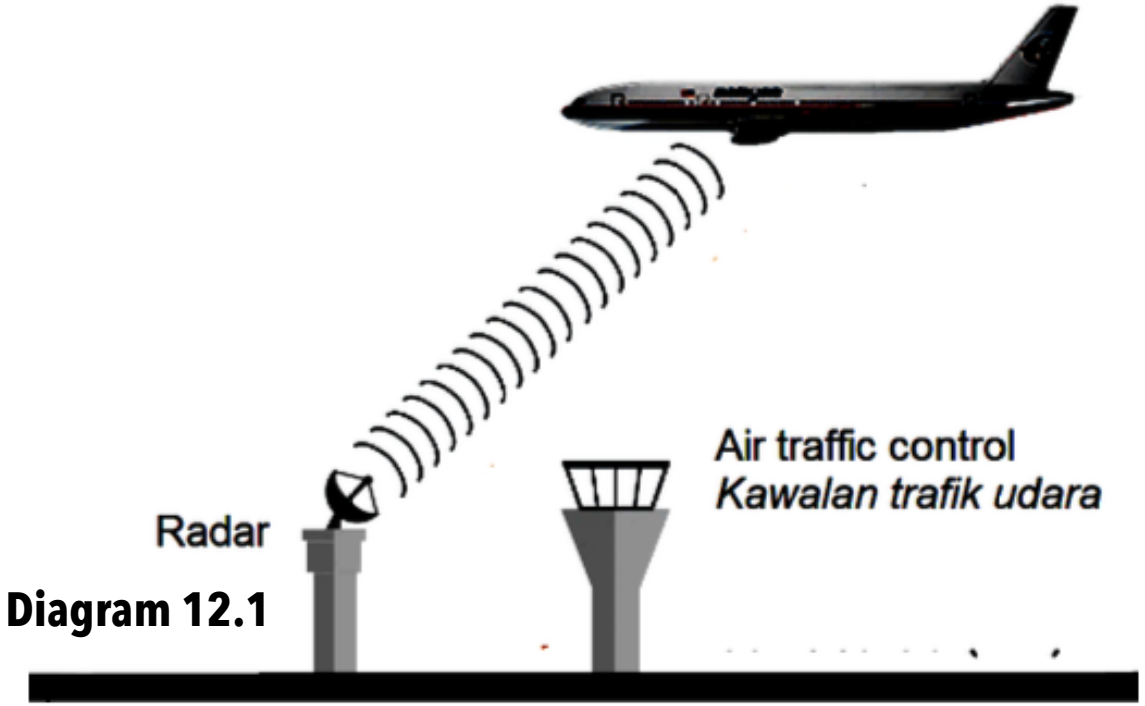


Diagram 12.1

(a) What is meant by transverse waves?

A transverse wave is a wave in which matter / medium particles move **perpendicular** to the direction of wave propagation.

(b) Explain how the position of the aeroplane can be determined.

- Radar send signal to the aeroplane
- The signal reflected from the aeroplane
- Receiver on the radar capture signal.
- Data displayed the position of the aeroplane is calculated by using formula: $s = \frac{vt}{2}$

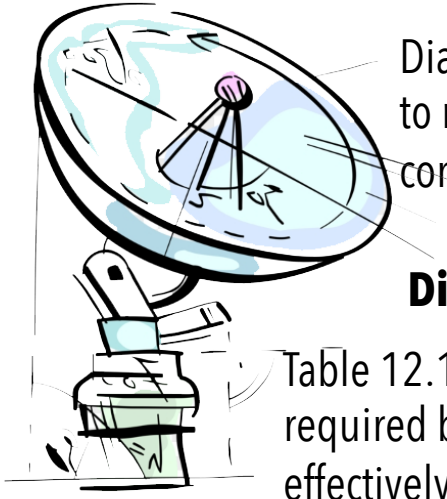


Diagram 12.2 shows a parabolic disc used to receive wave signal transmitted by the communication satellites.

Diagram 12.2

Table 12.1 shows four type of satellite disc P, Q, R and S required by satellite tv systems to receive wave signals effectively.

Parabolic disc	Frequency and waves energy	Diffraction of waves	The distance between signal receiver and parabolic disc	Diameter of parabolic disc
P	Low	High	Same as focal length	Small
Q	High	High	Same as focal length	Big
R	Low	Low	Less than focal length	Big
S	High	Low	Less than focal length	Small

Table 12.1

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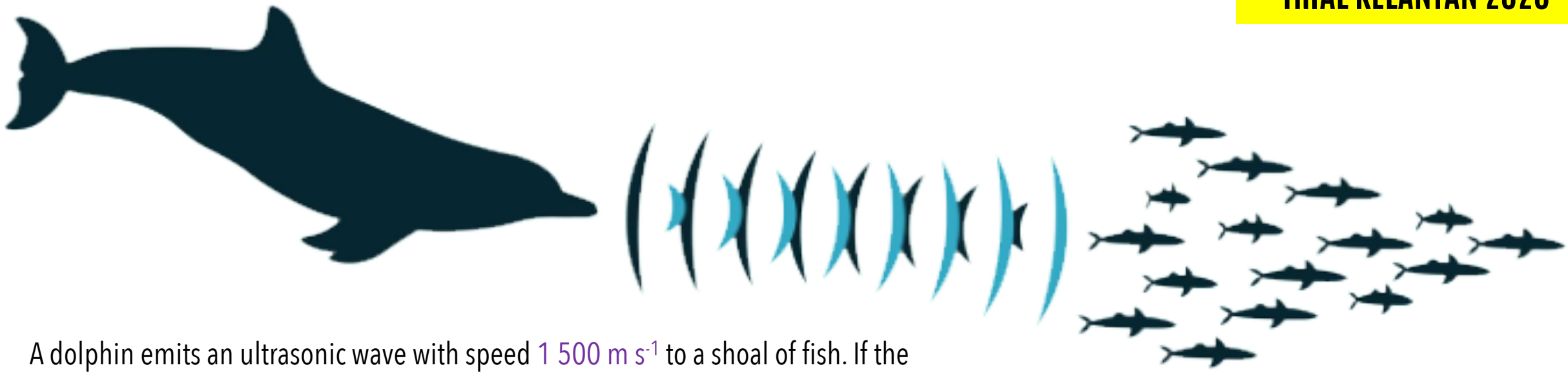
Characteristics	Reason
Frequency and waves energy HIGH	shorter wavelength // easy to reflected
Diffraction of waves HIGH	Easy to overcome obstacles such as buildings and hills
The distance between signal receiver and parabolic disc Same as focal length	Receive the strongest reflected wave signal // signal will be focused
Diameter of parabolic disc BIG	Receives and reflects many wave signals
Q	Frequency and waves energy: HIGH Diffraction of waves: HIGH The distance between signal receiver and parabolic disc: Same as focal length Diameter of parabolic disc: BIG



A dolphin emits an ultrasonic wave with speed 1 500 m s^{-1} to a shoal of fish. If the frequency of the ultrasonic wave is 120 kHz, calculate;

(i) the wavelength of the ultrasonic wave in water

$$V = f\lambda$$

$$\lambda = \frac{v}{f} = \frac{1\,500}{120\,000} = \mathbf{0.0125\ m}$$

(ii) the distance between the dolphin and the shoal of fish when the echo returns after 50 milliseconds.

$$s = \frac{vt}{2}$$

$$s = \frac{(1\,500)(50\ x\ 10^{-3})}{2} = \mathbf{37.5\ m}$$

PART 2: ESSAY C

TRIAL WILAYAH PERSEKUTUAN 2020

Diagram 12.1 shows a Jetty of Pulau Indah for a small boat to park their boat.

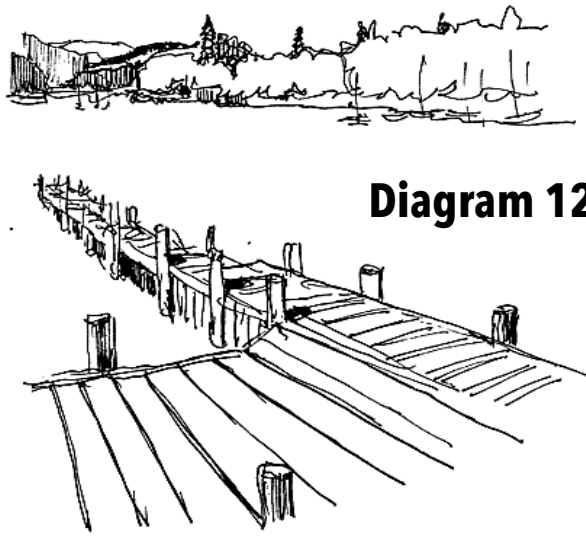


Diagram 12.1

(a) What type of wave is sea waves?

TRANSVERSE WAVE

(b) Explain the suitable characteristic to build a new jetty?

- Build at a bay : more calm
- Built with a high retaining wall with a small opening
- The opening gap will reduce an energy
- Big bottom of retaining wall to withstand a high pressure

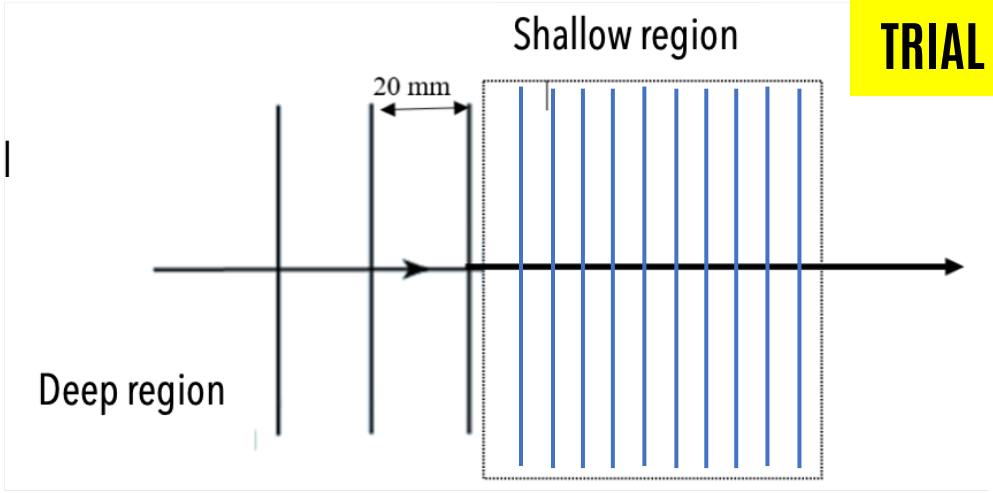


Diagram 12.2

(c) Diagram 12.2 show a refraction of water waves.

(i) Draw a wave pattern on Diagram 12.2.

(ii) If the speed of water waves at deep region is 30 ms $^{-1}$. Calculate the frequency of the water waves before it enters to shallow region.

$$v = f\lambda$$

$$f = \frac{v}{\lambda} = \frac{30}{20\ x\ 10^{-3}} = \mathbf{1\ 500\ Hz}$$

(iii) Determine the frequency of water waves after it enters to the shallow region.

$$f = \mathbf{1\ 500\ Hz}$$

(d) Fahim Entertainment wants to install a new communication system for digital broadcasting system. Based on the Table 12, choose the best system of communication satellite and station on the Earth.

Type of system	Type of waves transmitted	Frequency of waves (Hz)	Diameter of receiver	Location of transmitter and receiver
X	Microwave	1×10^{9}	Big	High
Y	Radio wave	1×10^{3}	Big	Low
Z	Infrared	1×10^{-7}	Small	High
R	Ultraviolet	1×10^{-4}	Small	Low

Table 12

Characteristics	Reason
Microwaves	Can penetrate at atmosphere
High frequencies	Have a high energy
Big diameter	Can reflect and receives more signal
High location	Reduce diffraction effect // No blockage
X	Microwaves High frequencies Big diameter High location

Amazing

PHYSICS

is around you

"Life isn't about finding yourself. Life is about **creating** yourself."

Follow the excellence,
the success will chase you!