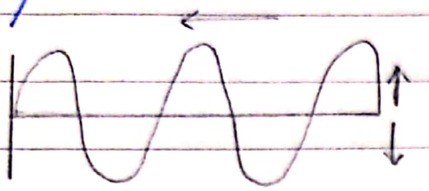
Date: 21/9/20

WAVES

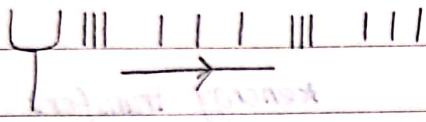
→ disturbance produced in a medium travelling in outward direction away from the source or mechanism by which transfer of energy occurs (without transfer of matter)

e.g/

1. 

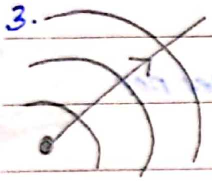
source : hand

disturbance in string

2. 

source : vibrating tuning fork

disturbance caused in air

3. 

source : stone/rock

disturbance caused in water

* particles vibrate
* waves travel (movement of energy in the form of vibrations)

TYPES OF WAVES

1. Mechanical Wave
2. Non-mechanical Wave

mechanical wave : a wave which requires a medium for its propagation

non-mechanical wave : a wave which does not require a medium for its propagation e.g/ electromagnetic waves (all)

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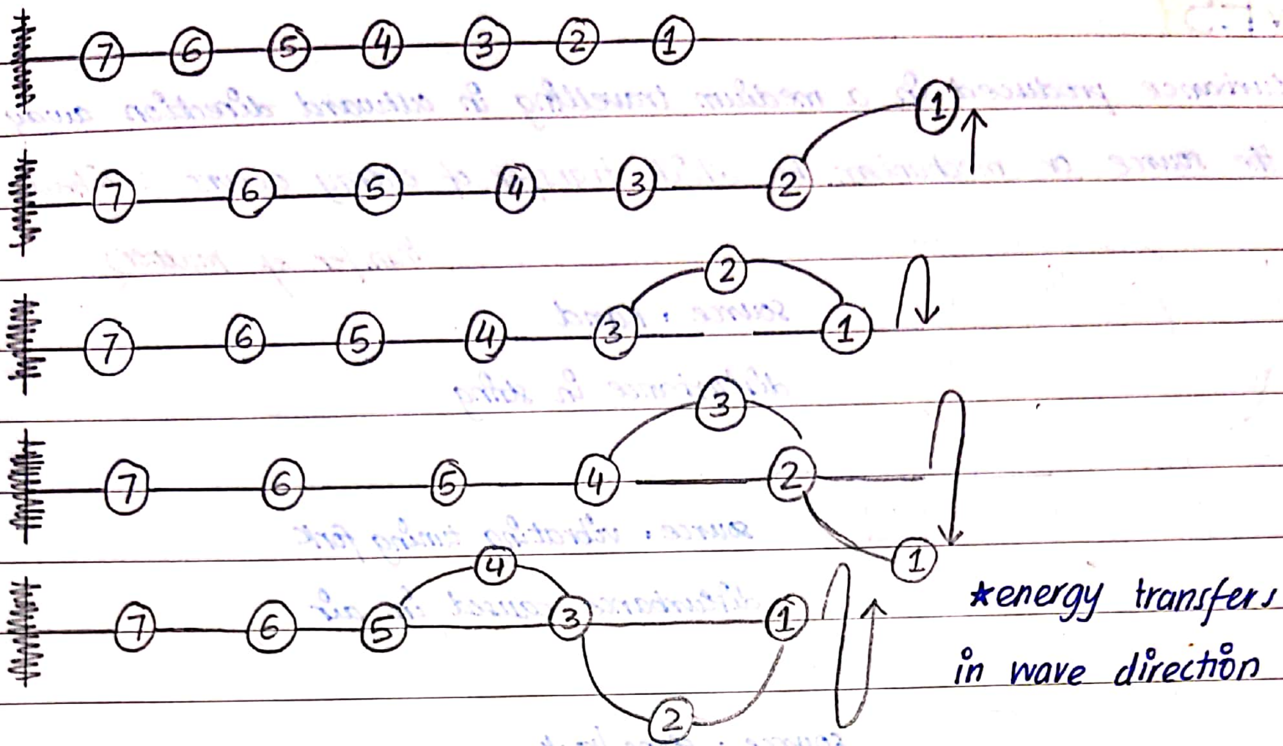

*. the particle oscillates/moves about in its own position, the particle does not move from its place

*. the only thing physically moving is the disturbance

transverse wave : a wave in which particles of medium oscillate in perpendicular direction with respect to direction of motion of wave
e.g/ string, water wave

longitudnal wave : a wave in which particles of medium oscillate in parallel direction with respect to direction of motion of wave
e.g/ sound wave, spring

6z 3s

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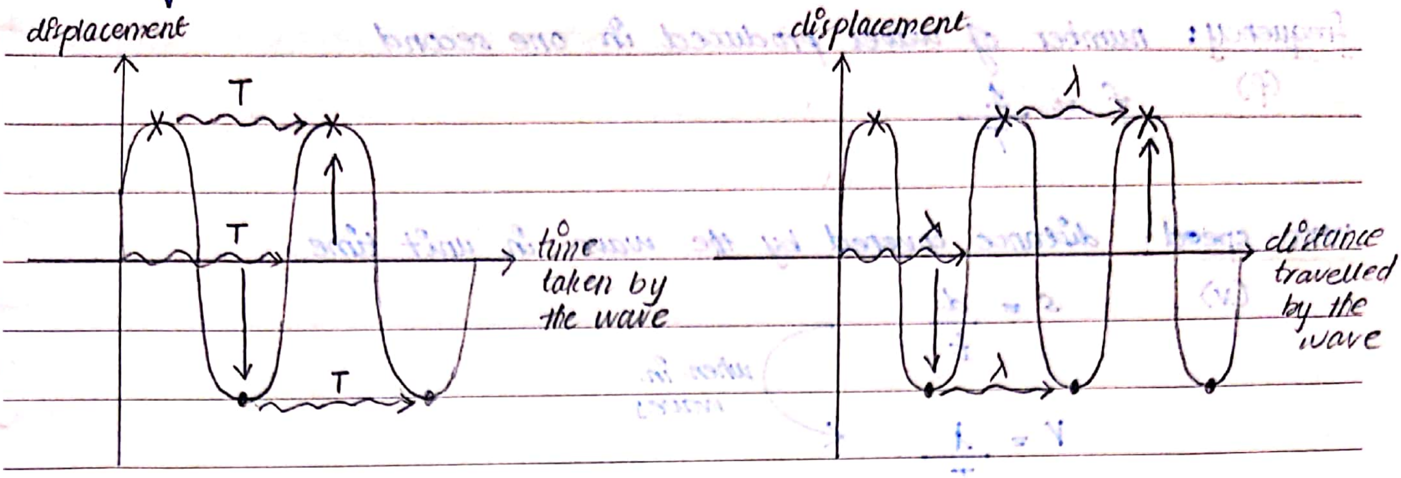

wave pattern : representation of a wave using displacement-time graph or displacement-distance graph

crest : highest point of the wave / a point which lies at the top of the wave

trough : lowest point of the wave / a point which lies at the bottom of the wave

oscillation : one complete cycle about a fixed point

amplitude : maximum displacement of the wave from mean position
displacement of crest or trough from the mean position ↑↓

wave length (λ) : shortest distance b/w two consecutive crests/troughs
distance travelled by one complete wave / in one time period
(can only be shown in a displacement-distance graph)

time period (T) : shortest time b/w two consecutive crests/troughs
time taken to form one complete wave / taken to complete 1 oscillation / oscillate once
(can only be shown in a displacement-time graph)

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frequency: number of waves produced in one second
(f)

$$f = \frac{1}{T}$$

wave speed: distance covered by the wave in unit time
(v)

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

when in waves

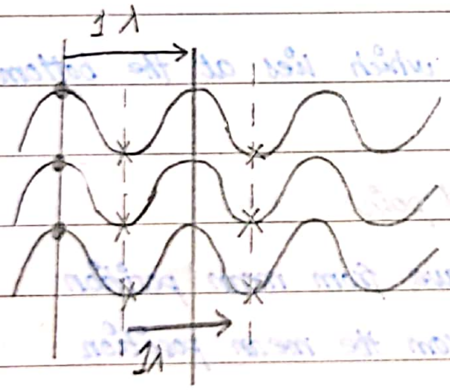
$$V = \frac{\lambda}{T}$$

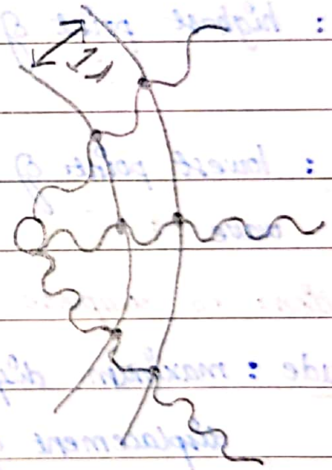
$$V = \lambda \times \frac{1}{T}$$

$V = \lambda f$ or

$$V = \frac{\lambda}{T}$$

wavefronts





Wave front: a surface joining the position of all the crests or all the troughs that are in phase / all identical points in a wave

distance b/w two wavefronts (consecutive) is equal to the wavelength of the wave

in phase: the points on a wave if they are at the same displacement and moving in the same direction

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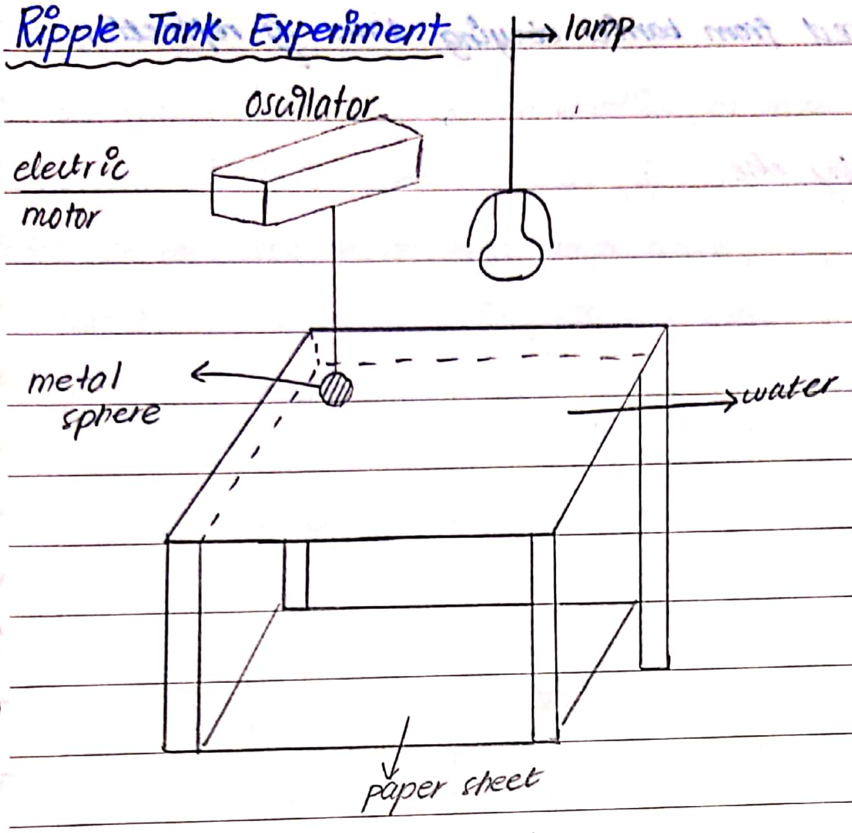
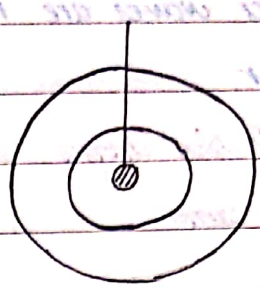
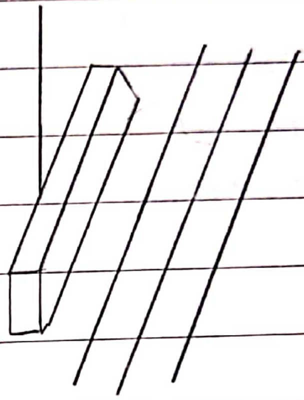
Ripple Tank Experiment







Ripple Tank Experiment is used to produce wave on the surface of water and is used to study the properties of wave produced on the surface of water.

* to find speed use, $v = f\lambda$
↳ frequency of electric motor will be used

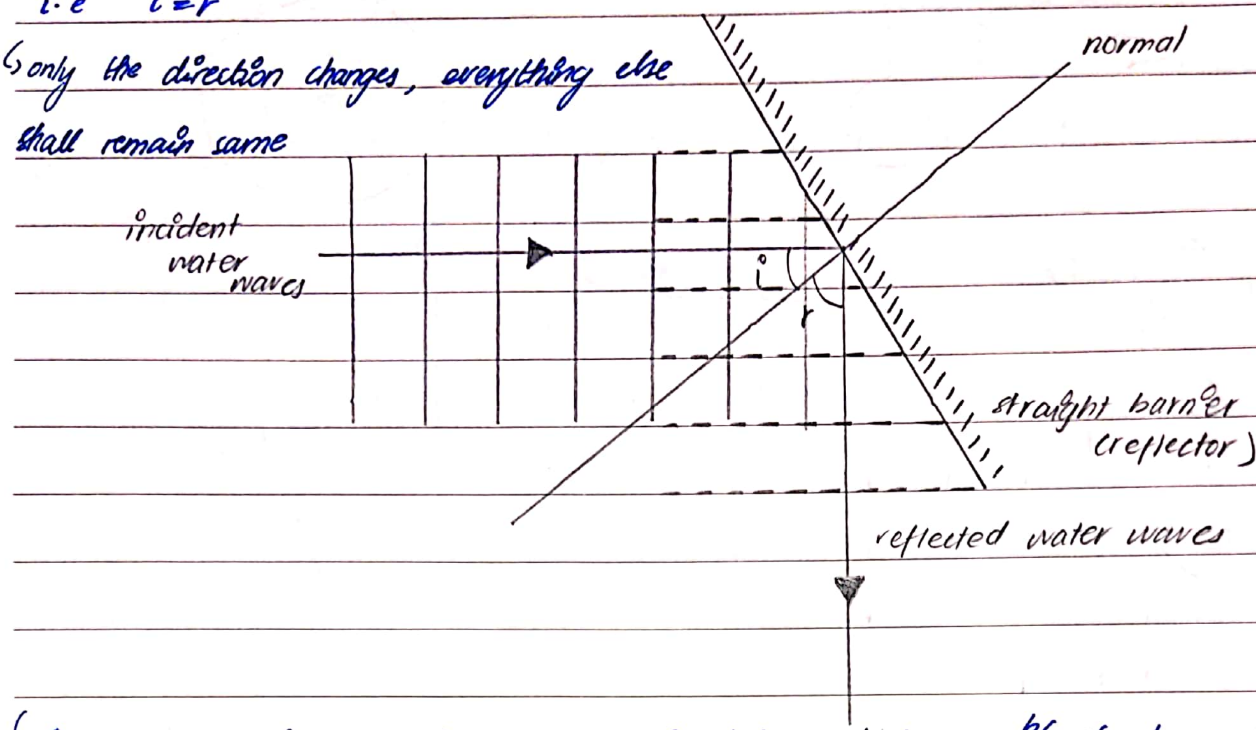
a). To study that water waves are transverse
→ keep the piece of paper on the surface of the water in the tank
→ produce water waves with vibrator, the paper vibrates up and down on its fixed position showing that the waves are transverse

b). To study reflection of water waves
→ place a straight barrier upright in water and produce water waves with a vibrator

Date:

→ the water waves are reflected from barrier obeying laws of reflection
i.e $i = r$

↳ only the direction changes, everything else shall remain same



↳ when enters at 90°, nothing happens to direction but speed changes b/c of change in medium.

c) To study refraction of waves ↓↓ part of this

→ first make water deep and shallow by keeping glass block inside tank

→ when water waves enter from deep → shallow water:

↳ frequency remains the same (b/c the source is the same)

↳ wavelength decreases

↳ speed decreases

→ calculate the refractive index ∴ $n = \frac{\lambda_1}{\lambda_2} = \frac{V_1}{V_2}$

(V is speed is deep & shallow water)

→ speed of wave is ↑ in deep water and ↓ in shallow water

↳ ↑ wavelength in deep water, ↓ wavelength in shallow

↳ $v = f\lambda$, so v & λ are directly proportional
(f ↓ constant)

→ jahan speed ziada hogi wahan angle ziada hoga

Date: 23/9/20

SOUND

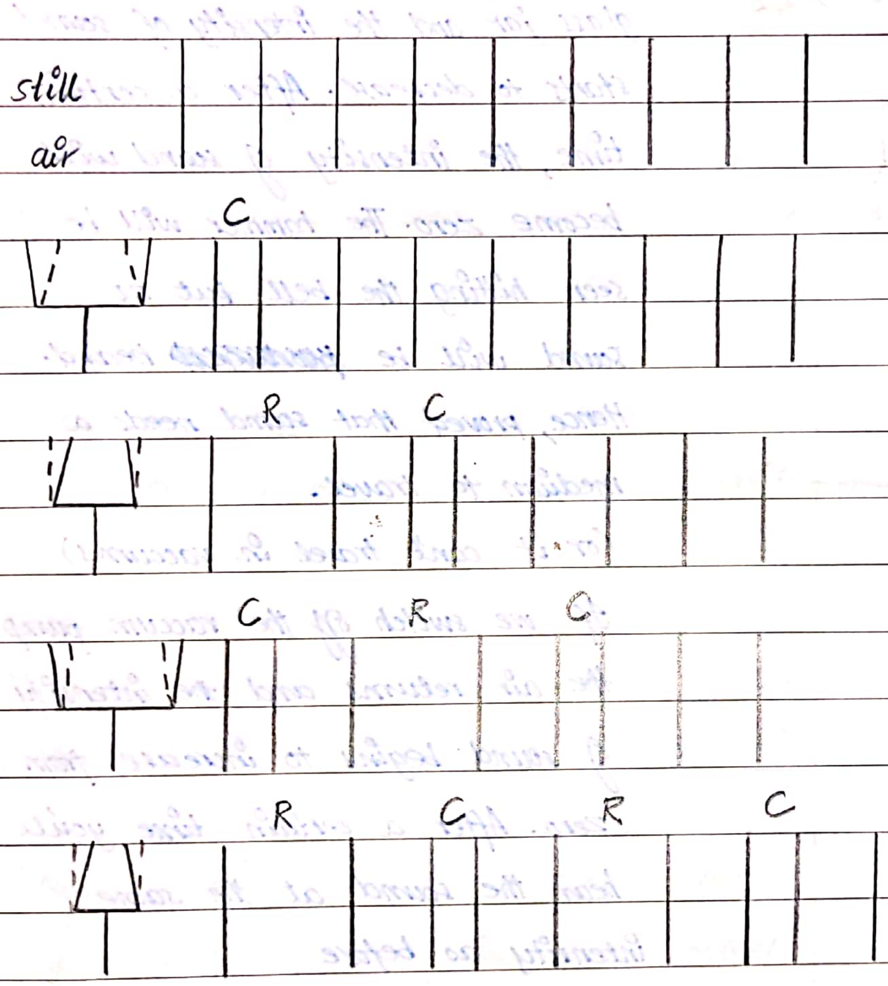
→ disturbance produced in the medium in form of compressions and rarefactions travelling in outward direction is called a sound wave

→ it is an example of longitudinal wave

→ can be produced in solids, liquids, gases

(sound is generally motion of compressions & rarefactions)

* all sound generating source have one part that vibrates



rarefaction : a region of low pressure in which particles of medium are forced apart from each other

compression : a region of high pressure in which particles of medium are close to each other

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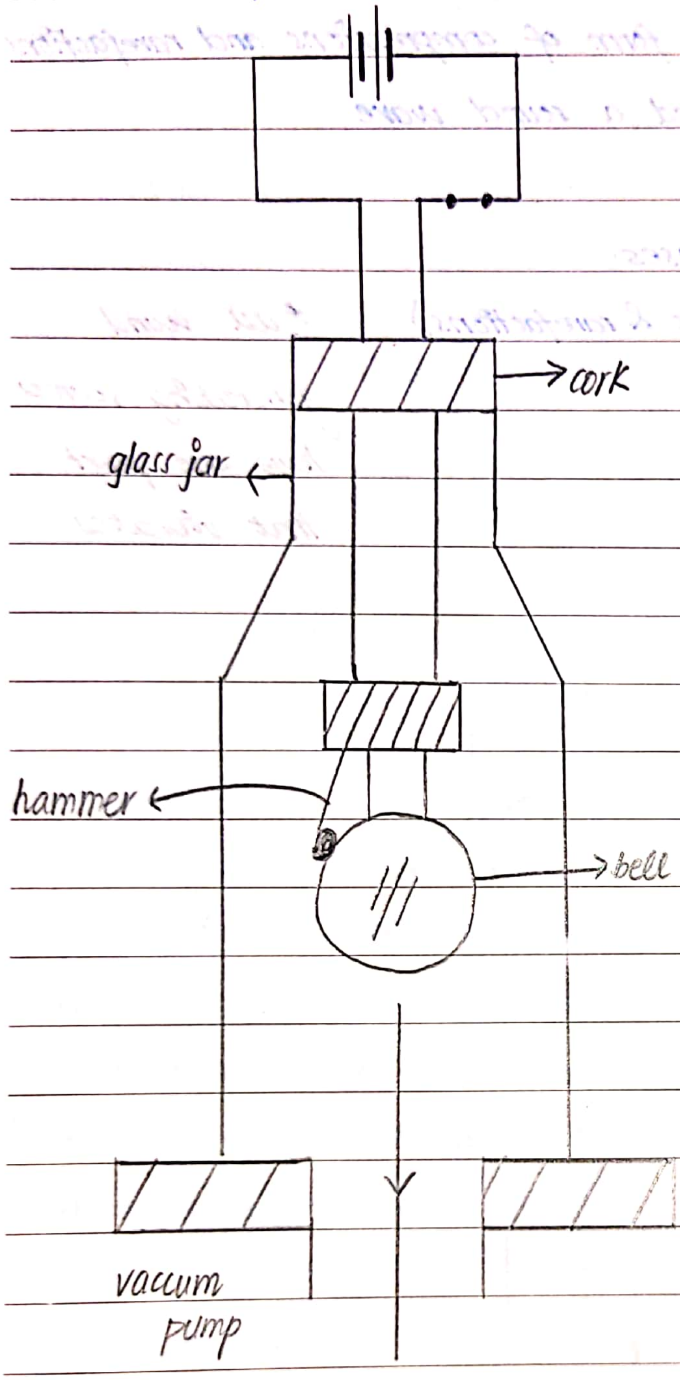
Bell Jar Experiment



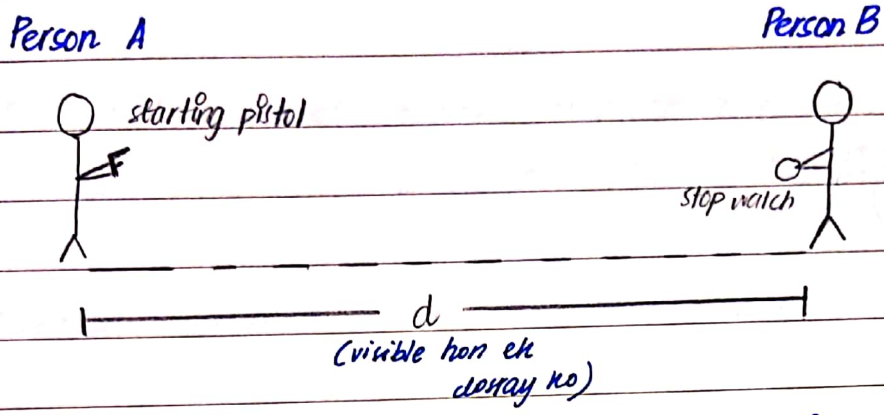
When we close the switch current passes through the hammer and it continuously hits the bell producing a sound. If we switch on the vacum pump, the air gradually leaves the glass jar and the intensity of sound starts to decrease. After a certain time, the intensity of sound will become zero. The hammer will be seen hitting the bell but no sound will be ~~produced~~ heard. Hence, proved that sound needs a medium to travel.
(or it can't travel in vaccums)
If we switch off the vaccum pump the air returns and the intensity of sound begins to increase from zero. After a certain time you'll hear the sound at the same intensity as before

→ we can use the vaccum pump both ways, to ~~sp~~ suck air from the glass jar or let air inside

→ the hitting of hammer could not produce a sound because there were no particles to be disturbed or to oscillate on their mean position

Date: 25/9/20

Determination of Speed of Sound in Air :



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

$s = \frac{800\,m}{2.4\,s}$

$s = 333\,m/s$

→ starting pistol produces a sound & a flash of light
→ light reaches person B before sound and they start the stop watch
→ after a few seconds second sound reaches person B and they stop the stopwatch
→ we use the formulae of speed to calculate speed of sound in air
(d = distance b/w the two persons)

(to avoid echo ↔) · large open field
· measuring tape
· sound source
· stopwatch

→ speed of sound = 333 m/s
→ it varies from 300 to 330 m/s because of temperature in air
↳ (density of air effects travel of sound) (↑ density = speed of sound)

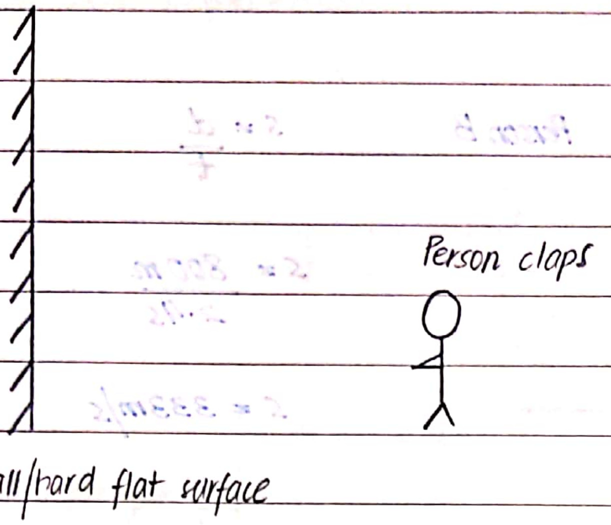
Medium	(all solids) Iron	Water	Air
Speed of Sound	5000 m/s	1500 m/s	300 m/s

particles closer ↑ together, vibrations jaldi pass hongi
solid > liquid > gas

speed of light = $3 \times 10^8\ m/s$

Scanned with CamScanner

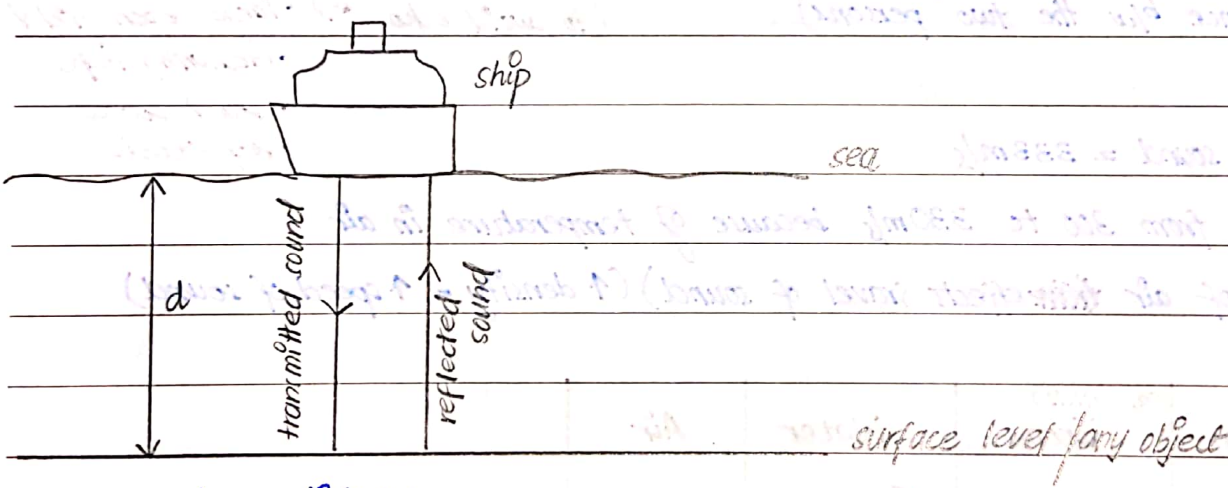
Date: 25/9/20



echo : hearing of reflected sound short after the actual sound is produced.

Uses of Echo:

→ determine depth below sea level → position of objects (echolocation)



$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

$$v = \frac{2d}{t}$$

$$\therefore d = \frac{vt}{2}$$

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reverberation: prolonging of sound due to the over-lapping echo with actual sound

→ to produce sound we need to place a vibrating object in a medium
→ frequency of vibrating object's vibration = frequency of sound

→ humans can hear sounds that have frequency 20Hz — 20,000 Hz

audible sound: a sound which can be heard by the human ear (20Hz – 20kHz)

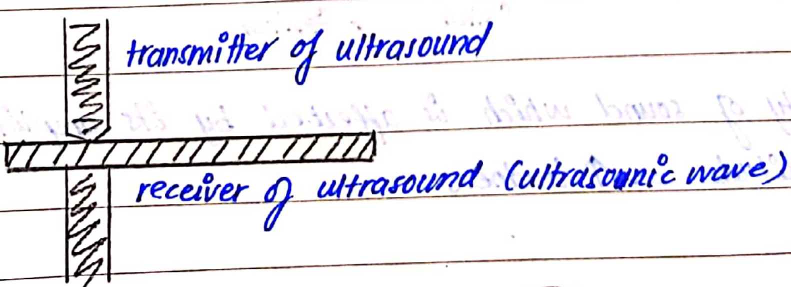
range of audibility: range of frequency of sound which can be heard by humans : 20Hz – 20,000 Hz

infra sound: sound with frequency less than 20Hz
e.g./ steel ruler (when hit with a surface & vibrates)

ultrasound: sound with frequency greater than 20kHz
e.g./ dog whistle

Uses of Ultrasound:

1. Quality / Thickness control
→ to check if an object has uniform/desired thickness or density



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→ uniform density : the wave passes

→ non-uniform density : completely or partly deflects

→ the receiver records intensity of the wave helping us to check whether the density of object is uniform or not

2. Cleaning of small objects

→ e.g/ jewellery

→ placed inside a cleaning liquid

→ ultrasound hits jewellery causing it oscillate with frequency of ultrasound (which is v.high btw)

→ the dirt is dusted off

3. Prenatal Scanning

→ to form a two-dimentional image of an unborn baby inside a mother's womb using ultrasound (ultrasound pulses are sent into body by means of transmitter and the echoes are reflected) (absorbed by soft surfaces and reflected by hard)

4. Depth below sea level

→ (refer to previous notes)

pitch of sound : a property of sound which is affected by its frequency

↑ frequency = ↑ pitch (shrill or grave)
↑ pitch ↓ pitch

loudness of sound : a property of sound which is affected by its amplitude

↑ amplitude = ↑ loudness

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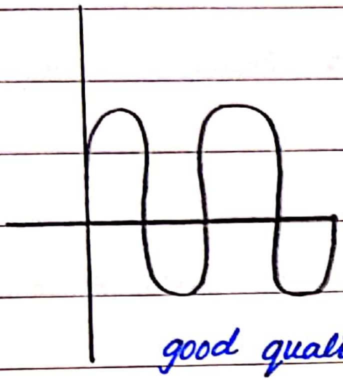
quality of sound (Timbre) : a property of sound which is affected by change in displacement of sound

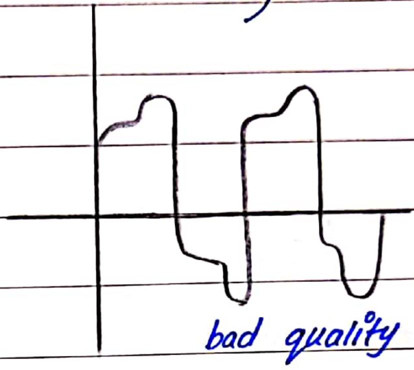
uniform change in displacement = good quality of sound

non-uniform change in displacement = bad quality of sound

(pitch & frequency are the same tho)



good quality



bad quality

Factors affecting speed of sound in air :

1. Temperature
2. Density
3. Humidity

} directly proportional

Factors affecting quality of sound :

1. Waveform of sound wave
2. Fundamental frequency of sound
3. Higher frequencies known as harmonics