

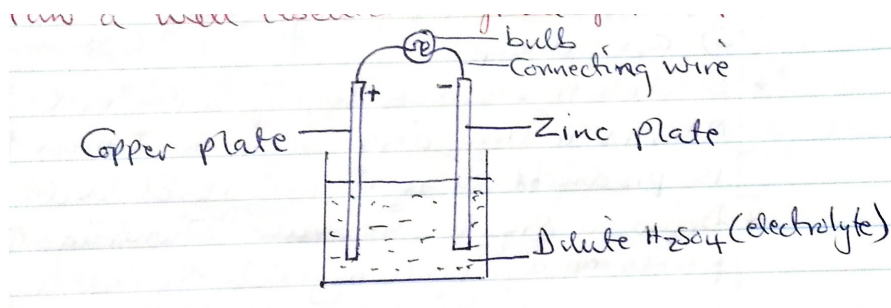
NSANGI SECONDARY SCHOOL

PHYSICS DEPARTMENT

REVISION NOTES

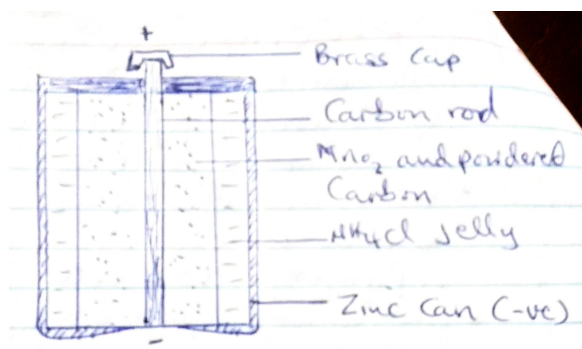
1.ELECTRIC CELLS

- An electric cell is a device that is capable of causing an electric current to flow through a circuit.
- Name and define the two types of electric cells, giving two examples of each.
 - (i) Primary cells- are cells that can not be recharged when used up. e.g., simple cells and dry cells.
 - (ii) Secondary cell- are cells that be recharged when used up. e.g., Lead acid accumulator (Battery), Nife cell.
- Draw a well labeled diagram of a simple cell.



- Name and define two defects of a simple cell.
 - (i) Polarization- Is the formation of hydrogen gas bubbles at the copper plate.
 - (ii) Local action- Is the formation of hydrogen gas bubbles at the Zinc plate due to impurities reacting with H_2SO_4 .
- State how each of the defects named above can be overcome.
 - ◇ Polarization is overcome by
 - (i) Use of a depolarizing agents like $KMnO_4$, MnO_2
 - (ii) Occasionally brushing off hydrogen gas bubbles from the copper plate.
 - ◇ Local action is overcome by
 - (i) Coating Zinc plate with mercury after cleaning it with conc. H_2SO_4 (amalgamation).
 - (ii) Using pure Zinc plate.

- Draw a well labeled diagram of a dry cell.



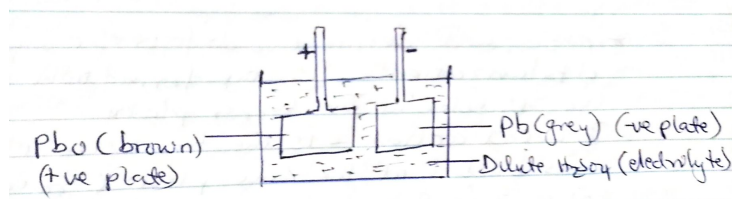
- State three advantages of dry cells.

- are portable
- Provide relatively high e.m.f
- are cheap.

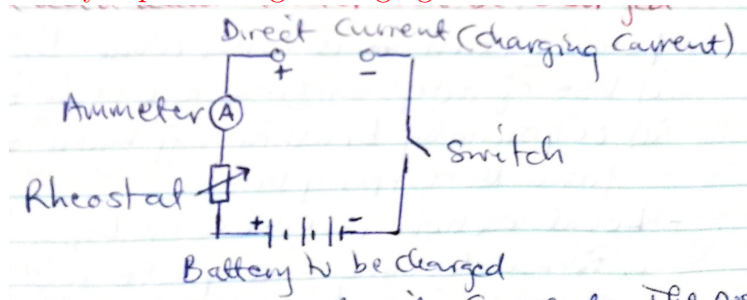
- State one disadvantage of a dry cell.

MnO_2 is a slow depolarizer and more hydrogen is produced than it can react with.

- Draw a simple cell diagram showing the essential parts of a secondary cell e.g., a battery.



- Briefly explain using a charging circuit how a lead acid accumulator can be charged.



It is charged using a direct current. the positive terminal of the direct current is connected to the positive terminal of the battery such that current in the battery flows in the reverse direction. The current is adjusted according to the specification and charging is allowed to slowly go on. Gassing (evolution of H_2 and O_2 gases at the -ve and +ve plates respectively) confirm that charging is complete.

- State four advantages of secondary cells

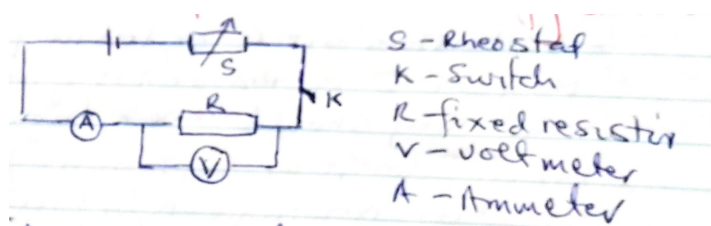
- Can be recharged
- last much longer

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- (iii) Supply a lot of e.m.f
 - (iv) Have low internal resistance
 - State the ways of prolonging the life of a lead acid cell (how to maintain it.)
 - (i) Should be charged regularly.
 - (ii) Liquid level must be maintained by use of distilled water.
 - (iii) Should be charged slowly.
 - (iv) Keep terminals clean
 - (v) Avoid shorting terminals
 - (vi) Avoid keeping battery on bare ground.
 - Name the two poles of a nife cell and state the electrolyte used.
 - (i) Nicked (ii) hydroxide (positive)
 - (ii) Iron (Fe) (negative)
 - (iii) KoH solution (electrolyte)
 - State the advantages of Nife cell over lead acid cells.
 - (i) It is more robust (active) than lead acid cell.
 - (ii) Has a longer life span.
 - (iii) Can remain in uncharged conditions for a much longer time.
 - (iv) Large current can be taken from it without much damage.
 - (v) The electrolyte does not need much attention.
 - Disadvantages of a Nife cell.
 - (i) Gives a lower e.m.f
 - (ii) The e.m.f falls continually on discharging.

2. ELECTRIC CURRENT

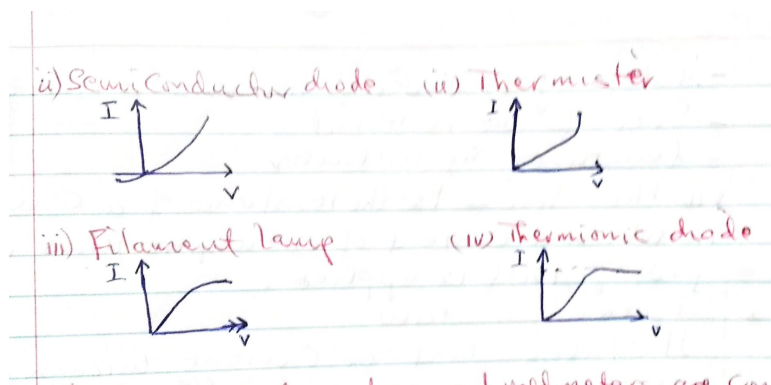
- Define the following terms, stating their basic units
 - (i) Current-
 - (ii) Ampere- Is the current which when flowing in two straight parallel wires of infinite length placed one meter apart in a vacuum produces on each of the wires a force of $2 \times 10^{-7} N$ per meter length.
 - (iii) Coulomb, C- Is the quantity of electricity which passes any point in the circuit when a steady current of one ampere flows for one second.
- State two factors on which the quantity of electricity passing any point in the circuit depends.
 - (i) Strength of the current, I .

- (ii) Time, t for which the current flows. i.e., $Q = It$
- (iv) **Potential difference (p.d)**- Is the work done to pass one coulomb of electricity across a resistor. (Units- Volts, V) **OR** - It is the work done in transferring one coulomb of electricity from one point to another in a circuit.
- (v) **Electromotive force (e.m.f)**- Is the total work done to pass one coulomb of electricity throughout the circuit including the cell itself.
OR It is the total energy required to move one coulomb of charge through a complete circuit.
OR- It is the voltage of a cell when it is not supplying any current. (Units- Volts, V)
- (vi) **Volt**- Is the p.d between two points when one joule of work is done in moving one coulomb of electricity from point to another.
- (vii) **Resistance, R**- Is the opposition to the flow of current. (Units-Ohms, Ω)
- **State three factors on which resistance of a conductor depends on.**
 - (i) Nature of the material from which it is made.
 - (ii) Size of the material
 - (iii) Length of the conductor
 - (vii) **The Ohm**- Is the resistance of a conductor in which a current of one ampere flows when a p.d. of one volt is applied.
 - **State Ohm's law**
It states that the current through a metallic conductor is directly proportional to the potential difference across its ends provided temperature and other physical factors are constant. (i.e. $V=IR$)
 - **Describe an experiment to verify Ohm's law.**



Procedure

- ◇ The circuit is connected as shown above, and the circuit is completed. The rheostat is adjusted so that the ammeter gives a suitable reading of the current I which is recorded.
- ◇ The corresponding value of p.d V read from the voltmeter is also recorded.
- ◇ The procedure is repeated for other suitable values of current I and their corresponding values of p.d, V .
- ◇ The results are tabulated in suitable table and a graph of V against I .
- **Draw sketch graphs of current against p.d for the following.**



- State how Ammeters and voltmeters are connected in a circuit and why they are connected in that way.

- ✓ Ammeters are connected in series- because they measure current flowing in the circuit hence should have a low resistance.
- ✓ Voltmeters are connected in Parallel- because they measure p.d across a given point in the circuit and they should have a high resistance.

- Write down the expression for calculating effective resistance R , for the three resistors in

(i) Series

$$R = R_1 + R_2 + R_3$$

(ii) Parallel

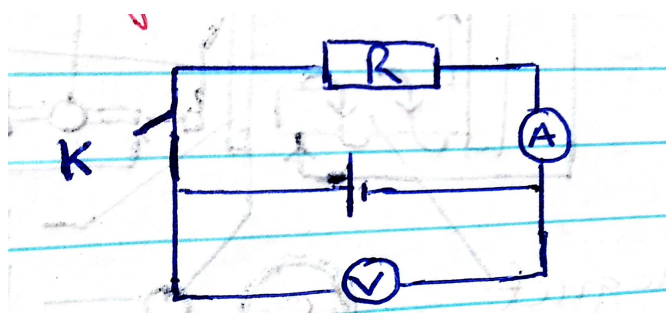
$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

- Derive an expression for effective resistance of two resistors in parallel.

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{R_1 + R_2}{R_1 R_2}$$

$$R = \frac{R_1 R_2}{R_1 + R_2} = \frac{\text{Product}}{\text{Sum}}$$

- Define internal resistance of a cell. This is the opposition to the flow of current provided by the cell its self.
- Describe an experiment to determine the internal resistance of a cell.



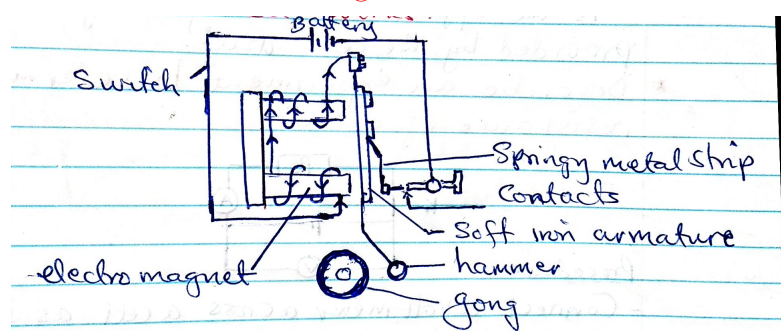
Procedure

- ◇ Connect a voltmeter across a cell as shown in the circuit above and record its reading E .

- ◇ Connect an external resistor R and an ammeter A . close the switch k , note and record the voltmeter reading V and ammeter reading I .
- ◇ Obtain the internal resistance r , of the cell from $r = \frac{E-V}{I}$

3. ELECTROMAGNETS

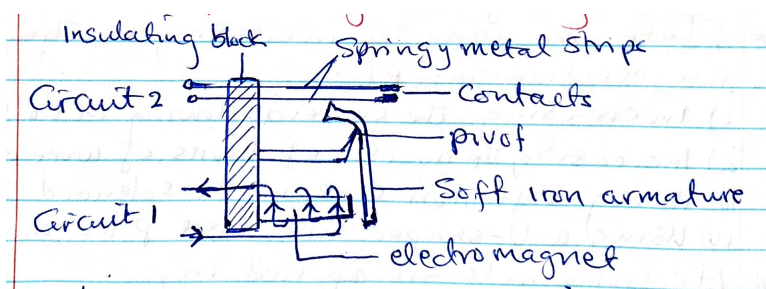
- **Define an electromagnet.** It is a piece of soft iron that becomes magnetized when an electric current passes through the coil surrounding it.
- **State the properties of electromagnets**
 - (i) They are temporally magnets.
 - (ii) They are made of soft magnetic materials like iron.
 - (iii) They are stronger than permanent magnets.
- **State ways of increasing the strength of an electromagnet.**
 - (i) Increasing the current flowing in the solenoid.
 - (ii) Increasing the number of turns of the wire on the solenoid.
 - (iii) Using soft iron core in the solenoid.
 - (iv) Using a U-shaped core where poles are closer.
- **State the applications of electromagnets**
 - Electric bells
 - Magnetic relay switch
 - Telephone receiver.
- **With aid of a labeled diagram describe how the electric bell works**



How it works

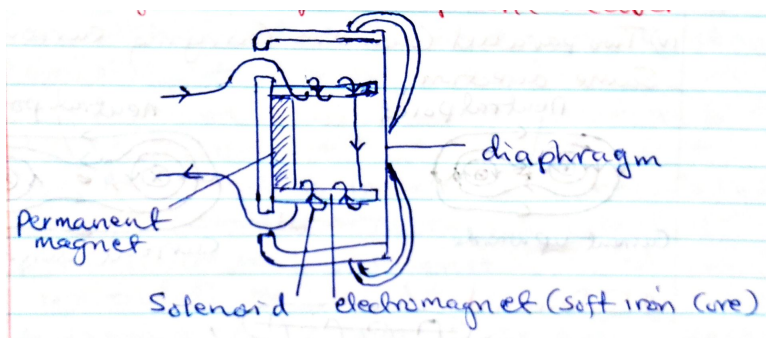
When the switch is closed, currents flows. The electromagnet becomes magnetized and attracts the soft iron armature which is which pulls the hammer to strike the gong and sound is produced. The circuit is broken and current stops flowing and the electromagnet losses its magnetism. The spring pulls back the armature and connects again and the electromagnet regains its magnetism. The armature is pulled and the hammer hits the gong again. The cycle repeats and the bell rings continuously.

- With aid of a labeled diagram describe the mode of action of a magnetic relay switch.



A small current in the circuit, I magnetizes the soft iron core which attracts the soft iron armature. This turns about a pivot, closing the contacts and switching on circuit 2 of the large current. In this way a low voltage supply circuit (safe) controls a high voltage supply circuit (dangerous). When circuit 1 is switched off, the soft iron core losses the magnetism and releases the armature. The springy metal current in the circuit 2 is switched off.

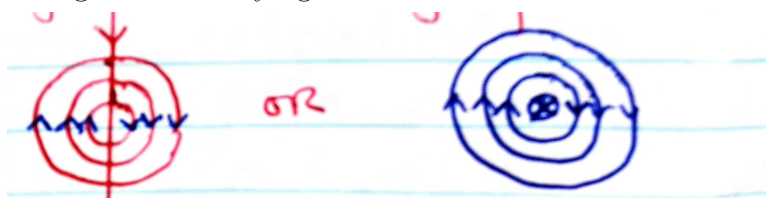
- With aid of a labeled diagram describe the mode of action of a telephone receiver



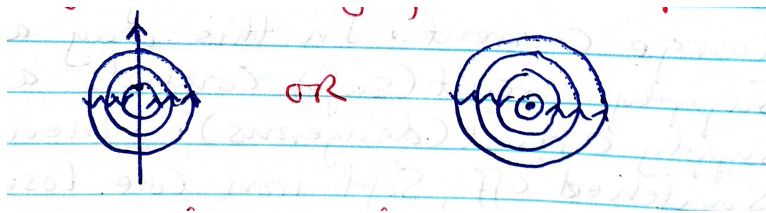
The person at the other end speaks into the mouth piece, causing a varying electric current similar in frequency to the sound waves produced. A similar electric current flows through the coil which magnetizes the soft iron core with varying magnetic strength. This cause the corresponding variation in the pull of the diaphragm. The diaphragm vibrates and produces the sound which is a replica (photocopy) of the sound produced by the the person at the other end.

- Sketch the magnetic field patterns due to the following

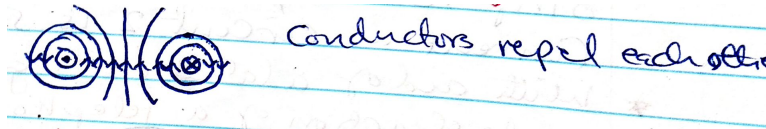
(i) Straight wire carrying current down wards.



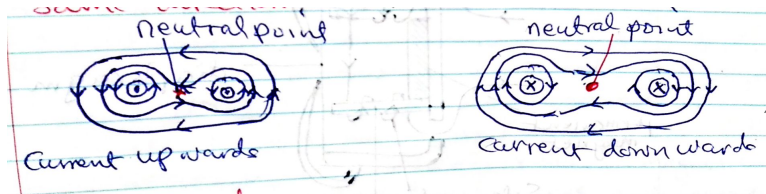
(ii) Straight wire carrying current upwards.



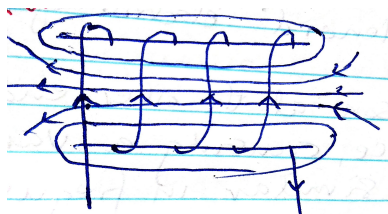
(iii) Two parallel conductors carrying current in opposite directions.



(iv) Two parallel conductors carrying current in same direction.



(v) Solenoid.



4. ELECTROMAGNETIC INDUCTION

- **What is meant by electromagnetic induction?**

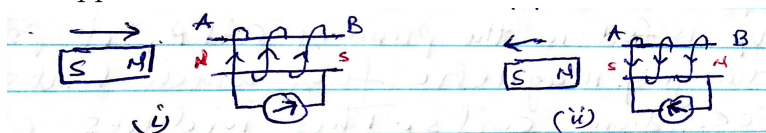
This is the process by which an e.m.f is induced in a circuit due to change in the magnetic flux linked to the circuit.

- **State the laws of electromagnetic induction.**

- **Faraday's law**- It states that the magnitude of an induced e.m.f in a conductor is directly proportional to the rate at which it cuts the magnetic field lines.
- **Lenz's Law**- It states that the induced e.m.f is in such a direction as to oppose the change causing it.

- **Describe an experiment to demonstrate Lenz's Law.**

- A solenoid is wound and then connected to a galvanometer. One known pole of a permanent bar magnet is moved towards one end of the solenoid.
- **Observation**- The pointer of the galvanometer is seen to deflect in one direction. When the magnet is being moved away the galvanometer is seen to deflect in the opposite direction.



- **Conclusion** - In (i) induced emf/current flows to make end A a N-pole to oppose the movement of the magnet.
-In (ii) the induced emf/current flows to make end A a S-pole to oppose the movement off the magnet.

- **State three ways of increasing the emf induced in a coil/solenoid.**

- Increasing the strength of the magnetic field (using strong magnet).
- Increasing the speed of movement of the magnet.
- Increasing the number of turns of the coil.

- **State three factors on which emf induced in a coil depends on**

- Strength of the magnetic field.
- Speed of movement of the coil.
- Number of turns of the coil.

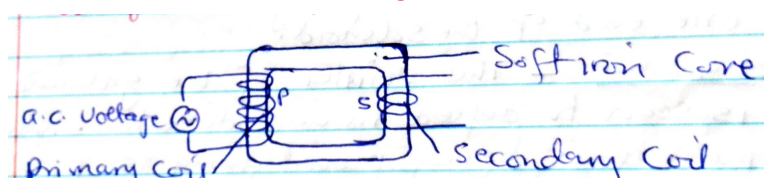
- **What is a transformer?**

It is a device for changing alternating current/voltage from high to low or low to high.

- **Name and briefly explain two types of transformers.**

- Step down transformer**- reduces a.c voltage from high to low. It has more turns on the primary coil than on the secondary coil.
- Step up transformer**- Increases a.c voltage from low to high. It has more turns turns on the secondary coil than on primary coil.

- **With aid of a well labeled diagram describe the mode and operation of a transformer.**



When an alternating current voltage V_P is fed in the primary coil P , it produces a changing magnetic flux which links up with the secondary coil. This induces an emf V_S in the secondary coil whose magnitude is proportional to the number of turns in the secondary coil.

- **State the causes of energy/power loss in a transformer and state hoe they can be minimized**

- Power loss to eddy currents - minimized by using soft iron core.
- Power loss due to heating in the windings.- minimized by use of thick copper wires to reduce resistance.
- Energy loss due to repeated magnetization and demagnetization (hysteresis)- Minimized by using a soft iron core.
- Energy loss due to loss of magnetic flux- minimized by winding the secondary coil over the primary coil.

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- Write down the expression relating primary voltage V_P , secondary voltage V_S , turns in the secondary coil N_S and turns in the primary coil N_P

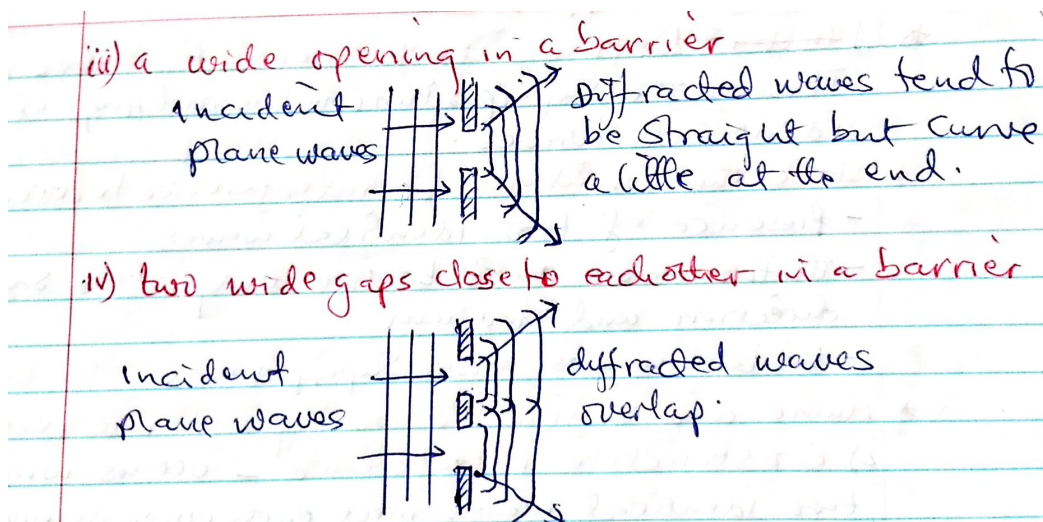
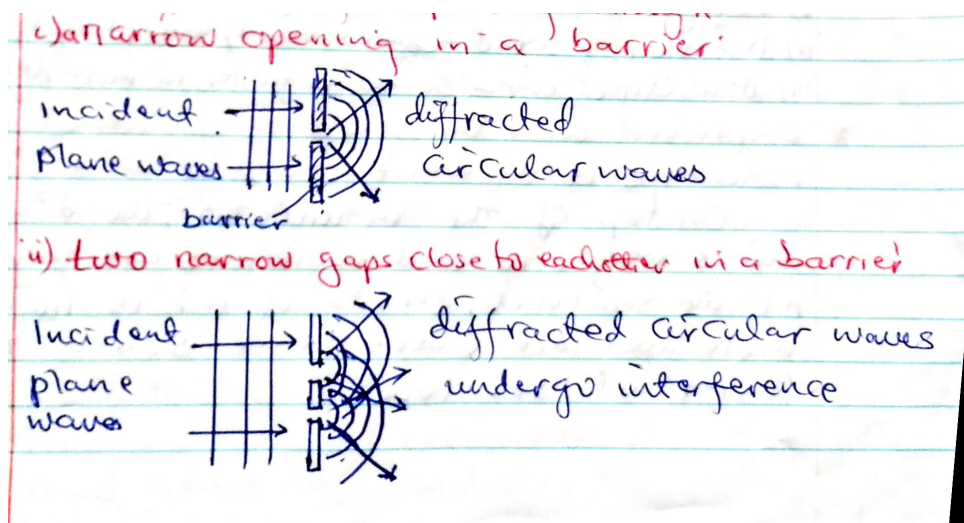
$$\frac{V_S}{V_P} = \frac{N_S}{N_P}$$

- State the advantages of a.c over d.c power transmission.
 - (i) a.c is easily and cheaply changed from one voltage to another by a transformer with very little energy loss.
 - (ii) a.c can be transmitted at high voltages and over long distances with minimum power loss.
 - (iii) a.c is cheaper to generate.
- What is a fuse?
A fuse is a thin wire which becomes hot, melts and breaks as soon as current through it exceeds the rated value.
- What is the work of a fuse?
It protects houses/ appliances against fire risk due to overload or short circuits. It is always connected in the live side of the circuit.
- Write down the color codes for wiring in homes.
 - * Red/ Brown- for live(L)
 - * Blue/Black - for neutral(N)
 - * Yellow/green- for earth(E)

5. WAVES

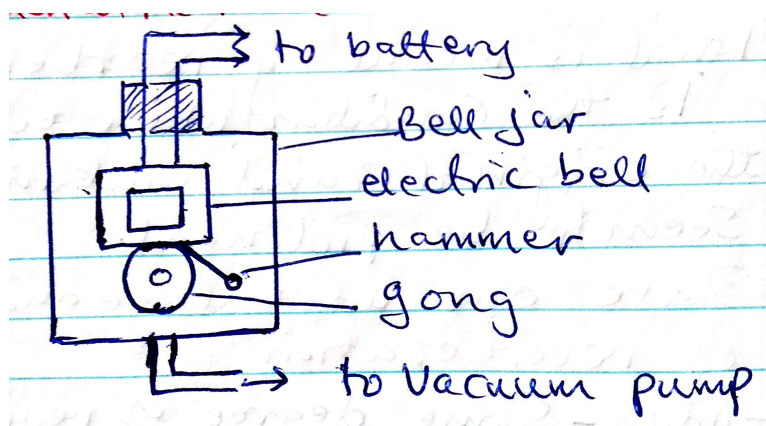
- Define interference of waves.
This is the superposition (meeting, overlapping) of two identical waves.
- State the conditions for interference to occur.
 - Presence of two identical waves.
 - The two waves must be traveling in the same direction and medium.
 - The two waves must superpose.
- Name and define two types of interference.
 - (i) **Constructive inference**- Occurs when two identical waves meet each other in phase.
 - (ii) **Destructive inference**-Occurs when two identical waves meet each other when they are out of phase.
- State the effects of constructive interference on:
 - **Sound waves**- increase in loudness.

- **Light waves** - increase in the brightness.
- **What is the effect of destructive interference on:**
 - **Sound waves**- decrease in loudness.
 - **Light waves** - decrease in the brightness or presence of darkness.
- **Define diffraction of waves.**
This is the spreading of waves around obstacles as they pass through gaps or openings.
OR- It is the bending of waves as they pass around the edge of a barrier.
- **Sketch diagrams to show how waves are diffracted after passing through:**



- **State factors that affect diffraction of waves.**
 - Wavelengths of the two waves.
 - Width of the gap.
- **Why do sound waves easily bend around corners?**
Sound waves have longer wave length.

- **What is sound?**
Is a form of energy produced by vibrating objects.
- **State factors that affect sound waves.**
 - (i) Wavelength (long wavelength- low pitch sound).
 - (ii) Amplitude (large amplitude - louder sound).
 - (iii) Frequency (higher frequency - higher sound pitch.)
- **State factors affecting speed of sound in air.**
 - (i) Temperature (Sound is faster at higher temperature).
 - (ii) Direction of wind (same direction of wind and sound, speed is faster).
 - (iii) Density of air (sound is faster in more denser air).
- **Explain why the speed of sound at high mountain is different from that at sea level.**
On top of the mountain, the density of air is very low and molecules are far apart. At the sea level, density of air is higher and molecules are close, hence sound travels faster at sea level.
- **Describe an experiment to show that sound requires a material medium for transmission (does not travel through the vacuum.)**

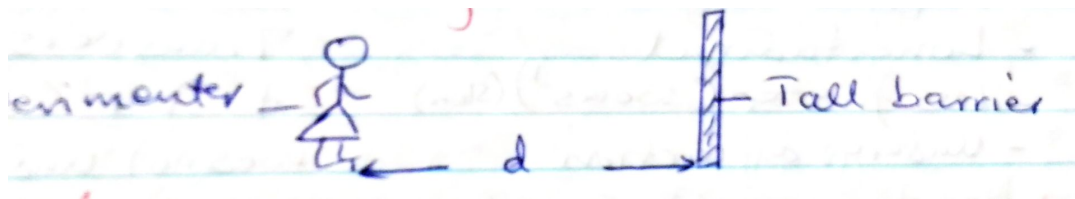


Procedure

The bell is switched on and the sound made by it is heard from the jar. Air from the jar is continually pumped out using a vacuum pump. As the air is pumped out the sound from the jar gradually reduces until when it is completely ceases to be heard when all the air is pumped out even though the hammer is still seen hitting the gong. This shows that light does not travel through a vacuum.

- **What is an echo?**
Is the reflected sound.
- **What is meant by reverberation?**
Is the condition when echoes join up with the original sound, making the original sound seem to be prolonged.
- **State one advantage and one disadvantage of reverberation.**

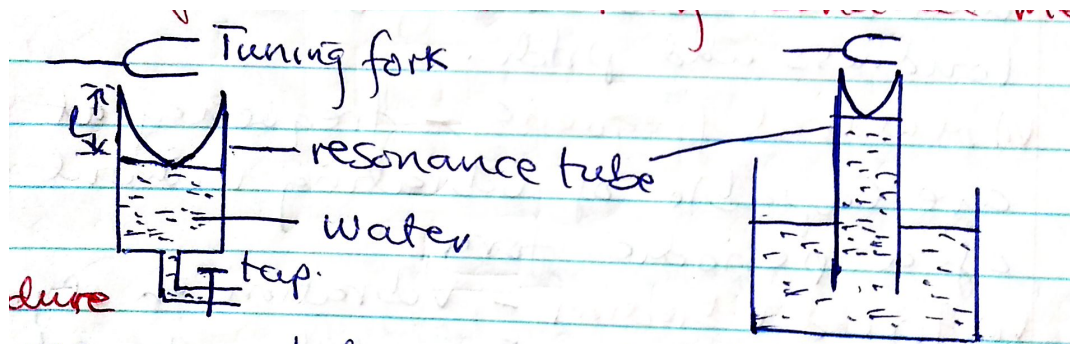
- **Advantage:-** Some degree of reverberation improves hearing because the speech takes long to die away.
- **disadvantage:-** too much reverberation causes confusion and the speech is lost since some words are not clearly heard.
- **Briefly explain how unwanted echoes can be minimized in big halls.**
By covering the seats, walls, roofs and ceiling with sound absorbing materials like sound proof tiles, soft boards, curtains, carpets, etc.
- **What is reverberation time?**
Is the time taken by a particular intensity of sound to die away.
- **Describe an experiment to measure the speed of sound in air by echo method.**



Procedure

An experimenter stands at a known distance, d from a tall barrier and makes a loud sound. A stop clock is simultaneously started. The clock is stopped immediately an echo is heard. The time, t taken for the echo to be heard is read and recorded. This time is taken to cover twice the distance, d . Therefore total distance covered in time $t = 2d$. The speed of sound in air is obtained from $V = \frac{2d}{t}$. The experiment may be repeated and the average value of V is obtained.

- **Describe an experiment to determine speed of sound in air by resonance method.**



Procedure

A resonance tube with a closed tap at the bottom is filled with water. A turning fork of known frequency, f is sounded and placed close to the top (mouth) of the resonance tube. The tap is opened and water is allowed to run out until a loud sound is heard (1st resonance). The tap is closed and the length of the air column, l is measured. The length $l = \frac{\lambda}{4} \Rightarrow \lambda = 4l$. From $V = \lambda f. \Rightarrow V = 4fl$ from which V can be calculated.

- **What is meant by audible range?**
This is the range of frequency of sound waves a human ear is sensitive to ($30Hz - 20KHz$).

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- **What are ultrasonic sound waves?**
These Waves of frequencies greater than 20KHz .
 - **State the applications of ultrasonic sound waves.**
 - Ultrasound scanning
 - echo sounders to determine depth of the sea
 - Breaking kidney stones
 - Cleaning delicate materials e.g., CDs
 - Ultrasound drilling
 - In spectacles for the blind
 - **Define the following terms as applied to sound.**
 - (i) **Pitch**-- Is the sharpness of sound.
 - (ii) **Music**- Sound of regular frequency.
 - (iii) **Noise**- Combination of sound of irregular frequencies.
 - (iii) **Loudness**- Is the sensation of the note produced in the mind of an individual.
 - (iv) **Quality/ timber**- Is the property of a note that distinguishes it from other notes of the same loudness and pitch.
 - (v) **Natural frequency**- Is the frequency at which objects are capable of vibrating without application of a periodic force.
 - (vi) **Forced vibration**- vibration of objects at some other frequency different from its natural frequency by application of a periodic force.
 - (vii) **Resonance**- Phenomenon which occurs when a body is set into vibrations at its natural frequency due to impulses from a nearby object vibrating at the same frequency.
 - **Describe an experiment to measure depth of the sea using echo sounder.**

An echo sounder on the ship produces ultrasonic sound and sends it down towards the sea bed. On reaching the sea bottom, sound is reflected back and is received by the hydrophone connected to the echo sounder to be received. The sea depth, d is then calculated from

$$d = \frac{Vt}{2}$$
 - **Describe an experiment to demonstrate resonance in a closed tube.**
 - Get a resonance tube with a closed tap at the bottom and fill it with water.
 - Sound a tuning fork and hold it close to the mouth of the resonance tube.
 - Slowly open the tap until a loud sound is heard and this is resonance.

END