Experiment

Aim

To verify the laws of reflection of sound.

MATERIALS AND APPARATUS REQUIRED

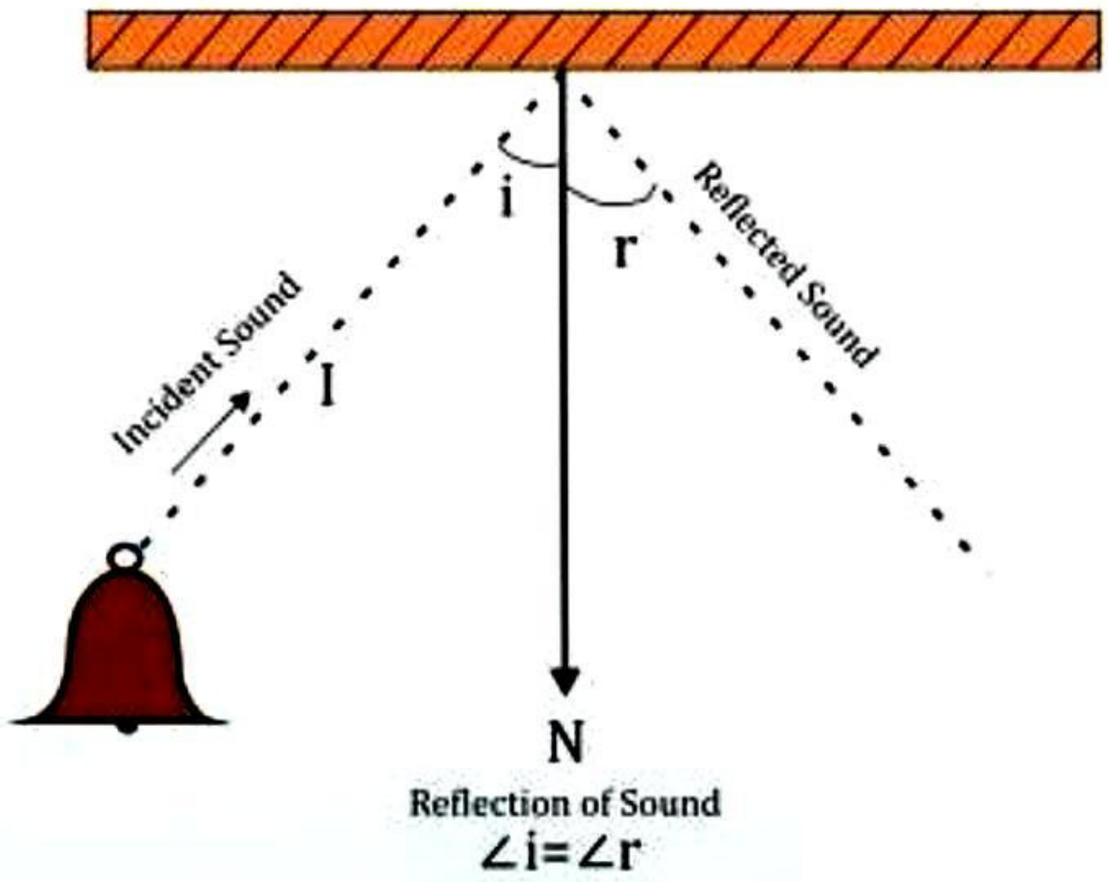
Two highly polished metal tubes made up of stainless steel or aluminium of length 25 cm and diameter 2 cm, a drawing sheet, metal plate, a geometrical set, thumb pins, drawing board/table, stopwatch, and metal stand.

THEORY

1. **Sound:** It is a form of energy produced by vibration and it needs a medium to propagate.
2. **Reflection of sound:** As light reflects when it strikes any hard object (opaque), sound also gets reflected when it strikes any object.

LAWS OF REFLECTION OF SOUND

1. The angle of incidence is always equal to the angle of reflection.
2. The incident sound wave, the normal and the reflected sound wave lie in the same plane.



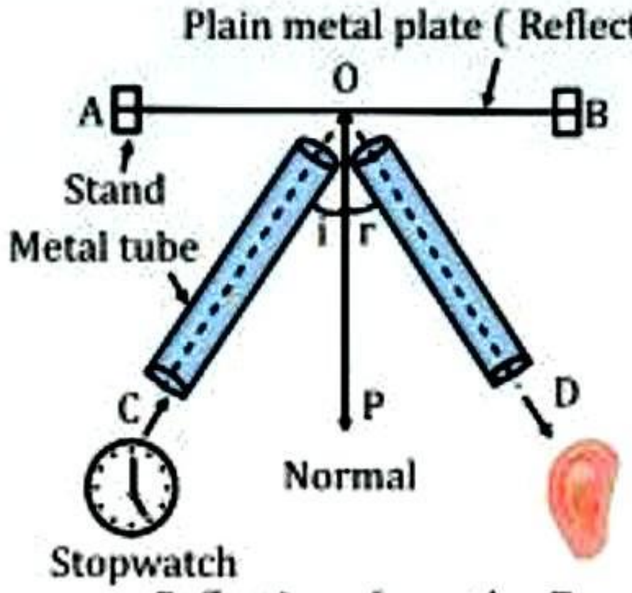
Reflection of Sound

$\angle i = \angle r$

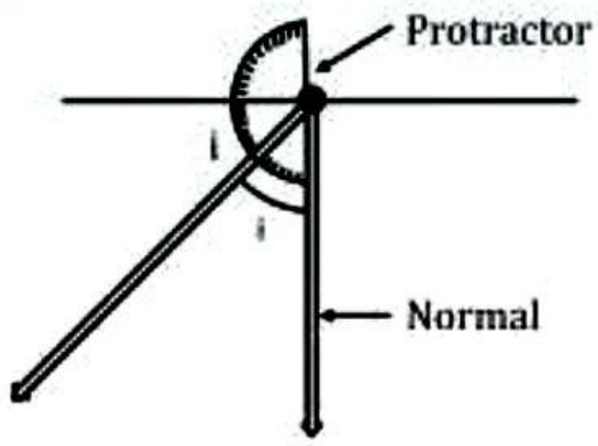
PROCEDURE

1. Fix the white sheet on the drawing board with a thumb pin.
2. Draw a line AB to place the metal plate as a reflecting surface with the help of a metal stand and draw normal OP to this line as shown in the figure.
3. Now draw a line OC making an angle of 30° with the line OP.
4. Place one metal tube near to the point O of normal and a metal plate on the line OC.
5. Place the ticking watch closer to one end of this metal tube.

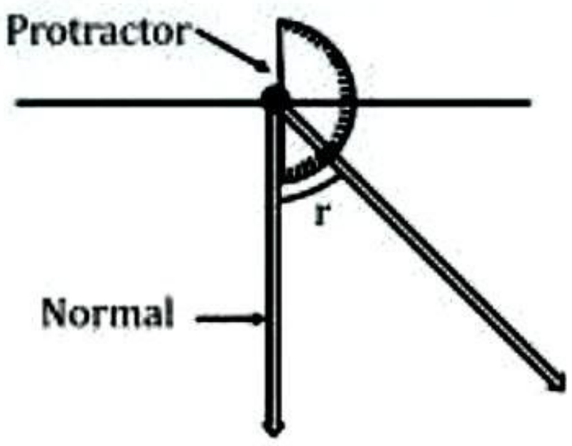
6. Now place the second tube so that its one end is near to the point O. Bring your ear close to the other end and adjust its position such that it collects the maximum reflected sound.
7. Mark the position of the tube when it collects the clear and maximum reflected sound.
8. Draw an extended line of reflected sound wave and mark it as OD.
9. Measure the angle of incidence and the angle of reflection.
10. Follow the above procedure and record your observation thrice.



Reflection of sound



Ear



Measurement of∠ i and∠ r

OBSERVATION TABLE

S. No.	The angle of Incidence ∠i	The angle of Reflection ∠r
1.		
2.		
3.		

RESULT

1. The angle of incidence is equal to the angle of reflection r, i.e., ∠i = ∠r .
2. The incident, normal and reflected sound waves lie in the same plane.

PRECAUTIONS

1. The metal plate should be placed vertical on the drawing board.
2. Both the pipes used should be clean and shining.
3. The sound producer i.e., stopwatch should be placed closer to the end of the metallic tube.
4. Avoid touching the source of sound to the metal tube.
5. Maintain complete silence in the lab.

VIVA VOCE

Q1. What produces sound?
Ans. Vibration produces sound.

Q2. How do human beings produce sound?
Ans. Due to the vibration of vocal cords.

Q3. Can sound travel through the vacuum?
Ans. No.

Q4. How is the reverberation of sound reduced at home/auditorium?
Ans. By using sound absorbing materials like curtains, draperies, ceilings with fibre boards etc.

Q5. What is the audible range of sound for human beings?

Ans. The audible range of sound is 20 Hz to 20,000 Hz.

Q6. Can sound be visualised as a wave? Why?

Ans. Yes, sound travels in a wave which causes disturbance in the medium particles, set them in motion and wave travels.

Q7. Why are sound waves called mechanical waves?

Ans. As sound waves set the particles of the medium in motion so they are called mechanical waves.

Q8. What happens to the speed of sound if the medium is changed?

Ans. The speed of sound depends on the media in which it is travelling. The speed of sound is higher in solids, lower in liquids and least in gases.

Q9. If the temperature of the medium is increased will that affect the speed of sound?

Ans. Yes, the speed of sound increases if the temperature of the medium is increased reflecting surface because the reflection from this surface will be more. Thermocol sheet acts as a good absorber of sound'

Q10. While performing this experiment, why do we prefer to use pipes of larger length but of smaller diameter?

Ans. In this experiment, it is assumed that the sound source is directional. Practically, due to the presence of unwanted sound in our surroundings, the sound coming from the source will not remain unidirectional. Therefore, it is advised to use pipes of larger length but of smaller diameter.

Q11. How the experiment on the reflection of sound is different from the experiment on the laws of reflection of light?

Ans. For the reflection of the sound wave, the surface may be polished or rough while the reflecting Surface for the light wave should be smooth and well-polished.

Q12. Which sheet will you choose as sound reflecting surface for this experiment.
(a) A smooth wooden board or (b) A thermocouple sheet? Why?

Ans. A smooth wooden board will be chosen as sound.

Q13. Suppose the whole experimental set-up of this experiment is submerged in water. What changes do you expect in your observations?

Ans. The speed of sound in water at 20 °C is 1482 m/s while in the air it is 343 m/s at 20 °C. Therefore, when the whole experimental set-up is submerged in water, the reflected sound will be heard faster as compared to air.

Q14. Why do we require a low-amplitude sound source in this experiment?

Ans. If we take the high amplitude sound source, then we may hear the sound from the source to our ear directly and not through the reflecting ray pipe. Therefore, it is required to have a low amplitude sound source in this experiment.

Q15. What alterations can be made in the pipes to make the reflected sound more distinct and clearer?

Ans. To absorb all unwanted sound rays from our surroundings and to make the reflected sound more distinct and clearer, the inner surfaces of the two pipes should be painted black and kept rough. Rough paper is a good absorber of sound so when we use plastic pipes, a layer of newspaper may be inserted into these pipes.