



Class 9 Science Chapter 10 – Important Questions

Sound Waves: Characteristics and Applications

 **New NCERT *Exploration* | 2026–27**

Chapter 10 covers **production and propagation of sound, mechanical and longitudinal waves, compressions and rarefactions, wavelength, frequency, time period, amplitude, intensity, speed of sound, pitch, loudness, human hearing, reflection, echo, reverberation, infrasonic and ultrasonic sound, echolocation and SONAR.**



SECTION A – VERY SHORT ANSWER QUESTIONS

1. What is sound?
2. How is sound produced?
3. What is a vibration?
4. What type of energy is sound?
5. What is a mechanical wave?
6. Why is sound called a mechanical wave?
7. Does sound require a medium for propagation?
8. Can sound travel through vacuum?
9. What is a longitudinal wave?
10. What are compressions?

11. What are rarefactions?
 12. What is wavelength?
 13. What is frequency?
 14. What is time period?
 15. What is amplitude?
 16. What is pitch?
 17. What is loudness?
 18. What is intensity of sound?
 19. What is an echo?
 20. What is reverberation?
 21. What is ultrasound?
 22. What is infrasound?
 23. What is echolocation?
 24. What is SONAR?
 25. What is the SI unit of frequency?
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SECTION B – PRODUCTION OF SOUND

26. How is sound produced by a vibrating object?
27. Give three examples of objects that produce sound by vibration.

- 28. Explain how a tuning fork produces sound.**
- 29. How does a vibrating string produce sound?**
- 30. How is sound produced by a musical instrument?**
- 31. Why does a vibrating object stop producing sound when its vibrations stop?**
- 32. How can you demonstrate that sound is produced by vibrations?**
- 33. Why can we hear the sound of a vibrating tuning fork?**
- 34. Explain the relationship between vibration and sound production.**
- 35. Why does a drum produce sound when struck?**

The chapter begins with the idea that sound is produced by **vibrations** and explores how that sound reaches our ears.

SECTION C – PROPAGATION OF SOUND

- 36. What is meant by propagation of sound?**
- 37. Why does sound need a medium to travel?**
- 38. Why cannot sound travel through vacuum?**
- 39. What happens to the particles of a medium when sound passes through it?**
- 40. Explain the propagation of sound through air.**
- 41. What are compressions and rarefactions?**
- 42. How are compressions formed?**

- 43. How are rarefactions formed?
- 44. Explain how energy is transferred through a sound wave.
- 45. Do the particles of the medium travel from the source to the listener with the sound wave?
- 46. Why is sound described as a longitudinal wave?
- 47. Differentiate between longitudinal and transverse waves.
- 48. Give one example of a longitudinal wave.
- 49. Give one example of a transverse wave.
- 50. What is the direction of particle vibration in a longitudinal sound wave?

Sound is a longitudinal wave in which particles vibrate **parallel to the direction of propagation**.



SECTION D – CHARACTERISTICS OF SOUND WAVES

- 51. What is wavelength?
- 52. What is the symbol used for wavelength?
- 53. What is the SI unit of wavelength?
- 54. What is frequency?
- 55. What is the SI unit of frequency?
- 56. What is time period?
- 57. What is the SI unit of time period?

- 58. What is amplitude?
 - 59. What is the relationship between amplitude and loudness?
 - 60. What is the relationship between frequency and pitch?
 - 61. What happens to pitch when frequency increases?
 - 62. What happens to pitch when frequency decreases?
 - 63. What happens to loudness when amplitude increases?
 - 64. What happens to loudness when amplitude decreases?
 - 65. What is the relationship between wavelength, frequency and speed?
 - 66. What happens to wavelength if frequency increases while speed remains constant?
 - 67. What happens to wavelength if frequency decreases while speed remains constant?
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SECTION E – IMPORTANT SOUND FORMULAS

- 68. Write the formula relating speed, frequency and wavelength.
- 69. Write the formula for frequency in terms of time period.
- 70. Write the formula for time period in terms of frequency.
- 71. Write the formula for speed in terms of distance and time.
- 72. What does the equation $v = f\lambda$ represent?
- 73. What does $f = 1/T$ represent?

74. What does $T = 1/f$ represent?

75. What are the SI units of v , f , λ and T ?

Formula Box

Speed of wave = Frequency $\times$ Wavelength

$$v = f \times \lambda$$

Frequency = $1 / \text{Time period}$

$$f = 1 / T$$

Time period = $1 / \text{Frequency}$

$$T = 1 / f$$

Speed = Distance / Time

$$v = d / t$$



SECTION F – NUMERICAL QUESTIONS

76. A sound wave has a frequency of 500 Hz and wavelength of 0.68 m. Find its speed.

77. A sound wave travels at 344 m/s and has a frequency of 500 Hz. Find its wavelength.

78. A sound wave has a wavelength of 3.44 m and travels at 344 m/s. Find its time period.

79. A sound wave has a frequency of 200 Hz. Find its time period.

80. A sound wave has a time period of 0.005 s. Find its frequency.

81. A wave has frequency 1000 Hz and wavelength 0.34 m. Calculate its speed.

82. A sound wave travels at 340 m/s and has wavelength 2 m. Find its frequency.

83. A sound wave travels 680 m in 2 seconds. Find its speed.

84. A source produces 20 complete vibrations in 4 seconds. Find its frequency.

85. A source vibrates at 50 Hz. How many vibrations will it complete in 10 seconds?

The textbook itself includes numerical questions involving frequency, wavelength, speed and time period, including a wave of wavelength **3.44 m** travelling at **344 m/s**.



SECTION G – WAVE GRAPHS

86. How can a sound wave be represented graphically?

87. What does wavelength represent on a sound-wave graph?

88. What does amplitude represent on a sound-wave graph?

89. How can two sound waves with different frequencies be identified from graphs?

90. How can two sound waves with different amplitudes be identified from graphs?

91. Which wave has a higher frequency: a wave with more cycles per unit distance or fewer cycles per unit distance?

92. Which wave has greater amplitude: a wave with larger or smaller maximum displacement?

93. Draw a sound-wave graph having wavelength 4 cm and amplitude 3 units.

94. Two sound waves have the same amplitude but different frequencies. Which has the higher pitch?

95. Two sound waves have the same frequency but different amplitudes. Which is louder?

Graph interpretation is explicitly included in the chapter-end questions, including comparing **wavelength and amplitude** from wave graphs.

SECTION H – PITCH, LOUDNESS & INTENSITY

96. What determines the pitch of a sound?

97. What determines the loudness of a sound?

98. Differentiate between pitch and loudness.

99. Why does a high-frequency sound have a higher pitch?

100. Why does a sound with greater amplitude generally sound louder?

101. Can two sounds have the same pitch but different loudness?

102. Can two sounds have the same loudness but different pitch?

103. What is the difference between frequency and amplitude?

104. Why does a mosquito produce a high-pitched sound?

105. Why does a bass drum produce a low-pitched sound?

SECTION I – HUMAN HEARING

- 106. What is the audible range of sound for humans?
 - 107. What are infrasonic sounds?
 - 108. What are ultrasonic sounds?
 - 109. Give one example of an infrasonic source.
 - 110. Give one example of an ultrasonic source.
 - 111. Why can humans not hear ultrasonic sounds?
 - 112. Why can humans not hear infrasonic sounds?
 - 113. Name animals that can detect ultrasonic sounds.
 - 114. What is the importance of frequency in human hearing?
 - 115. Differentiate between audible, infrasonic and ultrasonic sound.
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SECTION J – REFLECTION OF SOUND

- 116. What is reflection of sound?
- 117. What happens when a sound wave strikes a hard surface?
- 118. What type of surfaces reflect sound effectively?
- 119. What is an echo?
- 120. What conditions are required to hear a distinct echo?
- 121. Why is a minimum time gap required to hear a separate echo?
- 122. What is reverberation?
- 123. How is reverberation different from an echo?

124. Why can excessive reverberation make speech unclear?
125. How can reverberation be reduced in auditoriums?
126. Why are soft materials used on walls, ceilings and seats of auditoriums?
127. Give examples of surfaces that produce strong reflection of sound.
128. Give examples of materials that absorb sound.
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SECTION K – ECHO NUMERICALS

129. A person hears an echo 2 seconds after shouting. If the speed of sound is 340 m/s, calculate the distance of the reflecting surface.
130. A sound pulse returns after 0.5 seconds. If the speed of sound is 344 m/s, find the distance of the reflecting surface.
131. An echo is heard after 3 seconds. Calculate the distance of the reflecting wall if sound travels at 340 m/s.
132. Why do we divide the total distance travelled by sound by 2 while calculating the distance of an obstacle using an echo?
133. A reflected sound reaches the ear 0.05 s after the original sound. Will it be heard as an echo or reverberation? Explain.

This exact type of question appears in the textbook's chapter-end exercise.



SECTION L – REVERBERATION & ACOUSTICS

134. What is reverberation?

- 135. Why does reverberation occur in large halls?**
- 136. What problems can excessive reverberation cause?**
- 137. How can reverberation be controlled?**
- 138. Why are curtains and carpets used in auditoriums?**
- 139. Why are acoustic panels used on walls?**
- 140. How does the design of a concert hall affect sound quality?**
- 141. Why are some ceilings and walls curved in auditoriums?**
- 142. How can reflection of sound be useful in architecture?**

The textbook specifically asks students to consider how **curved ceilings and walls behind stages improve sound quality**.



SECTION M – ECHOLOCATION

- 143. What is echolocation?**
 - 144. How does echolocation work?**
 - 145. Which animals use echolocation?**
 - 146. How do bats use sound to locate objects?**
 - 147. How do dolphins use sound for navigation?**
 - 148. What is the role of reflected sound in echolocation?**
 - 149. What is the difference between an echo and echolocation?**
 - 150. Give two applications of the principle of echolocation.**
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SECTION N – SONAR

151. What is SONAR?
152. What does SONAR stand for?
153. Which type of waves are used in SONAR?
154. Explain the working principle of SONAR.
155. How is SONAR used to measure the depth of the ocean?
156. How is SONAR used to locate underwater objects?
157. Give two applications of SONAR.
158. Why are ultrasonic waves suitable for SONAR?
159. What information can be obtained from reflected SONAR waves?
160. Differentiate between echolocation and SONAR.

SONAR sends **ultrasonic waves** into water and analyses the **reflected waves** to determine the distance, direction and speed of underwater objects.



SECTION O – SONAR NUMERICALS

161. A SONAR signal returns after 4 seconds. If the speed of sound in seawater is 1500 m/s, calculate the depth of the ocean.
162. A SONAR signal is received after 0.90 s. If sound travels in seawater at 1530 m/s, find the distance of the underwater object.
163. Why is the total time taken by a SONAR pulse divided by 2 to calculate the depth?

164. A ship detects an underwater object after receiving an echo 5 seconds after transmission. If the speed of sound in seawater is 1525 m/s, calculate the approximate depth.

165. An ultrasonic parking sensor detects an obstacle 1.2 m away. If the speed of ultrasound in air is 345 m/s, calculate the time taken for the wave to travel to the obstacle and return.

These numerical situations are directly reflected in the textbook's Chapter 10 exercises and examples.



SECTION P – ULTRASOUND APPLICATIONS

166. What is ultrasound?

167. Why is ultrasound useful in medicine?

168. What is medical ultrasonography?

169. How are ultrasonic waves used for imaging inside the body?

170. Mention two medical applications of ultrasound.

171. Mention two industrial applications of ultrasound.

172. How can ultrasound be used to detect flaws in materials?

173. How is ultrasound used for cleaning?

174. Why are ultrasonic waves useful for detecting small objects or defects?

SECTION Q – APPLICATION-BASED QUESTIONS

175. A student strikes a tuning fork and places it near the ear.

- a) What produces the sound?
 - b) What happens to the air around the tuning fork?
 - c) How does the sound reach the ear?
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176. Two sound waves have the same frequency but different amplitudes.

- a) Which characteristic is the same?
 - b) Which characteristic is different?
 - c) Which sound will be louder?
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177. Two waves have the same amplitude but different frequencies.

- a) Which characteristic determines pitch?
 - b) Which wave has higher pitch?
 - c) Which wave has more vibrations per second?
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178. A sound wave has frequency 500 Hz and wavelength 0.68 m.

- a) Calculate its speed.
 - b) What happens to wavelength if frequency increases while speed remains constant?
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179. A person shouts near a large cliff and hears the sound again after 2 seconds.

- a) What phenomenon occurs?
 - b) Why does the sound return?
 - c) How can the distance of the cliff be calculated?
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180. A large auditorium has excessive reverberation.

- a) What problem will the audience face?
 - b) Suggest two methods to reduce it.
 - c) Why do these methods work?
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SECTION R – COMPETENCY-BASED QUESTIONS

181. Case Study – Sound Wave

A source produces 20 compressions in 4 seconds.

- a) Calculate the frequency.
 - b) What is the time period?
 - c) What does frequency tell us about the sound?
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182. Case Study – Two Sound Waves

Two sound waves are represented graphically. Wave A has greater amplitude, while Wave B has greater frequency.

- a) Which sound is louder?
 - b) Which sound has higher pitch?
 - c) Which property is related to amplitude?
 - d) Which property is related to frequency?
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183. Case Study – Echo

A student stands at a distance from a cliff and shouts. The echo returns after 1.5 seconds.

- a) What phenomenon is observed?
- b) If the speed of sound is 340 m/s, calculate the distance of the cliff.
- c) Why is the answer divided by 2?

184. Case Study – SONAR

A ship sends an ultrasonic pulse towards the seabed. The reflected signal returns after 4 seconds.

- a) What device is being used?
 - b) Why are ultrasonic waves used?
 - c) If the speed of sound in seawater is 1500 m/s, calculate the depth.
 - d) Why is the total distance divided by 2?
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SECTION S – HIGHER-ORDER THINKING QUESTIONS

185. Why can astronauts not communicate directly through sound in outer space?

186. Why can light travel through vacuum while sound cannot?

187. Why is sound classified as a mechanical wave?

188. Why does sound travel through a medium without the particles travelling along with the wave?

189. Why is sound a longitudinal wave in air?

190. Why does increasing frequency increase pitch?

191. Why does increasing amplitude make sound louder?

192. Why can a high-frequency sound be faint while a low-frequency sound can be loud?

193. Why is an echo not heard distinctly in a small room?

194. Why is reverberation undesirable in a classroom?

195. Why are soft materials used to reduce reverberation?
196. Why are ultrasonic waves useful for SONAR?
197. Why is the distance calculated using half the total travel distance in echo and SONAR problems?
198. Why can bats navigate in darkness using sound?
199. Why can humans not hear all sounds produced by animals?
200. Why can sound be used to detect objects that cannot be seen?
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SECTION T – LONG ANSWER QUESTIONS

201. Explain how sound is produced and propagated through a medium.
202. Explain the formation of compressions and rarefactions in a longitudinal sound wave.
203. Explain the characteristics of a sound wave: wavelength, frequency, time period and amplitude.
204. Explain the relationship between frequency and pitch and between amplitude and loudness.
205. Differentiate between longitudinal and transverse waves.
206. Explain reflection of sound with examples.
207. Explain echo and state the conditions necessary for hearing a distinct echo.
208. Explain reverberation and methods of reducing it.
209. Explain echolocation and its applications.

210. Explain the working of SONAR with a labelled diagram.
211. Explain the applications of ultrasound in medicine and industry.
212. Explain how the speed of sound can be determined experimentally.
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MOST IMPORTANT QUESTIONS FOR EXAM

If students have limited time, prepare these **first**:

- ★ 1. How is sound produced?
- ★ 2. Why is sound called a mechanical longitudinal wave?
- ★ 3. Explain compressions and rarefactions.
- ★ 4. Define wavelength, frequency, time period and amplitude.
- ★ 5. Explain the relationship between frequency and pitch.
- ★ 6. Explain the relationship between amplitude and loudness.
- ★ 7. Write and use the formula $v = f\lambda$.
- ★ 8. Solve numerical problems involving frequency, wavelength and time period.
- ★ 9. What is reflection of sound?
- ★ 10. Explain echo and solve echo numericals.
- ★ 11. Differentiate between echo and reverberation.
- ★ 12. Explain how reverberation can be reduced in auditoriums.
- ★ 13. What are infrasonic and ultrasonic sounds?
- ★ 14. Explain echolocation.
- ★ 15. Explain the working and applications of SONAR.
- ★ 16. Solve SONAR depth/distance numericals.

★ 17. Explain applications of ultrasound.



IMPORTANT FORMULAS

Wave Speed

$$v = f \times \lambda$$

Frequency

$$f = 1 / T$$

Time Period

$$T = 1 / f$$

Speed

$$v = d / t$$

Echo / SONAR Distance

$$\text{Distance of object} = v \times t / 2$$

Symbols

v = Speed of sound

f = Frequency

λ = Wavelength

T = Time period

d = Distance

t = Time

QUICK REVISION BOX

 **Sound** → Produced by vibrations

 **Sound wave** → Mechanical longitudinal wave

 **Compression** → Region of high pressure/density

↔ **Rarefaction** → Region of low pressure/density

 **Wavelength** → Distance between successive compressions or rarefactions

 **Frequency** → Number of vibrations per second

 **Time period** → Time for one complete vibration

 **Amplitude** → Maximum displacement

 **Pitch** → Depends mainly on frequency

 **Loudness** → Related to amplitude/intensity

 **Echo** → Reflected sound heard separately

 **Reverberation** → Persistence of sound due to multiple reflections

 **Echolocation** → Using reflected sound to locate objects

 **SONAR** → Uses reflected ultrasonic waves to detect underwater objects

TOP NUMERICALS TO PRACTISE

1. $v = f\lambda$
2. $f = 1/T$
3. $T = 1/f$
4. **Speed = Distance/Time**
5. **Echo distance = $vt/2$**
6. **SONAR depth = $vt/2$**
7. **Frequency from number of vibrations**
8. **Wavelength from speed and frequency**
9. **Time period from wavelength and speed**
10. **Ultrasonic parking-sensor problems**

★ Exam Tip

For **echo** and **SONAR** numericals, remember:

Sound travels from source → object → back to source/listener.

Therefore:

Total distance travelled = 2 × distance of object

So:

Distance = Speed × Time / 2

This is the key step students often miss. The textbook uses the same half-time/half-distance approach in its SONAR example.