EXERCISE 7(C)

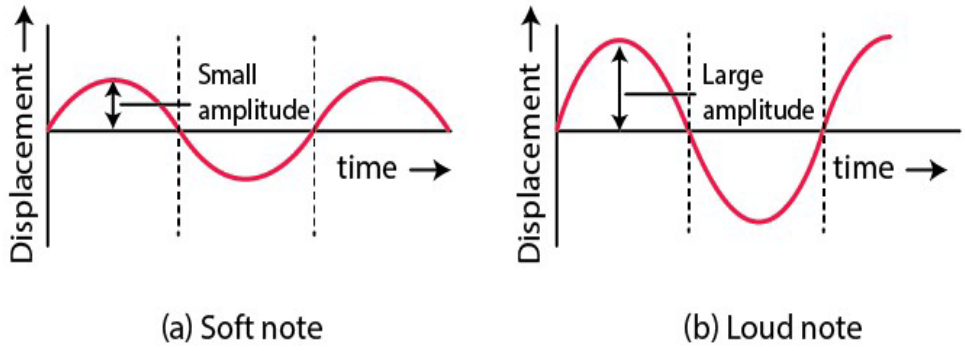
Solution:
The three characteristics of sound are
(i) Loudness
(ii) Pitch or shrillness
(iii) Quality or timber

Solution:
(a) The amplitude of the wave determines the loudness of a sound wave. A larger amplitude means a loud sound while a smaller amplitude means a soft sound.
(b) Loudness is proportional to the square of the amplitude.

Solution:
Since the loudness of sound is directly proportional to the square of amplitude. Thus if the amplitude of the wave is doubled then the sound will become 4 times louder.

Solution:
(i) Loudness is proportional to square of amplitude
∴ Ratio of loudness = 1: 9
(ii) If pitch is unchanged, then the frequency remains same.
∴ Ratio of frequencies = 1: 1

Question: 5
How does the wave pattern of a loud note differ from the soft note? Draw a diagram.
Solution:



(a) Soft note (b) Loud note

Question: 6
Name the unit in which the loudness of sound is measured?
Solution:
The loudness of sound is measured in units known as decibels

Question: 7
Why is the loudness of the sound heard by a plucked wire increased when it is mounted on a sound board?
Solution:
This is because, the board provides almost a large area and forces a large volume of air to vibrate and hence increases the sound energy reaching our ears.

Question: 8
Define the term intensity of a sound wave. State the unit in which it is measured.
Solution:
The intensity of the sound wave at a point of the medium is the amount of sound energy passing per second normally through an unit area at that points. The unit of intensity of sound wave is watt per metre^2 (W m^{-2})

Question: 9
How is the loudness of sound related to the intensity of wave producing it?
Solution:
Relationship between loudness L and intensity I is given by

$$L = K \log_{10} I$$

where K is constant of proportionality

Question: 10
Comment on the statement 'loudness of sound is a subjective nature, while intensity is an objective nature'
Solution:
The intensity of a sound wave at a point of the medium is the amount of sound energy passing per second normally through an unit area at that point.
The loudness of a sound depends on the intensity i.e the energy conveyed by the sound wave near the eardrum of the listener. Loudness also depends on the sensitivity of the ears of the listener. Thus the loudness of sound of a given intensity may differ from listener to listener. Further, two sounds of the same intensity but of different frequencies may differ in loudness even to the same listener. This is because the sensitivity of ears is different for different frequencies. Therefore the loudness has a subjective nature while intensity, being a measurable quantity, has an objective nature.

Question: 11
State three factors which affect the loudness of sound heard by a listener.
Solution:
The loudness of sound heard by a listener depends on the following factors
(i) Loudness is proportional to the square of the amplitude
(ii) Loudness is inversely proportional to the square of distance
(iii) Loudness depends on the surface area of the vibrating body.

Question: 12
The bells of a temple are big in size. Why?
Solution:
According to the study of bells, larger bells provide less resonant frequency. It is essential that the frequency of the sound is less for a sound wave to travel long distances. Also it is observed that thicker the body of a bell, the quality of sound will be richer. Hence the bells of a temple are big in size.

Question: 13
Name the unit used to measure the sound level.
Solution:
The unit to measure the sound level is decibel

Question: 14
What is the safe limit of sound level in dB for our ears?
Solution:
The safe limit of sound level in dB for our ears is upto 120 dB

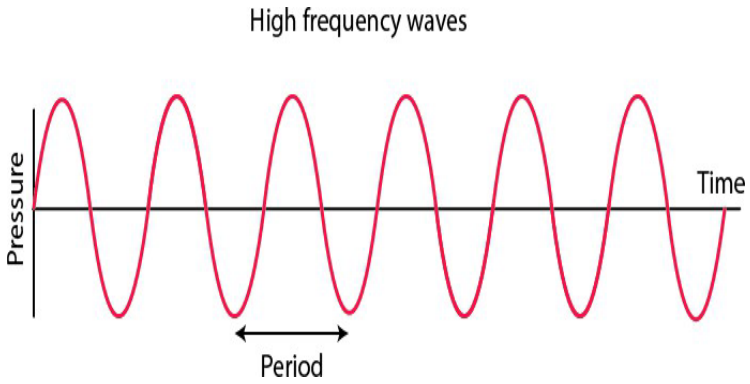
Question: 15
What is meant by noise pollution? Name one source of sound causing noise pollution.
Solution:
The disturbance produced due to undesirable loud and harsh sound of level above 120 dB from the various sources such as loudspeaker, moving vehicles etc in the environment is called noise pollution.

Question: 16
What determines the pitch of sound?
Solution:
Pitch of a note depends on its frequency. Two notes with same amplitude sounded on the same instrument, will differ in pitch when their vibrations are of different frequencies.

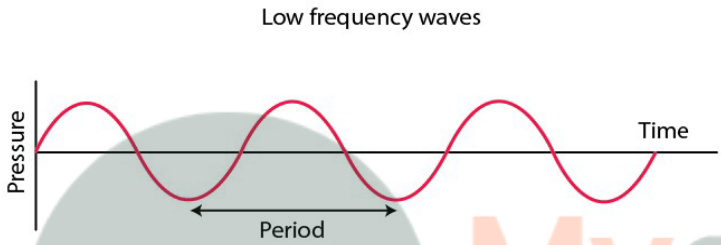
Question: 17
Name the subjective property of sound related to its frequency.
Solution:
Pitch is the subjective property of sound related to its frequency

Question: 18
Name and define the characteristic which enables one to distinguish two sounds of same loudness, but of different frequencies given by the same instrument.
Solution:
The characteristic by which two sounds of same loudness, but of different frequencies given by the same instrument can be distinguished known as ‘pitch’.

Question: 19
Draw a diagram to show the wave pattern of high pitch note and a low pitch note, but of the same loudness.
Solution:
The diagram for high pitch note is



The diagram for low pitch note is



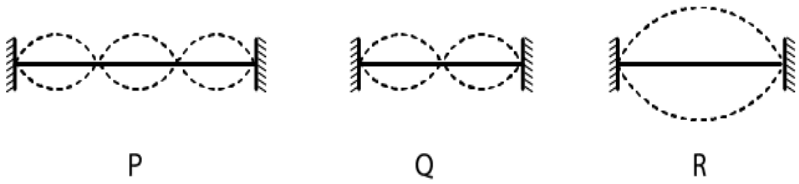
Question: 20
How is it possible to detect the filling of a bottle under a water tap by hearing the sound at a distance?
Solution:
The length of air column decreases, as the water level in a bottle kept under a water tap rises. Thus the frequency of sound produced increases. Hence one can get the idea of water level in the bottle by hearing sound from a distance.

Question: 21
The frequencies of notes given by flute, guitar and trumpet are respectively 400 Hz, 200 Hz and 500 Hz. Which one of these has the highest pitch?
Solution:
The frequency of trumpet is highest. So the trumpet has the highest pitch.

Question: 22
Complete the following sentences:
(a) The pitch of sound increases, if its frequency _____.
(b) If the amplitude of the sound is halved, its intensity becomes _____.

Solution:
(a) The pitch of sound increases, if its frequency increases.
(b) If the amplitude of the sound is halved, its intensity becomes one-fourth.

Question: 23
The diagram below shows three different modes of vibration P, Q and R of the same string of a givens length.



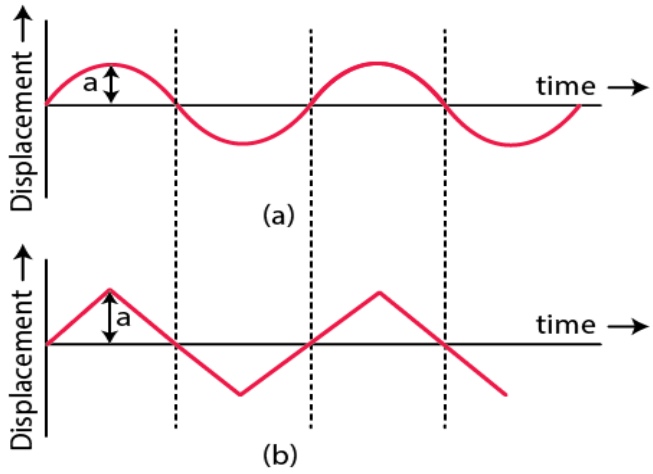
(a) Which vibration will produce a louder sound and why?
(b) Which vibration will produce sound of maximum shrillness (or pitch) and why?
(c) What is the ratio of wavelength of vibrations P and R?
Solution:
(a) The amplitude of R is maximum. So, R will produce a louder sound
(b) The frequency of P is maximum. So, P will produce a maximum shrillness.
(c) The ratio of wavelength of vibrations P and R is

λ_p: λ_R = 1: 3

Question: 24
Name the characteristic which enables one to distinguish the sound of two musical instruments even if they are of the same pitch and same loudness.
Solution:
The characteristic which enables one to distinguish the sound of two musical instruments even if they are of the same pitch and same loudness is quality or timber of sound.

Question: 25
How does the two sounds of same loudness and same pitch produced by different instruments differ? Draw diagrams to illustrate your answer.
Solution:
The two sounds of same loudness and same pitch produced by different instruments differ because of their different waveforms.
The waveforms depend on the number of the subsidiary notes and their relative amplitude along with the principal note.

The below diagram shows the wave patterns of two sounds of same loudness and same frequency but of different wave forms. One is a sine wave and the other is a triangular wave.



Question: 26

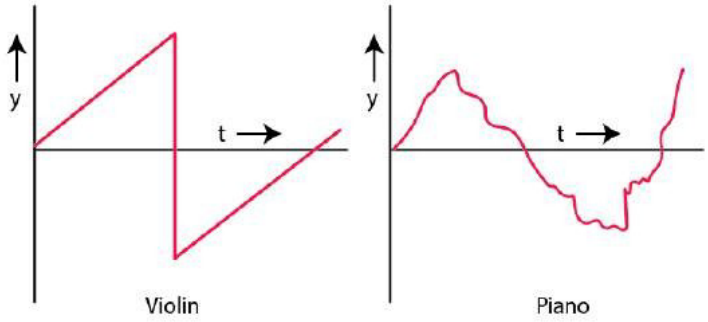
Two identical guitars are played by two persons to give notes of the same loudness and pitch. Will they differ in quality? Give a reason for your answer.

Solution:

As the guitars are identical, they will have a similar waveform and hence, the similar quality.

Question: 27

Two musical notes of the same pitch and same loudness are played on two different instruments. Their wave patterns are as shown in the diagram below.



Explain why the wave patterns are different.

Solution:

Different instruments produce different subsidiary notes. A note played on one instrument has a large number of subsidiary notes, while the same note played on other

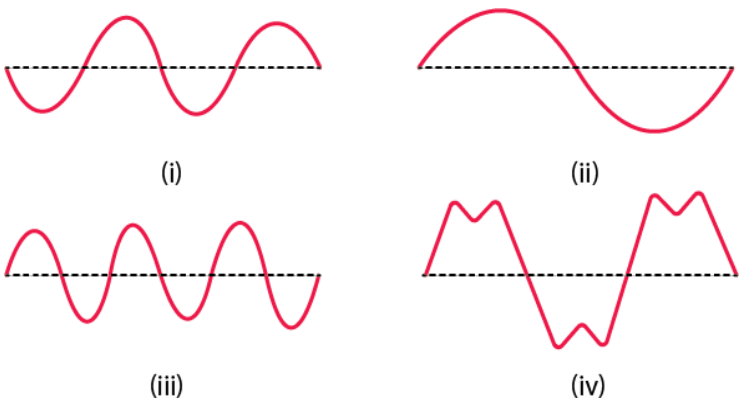
instrument contains only a few subsidiary notes. Hence, they have different waveforms.

Question: 28
Which characteristic of sound makes it possible to recognise a person by his voice without seeing him?
Solution:
The quality or timbre of sound is the characteristic which enables us to recognise a person by his voice even without seeing him.

Question: 29
State the factor that determines
(i) the pitch of a note,
(ii) the loudness of the sound heard, and
(iii) the quality of the note.
Solution:
(i) Frequency determines the pitch of a note.
(ii) Amplitude determines the loudness of the sound heard
(iii) Waveforms determines the quality of the note

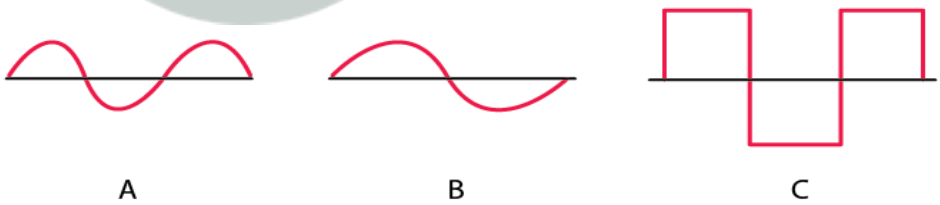
Question: 30
Name the characteristic of the sound affected due to a large in its (i) amplitude, (ii) wave form, and (iii) frequency
Solution:
(i) The characteristic of the sound affected due to large in its amplitude is loudness
(ii) The characteristic of the sound affected due to large in its waveform is quality
(iii) The characteristic of the sound affected due to large in its frequency is pitch

Question: 31
The sketches I to IV in figure show sound waves, all formed in the same time interval.



Which diagram shows
(i) a note from a musical instrument,
(ii) a soft (or feeble) note,
(iii) a bass (or low frequency) note.
Solution:
(i) A figure IV is a note from a musical instrument
(ii) A figure I is a soft (or feeble) note
(iii) A figure II is a bass (or low frequency) note

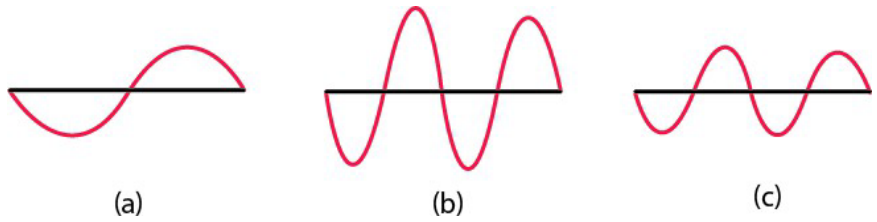
Question: 32
Shows the wave patterns of three sounds A, B and C. Name the characteristic of sound which is same between (i) A and B, (ii) B and C, and (iii) C and A



Solution:
(i) Both A and B have same amplitude and waveform. Thus loudness and quality is same.
(ii) In figures B and C, neither amplitude nor waveform is same. Therefore no characteristic is same
(iii) In figures C and A, frequency of both the sound is same and hence, pitch is same

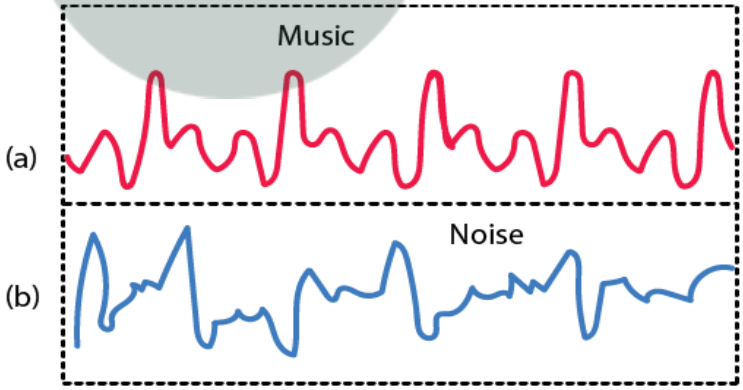
Question: 33
A microphone is connected to the Y-input of a C.R.O. Three different sounds are made in turn in front of the microphone. Their traces (a), (b) and (c) produced on

the screen are shown in figure



(i) Which trace is due to the loudest sound? Give reason for your answer.
(ii) Which trace is due to the sound with the lowest pitch? Explain your answer.
Solution:
(i) Figure (b) is due to the loudest sound because amplitude is largest
(ii) Figure (a) is due to the sound with the lowest pitch because frequency is lowest

Question: 34
In what respect does the wave pattern of a noise and music differ? Draw diagram to explain your answer.
Solution:
The wave pattern of a noise is irregular while the wave pattern is regular in music. The below figure shows the wave forms of a music and a noise.



Question: 35
State one difference between a musical note and a noise.
Solution:

Music	Noise
It is regular, smooth and pleasant to the ears	It is harsh, discordant and unpleasant to the ear
The sound level is low (between 10 dB to 30 dB)	The sound level is high (above 120 dB)

MULTIPLE CHOICE TYPE
Question: 1
By reducing the amplitude of the sound wave, its:
(a) pitch increases
(b) loudness decreases
(c) loudness increases
(d) pitch decreases
Solution:
If the amplitude of the sound wave is reduced, its loudness decreases

Question: 2
Two sounds of same loudness and same pitch produced by the two different instruments differ in their
(a) amplitudes
(b) frequencies
(c) wave forms
(d) all the above
Solution:
Two sounds of same loudness and same pitch produced by the two different instruments differ in their waveforms

Question: 3
Two sounds A and B are of same amplitudes, same wave forms but of frequencies f and 2f respectively. Then:
(a) B differ in quality from A
(b) B is grave, A is shrill
(c) B is shrill, A is grave
(d) B is louder than A
Solution:

Two sounds A and B are of same amplitudes, same wave forms but of frequencies f and 2f respectively. Then B is shrill, A is grave