



# PHYSICS

## BOOKS - BITSAT GUIDE

### SOUND WAVES

#### Practice Exercise

1. A physicist points out that glass is rarer than water.

- A. This statement is correct in the case of  
sound
- B. This statement is always wrong
- C. This statement is correct in the case of  
light
- D. This statement is always correct

**Answer: A**



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2. When height increases, velocity of sound decreases

A. this is due to decrease of pressure

B. this is due to decrease in temperature

C. this is due to both decrease in temperature and pressure

D. statement is wrong

**Answer: B**



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3. The velocity of sound is not affected by change in

A. temperatuer

B. medium

C. pressure

D. wavelength

**Answer: C**



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4. If copper has modulus of rigidity  $12 \times 10^{10} \text{ N/m}^2$  and Bulk modulus  $12 \times 10^{11} \text{ N/m}^2$  and density  $9 \text{ g/cm}^3$  then find the velocity of longitudinal wave, when set-up in solid copper.

A. 4389 m/s

B. 5000 m/s

C. 4000 m/s

D. 4300 m/s

**Answer: A**



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5. A piezo electric quartz plate of Young's modulus of elasticity  $8 \times 10^{10} N/m^2$  and density  $265 \times 10^3 kg/m^3$  is vibrating in resonant condition. The fundamental frequency of vibration is 550 KHz. What is thickness of the plate?

A. 0.05 cm

B. 0.5 cm

C. 1.25 cm

D. 0.55 cm

**Answer: B**



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**6.** The value of adiabatic constant  $\gamma$  for oxygen and nitrogen is same. The speed of sound in oxygen is 470 m/s at STP. The speed of sound in nitrogen at STP is

A. 340 m/s

B. 580 m/s

C. 502 m/s

D. None of these

**Answer: C**



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7. At SPT, The speed of sound in hydrogen is 1324 m/s then the speed of sound in air

A. 331 m/s



B. 220 m/s

C. 340 m/s

D. 230 m/s

**Answer: A**



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**8.** If the speed of sound is changed by 1 per cent, how much must the temperature of air near  $0^{\circ} C$  be changed

A.  $5^{\circ} C$

B.  $6^{\circ} C$

C.  $5.5^{\circ} C$

D.  $6.5^{\circ} C$

**Answer: C**



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9. If the speed of sound wave in a stretched string is  $V$  and Hook law is obeyed, then the

extension in the string if the speed of sound wave will become  $1.22v$ .

A.  $1.5x$

B.  $1x$

C.  $0.5x$

D.  $2x$

**Answer: A**



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10. A boy watches a jet plane flying from north to south. When the jet is just seen above his head, the sound of jet appears to reach him making some angle with horizontal from north. If the velocity of jet is  $v/2$ , then find the angle.

A.  $60^\circ$

B.  $30^\circ$

C.  $45^\circ$

D.  $15^\circ$

**Answer: A**



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**11.** A stone is dropped into a lake from a tower 500 metre high. The sound of the splash will be heard by the man approximately after

A. 11.5 s

B. 21 s

C. 10 s

D. 14s

**Answer: A**



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**12.** A light pointer fixed to one prong of a tuning fork touches a vertical plate. The fork is set vibrating at a frequency of 56 Hz and allowed to free fall. Calculate how many complete oscillation are counted when plate falls 10 cm

A. 10

B. 9

C. 8

D. 7

**Answer: C**



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**13.** The equation of a sound wave in air is  $P = 0.01 \cos (1000t - 3xx)$  where  $P$ ,  $x$  and  $t$  are in SI. The bulk modulus of elasticity is

$1.4 \times 10^5 \text{ N/m}^2$  the displacement amplitude is

A. 0.24 m

B.  $0.24 \times 10^{-7} \text{ m}$

C.  $8 \times 10^{-7} \text{ m}$

D. 10 m

**Answer: B**



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14. A sound wave of pressure amplitude 14 pascal propagates through the air medium. The normal pressure of air is  $1.0 \times 10^5 N/m^2$  the difference between maximum and minimum pressure in the medium is

A.  $5 \times 10^5 N/m^2$

B.  $10 \times 10^5 N/m^2$

C.  $10 N/m^2$

D. None of these

**Answer: C**



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15. A sound wave having a frequency of 100 Hz and pressure amplitude of 10 pa, then calculate the displacement amplitude (Given speed of sound in air = 340 m/s and density of

$$\text{air} = 1.29 \text{ k} \frac{\text{g}}{\text{m}^3})$$

A.  $3.63 \times 10^{-5} \text{ m}$

B.  $3 \times 10^{-5} \text{ m}$

C.  $4.2 \times 10^{-5} \text{ m}$

D.  $6.4 \times 10^{-5}m$

**Answer: A**



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**16.** when a wave is propagated from rarer medium to denser medium. Which of the following will remain unchanged?

A. Wave speed

B. Propagation constant

C. Frequency

D. None of these

**Answer: C**



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**17.** A sonar system fixed in a submarine operates at a frequency  $40.0 \text{ kHz}$ , An enemy submarine moves towards the sonar with a speed of  $360 \text{ km/h}$ . What is the frequency of

sound reflected by the submarine? (Take the speed of sound in water to be 1450 m/s)

A. 52.3 KHz

B. 45.93 KHz c.

C. 62.49 Kz

D. 54.34 kHz

**Answer: B**



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**18.** A small speaker has a capacity of power 3 W. A microphone is placed at distance 2 m from the speaker. Find the displacement amplitude of particles of air near to microphone. The frequency of sound emitted by speaker is 1.0 KHz

(Density of air =  $1.2 \text{ kg/m}^3$  and speed of sound in air = 330 m/s)

A.  $2.76 \times 10^{-4} \text{ cm}$

B.  $4 \times 10^{-4} \text{ cm}$

C.  $10 \times 10^{-4} \text{ cm}$

D.  $3.8 \times 10^{-3} \text{ cm}$

**Answer: A**



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**19.** From a height of 2 m a drop of water of radius  $2 \times 10^{-3}$  m fall and produces a sound. The sound produced can be heard upto a distance of 20 m. If the gravitational energy is converted into sound energy in 0.5 s, then calculate the intensity at a distance of 20 m.

A.  $2 \times 10^{-7} W / m^2$

B.  $2.6 \times 10^{-6} W / m^2$

C.  $2.6 \times 10^{-7} W / m^2$

D.  $3 \times 10^{-7} W / m^2$

**Answer: C**



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**20.** Velocity of sound wave in air is 330 m/s for a particular sound in air. A path difference of



40 cm is equivalent to a phase difference of  $1.6$

$\pi$ . The frequency of this wave is

A. 165 Hz

B. 150 Hz

C. 660 Hz

D. 330 Hz

**Answer: C**



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21. A tuning fork A of frequency 512 Hz produces 4 beats per second when sounded with a tuning fork B. Due to filing of the prongs of the tuning fork B, the number of the beats per second becomes 6. The actual frequency of B is

A. 517 Hz

B. 509 Hz

C. 513 Hz

D. None of these

**Answer: A**



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22. A tuning fork A of frequency 260 Hz produces 4 beats per second when sounded with a tuning fork B. The number of beats produced per second becomes 3. Then, what is the frequency of tuning fork B?

A. 264

B. 263

C. 256

D. 260

**Answer: C**



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**23.** When temperature of air is  $20^{\circ}C$  a tuning fork sounded over the open end of an air column produces 4 beats per second, the tuning fork given a lower note. If the frequency of tuning fork is 34 Hz, then find

how many beats will be produced by the tuning fork if temperature falls to  $5^{\circ}C$ ?

A. 2 beat/s

B. 4 beat/s

C. 1 beat/s

D. 3 beat/s

**Answer: D**



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24. Two wires A and B are of same length, radius and same material are in unison. If tension in A is increased by 4% 4 beats are heard, then the frequency of the note produced when they were in unison, will be

A. 50 Hz

B. 100 Hz

C. 150 Hz

D. 200 Hz

**Answer: D**



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25. The velocity of sound in air at NTP is 331 m/s. Find its velocity when temperature rises to  $91^{\circ}C$  and its pressure is doubled.

A. 372 m/s

B. 382.1 m/s

C. 423 m/s

D. 392.5 m/s

**Answer: B**



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26. The fundamental frequency of a closed organ pipe is equal to second of an open organ pipe is the length of closed organ pipe is 15 cm. The length of open organ pipe is

A. 90 cm

B. 30 cm

C. 15 cm

D. 20 cm



**Answer: A**



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27. An organ pipe closed at one end resonates with a tuning fork of frequencies 180 Hz and 300 Hz it will also resonate with tuning fork of frequencies

A. 630 Hz

B. 420 Hz

C. 480 Hz

D. 540 Hz

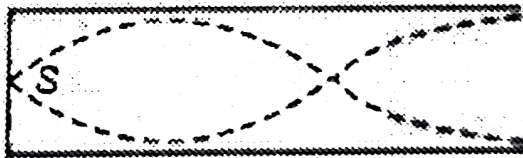
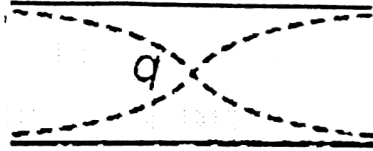
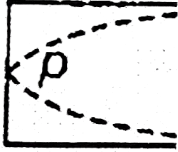
**Answer: B**



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**28.** Figures shows the vibrations of four air columns. The ratio of frequencies

$n_p : n_q : n_r : n_s$  is



A. 12:3:3:4

B. 1:2:4:3

C. 4:2:3:1

D. 4:3:2:1

**Answer: B**



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**29.** A steel rod 100 cm long is clamped at its middle. The fundamental frequency of longitudinal vibrations of the rod are given to be 2.53 KHz. What is the speed of sound in steel?

A. 6.2 km/s

B. 5.06 km/s

C. 7.23 km/s

D. 7.45 km/s

**Answer: B**



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**30.** Two organ pipes are emitting their fundamental notes, when each closed at end, give 5 beat/s if their fundamental

frequencies are 250 Hz and 255 Hz. Then find the ratio of their lengths.

A.  $\frac{49}{50}$

B.  $\frac{49}{51}$

C.  $\frac{50}{51}$

D.  $\frac{51}{50}$

**Answer: C**



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**31.** In the case of vibration of closed end organ pipe in fundamental mode of vibration, the pressure is maximum at

- A. open end
- B. closed end
- C. at middle
- D. None of these

**Answer: B**



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**32.** An air column in a pipe which is closed at one end will be in resonance with a vibrating tuning fork of frequency 264 Hz if the length of the air column in cm is (Speed of sound in air = 340 m/s)

A. 32.19 cm

B. 64.39 cm

C. 100 cm

D. 140 cm

**Answer: A**





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33. When two waves of almost equal frequencies  $n_1$  and  $n_2$  are produced simultaneously, then the time interval between successive maxima is

A.  $\frac{1}{n_1 - n_2}$

B.  $\frac{1}{n_1} - \frac{1}{n_2}$

C.  $\frac{1}{n_1} + \frac{1}{n_2}$

D.  $\frac{1}{n_1 + n_2}$

**Answer: A**



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**34.** A metal rod of length 1.5 m is clamped at the centre. When it is set with longitudinal vibrations it emits a note of 1000 Hz. Determine the Young's modulus if the density

of material =  $8 \times 10^3 \text{ kg/m}^3$

A.  $7 \times 10^{10} \text{ N/m}^2$

B.  $7.2 \times 10^{10} \text{ N/m}^2$

C.  $0.7 \times 10^{10} \text{ N/m}^2$

D.  $6.8 \times 10^{10} \text{ N/m}^2$

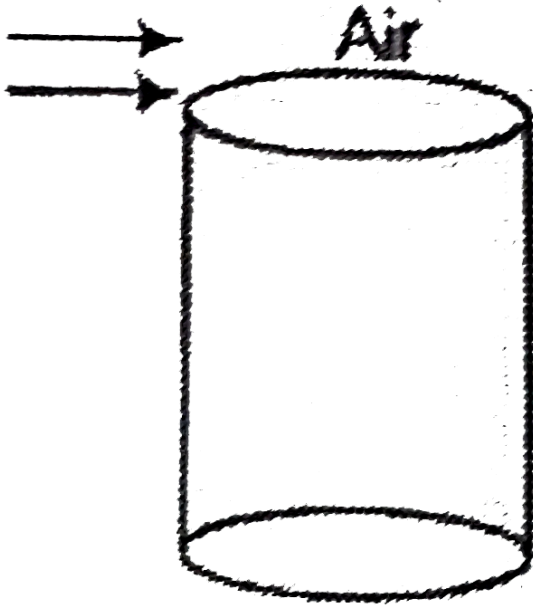
**Answer: B**



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**35.** A long tube of length  $l = 25$  cm and diameter equal to 2 cm is taken and at its mouth air is blown as shown in figure. The sound emitted by tube will have all the frequencies of the group (velocity of sound =

330 m/s )



A. 660, 1320, 2640 Hz

B. 660, 1000, 3300 Hz

C. 302, 684, 1320 Hz

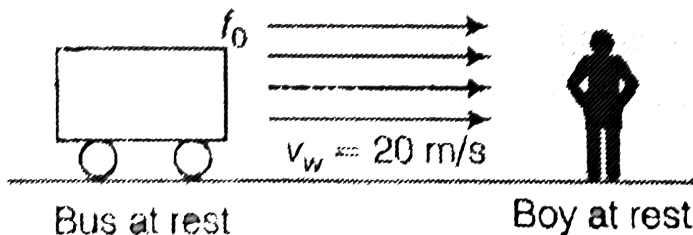
D. 330, 990, 1690 Hz

**Answer: A**



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**36.** In the above situation, bus is at rest blowing horn of frequency  $f_0$ . A boy is at rest at some distance. What will be apparent frequency of sound, if the air starts moving with the speed of 20 m/s from bus towards boy?



A.  $< f_0$

B.  $> f_0$

C.  $= f_0$

D. None of these

**Answer: C**



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**37.** The first overtone of an open organ pipe beats with the first overtone of a closed organ pipe with a beat frequency of 2.2 Hz. The

fundamental frequency of closed organ pipe is 110 Hz. Find length of the open pipe. (Given, sound in air = 330 m/s )

A. 2.43 m

B. 0.73 m

C. 0.993 m

D. 2.93 m

**Answer: C**



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38. The apparent frequency is  $f_1$  when a source of sound approaches a stationary observer with a speed  $u$  and  $f_2$  when the observer approaches the stationary source with same speed. If  $v$  is the velocity of sound, then

A.  $f_1 = f_2$

B.  $f_1 > f_2$  if  $u < v$

C.  $f_2 > f_1$  if  $u < v$

D.  $f_2 > f_1$  if  $u < v$



**Answer: D**



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**39.** A locomotive engine approaches a railway station and whistles at a frequency of 400 Hz. A stationary observer on the platform observes a changes of 40 Hz. As the engine passed across him. If velocity of sound is 330 m/s. The speed of the engine is

A. 33 m/s

B. 18 m/s

C. 16.5 m/s

D. 24 m/s

**Answer: C**



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**40.** Two trains one moving at a speed of 30 mile/h and iother at 60 mile/h, approaching each other. When a faster train blows a whistle, the apparent friequency of the note

head by an observer at rest behind the faster train is 1852 Hz. Calculate the frequency of note produced by faster train (Assume speed of sound to be 1100 ft/s)

A. 2000 vib/s

B. 1500 vib/s

C. 1000 vib/s

D. 2500 vib/s

**Answer: A**



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41. A boy with a radio, playing a music at a frequency 'f' is moving towards a wall with velocity  $v_b$ . A motrist is following the boy with a speed  $v_m$ . Find the expression for the beat frequency heard by the motorist., if the speed of sound is v

A.  $\left( \frac{v + v_m}{v + v_b} \right) f$

B.  $\frac{v + v_m}{v + v_b}$

C.  $\frac{2v_b(v + v_m)}{(v^2 - v_b^2)} f$

D.  $\frac{2v_m(v + v_b)}{(v^2 - v_m^2)} f$

**Answer: C**



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**42.** There is a road between two parallel rows of buildings and the distance between the rows of buildings is 106 m. Find the velocity of a car if a horn is blown and an echo is heard by the driver after 1 s.

(Given, speed of sound = 340 m/s)

A. 180 m/s

B. 165 m/s

C. 323 m/s

D. 150 m/s

**Answer: C**



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**43.** The produced rays in sonography are

A. microwaves

B. infrared waves

C. sound waves

D. ultra sound

**Answer: D**



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**44.** The source of sound generating a frequency of 3 kHz reaches an observer with a speed of 0.5 times the velocity of sound in air. The frequency heard by the observer is

A. 1 kHz

B. 2 kHz

C. 4 kHz

D. 6 kHz

**Answer: D**



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**45.** If  $v_m$  is the velocity of sound in moist air,  $v_d$  is the velocity of sound in dry air, under



identical conditions of pressure and temperature

A.  $v_m > v_d$

B.  $v_m < v_d$

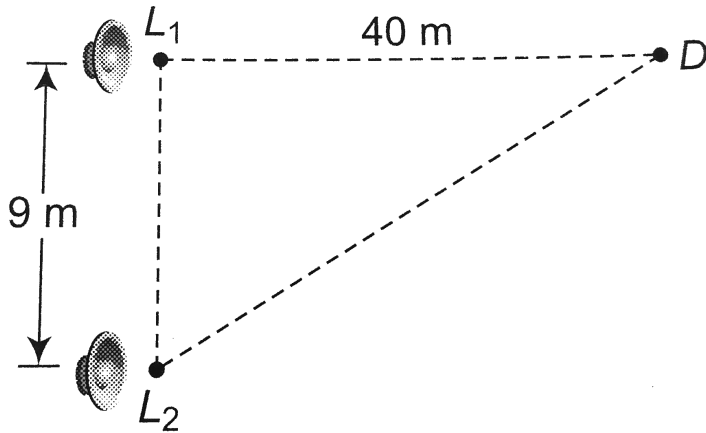
C.  $v_m = v_d$

D.  $v_m \cdot v_d = 1$

**Answer: A**



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46.

Two loudspeakers  $L_1$  and  $L_2$  driven by a common oscillator and amplifier, are arranged as shown. The frequency of the oscillator is gradually increased from zero and the detector at  $D$  records a series of maxima and minima. If the speed of sound is  $330\text{ms}^{-1}$

then the frequency at which the first maximum is observed is

- A. 165 Hz
- B. 330 Hz
- C. 495 Hz
- D. 660 Hz

**Answer: B**



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47. When a sound wave of wavelength  $\lambda$  is propagating in a medium, the maximum velocity of the particle is equal to the velocity.

The amplitude of wave is

A.  $\lambda$

B.  $\frac{\lambda}{2}$

C.  $\frac{\lambda}{2\lambda}$

D.  $\frac{\lambda}{4\lambda}$

**Answer: C**



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**48.** The disc of a siren containing 60 holes rotates at a constant speed of 360 rpm. The emitted sound is in unison with a tuning fork of frequency

A. 10 Hz

B. 360 Hz

C. 216 Hz

D. 60 Hz

**Answer: B**



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**49.** The ratio of velocity of sound in hydrogen and oxygen at STP is

A. 16 : 1

B. 8 : 0

C. 4 : 1

D. 2 : 1

**Answer: C**



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**50.** In an experiment with sonometer a tuning fork of frequency 256 Hz resonates with a length of 25 cm and another tuning fork resonates with a length of 16 cm. Tension of the string remaining constant the frequency to the second tuning fork is

A. 163.84 Hz

B. 400.Hz

C. 320 Hz

D. 204.8 Hz

**Answer: B**



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1. A sound source is moving towards a stationary observer with  $1/10$  of the speed of



sound. The ratio of apparent to real frequency

is

A.  $\left(\frac{9}{10}\right)^2$

B.  $\frac{10}{9}$

C.  $\frac{11}{10}$

D.  $\left(\frac{11}{10}\right)^2$

**Answer: B**



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