TOPIC WISE MULTIPLE CHOICE QUESTIONS

8.2 PERIODIC WAVES

(1) The speed of periodic wave can be found indirectly from its
(a) frequency **(b)** wavelength
(c) both a and b **(d)** none of these

(2) If 30 waves per second pass through a medium at speed of 30 ms^{-1}, the wave-length is **LHR-2018 (G-II)**
(a) 30 m **(b)** 15 m
(c) 1 m **(d)** 900 m

(3) The distance between two consecutive troughs is called **DGK-2018 (G-I)**
(a) displacement **(b)** amplitude
(c) wave length **(d)** wave front

(4) The example of mechanical waves is **MTN-2018 (G-II)**
(a) water waves **(b)** radio waves
(c) infra-red waves **(d)** ultra-voilet waves

(5) Longitudinal waves are also known as: **(GRW 2015)**
(a) Stationary waves **(b)** Transverse waves
(c) **Compressional waves** (d) **Electromagnetic waves**

(6) In wave pattern, all parts move with
(a) same speed **(b)** double speed
(c) different speed **(d)** half speed

(7) The crest moves one wavelength in
(a) one period of oscillation **(b)** two period of oscillation
(c) three period of oscillation **(d)** half period of oscillation

(8) When wave passes from medium to another, deviate from it's path is called
(a) reflection **(b)** refraction
(c) diffraction **(d)** transmission

(9) When two identical waves are superposed, the velocity of the resultant wave
(a) decreases **(b)** increases
(c) remain unchanged **(d)** becomes zero

(10) The linear distance between two nearest points of a medium vibrating in phase is
(a) path difference **(b)** time period
(c) wavelength **(d)** frequency

(11) The product of time period and frequency is
(a) velocity **(b)** 1
(c) 2 **(d)** Acceleration

(12) The portion of a wave below the mean level is called.
(a) crest **(b)** trough
(c) node **(d)** anti-node

(13) Continuous, regular and rhythmic disturbance in a medium is called

(a) periodic waves **(b)** pulse
(c) stationary waves **(d)** complex waves

(14) What kind of waves can be setup in liquids?

(a) transverse waves **(b)** longitudinal waves
(c) both a and b **(d)** matter waves

(15) The formation of compressions and rarefactions are in

(a) transverse wave **(b)** longitudinal waves
(c) electromagnetic wave **(d)** none of these

8.3 SPEED OF SOUND IN AIR

(16) The speed of sound depends upon

(a) compressibility of fluids **(b)** Inertia of fluids
(c) both a and b **(d)** none

(17) Speed of sound at 0°C, in air is: **LHR-2019 (G-I)**

(a) 332 ms^{-1} **(b)** 280 ms^{-1}
(c) 1400 ms^{-1} **(d)** 5500 ms^{-1}

(18) If the pressure of the gas is doubled, then the speed of sound: **GRW-2016 (G-I),LHR-2017 (G-I)**

(a) is also doubled **(b)** becomes half
(c) is not affected **(d)** becomes zero

(19) Speed of sound in aluminum at 20°C is: **LHR-2016 (G-II)**

(a) 3600 m/s **(b)** 5100 m/s
(c) 5130 m/s **(d)** 5500 m/s

(20) The velocity of sound is greatest in: **LHR-2016 (G-II)**

(a) steel **(b)** air
(c) iron **(d)** water

(21) The velocity of sound in vacuum is: **SGD-2016 (G-II), FSD-2017, FSD-2019 (G-I) LHR-2016 (G-II)**

(a) zero **(b)** 332 m/s
(c) 280 m/s **(d)** 330 m/s

(22) Speed of sound in copper is: **RWP-2016 (G-I)**

(a) 3800ms^{-1} **(b)** 3600ms^{-1}
(c) 3500ms^{-1} **(d)** 3400ms^{-1}

(23) The value of "γ" for polyatomic gas is: **MTN-2019 (G-II)**

(a) 1.40 **(b)** 1.29
(c) 1.67 **(d)** 1.19

(24) If speed of sound in air at a given pressure is "V" and now if pressure is doubled then new speed will be: **MTN-2019 (G-I)**

(a) 2V **(b)** $\frac{V}{2}$
(c) V **(d)** 4V

(25) Newton calculated speed of sound in air using the process: **BWP-2019 (G-II)**

(a) Adiabatic **(b)** Isobaric
(c) Isochoric **(d)** Isothermal

(26) ________ **is correct:** **MTN-2018 (G-I)**

(a) $\frac{v_t}{v_o} = \frac{\rho_o}{\rho_t}$ **(b)** $\frac{v_t}{v_o} = \frac{\rho_t}{\rho_o}$

(c) $\frac{v_t}{v_o} = \sqrt{\frac{\rho_t}{\rho_o}}$ **(d)** $\frac{v_t}{v_o} = \sqrt{\frac{\rho_o}{\rho_t}}$

(27) **Expression for Newton's speed of sound in fluids is**

(a) $v = \sqrt{E/r}$ **(b)** $v = \sqrt{\frac{r}{E}}$

(c) $v = \sqrt{Er}$ **(d)** $v = \sqrt{\frac{1}{Er}}$

(28) **The process followed by Newton for the determination of speed of sound in air is:**

(a) adiabatic **(b)** isothermal

(c) isobaric **(d)** isochoric

(29) **The speed of sound in air at S.T.P**

(a) 332 ms^{-1} **(b)** 280 ms^{-1}

(c) 333 ms^{-1} **(d)** 330 ms^{-1}

(30) **The speed of sound higher in solids than**

(a) liquid **(b)** gases

(c) both a and b **(d)** none of these

(31) **If** V_t **and Vo are velocities of sound in air at temperature T and T_o then**

(a) $\frac{V_t}{V_o} = \sqrt{\frac{T}{T_o}}$ **(b)** $\frac{V_t}{V_o} = \sqrt{\frac{T_o}{T}}$

(c) $\frac{V_o}{V_t} = \sqrt{\frac{T_o}{T_o}}$ **(d)** $\frac{V_t}{V_o} = \frac{T_o}{T}$

(32) **The value of constant (γ) for diatomic gas is:**

(a) 1.87 **(b)** 1.40

(c) 1.29 **(d)** 1.90

(33) **Lap lace's value for speed of sound in a gas at S.T.P**

(a) 333 ms^{-1} **(b)** 332 ms^{-1}

(c) 280 ms^{-1} **(d)** 300 ms^{-1}

(34) **The value of constant (γ) for mono-atomic gas is.**

(a) 1.40 **(b)** 1.28

(c) 1.67 **(d)** 1.90

(35) **A conical surface of concentrated sound energy sweeps over the ground as a super sonic plane passes over head called**

(a) ultra sonic boom **(b)** ultra violet boom

(c) infrasonic boom **(d)** sonic boom

(36) **At what temperature the velocity of sound in air is two times its velocity at 10°C**

(a) 859K **(b)** 10 C°

(c) 1132K **(d)** 890 C°

(37) The Laplace correction in the expression for the velocity of sound is needed because sound waves
(a) are longitudinal
(b) propagate adiabatically
(c) propagate isothermally
(d) are of long wavelength

(38) Velocity of sound in vacuum
(a) 340m/sec
(b) 332 m/sec
(c) 280 m/sec
(d) zero

(39) Velocity of sound is maximum on
(a) A hot dry day
(b) Hot humid day
(c) A cool day
(d) A cool humid day

(40) The ratio of the speed of sound in hydrogen to the speed of sound oxygen is
(a) 1:2
(b) 2:1
(c) 1:4
(d) 4:1

(41) Audible frequency range for a normal human being is
(a) 200 to 2000Hz
(b) 20 to 20000 Hz
(c) 10 to 20000Hz
(d) 200 to 200000Hz

(42) Speed of sound at 1 atm pressure is 332m/sec. the speed of sound at 2 atm pressure at same temperature is
(a) 332m /sec
(b) 664m/sec
(c) 166m/sec
(d) 83m/sec

(43) The speed of sound is independent of
(a) moister
(b) temperature
(c) density
(d) pressure

(44) For all gases
(a) $v_t = v_o\sqrt{1-\frac{t}{273}}$
(b) $v_t = v_o\sqrt{1+\frac{t}{273}}$
(c) $v_t = v_o\sqrt{1+273t}$
(d) $v_t = v_o\sqrt{1+\frac{273}{t}}$

(45) Newton proposed that the speed of sound in air is
(a) $333ms^{-1}$
(b) $280ms^{-1}$
(c) $330ms^{-1}$
(d) $332ms^{-1}$

(46) Th00000e speed of sound is higher in solid than the gases due to high
(a) temperature
(b) frequency
(c) elasticity
(d) density

(47) For small changes in temperature, the velocity of sound can be find by the relation
(a) $v_t = v_o + 0.61t$
(b) $v_t = v_o + 0.061t$
(c) $v_t = v_o - 0.61t$
(d) $v_t = v_o - 0.061t$

(48) If speed of source becomes greater than speed of sound then it produces
(a) Doppler's effect
(b) silence zone
(c) sonic boom
(d) all

(49) One degree Celsius rise in temperature increases the speed of sound by
(a) $0.661ms^{-1}$
(b) $1.62ms^{-1}$
(c) $0.61ms^{-1}$
(d) $1.67ms^{-1}$

(50) The speed of sound in hydrogen at STP
(a) $258\ ms^{-1}$
(b) $1286\ ms^{-1}$
(c) $332\ ms^{-1}$
(d) $315\ ms^{-1}$

(51) According to Laplace sound travels in air under
(a) isothermal condition **(b)** adiabatic conditions
(c) isobaric conditions **(d)** isochoric conditions

8.6 BEATS

(52) Phenomenon of beats is due to
(a) interference **(b)** diffraction
(c) polarization **(d)** refraction

(53) Tuning fork is a source of: **(GRW 2015), GRW-2019 (G-II)**
(a) energy **(b)** heat
(c) light **(d)** sound

(54) The louder the sound, the greater will be its: **GRW-2019 (G-I)**
(a) wavelength **(b)** amplitude
(c) speed **(d)** frequency

(55) Beats can not be recognized if difference of frequencies of two sounds is:
SWL-2017, LHR-2017 (G-II)
(a) less than 10 Hz **(b)** more than 10 Hz
(c) less than 5 Hz **(d)** less than 7 Hz

(56) On loading the prong of tuning fork with wax, the frequency of sound: **RWP-2019 (G-I)**
(a) increases **(b)** decreases
(c) remains same **(d)** periodic increase and decrease

(57) The basic principle of beats is: **DGK-2018 (G-II)**
(a) interference **(b)** diffraction
(c) polarization **(d)** superposition

(58) Which of the following is not an application of superposition principle?
(a) interference **(b)** beats
(c) stationary waves **(d)** none

(59) Two tuning forks A and B give four beats / sec. If one of the tuning fork is loaded with wax then number of beats/sec
(a) increases **(b)** decreases
(c) remains same **(d)** may increase or decrease

(60) If a tuning fork is loaded with some wax, its frequency
(a) increases **(b)** decreases
(c) may increase or decrease depending upon frequency
(d) remains same

(61) Two waves of frequency f_1 and f_2 ($f_1 > f_2$) produces beats. The number of beats produced per sec are
(a) $f_1 - f_2$ **(b)** $f_1 + f_2$
(c) $\frac{f_1}{f_2}$ **(d)** $\frac{f_2}{f_1}$

(62) Beats cannot be heard if the difference of frequencies is more than about
(a) 6 HZ **(b)** 10Hz
(c) 4 Hz **(d)** 9 Hz

(63) Beast are produce when
(a) sound is heard after multiple reflections
(b) interference of two sound waves of slightly different frequencies take place
(c) sound waves enter into a highly dispersive medium
(d) interference of two sound waves of the same frequency but different in amplitude take place

(64) The pitch of sound depends upon

(a) frequency **(b)** amplitude
(c) harmonics **(d)** intensity

(65) Two tuning forks of frequency 260 Hz and 257 Hz are sounded together the number of beats per second is:

(a) 3 **(b)** 2
(c) zero **(d)** 4

(66) Loudness of sound depends upon

(a) frequency **(b)** pitch
(c) amplitude **(d)** none

8.8 & 8.9 STATIONARY WAVES & STATIONARY WAVES IN A STRETCHED STRING

(67) The distance between 1st node and 4th antinode is: **FSD 2017**

(a) $\frac{7}{4}\lambda$ **(b)** $5\frac{\lambda}{4}$
(c) $13\frac{\lambda}{4}$ **(d)** $11\frac{\lambda}{4}$

(68) If a stretched-string is 4m and it has 4 loops of stationary waves, then wave length is **LHR-2018 (G-I)**

(a) 1m **(b)** 2m
(c) 3m **(d)** 4m

(69) A stationary wave is established in a string which vibrates in four segments at a frequency of 120 Hz. Its fundamental frequency is: **LHR-2017 (G-I)**

(a) 15 Hz **(b)** 30 Hz
(c) 60 Hz **(d)** 480 Hz

(70) If a string vibrates in "n" loops, the wavelength of stationary wave will be: **FSD 2019 (G-I)**

(a) $\frac{2\ell}{n}$ **(b)** $\frac{n\ell}{2}$
(c) $\frac{2n}{\ell}$ **(d)** $\frac{\ell}{2n}$

(71) If a stationary wave is established along a stretched string of length ℓ and it vibrates in one loop, the wave length is equal to: **MTN-2019 (G-II)**

(a) ℓ **(b)** $\frac{\ell}{2}$
(c) $\frac{\ell}{3}$ **(d)** 2ℓ

(72) In the stretched string if speed of the wave is doubled, the tension will be **DGK-2018 (G-I)**

(a) 2 **(b)** 4
(c) 8 **(d)** 6

(73) When a transverse wave is incident on rarer medium from a denser medium, the phase change will be: **LHR-2017 (G-II)**

(a) 90° **(b)** 60°
(c) 180° **(d)** 0°

(74) A string stretched between two rigid supports is plucked from one quarter then the number of loops formed are

(a) one **(b)** two
(c) three **(d)** four

(75) The fixed ends of vibrating string are called

(a) nodes **(b)** antinodes
(c) overtone **(d)** none

(76) The fundamental frequency of stationary wave is

(a) $f = \frac{1}{2l}\sqrt{\frac{F}{f}}$ **(b)** $f = \frac{v}{l}$
(c) $f = \frac{1}{2l}\sqrt{\frac{F}{m}}$ **(d)** $f = \frac{1}{2vl}$

(77) The product of frequency and wavelength is equal to.

(a) speed of wave **(b)** time period (T)
(c) force **(d)** none of these

(78) The distance between two consecutive crests or troughs is called

(a) frequency **(b)** wavelength
(c) time period **(d)** amplitude

(79) When the antinodes are all at their extreme displacements, the energy stored is

(a) K.E **(b)** P.E
(c) thermal energy **(d)** all of these

(80) The distance between the node and anti node is

(a) $\frac{\lambda}{2}$ **(b)** $\frac{\lambda}{4}$
(c) λ **(d)** $\frac{\lambda}{3}$

(81) The fundamental frequency of stationary wave in a stretched string is

(a) maximum frequency **(b)** minimum frequency
(c) average frequency **(d)** zero

(82) The frequency of a string on a musical instrument can be changed by

(a) changing the length **(b)** changing the amplitude
(c) changing the tension **(d)** either a or b

(83) The speed of the waves in the string is given by

(a) $v = \sqrt{\frac{F}{g}}$ **(b)** $v = \sqrt{\frac{m}{F}}$
(c) $v = g\sqrt{\frac{F}{m}}$ **(d)** $v = \sqrt{\frac{F}{m}}$

(84) When the string vibrates in two loops, its frequency becomes ________ than when it vibrates in one loop.

(a) half **(b)** double
(c) 4 times **(d)** remain same

(85) For 'n' number of loops in a string the fundamental frequency is given by

(a) $f_1 = \frac{f_n}{2n}$ **(b)** $f_1 = \frac{f_n}{n}$

(c) $f_1 = nf_n$ **(d)** $f_1 = \frac{n}{f_n}$

(86) When the string vibrates in three loops then the length 'l' of the string is expressed as

(a) $l = \frac{3\lambda}{4}$ **(b)** $l = \frac{\lambda}{2}$

(c) $l = \frac{3\lambda}{2}$ **(d)** $l = \frac{2\lambda}{3}$

(87) A standing-wave pattern is formed when the length of the string is an integral multiple of

(a) half wavelength **(b)** double wavelength

(c) quarter of wavelength **(d)** 1/4 of wavelength

(88) If tension in a string is made four times then speed of wave becomes

(a) double **(b)** four times

(c) one times **(d)** none

(89) The energy remains standing in the medium.

(a) between nodes **(b)** between antinodes

(c) between node and antinodes **(d)** none of these

(90) Stationary waves are also known as

(a) micro waves **(b)** sound waves

(c) standing waves **(d)** ultra sonics

(91) When the string vibrate in one segment (loop) then length of string is

(a) $l = \lambda$ **(b)** $l = \frac{\lambda}{2}$

(c) $l = \frac{\lambda}{4}$ **(d)** $l = 2\lambda$

8.10 STATIONARY WAVES IN AIR COLUMN

(92) In open pipe, harmonics generated are

(a) even **(b)** odd

(c) both a even and odd **(d)** no

(93) When one end of organ pipe is closed then frequency of stationary waves of any harmonic in it is given by **LHR-2018 (G-I)**

(a) $f_n = \frac{nv}{2k\ell}$ **(b)** $f_n = \frac{n\ell}{4v}$

(c) $f_n = \frac{4v}{n\ell}$ **(d)** $f_n = \frac{nv}{4\ell}$

(94) If the organ pipe is closed at one end, the frequency of fundamental harmonic is: **(RWP 2015)**

(a) $f_1 = \frac{v}{2l}$ **(b)** $f_1 = \frac{v}{4l}$

(c) $f_1 = \frac{4l}{v}$ **(d)** $f_1 = \frac{2l}{v}$

(95) **The wave length of fundamental note in one end closed pipe in terms of le0ngth "l" of pipe is** **SWL 2018**

(a) 4ℓ **(b)** 2ℓ

(c) ℓ **(d)** $\frac{\ell}{2}$

(96) **In resonance tube, which of the followings is formed at open end**

(a) node **(b)** antinodes

(c) neither a nor b **(d)** either a or b

(97) **The stationary longitudinal waves in a pipe closed at one end, only _______ harmonics are present.**

(a) even **(b)** odd

(c) just multiple of 5 **(d)** all of these

(98) **In stationary longitudinal waves the air vibrations are longitudinal along the**

(a) diameter of the pipe **(b)** length of pipe

(c) radius of pipe **(d)** none of these

(99) **In fundamental mode of vibration of a closed end pipe, the wavelength is**

(a) l **(b)** 2l

(c) $\frac{l}{2}$ **(d)** 4l

(100) **When one end of organ is closed, then the wave length of stationary wave of any harmonic in it is given by**

(a) $\lambda n = \frac{4l}{n}$ **(b)** $\lambda n = \frac{4n}{l}$

(c) $\lambda n = \frac{l}{4n}$ **(d)** $\lambda n = \frac{n}{4l}$

(101) **The organ pipe which is open at both ends is**

(a) weaker in harmonics **(b)** richer in harmonics

(c) no harmonics produce **(d)** none of these

ANSWER KEYS

(Topic Wise Multiple Choice Questions)

1	c	16	c	31	a	46	d	61	a	76	c	91	d
2	c	17	a	32	b	47	b	62	b	77	a	92	c
3	c	18	c	33	a	48	c	63	b	78	b	93	d
4	a	19	b	34	c	49	c	64	a	79	a	94	b
5	c	20	b	35	d	50	b	65	a	80	b	95	a
6	a	21	b	36	c	51	b	66	c	81	b	96	b
7	a	22	b	37	b	52	a	67	a	82	a	97	b
8	b	23	b	38	d	53	d	68	b	83	d	98	b
9	c	24	c	39	d	54	b	69	d	84	b	99	a
10	c	25	d	40	d	55	b	70	a	85	b	100	a
11	b	26	d	41	b	56	b	71	d	86	c	101	b
12	b	27	a	42	a	57	a	72	b	87	a		
13	a	28	b	43	d	58	d	73	d	88	a		
14	c	29	a	44	b	59	b	74	b	89	a		
15	b	30	c	45	b	60	b	75	a	90	c		

SHORT QUESTIONS

(From Textbook Exercise)

8.3. It is possible for two identical waves traveling in the same direction along a string to give rise to a stationary wave?

BWP-15(G-I), FSD-15(G-I), RWP-15(G-I), SGD-16 (G-I), FSD-17, LHR-17 (G-I), GRW-18, GRW-19 (G-II), BWP-19 (G-II)

Ans: No, it is not possible for two identical waves traveling in the same direction along a string to give rise to stationary waves, because production of stationary waves requires two identical waves traveling along a straight line in opposite direction.

8.6. Why does sound travel faster in solids than in gases?

MTN-15(G-I)&(G-I), DGK-15(G-I),GRW-15(G-I), MTN-16 (G-II), DGK-16 (G-I), BWP-16 (G-I), LHR-16 (G-I), SWL-17, BWP-17 (G-I) & (G-II), FSD-18, DGK-18 (G-II), GRW-18, RWP-19 (G-I), GRW-19 (G-I), MTN-19 (G-I)

Ans: The velocity of sound in a medium is directly proportional to the square root of the elasticity of the medium.

As by formula:

$$V = \frac{\sqrt{E}}{\sqrt{\rho}} \quad \text{or} \quad V \propto \sqrt{E}$$

Since, the elasticity of solids is larger than that of gases, therefore sound trav0els faster in solids than in gases.

8.7. How are beats useful in tuning musical instrument?

SGD-15(G-I) & (G-II), BWP-15 (G-I), MTN-15(G-II), SWL-16, DGK-16 (G-I)&(G-II), GRW-16 (G-I), LHR-16 (G-II), LHR-18 (G-II), LHR-18 (G-II), SGD-18 (G-I), FSD-19 (G-I), LHR-19 (G-II), MTN-19 (G-I)

Ans: To tune a musical instrument, we compare the note of the instrument with some other note of known frequency. We know that beats are equal to the difference of frequencies, therefore we can use knowledge of beats in tuning musical instruments by adjusting the desired frequency by tightening or loosening the string until no beats are heard.

8.10. Explain why sound travels faster in warm air than in cold air.

SGD-15(G-II), LHR-15(G-I), MTN-16 (G-I), DGK-16 (G-II), SGD-16 (G-I), GRW-16 (G-I), LHR-16 (G-II), DGK-18 (G-I), GRW-19 (G-II), BWP-19 (G-I)

Ans: The velocity of sound in a medium is inversely proportional to the square root of density of the medium i.e.

$$V \propto \frac{1}{\sqrt{\rho}}$$

As the density of warm air is lesser than that of cold air, therefore, sound travels faster in warm air then in cold air. More over velocity of sound increases with temperature hence in warm air the sound travels faster.

TOPIC WISE SHORT QUESTIONS

8.2 PERIODIC WAVES

(1) A wave has speed 400 m / sec. Find wavelength of a wave if frequency is 2 kHz.

Ans: v = 400 m / s

$\lambda = ?$

$f = 2kHz = 2\times10^3 Hz$

$v = f\lambda$

$\lambda = \frac{v}{f}$

$\lambda = \frac{400}{2\times10^3} = 0.2$ m

8.3 SPEED OF SOUND IN AIR

(2) Does the speed of sound according to Newton's formula differs from e0xperimental value?

Ans: Yes according to Newton's formula the speed of sound comes out to be 280 m/s. But its experimental value is 332 m/s (about 16% error).

(3) What is the velocity of sound in vacuum?

Ans: Sound waves are mechanical waves and it cannot travel or propagate without medium. Because mechanical waves produced due to oscillation of particles of medium. In vacuum due to absence of medium velocity of sound is zero.

(4) How the speed of sound is effected by temperatures? LHR-2019 (G-II)

Ans: Laplace was the first man who provided evidence of effect of temperature on the speed of sound. According to him speed of sound increases by 0.61 ms^{-1} for every 1^oC rise in temperature. If speed of sound v_o at S.T.P (i.e; at 0^oC) is $332ms^{-1}$ then the new speed v_t at some temperature t is determined by

$v_t = v_o + 0.61t$

$v_t = 332 + 0.61t \quad \left[\because v_o = 332ms^{-1}\right]$

(5) The speed of sound in air at 0^oC is 332 ms^{-1}. Find its speed at $20^{o00}C$.

Ans: The speed of sound varies directly proportional to temperature and can be measured by using the following equation.

$v_t = v_o + 0.61t$

$v_t = 332 + 0.61(20) \quad \left[\because v_o = 332ms^{-1}\right]$

$v_t = 344.2ms^{-1}$

(6) Write the formula for speed of sound at 0^oC.

Ans: Let v_o = speed of sound at 0^oC

and v_t = speed of sound at t^oC

then the relation between them can be written as

$v_t = v_o + 0.61t$

$v_o = v_t - 0.61t$

(7) Explain effect of pressure and density on speed of sound through air or gas.

Ans: Effect of pressure:

Since density is proportional to the pressure, the speed of sound is not affected by a variation in the pressure of the gas.

Effect of density:

At the same temperature and pressure for the gasses having the same value of γ, the speed $\left(v = \sqrt{\frac{\gamma P}{\rho}}\right)$ is inversely proportional to the square root of their densities. Thus the speed of sound in hydrogen is four times its speed in oxygen as density of oxygen is 16 times that of hydrogen.

(8) What are the factors on which speed of sound in air depends? LHR-2017 (G-I)

Ans: Following are the factors on which speed of sound depends:

(i) Density

At the same temperature and pressure for the gasses having the same value of γ, the speed $\left(v = \sqrt{\frac{\gamma P}{\rho}}\right)$ is inversely proportional to the square root of their densities.

(ii) Temperature

When a gas is heated at constant pressure, its volume is increased and hence it density is decreased. The speed of sound varies with temperature by that relation.

$$v \propto \sqrt{T}$$

(9) Find the temperature of air, if the velocity of sound is 340 ms^{-1} at that temperature.
0 SGD-2016 (G-II)

Ans: $v_o = 332\ ms^{-1}$ $v_t = 340\ ms^{-1}$ $t = ?$

$v_t = v_o + 0.61\ t$

$$t = \frac{v_t - v_o}{0.61} = \frac{340 - 332}{0.61} = \frac{8}{0.61}$$

$t = 13.1°C$

(10) What do you understand by forced vibrations of pressure on the speed of sound in gas? DGK-2014

Ans: Since density is proportional to the pressure, the speed of sound is not affected by a variation in the pressure of the gas.

8.6 BEATS

(11) What it becomes difficult to recognize the beats?

Ans: Number of beats per second is equal to difference between the frequencies of the tuning forks. When the difference between the frequencies of the two sounds is more than 10Hz then it becomes difficult to recognize the beats.

(12) What are the uses of beats?

Uses of beats are following:

Ans: **(i)** These are used to tune musical instruments, such as piano or violin:

(ii) Beats are used to find unknown frequency of tuning fork.

(13) Define Beat and Beat Frequency. MTN-2015

Ans: BEATS

When two sound waves of slightly difference frequencies and travelling in the same direction are superimposed with each other then fluctuating sound is heard called beats.

Beat Frequency

Number of beats per second is equal to difference between the frequencies of the tuning forks. Beats frequency is given by

$n = \pm f_1 - f_2$

8.8 STATIONARY WAVES

(14) How the K.E and P.E alternates in stationary waves?

Ans: When anti-nodes are all their extreme displacements, the energy stored in wholly potential. When they are simultaneously passing through their equilibrium position, the energy is wholly kinetic.

(15) Write characteristics of stationary waves?

Ans: **(i)** Distance between two consecutive nodes or anti nodes is equal to $\frac{\lambda}{2}$.

(ii) Distance between node and next anti node is $\frac{\lambda}{4}$

(iii) In stationary waves, Nodes always remain at rest, so energy cannot flow past through nodes

(iv) Amplitude is maximum at antinodes and minimum at nodes.

(v) Points of constructive interference are called antinodes while points of destructive interference are called nodes.

8.9 STATIONARY WAVES IN A STRETCHED STRING

(16) What is meant by harmonic series?

Ans: The frequency of stationary waves setup on strings will be

$$f_n = nf_1$$
$$n = 1, 2, 3, \ldots$$

The stationary waves in any medium have discrete set of frequencies f_1, $2f_1$, … nf_1. This is known as harmonic series. The fundamental frequency f_1 corresponds to the first harmonic, then $f_2 = 2f_1$ corresponds to the second harmonic an so on.

(17) What happens to the frequency and wavelength of the wave? When a string fixed at its ends, vibrates in more than one loops.

Ans: When the string vibrates in more and more loops its frequency increases and the wavelength gets corresponding shorter. However the product of frequency and wavelength is always, the speed of waves.

$$v = f\lambda$$

8.10 STARIONARY WAVES IN AIR COLUMNS

(18) In which type of an organ pipe, the fundamental frequency is doubled then that of other type?

Ans: In case of open organ pipe fundamental frequency is given by

$$f_{open} = \frac{v}{2\ell}$$

In case of closed organ pipe from one end the fundamental frequency is given by

$$f_{closed} = \frac{v}{4\ell} = \frac{1}{2}\left(\frac{v}{2\ell}\right)$$

So

$$f_{open} = 2 \times f_{closed}$$

Therefore, in open organ pipe fundamental frequency is double as compared to closed organ pipe.

(19) What kind of the waves are there within an organ pipe and in a stretched string.

Ans: The kind of waves within an organ pipe are the longitudinal stationary waves and within a stretched string, the transverse stationary waves are produced.

(20) Why are both odd and even harmonics produced in an open pipe?

Ans: When the pipe is open, antinodes are produced at both ends of pipe. This is due to this reason that all the harmonics are produced in an open pipe.

(21) Which is richer in harmonics, and why:
(a) An open organ pipe. (b) A closed organ pipe. **LHR-2017 (G-I)**

Ans: In case of open organ pipe the frequencies is given by

$$f_n = nf_1$$
$$n = 1, 2, 3, \ldots$$

In case of closed organ pipe the frequencies is given by

$$f_n = nf_1$$
$$n = 1, 3, 5, \ldots$$

In case of closed organ pipe even frequencies are missing and only odd frequencies are present. So, therefore open organ pipe richer in harmonics.