AR Assertion & Reason

For AIIMS Aspirants

Read the assertion and reason carefully to mark the correct option out of the options given below:

(a) If both assertion and reason are true and the reason is the correct explanation of the assertion.
(b) If both assertion and reason are true but reason is not the correct explanation of the assertion.
(c) If assertion is true but reason is false.
(d) If the assertion and reason both are false.
(e) If assertion is false but reason is true.

1. Assertion : Two persons on the surface of moon cannot talk to each other.
Reason : There is no atmosphere on moon.

2. Assertion : Transverse waves are not produced in liquids and gases.
Reason : Light waves are transverse waves.

3. Assertion : Sound waves cannot propagate through vacuum but light waves can.
Reason : Sound waves cannot be polarised but light waves can be polarised. **[AIIMS 1998]**

4. Assertion : The velocity of sound increases with increase in humidity.
Reason : Velocity of sound does not depend upon the medium.

5. Assertion : Ocean waves hitting a beach are always found to be nearly normal to the shore.
Reason : Ocean waves are longitudinal waves.

6. Assertion : Compression and rarefaction involve changes in density and pressure.
Reason : When particles are compressed, density of medium increases and when they are rarefied, density of medium decreases.

7. Assertion : Transverse waves travel through air in an organ pipe.
Reason : Air possesses only volume elasticity.

8. Assertion : Sound would travel faster on a hot summer day than on a cold winter day.
Reason : Velocity of sound is directly proportional to the square of its absolute temperature.

9. Assertion : The basic of Laplace correction was that, exchange of heat between the region of compression and rarefaction in air is not possible.
Reason : Air is a bad conductor of heat and velocity of sound in air is large.

10. Assertion : Particle velocity and wave velocity both are independent of time.
Reason : For the propagation of wave motion, the medium must have the properties of elasticity and inertia.

11. Assertion : When we start filling an empty bucket with water, the pitch of sound produced goes on decreasing.
Reason : The frequency of man voice is usually higher than that of woman.

12. Assertion : A tuning fork is made of an alloy of steel, nickel and chromium.
Reason : The alloy of steel, nickel and chromium is called elinvar.

13. Assertion : The change in air pressure effect the speed of sound.
Reason : The speed of sound in a gas is proportional to square root of pressure.

14. Assertion : Solids can support both longitudinal and transverse waves but only longitudinal waves can propagate in gases.
Reason : For the propagation of transverse waves, medium must also neccessarly have the property of rigidity.

15. Assertion : Under given conditions of pressure and temperature, sound

travels faster in a monoatomic gas than in diatomic gas.

Reason : Opposition for wave to travel is more in diatomic gas than monoatomic gas.

16. Assertion : The speed of sound in solids is maximum though their density is large.

Reason : The coefficient of elasticity of solid is large.

17. Assertion : On a rainy day sound travel slower than on a dry day.

Reason : When moisture is present in air the density of air increases.

18. Assertion : To hear distinct beats, difference in frequencies of two sources should be less than 10.

Reason : More the number of beats per sec more difficult to hear them.

19. Assertion : Sound produced by an open organ pipe is richer than the sound produced by a closed organ pipe.

Reason : Outside air can enter the pipe from both ends, in case of open organ pipe.

20. Assertion : It is not possible to have interference between the waves produced by two violins.

Reason : For interference of two waves the phase difference between the waves must remain constant.

21. Assertion : Beats can also be observed by two light sources as in sound.

Reason : Light sources have constant phase deference.

22. Assertion : In the case of a stationary wave, a person hear a loud sound at the nodes as compared to the antinodes.

Reason : In a stationary wave all the particles of the medium vibrate in phase.

23. Assertion : Velocity of particles, while crossing mean position (in stationary waves) varies from maximum at antinodes to zero at nodes.

Reason : Amplitude of vibration at antinodes is maximum and at nodes, the amplitude is zero, And all particles between two successive nodes cross the mean position together.

24. Assertion : Where two vibrating tuning forks having frequencies 256 *Hz* and 512 *Hz* are held near each other, beats cannot be heard.

Reason : The principle of superposition is valid only if the frequencies of the oscillators are nearly equal.

25. Assertion : The fundamental frequency of an open organ pipe increases as the temperature is increased.

Reason : As the temperature increases, the velocity of sound increases more rapidly than length of the pipe.

26. Assertion : Sound travel faster in solids than gases.

Reason : Solid possess greater density than gases.

[AIIMS 2000]

27. Assertion : Like sound, light can not propagate in va

Reason : Sound is a square wave. It propagates in a medium by a virtue of damping oscillation .

[AIIMS 2000]

28. Assertion : Speed of wave $= \frac{\text{Wave length}}{\text{Time period}}$

Reason : Wavelength is the distance between two nearest particles in phase. **[AIIMS 2002]**

29. Assertion : The flash of lightening is seen before the sound of thunder is heard.

Reason : Speed of sound is greater than speed of light

[AIIMS 2002]

30. Assertion : When a beetle moves along the sand with in a few tens of centimeters of a sand scorpion the scorpion immediately turn towards the beetle and dashes to it

Reason : When a beetle disturbs the sand, it sends pulses along the sands surface

one set of pulses is longitudinal while other set is transverse. [AIIMS 2003]

31. Assertion : The reverberation time dependent on the the shape of enclosure, position of source and observer.

Reason : The unit of absorption coefficient in *mks* system is metric sabine. [EAMCET 20

Answers

Basics of Mechanical Waves

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

Progressive Waves

1	d	2	c	3	b	4	c	5	d
6	d	7	c	8	d	9	c	10	c
11	c	12	c	13	c	14	b	15	b
16	abcd	17	b	18	b	19	d	20	bc
21	a	22	b	23	a	24	a	25	a
26	a	27	acd	28	d	29	a	30	a
31	b	32	d	33	b	34	d	35	d
36	d	37	a	38	a	39	b	40	b
41	d	42	c	43	b	44	c	45	a
46	a	47	d	48	a	49	b	50	d
51	d	52	abc	53	a	54	a	55	b
56	d	57	b	58	d	59	c	60	a
61	b	62	a	63	d	64	a	65	b
66	b	67	b	68	b	69	d	70	b
71	a	72	b	73	d	74	ac	75	c
76	b	77	b	78	c	79	b	80	a

Interference and Superposition of Waves

1	b	2	d	3	a	4	d	5	b
6	d	7	d	8	bc	9	c	10	c
11	a	12	b	13	c	14	d	15	b
16	c	17	a	18	a	19	b	20	c
21	a	22	b	23	a	24	c	25	d
26	b								

Beats

1	c	2	d	3	c	4	a	5	d
6	b	7	c	8	a	9	d	10	b
11	c	12	b	13	a	14	c	15	c
16	c	17	c	18	b	19	c	20	a
21	d	22	c	23	d	24	c	25	c
26	d	27	a	28	c	29	b	30	a
31	c	32	a	33	a	34	a	35	d
36	b	37	a	38	a	39	a	40	b
41	a	42	c	43	d	44	b	45	a
46	c	47	a	48	b	49	b	50	b
51	b								

Stationary Waves

1	c	2	c	3	c	4	c	5	b
6	a	7	b	8	d	9	a	10	a
11	b	12	d	13	b	14	d	15	d
16	abc	17	a	18	d	19	a	20	a
21	a	22	b	23	c	24	b	25	a
26	c	27	d	28	c	29	b	30	d
31	b	32	a	33	b	34	a	35	a
36	a	37	a	38	d	39	d		

Vibration of String

1	c	2	d	3	c	4	c	5	c
6	b	7	b	8	d	9	a	10	c
11	d	12	c	13	c	14	a	15	a

16	d	17	a	18	a	19	c	20	b
21	d	22	c	23	a	24	b	25	a
26	b	27	b	28	b	29	c	30	c
31	b	32	a	33	d	34	b	35	d
36	c	37	d	38	a	39	d	40	b
41	a	42	a	43	d	44	d	45	d
46	c	47	a	48	b	49	d	50	c
51	d	52	b						

Organ Pipe (Vibration of Air Column)

1	c	2	a	3	c	4	d	5	c
6	acd	7	d	8	a	9	b	10	c
11	b	12	c	13	b	14	b	15	b
16	a	17	b	18	a	19	c	20	a
21	b	22	a	23	a	24	b	25	c
26	a	27	a	28	b	29	a	30	d
31	c	32	a	33	b	34	b	35	b
36	b	37	b	38	c	39	b	40	b
41	b	42	b	43	a	44	c	45	a
46	c	47	a	48	d	49	b	50	c
51	a	52	a	53	b				

Doppler's Effect

1	d	2	b	3	a	4	b	5	c
6	b	7	c	8	b	9	a	10	a
11	b	12	a	13	d	14	c	15	b
16	a	17	a	18	c	19	d	20	a
21	d	22	a	23	a	24	b	25	c
26	b	27	c	28	d	29	b	30	d
31	a	32	c	33	d	34	d	35	a
36	b	37	c	38	d	39	a	40	c
41	a	42	c	43	a	44	d	45	d
46	b	47	b	48	b	49	b	50	a
51	a	52	c	53	d	54	b	55	a
56	c	57	c	58	d	59	c	60	a
61	c	62	b	63	a	64	a	65	b

Musical Sound

1	d	2	a	3	a	4	c	5	b
6	c	7	a	8	d	9	d	10	d
11	d	12	c	13	d	14	c	15	b
16	c	17	b	18	a	19	d	20	b
21	c	22	d	23	b	24	a	25	b
26	d	27	d	28	b	29	b	30	a
31	d	32	a						

Critical Thinking Questions

1	abcd	2	bc	3	c	4	a	5	c
6	b	7	b	8	c	9	b	10	d
11	b	12	abc	13	b	14	b	15	a
16	b	17	a	18	d	19	a	20	c
21	a	22	abcd	23	b	24	d	25	a
26	a	27	c	28	a	29	b	30	a
31	b	32	b	33	a	34	c	35	b
36	a	37	d	38	b	39	a	40	c
41	b	42	b	43	c	44	ac	45	c
46	b	47	d	48	c	49	c	50	c
51	c								

Graphical Questions

1	c	2	b	3	a	4	b	5	d
6	c	7	d	8	d	9	c	10	c
11	c	12	c	13	c	14	b	15	bd
16	d	17	b	18	d				

Assertion and Reason

1	a	2	b	3	b	4	c	5	c
6	a	7	e	8	c	9	c	10	e
11	d	12	b	13	e	14	a	15	c
16	a	17	d	18	b	19	b	20	a
21	d	22	c	23	a	24	c	25	a
26	b	27	d	28	b	29	c	30	a
31	e								

AS Answers and Solutions

Basics of Mechanical Waves

1. (d) Air is more rarer for sound to travel as compared to vacuum.
2. (c)
3. (a)
4. (a) $v = n\lambda = 2 \times 5 = 10\ cm/sec$
5. (d) $v = n\lambda \Rightarrow \lambda = \frac{v}{n} = \frac{330}{256} = 1.29m$
6. (d) Time lost in covering the distance of 2 km by the sound waves $t = \frac{d}{v} = \frac{2000}{330} = 6.06\ sec \approx 6\ sec$
7. (a) $v_{max} = a\omega = a \times 2\pi n = 0.1 \times 2\pi \times 300 = 60\pi\ cm/\sec$

8. (c) Audiable range of frequency is $20Hz$ to $20kHz$

9. (c) Phase difference $=\frac{2\pi}{\lambda}\times$ path difference

$\Rightarrow 1.6\pi=\frac{2\pi}{\lambda}\times 40 \Rightarrow \lambda=50\ cm=0.5m$

$\Rightarrow v=n\lambda \Rightarrow 330=0.5\times n\Rightarrow n=660\ Hz$

10. (a) $\lambda=\frac{v}{n}; n\approx 50{,}000\ Hz, \quad v=330\ m/sec \Rightarrow$

$\lambda=\frac{330}{50000}m$

$=6.6\times 10^{-5}\ cm\approx 5\times 10^{-5}\ cm$

11. (a)

12. (a) $\lambda=\frac{v}{n}=\frac{1.7\times 1000}{4.2\times 10^6}=4\times 10^{-4}\ m$

13. (d) Since maximum audible frequency is 20,000 *Hz,* hence $\lambda_{\min}=\frac{v}{n_{\max}}=\frac{340}{20{,}000}\approx 20\ mm$

14. (c) Velocity of sound in gas $v=\sqrt{\frac{\gamma RT}{M}} \Rightarrow$

$v\propto\sqrt{\frac{\gamma T}{M}}$

$\Rightarrow \frac{v_{N_2}}{v_{He}}=\sqrt{\frac{\gamma_{N_2}}{\gamma_{He}}\times\frac{M_{He}}{M_{H_2}}}=\sqrt{\frac{\frac{7}{5}R\times 4}{\frac{5}{3}R\times 28}}=\frac{\sqrt{3}}{5}$

15. (a) Time required for a point to move from maximum displacement to zero displacement is $t=\frac{T}{4}=\frac{1}{4n}$

$\Rightarrow n=\frac{1}{4t}=\frac{1}{4\times 0.170}=1.47\ Hz$

16. (b) Wave number is the reciprocal of wavelength and is written as $\bar{n}=\frac{1}{\lambda}$.

17. (c) $\lambda=\frac{v}{n}=\frac{340}{200}=1.7\ m$

18. (b)

19. (d) $v\propto\lambda\Rightarrow\frac{\lambda_1}{\lambda_2}=\frac{v_1}{v_2}=\frac{2/3}{3/10}=\frac{20}{9}$

20. (a) The time taken by the stone to reach the lake

$t_1=\sqrt{\left(\frac{2h}{g}\right)}=\sqrt{\left(\frac{2\times 500}{10}\right)}=10\ sec$ (Using $h=ut+\frac{1}{2}gt^2$)

Now time taken by sound from lake to the man

$t_2=\frac{h}{v}=\frac{500}{340}\approx 1.5\sec$

$\Rightarrow$ Total time $=t_1+t_2=10+1.5=11.5\sec$

21. (b) When medium changes, velocity and wavelength changes but frequency remains constant.

22. (b) $t=\sqrt{\frac{2h}{g}}+\frac{h}{v}=\sqrt{\frac{2\times 19.6}{9.8}}+\frac{19.6}{v}=2.06$

$\Rightarrow v=326.7\ m/s$

23. (b) $v\propto\sqrt{T}\Rightarrow\frac{v_2}{v_1}=\sqrt{\frac{T_2}{T_1}}\Rightarrow 2=\sqrt{\frac{T_2}{(273+0)}}$

$\Rightarrow T_2=273\times 4=1092\ K=819^oC$

24. (d) Velocity of sound in steel is maximum out of the given materials water and air. In vacuum sound cannot travel, it's speed is zero.