EXERCISE – II

MULTIPLE CHOICE QUESTIONS

1. B

$\frac{\partial y}{\partial t} = -v_w \frac{\partial y}{\partial x}$, $v = -ve$

$\frac{\partial y}{\partial t} = -ve \Rightarrow \frac{\partial y}{\partial x} = -ve$

2. C

3. A

4. ABD

5. AD

6. C

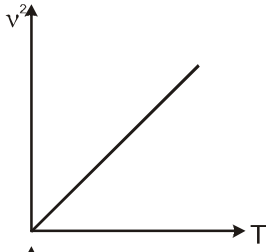
Stationary point or Max Displacement point.

$\frac{\partial y}{\partial x} = 0. \frac{\partial y}{\partial t} = 0.$

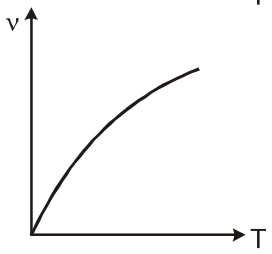
7. B,C

$v \propto \sqrt{T}$

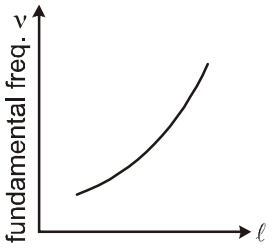
$v^2 \propto T$



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



$f = \frac{nv}{2\ell}$



8. A, B, C, D

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

$v \uparrow$ is humid air.

9. C

$\lambda_1 = \lambda_2$, $f_1 = f_2$

$A_1 = A_2$ $\Delta\phi = \frac{\pi}{2}$

$A_{net} = \sqrt{A_1^2 + A_2^2 + 2A_1A_2\cos\frac{\pi}{2}}$

$= \sqrt{A_1^2 + A_2^2}$

$v = f\lambda = f_1\lambda_1 = f_2\lambda_2$

10. A, B, C

$\Delta x = \pi R = n\lambda$

$\lambda = \frac{\pi R}{n}$

$n = 1$ $\lambda = \pi R$

$n = 2$ $\lambda = \frac{\pi R}{2}$

$n = 3$ $\lambda = \frac{\pi R}{3}$

$n = 4$ $\lambda = \frac{\pi R}{4}$

11. A,C,D

$\Delta x = \frac{3}{4}(2\pi r) - \frac{2\pi r}{4}$

$= \pi r = (2n + 1)\frac{\lambda}{2}$

$\lambda = \frac{2\pi r}{2n+1}$

$n = 0$ $\lambda = 2\pi r$

$n = 1$ $\lambda = \frac{2\pi r}{3}$

$n = 2$ $\lambda = \frac{2\pi r}{5}$

12. B

$I_{max} = 4I_0\cos^2\frac{\Delta\phi}{2}$, $\Delta\phi = \frac{\pi}{2}$

$= 4I_0\cos^2(\frac{\pi}{4})$, $= 2I_0$

13. A

$\Delta x = \pi R = n\lambda$

$\lambda = \frac{\pi R}{n}$ for λ max $n = 1$

$\lambda = \pi R$

14. B

$\Delta x = \pi R = (2n + 1)\frac{\pi}{2}$

$\lambda = \frac{2\pi R}{(2n+1)}$

for λ_{max} $n = 0$

$\lambda = 2\pi R$ $\lambda = \frac{\pi R}{n}$

15. C,D

$\ell_1 = \frac{3\lambda_1}{2}$ $\ell_2 = \frac{5\lambda_2}{4}$

$\lambda_1 = \frac{2\ell_1}{3}$ $\lambda_2 = \frac{4\ell_2}{5}$

$f = \frac{3v}{2\ell_1} = \frac{5v}{4\ell_2} \Rightarrow \frac{\ell_1}{\ell_2} = \frac{6}{5}$

Fundamental

$f_A = \frac{v}{2\ell_1}$ $f_B = \frac{v}{4\ell_2}$

$\frac{f_A}{f_B} = \frac{2\ell_2}{\ell_1} = \frac{10}{6}$ (B)

1st Overtone

$f_A = \frac{v}{\ell_1}$ $f_B = \frac{3v}{4\ell_2}$

$\frac{f_A}{f_B} = \frac{4\ell_2}{3\ell_1} = \frac{20}{18} = \frac{10}{9}$

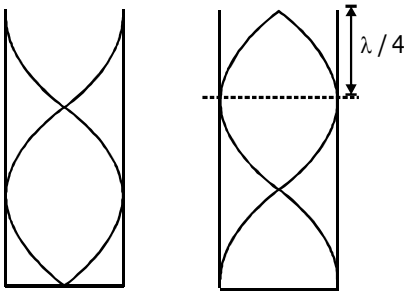
16. C

$v = \sqrt{\frac{\lambda RT}{M}}$, $\frac{fc}{fc} = \frac{v_c}{v_D} \times \frac{2\ell/3}{4\ell/3}$, $\sqrt{\frac{11}{28}}$

17. B,D

$f = \frac{v}{21}$, $= \sqrt{\frac{\lambda RT}{M}} \times \frac{1}{2\ell}$, $f \propto \frac{1}{\sqrt{m}}$ $M \downarrow f \uparrow$

18. B



Displacement Pressure

$\frac{3\lambda}{4} = 1.2$, $\frac{\lambda}{4} = \frac{1.2}{3} = 0.4$ from open end.

19. C

Open organ pipe $f = \frac{nv}{2\ell}$

$\frac{f}{v} = \frac{n}{2\ell} = 1.25$ (1)

$\frac{n+1}{2\ell} = 1.75$ (2)

$\frac{n+2}{2\ell} = 2.25$ (3)

from (1) and (2) $\frac{2.5\ell + 1}{2\ell} = 1.75$

$2.5\ell + 1 = 3.5\ell$ $\ell = 1$

Close organ pipe

$f = (2n - 1)\frac{v}{4\ell}$

$\frac{f}{v} = \frac{(2n-1)}{4\ell} = 1.25$ (1)

$\frac{2n+1}{4\ell} = 1.75$ (2)

$\frac{2n+3}{4\ell} = 2.25$ (3)

from eq. (1) and (2)

$2n-1 = 5\ell$

$2n+1 = 7\ell$

$-2 = -2\ell$ $\ell = 1$ m.

20. C

$P = P_0 \cos \frac{3\pi x}{2} \sin 300\ \pi t$

at close end Pr → Antinode

at open end Pr → node

(A) at x = 0

$P = P_0 \cos 0° = P_0$ Antinode

at x = 0.5 m

$P = P_0 \cos 3\pi = -P_0$ Antinode

(c) at x = 0 antinode – close end.

at x = 2m.

$P_0 \cos 3\pi$ = antinode – close end.

(D) x = 0 antinode – close end.

$x = \frac{2}{3}$ Antindde – close end.

21. C

(A) $f = \frac{v}{v + v_B} \times 500$

$= \frac{350}{350 + 50} \times 500 = 437.5$

(B) $f = \frac{v + v_0}{v + v_B} \times 500$

$= \frac{350 + 25}{350 + 50} \times 500$, $= 468.7 \approx 469$ Hz.

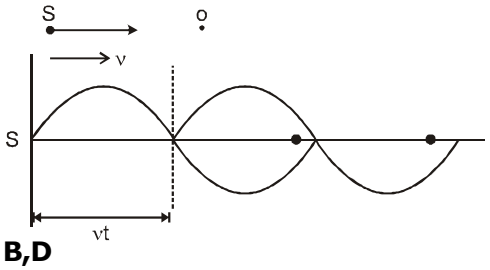
(C) $f_1 = \frac{v - v_0}{v} \times 500 = 464.3$ Hz

$(f_B - f_A) = 4.5$ Hz

(D) $f_A = \frac{v}{v + v_B} \times 500 = 437.5$ Hz

$f_B = \frac{v - v_B}{v} \times 500$, $= 428.6$ Hz

22. C



23. B,D

$f' = \frac{v + v_0}{v - v_c}$ $\xrightarrow{v_c}$ $f' = \frac{v}{v - v_c}.f$

(B) $\lambda = \frac{v}{f'} = \frac{v - v_c}{f}$

(D) Beat frequency $= \left(\frac{v + v_0}{v + v_c} - \frac{v + v_0}{v - v_c}\right) f$

$= \frac{2v_c(v + v_0)}{v^2 - v_c^2}.f$