TEST - 8

Sound	9 k; tFg;G	myF–8 - Xyp
	10 k; tFg;G	myF 5 xypapay;

9th mwptpay;
myF – 8

mwpKfk;:

- xypahdJ xUtpj MwwyhFk. mJ ekJ nrtpia milAkNghJ czhit VwgLjJfpdwJ. rpy xypfs nrtpfF ,dpikahfTk> rpy xypfs NflgjwF ,dpikawwjhfTk ,Uffpdwd. Mdhy midjJ xypfSk nghUlfs mjph tiltjhNyNa czlhfpdwd. ,ttjphTfs xU Clfjjpd topNa Mwwyhf gutp ek nrtpia milfpdwd. kdpjdpd nrtpfshy xU Fwpggpll mjphntz neLffk kwWk Mwwy nfhzl xyp miyfis klLNk NflLzu KbAk. xypapd nrwpthdJ xU Fwpggpll msittplf Fiwthf ,Uejhy mtnthypia ek nrtpahy Nflf ,ayhJ. xypapd RuggzGk (quality) xtnthU xypfFk nttNtwhf ,UfFk. ,it midjjpwFk fhuzk vdd? xypahdJ gy gzGfisg ngwwpUggNj ,jwfhd fhuzkhFk. ,ejg ghljjpy xyp czlhjy> guTjy kwWk mtwwpd gyNtW gzGfisg gwwp ehk fwNghk. NkYk knahyp kwWk mjd mdwhl thotpay gadfisAk mwpNthk.

xyp VwgLjy; :

- nttNtW xyp %yqfypUeJ NjhdWk nttNtW xypfis eqfs jpdKk NflfwhfsD. mit vtthW czlhfpdwd vdgijg gwwp rpejpjjpUffpwhfsh? xyp vtthW czlhfpwJ vdgijg GhpeJ nfhss fNo nfhLffgglLss nrayghlbidr nraJ ghhgNghk.

- ,irffitapd Gaqfis ,uggh glilapy mbfFk NghJ mJ mjphtilfpwJ. ,irf fitapd Gaqfs mjphtiltjhy mUfpYss fhwW %yf$Wfs mjphtilfpdwd. ,tthW mjphTfs xypia czlhfFfpdwd.

xyp miyfs; guTjy;:
xyp miyfs; gut Clfk; Njit

- xyp miyfs guTtjwF fhwW> eh v/F Nghdw nghUsfs Njit. xyp miyfs ntwwpljjpy gut KbahJ. ,jid kzprrhb Nrhjid %yk tpsffyhk.

- xU kdrhu kz kwWk xU kzrrhbia vLjJf nfhsNthk. kdrhu kzahdJ fhwWgGfhj kzrrhbaDs nghUjjggLssJ. [hbahdJ xU ntwwlkhfFk gkGld ,izffggLssJ. kzia xyffr nraAkNghJ› ehk xyiaf Nflf‌Nwhk. ntwwlkhfFk gkgd %yk [hbaYss fhwiw rwJ rwjhf ntsNawWkNghJ› xyad msT rwJ rwjhff Fiwaj njhlqFfwJ. fhwiw KwwYkhf ntsNawwa gwF xy Nflgjyiy. FLitaDs kzLk fhwiwr nrYjjdhy xyahdJ kzLk Nflfj njhlqFk.

xy xU miy :

- xyahdJ xy %yjjyUeJ xU Clfjjd toNa Nflgthd nrtia nrdwilfwJ. xU nghUs mjhtilakNghJ mJ mjidr RwwAss Clfjjd JfsfisAk mjhtilar nrafwJ. Mdhy› Clfjjd Jfsfs ,lkngahtjyiy. xy %yjjyUeJ mjd ghjgG klLNk ,yffwF vLjJr nryyggLfwJ. nghUnshdW mjhtilak NghJ› mejg nghUswF mUfYss JfshdJ jdJ rkeiyg GssayUeJ tyffggLfwJ. ,jJfs mUfYss JfskJ xU tiriar nrYjj mjd fhuzkhf mUfYss Jfs jdJ xaT eiyayUeJ efheJ nryfwJ. mUfYss Jfis ,lgngahrr milar nraj gddh Kjy Jfs jdJ gioa eiyia milfwJ. xyahdJ ekJ nrtia milAk tiu ,eefothdJ njhlheJ eilngWk. MfNt› xy %yjjdhy cUthFk ghjgG klLNk nryfwJ. Mdhy Jfsfs mNj eiyay jhd cssJ CIfjjYss midjJj JfsfSNk jqfsJ rkeiyg Gssay ,oeJ mjhT vdggLk KdDk gdDkhd ,affjij Nkwnfhsfdwd. ,jdhy› mjhtdhJ KdNdhffr nryfdwJ. ,tthW KdNdhffr nryYk mjhNt miy vdggLk.

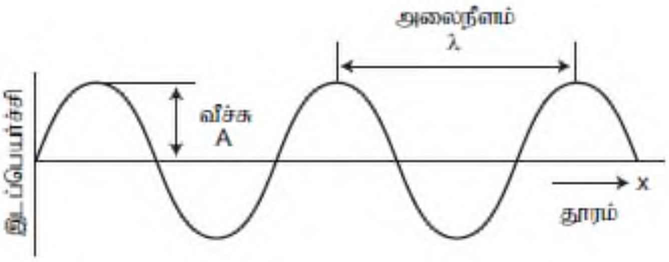
xy miyfs; nel;liyfsh?

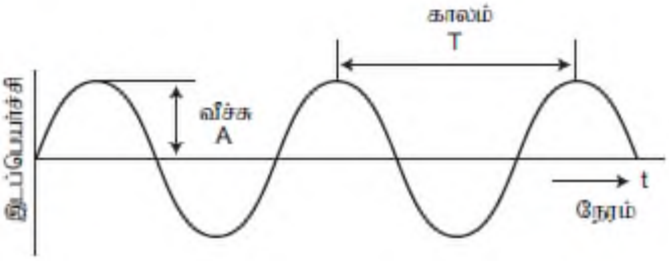
- NkNy css nrayghlby fkgr RUsd xU ry gFjfsy RUsfs neUffkhf cssijf fzBhfs. ,ggFj neUffggFj myyJ mOjjggFj vdggLfwJ. ,uzL neUffqfSffilNa fkgr RUs tyf ,UfFk gFj nefoTggFj vdggLk. fkgrRUs mjhTWk NghJ neUffKk (C) nefoTk (R) fkgrRUsd toNa efheJ nryYk. ,tthW neUffKk nefoTrrAkhfr nryYk miyfNs nelliyfs vdggLfdwd. nelliys CIfjjd Jfsfs guTk jirfF ,izahf KdDk gdDkhf mjhTWfdwd.

- KdDk gdDkhf mjhTWk (nelliyfs) xyAk xU nelliyahFk. CIfjjYss Jfsfs neUffKk nefoTrrAk milAk NghJjhd mjd toNa xy miyfs nryyKbAK. neLffk vdgJ Jfsfs mUfUNf ,UfFk gFjahFk. nefoT vdgJ Fiwej mOjjk css gFj MFk. mqF› Jfssf tyfNa ,UfFk. xy vdgJ vejutay nelliyfF xU cjhuzkhFk. xU CIfjjy xy miyad nelliyj jdikia tsfFfwJ.

xy miyad; gzGfs;:

- trR› mjhnt z› miyTffhyk› miyesk kwWk Ntfk myyJ jirNtfk Mfa gzGfisf nfhzL xU xy miyia KOikahf tiuaWff KbAk.





tlrR (A):

- xy miyahdJ› xU Clfjjd toNa nryYk NghJ› mej Clfjjd Jfsfs eLeiyg GssayUeJ milAk ngUk ,lgngahrr trR vdggLk. mjhTWk nghUsd trR mjfkhf ,Uejhy› xy cujj xyahfTk› trR Fiwthf ,Uejhy mJ nkdikahd xyahfTk ,UfFk. trrhdJ A vdw vOjjhy Fwgglg gLfwJ. ,jd SI myF kllh (k) MFk.

mjhntz; (n):

- mjhtilak nghUs xU nehbay VwgLjJk mjhTfsd vzzfifahdJ mjd mjhntz vdggLk. ,J 'n' vdw vOjjhy FwgglggLfwJ. mjntzzd SI myF n`hl] (Hz) myyJ nr$^{-1}$ MFk. 20 Hz Kjy 20,000 Hz tiu mjhntzfs nfhzl xy miyfis klLNk kdjdd nrtfs NflLzu KbAk. 20 n`hl]fFk Fiwthd mjhntz nfhzl xyfs Fwnwhyfs vdggLk. mjhntz 20›000 Hz fF mjfkhd xy kifnahy myyJ knahy vdggLk. ,jjifa xyfis ek fhJfshy czu KbahJ.

miyTf;fhyk; (T):

- mjhTWk Jfs› xU KOikahd mjhtwF vLjJf nfhsSk fhyk miyTffhyk vdggLk. ,J T vdw vOjjhy FwffggLfwJ. SI myF Kiway ,jd myF tdhb. miyTffhyk kwWk mjhntz Mfait xdWfnfhdW vjhtfjjjy cssd.

miy elsk; (λ)

- mjhTWk JfnshdW› xU mjhtwF vLjJf nfhsSk Neujjy Clfjjy miy guTk njhiyT miyesk vdggLk. xU xy miyay ,uzL neUffqfs kwWk nefoTfsd ikaqfSfF ,ilggll njhiyNt xU miyesk vdggLk. miyeskhdJ› λ vdw vOjjhy FwffggLfwJ. ,jd SI myF kllh MFk.

xyad; jirNtfk; myyJ Ntfk; (V)

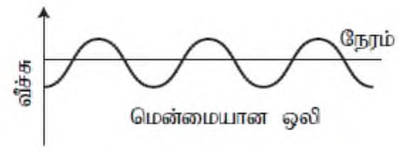
- xU tdhb Neujjy xy miy flfFk njhiyT jirNtfk myyJ Ntfk vdggLk. ,jd SI myF k.t^{-1} MFk.

gyNtW xyfis NtWgLjJjy;

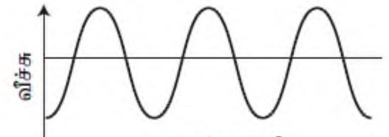
- xyfis foffhZk fhuzfisf nfhzL xdwyUeJ kwnwhdwhf NtWgLjjyhk.
    1. xy cugG kwWk xyrnrwT
    2. RUj
    3. juk

xyrnrwT:

- xNu mjntz nfhzl ,uzL xyfs cugGg gzG %yk NtWgLjjggLfdwd. xU xyahdJ cujjjh myyJ nkdikahdjh vdgJ mjd trirg nghWjJ mikAk. xU Nkiria nkJthfj jlLkNghJ nkJthd Xir NflFk. Vnddy› Fiwej trRila xyahdJ czlhfwJ. Nkiria Ntfkhf mbfFk NghJ cujj xy NflfwJ. mjf nrwTila xyahdJ mjf Mwwiyg ngwwUggjhy mJ mjf J}uk nryy KbAk. xyahdJ mjd %yjjyUeJ theJ nfhzNl nrytjhy mjd trR FiweJ nfhzNl nryYk. xNu mjhntz nfhzl nkdikahd kwWk cujj xy miyad tbtjij FwffwJ.



மென்மையான ஒலி



உரப்பு ஒலி

- xyad cugGg gzghdJ mjd nrwitr rhhejUfFk. XuyF fhyjjy XuyF guggd toNa miy guTk jirfF nrqFjjhfr nryYk Mwwyd msT nrwT vd tiuaWffggLfwJ.

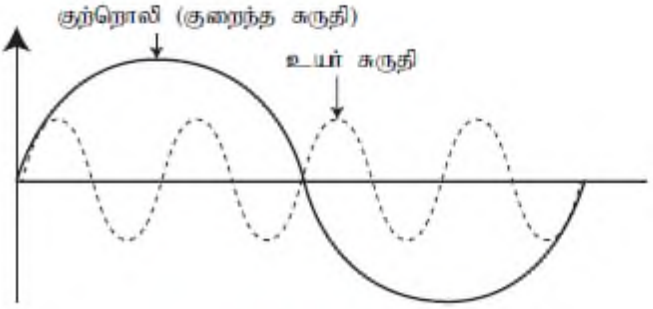
Xhljjy NflFk xyad nrwthdJ foffzl fhuzfisr rhhejUfFk.

1. xy %yjjd trR
2. xy %yjjwFk NflgtUfFk ,ilNa css njhiyT
3. xy %yjjd gugG
4. Clfjjd mlhjj
5. xy %yjjd mjhntz

- xyad nrwthdJ nlrngy (dB) vdw myfhy mstlggLfwJ. njhiyNgriaf fzL gbjj mnyf]hzlh fu`hk ngy vdgthd eidthf ,gngauhdJ toqfggLfwJ.

RUj :

- RUj vdgJ xU xyahdJ fdjjjh myyJ frryhdjh vdgij mwa cjTk xyad gzghFk. mjf RUj nfhzl xyfs fdjjjhfTk ,UfFk. ,uzL ,irf fUtfshy vOgggLk xNu trirf nfhzl ,uzL xyfs NtWgll mjntzfisf nfhzbUejhy› mit xdWf nfhdW NtWgLfdwd. Fiwej RUj kwWk mjf RUj nfhzl ,uzL xyfisf FwfFk miyfs fhllgglLssd.



படம் 8.6 சுருதி

- ,uzL nttNtW ,irffUtpfshy vOgggglI> xNu khjjpahd cugG kwWk RUjpiaf nfhzl ,uzL xypfis NtWgLjJtjwF juk vdw gzG gadgLfpwJ. xNu xU mjpHntz izf nfhzl xypahdJ njhdp (tone) vdggLfpwJ. gyNtW njhdpfspd njhFgG ,irfFwpgG (note) vdggLfpwJ Ruk (Timre) vdgj njhdp vdgij NtWgLjjf $ba gzghFk.

xypapd; Ntfk;:

- klrpj jdik nfhzl Clfjjpd topNa guTk nghOJ> xypahdJ XuyF fhyjjpy flej njhiyNt xypapd Ntfk vdW tiuaWffggLfpwJ.

$$\text{Ntfk (v)} = \frac{\text{flej njhiyT}}{\text{fhyk}}$$

xU miyahdJ flej njhiyT xU miy esk (λ) vdTk> mJ guTtjwF vLjJf nfhzl fhyk miyTffhyk (T) vdTk nfhzlhy.

$$\text{Ntfk (v)} = \frac{\text{xU miyesk}(l)}{\text{xU miyTf fhyk }(T)} \quad \text{(m)} \quad v = \frac{l}{T}$$

$$T = \frac{1}{n} \text{ vdgjhy } v = n\lambda$$

- Clfjjpd gzGfs khwhky ,UfFk NghJ> midjJ mjpHntzfisf nfhzl xypfspd NtfKk xdwhfNt ,UfFk.

- xU xyp miyapd mjpHntz 2 fpNyh n`hl] kwWk miyesk 5 nr.k vdpy 1.5 fp.k J}ujijf flff> mJ vLjJf nfhsSk fhyk vdd?

jPhT:

Ntfk> $v = n\lambda$

,qF> $n = 2$ fpNyh n`hl] $= 2000$ n`hl]

$\lambda = 15$ nr.k $= 0.15$ k

$v = 0.15 \times 2000 = 300$ knr^{-1}

$$\text{Ntfk (v)} = \frac{\text{flej njhiyT}(d)}{\text{fhyk }(d)}$$

$$= \frac{1500}{300} = 5 \text{ tp}$$

xypahdJ 1.5 fp.k njhiyit 5 tpdhbfs MFk.

20ºC ntggepiyapy 22 nkfh n`hl] mjph ntz nfhzl xypapd miy esk vdd?

jhT:

λ = v/n

, qNf› v = 344 ms^{-1}

n = 22 MHz = 22 × 10^{6} Hz

λ = 344 / 22 × 10^{6} = 15.64 ×10^{-6} m = 14.64 μm

gyNtW Clfq;fspy; xypapd; Ntfk;

- xypahdJ xU Clfjjpd toNa xU Fwpgpll Ntfjjpy guTfpwJ. thdjjpy kpddy NjhdwP ,b ,bfFk NghJ› KjyhtJ kpddiyf fhzfpNwhk. gpwFjhd ,b Xiriaf NflfpNwhk. MfNt xypahdJ xspiatpl kpff Fiwthd NtfjjpNyNa nrlfpwJ vdgij ehk mwpayhk. xypapd NtfkhdJ› mJ gazpfff$ba Clfjjpd gz igg nghWjNj cssJ.

- xypapd NtfkhdJ› jpIgnghUis tpl thAtpy kpff Fiwthf ,UfFk. vejnthU ClfjjpYk ntggepiy mjpfhpfFk NghJ xypapd NtfKk mjpfhpfFk. cjhuzkhf› fhwwpy 0°C ntggepiyapy xypapd Ntfk 330 ktp^{-1} MFk. NkYk 25°C ntggepiyapy 34 ktp^{-1} MFk. xU Fwpgpll ntggepiyapy nttNtW Clfjjpy xypapd Ntfk nfhLffgglLssJ.

25°C ntgepiyapy; nttNtW Clfj;jpy; xypapd; Ntfk;

epiy	Clfk;	Ntfk; (kP tp^{-1})
jpIgnghUsfs	mYkpdpak	6420
	epffy	6040
	v/F	5960
	,UkG	5950
	gpjjis	4700
	fzzhb	3980
jputqfs	eh (fly eH)	1531
	eh (J}a eh)	1498
	vjjdhy	1207
	nkjjdhy	1103
thAffs	i`lu[d	1284
	`ypak	965
	fhwW	340
	Mf]p[d	316
	fej il Mfi]L	213

xypahdJ fhwiwtpl 5 klqF Ntfkhf ehpy gazpfFk. fly ehpy xypapd Ntfk kpf mjpfkhf (mjhtJ 5500 fp.k / kzp) ,Uggjhy› fly eUfFs Mapuk fpNyh kIlh njhiytpy ,UfFk ,uzL jpkpqfpyqfs xdWld xdW vspjpy Ngrpf nfhsss KbAk.

xyp vjpnuhypj;jy;

- xU ,uggh geJ Rtwwpy gIL gpujpgypggJ Nghy xypahdJ jpIgnghUs myyJ jputjjpd kJ gIL gpujpgypfFk. xyp vjpnuhypggjwF› totogghd myyJ nrhunrhugghd xU nghpa gugG NjitggLfpwJ. vjpnuhypjjy tpjpfshtd:
  - xypahdJ xU GsspapYUeJ VwgLjJk gLNfhzKk mJ vjpnuhypfFk NfhzKk rkkkhf ,UfFk.

- xy gLk jir> vjnuhyfFk jir kwWk mgGssay tiuaggll nrqFjJfNfhL Mfait xNU jsjjy mikfdwd.

gyKiw vjnuhyjjyd gad;fs;:
,irf; fUtpfs;:

- FoyngUffp> xyngUffp> Foyfs> ehj]tuk> nrdha> jhiu Nghdw ,irf fUtfsahTk xyahdJ xU Fwggll jiray guTk tifay tbtikffggLssd. ,ffUtfsy xU Fohaidj njhlheJ xU $kG tbt mikgghdJ xyiag ngUffkilar nraJ Nflgtiu Nehff KdNdwr nryYkhW mikffgglLssJ.

,jaj;Jbggstp (Stethoscope):

- ,jajJbggst vdgJ xU kUjJtf fUtahFk. ,J clyy czlhFk xyfisf Nflf cjTfwJ. clyy NjhdWk xyahdJ> ,ffUtay css ,izgGf Fohay gyKiw vjnuhyggileJ> kUjJthd nrtia milfwJ.

vjpnuhyp:

- caukhd fllqfs> kiyfs Nghdw vjnuhyfFk gugGfsd mUNf ehdW ifjlbdhNyh myyJ Fuy vOggdhNyh rwJ Neuk foj Jk mjid ehk kzLk NflFKbAk. ,ej xyahdJ vjnuhy vdggLfwJ.

- xU tdhbay gjjy xU gqF fhyjjwF xyahdJ njhlheJ %isay czuggLfwJ. vdNt> vjnuhyffggll xyia njsthff Nflf NtzLnkdy xy kwWk vjnuhyfF ,ilggll fhyk FiwejJ 0.1 tehbahf ,Uff NtzLk. xU Fwggll ntggeiyay xyad Ntfk 340 kt^{-1} vdf fUJNthk. xyahdJ %yjjyUeJ nrdW> jilgIL> vjnuhyjJ 0.1 tdhbfFg gwF Nflgtiu milfwJ. vdNt> xy gazjj nkhjj njhiyT 340 kt^{-1} × 0.1 t = 34 k

- MfNt> vjnuhyia njsthff Nflf NtzLkhdhy vjnuhyfFk gugG FiwejglrK 17 k njhiyty ,Uff NtzLk ,ejj njhiytdhJ fhwwd ntggeiyiag nghWjJ khWgLk. njhlh myyJ gyKiw vjnuhyjjydhy vjnuhyia xU KiwfF NkYk Nflf ,aYk. nttNtW cajjYss Nkfqfs kwWk eyk Nghdw gyNtW vjnuhyfFk gugGfsd kJ gLk xy miyfsd njhlh vjnuhyggd fhuzkhf ,bKoffk VwgLfwJ.

- xUth jdJ Jgghffia RII 5 tdhbfFg gwF vjnuhyiaf Nflfwhh. mth Fdiw Nehffp 310 k KdNdhffp efheJ kzLk RLfwhh. ,gnghOJ 3 tdhbfFg gwF vjnuhyiaf Nflfwhh vdy xyad Ntfk vttsT?

jhT:

njhiyT (d) = Ntfk (v) × fhyk (t)

Kjy Kiw RLkINghJ xy flej njhiyT> 2d = v × 5

,uzlhtJ Kiw RLkNghJ xy flej njhiyT> 2d – 620 = v × 3

rkdghL 2 I khwwp vOjdhy>

$$2d = (v \times 3) + 620$$

rkdghL 1 kwWk 3 yUeJ> 5v = 3v + 620

$$2v = 620$$

xyad jirNtfk, v = 310 k / t^{-1}

vjh Kofkfk:

- nghpa miwfsy VwgLjjggLk xyahdJ› miwad Rthfsy gIL kzLk vjnuhygG mileJ mjd NflFk jdik RoahFk tiu ebjjUfFk. gdKf vjnuhyggd fhuzkhf› xyad Nflly ebjjUfFk jdik vjh KOffk vdggLk fiyauqfk› nghpa miwfs› jiuauqfk› xyggjTf$lqfs NghdwtwwyVwgLk mjfkhd vjh Koffk tUkgjjffJ myy. Vnddy ,iria urffNth› Ngrir njsthff NflfNth ,ayhJ. vjh Koffjijf FiwggjwF fiyauqfjjd Nkw$iu› Rthfs Nghdwit xyia clftUk jdik nfhzl nghUsfshyhd mKffggll ehh mlil› jiurriyfs› gsh]lh Nghdw nghUsfshy %lgglbUfFk. ghhitahshfs mkUk ,UfiffSk xyia clftUk gzgd mbggilaNyNa njhT nraaggLfdwd. ,jdhy› kff Fiwej xyNa gujgyggG milfwJ. muqfqfs› eforr miwfs kwWk jNallhfis tbtikfFk NghJ ,ej fhuzqfs fUjjy nfhssggLfdwd.

knahy:

- 20›000 n`hl]fFk mjfkhd mjh ntzizf nfhzl xy miyfs knahy miyfs vdggLfdwd. ,ej miyfis kdj nrtfshy czuKbahJ. Mdhy› tyqFfs ,twiwf NflLzuKbAk. cjhuzkhf› ehahy knahy miyfisf NflfKbAk. rhiyfsd eLNt XbtUk khdfs› thfdjjwF Kdghf ghaeJ tlhjgbfF› knahy miyfisf nfhzl xygghdfs thfdqfsy gadgLjjggLfdwd.

- knahy miyfsd Kffakhd gad vddntdwhy› ,it kdj clyd cWgGffis MuhatjwFg gadgLfdwd. knahy miyfis clyDs nrYjjkNghJ› mit cly cWgGfs kwWk vYkGfsy glL vjnuhyffdwd. ,ej miyfs fzlwaggIL› MuhaggIL fzdaly NrkffggLfdwd. ,tthW ngwggLk tiu gljjwF vjnuhy MotiuT (Echogram) vdW ngah. ,J kUjJt MaTfsy gadgLfdwJ. fly fzfhzggYk knahy miyfs gadgLfdwd.

knahyad gadfs:

- knahy miyfs J}aikahfFk njhoy ElgjJy gadgLfdwd. nghUsfsd kJss kfr rwa Jfsfis efFtjwF› mgnghUsfs knahy nryYk jutjDs itjJ J}aikg gLjjggLfwJ.
- cNyhfg glilfsYss ntbgG kwWk Fiwfis knahy miyfisf nfhzL fzlwayhk.
- knahy miyfs ,jajd gyNtW gFjfsyUeJ vjnuhyffgglL ,jajd gkgjij VwgLjJfdwd. ,jnjhoy ElgjjwF knahy ,ja tiut vdW ngah.
- knahy miyfisfnfhzL rWeufjjYss fwfis rWrW Jfsfshf cilff KbAk. gddh mit rWeh toahf ntsNawwggLfdwd.

Nrhdh (Sonar):

- Nrhdh (SONAR) vdw nrhyyd thhthffk Sound Navigation and Ranging vdgjhFk. Nrhdh vdw fUtahdJ knahy miyfisr nrYjj eUfF mbaYss nghUsfsd J}uk› jir kwWk Ntfk MfatwiwF fzffl gadgLfwJ. ,jy knahyfisg guggf$ba rhjdKk› knahyfis czuf$ba czhtAk csd. mit glF kwWK fggyfSfF mbay nghWjjgglLssd. guggahdJ knahyfis cUthff gugGfdwJ. ,ttiyfs eUfFs gazjJ› flyd mbjjsjjy css nghUlfsd kJ (mjhtJ fly gLif› kdfsd $llk) glL› vjnuhyggileJ kzLk tUknghOJ czhtadhy czuggLfdwd. czhtahdJ knahyfis kdrhu iriffshf khwwkilar nrafdwJ. mtwwyUeJ jftyfs ngwggLfdwd. eHy xyad jirNtfk kwWk gugggll xyfFk› ngwggll vjnuhyfFk ,ilNa css fhy ,ilnts MfatwiwF fzffIL› mjd %yk eUfFssUeJ knahy miyfis vjnuhyjj nghUsd njhiyitf fzffIyhk.

- gugggglI kwWk ngwggII knahy miyfSfF ,ilNaahd fhy ,ilntsia 't' vdTk› ehd Ntfjij 'v' vdTk nfhzlhy› knahyahdJ flej njhiyT 2d /t = v MFk.
- ,tthW nghUsfsd njhiyitf fzlwAk Kiw vjnuhy neLffk (echo-ranging) vdggLk. flyd Mojij mwaTk› eUfF mbay mikeJss kiyfs› FdWfs› eh%offf fggyfs kwWk gdgghiwfs Mfatwiw ,lk fzlwtjwFk ,ej KiwahdJ gadgLfdwJ.
- xU fggyyUeJ mDggggLk knahyahdJ flYfF mbaYss nghUsd kJ vjnuhyffgglL 3.42 tdhbfFg gwF

fzf;fIL 4:

- xU fggyyUeJ mDggggLk knahyahdJ flYfF mbaYss nghUsd kJ vjnuhyffgglL 3.42 tdhbfFg gwF kzLk tejilfwJ. fly ehy knahyad Ntfk 1531 vdy fggyyUeJ flyd mbggFj tiu css njhiyT vttsT?

jhT:

knahy flej njhiyT = 2 × flyd Mok

njhiyT = Ntfk × Neuk vdgjhy›

2d = Ntfk × Neuk

\ $d=\frac{5236}{2}=2618$ k

MfNt› fggyyUeJ flyd Mok = 2618 k myyJ 2.618 f.k

kd; xy ,ja tiuglk; (ECG):

- kd xy ,ja tiuglk vdgJ ,jajiijg gww mweJ nfhstjwfhd vsa kwWk goikahd KiwahFk. ,J ,jajiijg gww mNef jftyfis msffdwJ. NkYk ,ja Nehahsfisg gwwa Matd kf KffakhdgFjahfTk ,J cssJ. ,kKiway› ,jajjyUeJ ngwggLk xyahdJ› kd rfdyfshf khwwggLfdwd. vdNt ECG vdgJ› Neujiijg nghWjJ khwf$ba ,jaj jirfsd kdrhu nraygh Lfisf FwggjhFk. nghJthf› gFgghaT nratjwfhf› jhsfsd kJ ,it mrrlggLfdwd. ,jajjd nraygh Lfis xUry ekl Neu ,ilntsay ngUffkilar nraJ› gjT nraAk KiwNa ECG vdggLk.

nrtad; mikgG:

- ehk vtthW xhiaf NflfNwhk? nrt vdggLk kf Ezza czh cWggd %yk ehk xyiaf NflfNwhk. Nflff$ba mjhntzfisf nfhzl fhwwdy VwgLk mOjj khWghLfis kdrhu iriffshf khwWtjwF ,it cjTfdwd. ,ej iriffs› fhJ eukGfs toNa %isiar nrdwilfdwd. nrtahdJ xyiaf NflFk tjkhdJ fNo tsffgglLssJ.
- nrtad ntsggFj nrtkly vdW miofffggLfwJ. ,J RwWgGwjjyUeJ xyiar NrfhffdwJ. Nrfhffggll xyahdJ› ntsr nrtf Foha %yk nrtfF csNs nryfwJ. ntsr nrtf Fohad Kbty› nrtggiw (Tympaic membrane)

cssJ. fhwW Clfjjpy xU neUffkhdJ czlhFkNghJ› nrtpggiwapd ntspggFjpapYss mOjjkhdJ mjpfhpjJ› nrtpggiwahdJ clGwk jssggLfpwJ. mJNghyNt› fhwW Clfjjpy xU nefpoorrp czlhFk NghJ› nrtpggiwahdJ. ntspgGwk jssggLfpwJ. ,tthwhf nrtpggiwahdJ mjphtilfpdwJ. ,ej mjphthdJ› eLrnrtpapYss %dW vYkGfshy (Rjjp› glil kwWk mqftb) gyKiw ngUffkilfpwJ. xyp miyapypUeJ ngwggIL ngUffkilej mOjjNtWghlhdJ› eLrnrtpypUeJ clnrtpfFf fljjggLfpwJ. clnrtpapDs fljjggll mOjjNtWghlhdJ› fhfypah (Cochlea) %yk kpdiriffshf khwwggLfpdwJ. ,ej kpd iriffs fhJ eukG topNa %isfF nrYjjggLfpdwd. %isahdJ mtwiw xypahf czhfpdwJ.

epidtpy; nfhs;f:

- ngiUsfspd mjphtpdhy xyp czlhfpwJ.
- xypahdJ xU Clfjjpd topNa nelliyfshfg guTfpwJ.
- xypahdJ neUffkhfTk neopoorrpahfTk Clfjjpd topNa guTfpwJ.
- xyp guTk NghJ Mwwy kILNk guTfpwJ. Clfjjpd Jfsfs efhtjpyiy.
- ntwwplljjpd topNa xyp nrytjpyiy.
- miy esk (λ), mjphntz (n) kwWk Ntfk (v) ,twwpwfpilNa css njhlhG : v = nλ
- xyp vjpnuhypjjy tpjpggb xypgLk jpir› xyp vjpnuhypfFk jpir kwWk nrqFjJ NfhL ,it %dWk xNu jsjjpy mikAk› gLNfhzKk ks Nfhzkk vgNghJk rkkhfNt ,UfFk.
- vjpnuhypia njspthff Nflf NtzLkhdhy› Kjdik xypfFk› vjpnuhypffggll xypfFk ,ilNaahd fhy ,ilntsp 0.1 tpdhbia tpl mjpfkhf ,Uff NtzLk.
- gdKf vjpnuhypggpdhy xypapd Nflly ebjjpUfFk jdik vjph KOffk vdggLk.
- nrwpAzh xypapd mjphntz 20 n`hl] Kjy 20000 n`hl] tiu cssJ.
- nrwpAzh xypapd mjhntziz tpl Fiwthd mjphntz nfhzl xyp Fwnwhyp vdWk› nrwpAzh xypapd mjphntziz tpl mjpf mjphntz nfhzlit knahyp vdWk mioffggLfpdwd.
- Nrhdh (sonar) flypd Mojiijf fhzTk› eUfF mbapYss FdWfs› rkntspfs› eh%ofpf fggy kwWk gdpgghiwfs Mfpatwiwf fzlwpaTk gadgLfpwJ.

10TH mw▯t▯ay;
myF 5
xy▯a▯ay;

mw▯Kfk;

- xy▯ ekJ mdwhl thot▯y Kff▯ag gqF tf▯ff▯wJ. ehk xUtUfnfhUth njhlhG nfhss xy▯Na gadgLf▯wJ. j▯dKk ekikr Rww▯a▯UfFk kd▯jhfs› thfdqfs› t▯yqFfs Nghdwitfs vOgGk gyNtW tifahd xy▯fisf Nflf▯Nwhk. Mjyhy› xy▯ vtthW cUthf▯wJ?› xy▯ vtthW guTf▯wJ? xy▯a▯id ehk vtthW Nflf▯Nwhk? vdw Nfst▯fSfnfyyhk t▯il njh▯aNtzbaJ mtr▯akhf▯wJ. ,irffUt▯fis cUthfFtJ kwWk ,ir muqfqfis tbtikggJ klLNk xy▯a▯ay vdw jtwhd Gh▯jYk r▯yNeuqfs▯y VwgLf▯wJ. xy▯a▯ay vdgJ xy▯ cUthjy› xy▯ guty› xy▯ahwwiy flLggLjJjy kwWk xy▯a▯dhy VwgLk t▯isTfs Mf▯aitfisg gww▯ mw▯eJ nfhsSk ,awg▯ay▯d xU gh▯T MFk.

xy▯ miyfs;:

- ehk xy▯iag gww▯ e▯idfFk NghJ› xy▯ vtthW cUthf▯wJ? gyNtW xy▯ %yqfs▯y▯UeJ tUk xy▯ vtthW ekJ fhJfis milf▯wJ?. xy▯ vdgJ vdd? mJ t▯irah myyJ Mwwyh? vd gy t▯dhffs ekJ kd▯j▯y vOk› ,ej ghlj▯j▯y ,J Nghdw t▯dhffSfF t▯il fhzNghk.

- xy▯fFk kz▯ myyJ ,irfFk ,irffUt▯iaj njhlLg ghhfFk NghJ xy▯ahdJ mj▯hTfshy cUthf▯dwJ vdgij mw▯ayhk. mj▯htilak nghUlfs miy tbt▯y Mwwiy cUthfFf▯wJ. mJNt xy▯ miyfshFk.

- eAk› cdJ ezghfSk e▯yt▯y ,Uggjhff fUj▯fnfhsSqfs. cdJ ezgd vOgGk xy▯ia cddhy Nflf ,aYkh? e▯yt▯y ts▯ kzlyk ,yyhjjhy cdJ ezgd▯d xy▯iaf Nflf ,ayhJ. vdNt mj▯hTWk nghUlfs cUthfFk xy▯ gut▯l j▯l› j▯ut› thA Nghdw gUnghUs Clfqfs Njit vdgijg Gh▯eJ nfhssyhk. ,j▯y▯UeJ xy▯ahdJ j▯l› j▯ut myyJ thA Clfqfs▯y guTk.

nel;liyfs;:

- xy▯ miyfs nelliyfshFk. mit midj:J Clfqfs▯Yk (j▯zk› j▯ut› thA) guTk› mtww▯d j▯ir Ntfk gUnghUs Clfqfs▯d gzigg nghWjJ mikAk. xU Clfjj▯y xy▯aiy guTk j▯ira▯Ny Jfsfs mj▯hTwwhy mjid nelliy vdyhk. xtnthU %yf$Wk mjd ikaggFj▯a▯y▯UeJ esthff▯y ,lngahrr▯ miltjhy nelliyfs cUthf▯wJ. ,jdhy Clfjj▯d to▯Na nelliyfs guTk NghJ ,WffqfSk jshrr▯fSk cUthf▯dwd. Clfjj▯d to▯Na guTk nelliyfs▯y ,Wffqfs vdgJ mj▯f mOjjk css gFj▯ kwWk jshrr▯fs vdgJ Fiwej mOjjk css gFj▯ahFk. nelliyfs▯d ,WffqfSk jshrr▯fSk fhllgglLssJ.

xy▯ miyffis mj▯hntz;izg nghWj;J tifgLj;jy;:

1. **nrt▯Azh; xy▯ miyfs;:** ,it 20Hz Kjy 20,000 Hz fF ,ilggll mj▯hntz cila xy▯ miyfshFk. xy▯ miyfshFk. ,it mj▯htilAk nghUlfshd Fuy ehzfs kwWk ,OjJf fllggll fkg▯ Nghdwitfshy cUthffggLf▯wJ.

2. **Fwnwhy▯ miyfs;:** ,it 20 Hz I t▯lf Fiwthd mj▯hntz cila xy▯ miyfshFk. kd▯jhfshy Nflf ,ayhJ› e▯yeLffjj▯d NghJ cUthFk mj▯htiyfs› fly miyfs kwWk j▯k▯qfyqfs VwgLjJk xy▯ Nghdw xy▯fs Fwnwhy▯ miyfs MFk.

1. **knahy miyfs**: ,it 20,000 Hz fFk mjfkhd mjhntz nfhzl xy miyfshFk. kdjhfshy Nflf ,ayhJ. Mdhy nfhR› eha› ntsthy kwWk lhygd Nghdw cahdqfshy Nflf ,aYk. ntsthy VwgLjJk xyaid knahyfF vLjJffhllhf $wyhk.

xy kwWk; xs miyfSf;F ,ilNaahd NtWghLfs;:

t.vz;	xy miyfs;	xs miy
1.	guTtjwF Clfk Njit	guTtjwF Clfk Njitaiyiy
2.	nelliyfs	FWffiyfs
3.	miy esk 1.65 nr.k Kjy 1.65 k tiu ,UfFk.	miy esk 4 × 10^{-7}k Kjy 7 × 10^{-7} k tiu ,UfFk.
4.	xy miyfs 340 kt^{-1} jirNtfjjy guTk (NTP)	xs miyfs 3 × 10^{8} kt^{-1} jirNtfjjy guTk

xy miyfsd; jirNtfk;:

- xU miyad jirNtfk gwwp tthjfFk NghJ› ,U tifahd jirNtfqfis ehk fzffy vLjJf nfhss Ntzlk. mitfs mjhtilAk Jfsd jirNtfk kwWk miyad jirNtfk MFk. jirNtfjjd myF klh tdhb^{-1} MFk.

Jfs; jirNtfk;:

- xU Clfjjy miyfs tbty Mwwiyf fljJtjwfhf Jfsfs mjhtilAk jirNtfk Jfs jirNtfk vdggLk.

miyj; jirNtfk;:

- xU Clfjjd toNa miy guTk jirNtfk miyj jirNtfk vdggLfwJ. ,jid xuyF fhyjjy xy miy guTk J}uk vdTk FwggLyhk.

$$V = \frac{l}{T}$$

$$V = n\lambda$$

- jlgnghUlfsy klrgg zG mjfkhf ,Uggjhy mjd toahf xyaiy nryYk NghJ xyad jirNtfk mjfkhf ,UfFk. thAffSfF klrg gzG Fiwthf ,Uggjhy xyaiy thAffs toahf nryYk NghJ mjd jirNtfk Fiwthf ,UfFk.

fhyjjy xy miy guTk J}uk vdTk FwggLyhk.

$$\text{miyj jirNtfk} = \frac{\text{njhiyT}}{\text{gut vLjJfnfhzl fhyk}}$$

xU miyahdJ λ vdw J}ujij (miy esk) T fhyjjy fleJ nrdwhy mjd miyj jirNtfjij vd FwggLyhk.

$$V = \frac{l}{T}$$

- Mjyhy xU tehb Neujjy› xy miy flejj njhiyT miyj jirNtfk MFk. (n) = 1/T vdgij miyad mjhntz vd fUjdhy rkdghL vd vOjyhk.

$$V = n\lambda$$

- jplgnghUlfspy klrpggzG mjpfkhf ,Uggjhy mjd topahf xypaiy nryYk NghJ xypapd jpirNtfk mjpfkhf ,UfFk. thAffSfF klrpg gzG Fiwthf ,Uggjhy xypaiy thAffs topahf nryYk NghJ mjd jpirNtfk Fiwthf ,UfFk.

vdNt $V_{jpl} > V_{jput} > V_{thA}$

xypapd; jpirNtfj;ij gh;jpf;Fk; fhuzpfs;

xypapd; jpirNtfj;ij gh;jpf;Fk; fhuzpfs;

- jplg nghUlfspd topahf xyp nryYk NghJ mjd klrpggzG kwWk mlhjjp xypapd jpirNtfjijg ghjpffpwJ. klrpg gzghdJ klrpf Fzfjjpdhy Fwpffgglfpwj. xypapd jpirNtfkhdJ klrpf Fzfjjpd ,Ukb %yjjpwF Nehjjftpyk> mlhjjpapd ,Ukb %yjjpwF vjphjjftpYk mikAk.

- vdNt mlhjjp mjpfhpfFk NghJ> xypapd Ntfk FiwfpwJ. klrpg gzG mjpfhpfFk NghJ xypapd jpirNtfKk mjpfhpffpwJ. thAffisg nghWjjtiuapy fofzl fhuzpfs xypapd jpirNtfjjijg ghjpffpdwd.

mlhj;jpapd; tpisT:

- thAffspy xypapd jpirNtfk mjd mlhjjpapd ,Ukb %yjjpwF vjph jftpy mikAk. vdNt thAffspd mlhjjp mjpfhpfFk NghJ jpirNtfk FiwfpwJ.

$$v \alpha \sqrt{\frac{1}{d}}$$

ntggepiyapd; tpisT:

- thAffspy xypapd jpirNtfk> mjd ntggepiyapd ,Ukb %yjjpwF Neh jftpy mikAk. vdNt ntggepiy mjpfhpfFk NghJ> jpirNtfKk mjpfhpffpwJ. $v \alpha \sqrt{T}$ ntggepiy T°C y jpirNtfkhdJ.

$V_T = (V_0 + 0.61T)\ m\ s^{-1}$

,qF v_0 vdgJ 0°C ntggepiyapy thAffspy xypapd jpirNtfk MFk. fhwwpwF v_0 = 331 ktp^{-1} vdNt xtnthU bfphp nryrpa] ntggepiy mjpfhpggpwFk jpirNtfkhdJ 0.61^{-1} ktp mjpfhpffpwJ.

xgGik <uggjjjpd; tpisT:

- fhwwpd <uggjk mjpfhpfFk NghJ xypapd jpirNtfKk mjpfhpffpwJ. vdNt jhd kioffhyqfspy njhiytpypUeJ tuf$ba xypiaj njspthff Nflf KbfpwJ.

- gyNtW Clfqfspy xypapd jpirNtfk gwwp mlltiz nfhLffgglLssJ.

gy;NtW Clfq;fspy; xypapd; jpirNtfk;

t.vz;	Clfj;jpd; jd;ik	Clfk;	xypapd; jpirNtfk; (ktp^{-1})
1	jplgnghUs	jhkpuk	5010
2		,UkG	5950
3		mYkpdpak	6420
4	jput k	kznz znza	1324
5		eh	1493
6		fly eh	1533

7	thA	fhwW (0°C)	331
8		fhwW (20°C)	343

jPh;f;fggl;l fzf;F

- vej ntggepiyapy xypapd jpirNtfkhdJ 0ºC y cssij tpl ,uIbgghFk?

jPh;T:

Njitahd ntggepiyia TºC vdfnfhsNthk; v_1 kwWk v_2 vdgit KiwNa T_1K kwWk T_2K ntggepiyapy xypapd jpirNtfk MFk. T_1 = 273 K (0º C) kwWk T_2 = (Tº C + 273) K

,qF $\frac{v_2}{v_1} = 2$ vdf nfhLffgglLssJ.

$$\frac{v_2}{v_1} = \sqrt{\frac{T_2}{T_1}} = \sqrt{\frac{273+T}{273}} = 2$$

vdNt $\frac{273+T}{273} = 4$

T = (273 × 4) – 273 = 819ºC

xypapd; vjpnuhypgG:

- eqfs ntwW miw xdwpy mkheJ nfhzL NgRk NghJ; eqfs Ngrpa xyp kzLk kzLk cqfis tejiltij ftdpjjpUgghfs. ,J eqfs Ngrpa xypapd vjpnuhypgNg MFk. foffhZk nraygh lbd %yk xyp vjpnuhypgig tpthjpffyhk.

- xypahdJ xU Clfjjpyp UeJ kwnwhU Clfjjpw F guTk NghJ ,uzlhtJ Clfjjhy vjpnuhypffgglL Kjyhk Clfjjpw F jpUggp mDgggLfpwJ. ,ej vjpnuhypgghdJ xsp miyfspy eilngWk vjpnuhspgigg NghdwNj MFk. ,uzlhk Clfjij Nehffpr nryYk fjph gLfjph vdTk ,uzlhk Clfjjpy gIL jpUkgp tUk fjph vjpnuhypjjf fjph vdTk mioffggLfpwJ.

vjpnuhypgG tpjpfs;

- xyp miyfisg NghyNt; xyp miyfSk mbggil vjpnuhypgG tpjpfisg Ghjjp nraAk; foffhZk ,U vjpnuhypgG tpjpfSk xyp miyfSfFk nghUeJk.
  - gLfjph; vjpnuhypfFk jsjjpy tiuaggLk nrqFjJfNfhL kwWk vjpnuhypgGf fjph Mfpait xNu jsjjpy mikAk.
  - gLNfhzk <ikwWk vjpnuhypgGf Nfhzk <r Mfpait rkkhf ,UfFk.

- vjpnuhypgGj jsjij Nehffpr nryYk fjphfs gLfjphfs vdggLk. vjpnuhypgGj jsjjpy gIL kzLk jpUkgp tUk fjphfs vjpnuhypjjf fjphfs vdggLk. midjJg gadghLfSfFk gLfjph kwWk vjpnuhypgGf fjph Mfpait vjpnuhypgGj jsjjpy xNu Gssp topahfr nryYk.

- vjpnuhypgG jsjJfFr nrqFjjhf tiuagglLss NfhL nrqFjJf NfhL vd mioffggLfpwJ. nrqFjJf NfhlLld; gL fjph cUthfFk Nfhzk gLNfhzk (i) MFk. mNj Nghy nrqFjJf NfhlLld vjpnuhypjj fjph cUthfFk Nfhzk vjpnuhypgGf Nfhzk (r) vdTk mioffggLfpwJ.

Nfhynfhzlh Nfhlil (i ` juhghj; njYqfhdh) Nfhynfhzlh Nfhliilapyss ifjjlLk miwapd NkwGwk gy njhlhrrpahd tisTfs cssd. ,jpy xtnthU tisTk; Keija tisit tpl rpwpajhf fhzggLk. vdNt ,ej miwapd FwggpIlg gFjpapy vOggggLk xypahdJ;

mOjjgglL vjpnuhypffgglL› gpd Njitahd msT ngUffkileJ xU Fwpggpllj njhiytpwFf NflfpwJ.

mlhkpF Clfjjpd tpspkggpy xyp miyfspd vjpnuhypgG:

- xU nelliyahdJ Clfjjpy guTk NghJ ,WffqfshfTk› jshrrpfshfTk guTk. xyp miyapd ,Wffqfs ,lkpUeJ tykhf gutp xU Rtpy Nkhjpfnfhstjhf fUjpf nfhsNthk. mtthW Nkhjpfnfhs Sk NghJ ,Uffqfs Rtpid Nehffp F vdw xU tpiria nraygLjJk› mNj Ntisapy RtuhdJ mjwF rkkhd kwWk vjph jpiraply R=-F vdw tpiria jpUkgr nrYjJk› ,jdhy Rtwwpd mUfpy kzLk ,Wffqfs VwgLk› ,tthW ,Wffqfs Rtpy Nkhjp kzLk ,WffqfshfNt vjpnuhypffpwJ. mjd jpir klLk khwpapUfFk.

mlhFiw Clfjjpd tpspkgpy xyp miyfspd vjpnuhypgG:

- fhwW Clfjjpd guggpy F vdw tpiriar nrYjJk› mlhFiw Clfk (fhwW) Fiwej msT cUfFiyfFk gzig nghwWssjhy ,uzilAk gphpfFk NkwgugG gpdNdhffpj jssggLfpwJ. ,jdhy mlhFiw Clfjjpy Jfsfs kpf vspjhf ,aqFtjhy tpspkGggFjpapy jshrrpfs NjhdWfpdwd. ,lkpUeJ tykhf gazpjj ,Wffqfs vjpnuhypffgglI gpd jshrrpfshf khwp tyJ GwjjpypUeJ ,lJ Gwkhfg guTfpwJ.

mlhFiw kwWk mlhkpF Clfk vdwhy vd?
xypahdJ xU ClfjjpypUeJ kwnwhU ClfjjpwF nryYk NghJ mjd jpirNtfk mjpfhpjjhy mJ mlhFiw Clfk MFk. (fhwWld xggpLk NghJ euhdJ xypfF mlhFiw Clfk MFk)
xypahdJ xU ClfjjpypUeJ kwnwhU ClfjjpwF nryYk NghJ mjd jpirNtfk FwwAkhdhy mJ mlhkpF Clfk MFk. (eUld xggpLk NghJ fhwwhdJ xypfF mlhkpF Clfk MFk)

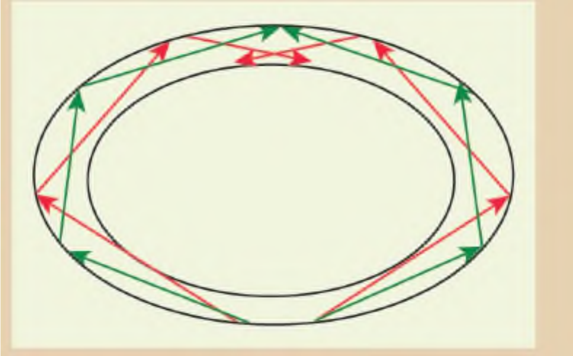
rkjsk kwWk tisthdg gFjpfspy xyp vjpnuhypgG:

- xyp miyfs rkjsg gugGfspy Nkhjp vjpnuhypfFk NghJ xyp vjpnuhypgG tpjpfSfF Vwgg guTfpwJ. mtthW xyp miyfs vjpnuhypfFk NghJ xyp miyfspd nrwpT $LtNjh myyJ FiwtNjh ,yiy.

Mdhy tisthdg gugGfspy glL Nkhjp vjpnuhypfFk NghJ mjd nrwpT khWfpwJ. Ftpej gFjpfspy Nkhjp vjpnuhypfFk NghJ vjpnuhypjj miyfs tphptileJ nryfpwJ. mjd nrwpTk FiwfpwJ. mNjNghy Fopthd gFjpfspy Nkhjp vjpnuhypfFk NghJ vjpnuhypjj miyfs xU Gsspapy FtpffggLfpwJ. vdNt vjpnuhypjjf fjphfspd nrwpTk xU Gsspapy FtpffggLfpwJ.

- xypia xU Fwpggpll Gsspapy Ftpff Ntzbaj Njitfs ,Uejhy klLNk tisthdg vjpnuhypfFk gFjpfs gadgLjjggLfpwJ. ngUkghyhd NgRk $lqfspd NkwgFjp gutisajjpd tbtpy mikffgglbUfFk. gutisajjpy gpujgypfFk xypahdJ Rtpy vqF NkhjpdhYk gutsajjpy xU Ftpag GsspapypUeJ kwnwhU Ftpag Gsspapy FtpffggLfpwJ. ,jdhy ,jDs mkheJ xUth nkyypa Fuypy NgrpdhYk› kzLk kzLk vjpnuhypjJ tUk xypapdhy muqfjjpy mkhejpUfFk midthpd nrtpiaAk milAk.

nkJthfg NgRk $lk kpfTk Gfo ngww nkJthfg NgRk $lk ,yzldpYss Gdpj ghy Nfjpluy Myajjpy mikeJssJ. mej miwapy xU Fwpggpll gFjpapy NgrggLk xypahdJ vjphGwk cssf Fwpggplg gFjpapy njspthff NflFk tifapy mikffgglLssJ. tisthd gFjpfspy eilngWk gyKid vjpnuhypgNg ,jwFf fhuzk MFk.



vjnuhyfs;

- xy miyfs Rthfs› Nkw$iufs› kiyfs Nghdwtwwd gugGfsy Nkhj gujgjffggLk efoNt vjnuhy MFk.

- eqfs kiyad mUfNyh myyJ xU flbljjd mUfNyh edW iffisj jlLk NghJ cqfshy mNj xyia kzLk Nflf ,aYk. ,tthW cqfshy kzLk Nflff $ba xyNa vjnuhy MFk. rwa miwfsy vjnuhyiaf Nflf ,ayhJ. rwa miwfsy vjnuhyiaf Nflf ,ayhJ vdgjhy mqF vjnuhygG eilngwtyiy vdgJ nghUyy› Vnddy rwa miwfs vjnuhyfF Ntzba mbggil egejidfisg Ghjj nratjyiy.

vjnuhyf;F Ntz;ba ege;jidfs;

- kdjhfshy NflfggLk xyahdJ› ekJ fhJfsy 0.1 tehbfSfF eiyjjUfFk› vdNt ehk ,uzL xyfisf Nflf NtzLkhdhy ,uzL xyfSfFk ,ilNa fhy ,ilntsFiwejglrk 0.1 tehbfs ,Uff NtzLk› vdNt vOggggLk xyfFk› vjnuhyfFk ,ilNa 0.1 tehbfs ,Uff NtzLk.

NkwfhZk egejidahdJ Ghjjahf NtzLnkdy xy %yjjwFk vjnuhyfFk guggwFk ,ilNa css njhiythdJ fofjhZk rkdghlil Ghjj nraa NtzLk.

$$
\text{jirNtfk} = \frac{\text{xy flej njhiyT}}{\text{gut vLjJ fnfhzl fhyk}}
$$

$$
v = \frac{2d}{t}
$$

$$
d = \frac{vt}{2}
$$

vdNt› t = 0.1 tdhb $d = \frac{v´\ 0.1}{2} = \frac{v}{20}$

Mjyhy vjnuhy Nflf NtzLkhdhy Fiwej glrj njhiythdJ fhwwy xyad jirNtfjjd kjggy 1/20 gFjahf ,Uff NtzLk. xyad jirNtfk fhwwd 344 kt^{-1} vdf fUjdhy vjnuhyf NflgjwfhdFiwej glrj njhiyT 17.2 k MFk.

vjnuyhyad; gadghLfs;

- ry tyqFfs ntF njhiytyy ,UfFk NghJ jqfSfFs njhlhG nfhssTk› xy rkfiffis mDgg mjyUeJ tUk vjnuhy %yk vjhYss nghUlfisf fzlwaTk gadgLfwJ.

- vjnuhyj jjJtk kfgNgway JiwayymyluhNrhNdh fuhg fUtayy gadgLfwJ. ,ijg gadgLjj jhad fUgigay css fUtd tshrrayid Muhaejwag gadgLfpwJ. ,ejf fUtp kpfg ghJfhgghdJ Vnddpy ,jpy jqF tpistpfFk fjphfs vJTk gadgLjjggLtjpy iy.

- Clfqfspy xypapd jpirNtfjijf fzlwpaTk vjpnuhyp gadgLfpwJ.

vjpnuhyp Kiwapy; xypapd; jpirNtfj;ijf; fhZjy;:

Njitahd fUtpfs;:

nra;Kiw:

1. xyp %yjjpwFk› vjpnuhypgGg guggpwFk ,ilNaahdj njhiyit (d) msT ehlhitg gadgLjjp mseJ nfhssTk.
2. xyp Vwgpia xyp %yjjpwF mUfpy itfffTk. jwNghJ xyp rkpfiQfs xyp %yjjpypUeJ ntspggLk.
3. epWjJf fbfhujijg gadgLjjp xyp %yjjpypUeJ ntspggll xyp rkpfiQfSfFk› vjpnuhypjJ tej xyp rkpfiQfSfFk ,ilNaahd fhy ,ilntspiaf FwpjJf nfhssTk. fhy ,ilntspia 't' vdNt xypapd jpirNtfkhdJ
4. ,ej Nrhjidia %dW myyJ ehdF Kiw nraJ ghhfffTk. ruhrhp fhy ,ilntspiaf fzffpITk.

xypapd; jpirNtfk; fzf;fply;:

xyp %yjjpypUeJ ntspahd xypjJbgG xyp %yjjpypUeJ Rth tiu nrdW gpddh vjpnuhypjJ xyp %yk tiuAss 2d njhiyit t NeujjpY fleJ nryfpwJ› vdNt

$$\text{xypapd jpirNtfk } (v) = \frac{\text{flej njhiyT}}{\text{vLjJf nfhzl Neuk}} = \frac{2d}{t}$$

xyp vjpnuhypggpd; gadghLfs;:

xyp vjpnuhypgG ml;il:

- ,J nghJthf tisej (Fopej) gugGfs MFk. ,it muqffqfspYk› ,irauqfqfspYk xypapd jujij mjpfhpffg gadgLfpwJ. xypg ngUffpahdJ xyp vjpnuhypgG mlilapd FtpggFjpapy ,UfFkhW nghUjjg gLfpwJ. xypgngUffpapypUeJ tUk xypahdJ› xyp vjpnuhypgG mlilahy vjpnuhypffggIL mjpfj jujJld ghhitahshfisr nrdwilfpwJ.

fhJ Nfl;f cjTk; fUtp:

- ,J fhJ NfllYfFj JizGhpAk fUtp MFk. ,J Nflly FiwghL csstfhfSfF gadgLfpwJ. ,ejf fUtpapd xU Kid mfdWk kWKid FWfyhfTk ,UfFk. xyp %yjjpypUeJ tuf$ba xypahdJ mfdw gFjpapd Rthpy vjpnuhypjJf FWfyhdg gFjpia milfpwJ. ,ejf fUtpahdJ xypiaf FtpfffTk› mjpfr nrwpNthL nrtpggiwia milaTk gadgLfpwJ. ,ejf fUtpahy FiwghL csstfshy edwhff Nflf ,aYfpwJ.

$kG xypgngUf;fp:

- $kG xypgngUffp vdgJ rpwpa msTf $lljjpdhpilNa ciuahl cjTk Foy tbt fUtpahFk. ,jd xU Kid mfdWk› kwnwhU Kidf FWfyhfTk fhzggLk. FWfyhdg gFjpapy NgRk xypahdJ gdKf vjpnuhypg gilfpwJ. vdNt xypahdJ mfdwg gFjpapd toNa ntFnjhiytpy mjpf nrwpTld Nflf ,aYfpwJ.

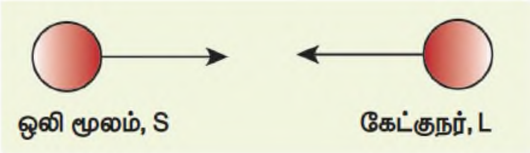
lhg;sh; tpisT:

- NtfkhF ,aqFk ,uapy tzbahdJ xaT epiyapYss NflFeiu neUqFk NghJ mjd Cjy xypapd RUjp mjpfhpggJ NghdWk› NflFeiu tpIL tpyfpr nryYk NghJ Cjy mjphntzzpy VwgLk Njhww khwwjij Kjd Kjypy M]jphpa ehlilr rhhej fzpjtpayhsUk› ,awgpayhsUkhd fpwp]bad lhgsh 91803 – 1853) fzlwpeJ tpsffpdhh. NflFeUfFk xyp %yjjpwFk ,ilNa rhhgpaffk ,UfFk NghJ NflFeuhy NflfggLk xypapd mjphntzzpwFk› xyp %yjjpd mjphntzzpwFk ,ilNa NtWghL cssijf fzlwpejhh. ,JNt lhgsh tpisT MFk.

1. NflFeh epiyahd xyp %yjij NehffpNa myyJ tpyfpNahr nryYjy.
2. xyp %ykhdJ epiyahd NflFeiu NehffpNah myyJ tpyfpNahr nryYjy.
3. xyp %yKk› NflFeUk xdWfnfhdW NehffpNah myyJ tpyfpNahr nryYjy
4. xyp %yKk› NflFeUk xaT epiyapy ,UfFk NghJ xyp guTk Clfk efUjy

fzffLfspd vspikffhf xyp guTk Clfk XaT epiyapy cssjhff fUJNthk. vdNt Clfjjpd jpirNtfk Rop MFk.

- xyp %yk S kwWk NflFeh L KiwNa v_s kwWk v_L kwWk jpirNtfjjpy efhtjhff fUJNthk› xyp %yKk› NflFeUk xdiwnahdW Nehffp efhtjhf vLjJf nfhsNthk. xyp %yjjpwFk› NflFeUfFk ,ilNaahdj njhiyTFiwAk NghJ Njhww mjphntzzhdJ czikahd mjphntzizz tpl mjpfkhf ,UfFk.



- xyp %yjjpd mjphntz ‘n’ vdTk› NflFeuhy czuggLk xypapd mjphntz ‘n’ vdTk nfhsNthk. mggbahdhy Njhww mjphntz ‘n’ffhd rkdghL

$$n'=\left(\frac{v+v_L}{v-V_S}\right)n$$

- ,qF V vdgJ Fwpggpll Clfjjpy xypapd jpirNtfk MFk. ehk jwNghJ xyp %yk kwWk NflFehpd ,affqfspd gyNtW rhjjpaf $WfSffhd rkdghLfisf fhzNghk.

lhg;sh; tpistpdhy; cUthFk; Njhww mjph;ntz;zpw;fhdr; rkd;ghLfs;:

epiy	xyp %yk; kwWk; NflFehpd; epiy	FwpgG	Njhww mjph;ntz;
1.	· xyp %yKk› NflFeUk ,affjjpy cssdh. · xUtiunahUth Nehffp efhfpdwdh	1. xsp %yjjpwFk NflFeUfFk ,ilNaahd njhiyT FiwfpwJ. 2. Njhww mjphntz czik mjphntziz tpl mjpfk	$n'=\left(\frac{v+v_L}{v-v_s}\right)n$
2.	· xyp %yKk› NflFeUk ,affjjpy cssdh. · xyp %yKk› NflFeUk xUtUfnfhUth tpyfpr nryfpdwdh.	1. xyp %yjjpwFk› NflFeUfFk ,ilgglljnjhiyT mjpfhpfFk. 2. Njhww mjphntz› czik mjphntziz tplf FiwT	$n'=\left(\frac{v-v_L}{v+v_s}\right)n$

		3. V_S kwWk V_L kj▯gG e▯iy 3y $wgglljwF vj▯h j▯ira▯y mikAk.	
3.	· xy▯ %yKk› NflFeUk ,affjj▯y csssdh. · xdwd g▯d xdwhf efhf▯dwdh. · NflFeiu xy▯ %yk g▯d njhlhf▯wJ	1. Njhww mj▯hntz xy▯ %yk kwWk NflFeh▯d j▯ir Ntfjijg nghWjJ 2. V_S MdJ e▯iy 2y $wgglljwF vj▯uhf mikAk.	$n' = \left(\frac{v - v_L}{v - v_s}\right)n$
4.	· xy▯ %yKk› NflFeUk ,affjj▯y csssdh. · xdwd g▯d xdwhf efhf▯dwdh. · xy▯ %yjij NflFeh g▯d njhlhf▯whh.	1. Njhww mj▯hntz xy▯ %yKk kwWk NflFeh▯d j▯irNtfjij nghWjJ MFk. 2. V_S kwWk V_L e▯iy 3y $wgglljwF vj▯h j▯ira▯y mikAk.	$n' = \left(\frac{v + v_L}{v + v_s}\right)n$
5.	· xy▯ %yk xaT e▯iya▯y csssJ. · NflFeh xy▯ %yjij Nehff▯ efhf▯whh.	1. xy▯ %yjj▯wFk› NflFeUfFk ,ilggllj njhiyT Fiwf▯wJ. 2. Njhww mj▯hntz czik mj▯hntzi z t▯lf mj▯fk. 3. e▯iy 1y› $V_S = 0$	$n' = \left(\frac{v + v_L}{v}\right)n$
6.	· xy▯ %yk xaT e▯iya▯y csssJ. · NflFeh xy▯ %yjij Nehff▯ efhf▯whh.	1. xy▯ %yjj▯wFk› NflFeUfFk ,ilggllj njhiyT mj▯fh▯ff▯wJ. 2. Njhww mj▯hntz czik mj▯hntziz t▯lf FiwF▯wJ. 3. e▯iy 2y› $V_S = 0$	$n' = \left(\frac{v - v_L}{v}\right)n$
7.	· NflFeh XaT e▯iya▯y csshh. · xy▯ %yk NflFeiu Nehff▯ efhf▯wJ.	1. xy▯ %yjj▯wFk› NflFeUfFk ,ilggllj njhiyT Fiwf▯wJ. 2. Njhww mj▯hntz czik mj▯hntziz t▯l mj▯fk. 3. e▯iy 1y $V_L = 0$	$n' = \left(\frac{v}{v - v_s}\right)n$
8.	· NflFeh xaT e▯iya▯y csshh. · xy▯ %yk NflFeiu t▯lL t▯yf▯r nryf▯wJ.	1. xy▯ %yjj▯wFk› NflFeUfFk ,ilggllj njhiyT mj▯fh▯ff▯wJ. 2. Njhww mj▯hntz czik mj▯hntziz t▯lf FiwT 3. e▯iy 2 y› $V_L = 0$	$n' = \left(\frac{v}{v + v_s}\right)n$

- xy▯ guTk Clfkhd J (fhwW) W vdw j▯irNtfjj▯y› xy▯ guTk j▯ira▯NyNa efhtjhff nfhsNthk. ,ee▯fotey xy▯a▯d j▯irNtfk 'v' MdJ (V +W) Mf khWf▯wJ. mNj Nghy Clfkhd J› xy▯ guTk j▯irfF vj▯h j▯ira▯y efUkhdhy xy▯a▯d j▯irNtfk 'v' MdJ (V - W) Mf khWf▯wJ.

jh;f;fggl;l f z f;flLfs;

1. 90 Hz mj▯hntziz cila xy▯ %ykhdJ xy▯a▯d j▯irNtfjj▯y (1/10) klqF Ntfjj▯y XaT e▯iya▯y css NflFeiu milf▯wJ. NflFeuhy czuggLk mj▯hntz vdd?
   jhT: XaT e▯iya▯y css NflFeiu Nehff▯› xy▯ %yk efUkNghJ› Njhww mj▯hntz Z ffhdr rkdghL.

$$n' = \left(\frac{v}{v - V_s}\right) n$$

$$= \left(\frac{v}{v - \left(\frac{1}{10}\right)V}\right) n = \left(\frac{10}{9}\right) n$$

$$= \left(\frac{10}{9}\right) \times 90 = 100\,Hz$$

2. 500 Hz mjhntz iz cila xy %ykhdJ› 30 kt^{-1} Ntfjjy NflFeiu Nehff efhfwJ. fhwwy xyad Ntfk 330 kt^{-1} vdy NflFeuhy czuggLk xyad mjhntz vdd?
jhT: XaT eiyay css NflFeiu Nehff› xy %yk efUkNghJ› Njhww mjhntz Zffhdr rkdghL.

$$n' = \left(\frac{v}{v - v_s}\right) n$$

$$n' = \left(\frac{330}{330 - 30}\right) \times 500$$

=550Hz

3. xU xy %ykhdJ 50 kt^{-1} jirNtfjjy xaT eiyay css NflFeiu Nehff efUfwJ. NflFeuhy czuggLk xy %yjjd mjhntz zhdJ 1000 Hz MFk. mej xy %ykhdJ xaT eiyay css NflFeiu tIL tyffr nryYk NghJ czuggLk Njhww mjhntz vdd? (xyad jirNtfk 33 k.t^{-1})

$$n' = \left(\frac{v}{v - v_s}\right) n$$

$$1000 = \left(\frac{330}{330 - 50}\right) n$$

$$n' = \left(\frac{1000 \times 280}{330}\right)$$

n = 848.48 Hz.

xy %yjjd czikahd mjhntz 848.48 Hz MFk. xy %ykhdJ NflFeiu tIL tyffr nryYkNghJ css Njhww mjhntz zwfhdr rkdghL.

$$n' = \left(\frac{v}{v + v_s}\right) n$$

$$= \left(\frac{330}{330 + 50}\right) \times 858.48$$

n = 736.84 Hz

4. xy %yKk› NflFeUk V/10 Ntfjjy xUtiunahUth Nehff efhfdwdh. ,qF V vdgJ xyad Ntfk MFk. xy %yjjy ntsggLk xyad mjhntz ‘f’ vdy› NflFeuhy NflfggLk xyad mjhntz vdd?

jhT: xyp %yKk> NflFeUk V/10 Ntfjjpy xUtiunahUth Nehffp efUkNghJ> Njhww mjpHntzzhdJ.

$$n' = \left(\frac{v+v_l}{v-v_s}\right).n$$

$$n' = \left(\frac{v+\frac{v}{10}}{v-\frac{v}{10}}\right).n$$

$$n' = \frac{11}{9}.f$$

$$= 1.22f$$

5. NflFeuhy NflfggLk Njhww mjpHntzzhdJ czikahd mjpHntzzpy ghjpahf ,Uff Ntz;Lnkdpy xyp %yk vttsT Ntfjjpy NflFeiu tpl;L tpyfpr nryy Ntz;Lk?

   jhT: xyp %ykhdJ> XaT epiyapy css NflFeiu tpl;L tpyfpr nryYk NghJ. Njhww mjpHntzzpwfhd rkdghL.

$$n' = \left(\frac{v}{v+v_s}\right).n$$

$$\frac{n}{2} = \left(\frac{v}{v-v_s}\right).n$$

$$V_s = V$$

lhg;sh; tpisT eilngwhky; ,Uf;f epge;jidfs;:

1. xyp %yk (S) kwWk NflFeh (L) ,uzLk xaT epiyapy ,UfFk NghJ>
2. xyp %yk (S) kwWk NflFeh (L) rk ,ilntspapy efUkNghJ
3. xyp %yk (S) kwWk NflFeh (L) xdWfnfhdW nrqFjjhf efUkNghJ>
4. xyp%ykhdJ tllgghijapd ikaggFjpapy mikeJ> NflFeh tllgghijapy efUkNghJ>

lhg;sh; tpis tpd; gad;ghLfs;:

1. **thfdk; xd;wpd; Ntfj;ij ms tpLjy;:**

   fhtyhpd fhhpy nghUjjgglbUfFk fUtp xdW kpd fhej miyia ckpOk. ,ej miyahdJ rhiyapy NtfkhF nryYk thfdjjpd kJ glL vjpnuhspffggLk. vjpnuhspjj miyapd mjpHntzzpy khwwk VwgLk. mej mjpHntzzpd khwwjijg gadgLjjp thfdjjpd Ntfjijf fhz ,aYk. ,J mjpNtf thfdqfisf fzfhzpff cJTfpwJ.

2. **Jiz f;Nfhs; xd;wpd; njhiy tpidf; fz f;fpLjy;:**

   JizfNfhs xdW Gtpapy;UeeJ ntF njhiytpwFr nryYk NghJ> mjdhy ckpoggll NubNah miyfspd mjpHntz FiwAk. mej mjpHntzzpd khwwjijg gadgLjjp JizfNfhspd ,Uggpljijf fzlwpayhk.

3. **Nulhh;** (RADAR – Radio Detection and Ranging):

NulhuhdJ mjhntz kff NubNah miyfis Mfha tkhdjij Nehff mDgGk. vjnuhsjJ tUk NubNah miyfis Nulhh eiyajjy css Vwgf fzlwAk mjhntz zy css NtWghliilf nfhzL tkhdjjd Ntfjijf fzfflyhk.

4. **Nrhdhh;** (SONAR – Sound Navigation and Ranging):

Nrhdhh fUtad %yk ehy mDgggll kwWk vjnuhyjjf fjhd mjhntz NtWghliilf nfhzL fly tho cahdqfs kwWk eh Koff fggyfisf fzlwayhk.

eid ty; nfhs;f:

- xU Clfjjy guTk miyad jirNtfk miyj jirNtfk MFk.
- jlgnghUsd klrg gzG jut› thA nghUlfistl mjfkhf ,Uggjhy xyad jirNtfk mjfkhf ,UfFk› thAffs Fiwej klrjjdik cilait.
- 20 Hz I tlf Fiwthd mjhntz cila xy FwnwhyMFk. ,itfis kdjdhy Nflf ,ayhJ.
- 20›000 Hz I tl mjfkhd mjhntziz cila xy knahyMFk. ,itfis kdjdhy czu ,ayhJ.
- xy miyfs vjnuhygG tjfisg Gj nraAk.
- mlhFiw Clfjjd tskgy NkhJk ,Wffqfs vjnuhyggwFg gd jshrrfshf vjnuhyfFk.
- vjnuhy vdgJ xyahdJ gujgyjJ kzLk kzLk NflfggLtJ MFk.
- vjnuhy Nflf NtzLk vdy xy %yjjwFk› vjnuhygGg guggwFk ,ilNa Fiwejglrk 17.2 k njhiyT ,Uff NtzLk.
- Njhww mjhntz vdgJ NflFeuhy NflfggLk xyad mjhntz MFk.