PHYSICS

CLASS – X

CHAPTER – 2

i dk'k dk vior u

REFRACTION OF LIGHT

प्रश्न 1. प्रकाश के अपवर्तन से आप क्या समझते हैं ?

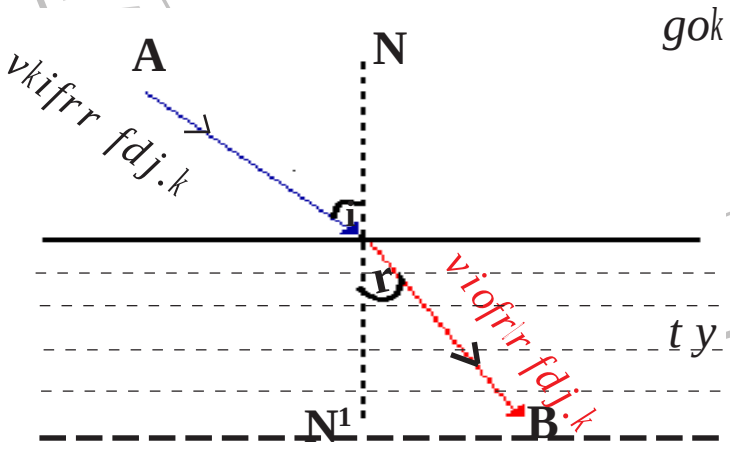
उत्तर – किसी माध्यम से संचारित होनेवाला प्रकाश जब एक माध्यम से दूसरे माध्यम में प्रवेश करता है तो प्रकाश की दिशा में परिवर्तन हो जाता है। प्रकाश की दिशा में परिवर्तन की यह घटना प्रकाश का अपवर्तन कहलाती है।

Rarer to Denser – *yEc dh vkj >d tkrh gA*

Denser to rarer *&yEc l nj gV tkrh gA*

vFkkr fojy l l?ku e tku ij yEc dh vkj >d tkrh gA l?ku l fojy e tku ij yEc l nj gV tkrh gA

Q. No.-1



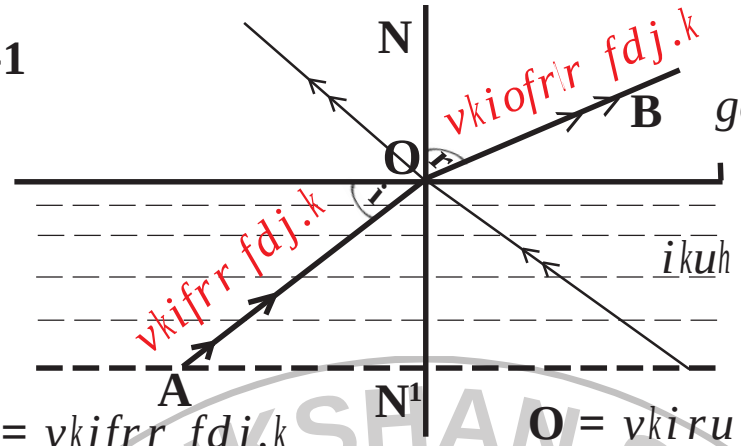
gok

t y

¼fojy l l?ku dh vkj çdk'k dk ox vf/kdre½

fp=&1

Q. No.-1



l?ku l fojy dh vkj çdk'k dk ox U;ure

AO = *vkifrr fdj.k* **O** = *vkiru fcn*

OB = *viofrr fdj.k* **<i** = *vkiru dk.k*

NN¹ = *vfHkyEc* **<r** = *vioru dk.k*

fp=&1

i'u 2-vioru d fu;ek dk fy[kA

vFkok]

Luy d fu;e dk fy[kA

mÙkj &vioru d nk fu;e g%&

(i) *vkifrr fdj.k] viofrr fdj.k ,o vkiru fcn ij Mkyk x;k yEc rhuk ,d gh ry e gkrs gA*

(ii) *fdlh [kkl jx d idk'k ,o [kkl nk ekè;ek d fy, vkiru dk.k dh T;k ,o vioru dk.k dh T;k e ,d fuf'pr vuikr gkrk gA*

$$\frac{\sin i}{\sin r} = \mathbf{1}\ fu;rkd$$

$$\frac{\sin i}{\sin r} = n_{21}$$

$$\frac{\sin i}{\sin r} = \frac{n_2}{n_1}$$

$$\boxed{n_1 \sin i = n_2 \sin r}$$

bl Luy dk fu;e dk lefer :i dgk tkrk gA bl fu;e dh [kkt 1621 b- e Luy u dhA

i'u 3-viorukd **(Refractive Index)** l vki D;k le>r g \

mÙkj &fdlh ekè;e e idk'k dh fdj.k dk fn'kk cnyu dh {kerk dk mldk viorukd dgr g A

vFkok

fdlh ekè;e dk viorukd 'kU; e idk'k dh pky **(c)** rFkk ml ekè;e e idk'k dh pky **(v)** d vuikr dk viorukd dgr g A bl **n** ;k **μ** ¼E;½ l lfpr fd;k tkrk gA

$$\text{fdlh ekè;e dk viorukd} = \frac{\text{'kU; e çdk'k dh pky}}{\text{fdlh ekè;e e çdk'k dh pky}}$$

vFkkr $\boxed{n = \frac{c}{v}}$

i'u 4-vkif{kd viorukd **(Relative Refractive Index)** fdl dgr g \

mÙkj &nk ekè;ek d fuji{k viorukdk d vuikr dk vkif{kr viorukd dgr gA

ekè;e&1 rFkk ekè;e&2 d fuji{k viorukd n_1 ,o n_2 gk rk ekè;e&2 dk ekè;e&1 d lki{k viorukd dk ik;% n_{21} l fu:fir fd;k tkrk gA

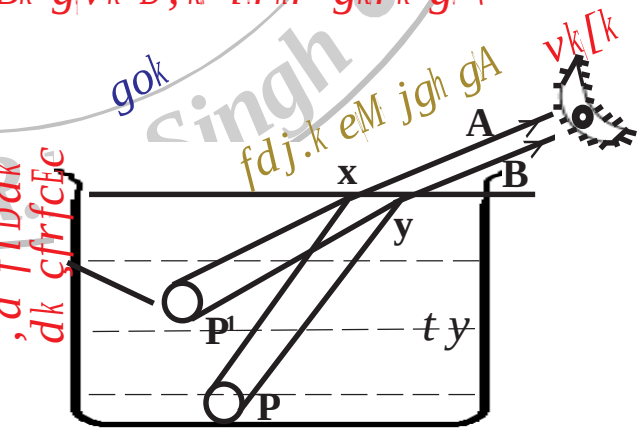
$$\boxed{n_{21} = \frac{n_2}{n_1}}$$

Økmu dkp **- 1.52,** fDyV dkp **- 1.65,** ikuh **- 1.33,** ghjk **- 2.42**

ukV %& gok dk viorukd lcl de rFkk ghjk dk lcl vf/kd gkrk gA

i'u 5-ikuh e j[kk gvk flDdk Åij mBk gvk D;k irhr gkrk g \

mÙkj &idk'k d vioru d dkj.k ikuh e j[kk gvk flDdk Åij mBk gvk irhr gkrk gA ikuh d vnj cru e flDdk dh fLFkfr **P** gA **PA** rFkk **PB** nk vkifrr fdj.k fudyrh gA **A** rFkk **B** l ;s fdj.k ok;q e viofrr gkrh gA vfHkyEc l nj gV tkrh gA D;kfd ikuh] ok;q dh vi{kk l?ku ekè;e gA ;s nkuk >dh fdj.k vk[k ij **P** fcn ij vkHkklh ifrfcEc **P'**

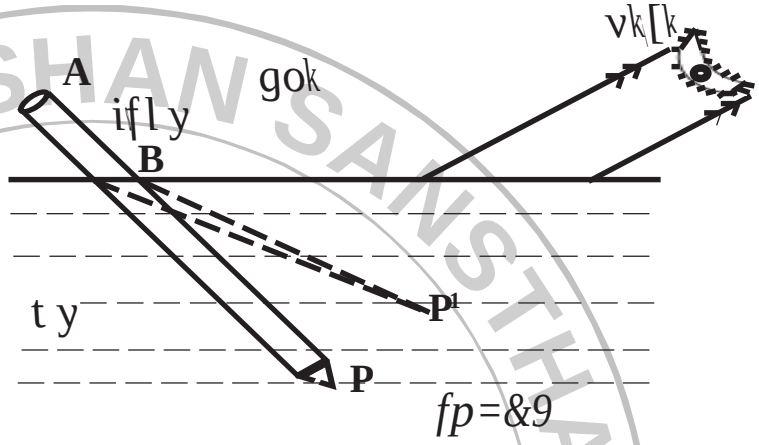


,d flDdk fp=&5

ij n[kh tkrh gA ,slk irhr gkrk g fd ikuh e flDdk dh okLrfod fLFkfr **P'** ij g yfdu **P'** ij flDdk dk vkHkklh fLFkfr g tks **P** ls Åij gA vr% ikuh e j[kk x;k flDdk n[ku ij dN mBk gvk ekye iMrk gA

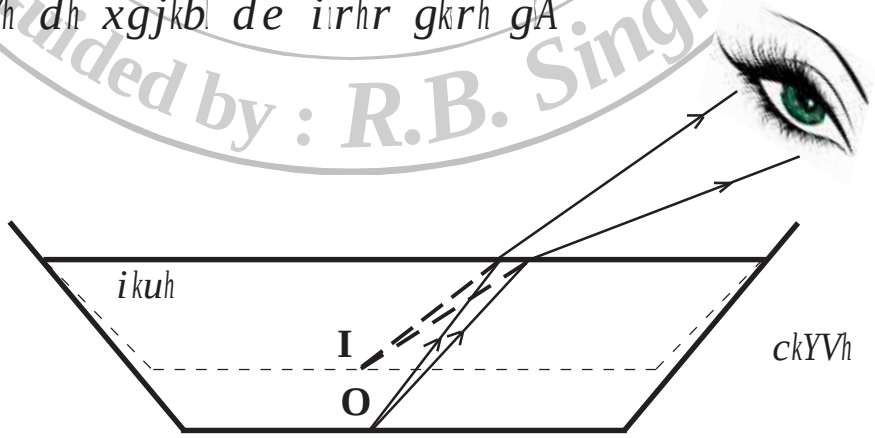
i'u 6-ikuh d vanj vkèkh Mcch gb ifly ;k dkp dh NM V<h ekye iMrh gA LoPN fp= }kjk le>kvksA

mÙkj &ikuh e v'kr% Mcch gb ifly vFkok dkp dh NM V<h irhr gkrh gA ;g ?kVuk idk'k d viorlu ij vkèkkfjr gA idk'k dh fdj.k l?ku ekè;e ls fojy ekè;e dh vkj pyrh g rk ;g vfHkyEc ls nj gV tkrh gA n'kd **P** fcnq dh fLFkfr **P'** ij n[krk gA vr% ifly d uhp dk Nkj FkkMk Åij mBk gvk rFkk ifly viorld lrg ij FkkMk V<k fn[krk gA



i'u 7-ikuh ls Hkjh ckYVh dh xgjkbZ de D;k ekye iMrh g

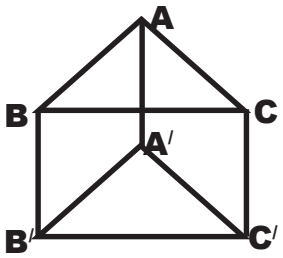
mÙkj &ikuh ls Hkjh ckYVh dh xgjkbZ idk'k d viorlu d dkj.k de irhr gkrh gA ikuh ls Hkjh ckYVh d inh ij dh ,d fljk **O** ls vkrh fdj.k ikuh dh lrg ij gok e vkrh g rk vfHkyEc ls nj gVdj vk[k ij igprh gA ;s fdj.k **I** ls vkrh gbZ irhr gkrh gA ckYVh mFkyh irhr gkrh gA vFkkr ckYVh dh xgjkbZ de irhr gkrh gA



fp= 2-10 ikuh ls Hkjh ckYVh dh xgjkbZ dk de irhr gkuk

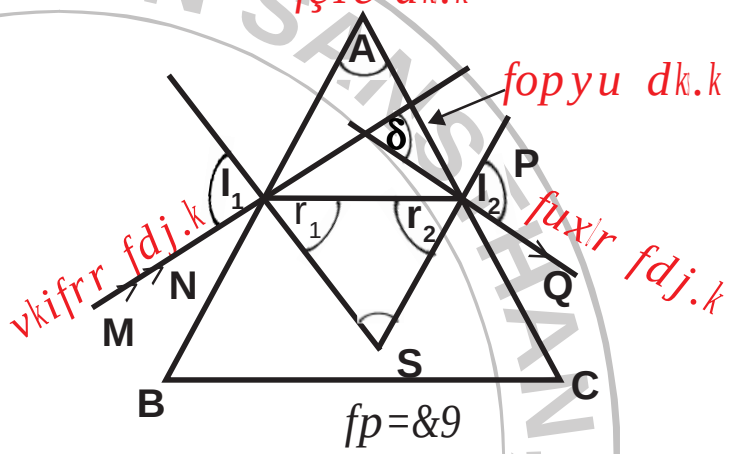
iz'u 8- fiTe **(Prism)** l vki D;k le>rs gSa \

mÙkj &rhu Qydksa l f?kjk gS, ikjn'kd ekè;e dk fiTe dgrs gSA bles dkbZ Hkh Qyd ,d&nwljs d lekukUrj ugha gksrkA bles ikap lrgksa gksrh gSa ftles nks f=Hkqt tkdkj ,oa rhu lrgksa vk;rkdkj gksrh gSA



iz'u 9-fiTe l gksdj izdk'k d vioru dk fn[kkoa rFkk lf{kIr o.kZu djsA

mÙkj &fp= esa **ABC** ,d fiTe gSA **<A** dks fiTe dk dks.k dgrs gSA bles **MN** vkifrr fdj.kZ **NP** vifrr fdj.k rFkk **PQ** fuxZr fdj.k gSA I_1 vioru dks.k rFkk I_2 fuxZr dks.k gSA I_1 dk lxr vioru dks.k r_1 rFkk I_2 dk lxr fuxZr dks.k r_2 gSA



fp=&9

$$<I_1 + <I_2 \text{ ----} <A + <\delta$$

iz'u 10- fopyu dks.k **(Angle of Deviation)** l vki D;k le>rs gSa \

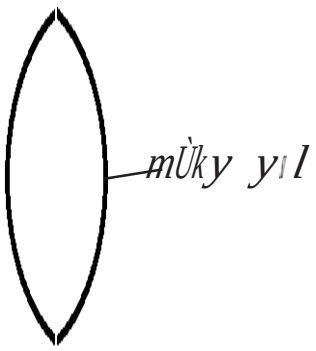
mÙkj & izdk'k dh fdj.k tc fiTe l gksdj xqtjrh gS rks vkifrr fdj.k ,oa fuxZr fdj.k ds chp cus dks.k dks fopyu dks.k dgrs gSA bls **δ (**MYVk**)** l lfpr fd;k tkrk gSA

iz'u 11- ySl fdls dgrs gSa \ ;s fdrus izdkj ds gksrs gSa \ ifjHkkf"kr djsA

mÙkj &nks Qydksa l f?kjs gksa, ikjn'kd ekè;e dk ySl dgrs gSA ftles de&l&de ,d lrg xksyh; gksrk gSA

vFkok

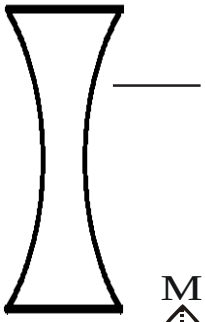
nks ikjn'kd xksyksa ds mHk;fu"B Hkkx dks ySl dgrs gSA ySl nks izdkj ds gksrs gSa%&

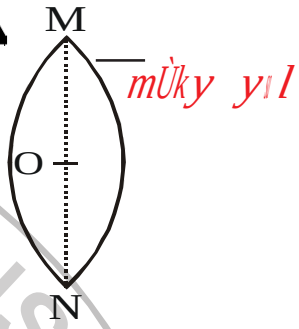


(i) mÙky ySl **(Convex Lens)** & ftl ySl dh lrgksa chp esa ckgj dh vksj mHkjh gksrh gSa ;k ftl ySl dh ekVkbZ chp esa vf/kd jgrh gS]

ml mÙky yl dgr gA

(ii) vory yl **(Concave Lens)** &ftl yl dh lrg chp e vnj dh vkj >dh gb jgrh g vFkok ftl yl dh ekVkb chp e de rFkk fdukjk ij vfèkd jgrh g] ml vory yl dgr gA





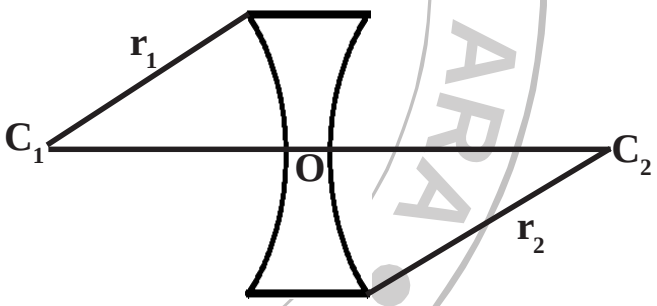
i'u 12- yl d }kjd ls vki D;k le>rs g\

mÙkj &yl d ?kj d 0;kl dk yl dk }kjd dgr gA fp= e **MON** }kjd gA

i'u 13- yl d oØrk dsUæ **(Centre of Curvature)** ,o oØrk f=T;k **(Radious of Curvature)** dh ifjHkk"kk nA

mÙkj &ftu nk ikjn'kd xkyk dk mHk;fu"B Hkkx ,d yl gkrk gA mu xkyk d dUnk dk oØrk dk dUn rFkk mudh f=T;kvk dk oØrk dh f=T;k dgr gA

fp= e **C_1** rFkk **C_2** oØrk dk dUn rFkk **r_1** ,o **r_2** oØrk dh f=T;k gA

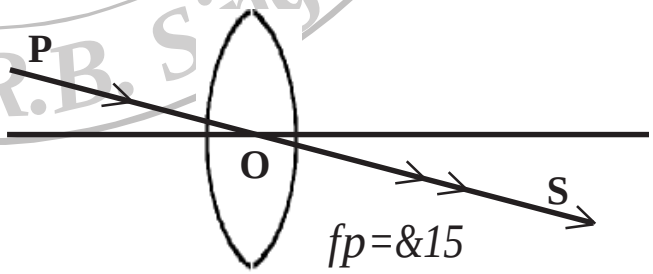


i'u 14- ièkku v{k **(Principle axis)** fdls dgr g\

mÙkj &yl d oØrk d dUnk ls xtju okyh dkYifud j[kk ièkku v{k dgykrh gA fp= e **C_1OC_2** ièkku v{k gA

i'u 15- idk'kh; dsUæ **(Optical Centre)** ls vki D;k le>rs g\

mÙkj &yl dk og fcUnq ftls xtju okyh fdj.k d fy, vkifrr fdj.k ,o fuxZr fdj.k lekukUrj gk tkr g] ml idk'kh; dUn dgr gA fp= e bls **O** ls fn[kk;k x;k gA

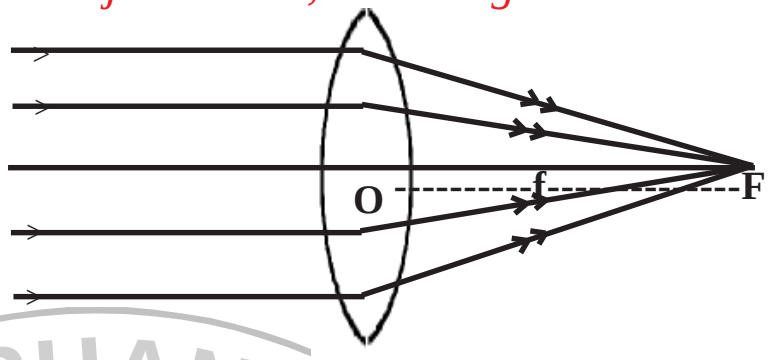


fp=&15

yl dh lHkh nfj;k idk'kh; dsUæ ls ekih tkrh gA

iz'u 16- ys l dk Qksd l rFkk Qksd lkUrj l vki D;k le>rs gSa \

mÙkj &ys l dk ièkku v{k dh lekukUrj vkrh gqbZ fdj.k ft l fcUnq ij lkl'r gksrh gS ;k ft l fcUnq ij vil'r gksrh gqbZ izrhr gksrh gS] ml fcUnq dk ys l dk Qksd l dgrs gSA



ys l dk izdk'kh; dsUnz **O** rFkk Qksd l **(F)** ds chp dh nwjh dks Qksd l nwjh dgrs gSA

bl fp= esa **f** l fn[kk;k x;k gSA

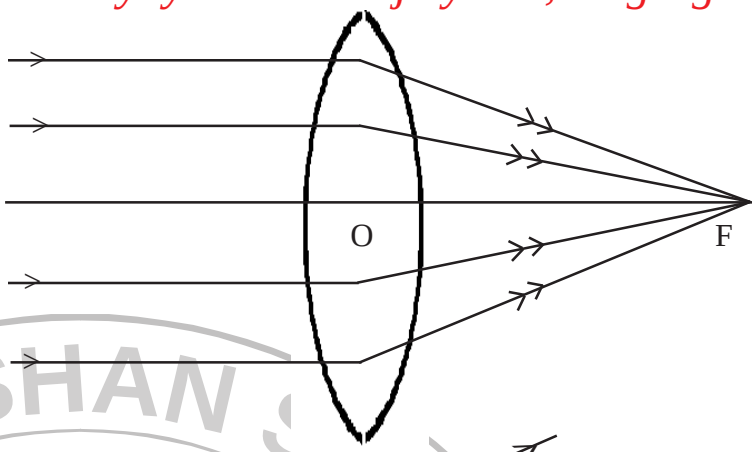
iz'u 17- mÙky ys l rFkk vory ys l esa vUrj Li"V djsA

mÙkj &mÙky ys l rFkk vory ys l esa fuEufyf[kr vUrj gSa%

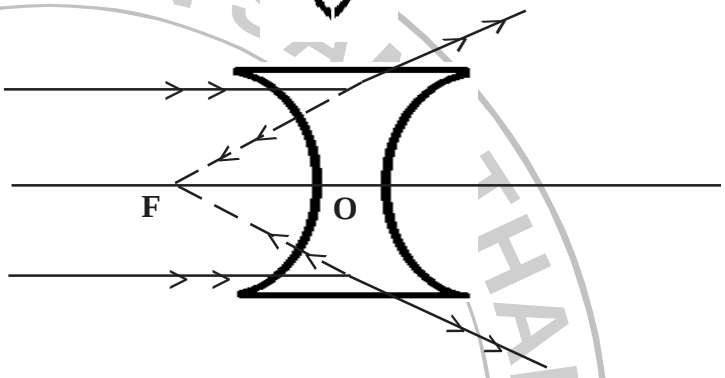
Ø0	mÙky ys l	voÙky ys l
(i)	fdukjs ij iryk ysfdu chp esa ekVk gksrk gSA	fdukjs ij ekVk ,oa chp esa iryk gksrk gSA
(ii)	mÙky ys l }kjk okLrfod ,oa dkYifud nksuksa izdkj ds ifrfcEc curs gSA	vory ys l }kjk dsoy dkYifud çfrfcEc gh curk gSA
(iii)	mÙky ys l dk Qksd l okLrfod gksrk gSA	vory ys l dk Qksd l dkYifud gksrk gSA
(iv)	mÙky ys l dh Qksd l nwjh /kukRed gksrh gS blfy, bldh {kerk /kukRed gksrh gSA	vory ys l dh Qksd l nwjh _.kkRed gksrh gS blfy, bldh {kerk _.kkRed gksrh gSA
(v)	mÙky ys l dk vfHkl kjh ys l dgrs gSA	vory ys l dk vil kjh ys l dgrs gSA

*iz'u 18- mÙky yl dk vfHklkjh rFkk vory yl dk vilkjh yl D;k dgrs gSa *

mÙkj &mÙky yl ls vkifrr lekukUrj fdj.k iqat yl ls fuxZr gksus ds ckn ls lajr gksrh gS vFkkr~ ,d fcUnq ij ,d= gks tkrh gSA bl dkj.k mÙky yl dk vfHklkjh yl dgrs gSA bls lajdkjh yl Hkh dgk tkrk gSA

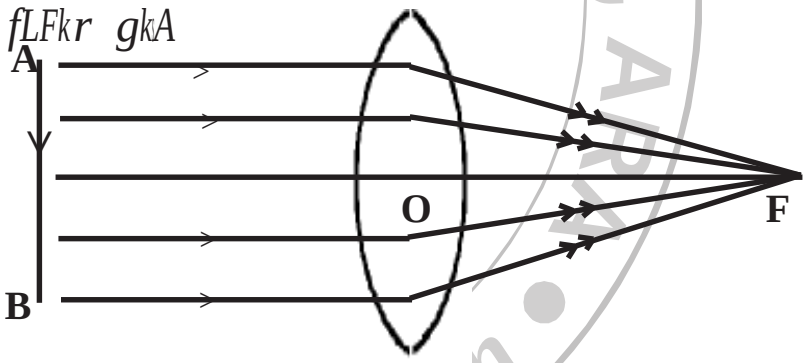


vory yl ls vkifrr lekukUrj fdj.k iqat yl ls fuxZr gksus ij vilajr gksrh gS vFkkr~ Qksdl tkrh gSA bl dkj.k vory yl dk vilkjh yl dgrs gSA bls vilajdkjh yl Hkh dgk tkrk gSA



iz'u 19- mÙky yl esa fofHkUu nfj;ksa ij j[ks oLrq dk ifrfcEc cukvksA

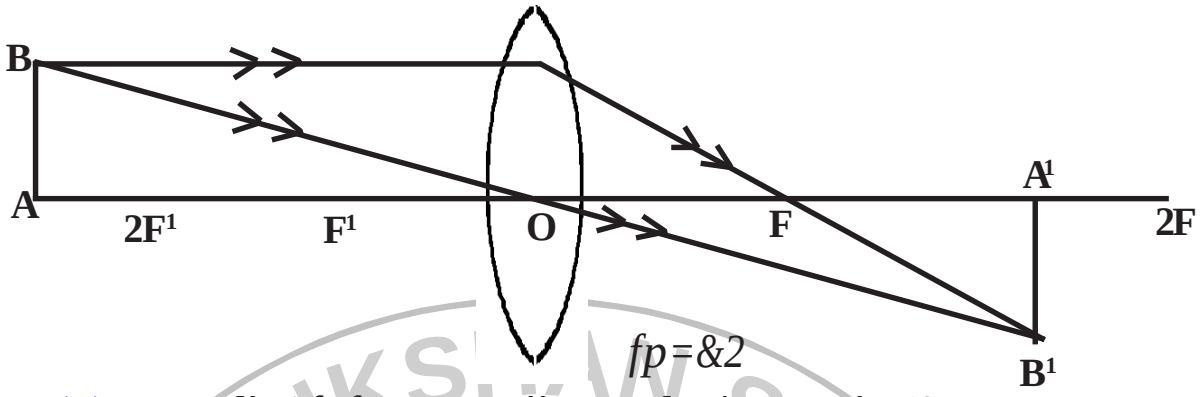
*mÙkj &***(1)** *tc oLrq vuUr ij fLFkr gksA*



(a) *oLrq dk ifrfcEc* **F** *ij curk gSA*

(b) *;g ifrfcEc okLrfod] mYVk rFkk oLrq ls cgqr gh NksVk gksrk gSA*

(2) *tc oLr| vuUr rFkk* **2F'** *d| chp fLFkr gkA*

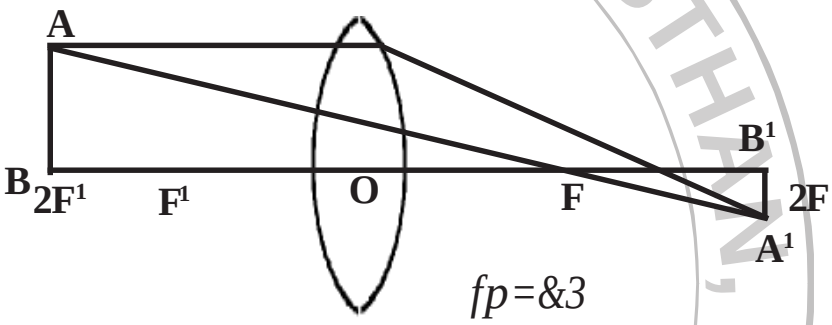


fp=&2

(a) *oLr| dk ifrfcEc* **F** *rFkk* **2F** *d| chp curk gA*

(b) *;g ifrfcEc okLrfod] mYVk rFkk oLr| l| NkVk gkrk gA*

(3) *tc oLr| yl dh nuh Qkdl njh* **(2F')** *ij fLFkr gkA*

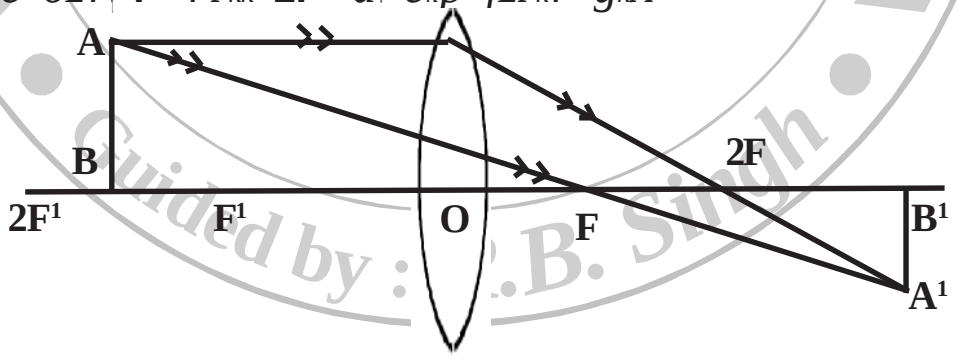


fp=&3

(a) *oLr| dk ifrfcEc* **2F** *ij curk gA*

(b) *;g ifrfcEc okLrfod] mYVk rFkk oLr| d| cjkcj gkrk gA*

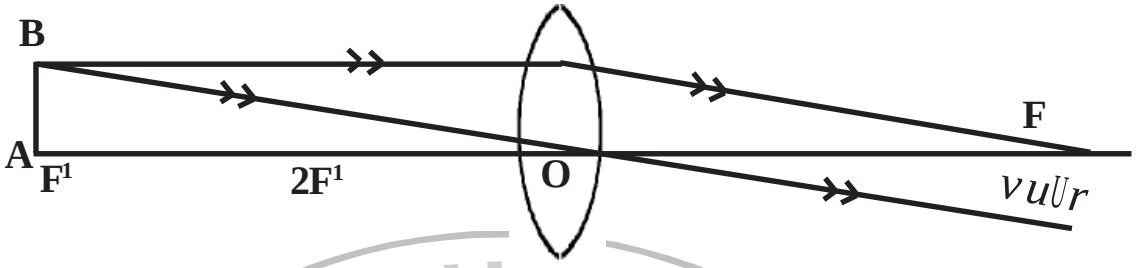
(4) *tc oLr|* **F'** *rFkk* **2F'** *d| chp fLFkr gkA*



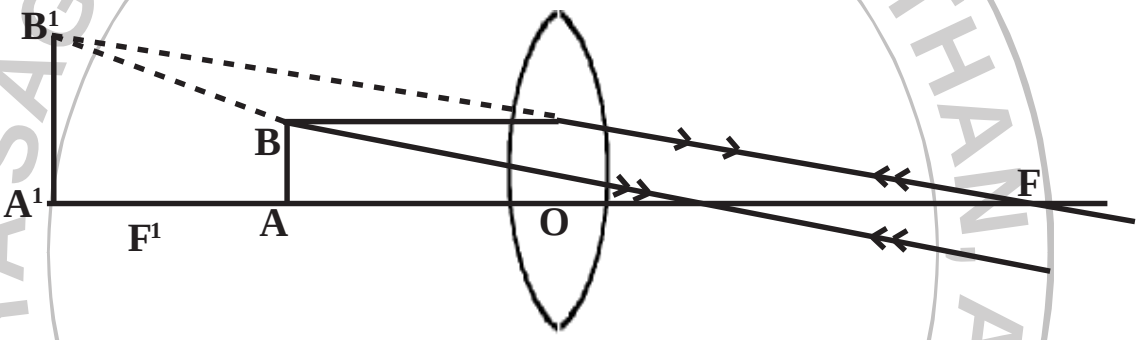
(a) *oLr| dk ifrfcEc* **2F** *l| nj curk gA*

(b) *;g ifrfcEc okLrfod] mYVk rFkk oLr| l| cMk gkrk gA*

(5) *tc oLr| yl d Qkdl* **(F')** *ij fLFkr gkA*



(a) *oLr| dk ifrfcEc vuUr ij curk gA*
(b) *;g ifrcEc okLrfod] mYVk rFkk oLr| l cMk gkrk gA*
(6) *tc oLr| yl d e[; Qkdl rFkk yl d chp fLFkr gkA*



(a) *oLr| dk ifrcEc yl d ihN curk gA*
(b) *;g ifrfcEc dkYifud] lhèkk rFkk oLr| l cMk gkrk gA*

i'u 20- yl dh {kerk **(Power of Lens)** *D;k g\ bldk ek=d fy[kA*

mÙkj&fdlh yl dh {kerk ml yl d Qkdlkurj dk 0;qRØe gkrk gA
;fn yl dh {kerk **(P)** *rFkk Qkdlkurj* **(f)** *gk rk*

$$P = \frac{1}{f}$$

SI *i)fr e yl dh {kerk dk ek=d Mkbvkslj* **(Diopter)** *gkrk gA bl* **D** *l lfpr djr gA bl ehVj e ekik tkrk gA mÙky yl dh {kerk èkukRed rFkk vory yl dh {kerk _.kkRed gkrh gA*

i'u 21- **1 Diopter** *dh ifjHkk"kk nA*

*mÙkj &***Diopter – 1 Diopter** *ml yl dh {kerk g ft ldh Qkdl nwjh* **1 m** *gkrh gA*

1 Diopter = 1 D = 1 m^{-1}

i'u 22-yl d l;ktu dh {kerk l vki D;k le>r g\ bldk l= fy[kA

mÙkj&tc vuad iry yslk dk ,d&nljs d lEid e j[kk tkrk g rk l;ktu dh {kerk mu yslk d vyx&vyx {kerkvk d chth; ;kx d cjkcj gkrk gA

;fn vuad ysl ftudh {kerk;sa Øe'k% P_1, P_2, P_3 ..... gk vkj mUgs ijLij lEid e j[kk tk, rk l;ktu dh {kerk

$$P = P_1 + P_2 + P_3 + ...$$

yslk d ,sl l;ktu dk mi;kx] dejk] l{en'kh rFkk njchu e fd;k tkrk gA

i'u 23-mÙky ysl rFkk vory ysl d nk&nk mi;kx crkoA

mÙkj &mÙky ysl d mi;kx%&

(i) bldk mi;kx l{en'kh] njchu rFkk QkVk dejk e fd;k tkrk gA

(ii) nh?kZ nf"V nk"k dk nj dju e bldk mi;kx gkrk gA

vory ysl d mi;kx&

(i) bldk mi;kx xyfy;k d njchu e uf=dk d :i e gkrk gA

(ii) bldk mi;kx fudV nf"Vnk"k nj dju e fd;k tkrk gA

i'u 24-vkidk ,d mÙky] vory rFkk dkp dh IyV nh x;h gA mudh lrgk dk fcuk N, dlk igpkuxA

mÙkj &fcuk Li'k fd;s mÙky] vory rFkk dkp dh IyV dk igpkuu d fy, ckjh&ckjh l fdlh iLrd d ,d i"B d fudV ykrs gA Ni v{kjk dk fujh{k.k djrs gA

(i) ;fn Ni v{kj viu okLrfod vkdkj l cM+s fn[kkbZ iMrs g rk ;g mÙky ysl gkrk gA

(ii) ;fn Ni v{kj viu okLrfod vkdkj l NksVs fn[kkbZ iMrs g rk ;g vory ysl gkrk gA

(iii) ;fn Ni v{kj viu okLrfod vkdkj d cjkcj fn[kkbZ iMrk g rk ;g dkp dh IyV gkrk gA

iz'u 25-ikuh dk vioruukd **1.33** gA bl dFku dk D;k rkRi;Z gS \

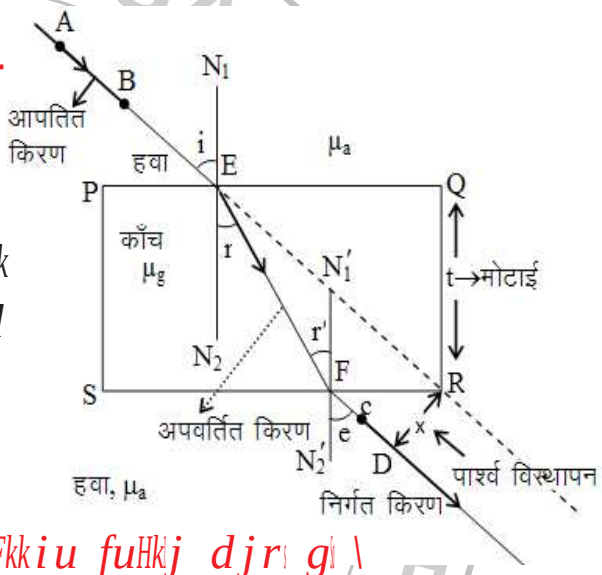
mÙkj& $$\text{ikuh dk vioruukd} = \frac{\text{gok esa çdk'k dh pky}}{\text{ikuh esa çdk'k dh pky}}$$

$$n_w = \frac{300000 \text{ Km/s}}{225000 \text{ Km/s}} = \frac{\cancel{300}^{4}\cancel{000}}{\cancel{225}^{3}\cancel{000}} = \frac{4}{3} = 1.33$$

gok esa izdk'k dh pky ikuh esa izdk'k dh pky dk **1.33** vFkkZr $\frac{4}{3}$ xquh gksrh gA

iz'u 26-ikf'od foLFkkiu **(Lateral Displacement)** Lo vki D;k le>rs gS \

mÙkj &dkp LySc ls fudyus okyh fuxZr fdj.k rFkk vkifrr fdj.k ds ey iFk ds chp ykfEcd nwjh dks ikf'od foLFkkiu dgrs gSA



fp= esa **DR = x** ikf'od foLFkkiu gSA

iz'u 27-fdu&fdu dkjdksa ij ikf'od foLFkkiu fuHkZj djrk gS \

mÙkj &fuEu dkjdksa ij ikf'od foLFkkiu fuHkZj djrk gSA

(i) ikf'od foLFkkiu dkp Lyc ds eVkbZ dk lh/kk lekuqikrh gksrk gSA

(ii) ikf'od foLFkkiu vkiru dks.k dk lh/kk lekuqikrh gksrk gSA

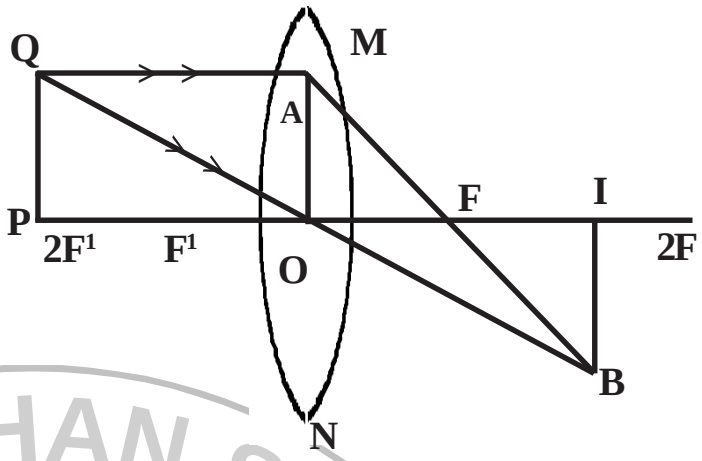
(iii) ikf'od foLFkkiu dkp ds vioruukd dk lh/kk lekuqikrh gksrk gSA

(iv) ikf'od foLFkkiu vkifrr fdj.k ds rjxnS?;Z dk 0;qRØekuqikrh gksrk gSA

iz'u 28- mÙky ySl esa fl) dhft, fd $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

vFkok] fdlh mÙky ySl esa oLrq dh nwjh **(u)**, ifrfcEc dh nwjh **(v)** rFkk Qksdl nwjh **(f)** esa lacU/k LFkkfir djsA

mÙkj &ekuk fd fp= esa **MN** ,d mÙky ySl gS **2F'** ls vuUr nwjh ij oLrq **PQ** fLFkr gSA ftldk ifrfcEc **IB** ij curk gSA



ΔPOQ rFkk ΔIOB le:i gA

$$\frac{IB}{PQ} = \frac{OI}{OP} \quad \text{... (i)}$$

ΔAOF rFkk ΔBIF le:i gA

$$\frac{IB}{OA} = \frac{IF}{OF} \quad \text{... (ii)}$$

(PQ = OA)

leh- (i) rFkk leh- (ii) ls]

$$\frac{OI}{OP} = \frac{IF}{OF}$$

$$\frac{OI}{OP} = \frac{OI - OF}{OF}$$

$$\frac{v}{-u} = \frac{v - f}{f}$$

$$vf = -u(v - f)$$

$$vf = -uv + uf$$

nkuksa rjQ **u, v, f** ls Hkkx nsus ij]

$$\frac{\cancel{vf}}{\cancel{uvf}} = \frac{-\cancel{uv}}{\cancel{uvf}} + \frac{\cancel{uf}}{\cancel{uvf}}$$

$$\frac{1}{u} = -\frac{1}{f} + \frac{1}{v}$$

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$\boxed{\frac{1}{v} - \frac{1}{u} = \frac{1}{f}}$$

fpUg ifjikVh ls]

OI = + *v*

OP = – *u*

OF = + *f*

iz'u 30- vory ysl esa fl) djsa fd $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

vFkok] fdlh vory ysl esa oLrq dh nwjh (*u*), izfrfcEc dh nwjh (*v*) rFkk Qksdl nwjh (*f*) esa lEcU/k LFkkfir djsaA

mÙkj &ekuk fd PQ ,d vory ysl gA blds izdk'kh; dsUnz (O) rFkk F ,oa

F' ifFke ,oa f}rh; Qkdl gA **F** ls dqN njh ij oLrq **AB** j[kh x;h gS ftldk ifrfcEc **A'B'** ij curk gSA

ledk.k **△OAB** rFkk **△OA'B'** le:i gSA**(A-A-A)** ¼le:irk ifjes;½

$$\frac{AB}{A'B'} = \frac{OB}{OB'} \quad \text{... (i)}$$

blh izdkj] ledk.k **△** FOM rFkk **△** A'B'F le:i gSA

$$\frac{OM}{A'B'} = \frac{OF}{B'F} \quad (OM = AB)$$

$$\frac{AB}{A'B'} = \frac{OF}{B'F} \quad \text{... (ii)}$$

leh- **(i)** rFkk leh- **(ii)** ls]

$$\frac{OB}{OB'} = \frac{OF}{B'F}$$

$$\frac{OB}{OB'} = \frac{OF}{OF - OB'}$$

$$\frac{-u}{-v} = \frac{-f}{-f+v}$$

$$\frac{u}{v} = \frac{-f}{-f+v}$$

$$u(v-f) = -vf$$

$$uv - uf = -vf$$

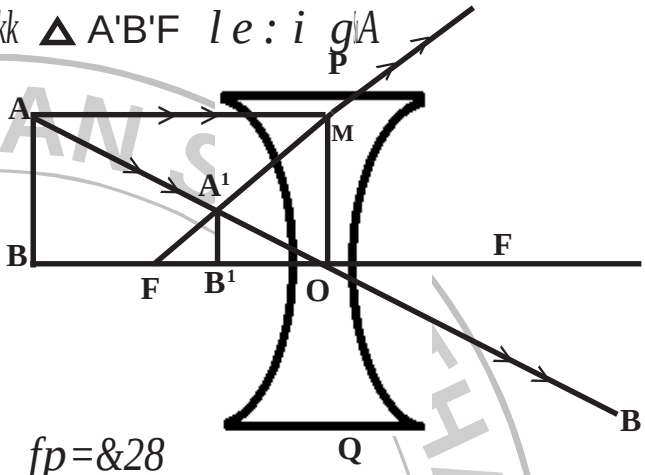
nksuksa rjQ **u, v, f** ls Hkkx nsus ij]

$$\frac{uv}{uvf} - \frac{uf}{uvf} = \frac{-vf}{uvf}$$

$$\frac{1}{f} - \frac{1}{v} = \frac{-1}{u}$$

$$\frac{1}{f} = \frac{-1}{u} + \frac{1}{v}$$

$$\boxed{\frac{1}{u} - \frac{1}{v} = \frac{1}{f}}$$



fp=&28

fpUg ifjikVh ls]

OF = - f

OB = –u

OB' = -v

iz'u 29-vkoèkku fdls dgrs gSa \ xkyh; ySl ds lUn= ij vkèkkfjr vkoèkku dk lUn= LFkkfir djsA

mÙkj &y| *l d*| *}kjk cu*| *ifrfcEc dh Å*|*pkbZ* **(h_2)** *,o oLr*| *dh Å*|*pkbZ* **(h_1)** *d*| *vu*|*ikr dk vkoèkku dgk tkrk g*A

$$m = \frac{h_2}{h_1}$$

fp= e| *mÙky y*| *l }kjk oLr*| **AB** *dk ifrfcEc* **A'B'** *ij curk g*A

ΔAOB *rFkk* **Δ A'OB'** *le:i g*A

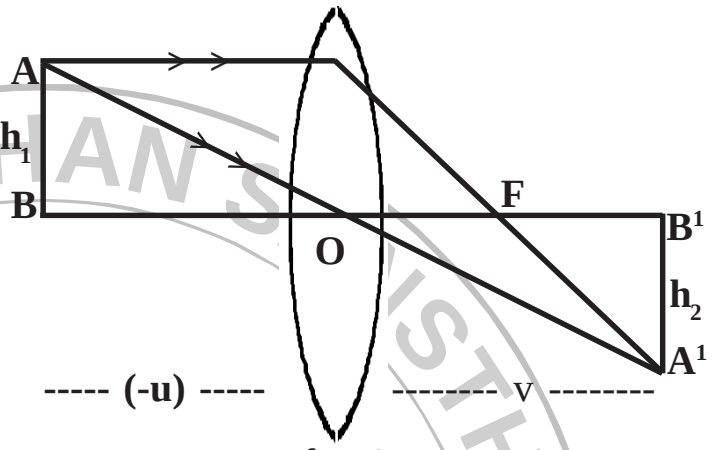
$$\frac{AB}{A'B'} = \frac{OB}{OB'} \quad \text{... (i)}$$

$$\frac{h_1}{-h_2} = \frac{-u}{v}$$

$$\frac{h_1}{h_2} = \frac{u}{v}$$

$$\frac{h_2}{h_1} = \frac{v}{u}$$

$$m = \frac{v}{u}$$



fp=&29

y| *l l*= *l*]

$$\boxed{\frac{1}{v} - \frac{1}{u} = \frac{1}{f}}$$

fpUg ifj ikVh l]

A'B' = $-h_2$

AB = h_1

OB = $-u$

OB' = v

nkuk rjQ ***v*** *l*| *x*|*.kk dju*| *ij*]

$$\frac{v}{-u} - \frac{v}{u} = \frac{v}{f}$$

$$1 - \frac{v}{u} = \frac{v}{f}$$

$$-\frac{v}{u} = \frac{v}{f} - 1$$

$$-\frac{v}{u} = -\left(1 - \frac{v}{f}\right)$$

$$\frac{v}{u} = 1 - \frac{v}{f} \qquad \left(m = \frac{v}{u}\right)$$

$$\boxed{m = 1 - \frac{v}{f}}$$

iz'u 30-Økfrd dks.k ls vki D;k le>rs gSa

mÙkj &tc izdk'k dh fdj.k lq?ku ekè;e ls fojy ekè;e ls izo'k djrh gS rks frjNh gks tkrh gSA bl voLFkk esa viorZu dks.k vkiru dks.k ls cMk gks tkrk gSA tc vkiru dks.k dk c<+k;k tkrk gS rks viorZu dks.k Hkh c<+ tkrk gSA ,d le; ;g dks.k **90°** *dk gks tkrk gSA bl viorZu dks.k dks fy, vkiru dks.k dk eku* **90°** *dk gks tkrk gS tks Økfrd dks.k dgykrk gSA bls* **C** *ls lqfpr fd;k tkrk gSA*

iz'u 31-i.kZ vkrfjd ijkorZu ls vki D;k le>rs gSa

mÙkj &;fn lq?ku ekè;e ls fojy ekè;e dh vkj vkifrr fdj.k dks fy, ijkorZu dks.k dk eku Økfrd dks.k ls FkksMk Hkh vfèkd gks tkrk gS rks izdk'k dh fdj.k iwq.kZ lq?ku ekè;e esa ykV tkrh gSA bl ?kVuk dks i.kZ vkrfjd ijkorZu dgrs gSA

ghjk dk peduk] rkjksa dk fVefVekuk] rFkk e'xejhfpdk dh ?kVuk izdk'k ds i.kZ vkrfjd ijkorZu ds dkj.k ?kfVr gksrh gSA

●●●