At 2nd face

$$n = \frac{\sin i_2}{\sin r_2}$$

$\sin i_2 = n \sin r_2 = 1.5 \sin 25°$

$= 1.5 \times .4184 = 0.6276$

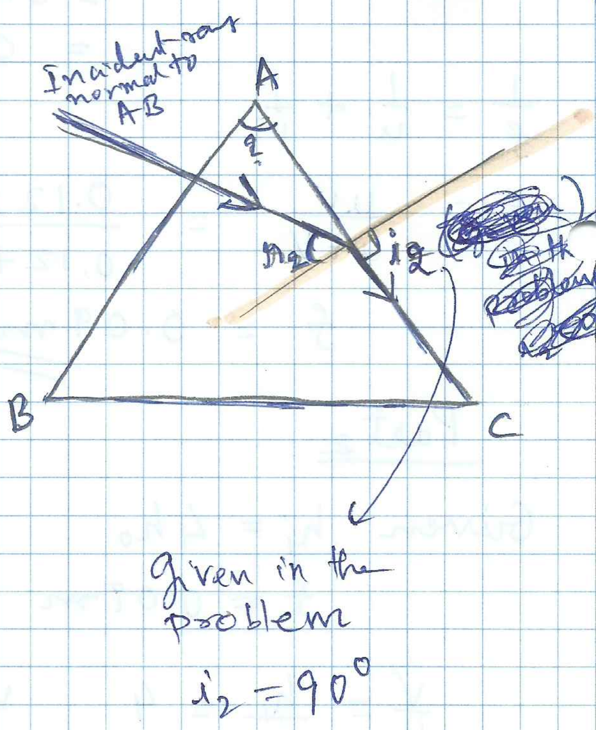
$i_2 = 39°$

$\delta = i_2 + i_1 - A$

$= 39 + \cancel{60} - \cancel{60} = 39$

---

4) A ray of light incident normally on the first face of a glass prism of n 1.6 just emerges from the other face. Find the $\angle^{le}$ of prism.



Sol:- $i_1 = 0 \quad r_1 = 0 \quad n = 1.6$

$i_2 = 90° \quad r_2 = ?$

$$n = \frac{\sin i_2}{\sin r_2} \quad \therefore \sin r_2 = \frac{\sin i_2}{n}$$

$$\sin r_2 = \frac{\sin 90°}{1.6} = \frac{1}{1.6}$$

$\boxed{r_2 = 39°}$

$A = r_1 + r_2$

$= 0 + 39$

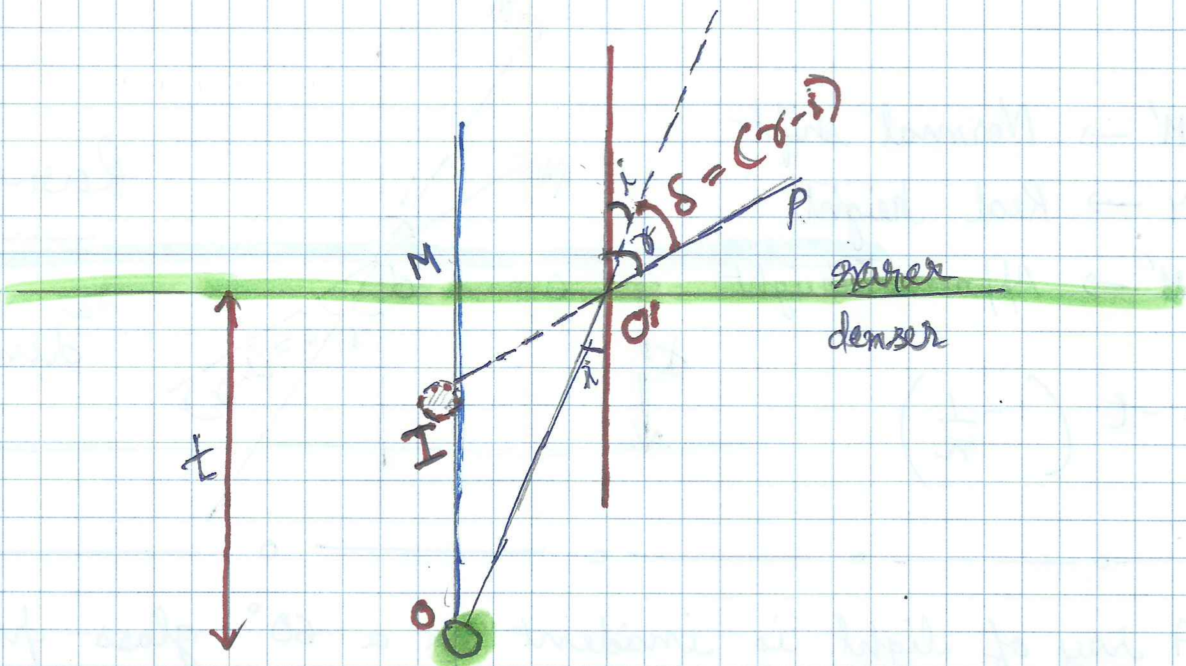
$= 39°$

81.22

Datum 23.12.18 20

Onderwerp : Normal shift

Case 1 :- object in denser medium observed ~~object~~ from rarer medium



$$ {}_{r}n_{d} = \frac{MO}{MI} = \frac{t}{MI} $$

$$ S_n = t - MI $$

$$ = t - \frac{t}{n} = t\left(1 - \frac{1}{n}\right) $$

OM → Real depth

MI → Apparent depth

IO → Normal shift

$$ \therefore \cancel{S_n}\ S_n = t\left(1 - \frac{1}{{}_{r}n_{d}}\right) $$

81.23

Datum .... 20......

Onderwerp :

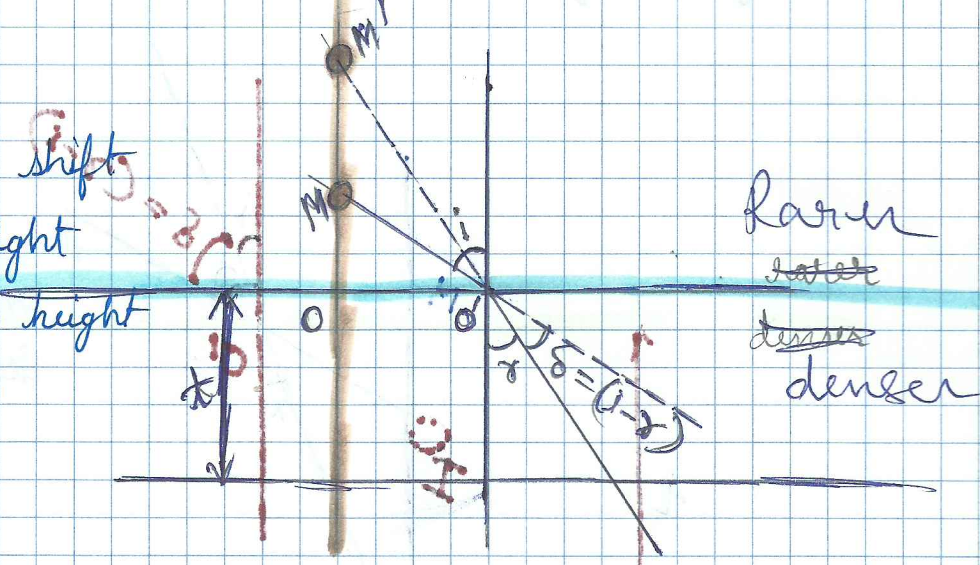
Case (ii) object in rarer medium observed from denser medium

MM' → Normal shift

OM → Real height

OM' → Apparent height

$S_n = -t\left(1 - \frac{1}{n}\right)$



3) A ray of light is incident on a 60° glass prism at an angle of 60°. Find the (i) $\angle^{ce}$ of emergence (ii) Angle of deviation, given the n of glass = 1.5.

Sol:- $A = 60°$ $\quad i_1 = 60°$ $\quad n_g = 1.5$

At first face, $n = \frac{\sin i_1}{\sin r_1} = \frac{\sin 60}{\sin r_1}$

$$1.5 = \frac{\sin 60°}{\sin r_1}$$

$$\sin r_1 = \frac{\sqrt{3}/2}{1.5} = 0.5773$$

$$\therefore r_1 = 35° 16'$$

$$A = r_1 + r_2$$

$$\therefore r_2 = A - r_1 = 60 - 35 = 25°$$

blank sheet

I pre-board ~~examination~~ 81·25

119 to 129

Datum .... 20......

Onderwerp : I pre-board exam

(4) ~~Section A~~ The sky appears to be blue during day time to a ~~person~~ person on earth. But appears dark instead of blue to an ~~astronaut~~ astronaut, why?

A: The appearance of colour or not is due to ~~phenomenon~~ phenomenon called scattering (Rayleigh scattering $I \propto \frac{1}{\lambda^4}$). ~~Since the earth~~ The scattering happens when light collides against ~~molecu~~ molecules in the atmosphere. Since the earth is surrounded by ~~atmosphere~~ atmosphere, for a person on earth during day time, and since the ~~blue has~~ blue has the shorter wavelength, the blue color gets scattered ~~more th~~ more than any other color. So the sky appears ~~blue~~ blue.

For ~~an~~ an astronaut, since there is no atmosphere, ~~there~~ there is no scattering of light, hence the sky appears ~~dark~~ dark.

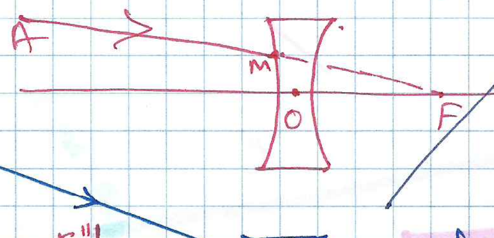
(5) The electrical resistivity of two materials is given below ~~in~~ in ohm-meter. Which of these materials can be used for ~~making~~ making element of a heating device?

(A) 6.84×10^{-8}
(B) 1.60×10^{-8} ✓
(C) 1.00×10^{-4} ✓
(d) 2.50×10^{12} → Insulator ✗
(e) 4.40×10^{-5} ✓

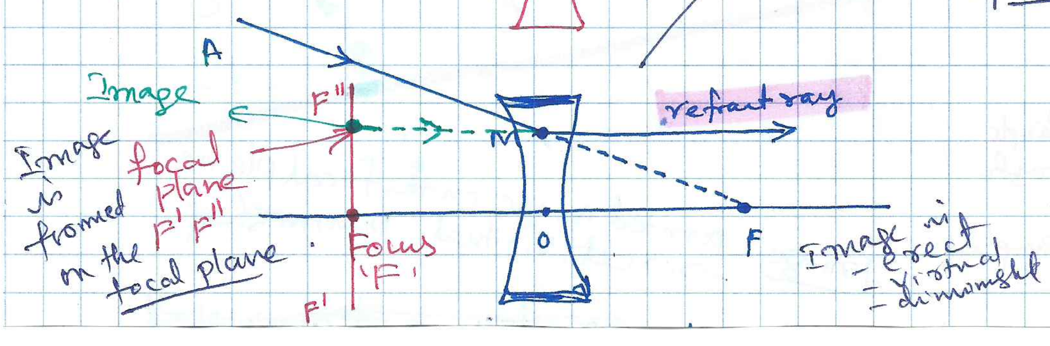
~~Note if d is 10~~ ~~the answer is~~

Answer is (C)

(6) A ray of light AM is incident on a spherical lens as shown in diagram. ~~in diagram~~ Redraw the diagram on the answer sheet and show the path ~~of refract~~ of refracted ray. Also mention the type of image formed!



Note: when a ray of light is incident on a concave lens at such an angle that it appears to pass through the focus, then the refracted ray emerge from the lens parallel to the principal axis



~~Note: when a ray of light incident on a concave lens at such an angle that it seems appears to pass through the focus, then the refracted ray emerge from the lens parallel to the principal axis~~

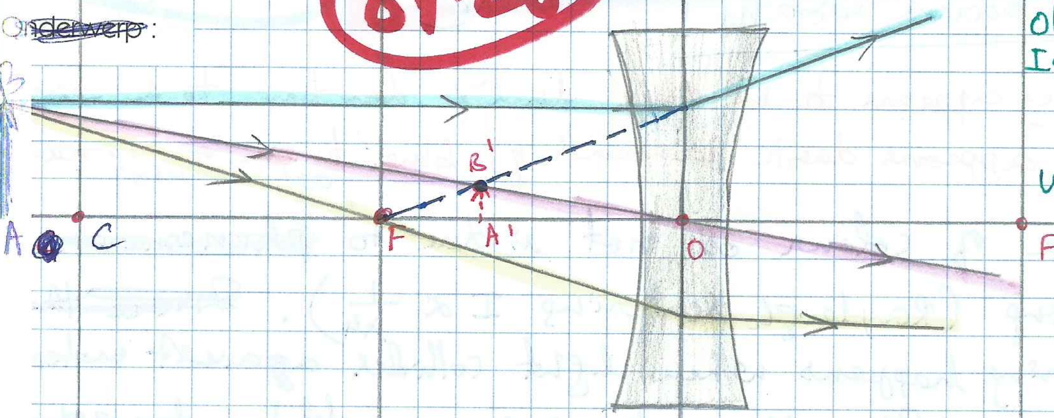
Rules
① Any ray passing through the optical centre of the lens, emerge without deviation after refraction.
② A ray passing through the principal focus (first) will emerge parallel to principal axis after refraction.
③ A ray from the object parallel to principal axis will ~~pass through the principal~~ appear to emerge from the principal focus (first) after refraction.

3 Rules

81.26

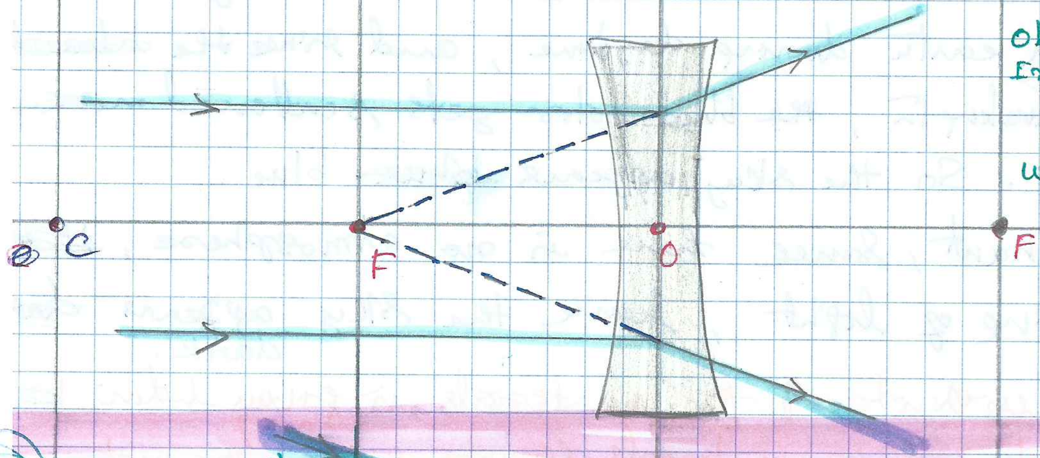
~~Datum~~

~~Onderwerp~~:



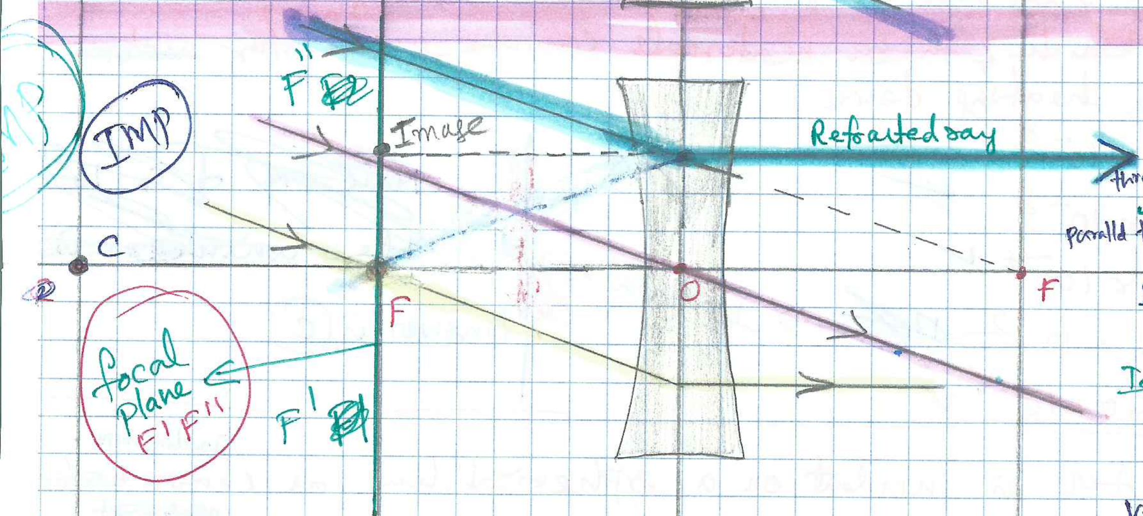
Object : Betn ∞ ~~and optical centre~~ and optical centre
Image : Betn F and ~~optical centre~~ optical centre
- Virtual
- erect
- diminished.

u, v, and f → ~~negative~~, negative



Object : at ∞
Image : At focus
- ~~erect~~ image (virtual, diminished, erect)

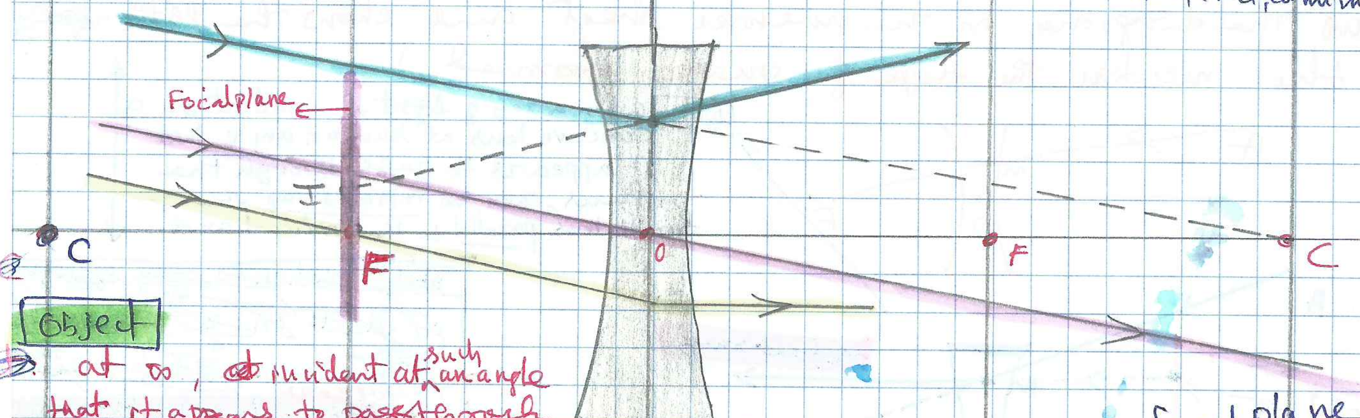
u, v, and f → ~~negative~~ negative



Object : at ∞, incident ~~at~~ at such an angle that it appears to pass ~~through~~ through principal focus (second)
- Refracted ray is ~~parallel to~~ parallel to principal axis.

~~Image~~ : ~~between F and O~~
- ~~Virtual, erect, diminished~~

Image : On the ~~focal~~ focal plane ~~F'F''~~ F' F''
: ~~virtual, erect, diminished~~.
Virtual, erect, diminished



Object
at ∞, ~~at~~ incident at such an angle that it appears to pass through Centre of curvature 'C'.
Refracted ray is at an angle to principal axis

Image : pointed image on the focal plane
→ erect, Virtual, Diminished

~~[illegible] diminished~~

Formation of image by a Convex mirror

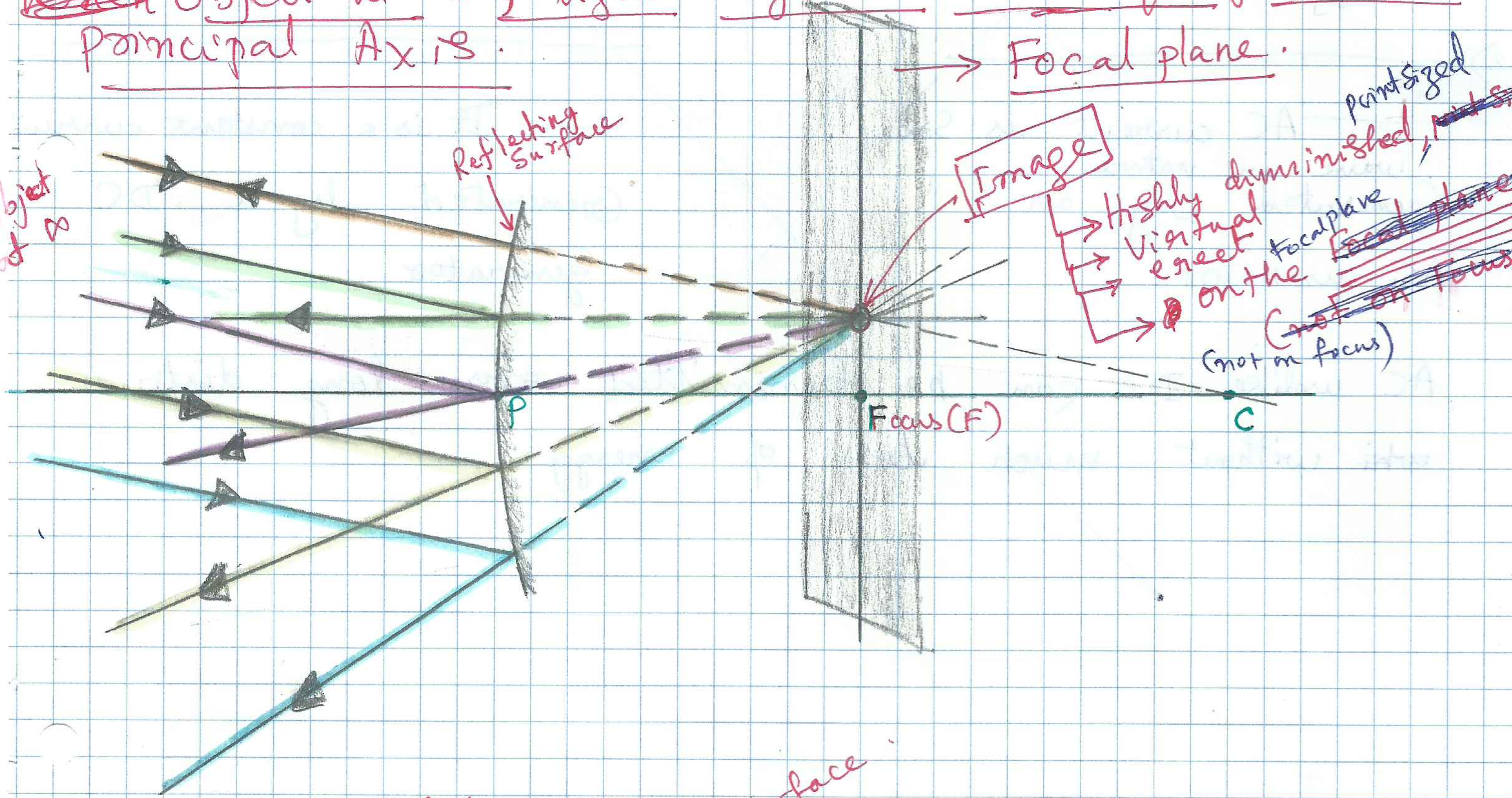
Datum 20

81.27

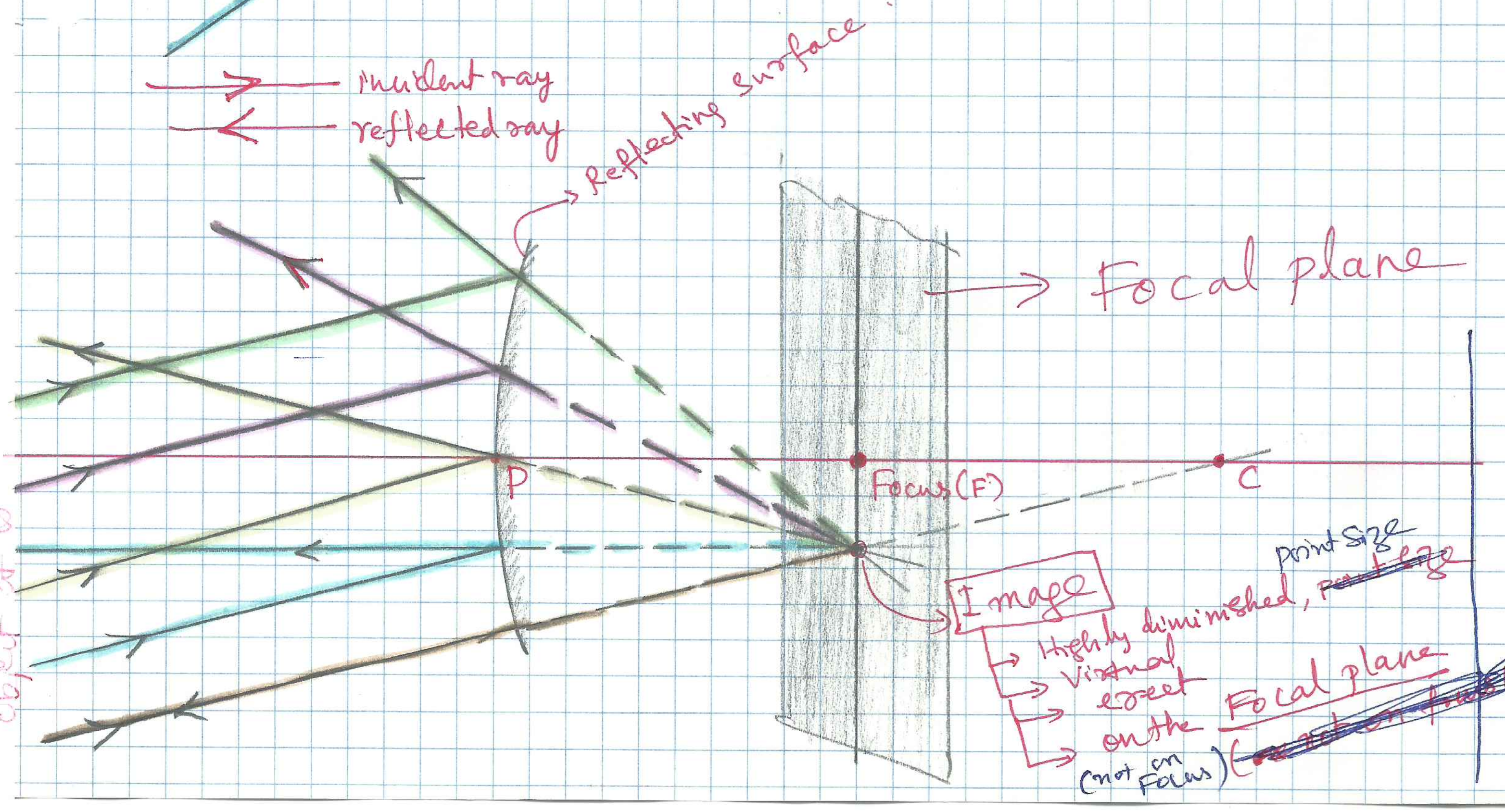
Onderwerp :

position of the object	position of the image	Size of image	Nature of Image
At ∞	At the focus F behind the Mirror	Highly diminished point sized	Virtual and Erect
Between ∞ and the pole P of the mirror	Between P and F, behind the mirror	Diminished	Virtual and Erect

~~When~~ Object at ∞, light rays incident obliquely to the Principal Axis.



→ incident ray
← reflected ray



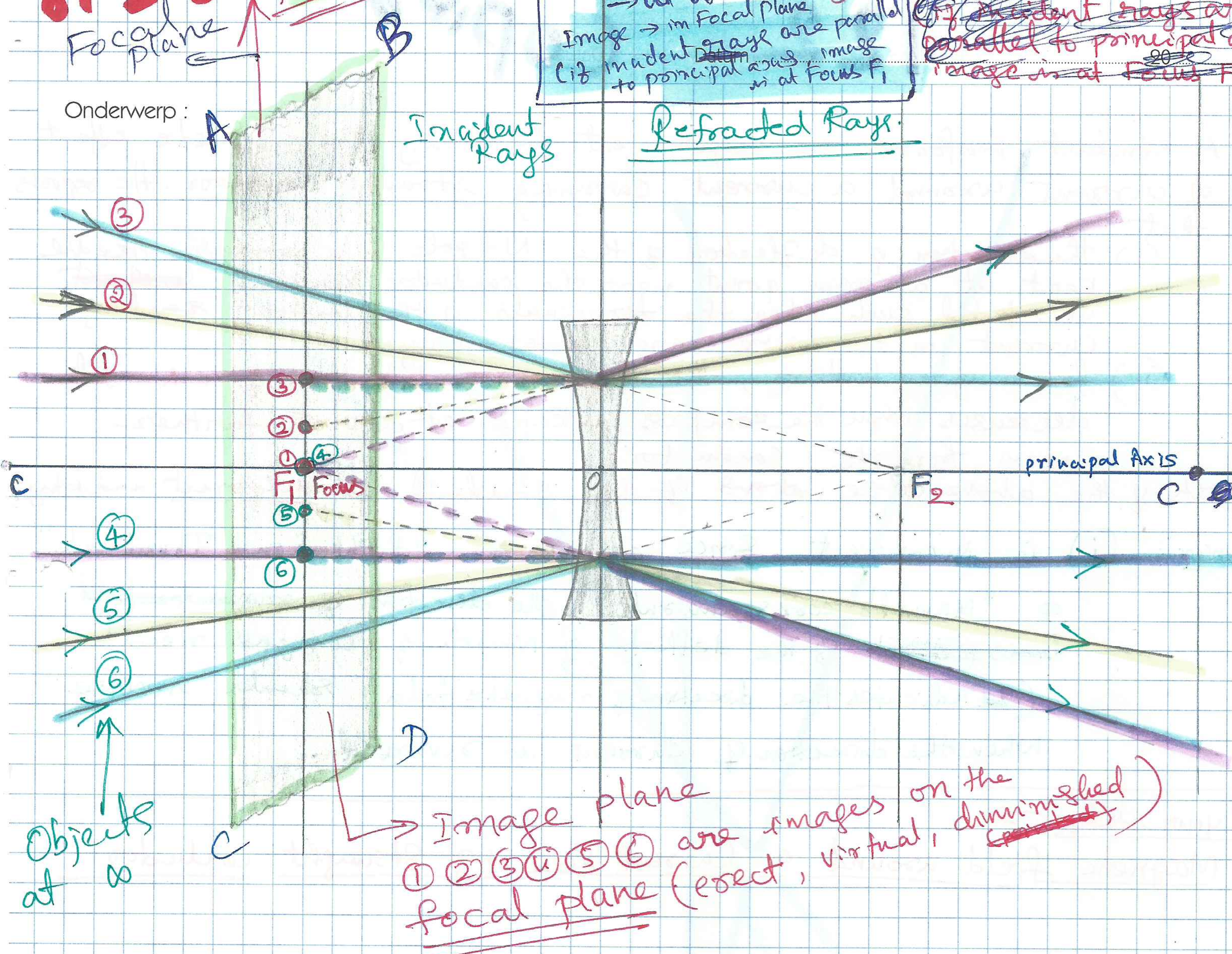
81·28

Focal plane

Onderwerp :

Object → at ∞
Image → in Focal plane
(if incident rays are parallel to principal axis, image is at Focus F_1)

~~Image → in Focalplane~~
~~(if incident rays are parallel to principal axis image is at Focus F~~



Conclusions

Case: object at infinity (∞)

- Image (virtual, erect, diminished) ~~is formed on the~~ appears to emerge from the "Focal plane" ABCD
- Important highlights in this case.
  - When incident rays are parallel to principal axis, image appears to emerge from Focus F_1 (F_1 is focus point on the principal axis) and the refracted ray emerges out making an angle with principal axis.
  - When the rays are incident at such an angle that it appears to pass through focus (F_2), the refracted ray emerges out parallel to the principal axis. The image ~~is~~ appears to emerge from the focal plane ABCD.
  - When the rays are incident ~~perpendicular to principal axis~~ horizontally and vertically with respect to principal axis, the image appears to emerge from the "focalplane ~~centre axis~~ centre axes"
  - When the rays are incident at any angle, the image appears to emerge from the focal plane.

~~124~~ 81.29

10 A person is able to see objects clearly only when these are lying at distances betw 50 cm and 300 cm from his eye?
(a) What kind of defects of vision he is suffering from?
(b) What kind of lenses will be required to increase his range of vision from 25 cm to infinity? Explain briefly.

(Normal eye-sight range is 25 cm to infinity)

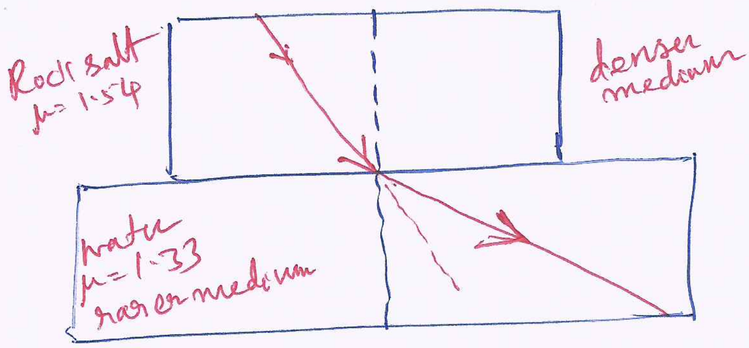
(a) He is suffering from presbyopia (both myopic and hypermetropic)
short sightedness, long sighted ness

(b) He requires bi-focal lens. Bi-focal lens is used to correct presbyopic eye. It contains a lens with upper concave and lower convex lens type. The concave lens part is used to correct his myopic problem and the convex lens part is used to correct his hypermetropic problem. (means concave lens → to see distant objects, convex lens part → to see near objects/reading).

problem: How does a light ray bend when it enters from rock salt to water (μ of rock salt = 1.54)

Ans: Given $\mu_{rock\ salt} = 1.54$

we know that $\mu_{water} = 1.33$ (Remember this number for water)



A light ray travelling obliquely from a denser medium (rock salt) to a rarer medium (water) bends away from the normal.

— 81·30 —

~~-125-~~

(14) (a) Two lenses have power of (i) + 2D (ii) − 4D. What is the nature and focal length of each lens.

(b) An object is kept at a distance of 100 cm from the second lens. Calculate the (i) image distance (ii) magnification.

(a) (i) + 2D → Convex lens used to correct long-sightedness (Hypermetropia)

$$f = \frac{1}{D} = \frac{100}{2} = 50 \text{ cm}$$

(ii) − 4D → Concave lens used to correct short-sightedness (myopia)

$$f = \frac{1}{D} = -\frac{100}{4} = -25 \text{ cm}.$$

(b) Lens Formula $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

(i)

$u = -100$ cm

$f = -25$ cm

$v = ?$

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

$$= -\frac{1}{25} - \frac{1}{100}$$

$$= -\left[\frac{1}{25} + \frac{1}{100}\right] = -\left[\frac{4+1}{100}\right]$$

$$= -\frac{\cancel{5}^{1}}{\cancel{100}_{20}} = -\frac{1}{20}$$

v = Image distance = −20 cm. (−0.2 m)

(ii) Magnification $= \frac{v}{u} = \frac{-20}{-100} = \frac{1}{5} = +0.2$

For you

Magnification +ve sign indicates that the image is erect and virtual.

The image is ~~half the~~ 1/5 th of size of the object

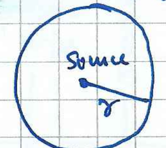
Not in CBSE Syllabus

81-31

Photometry :

* Photometry is a branch of physics which deals with the "measurement" of light energy

In photometry, the following terms are to be clearly understood.

Optical units	Defn :	unit	~~Represented by~~ ~~Refer~~
~~Magnetic light~~ ① "Luminous Flux" Φ	"Luminous flux" of a source of light is defined as the luminance energy emitted per second	Lumen (lm)	
② "Luminous Intensity" 'I' (Illuminating power of a source)	"Luminance Intensity" of a light source in any direction is the luminous flux emitted by that source in a "unit ~~angle~~ solid angle" in that direction.	candela (cd) IMP: $\boxed{\Phi = 4\pi I}$	1 candela = 1 lumen/steradian $1\,cd = 1\,lm\,sr^{-1}$
③ Illuminance "E" (or Intensity of illumination) Lambert's cosine law	Illuminance of a surface is defined as the luminance flux incident normally on unit area of the surface. Also $E \propto \cos\theta$ when θ is the angle which the incident light makes with the normal to the surface at that point. For normal incidence $\theta = 0$, $\cos\theta = 1$ ∴ E is maximum.	lux	$\boxed{E = \frac{\Phi}{A}}$ $\boxed{E = \frac{I}{r^2}}$ Sphere of radius r  $E = \frac{\Phi}{A} = \frac{4\pi I}{4\pi r^2}$ ∴ $\boxed{E = I/r^2}$
④ "Luminance" (Brightness) "B"	"Luminance" is defined as the luminous flux reflected into our eyes from a unit area of the surface. "Luminance" of the surface would depend upon – illuminance ~~of the surface~~ – nature of surface	$cd\,m^{-2}$ (Lambert)	Reflection coefficient of surface $r = \frac{B}{E}$
⑤ Refractive index (μ)	μ of a material = $\frac{\text{velocity of light in vacuum}}{\text{velocity of light in the medium}}$		

Not in CBSE Syllabus.

81-32

61

Efficiency of a electric light source = $\frac{\text{luminous flux } \phi}{\text{Input electric power}}$

Example

Source	Luminous flux ϕ	Efficiency (lumen/watt)
① 40 W fluorescent tube	2000	50
② 40 W tungsten lamp	465	12
③ 60 W	835	14
④ 100 W - 60 inch fluorescent tube	4400	44
⑤ 500 W tungsten lamp	9950	20

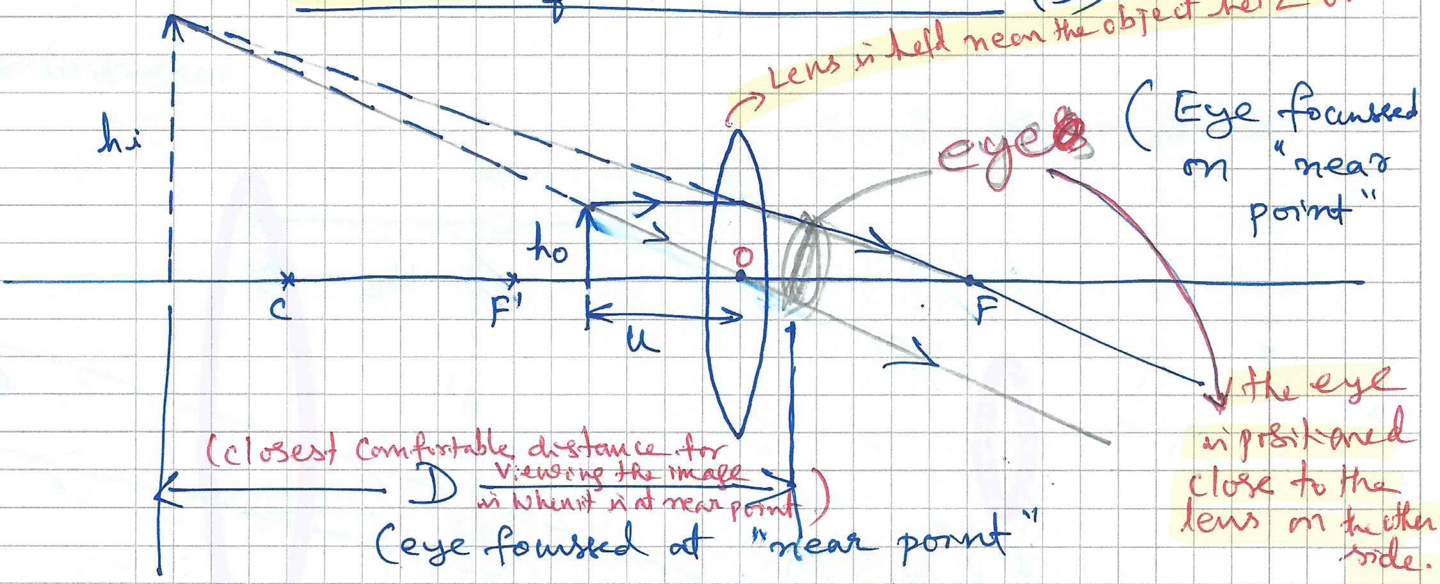
IMP

Steradian → is the unit solid angle

- Consider a sphere of radius r ($\therefore$ area $= 4\pi r^2$)
- On the surface of the sphere (whose area $= 4\pi r^2$), cut off an area r^2. This area forms a solid angle equal to 1 steradian at the centre of the sphere.
- Obviously total solid angle at the centre is 4π steradian.

Microscope (Simple Microscope)

Case (i): ~~Formed~~ Image is formed at the "least distance of distinct vision" (D)



Linear Magnification $\boxed{m = \frac{h_i}{h_o} = \frac{v}{u}}$ For lens

We also know lens formula is $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$$\therefore m = v\left[\frac{1}{v} - \frac{1}{f}\right] = 1 - \frac{v}{f}$$

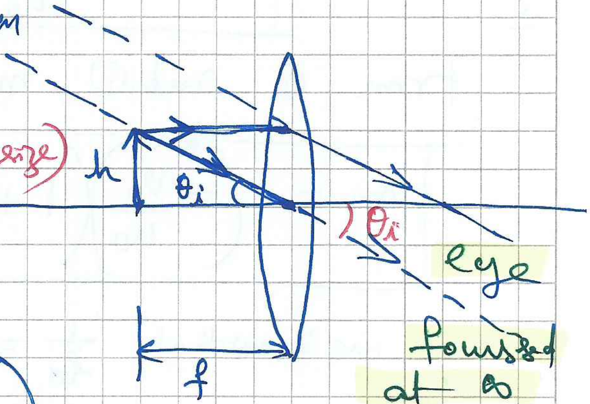
According to sign convention

Standard value for normal vision = 25 cm ∴ D = 25 cm

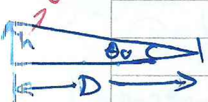
∴ To get magnification of 6, one needs convex lens of f = 5 cm

$$\left.\begin{array}{l} v = -D \\ f = +f \end{array}\right\} \therefore \boxed{m = 1 + \frac{D}{f}} \longrightarrow (1)$$

Case (ii): ~~Formed~~ Image formed at infinity.



- Here we need to calculate angular magnification
- Max. angle the object can subtend and be clearly visible (without lens), is when it is at the near point



$$\therefore \tan\theta_o = \frac{h}{D} \approx \theta_o$$

object height (or size)

- Angle subtend by image at the eye

$$\tan\theta_i = \frac{h'}{-v} \qquad \left(\text{Since } m = \frac{h'}{h} = \frac{v}{u}\right)$$

$$\tan\theta_i = \frac{1}{-\cancel{v}} \cdot \frac{\cancel{v}\, h}{u} = \frac{-h}{u} \approx \theta_i = \frac{h}{-u} \qquad \therefore (\theta_i = \theta_o)$$

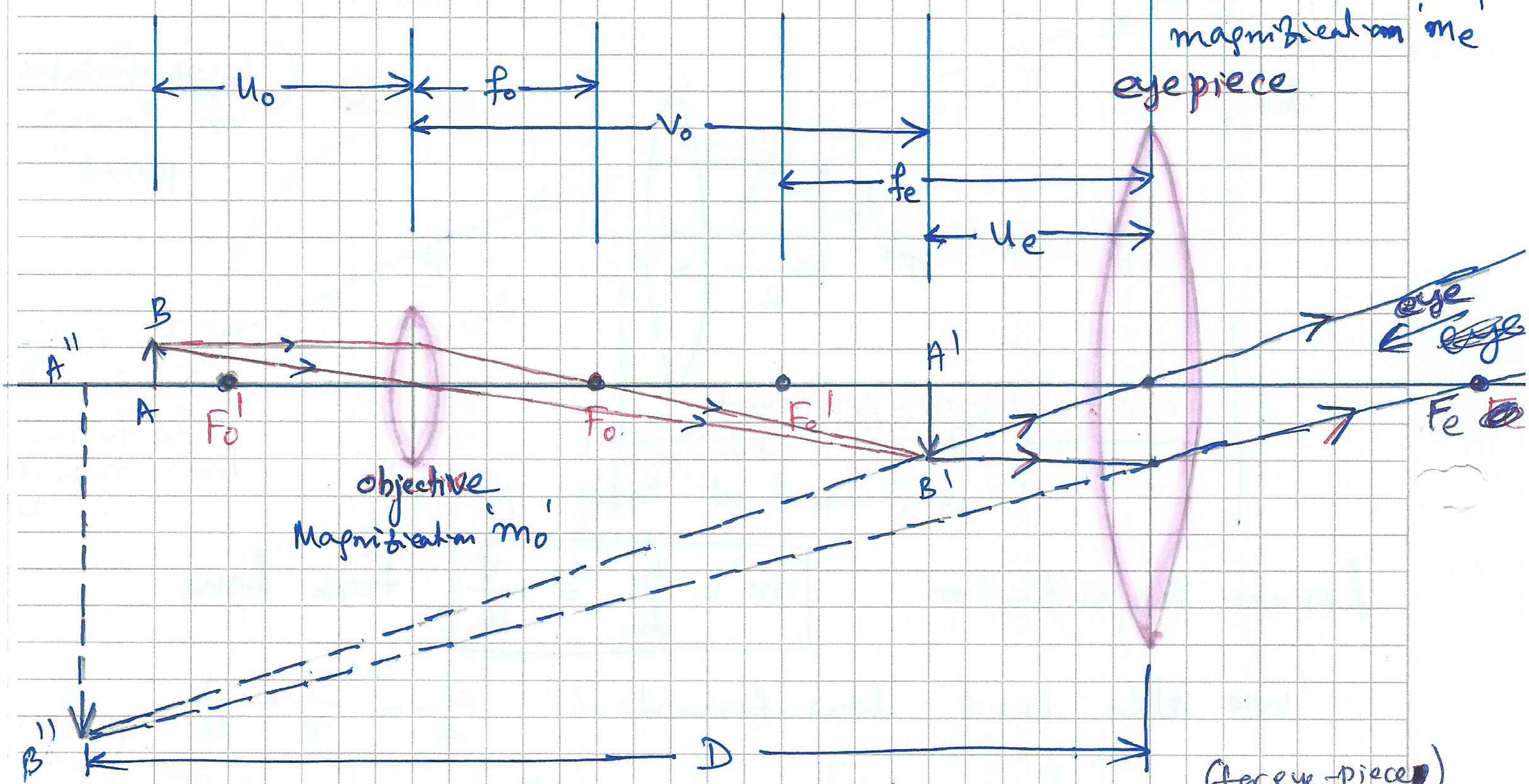
- For image at ∞, the object should be at focus $u = -f$

$$\therefore \theta_i = \frac{h}{f} \qquad \therefore m = \frac{\theta_i}{\theta_o} = \frac{\cancel{h}}{f} \cdot \frac{D}{\cancel{h}} = \frac{D}{f} \qquad \boxed{m = \frac{D}{f}} \rightarrow (2)$$

Compound Microscope [81-34]

A simple microscope has limited max. magnification. For greater m, one uses 2 lenses, one compounding the effect of the other.

Case (i) Final image is formed at the "near point" (D)



Total magnification $= m = m_o m_e$

To find m_o:

~~Fore~~ For lens

$$m_o = \frac{A'B'}{AB} = \frac{v}{u} = \frac{v_o}{-u_o}$$

$$\therefore \boxed{m_o = -\frac{v_o}{u_o}} \longrightarrow (2)$$

From (1) and (2), $m = m_o m_e$ becomes

$$\boxed{m = \left(-\frac{v_o}{u_o}\right)\left(1 + \frac{D}{f_e}\right)}$$

To find m_e (for eye-piece)

$$m_e = \frac{A''B''}{A'B'} = \frac{v}{u}$$

using $\frac{1}{f_e} = \frac{1}{v} - \frac{1}{u}$

$$m_e = v\left[\frac{1}{v} - \frac{1}{f_e}\right] = 1 - \frac{v}{f_e}$$

Since $v = -D$

$$\boxed{m_e = 1 + \frac{D}{f_e}} \rightarrow (1)$$

(Same as Simple Microscope)

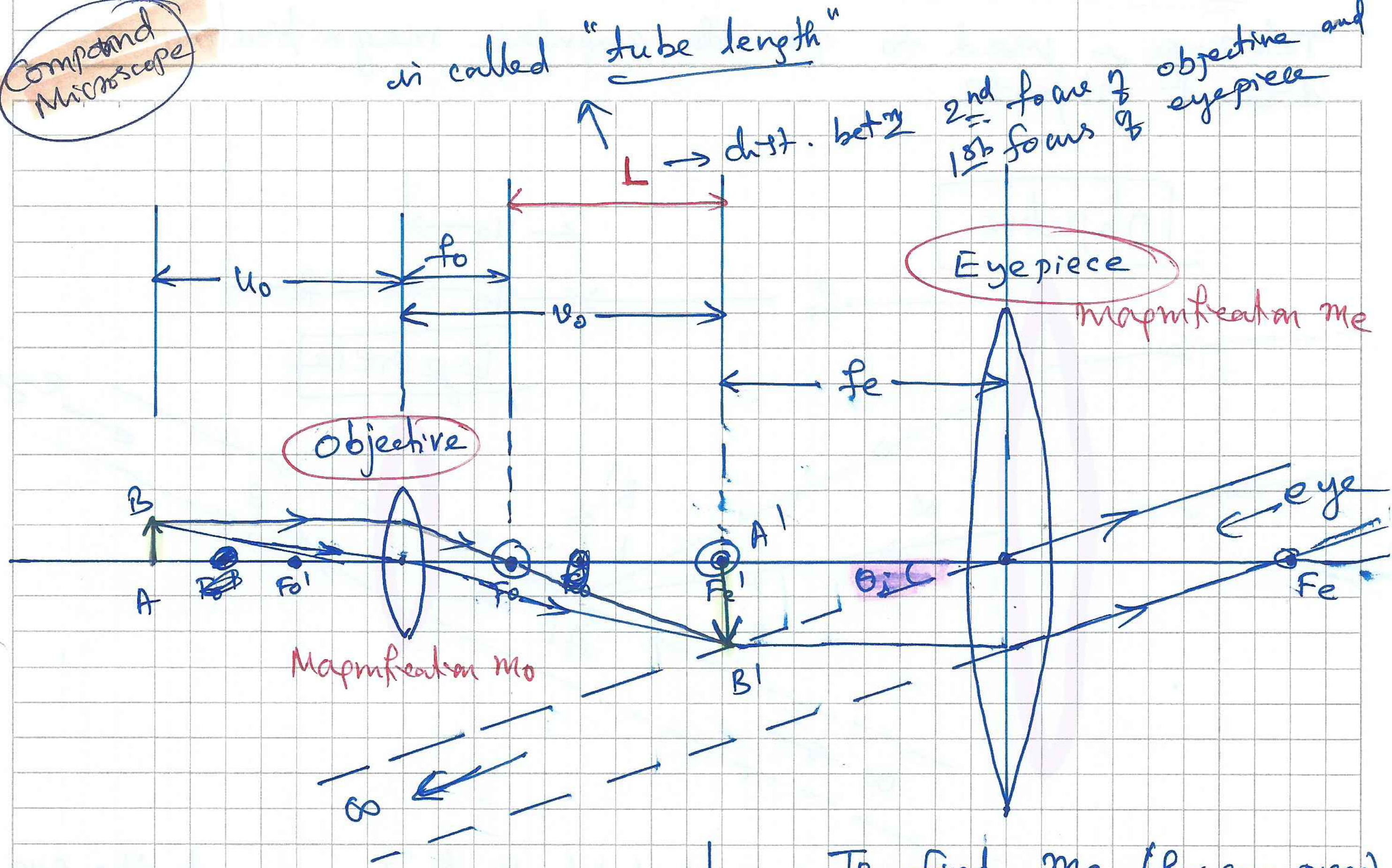
Also we know that $\frac{1}{f_o} = \frac{1}{v_o} - \frac{1}{u_o}$

$$m = -v_o\left[\frac{1}{v_o} - \frac{1}{f_o}\right]\left[1 + \frac{D}{f_e}\right] = \left[\frac{v_o}{f_o} - 1\right]\left[1 + \frac{D}{f_e}\right]$$

$$\therefore \boxed{m = \left[\frac{(v_o - f_o)}{f_o}\right]\left[1 + \frac{D}{f_e}\right]}$$

Case (ii) Final image is formed at ∞ | 81-35 |

Compound Microscope



Total magnification $= m = m_0 m_e$

<u>To find m_0:</u>

$$m_0 = \frac{A'B'}{AB} = \frac{v}{u} = \frac{v_0}{-u_0}$$

$$\therefore \boxed{m_0 = -\frac{v_0}{u_0}} \rightarrow (2)$$

using (1) and (2)

$$m = -\frac{v_0}{u_0}\left(\frac{D}{f_e}\right)$$

We know that $\frac{1}{f_0} = \frac{1}{v_0} - \frac{1}{u_0}$

$$m = -v_0\left[\frac{1}{v_0} - \frac{1}{f_0}\right]\left[\frac{D}{f_e}\right]$$

$$m = \left[\frac{v_0}{f_0} - 1\right]\left[\frac{D}{f_e}\right]$$

$$m = \frac{(v_0 - f_0)}{f_0} \times \frac{D}{f_e}$$

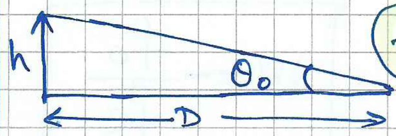
Suppose $L = v_0 - f_0$ which is distance bet^n 2 focal points as in figure

$$\boxed{m = \frac{L}{f_0} \times \frac{D}{f_e}}$$

L is called "tube length"

<u>To find m_e (for eye-piece)</u>

- (Need to calculate angular magnification)
- Max. angle the object can subtend and be clearly visible (without) lens, is when it is at the "near point"



$$\tan\theta_0 = \frac{h}{D} \simeq \theta_0$$

- Angle subtended at the eye by image

$$\tan\theta_i = \frac{h'}{-v_e}$$

Since $m = \frac{h'}{h} = \frac{v_e}{u_e}$

$$\tan\theta_i = -\frac{1}{\cancel{v_e}} \cdot \frac{h\,\cancel{v_e}}{u_e} = -\frac{h}{u_e}$$

- For image at ∞, the object should be at focus i.e. $u_e = -f_e$

$$\tan\theta_i \simeq \theta_i = \frac{h}{f_e}$$

$$m_e = \frac{\theta_i}{\theta_0} = \frac{\cancel{h}}{f_e} \cdot \frac{D}{\cancel{h}}$$

$$\therefore \boxed{m_e = \frac{D}{f_e}} \rightarrow (1)$$