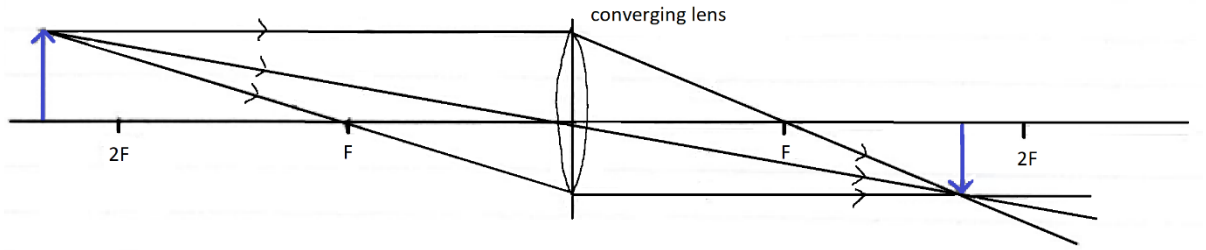
MEDICAL PHYSICS

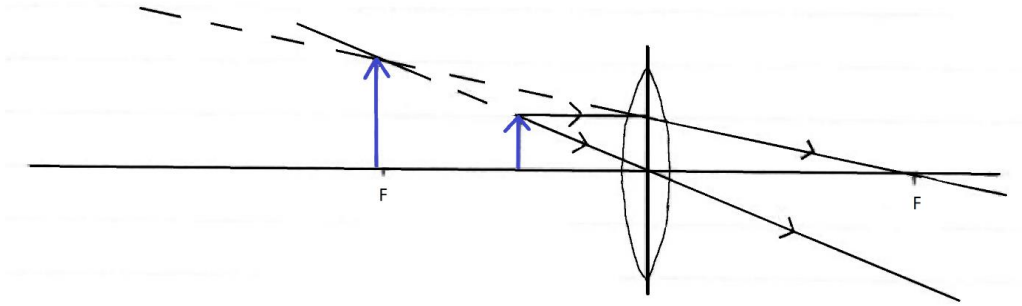
1-2 Lenses

1. (a) (i) Diagram:



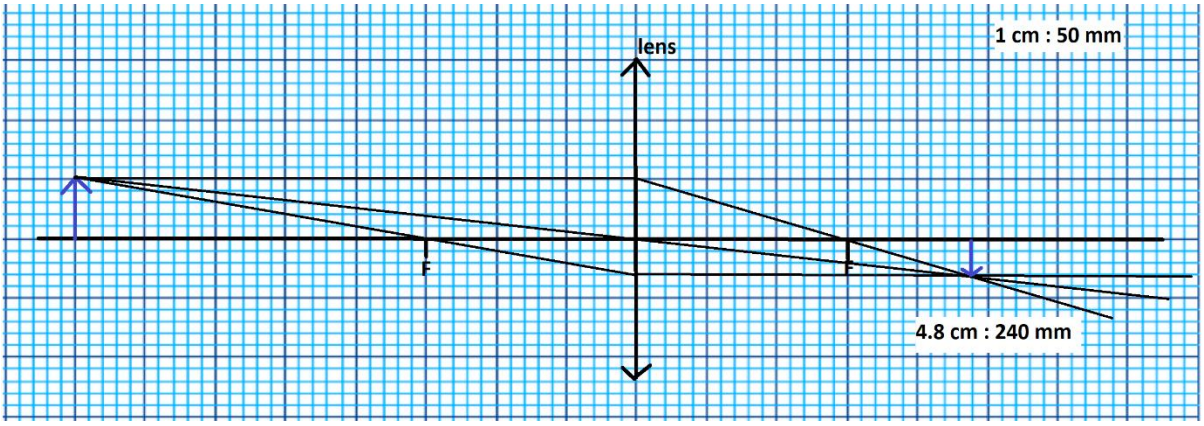
(ii) The image is real, diminished and inverted
i.e. can be formed on a screen, is smaller than the object and upside down

(b) (i) Diagram:



(ii) The image is virtual, magnified and upright
i.e. can't be formed on a screen, larger and in same orientation as the object

2. (a) Diagram:



(b) (i) The image is real

(ii) The image is inverted

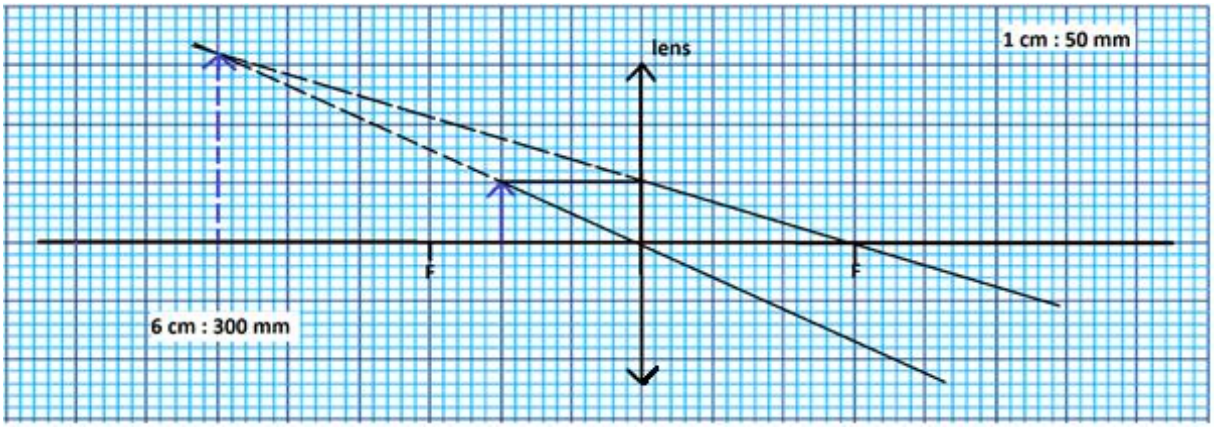
(c) To calculate the answer to check the diagram has been drawn correctly:

f = 150 mm, u = 400 mm

$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$ so $\frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{1}{f} - \frac{1}{u} = \frac{1}{150} - \frac{1}{400}$

Hence v = 240 mm = 0.240 m

3. (a) Diagram:



(b) (i) The image is virtual

(ii) The image is upright

(c) To calculate the answer to check the diagram has been drawn correctly:

f = 150 mm, u = 100 mm

$\frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{1}{150} - \frac{1}{100}$

Hence v = -300 mm = - 0.300 m

4. object height = 10 mm

Focal length f = - 0.200 m as the lens is a diverging one

(a) object distance u = 0.150 m

$\frac{1}{v} = \frac{1}{f} - \frac{1}{u} = -\frac{1}{0.200} - \frac{1}{0.150}$ = - 5.00 - 6.67 = -11.67 so v = $-\frac{1}{11.67}$ = - 0.08568… m

Hence v = - 0.086 m

The image height

$\frac{0.086}{0.150}$ x 10 = 5.733… mm = 5.7 mm

(b) object distance = 0.250 m

$\frac{1}{v} = \frac{1}{f} - \frac{1}{u} = -\frac{1}{0.200} - \frac{1}{0.250}$ = -5.00 – 4.00 = -9.00 so v = $-\frac{1}{9.00}$ = - 0.1111… m

Hence v = - 0.111 m

The image height

$\frac{0.111}{0.250}$ x 10 = 4.44… mm = 4.4 mm