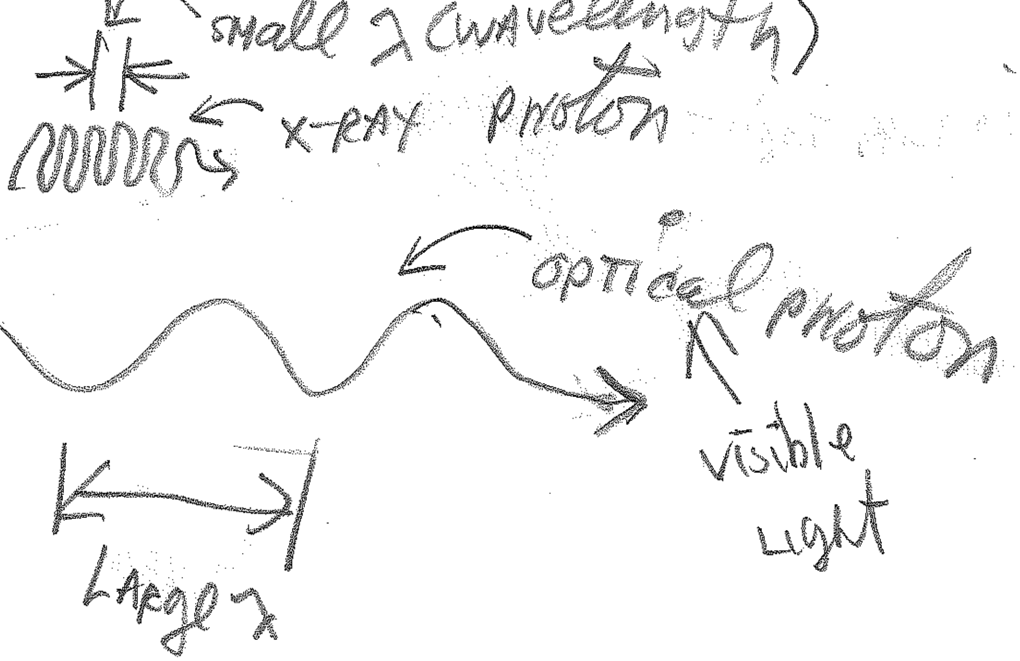
(P11)

12-5

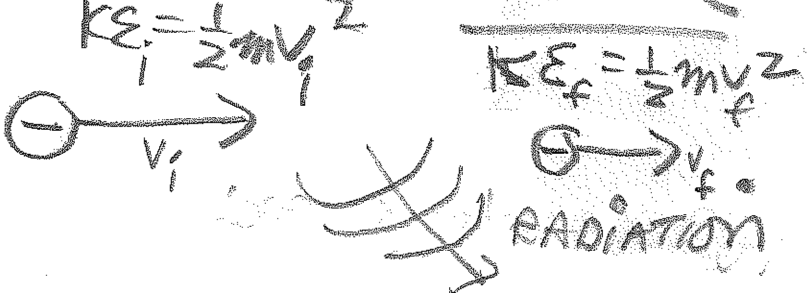
Radioactivity Ch 33

X-rays → see quiz 8, 9.

XRAYS have higher frequency than light.



common **XRAY SOURCE:** electrons slow down and radiate X-RAYS.



Electrons lose KE and cause RADIATION ENERGY.

V = speed

common RADIOACTIVE BYPRODUCTS:

Ⓐ- Alpha particle = He nucleus (++)

2 PROTONS ↗

$+2e$ CHARGE

Ⓑ- beta particle = electron

Ⓒ. Gamma RAY = high energy (small λ) photon: see Fig. 33.2

APPLICATIONS

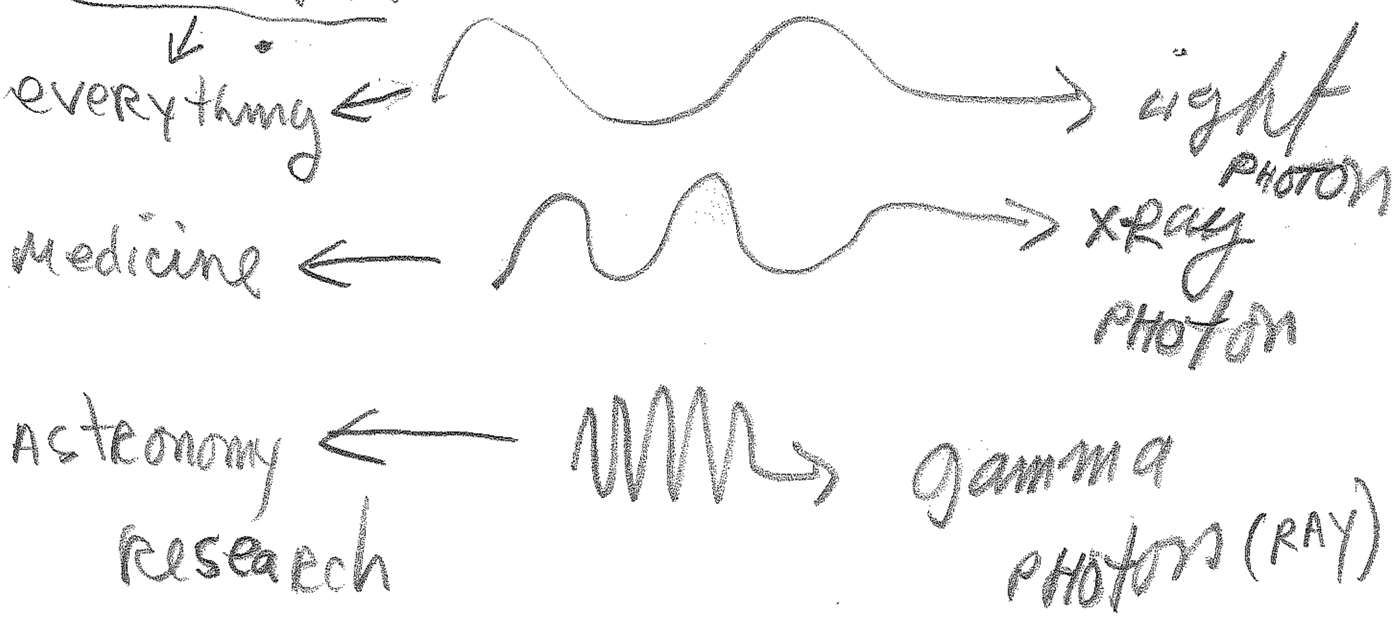


Fig 33.3

← Beta (−) ← electron

← Alpha (He nucleus ++)

Note: only β and α bend in magnetic field since they are charged (CH24)

Environmental radiation statistic:

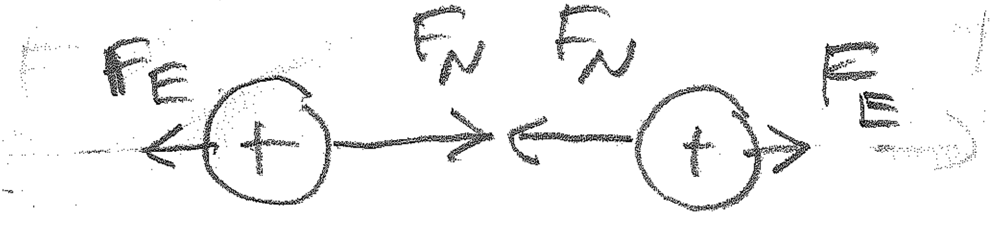
* 75% = "Background" (cosmic rays, radon, etc)

* 0.003% = nukes

Which is more dangerous?

Atomic nucleus and nuclear stability: p 584

Review Ch22



$F_E < F_N$ when protons are close.

↑ ↑

electric force nuclear force

↑ ↑

repulsive attractive

Large nucleus:

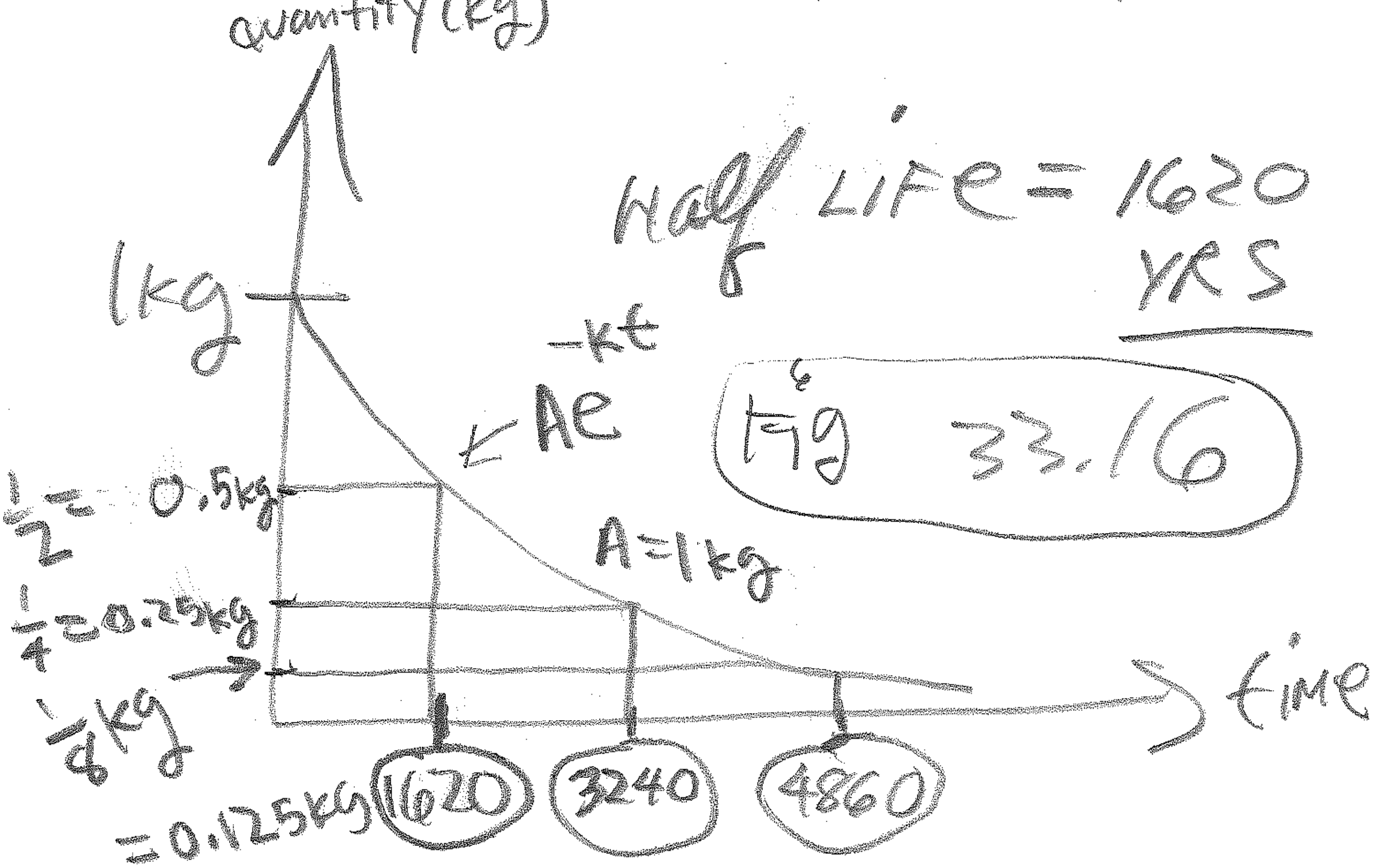
(PROTONS FAR APART)

$$F_N < F_E$$

Unstable!

Will come apart (decay) due to electric repulsion

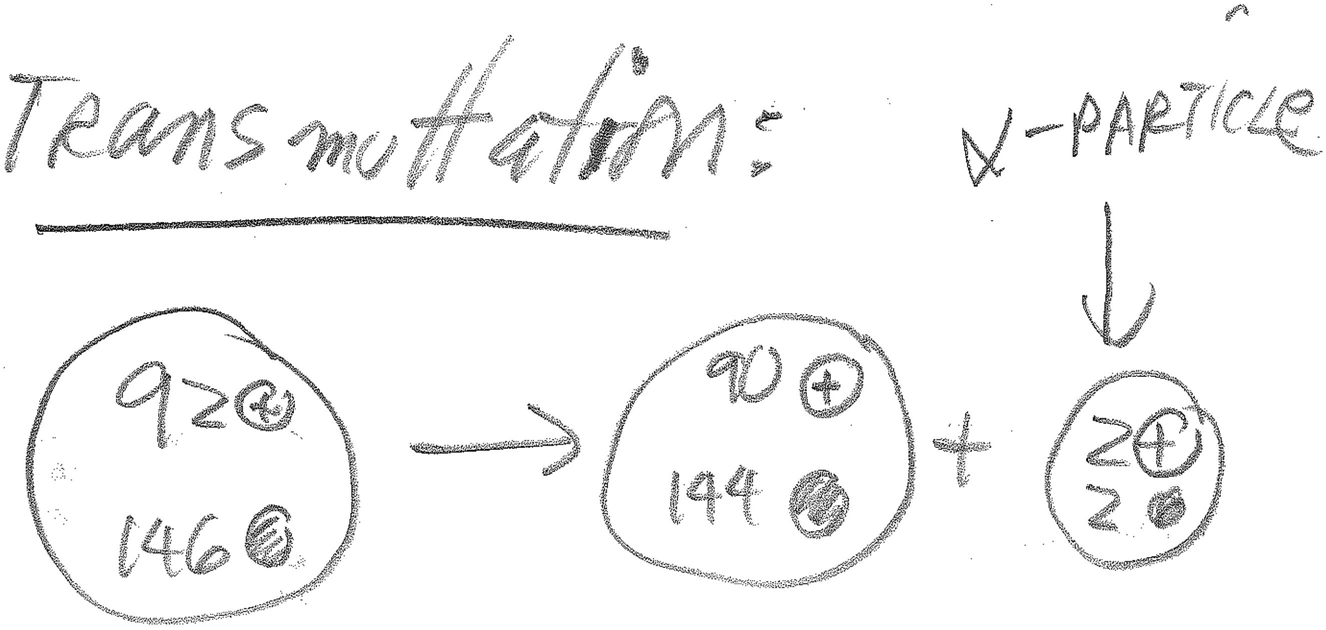
half LiFE for decay



half LiFE = 1620 YRS

t49 33.16

Transmuttation:



$$^{238}_{92}U \longrightarrow {}^{234}_{90}Th + {}^{4}_{2}He$$

new element

protons ⊕

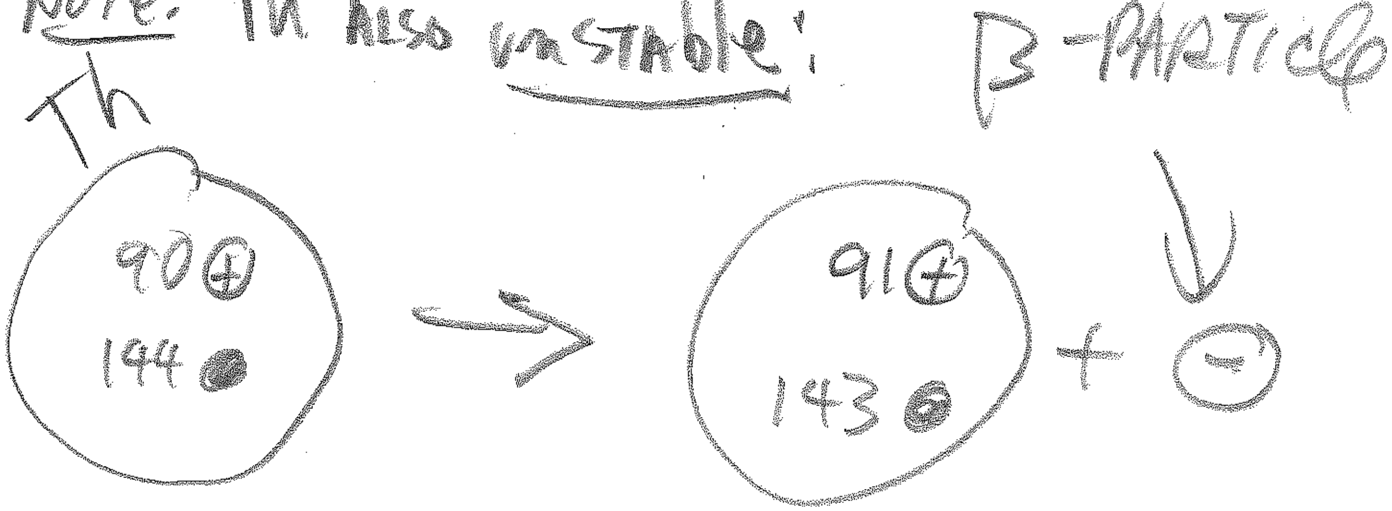
238-92
= 146 neutrons ●

NOTE: 92 = 90 + 2

146 = 144 + 2

conservation of charge:
92 = 90 + 2

NOTE: Th ALSO unSTABLE!



$$^{234}_{90}Th \rightarrow {}^{234}_{91}Pa + {}^{0}_{-1}e$$

new element

electron

after BREAK: fission

(atomic BOMBS, REACTORS)

caf : Thin lens (converging)

Ch 28 concepts

Lenses

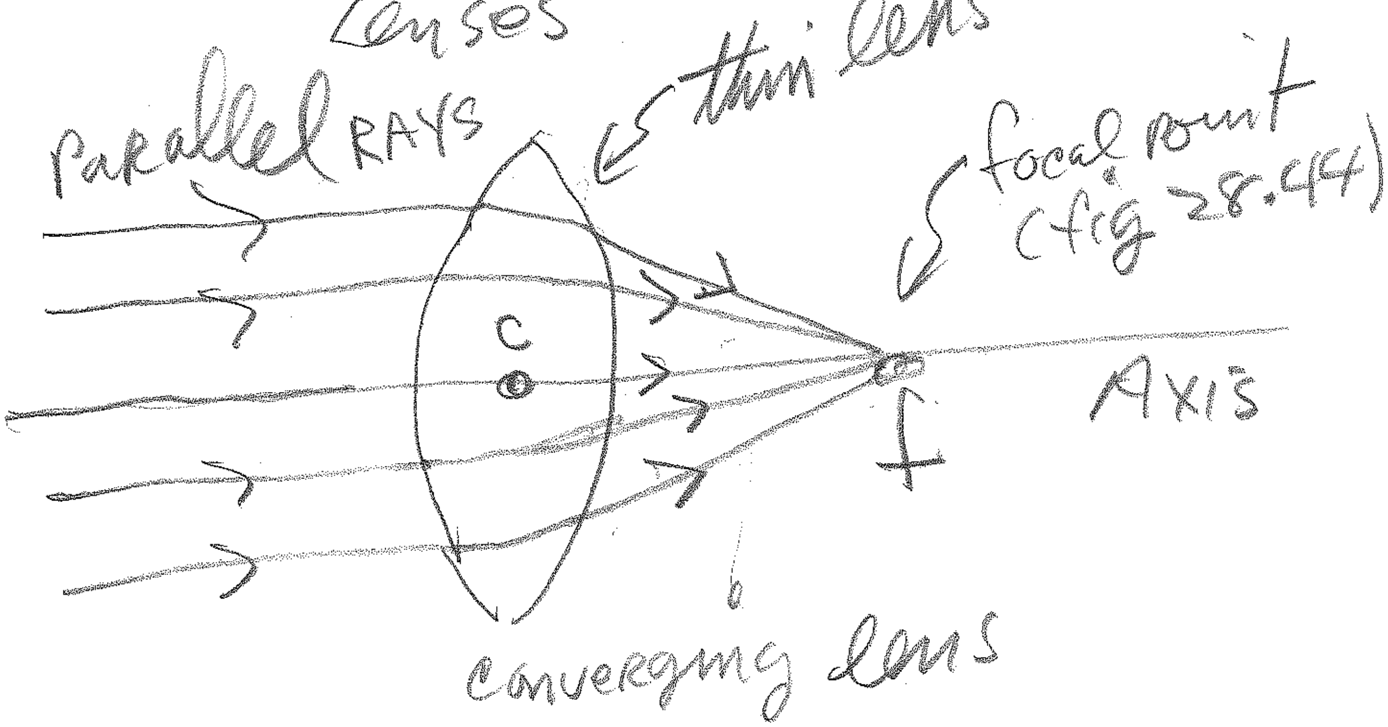
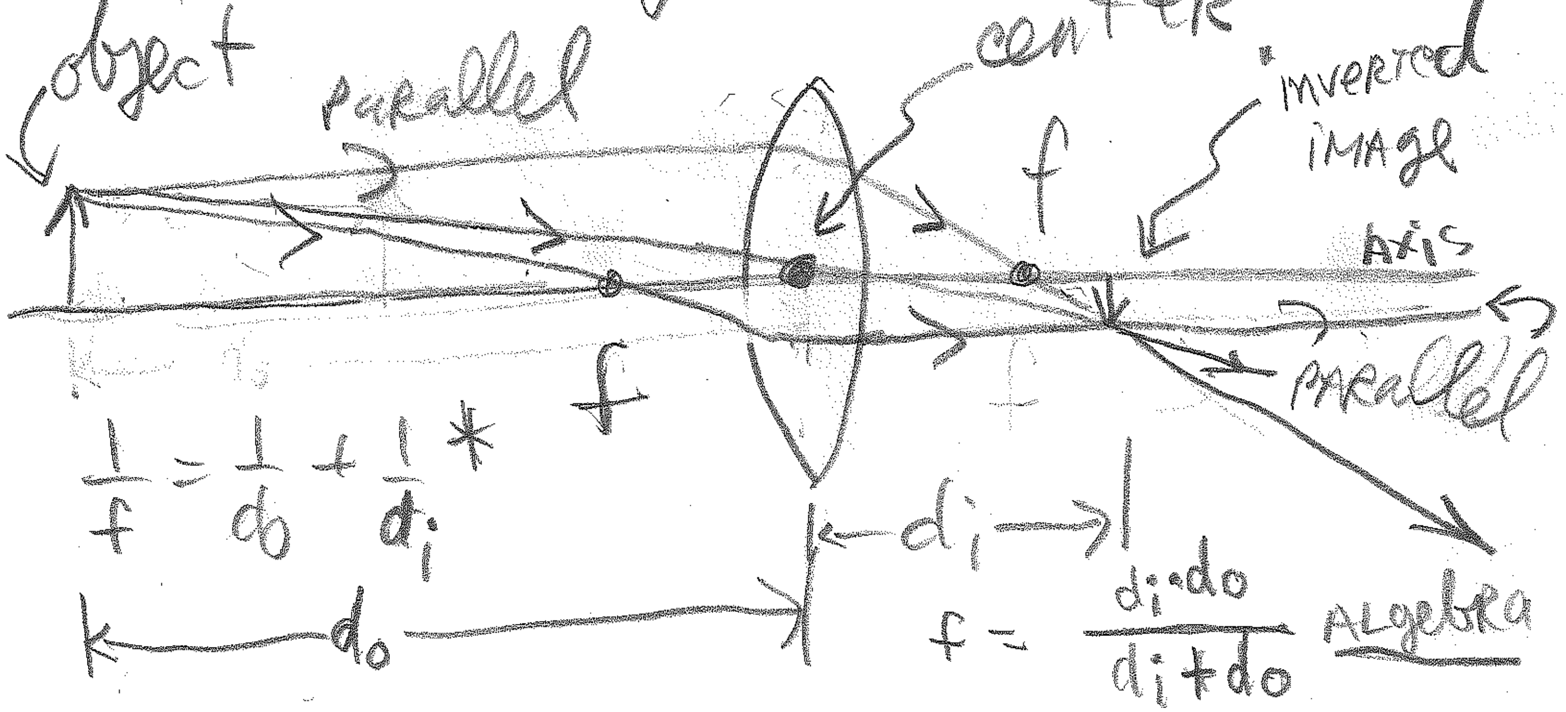


fig 28.42 ⓐ Ray Tracing:



$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$ *

$f = \frac{d_i \cdot d_o}{d_i + d_o}$ ALGEBRA

Data Sheet THIN LENS:
DETERMINATION OF f (converging lens.)

do		} 4 values
	d_{obest} = Average of 4 *	
	Δd_{oinst} = 0.05cm	
	$(d_{omax} - d_{omin})/4$	
	Δd_o (larger of previous two.)	
di		} 4 values
	d_{ibest} Average of 4 **	
	$\Delta d_{i\ inst}$ = 0.05	
	$(d_{imax} - d_{imin})/4$	
	Δd_i (larger of previous two.)	
f_{best}	$d_{obest}*d_{ibest}/(d_{obest}+d_{ibest})$ = f NOTE: $d_{o_{best}}$ = Average $d_{i_{best}}$ = Average **	*

Do NOT MOVE lens!

~~**Compare f_{best} and f_{acc} with the overall error, which gives the range, as discussed in class. Does the accepted value of f fall within the range centered at the best value? Hint: Check if $f_{min} < f_{acc} < f_{max}$, where f_{min} is the minimum possible using the values of the uncertainty and plugging into the formula by *subtracting the uncertainty* in the numerator and *adding the uncertainty* in the denominator; similar reverse logic should be used to get f_{max}: add in the numerator and subtract in the denominator.**~~

Percent error for f

f_{acc} = 20cm OR 10cm

$$\left| \frac{f_{exp} - f_{acc}}{f_{acc}} \right| \times 100\%$$

f_{exp} = YOUR value

Theoretical magnification m = $\boxed{-d_i/d_o}$

d_i = AVERAGE = $d_{i\,BEST}$

d_o = AVERAGE = $d_{o\,BEST}$

ACTUAL MAGNIFICATION m =

Percent error for magnification m

$$= \left| \frac{-d_i/d_o - h_i/h_o}{-d_i/d_o} \right| \times 100\%$$

→ ACTUAL MAGNIFICATION = RATIO of ARROW heights

$$m = \frac{h_i}{h_o}$$

h_i ← ARROW ON SCREEN

h_o ← ARROW ON LIGHT