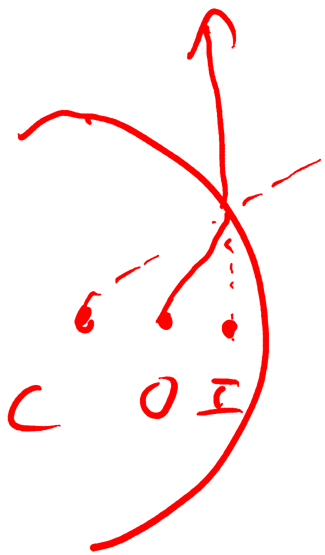
Final Exam Scheme

- Wednesday 12 December, 2pm-4pm
  - In our normal room, MWAH 347
- There's been ~one midterm's worth of new stuff since last midterm
  - So about half the final will look like a midterm on the EM waves & optics stuff
- However, it is a final exam after all, and there are two hours to take it, so the other half the final will be comprehensive, reviewing older stuff
  - That's more than a usual test, so you can bring two pages of notes instead of just the usual one

How to review old stuff?

- Start with your old midterms. Can you work them out, starting fresh?
  - Fresh? I mean read the problem, put your answer aside, and pretend you're taking the test again for the first time: then grade your new answer yourself
  - For topics that give you trouble, then go work out problems from HW (assigned, practice, online, whatever) related to that topic
- An old test, as per usual, is posted for more practice

Where is actual mosquito compared to image?



Picture from PBS' "Nova" show

Fig.38.14

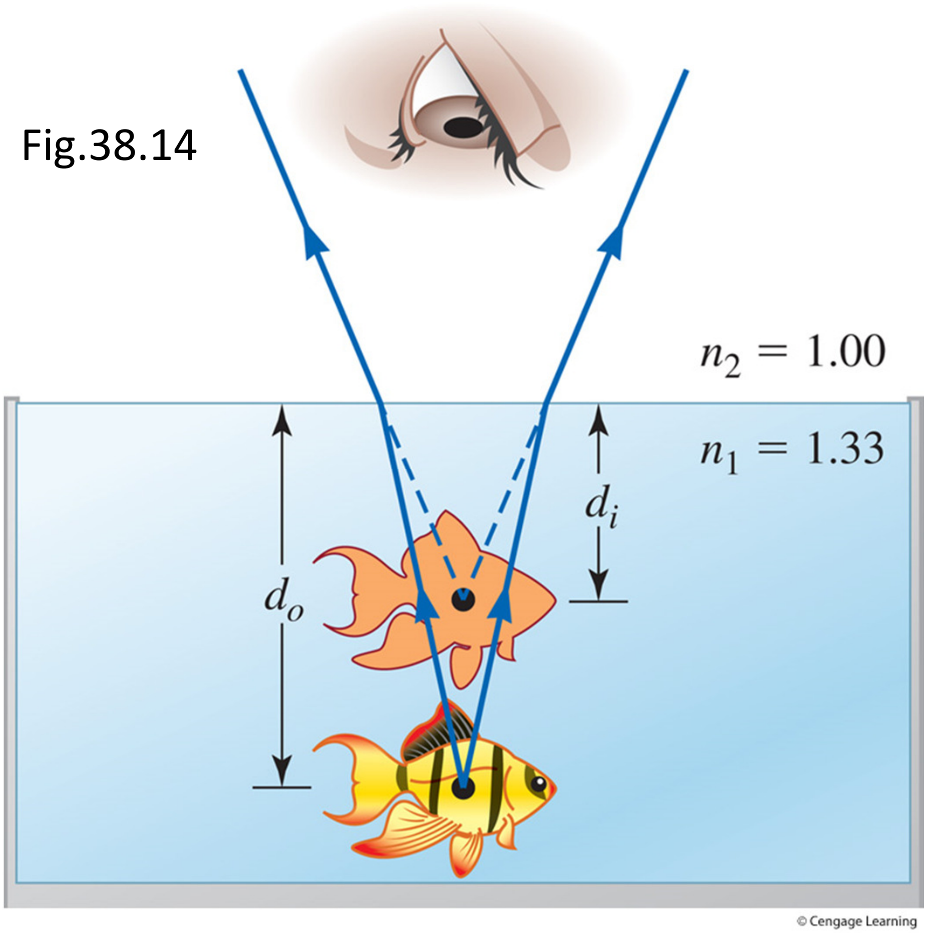
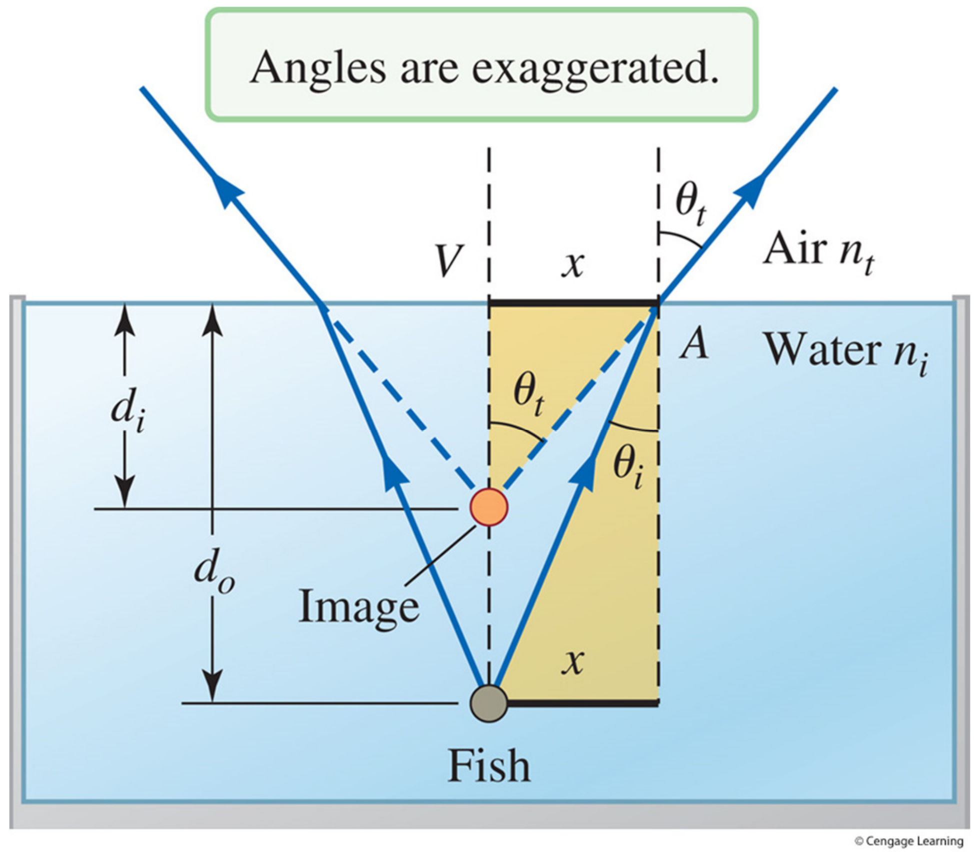
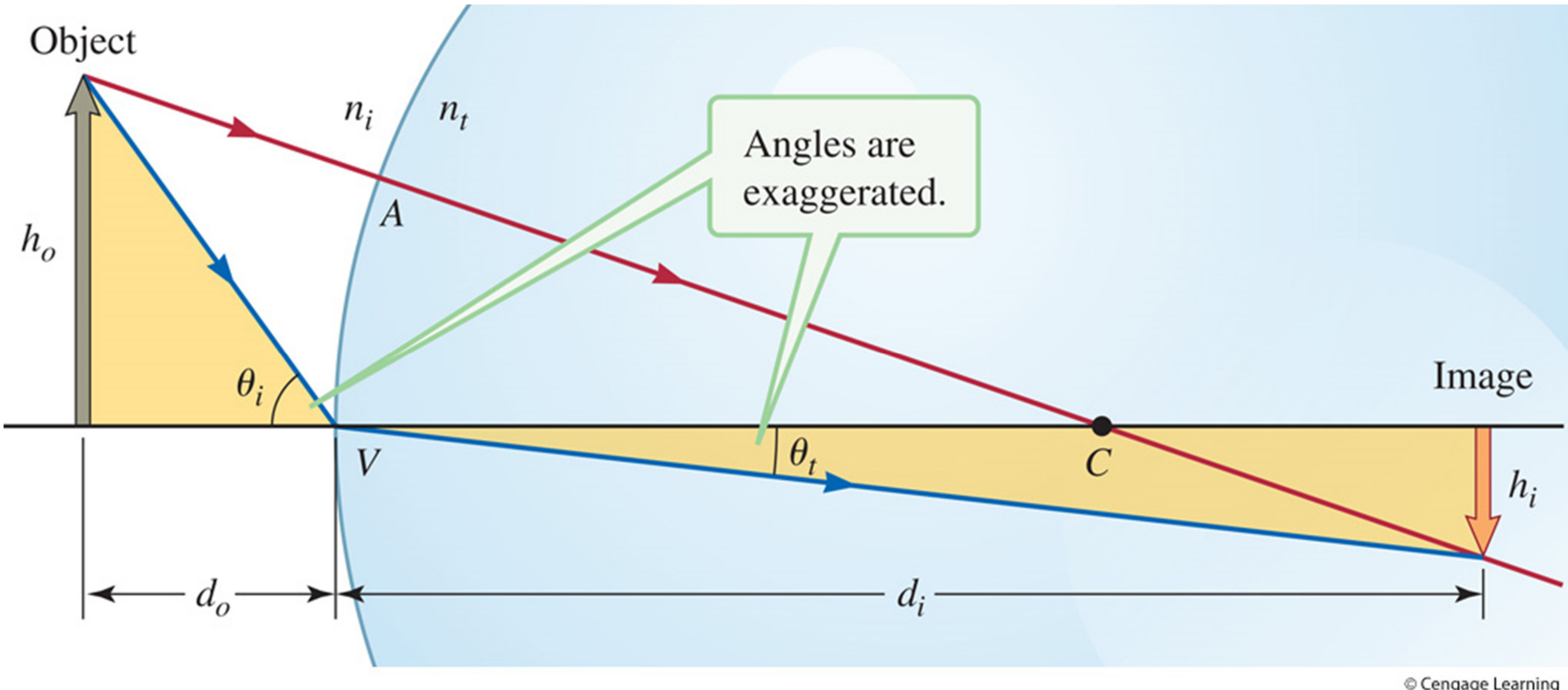


Fig.38.19



Do Refraction Problems worksheet

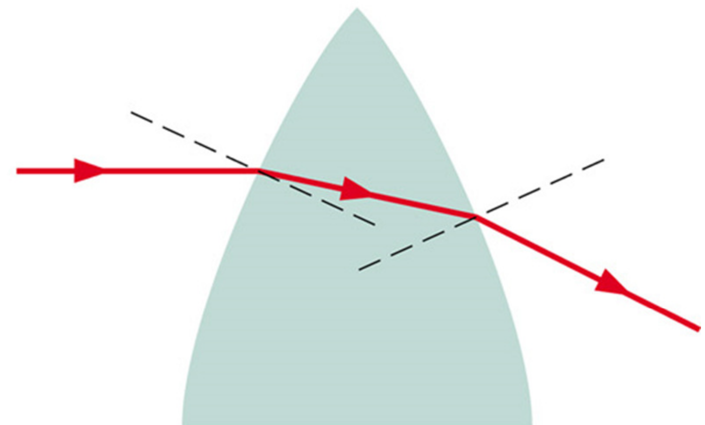
Fig.38.18



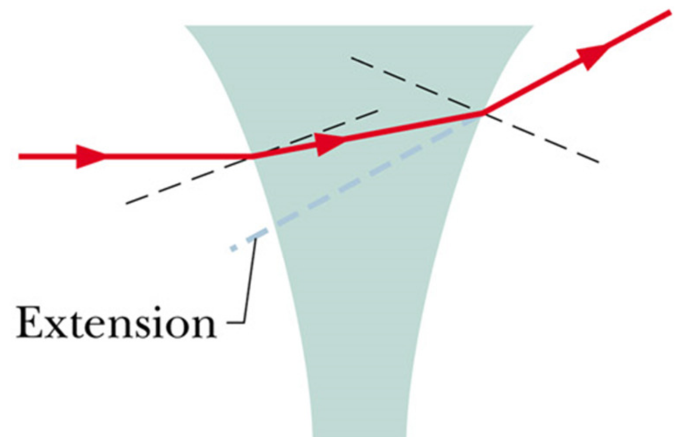
$$\frac{n_i}{d_o} + \frac{n_t}{d_i} = \frac{(n_t - n_i)}{r}$$

and

$$M = -\frac{h_i}{h_o} = -\frac{(n_i d_i)}{(n_t d_o)}$$



(*b*)



(*d*)

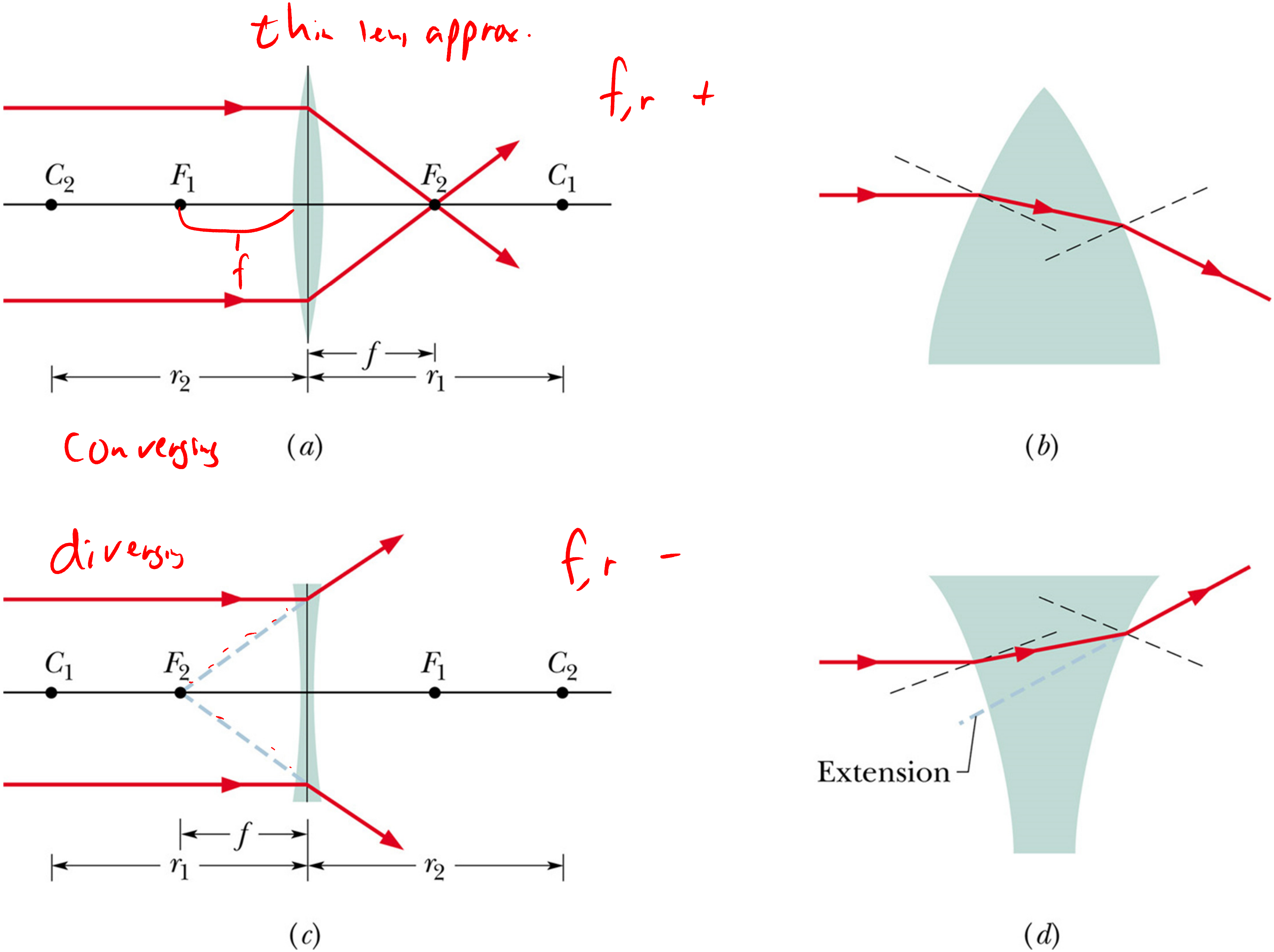
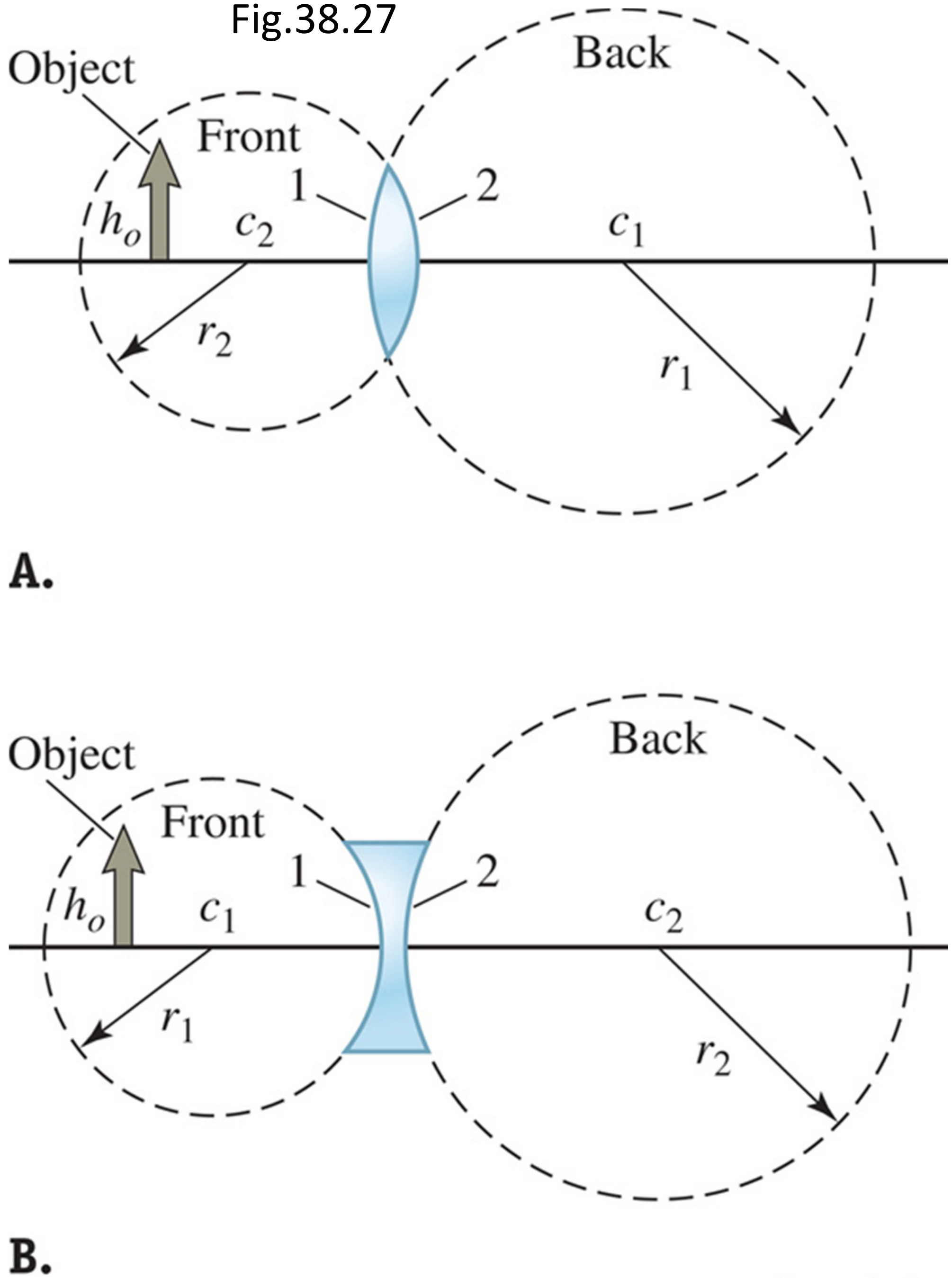

thin lens approx.
f, r +
C2
F1
F2
C1
f
r2
r1
Converging
(a)
(b)
diverging
f, r −
C1
F2
F1
C2
f
r1
r2
(c)
Extension
(d)

Fig.38.27



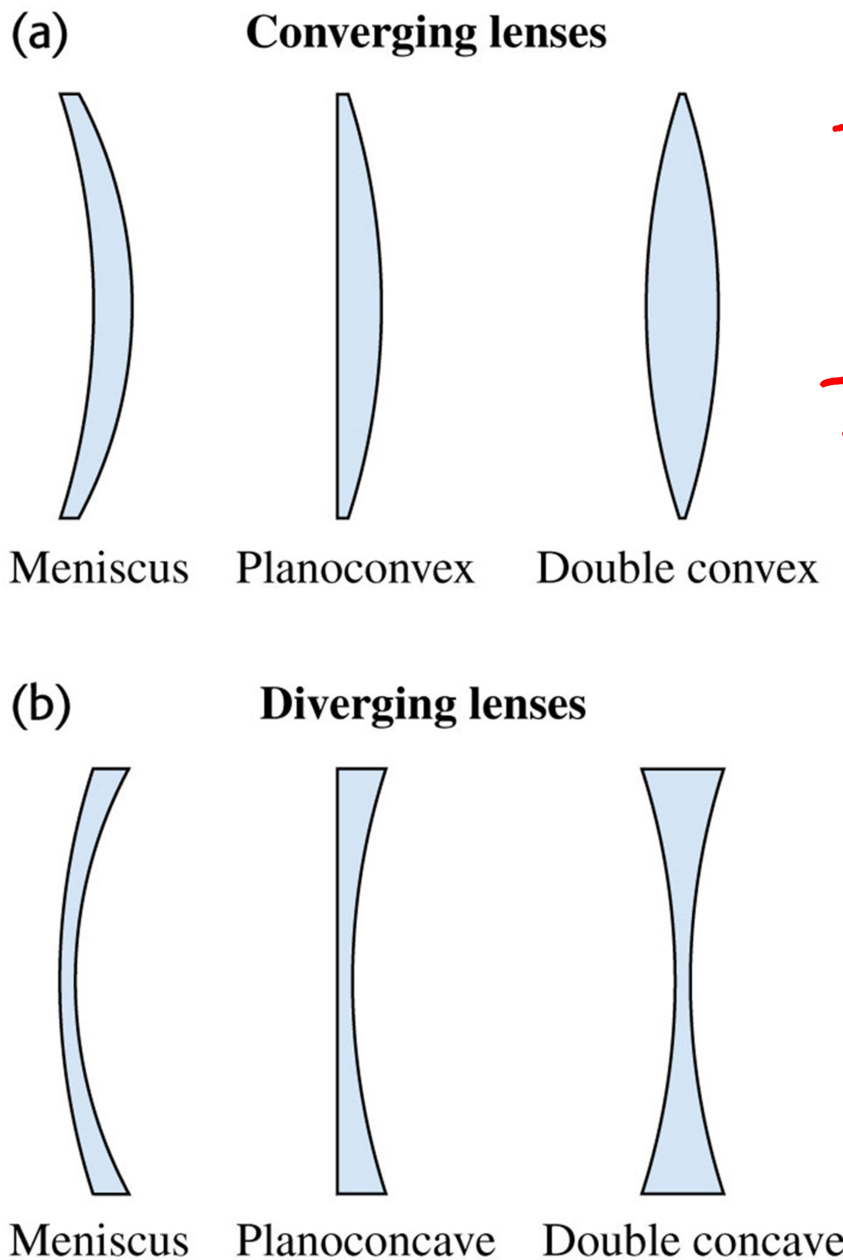
"Lensmaker's Equation"

$$\frac{1}{f} = (n - 1)\left[\frac{1}{r_1} - \frac{1}{r_2}\right]$$

Follows same sign convention as Table 38.3:

Convex surface (facing object) is "+"
Concave surface (facing object) is "-"

Positive focal length is converging
Negative focal length is diverging



Lensmaker's Equation:

$$\frac{1}{f} = (n-1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

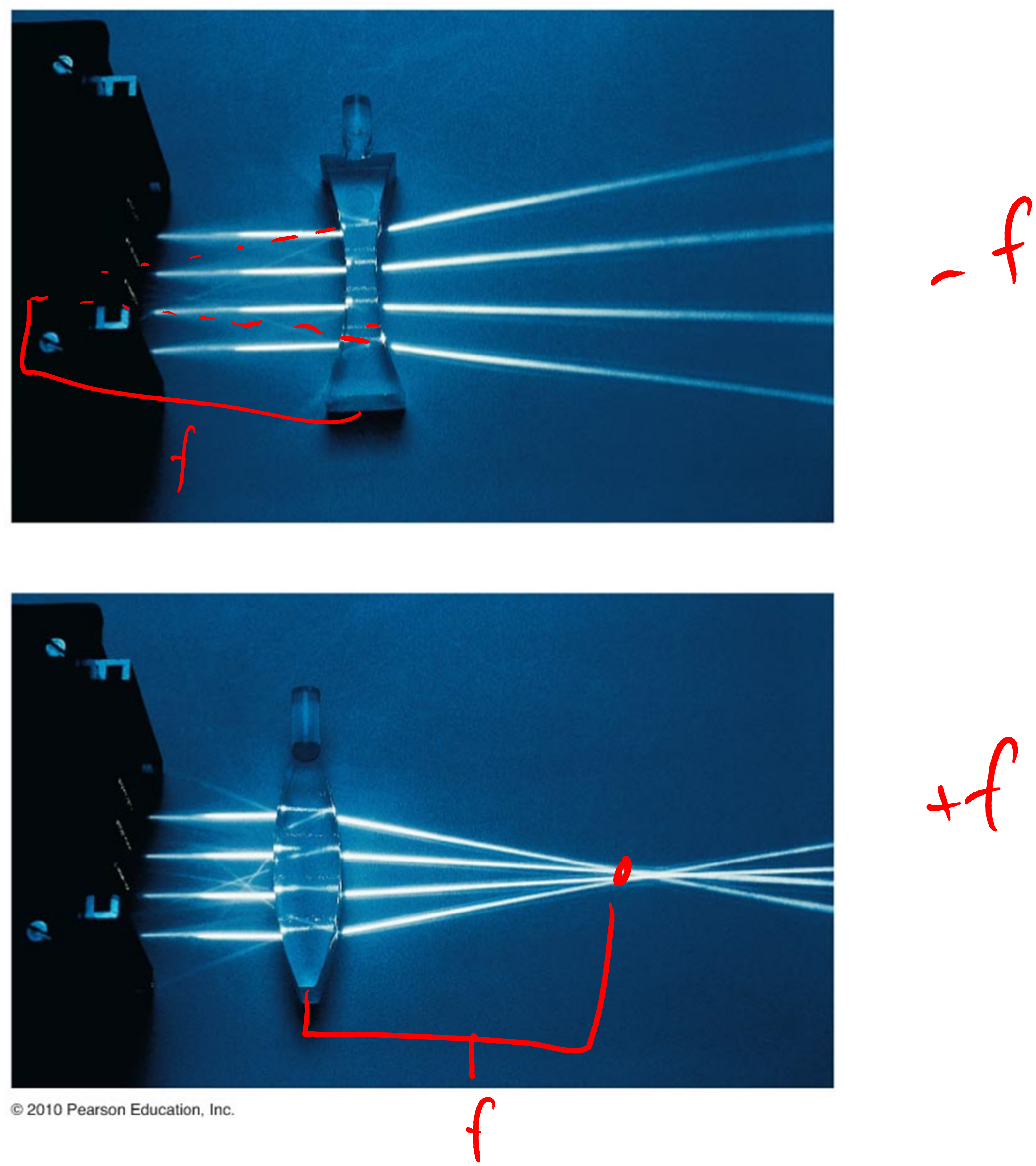
$\frac{1}{f}$ "power"

$\frac{1}{m}$ diopter

-4.25 diopters

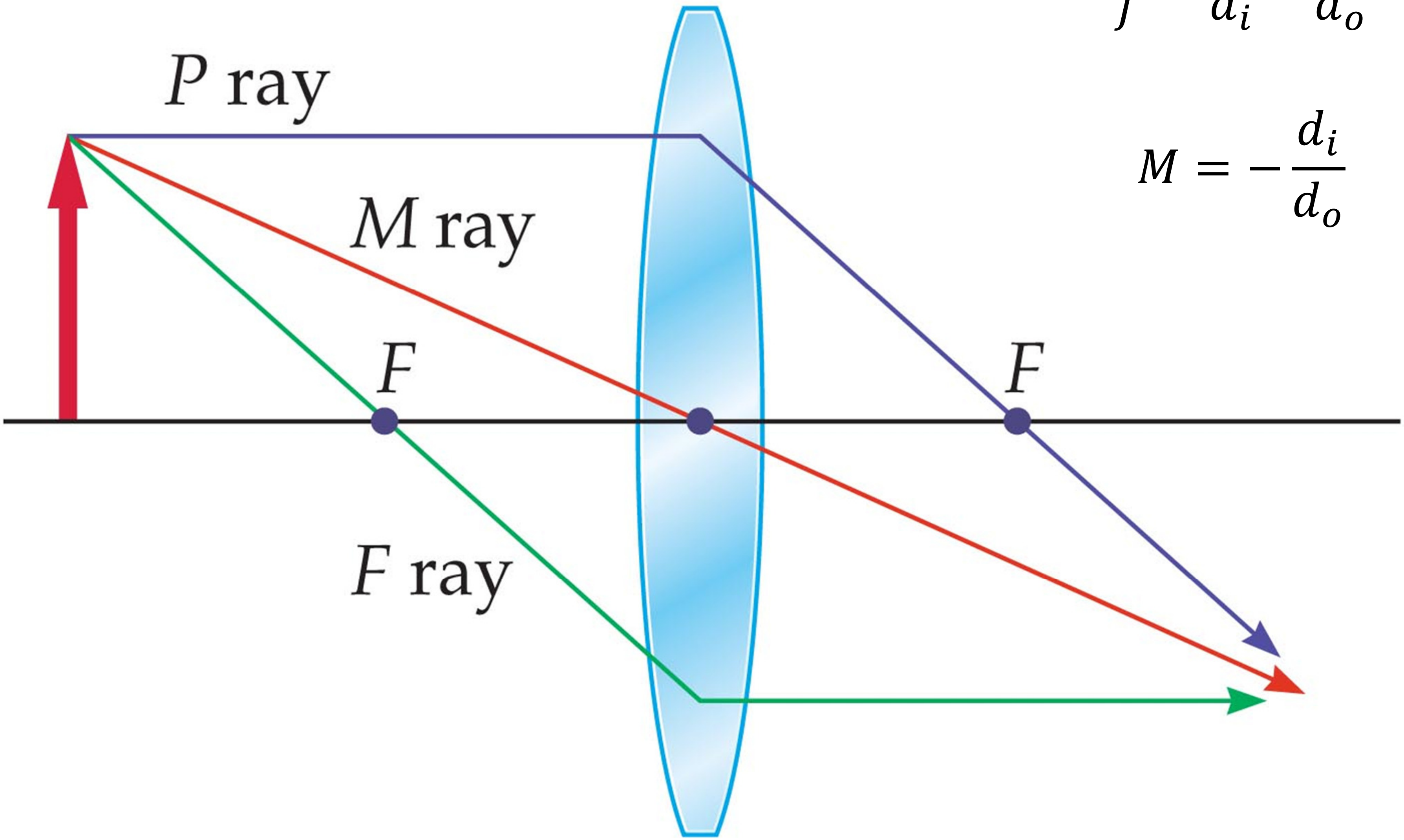
$$f = \frac{1}{-4.25} = -0.235\,m$$

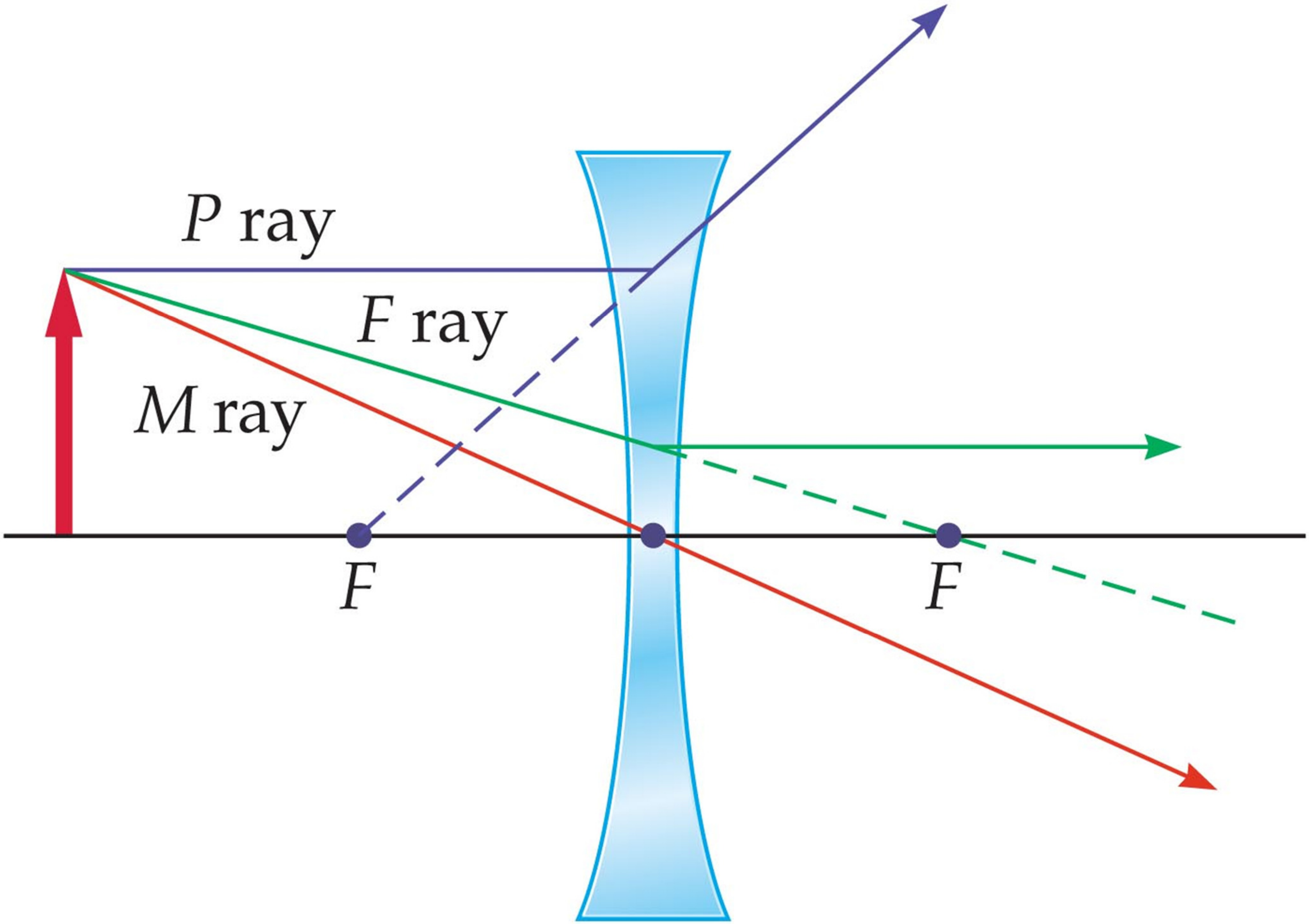
-23.5 cm


f
- f
+f
f

Same image and object rule as for mirrors: $$\frac{1}{f} = \frac{1}{d_i} + \frac{1}{d_o}$$

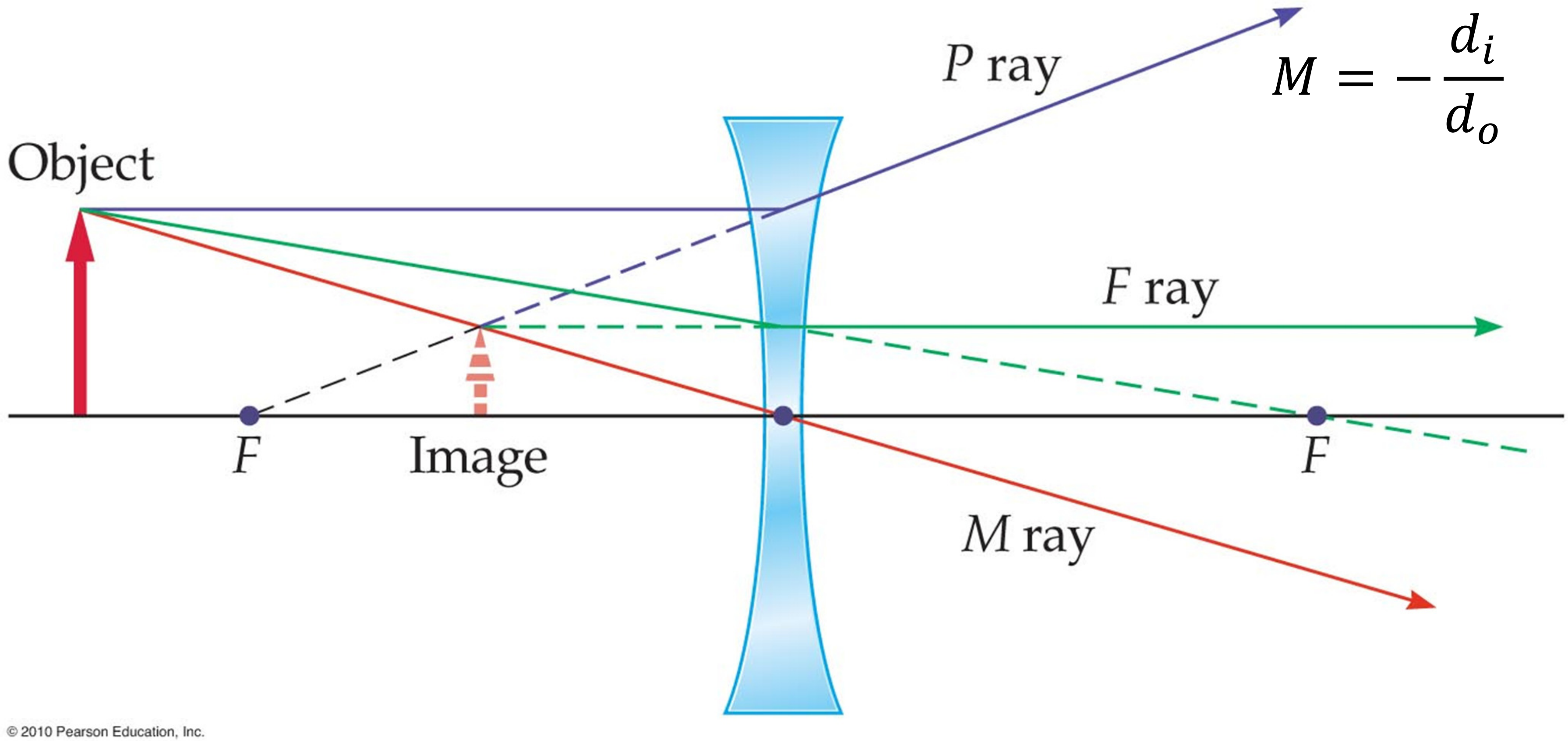
$$M = -\frac{d_i}{d_o}$$




P ray
F ray
M ray
F
F

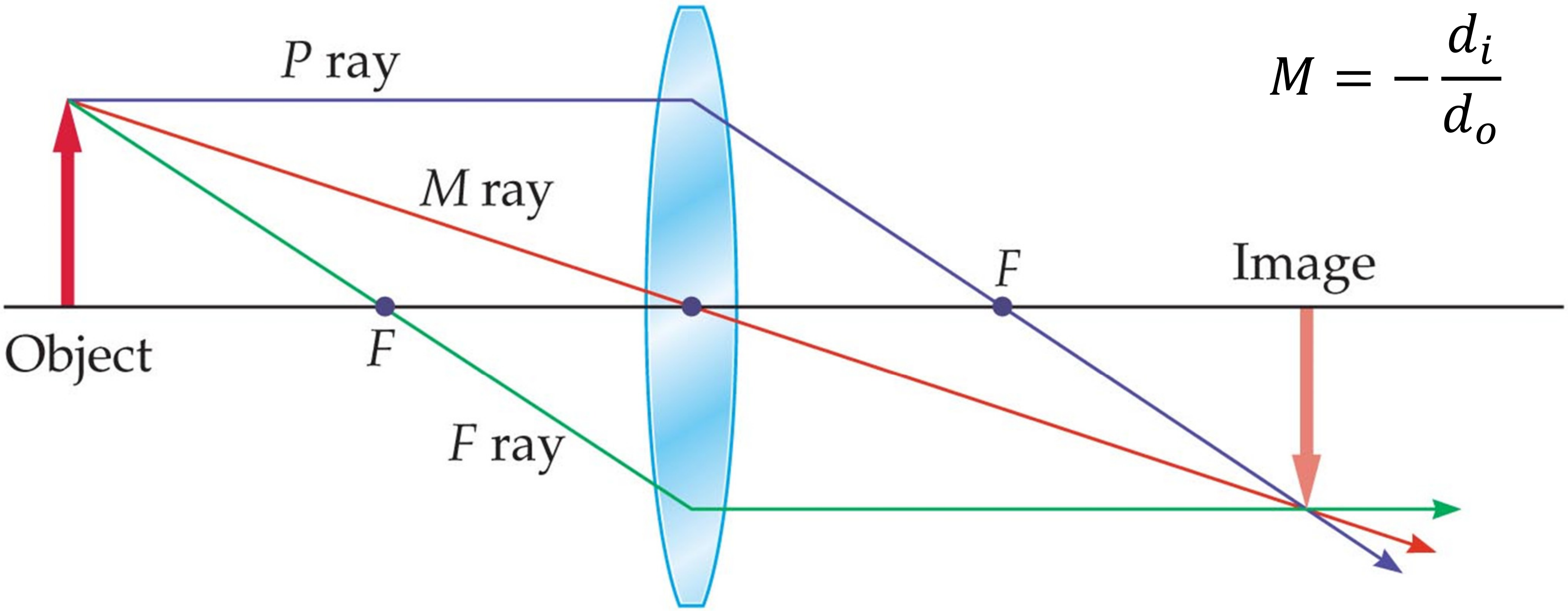
$$\frac{1}{f} = \frac{1}{d_i} + \frac{1}{d_o}$$

$$M = -\frac{d_i}{d_o}$$



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

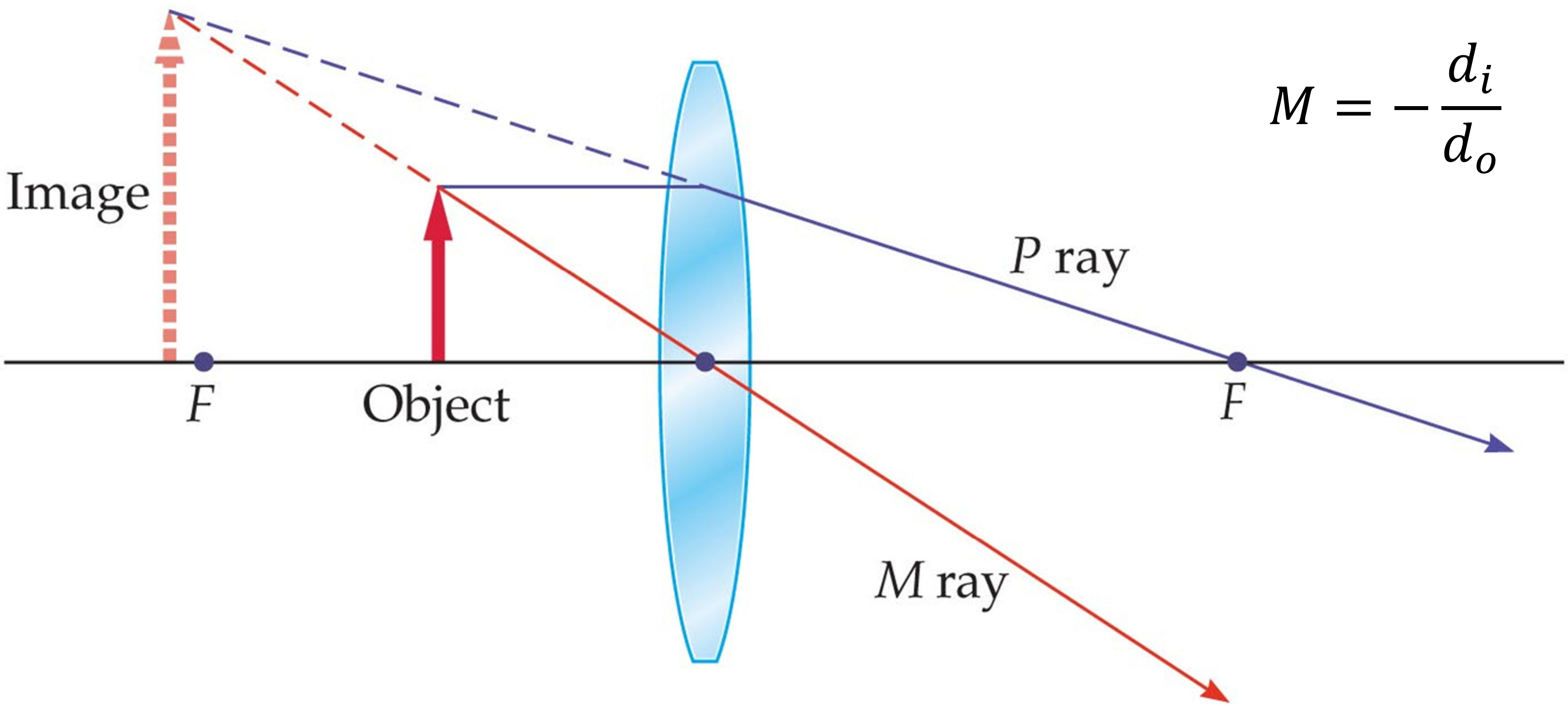
$$M = -\frac{d_i}{d_o}$$



(a) Object beyond focal point F

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

$$M = -\frac{d_i}{d_o}$$

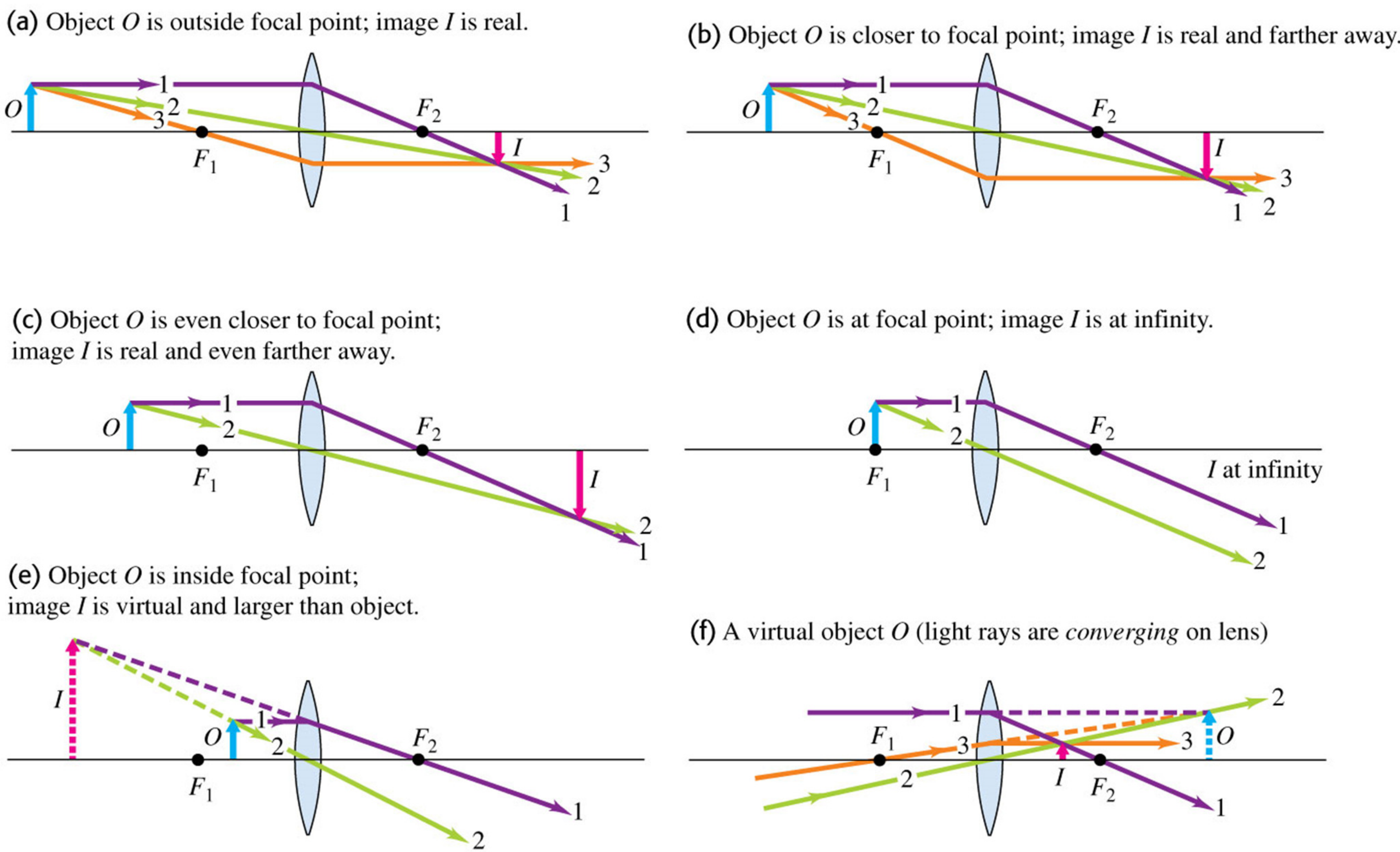


(b) Object between *F* and the lens

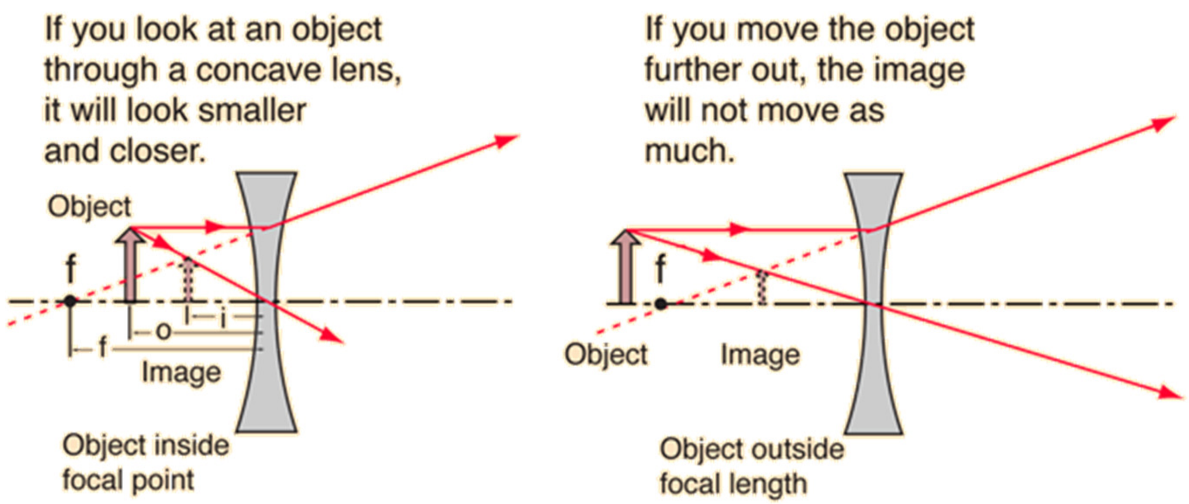
Ray Tracing Worksheet.

There could be two answers: is this lens converging or diverging?
Worksheet isn’t specific…
So do it each way: front and back!

Not quite the answers for that worksheet, but this figure covers it plus more…



Couldn't find exactly the last figure for the diverging lenses, but this is a pretty good one:



Stolen from this website, plenty of useful stuff here.

Rooftop solar water heater in Greece

$I_{sunlight} = 1.4 \, kW/m^2$

Image from Wikipedia's Thermal Solar Power article

3,500° Solar Furnace in Odeillo, France

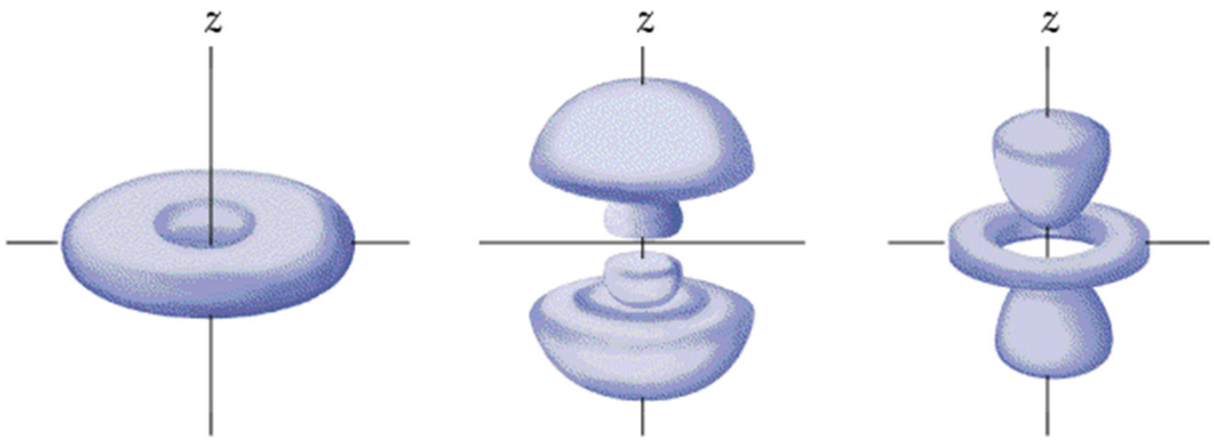
Image from Wikipedia's Thermal Solar Power article

Photovoltaic array at the
National Solar Energy Center, Israel

Image from Wikipedia’s Photovoltaic article

Duluth’s
Solar trash cans
Are from
BigBelly Solar

Thornton/Rex, Modern Physics for Scientists and Engineers, 2/e
Figure 7.13



$n = 2$
$\ell = 1$
$m_\ell = \pm 1$

$n = 3$
$\ell = 1$
$m_\ell = 0$

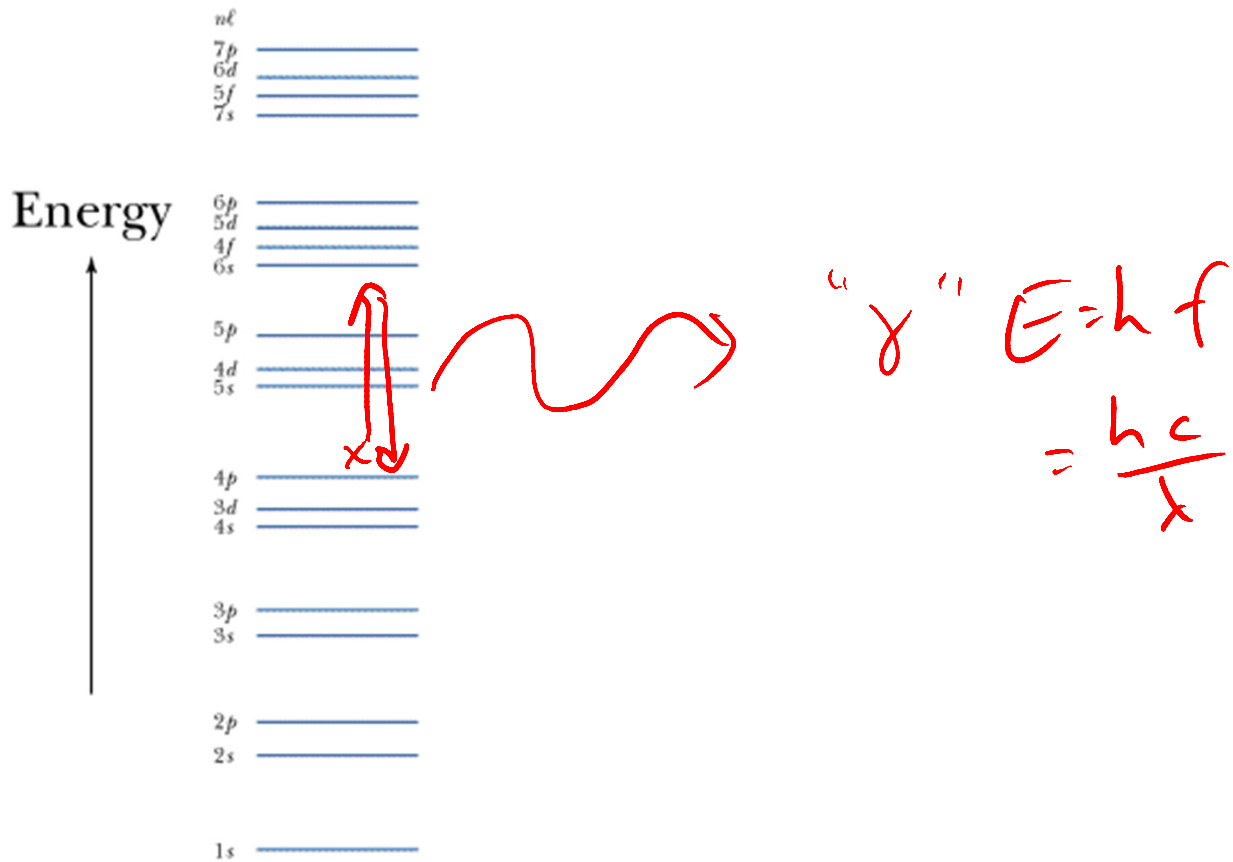
$n = 3$
$\ell = 2$
$m_\ell = 0$

Thornton/Rex, Modern Physics for Scientists and Engineers, 2/e
Table 8.1

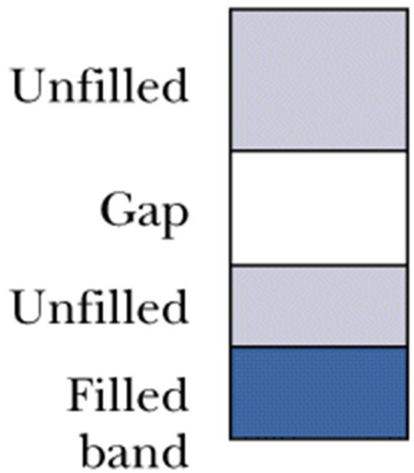
TABLE 8.1
Order of Electron Filling in Atomic Subshells

n	ℓ	Subshell	Subshell Capacity	Total Electrons in All Subshells
1	0	1*s*	2	2
2	0	2*s*	2	4
2	1	2*p*	6	10
3	0	3*s*	2	12
3	1	3*p*	6	18
4	0	4*s*	2	20
3	2	3*d*	10	30
4	1	4*p*	6	36
5	0	5*s*	2	38
4	2	4*d*	10	48
5	1	5*p*	6	54
6	0	6*s*	2	56
4	3	4*f*	14	70
5	2	5*d*	10	80
6	1	6*p*	6	86
7	0	7*s*	2	88
5	3	5*f*	14	102
6	2	6*d*	10	112

Thornton/Rex, Modern Physics for Scientists and Engineers, 2/e
Figure 8.1

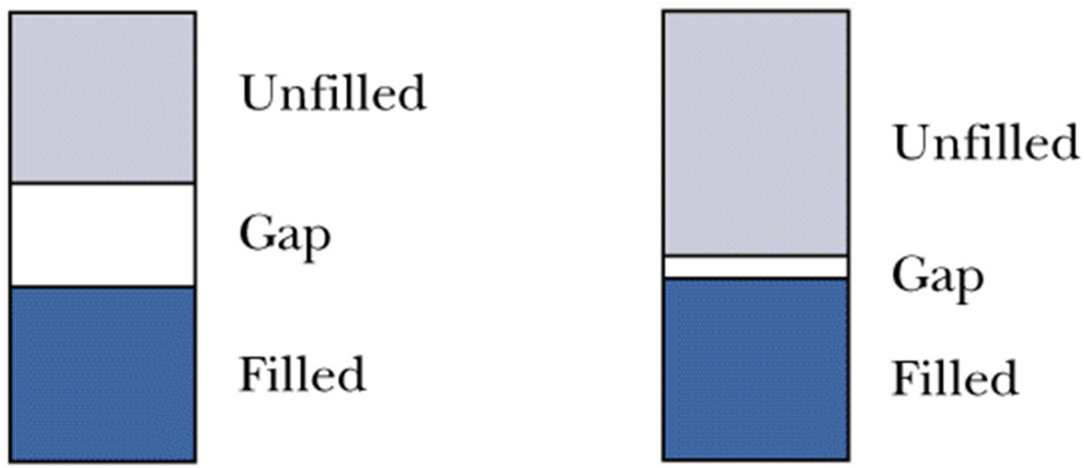


Thornton/Rex, Modern Physics for Scientists and Engineers, Figure 11.6a,b



(a) Conductor (unfilled valence band)

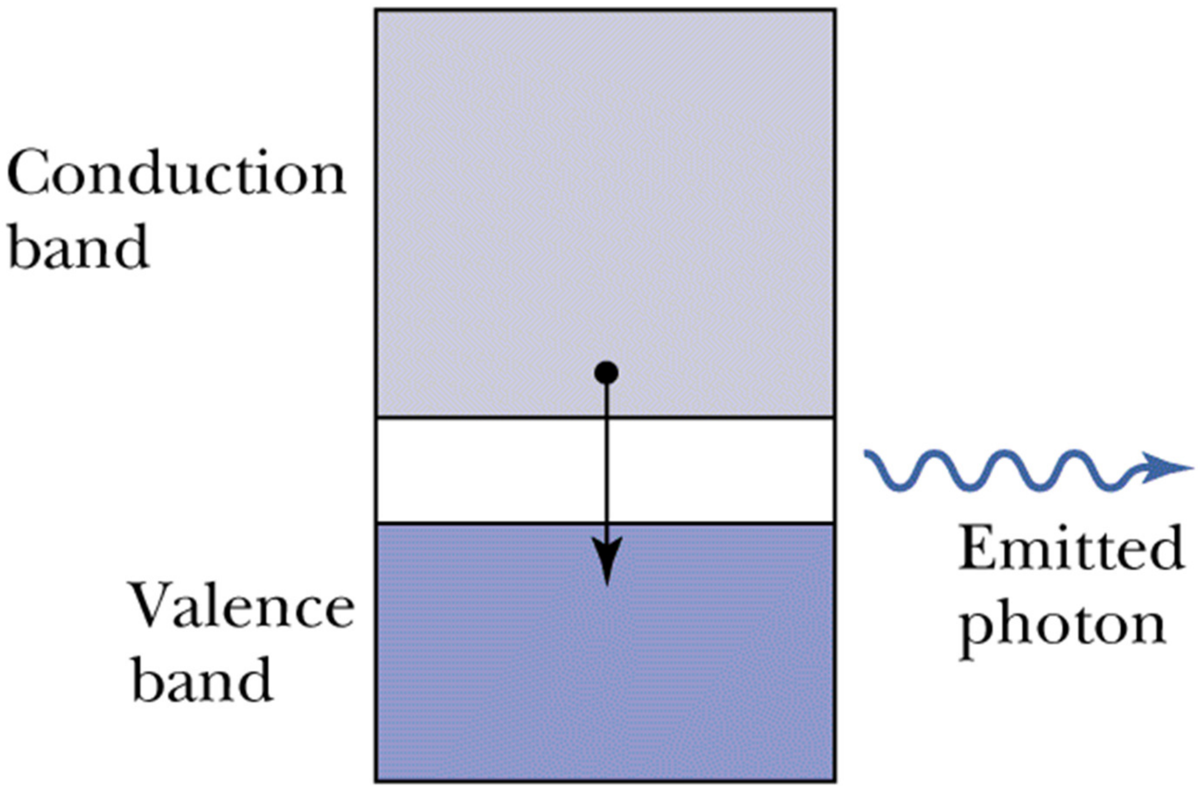
Thornton/Rex, Modern Physics for Scientists and Engineers, 2/e
Figure 11.6c,d



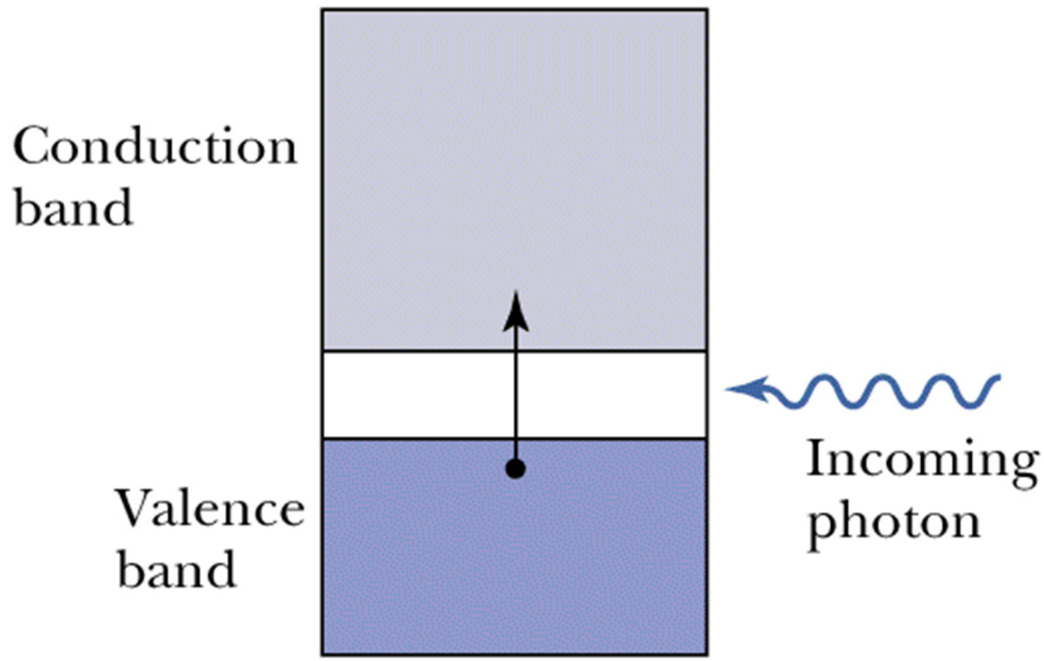
(c)
Insulator
(large
band
gap)

(d)
Semiconductor
(small
band
gap)

Thornton/Rex, Modern Physics for Scientists and Engineers, 2/e
Figure 11.17

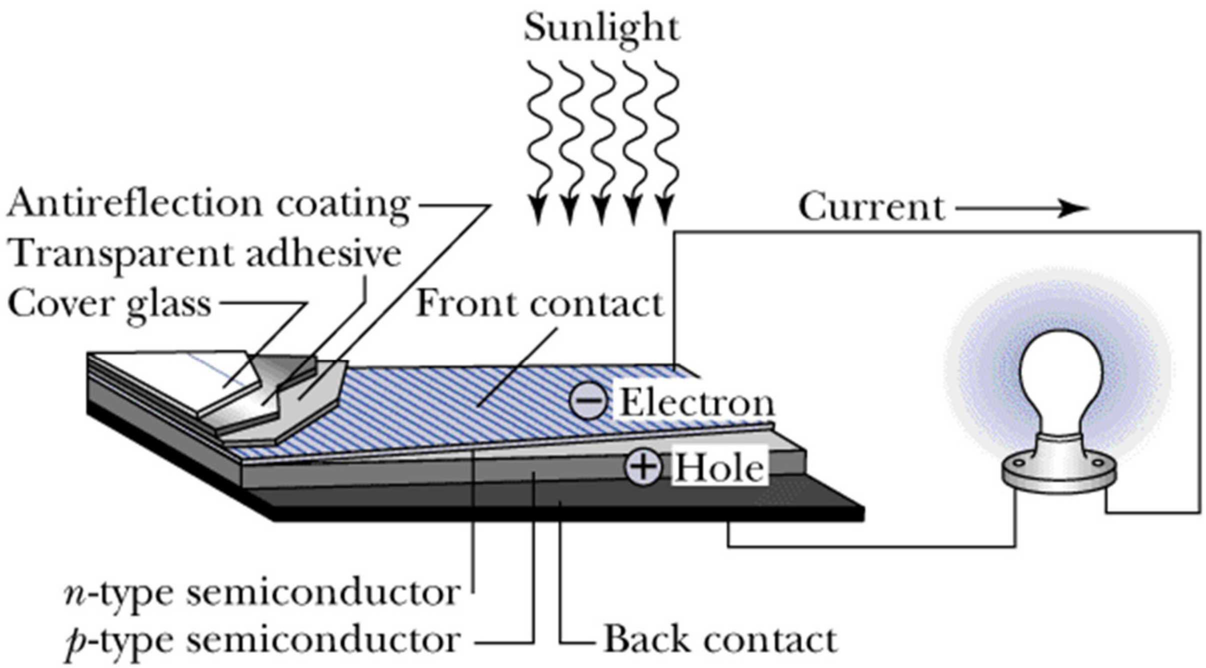


Thornton/Rex, Modern Physics for Scientists and Engineers, 2/e
Figure 11.18a



(a)

Thornton/Rex, Modern Physics for Scientists and Engineers, 2/e
Figure 11.18b



(b)