11-15. (a) According to Eq. (11-30) the condition for missing orders is, $a=(p/m)\,b$. The fourth order interference maxima are missing so $p=4\,m$ and $a=4\,b=4\,(0.1\,\text{mm})=0.4\,\text{mm}$.
(b) The irradiance is given by,

$$I=4\,I_0\left(\frac{\sin\beta}{\beta}\right)^2\cos^2\alpha$$

In zeroth order $I=4\,I_0$. The interference maxima occur for,

$$p\,\lambda=a\sin\theta\Rightarrow\sin\theta=0,\pm\lambda/a,\pm2\,\lambda/a,\pm3\,\lambda/a,...$$

Also $\cos^2\alpha=1$, so at the interference maxima

$$I=4\,I_0\left(\frac{\sin\beta}{\beta}\right)^2$$

where $\beta=(k\,b/2)\sin\theta=(\pi\,b/\lambda)\sin\theta$.Then:

$$p=1\text{: }\sin\theta=\lambda/a;\ \beta=\frac{\pi\,b}{\lambda}\frac{\lambda}{a}=\pi\,(b/a);\ \frac{I}{4\,I_0}=\left(\frac{\sin\beta}{\beta}\right)^2=\left(\frac{\sin\,(\pi/4)}{\pi/4}\right)^2=0.8106$$

$$p=2\text{: }\sin\theta=2\lambda/a;\ \beta=\frac{\pi\,b}{\lambda}\frac{2\lambda}{a}=2\pi\,(b/a);\ \frac{I}{4\,I_0}=\left(\frac{\sin\beta}{\beta}\right)^2=\left(\frac{\sin\,(\pi/2)}{\pi/2}\right)^2=0.4053$$

$$p=3\text{: }\sin\theta=3\lambda/a;\ \beta=\frac{\pi\,b}{\lambda}\frac{3\lambda}{a}=3\pi\,(b/a);\ \frac{I}{4\,I_0}=\left(\frac{\sin\beta}{\beta}\right)^2=\left(\frac{\sin\,(3\,\pi/4)}{3\,\pi/4}\right)^2=0.0.0901$$

11-20. The irradiance is given by,

$$I=I_0\left(\frac{\sin\beta}{\beta}\right)^2\left(\frac{\sin N\alpha}{\alpha}\right)^2$$

with $N=10$, $a=5\,b$, $b=10^{-4}$ cm, $\lambda=435.8$ nm. Recall that $\beta=\frac{\pi}{\lambda}\,b\sin\theta$, so $\alpha=4\,\beta$. For interference maxima,

$$\left(\frac{\sin N\alpha}{\alpha}\right)^2=1\Rightarrow I=I_0\left(\frac{\sin\beta}{\beta}\right)^2$$

Also, $\sin\theta=m\,\lambda/a$ and $\beta=\frac{\pi\,b}{\lambda}\left(\frac{m\,\lambda}{a}\right)=m\,\pi\,(b/a)=m\,\pi/5$. Then,

For $m=1$: $I/I_0=\left(\frac{\sin\beta}{\beta}\right)^2=\left(\frac{\sin(\pi/5)}{\pi/5}\right)^2=0.875$

For $m=2$: $I/I_0=\left(\frac{\sin(2\,\pi/5)}{2\,\pi/5}\right)^2=0.573$. For $m=3$: $I/I_0=\left(\frac{\sin(3\,\pi/5)}{3\,\pi/5}\right)^2=0.255$

For $m=4$: $I/I_0=\left(\frac{\sin(4\,\pi/5)}{4\,\pi/5}\right)^2=0.0547$. For $m=5$: $I/I_0=\left(\frac{\sin(5\,\pi/5)}{5\pi/5}\right)^2=0$.

12-4. $\mathfrak{R}=m\,N=\frac{\lambda\,a\,v}{\Delta\,\lambda}=\frac{589.2935}{0.597}=987$; $N=\frac{a}{m}$. So, for $m=1$, $N=987$ and for $m=2$, $N=494$.

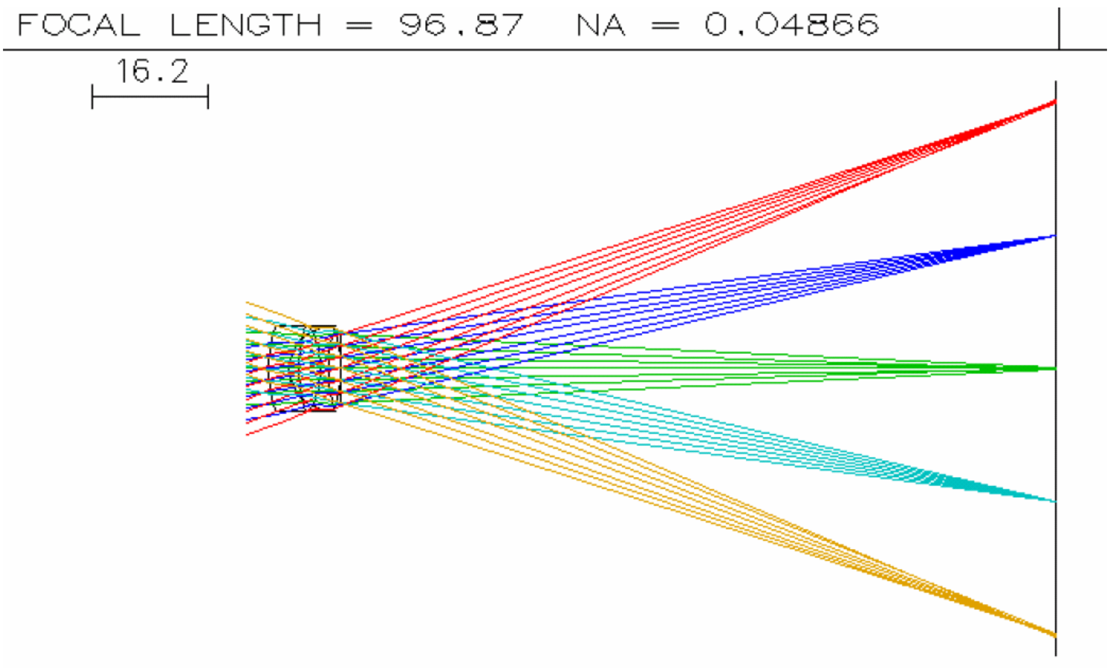
12-6. See Figure 12-14 that accompanies the statement of this problem in the text.

$$\mathfrak{R}\,(m=3)=m\,N=(3)\,(16,000\times2.5)=120,000$$
$$\mathfrak{R}\,(m=2)=m\,N=(2)\,(16,000\times2.5)=80,000$$
$$\Delta\,\lambda=\lambda/\mathfrak{R}=550\,\text{nm}/80,000=0.006875\,\text{nm}=0.069\,\text{Å}$$

HW#3, Problem#11: Landscape lens

Landscape Lens exercise

SRF	RADIUS	THICKNESS	APERTURE RADIUS	GLASS	SPE	NOTE
OBJ	--	1.6000e+03	585.468733	AIR		
1	--	--	6.000000	AIR		
2	17.500000 V	2.900000	6.000000	BAF9 C		
3	5.800000	1.300000 V	6.000000	BAF4 C		
4	18.600000	3.000000	6.000000	AIR		
5	-12.800000	1.100000	6.000000	BK8 C		
6	18.600000	1.800000	6.000000	F3 C		
7	-14.300000	--	6.000000	AIR		
AST	--	--	5.000000 A	AIR	*	
IMS	--	99.019295 V	40.000000		*	



HW#3, Problem#12: Proctor photographic lens with q = 9.54 mm

*LENS DATA
HOPKINS NA 0.25 10X

SRF	RADIUS	THICKNESS	APERTURE RADIUS	GLASS	SPE	NOTE
OBJ	--	1.6001e+05	3.0000e+03	AIR		
AST	--	9.000000	10.000000 A	AIR		
2	41.617167	3.000000	4.395252 S	BK7 C		
3	-24.333181	2.000000	4.324437 S	SF6 C		
4	-30.601130	7.000000	4.341550 S	AIR		
5	7.960651	3.000000	3.650026 S	BK7 C		
6	-17.483425	1.000000	2.985970 S	SF6 C		
7	101.578978	--	2.827264 S	AIR		
8	--	9.540000	2.827264 S	AIR		
9	--	--	0.307910 S	AIR		
IMS	--	--	0.307910 S		*