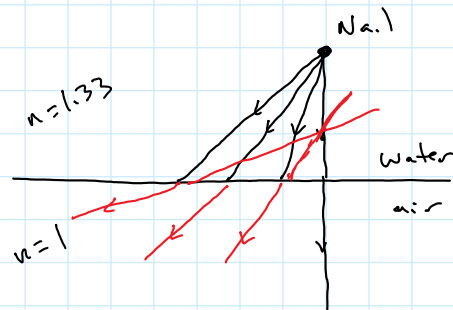
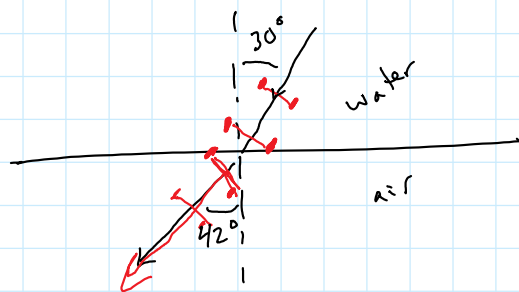


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$$n_1 \sin \theta_1 = n_2 \sin \theta_2$$

water	air
0°	0°
15°	20°
30°	42°
45°	70°

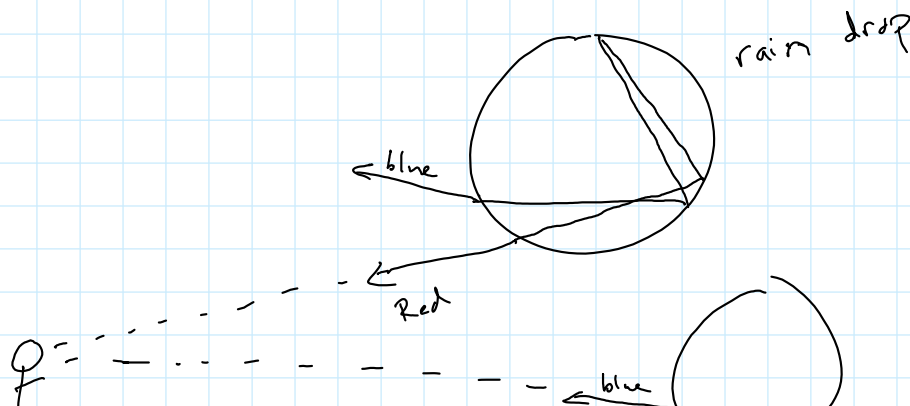


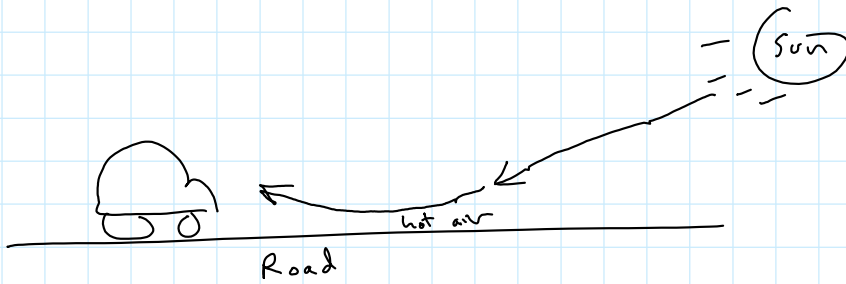
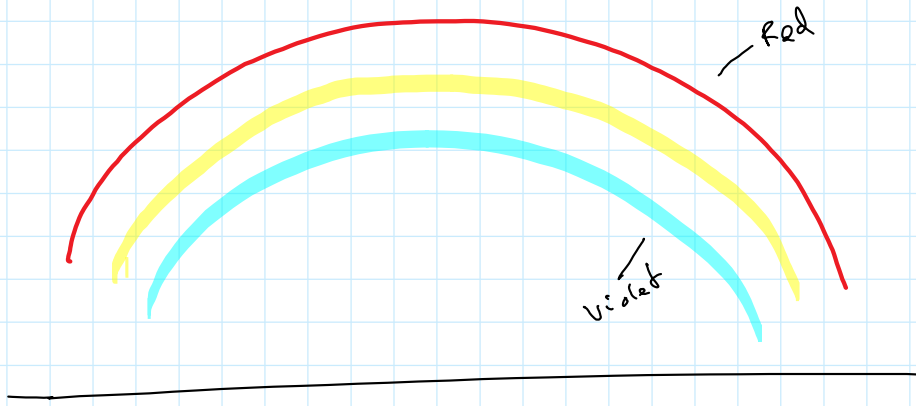
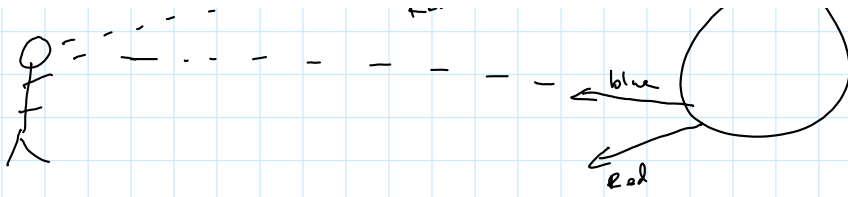
B) yes appears closer to surface

c) virtual

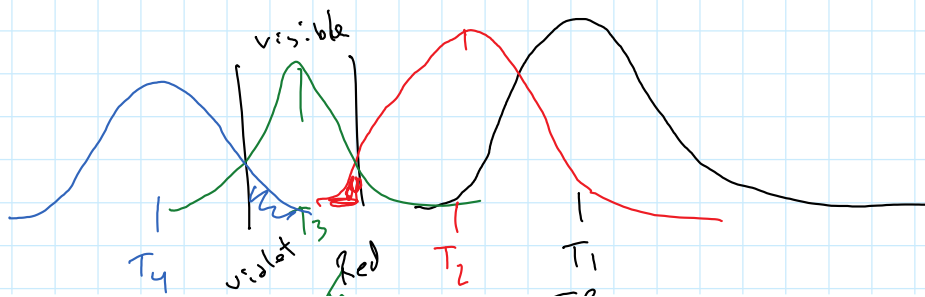
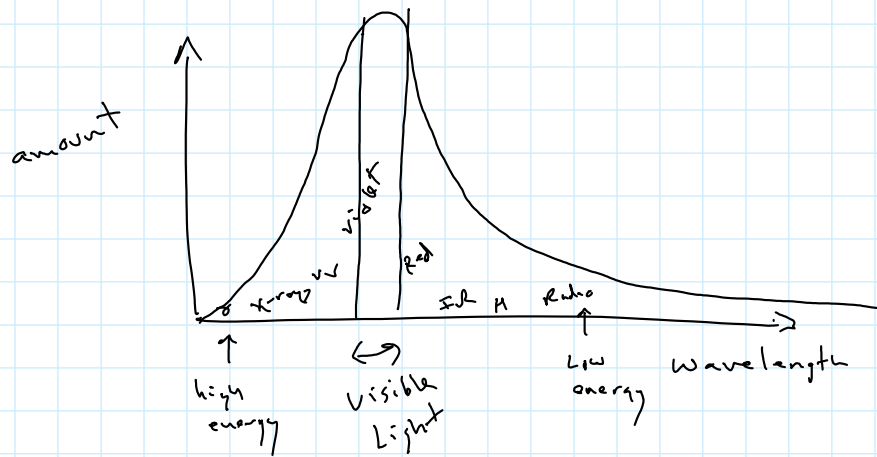
Applications:

white light  
↓ ↓

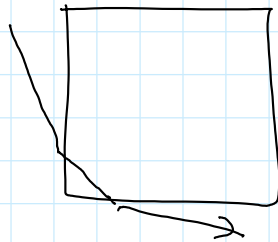
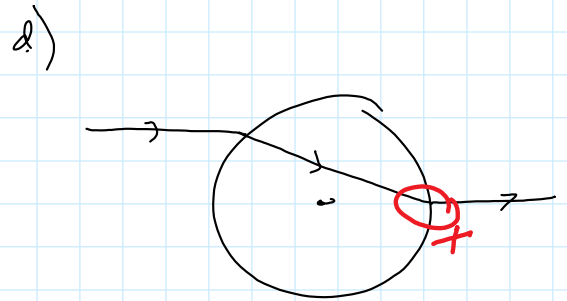
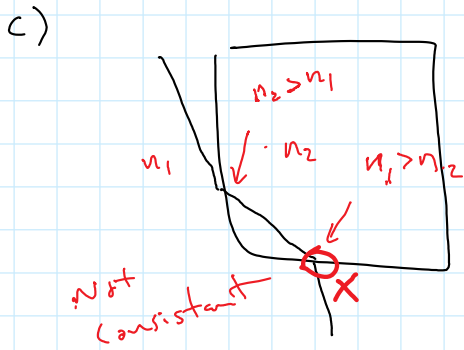
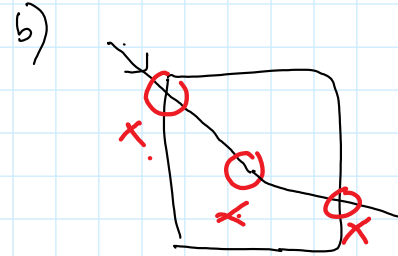
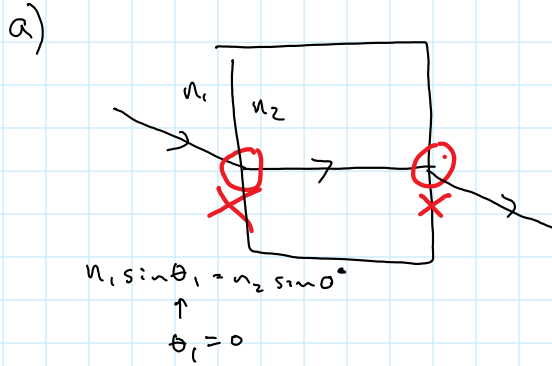
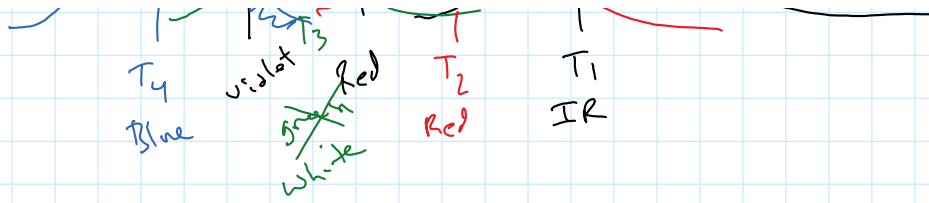




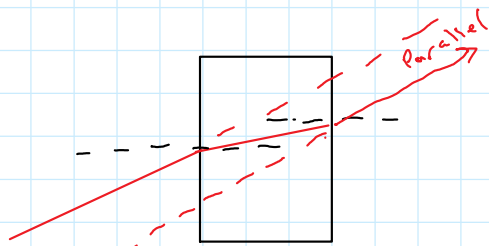
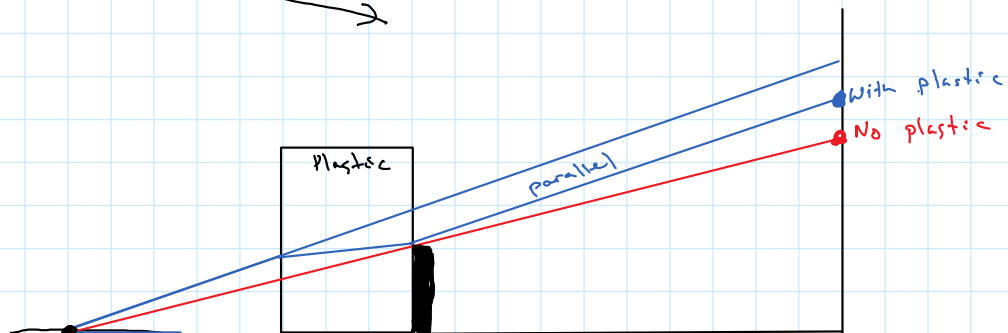
Light from Sun

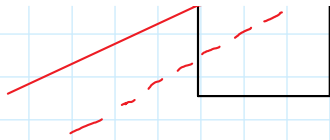


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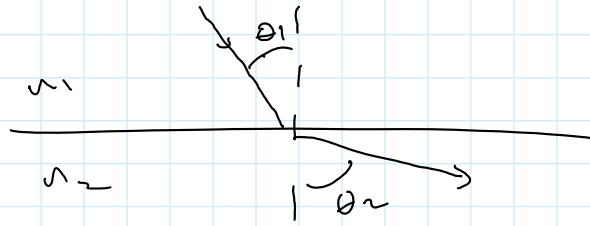


2)





Total internal reflection

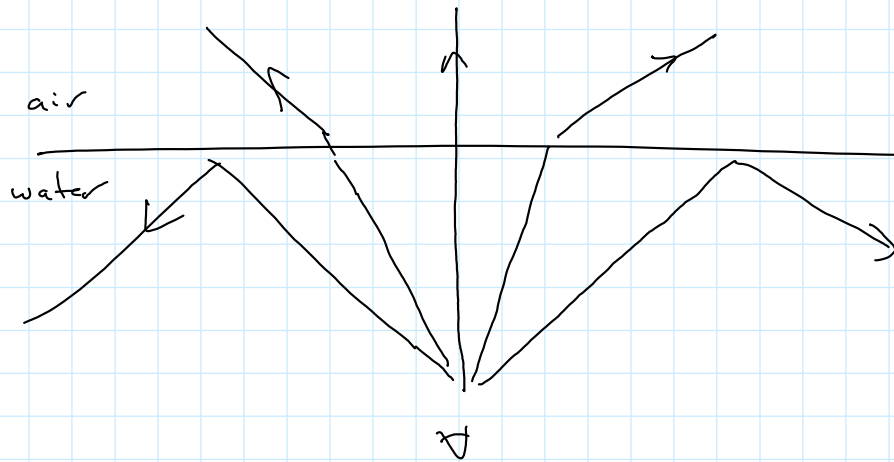


if  $n_1 > n_2$

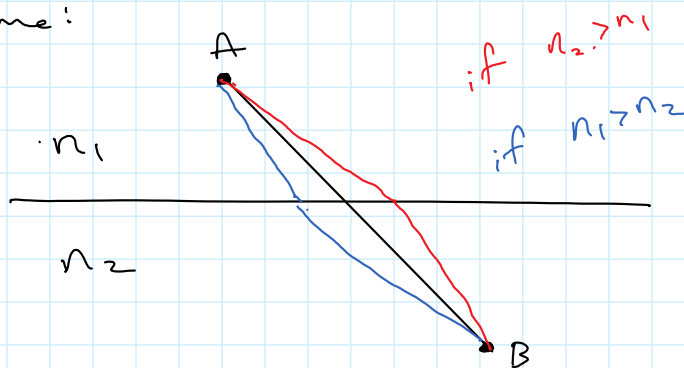
$$n_1 \sin \theta_1 = n_2 \sin \theta_2$$

$$= n_2 \sin 90^\circ$$

$$\sin \theta_{cr} = \frac{n_2}{n_1}$$

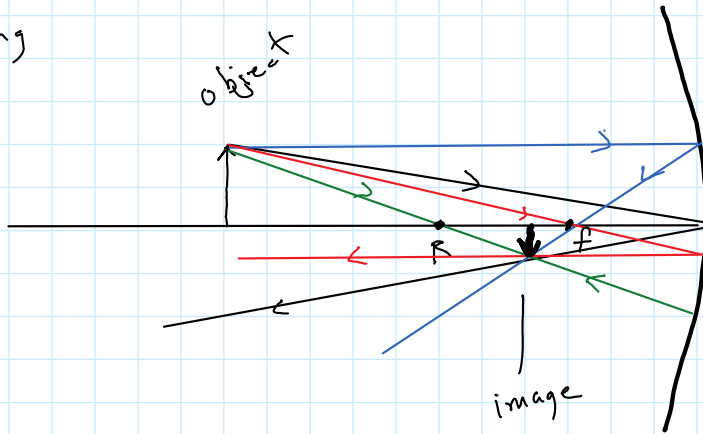


Least Time:



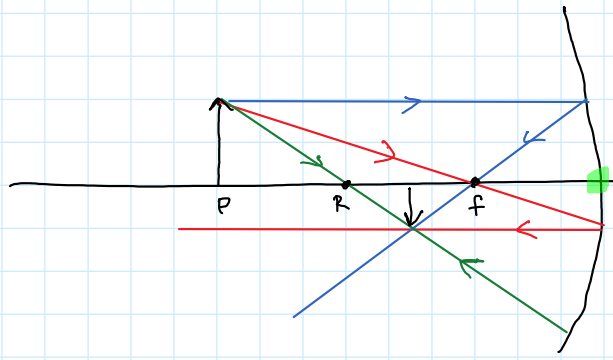
Light takes the path of least time from A to B

Ray Tracing



Exercise:

$R = 6$   
 $f = 3$   
 $p = 9$   
 $h = 2$



a) use Ray Tracing to find image

b) use equations to find  $q$ ,  $M$ ,  $h'$

$$\frac{1}{p} + \frac{1}{q} = \frac{1}{f}$$

$$M = \frac{h'}{h} = -\frac{q}{p}$$

$$\frac{1}{9} + \frac{1}{q} = \frac{1}{3}$$

$$M = -\frac{4.5}{9} = -\frac{1}{2}$$

↑  
inverted

$$q = 4.5$$

$$h' = \frac{1}{2} h = 1$$

1. next

+-



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