

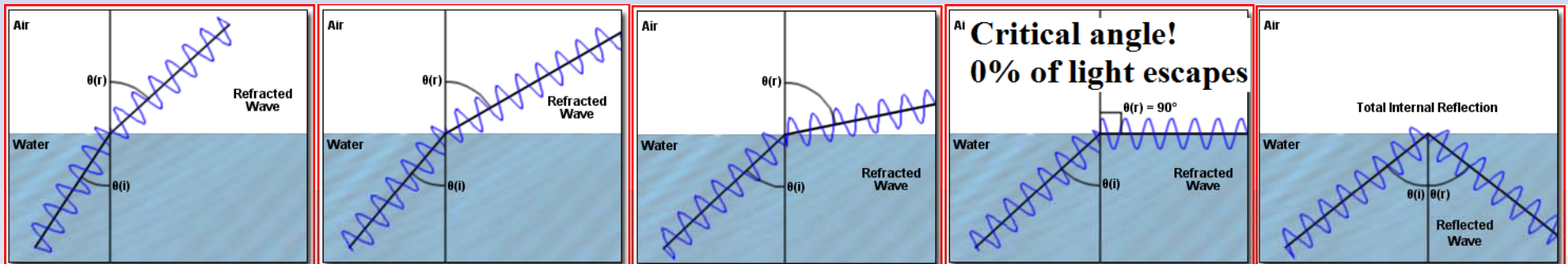
Critical Angle & Total Internal Reflection + Vision Correction

Traditional: 13-04

Themed: 04-04

Critical Angle & Total Internal Reflection

- When light is speeding up, it exits (refracted angle) at a bigger angle than incident angle
- When the refracted angle reaches 90° , light doesn't escape – ALL of it just reflects
- The incident angle where this happens is called the critical angle
- At angles less than critical angle, some light reflects and some refracts
- To find the critical angle, set refracted angle to 90°



Critical angle/Total internal reflection

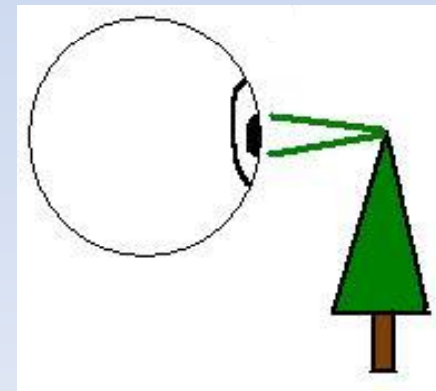
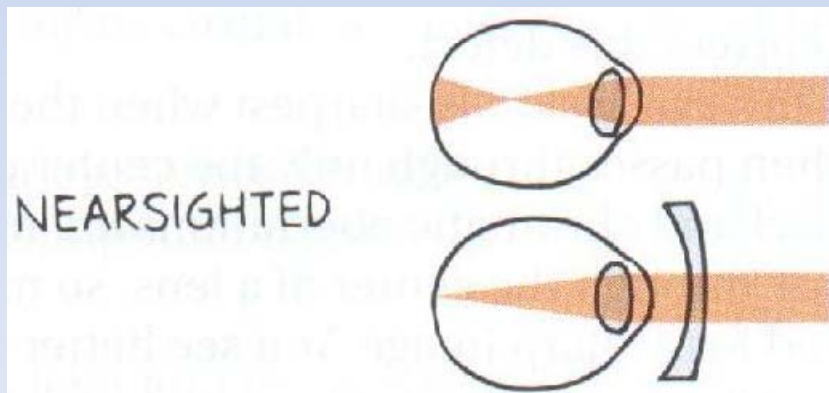
- Try it yourself: What is the critical angle of diamond to air?
 - Draw a sketch to model it
 - Use Snell's law
 - Set refracted angle to 90° , the angle no light escapes
 - You should know the indices of refraction water (1.33) and of air. The index of refraction for diamond: $n_{\text{diamond}} = 2.42$

Critical angle/Total internal reflection

- Technology using critical angle and total internal reflection
 - Fiber optics: use for internet, communication systems
 - Bendable lights
 - Brilliant diamonds
- Big advantage: 100% of light reflected means NO loss of light energy (mirrors lose a few percent per reflection)
- Can make cable systems many miles long (imperfections make cables have some energy losses)

Why things look blurry without my glasses

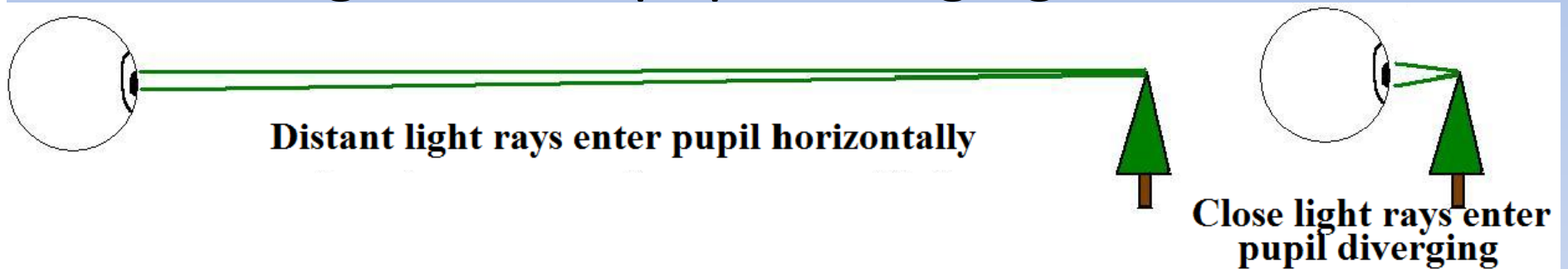
- Young people with glasses usually have myopia (near sightedness)
- Focused vision: a single point of light converges on a single point on the retina
- If a single point of light is spread out on retina, that's blur
- The top eyeball sees things blurry since the SINGLE point of the tree top is spread wide
- Do you see that the top eye converges too SOON?
- Concave (diverging) lens spreads light delaying convergence until back of eye...I can see clearly now!



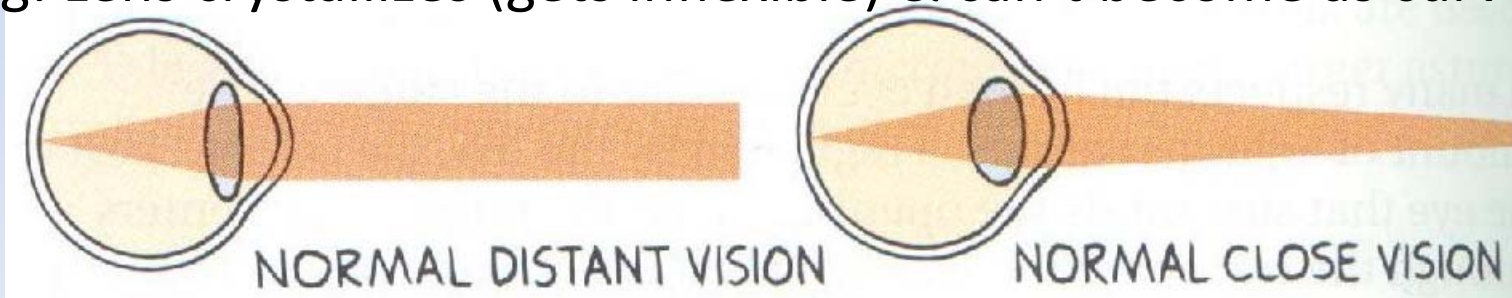
Looking at close up versus far

(why mom and dad ask you to read phone book for them!)

- Distant light enters pupil horizontally
- Close light enters pupil diverging



- Cornea: convex lens converges light to retina: does most of the work
- Lens: nature's high index of refraction built-in convex lens: does minor correcting
- Aging: Lens crystallizes (gets inflexible) & can't become as curved



Different problems need different lenses

- Graphic below summarizes it:

