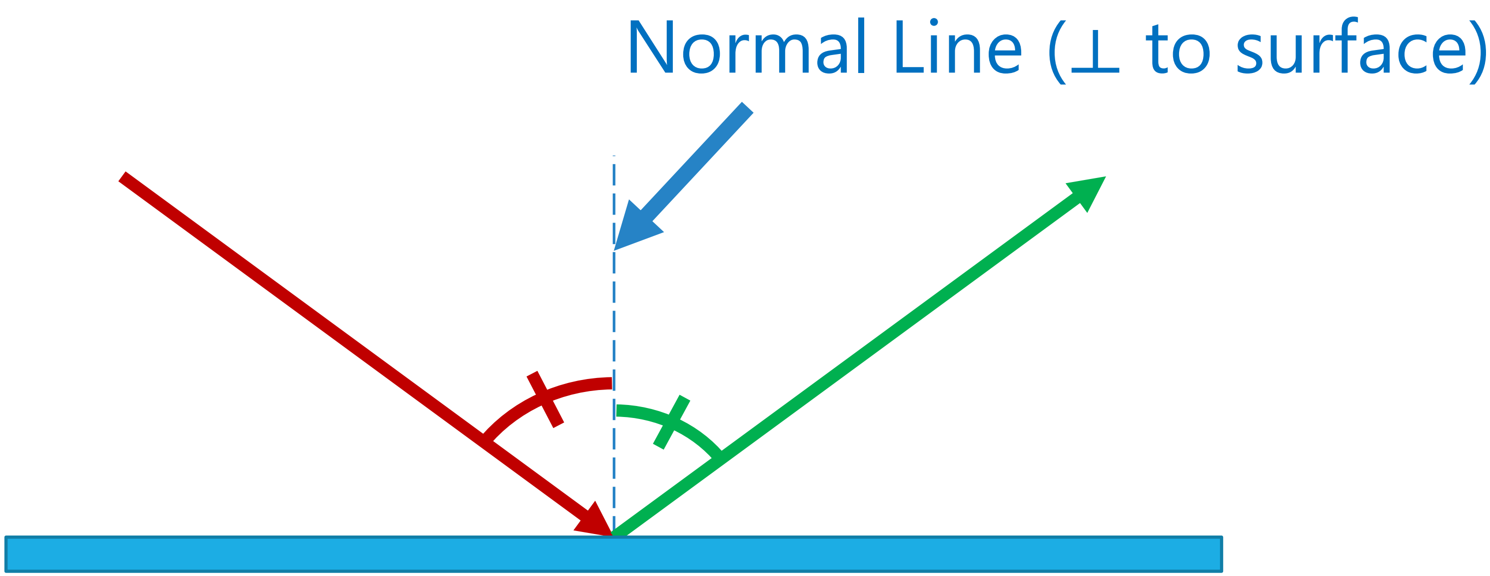
Reflection & Refraction

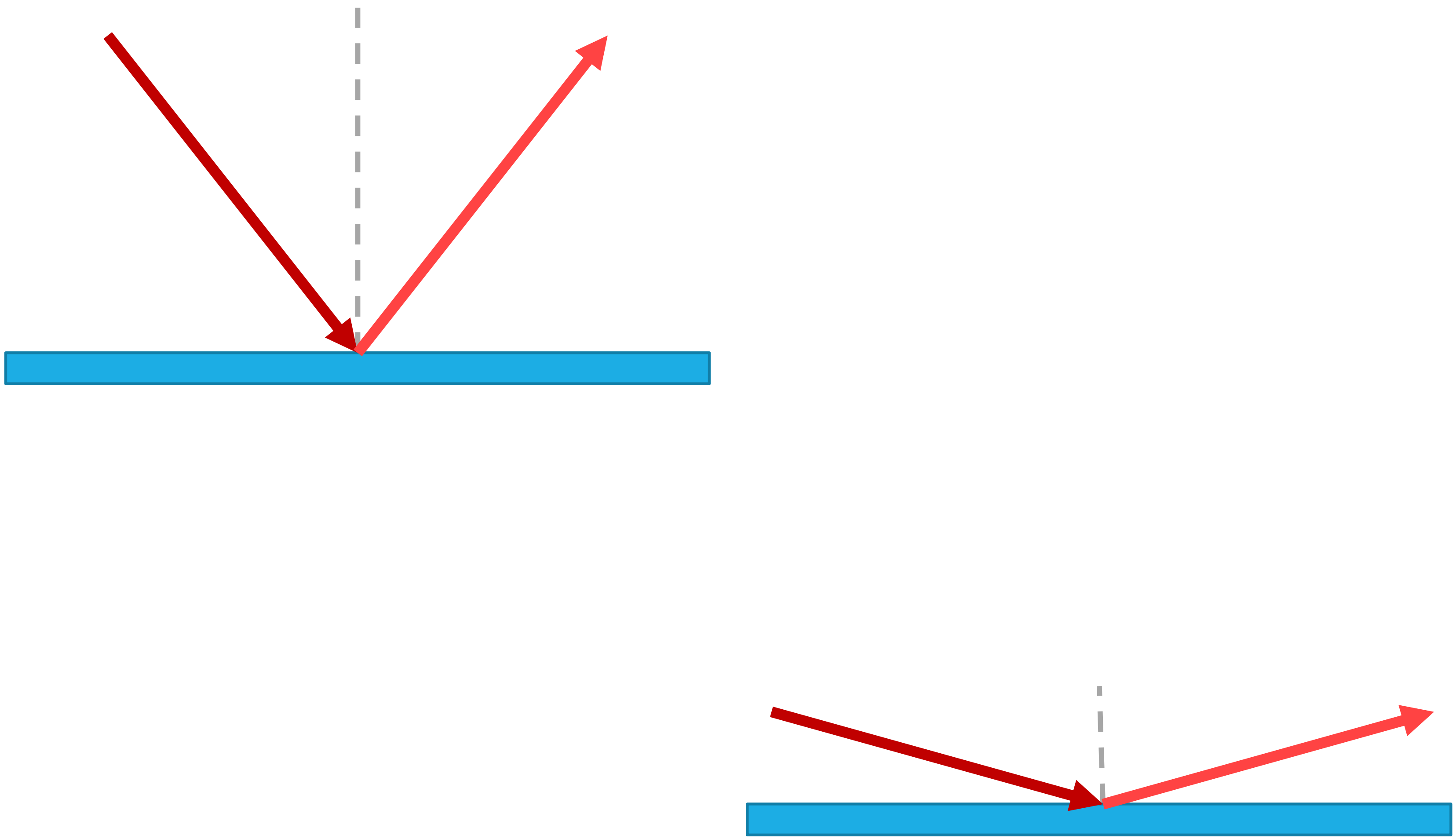
IB PHYSICS | WAVES - LIGHT

Reflection

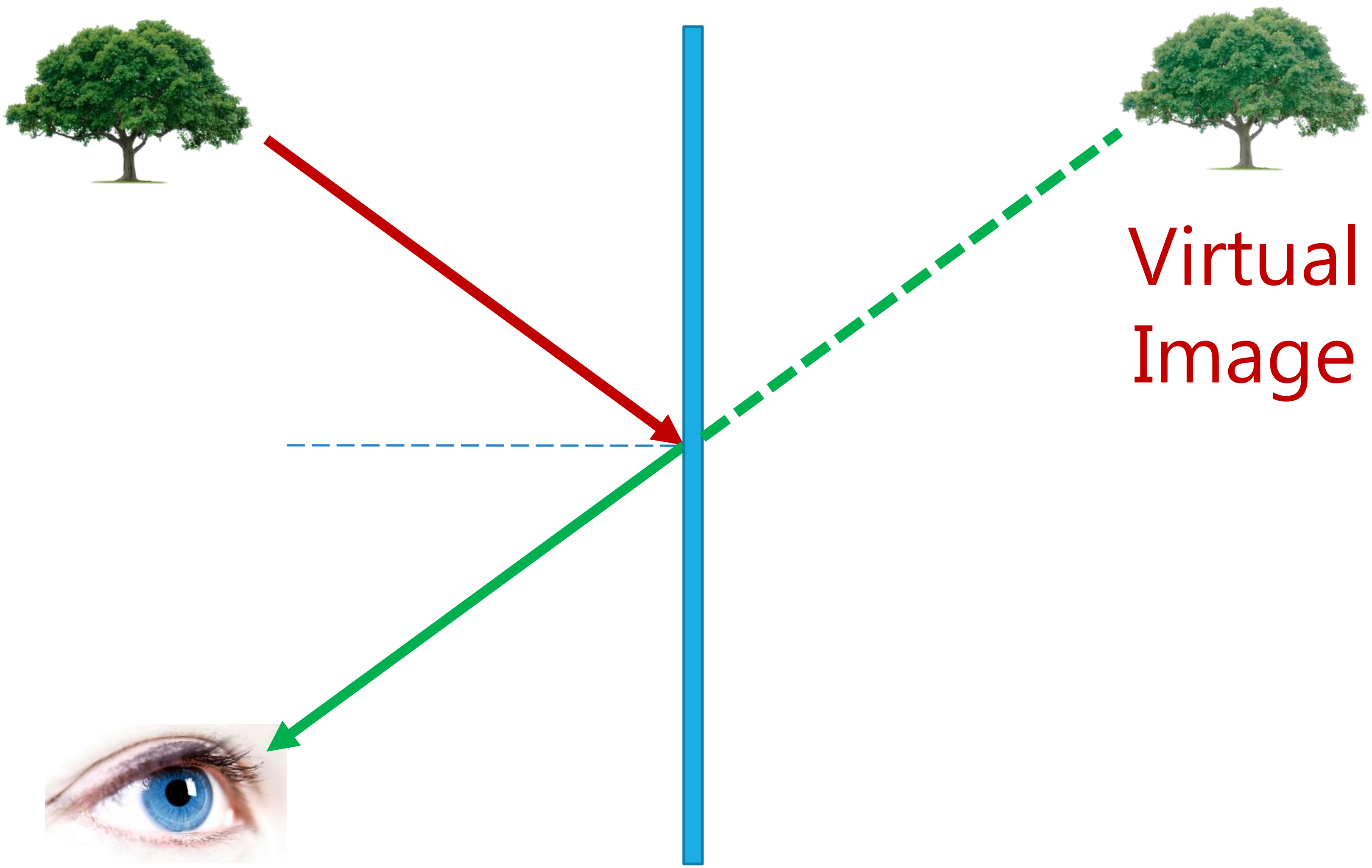
Angle of __Incidence__ = Angle of __Reflection__



Reflection

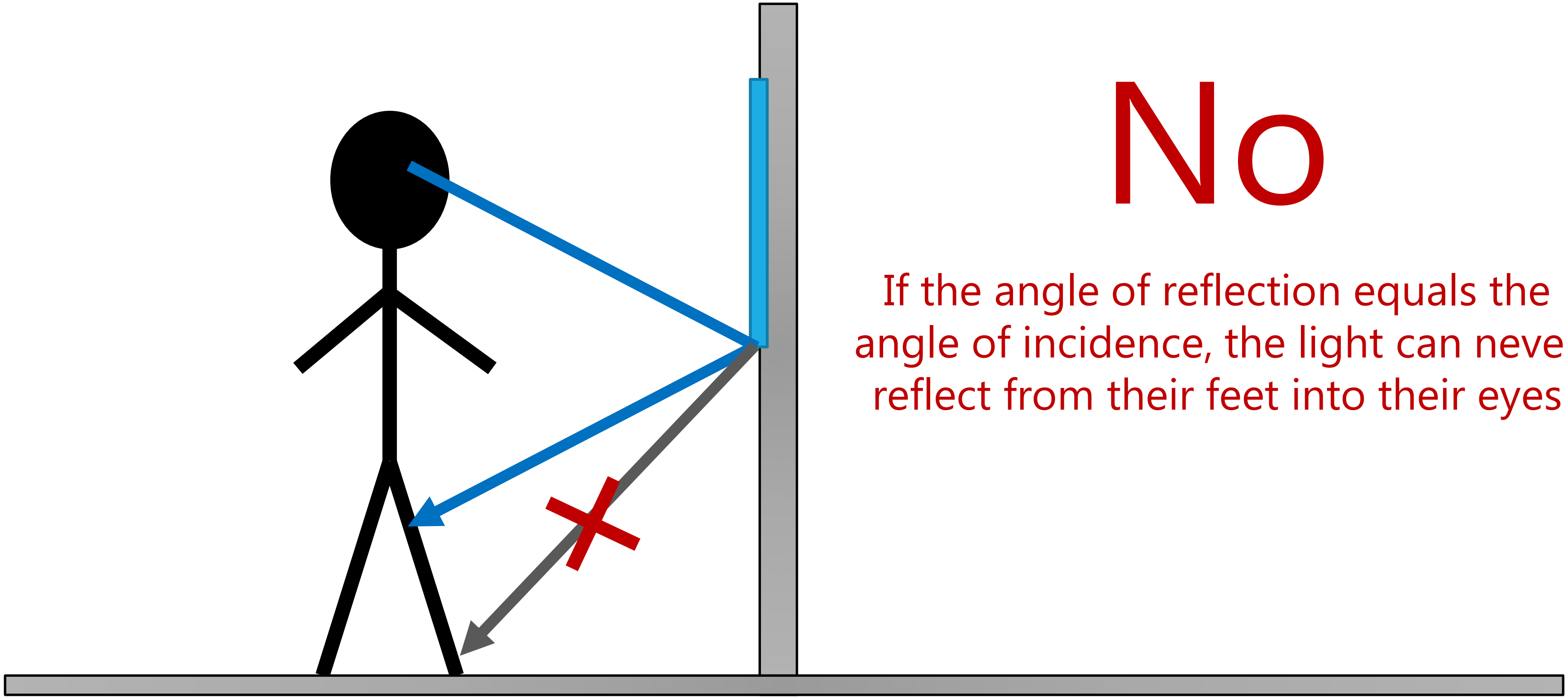


Reflection



Predict

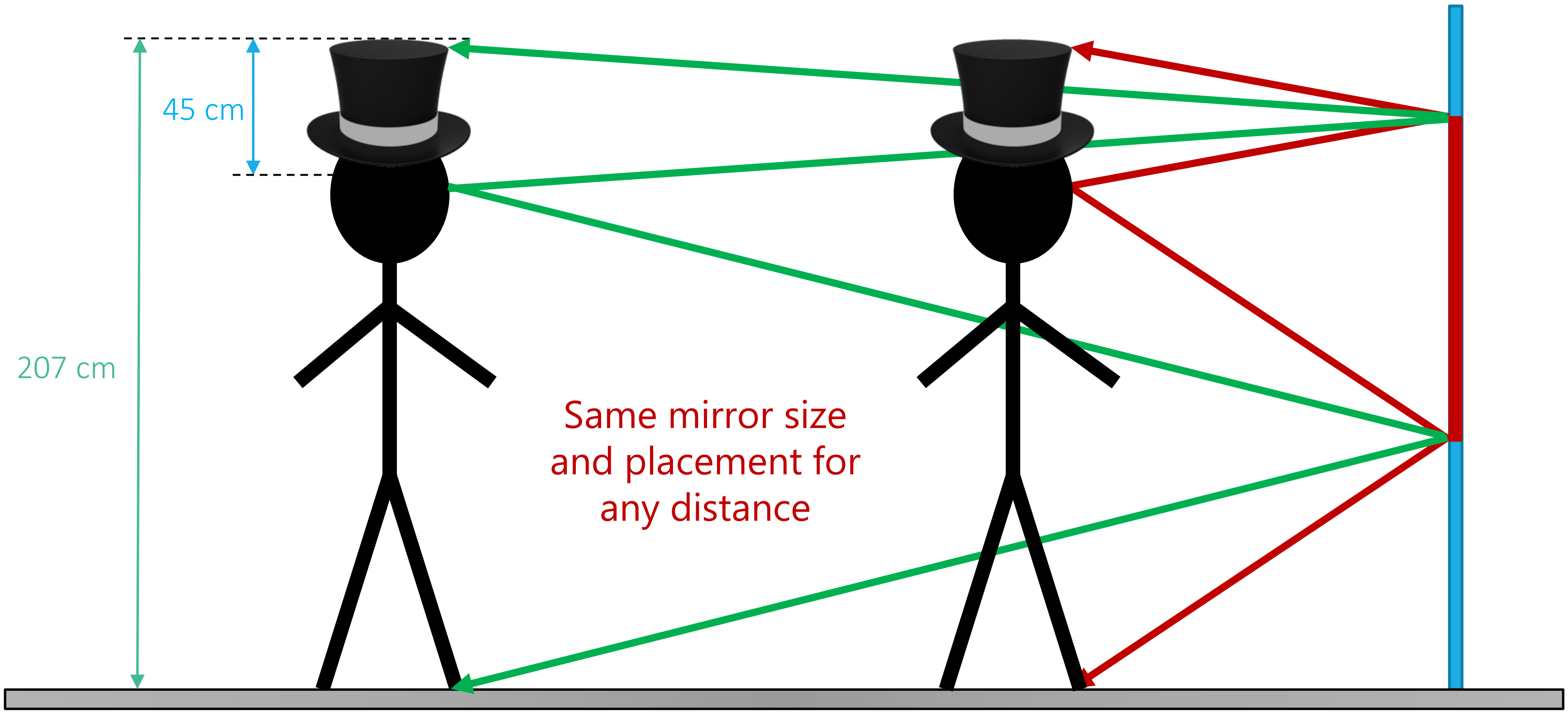
Can this person see their feet in the mirror?



No

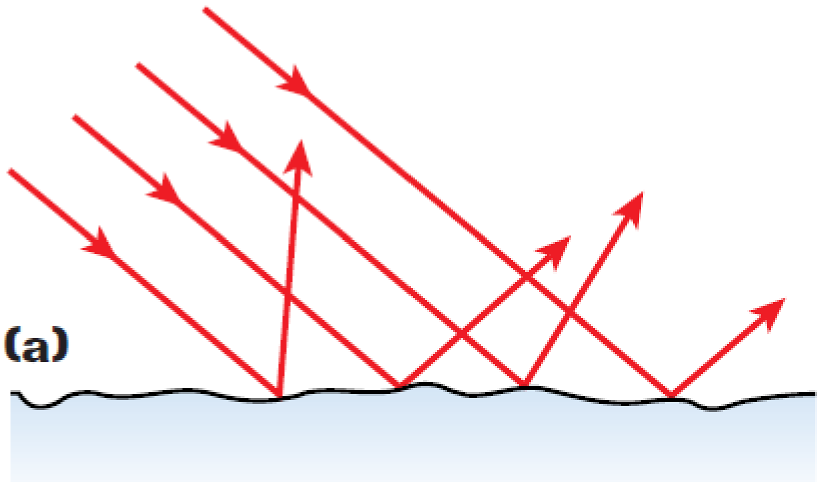
If the angle of reflection equals the angle of incidence, the light can never reflect from their feet into their eyes

“Full Length” Mirrors

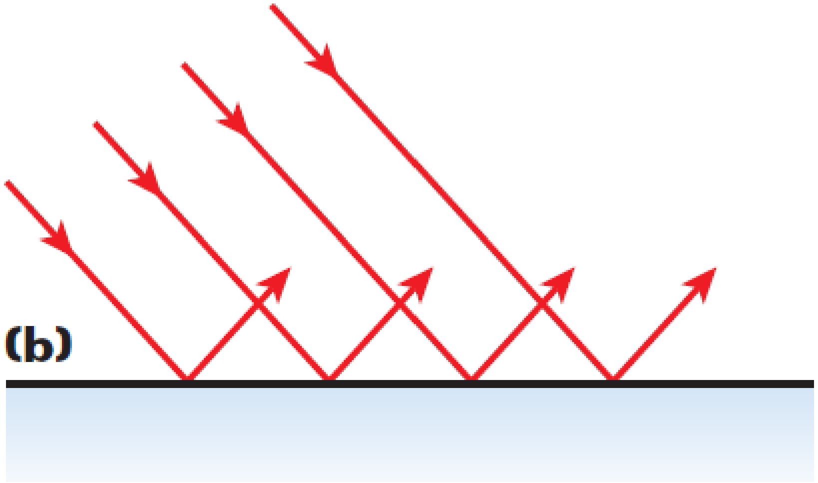


Not every surface is a flat mirror

Even surfaces that seem nice and flat are often textured

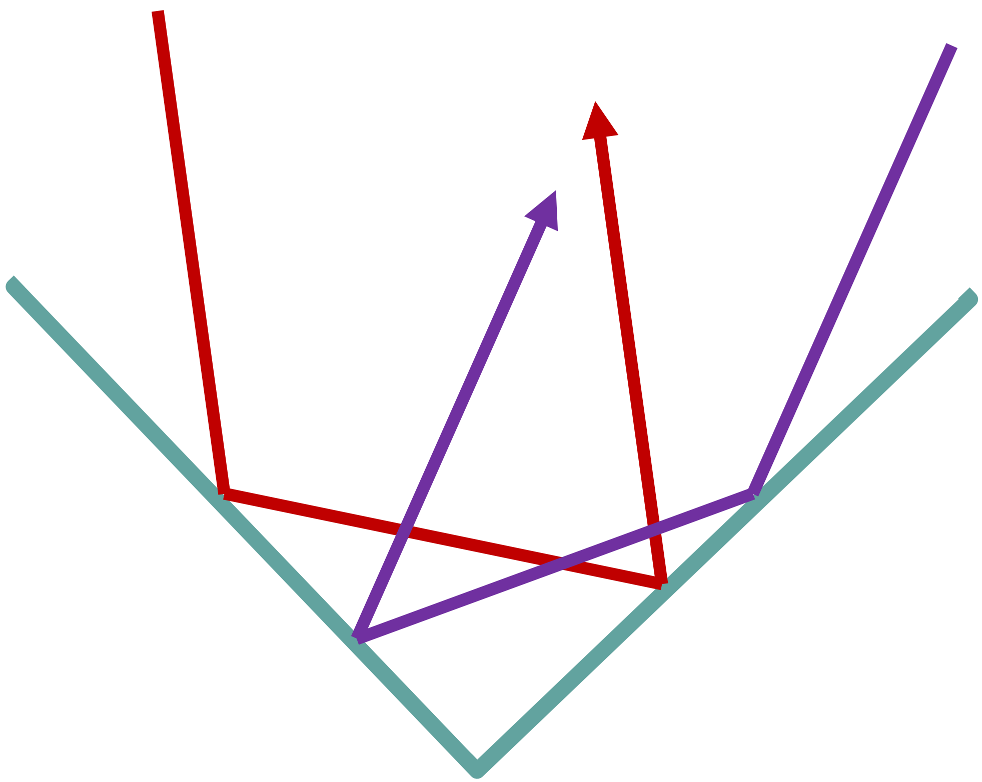


Diffuse Reflection

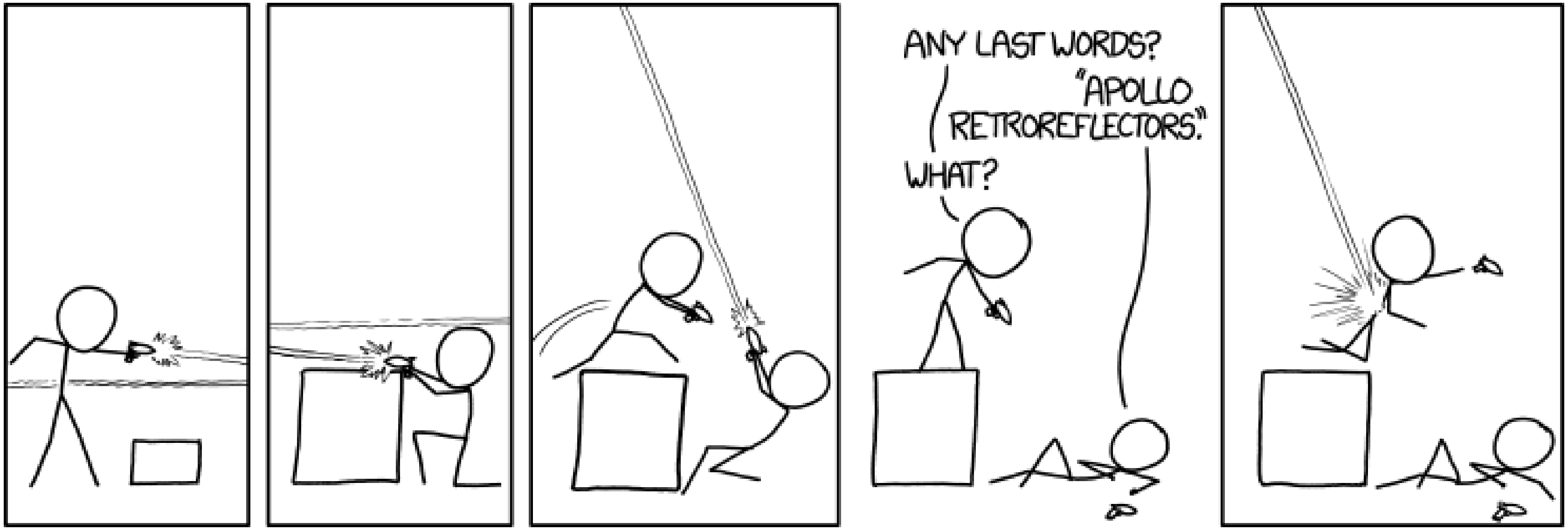


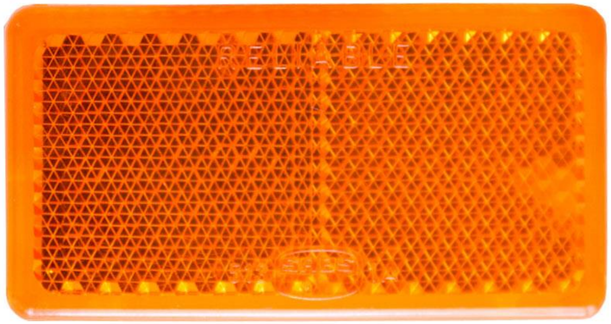
Retro-reflective Mirrors

Light always reflects directly back to the source



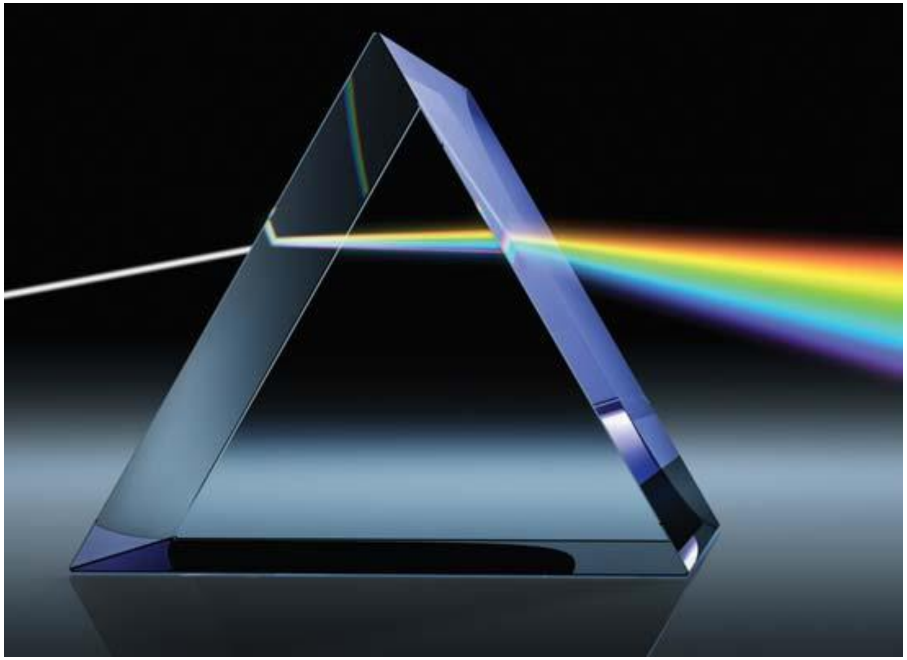
Retro-reflective Mirrors





Refraction

Bends because of a change in medium



Speed of Light

In a vacuum all electromagnetic waves travel at:

$$c = 299{,}792{,}458 \text{ m/s} = 3.00 \times 10^8 \text{ m/s}$$

Light slows down when it travels through different mediums

Air	2.999×10^8 m s^{-1}
Water	2.256×10^8 m s^{-1}
Glass	1.974×10^8 m s^{-1}

Index of Refraction → n

$$\frac{n_1}{n_2} = \frac{v_2}{v_1}$$

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1	Vacuum	3.00×10^8 m s^{-1}	1
	Air	2.999×10^8 m s^{-1}	1.0003 ~ 1
	Water	2.256×10^8 m s^{-1}	1.33
2	Glass	1.974×10^8 m s^{-1}	1.52

Try This

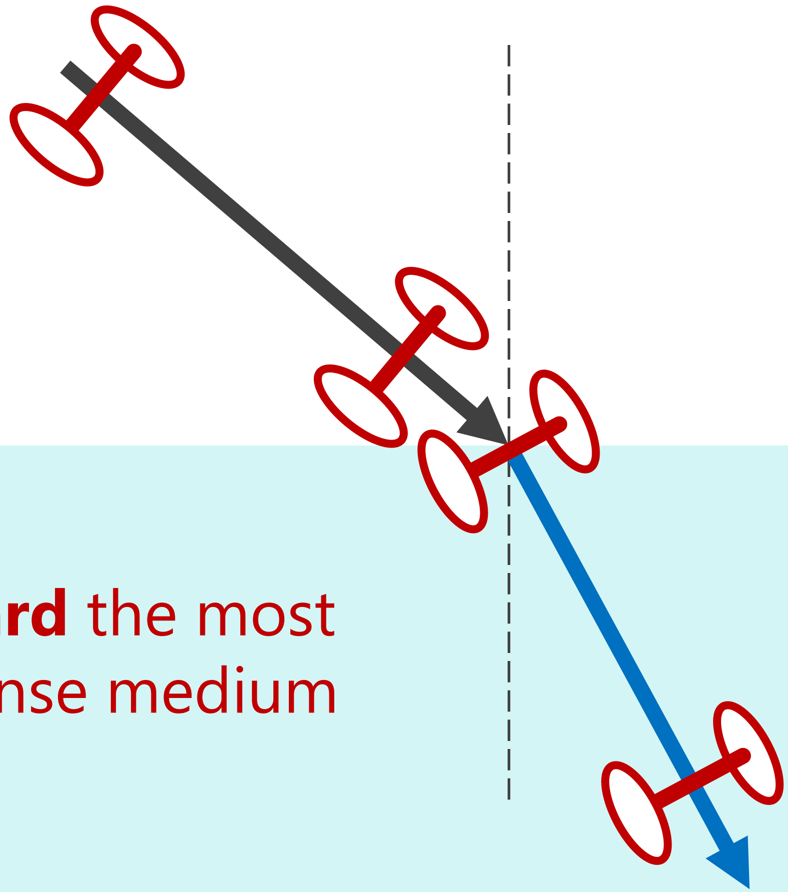
How fast does light travel through cubic zirconia (n = 2.15)?

$$\frac{n_1}{n_2} = \frac{v_2}{v_1}$$

$$\frac{1}{2.15} = \frac{v_2}{3.00 \times 10^8}$$

$$v_2 = 1.40 \times 10^8 \text{ m s}^{-1}$$

Predicting the Bend



faster

$n = 1$

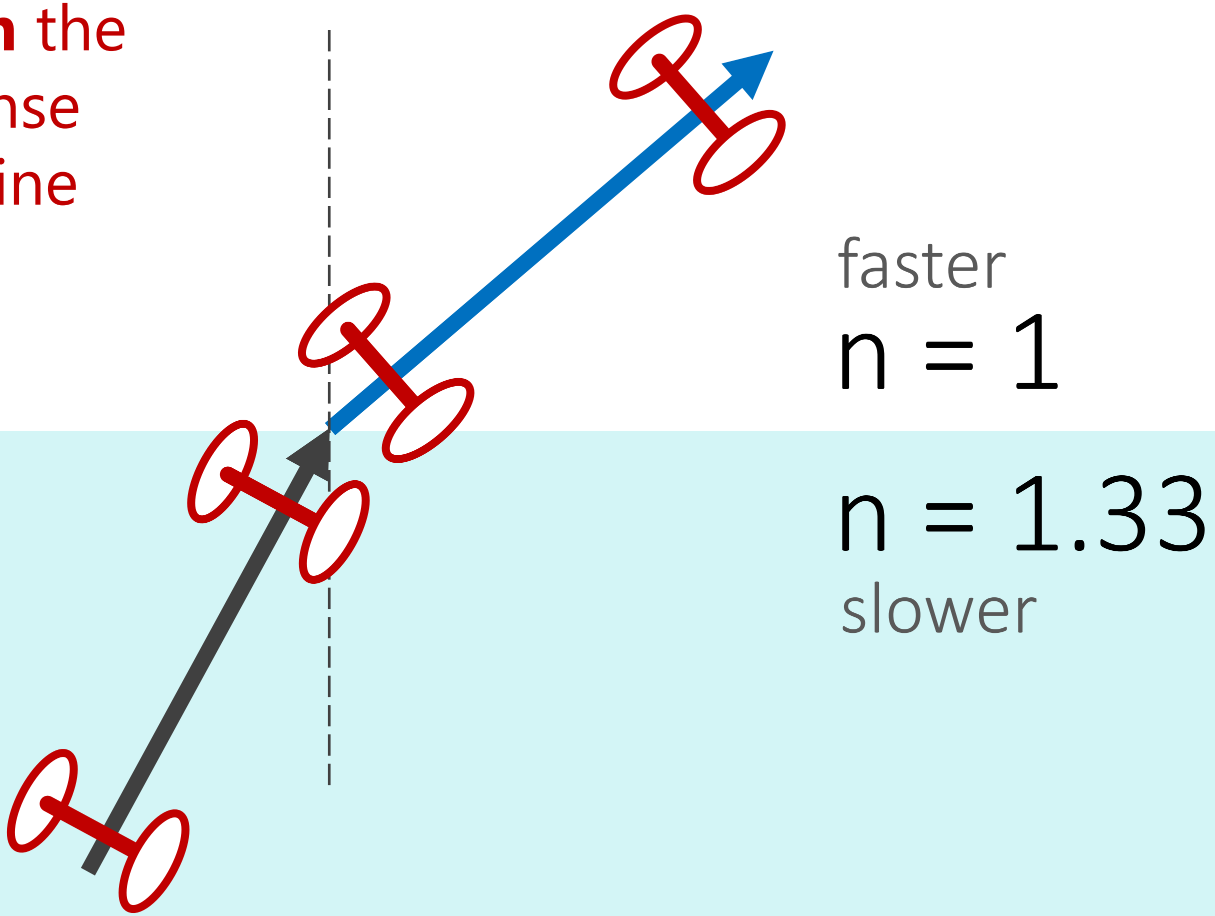
$n = 1.33$

slower

Bends **toward** the most optically dense medium normal line

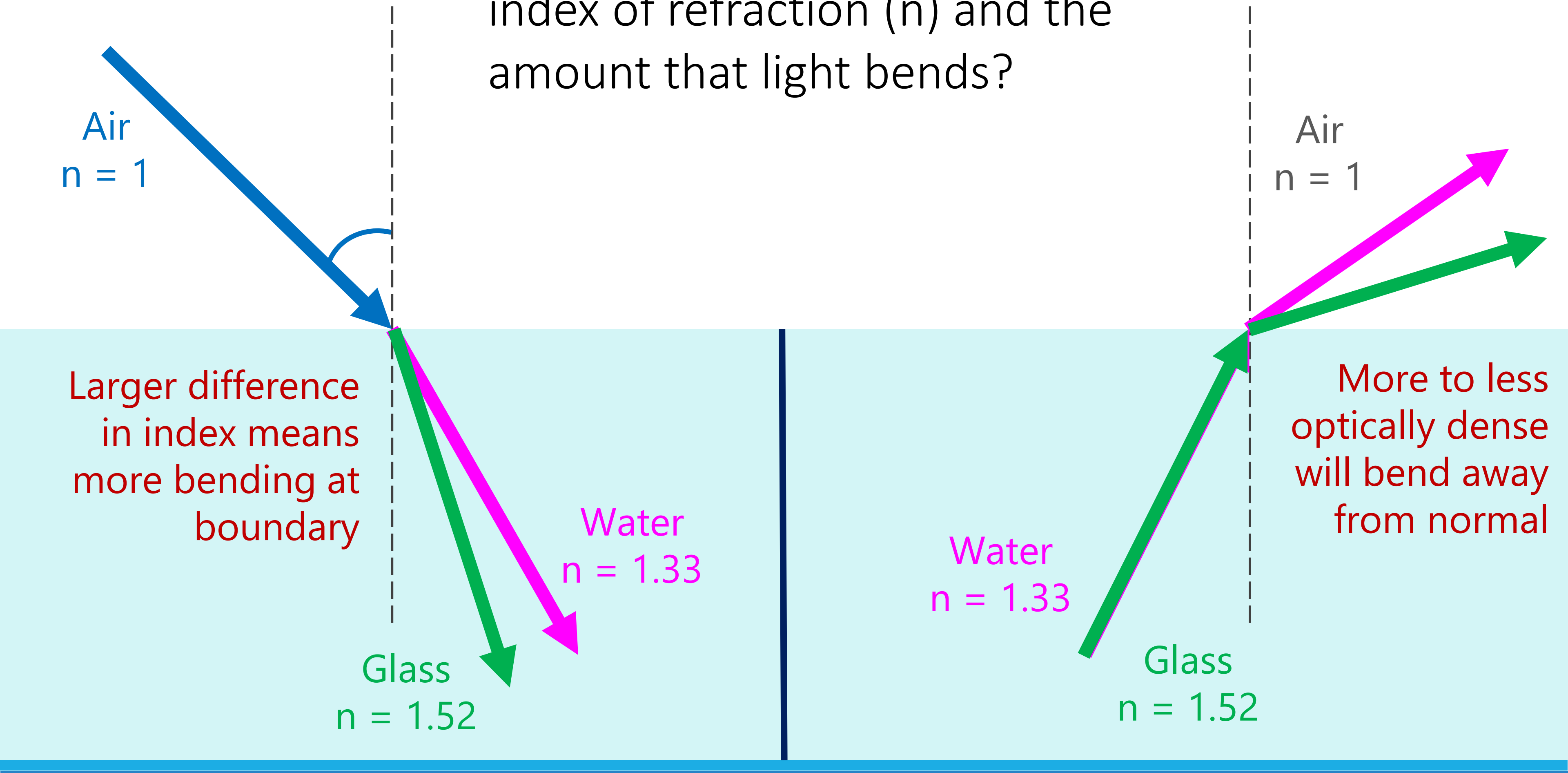
Predicting the Bend

Bends **away from** the least optically dense medium normal line



How Much Bend?

What's the relationship between index of refraction (n) and the amount that light bends?



Lesson Takeaways

- ❑ I can identify the angle of incidence and angle of reflection for a reflected wave ray
- ❑ I can use the law of reflection to predict the way light bounces off of a plane mirror
- ❑ I can relate the index of refraction of a material to the speed of light as it travels through
- ❑ I can qualitatively predict how light bends when transitioning between boundaries