

Refraction:

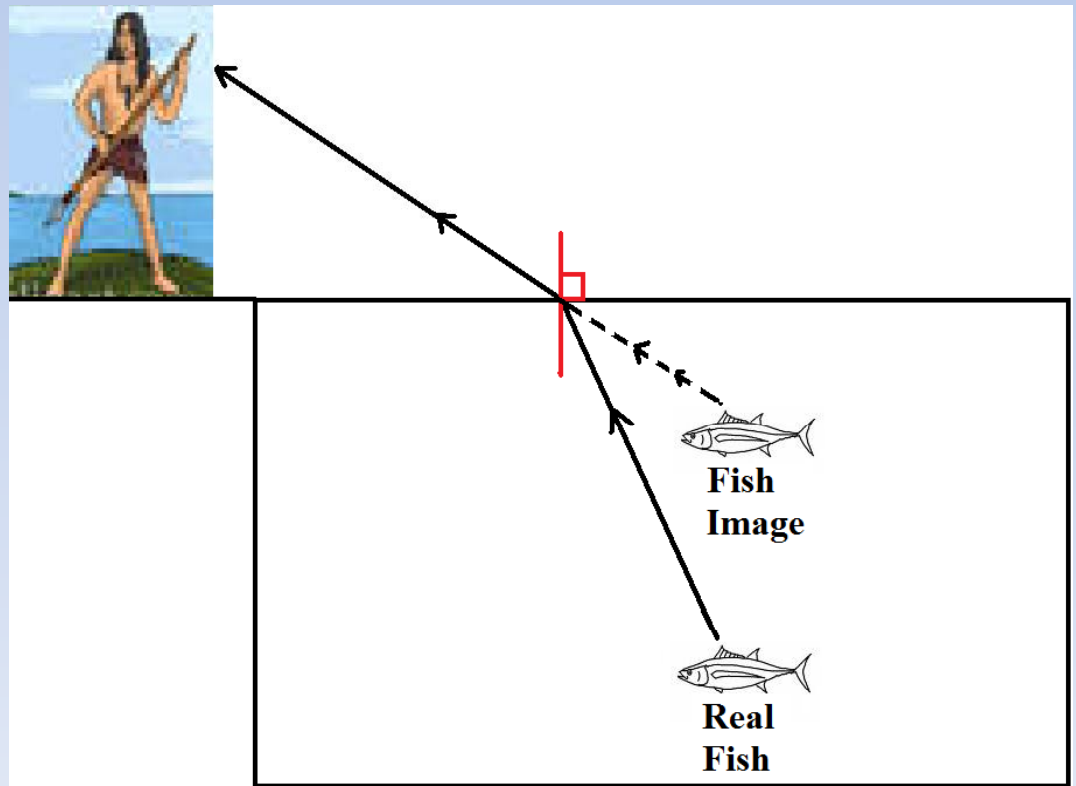
Spearing fish, prisms, rainbows, mirages

Traditional: 13-09

Themed: 04-07

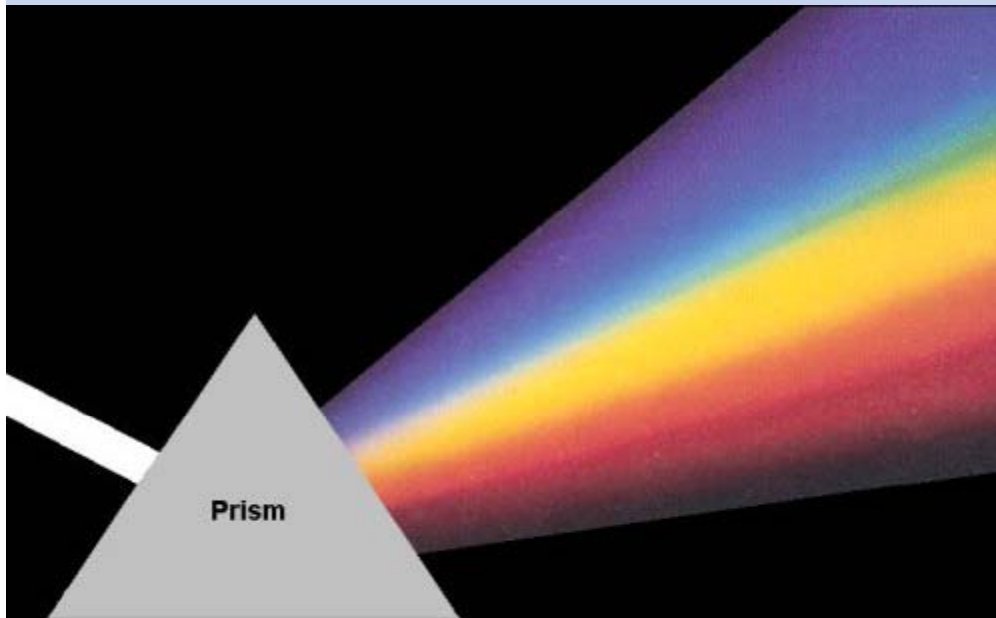
How to spear a fish

- Light from fish to fisherman bends away from normal
- Does fisherman aim high or low?
- Would fish aim high or low if he had a weapon?
- To shoot a laser point on the fish, would you aim high or low?



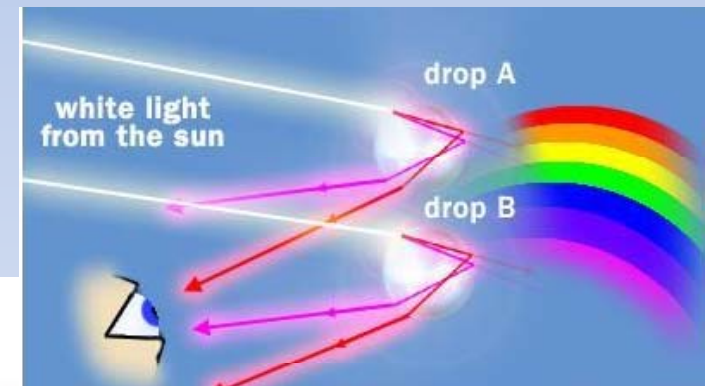
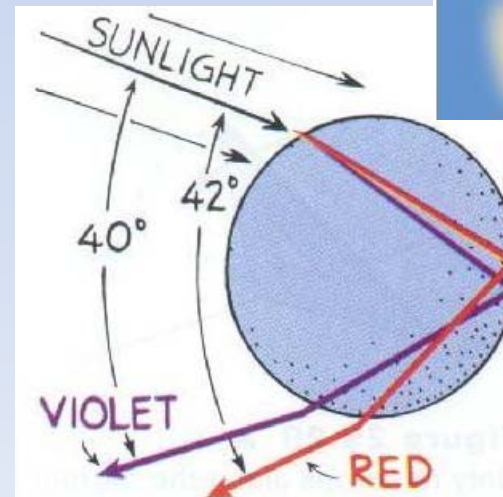
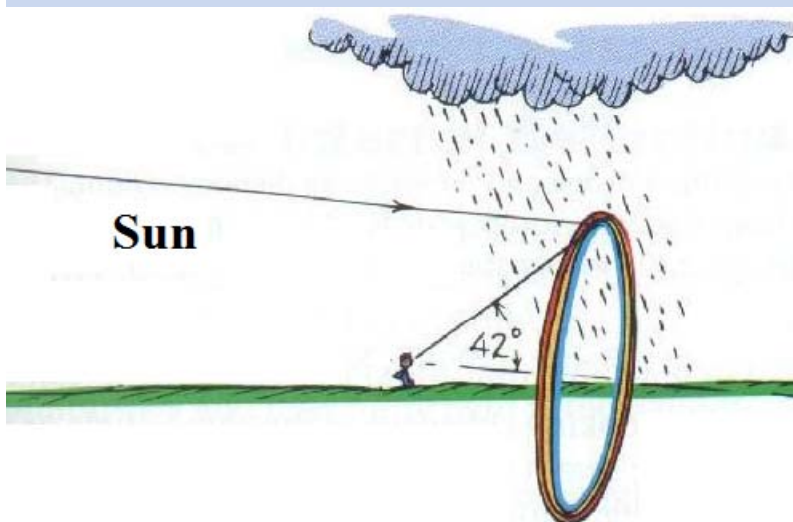
Dispersion - How prisms work

- Police tell crowd to disperse, what do they do?
- Blue light “interacts more” (slower) through glass than red
- More interaction means longer “stop lights” ...refracts more than red
- White light enters at same angle, exit angle depends on color
- “Dispersion” = separation



Rainbows – Dispersion & Total internal reflection

- Sun at your back, rain in front, raindrops are spheres
- Spherical raindrop: dispersion and total internal reflection
- Violet light seen at 40° in all directions, red at 42°
- Every color visible in all directions (concentric color rings)
- Horizon cuts rainbow in half: airplanes can see full rainbows
- Rainbow = prism + mirror (TIR)



Mirages – refraction making images appear

- Sunlight absorbed by ground = hot ground
- Air by ground is hot, higher up = cooler
- Hot air expands (like balloon) = fewer interactions (fewer stoplights)
- Fast near ground and slow up high = left turns
- Image formed: inverted, just like a lake in distance would do

Cool air, like cold balloon ($V = \text{small}$, crowded molecules), slow left wheel

