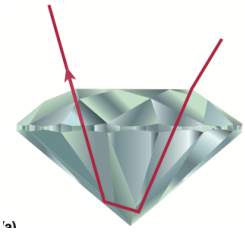
SNC2D

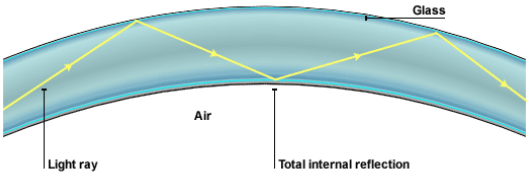
Total Internal Reflection

Draw a ray diagram of light as it moves through a diamond. Use the outline below.
Highlight/circle where TIR occurs.



Describe what a fibre optic cable is. Draw a ray diagram of how a fibre optic cable permits light to move from one end to another.

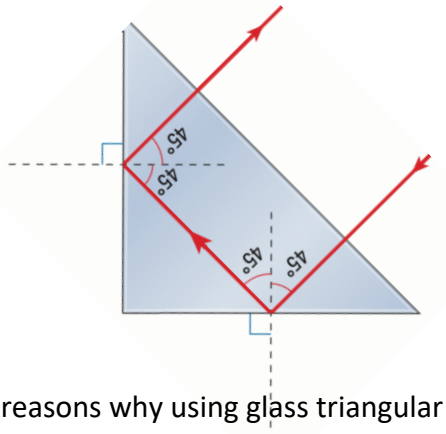
- A cable used to transmit information using light
- Usually glass since it has a small critical angle and TIR is needed to transmit light

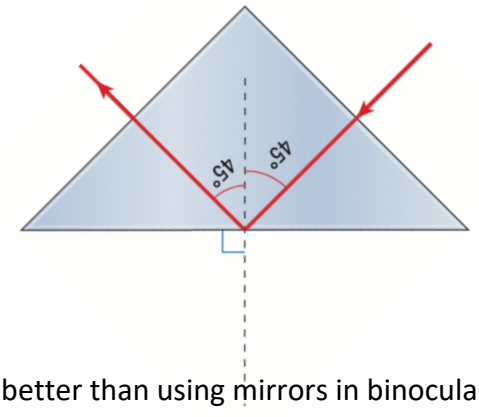


List 3 applications of the use of fibre optic cables (for more examples see pg 528 in the textbook.)

- Communications (phones, TV, computers)
- Movie industry
- Car instrument panels
- Medicine – cameras to see inside people

Complete the following two ray diagrams for glass triangular prisms.





Provide two reasons why using glass triangular prisms are better than using mirrors in binocular, cameras, and other technologies?

- Mirrors lose some light through absorption when they Reflect light
- Reflective surface of mirrors deteriorates over time

Describe what “retro-reflectors” are and provide 3 specific applications for how they are used.

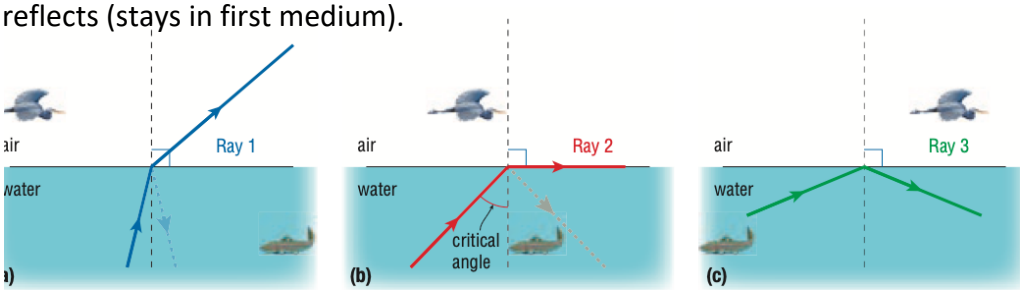
- A device that returns any incident light back in exactly the same direction from which it came
  - Bike reflectors
  - Reflective clothing
  - Road signs

Application Questions

Solve the following problems.

1. Why does total internal reflection occur only when light travels more slowly through the first medium than in the second and not the other way around? Include a ray diagram with your answer.

   - Light must be refracting away from the normal. TIR is when light refracts so far away from the normal it actually reflects (stays in first medium).



2. Will you get more total internal reflection with a medium that has a small critical angle or with one that has a large critical angle? Explain.
   - The smaller the critical angle the more TIR
     - Any angle greater than the critical angle causes TIR

3. Determine how much time it would take to send a signal through a fibre optic cable 10,583 km in length (the direct distance from Toronto to Beijing). Assume that light travelling through the fibre optic cable is made of glass.

   $c = 3.0 \times 10^8$ m/s 10 583 km = 10 583 000 m

   10 583 000 m ÷ 3.0×10^8 m/s

   10 583 000 m ÷ 30 000 000 000 m/s

   0.00035 seconds

Textbook Questions: pg. 531 #1-3, 5, 8, 9