

# Second Midterm

- Wednesday, 7 – 9 pm in **Merrill 1**.
- Chapters 24 – 29 and labs 1 – 5.
  - Exam **will not** include AC Circuits or Transformers.
- Bring a pen/pencil and a calculator (for arithmetic only)
- Practice Tutorials and problems on Mastering Physics
- Exam will have a page of key equations.
- No homework or lab this week.
- Lab report due on Friday, Nov. 18, 5 pm.

# Office hours this week

- Today: 3 - 4
- Tomorrow: 3:30 – 4:30
- Wednesday: 2 - 4

# Optics

- Geometric Optics - Light as rays that generally move in straight lines.
- Wave Optics – Light as waves that can show interference and can bend around corners (diffraction).

# Law of Reflection

- When a ray of light hits a reflective surface (e.g. mirror), the incident and reflected rays make the same angle with respect to the normal to the surface.

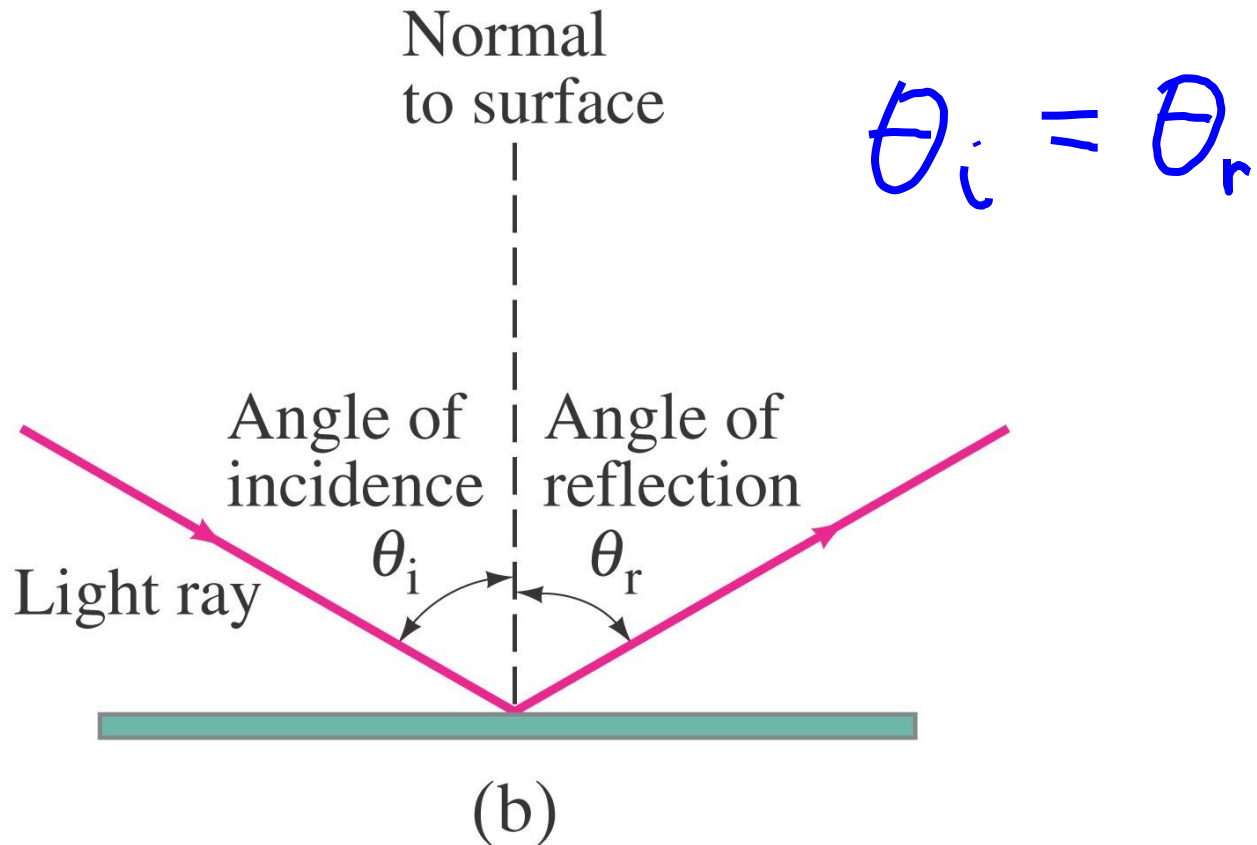
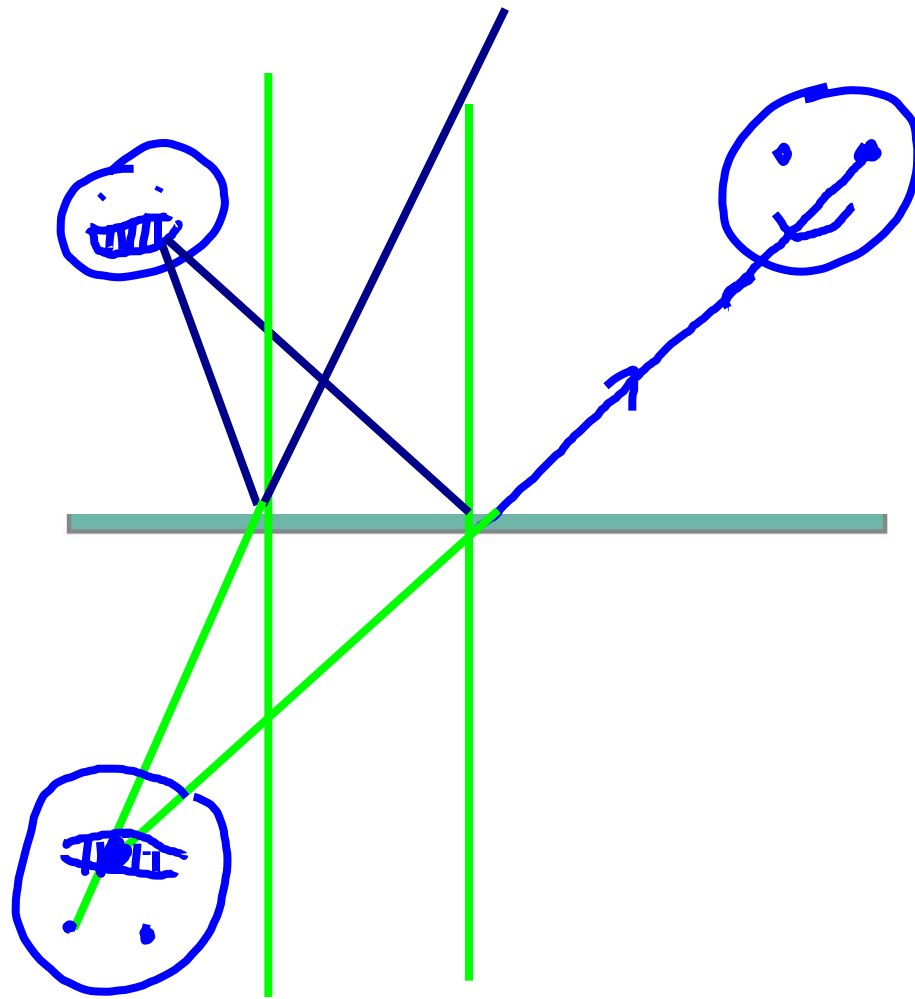
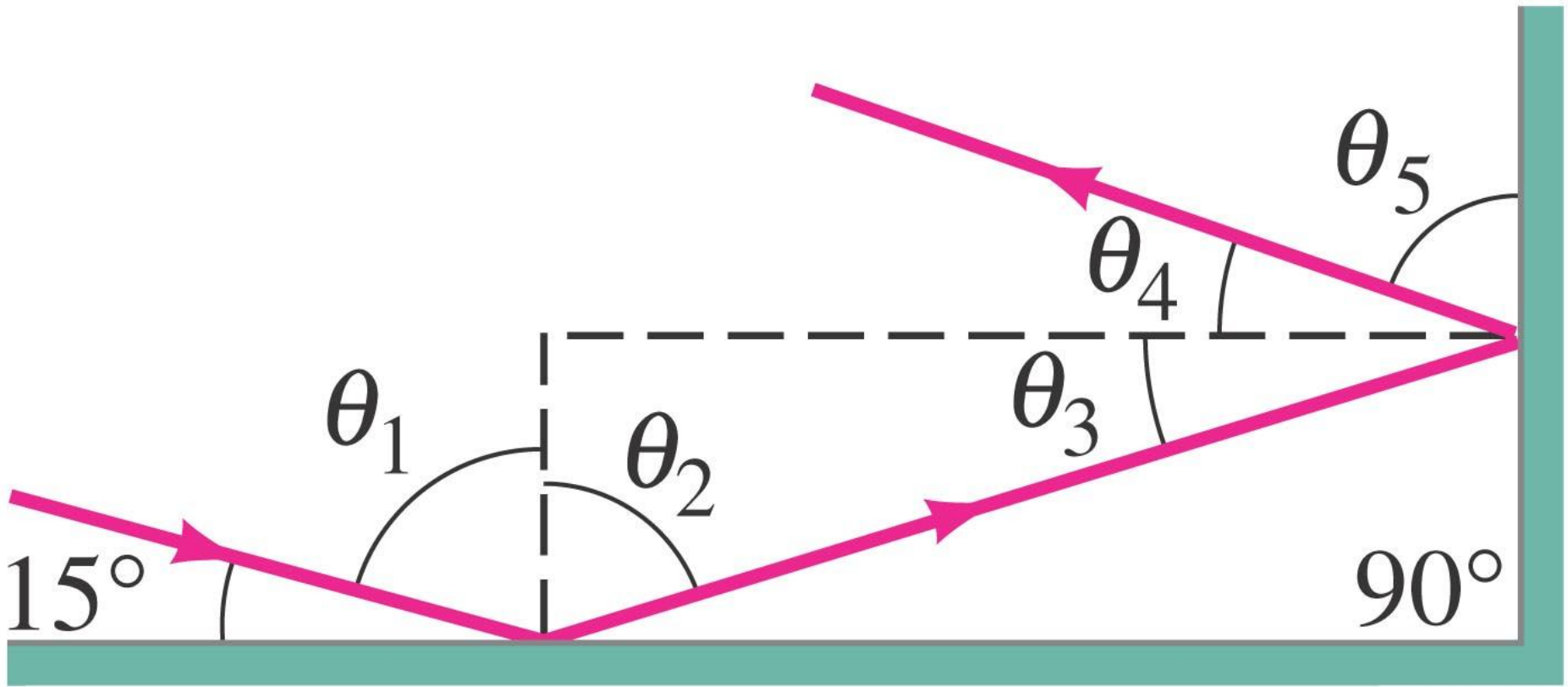


Figure 32.2b





(b)

What is the minimum height of a plane mirror in which a standing woman can see her entire body reflected?

1) It must equal her height.

2) It must be one-half her height.

3) It depends on how far from the mirror the woman stands.

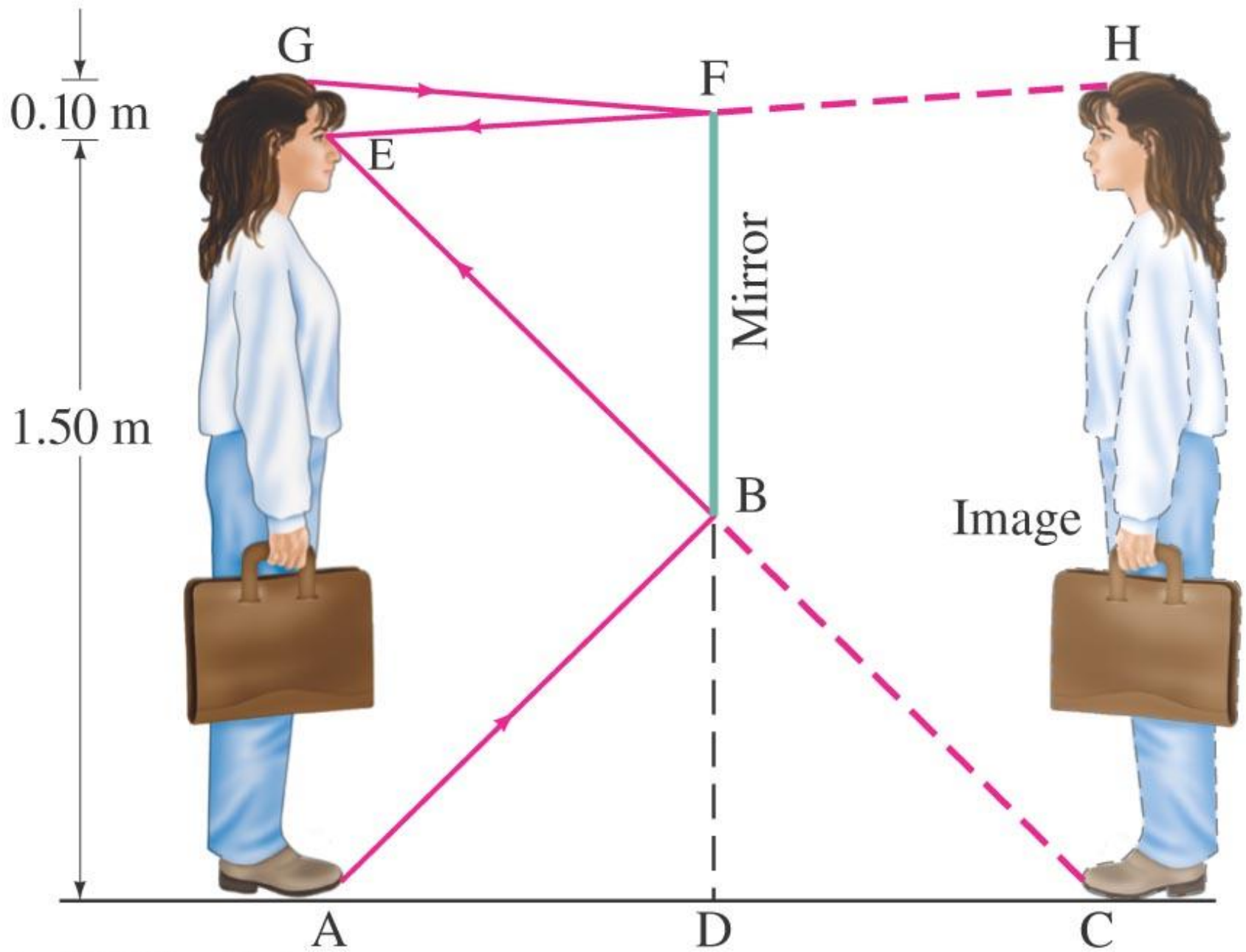


Figure 32.8



# Speed of Light

- The Ultimate Speed Limit
  - *Speed of Light in Vacuum:  $c = 3.00 \times 10^8$  m/s*
- Light moves slower in a medium
  - Different media have different speeds, but always less than  $c$ .
- Index of refraction for a medium – the ratio of speed of light in vacuum to speed in the medium:  
 $n = c/v$ .
  - $n_{air} = 1.0003$
  - $n_{water} = 1.333$
  - $n_{glass} = 1.5 - 1.6$

# Refraction

- When a light ray moves from one medium to another, the ray bends.
  - If the second medium has a higher index of refraction than the first, the refracted ray is bent towards the normal relative to the incident ray.

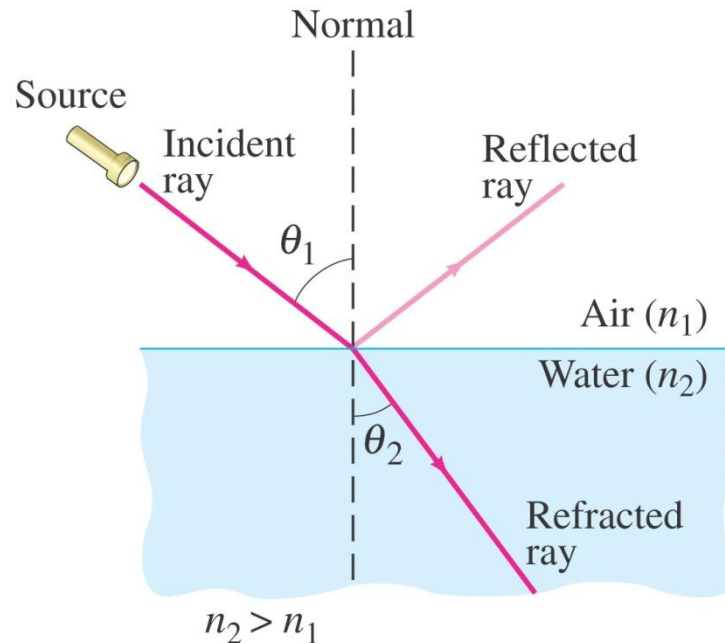


Figure 32.21a

# Snell's Law

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

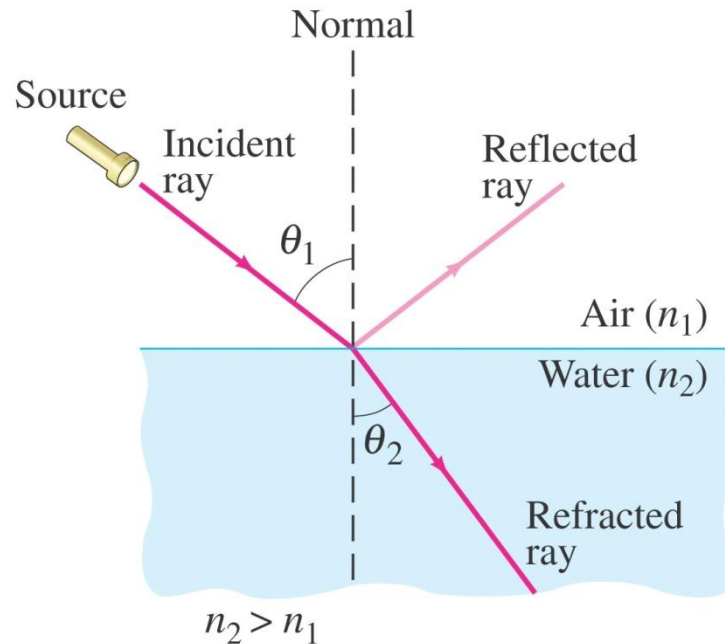
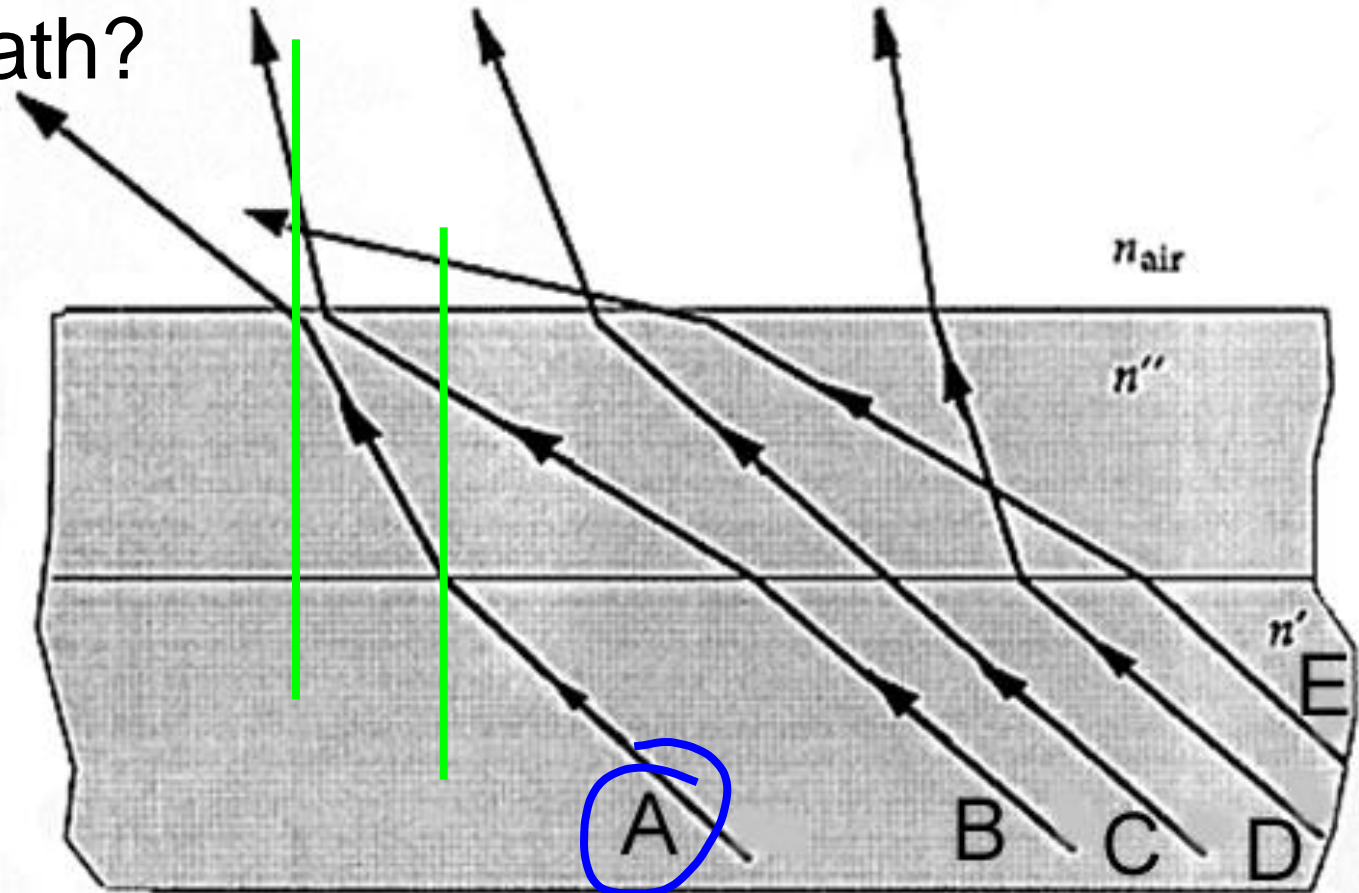


Figure 32.21a

As light passes from one medium into another, the angle of refraction is smaller in the medium with the \_\_\_\_\_ index of refraction and \_\_\_\_\_ speed of light.

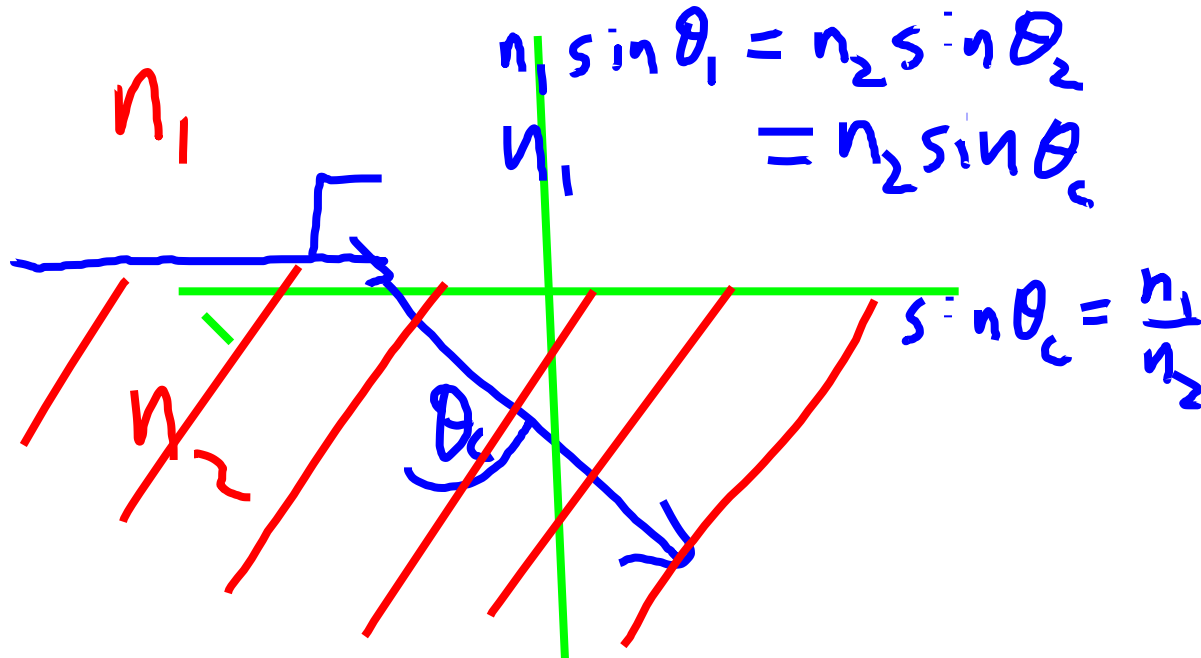
- 1) larger; lower
- 2) larger; higher
- 3) smaller; lower
- 4) smaller; higher

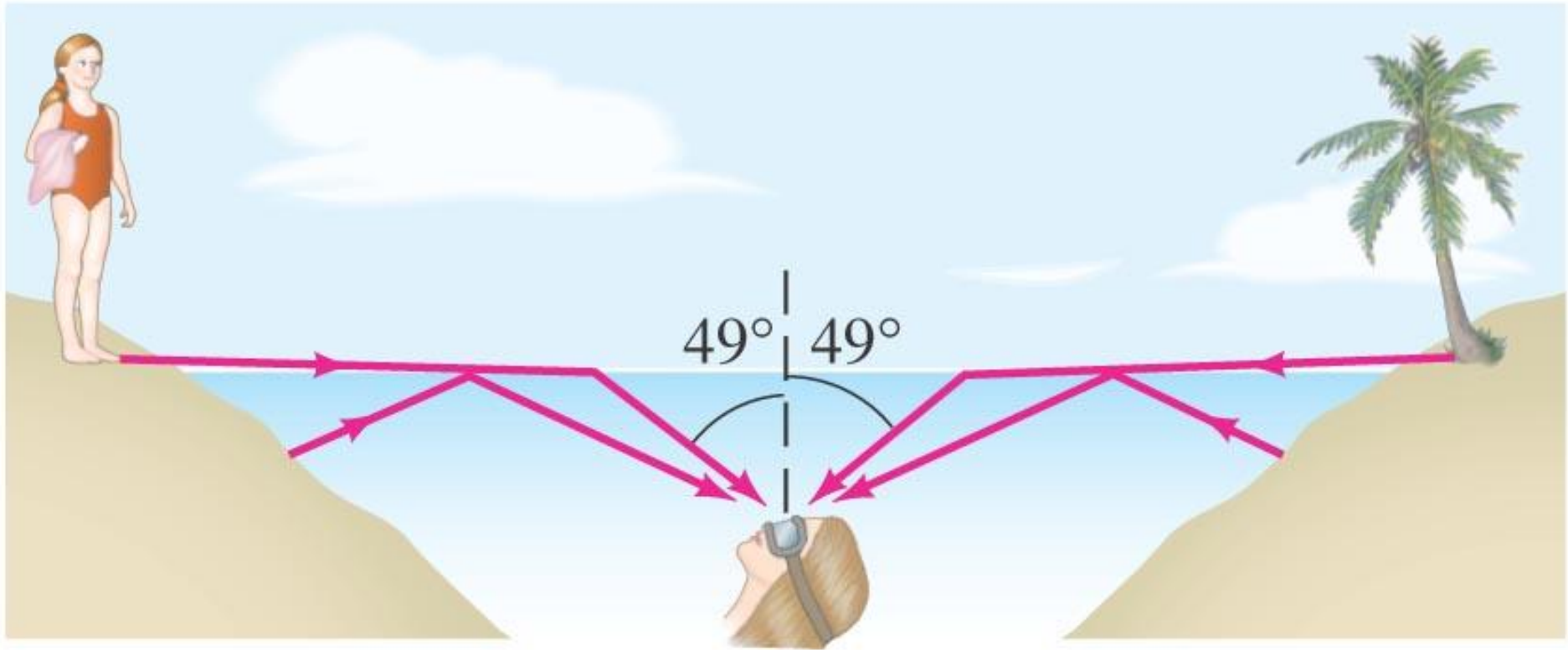
Light travels in a medium of index of refraction  $n'$ , passes into a medium of index  $n''$ , where  $n'' > n'$ , and then into air, where  $n_{\text{air}} < n' < n''$ . Which ray correctly shows the light path?



# Consequences of Snell's Law

- When light travels into a medium of higher index of refraction, there is a maximum angle for the refracted ray  $< 90^\circ$ .
  - The incident light from the first medium (e.g. air) is compressed into a cone in the second medium (e.g. water).

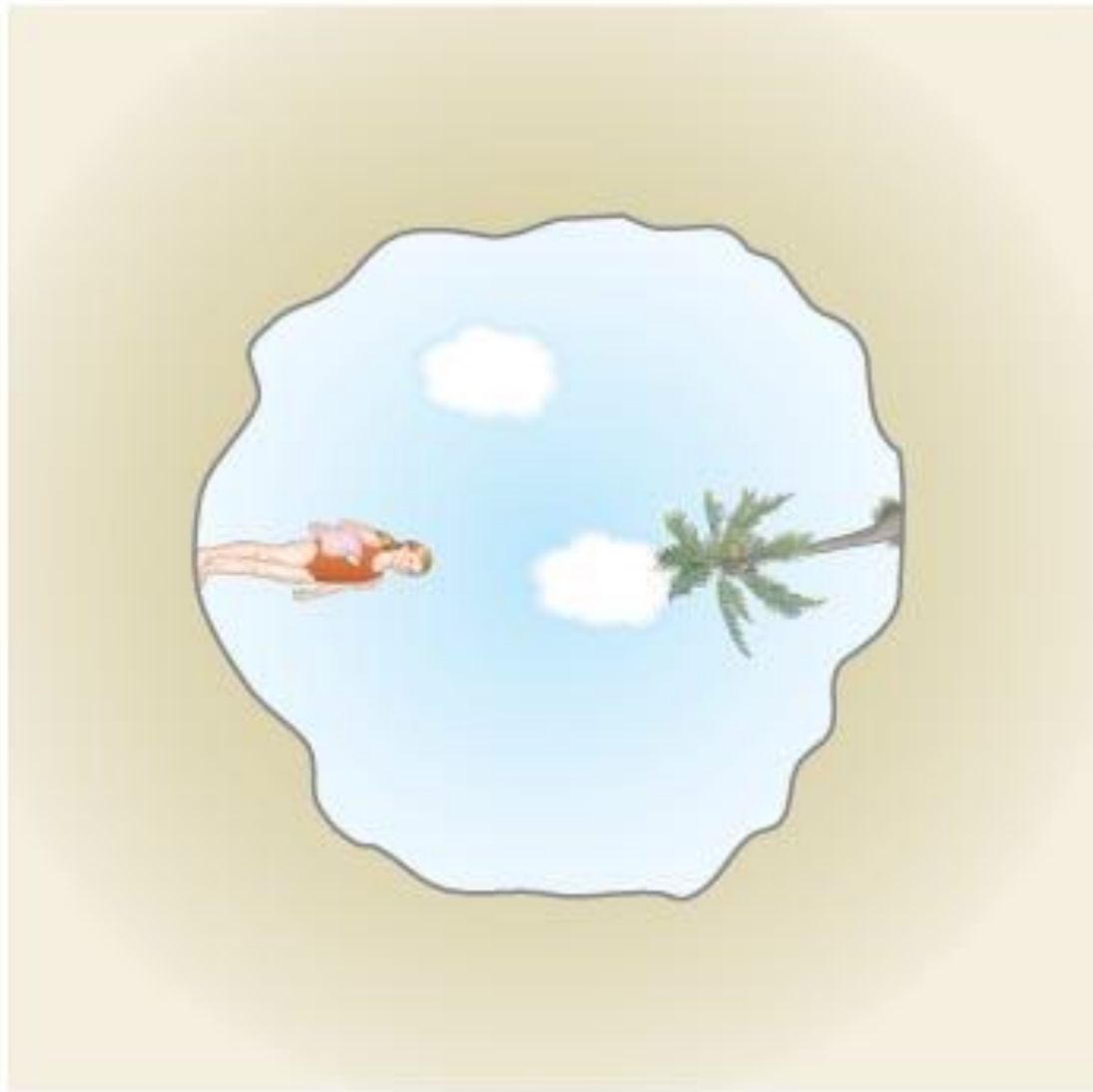




(a)

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Figure 32.32a



(b)

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