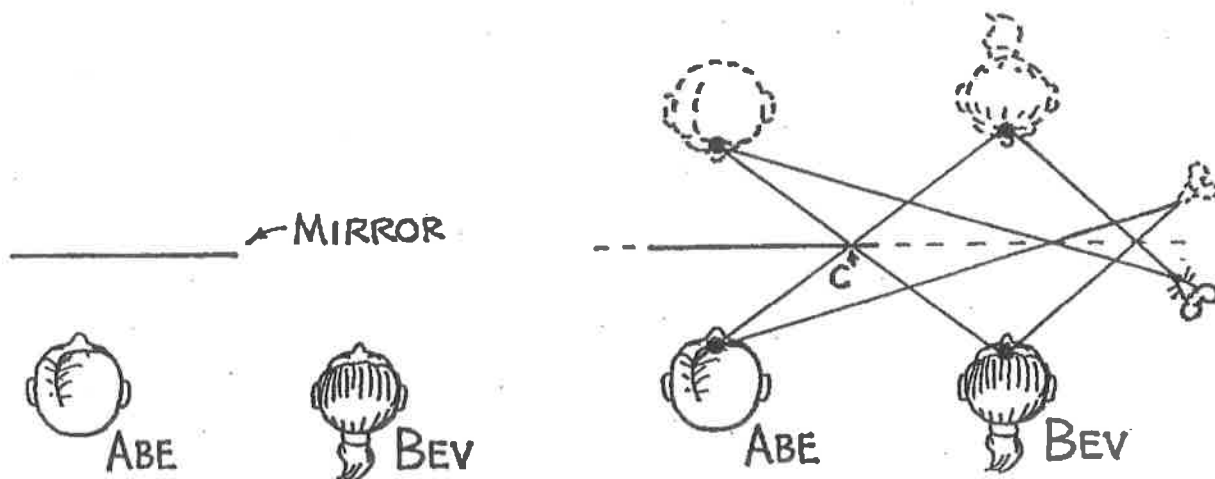


**Concept-Development
Practice Page**

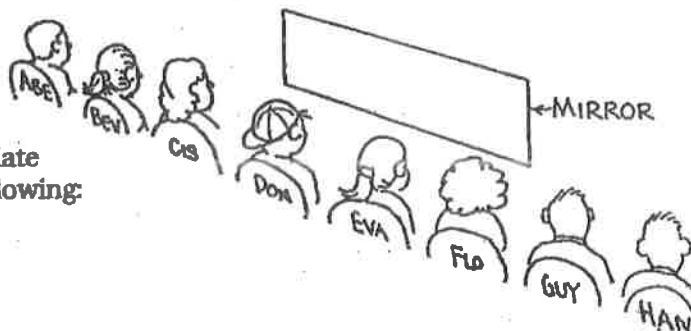
29-2

Reflection



Abe and Bev both look in a plane mirror directly in front of Abe (left, top view). Abe can see himself while Bev cannot see herself—but can Abe see Bev, and can Bev see Abe? To find the answer we construct their artificial locations “through” the mirror, the same distance behind as Abe and Bev are in front (right, top view). If straight-line connections intersect the mirror, as at point C, then each sees the other. The mouse, for example, cannot see or be seen by Abe and Bev.

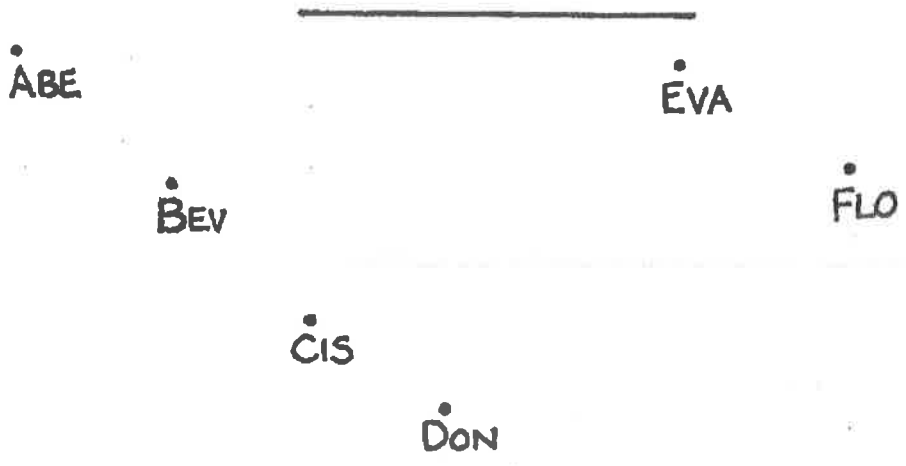
Here we have eight students in front of a small plane mirror. Their positions are shown in the diagram below. Make appropriate straight-line constructions to answer the following:



• ABE • BEV • CIS • DON • EVA • FLO • GUY • HAN

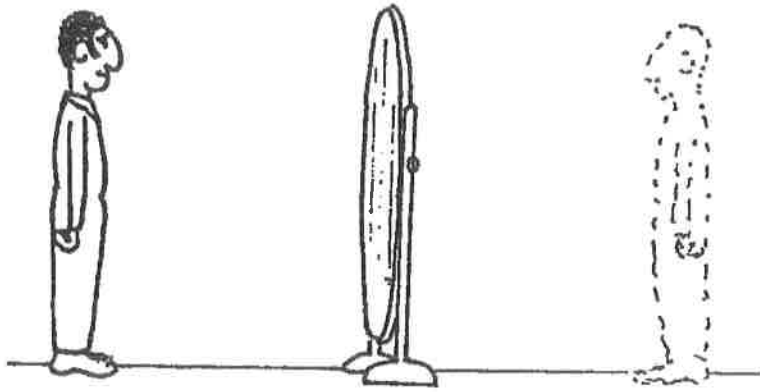
- | | |
|------------------------|----------------------------|
| Who can Abe see? _____ | Who can Abe not see? _____ |
| Who can Bev see? _____ | Who can Bev not see? _____ |
| Who can Cis see? _____ | Who can Cis not see? _____ |
| Who can Don see? _____ | Who can Don not see? _____ |
| Who can Eva see? _____ | Who can Eva not see? _____ |
| Who can Flo see? _____ | Who can Flo not see? _____ |
| Who can Guy see? _____ | Who can Guy not see? _____ |
| Who can Han see? _____ | Who can Han not see? _____ |

Six of our group are now arranged differently in front of the same mirror. Their positions are shown below. Make appropriate constructions for this more interesting arrangement, and answer the questions below.



- | | |
|------------------------|----------------------------|
| Who can Abe see? _____ | Who can Abe not see? _____ |
| Who can Bev see? _____ | Who can Bev not see? _____ |
| Who can Cis see? _____ | Who can Cis not see? _____ |
| Who can Don see? _____ | Who can Don not see? _____ |
| Who can Eva see? _____ | Who can Eva not see? _____ |
| Who can Flo see? _____ | Who can Flo not see? _____ |

Harry Hotshot views himself in a full-length mirror (right). Construct straight lines from Harry's eyes to the image of his feet, and to the top of his head. Mark the mirror to indicate the minimum area Harry uses to see a full view of himself.



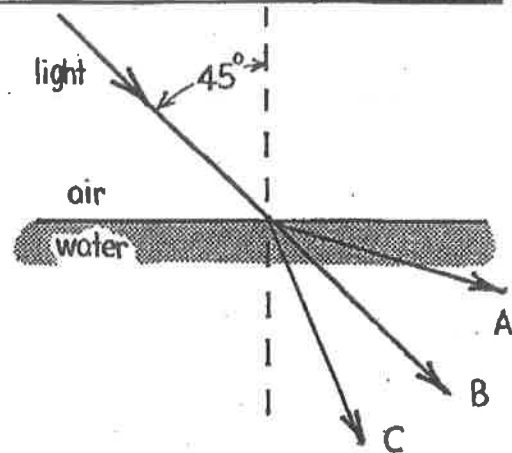
Does this region of the mirror depend on Harry's distance from the mirror?

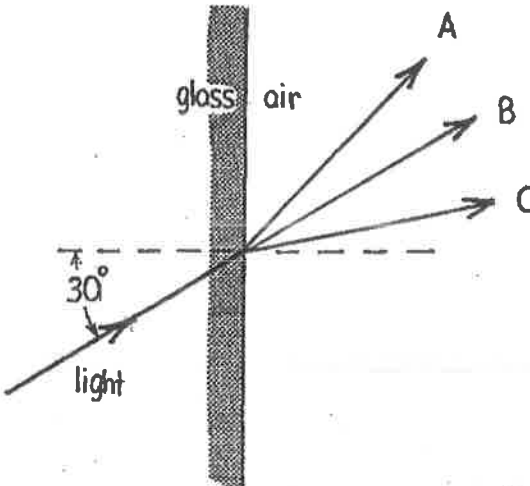
**Concept-Development
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29-4

Refraction

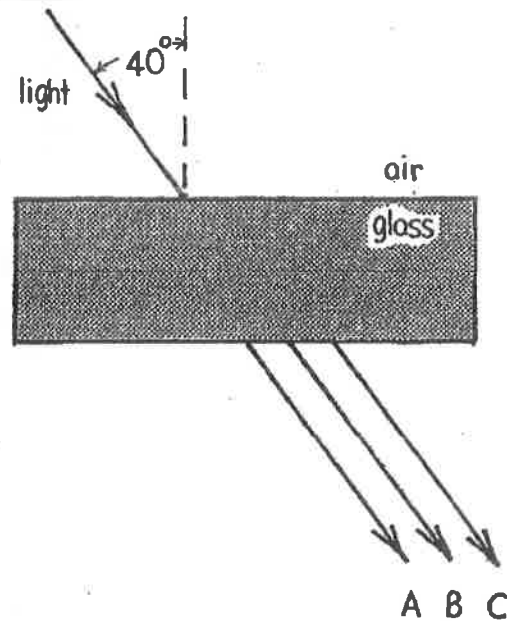
1. The sketch to the right shows a light ray moving from air into water, at 45° to the normal. Which of the three rays indicated with capital letters is most likely the light ray that continues inside the water?



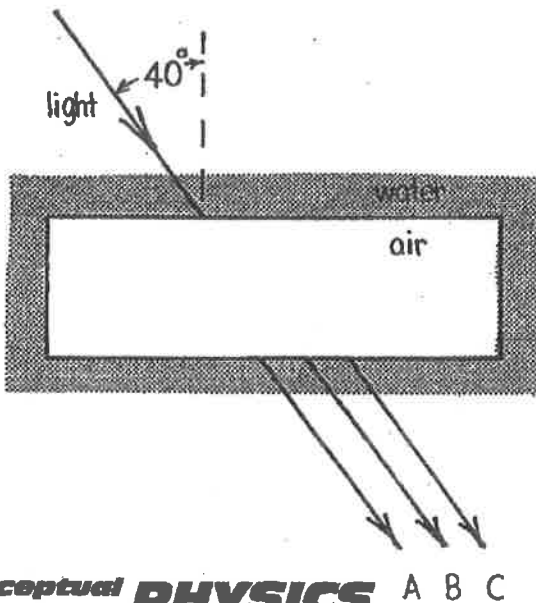


2. The sketch on the left shows a light ray moving from glass into air, at 30° to the normal. Which of the three is most likely the light ray that continues in the air?

3. To the right, a light ray is shown moving from air into a glass block, at 40° to the normal. Which of the three rays is most likely the light ray that travels in the air after emerging from the opposite side of the block?



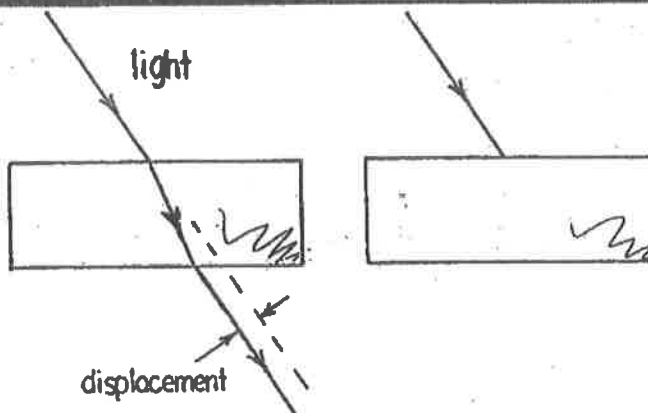
Sketch the path the light would take inside the glass.



4. To the left, a light ray is shown moving from water into a rectangular block of air (inside a thin-walled plastic box), at 40° to the normal. Which of the three rays is most likely the light ray that continues into the water on the opposite side of the block?

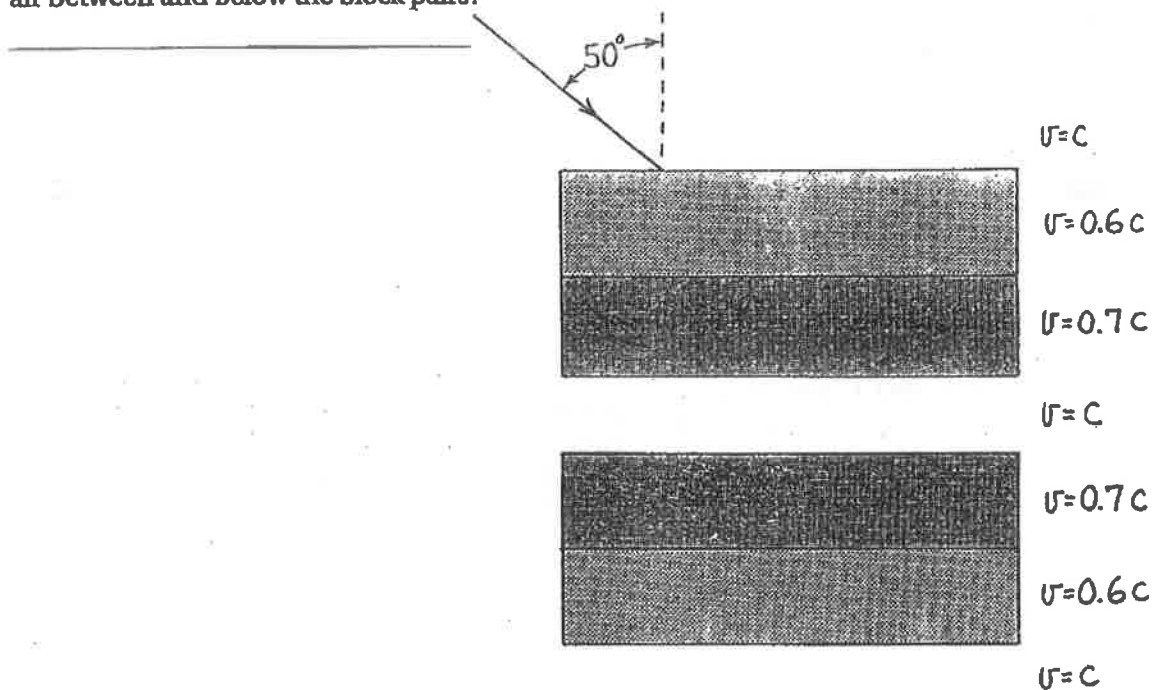
Sketch the path the light would take inside the air.

5. The two transparent blocks (right) are made of different materials. The speed of light in the left block is greater than the speed of light in the right block. Draw an appropriate light path through and beyond the right block. Is the light that emerges displaced more or less than light emerging from the left block?

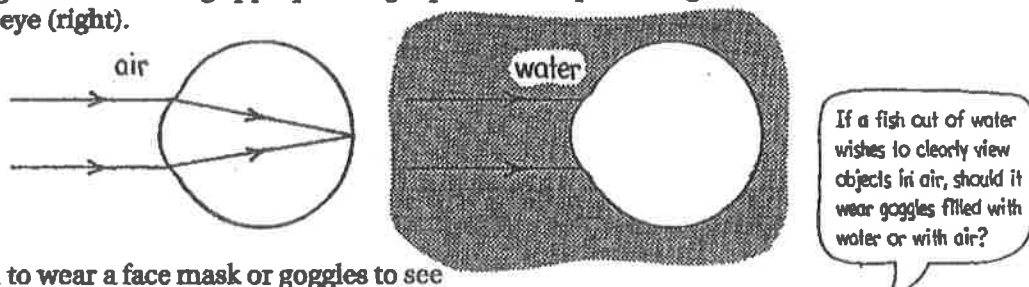


6. Light from the air passes through plates of glass and plastic below. The speeds of light in the different materials is shown to the right (these different speeds are often implied by the "index of refraction" of the material). Construct a rough sketch showing an appropriate path through the system of four plates.

Compared to the 50° incident ray at the top, what can you say about the angles of the ray in the air between and below the block pairs?



7. Parallel rays of light are refracted as they change speed in passing from air into the eye (left). Construct a rough sketch showing appropriate light paths when parallel light under water meets the same eye (right).



8. Why do we need to wear a face mask or goggles to see clearly when under water?

