

# ConcepTest PowerPoints

## Chapter 23

*Physics: Principles with Applications, 6<sup>th</sup> edition*

Giancoli

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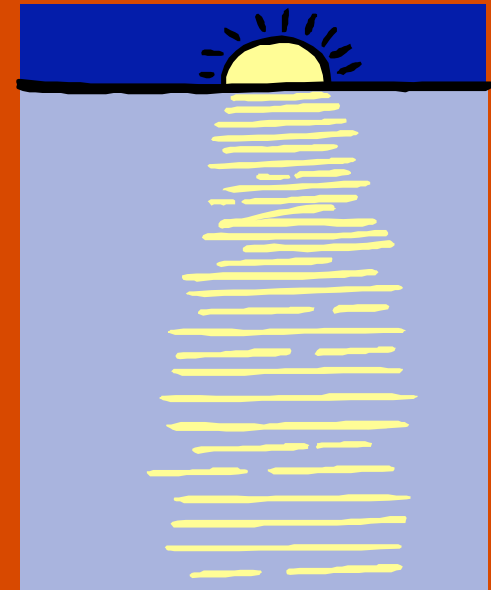
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## **ConceptTest 23.1**

When watching the Moon over the ocean, you often see a long streak of light on the surface of the water. This occurs because:

## **Reflection**

- 1) the Moon is very large
- 2) atmospheric conditions are just right
- 3) the ocean is calm
- 4) the ocean is wavy
- 5) motion of the Moon



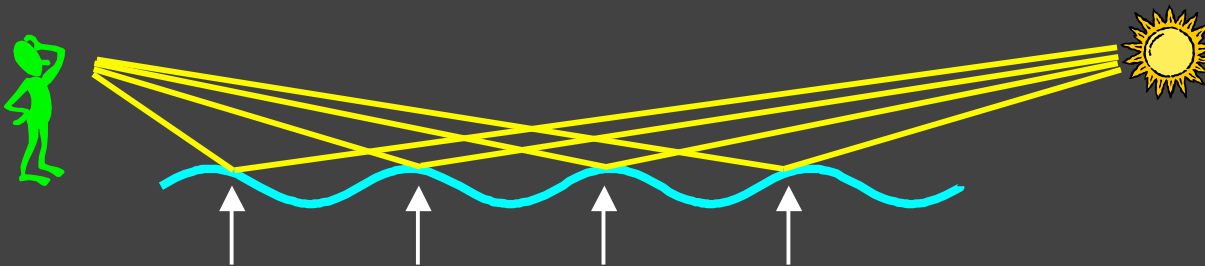
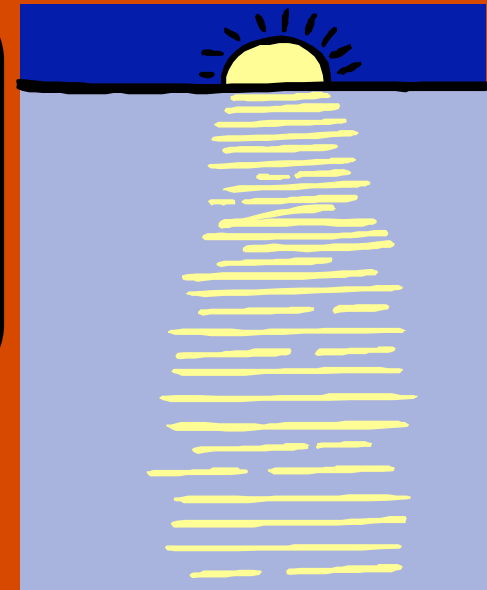
## ConceptTest 23.1

## Reflection

When watching the Moon over the ocean, you often see a long streak of light on the surface of the water. This occurs because:

- 1) the Moon is very large
- 2) atmospheric conditions are just right
- 3) the ocean is calm
- 4) the ocean is wavy
- 5) motion of the Moon

When the water surface changes, the angle of incidence also changes. Thus, different spots on the water can reflect the Moon into your eyes at different times.

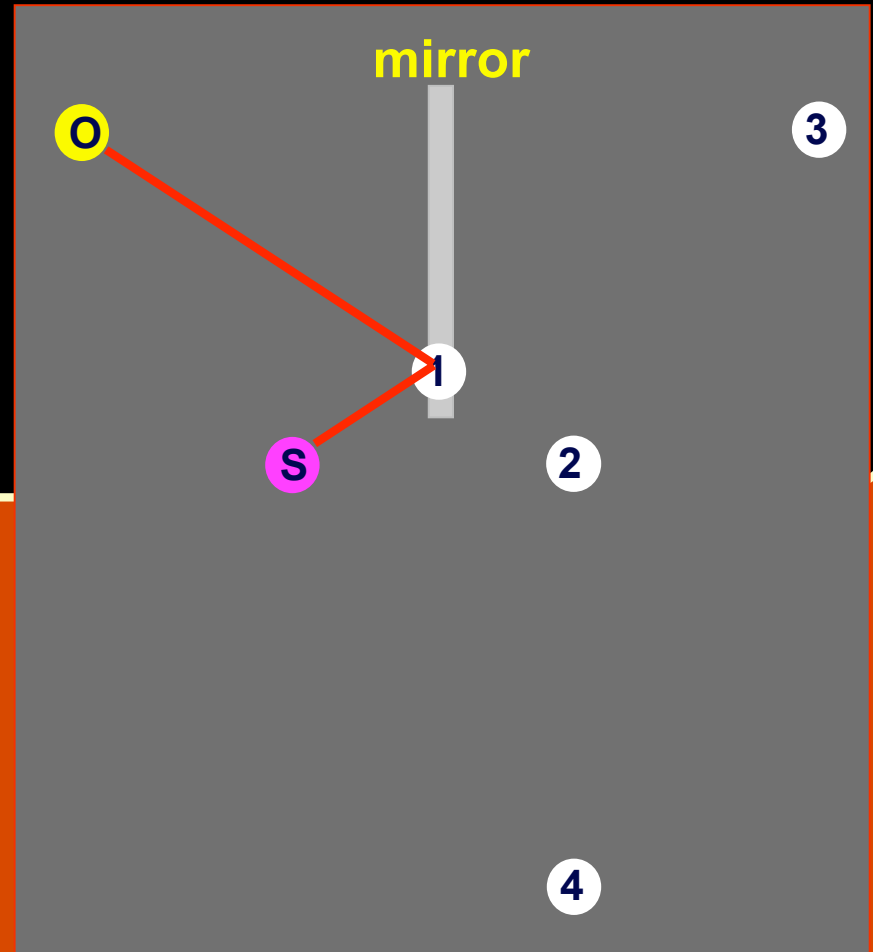


Follow-up: Where else does this occur?

## ConceptTest 23.2a

## Mirror I

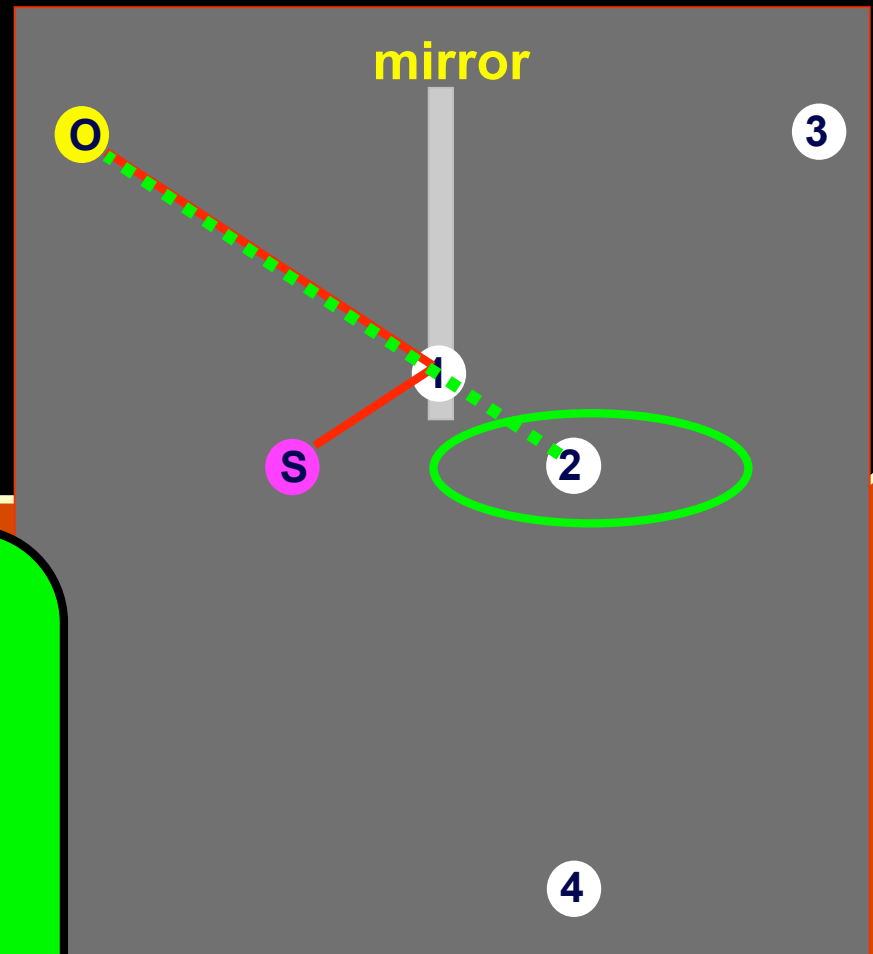
An observer at **point O** is facing a mirror and observes a **light source S**. Where does the observer perceive the mirror image of the source to be located?



## ConceptTest 23.2a

## Mirror I

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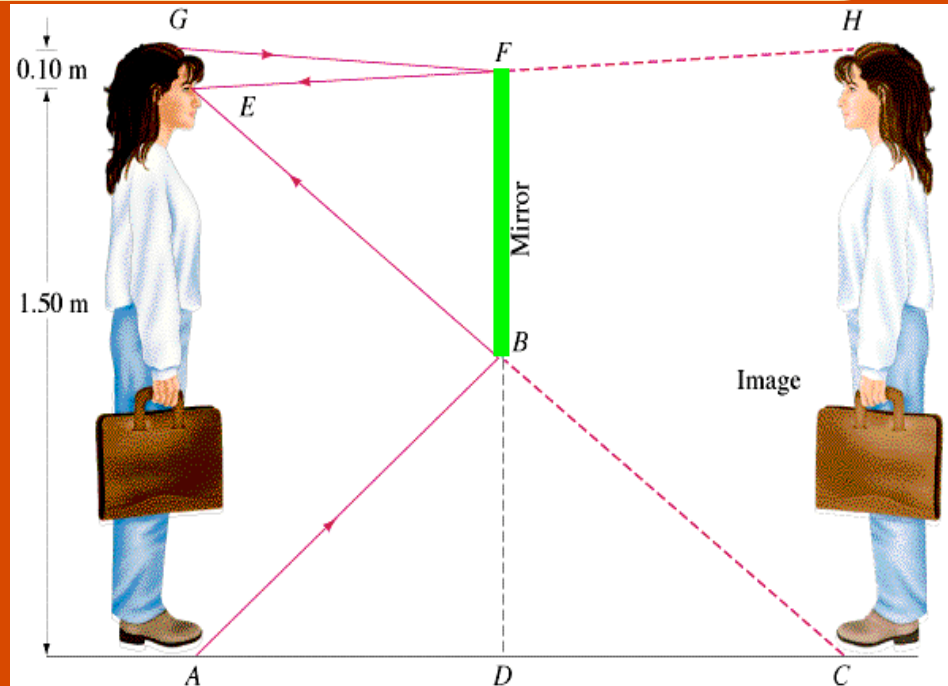
Trace the light rays from the object to the mirror to the eye. Since the brain assumes that light travels in a straight line, simply extend the rays back behind the mirror to locate the image.

**Follow-up:** What happens when the observer starts moving toward the mirror?

## ConceptTest 23.2b Mirror II

You stand in front of a mirror. How tall does the mirror have to be so that you can see yourself entirely?

- 1) same as your height
- 2) less than your full height but more than half your height
- 3) half your height
- 4) less than half your height
- 5) any size will do

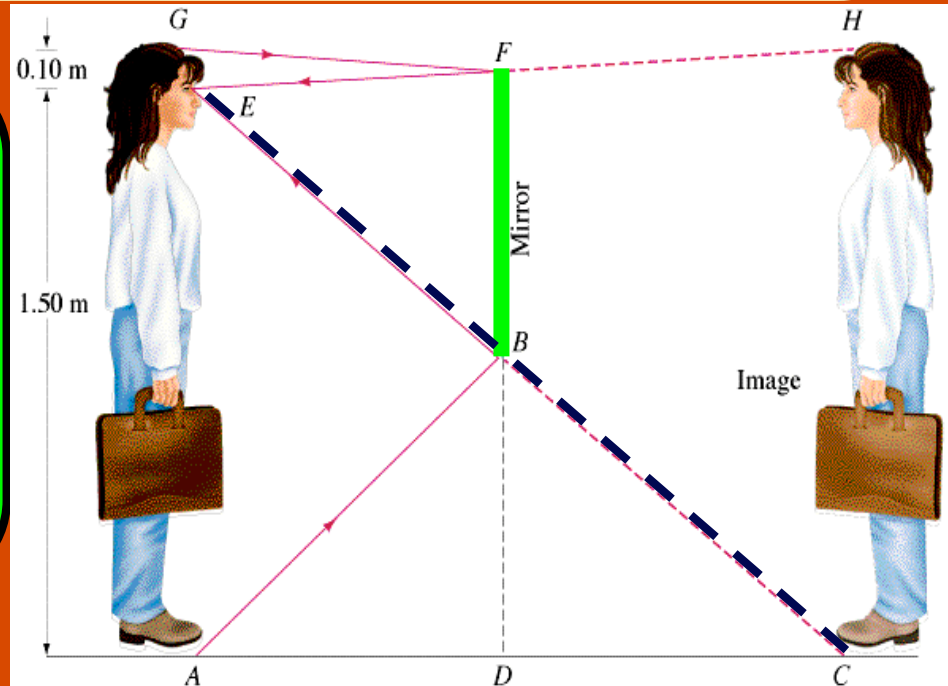


## ConceptTest 23.2b Mirror II

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- 1) same as your height
- 2) less than your full height but more than half your height
- 3) half your height
- 4) less than half your height
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Trace the light rays from the image's foot to the mirror and then to the eye. Since we know that  $\theta_i = \theta_r$ , you need a **mirror only half your size.**

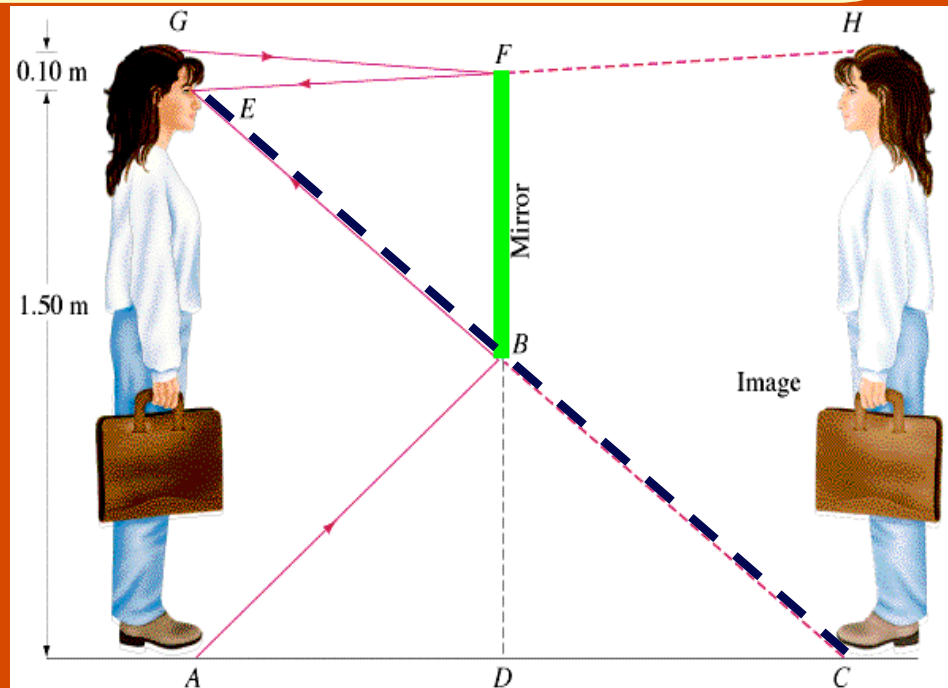


## ConceptTest 23.2c

## Mirror II

Does this depend on your distance from the mirror?

- 1) No.
- 2) Yes.
- 3) Depends on the mirror.
- 4) Depends on the person.





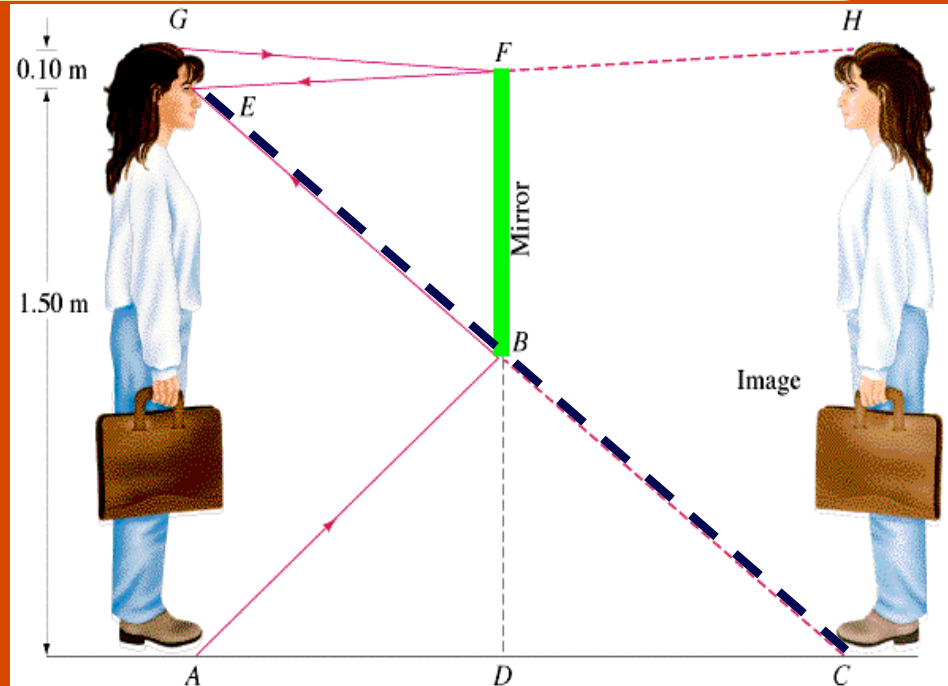
## ConceptTest 23.2c

## Mirror II

Does this depend on your distance from the mirror?

- 1) No.
- 2) Yes.
- 3) Depends on the mirror.
- 4) Depends on the person.

The further you step back, the smaller the incident and reflected angles will be. But the rays will still be reflected at the same points, so the ray from the foot will still be reflected at mid-height.

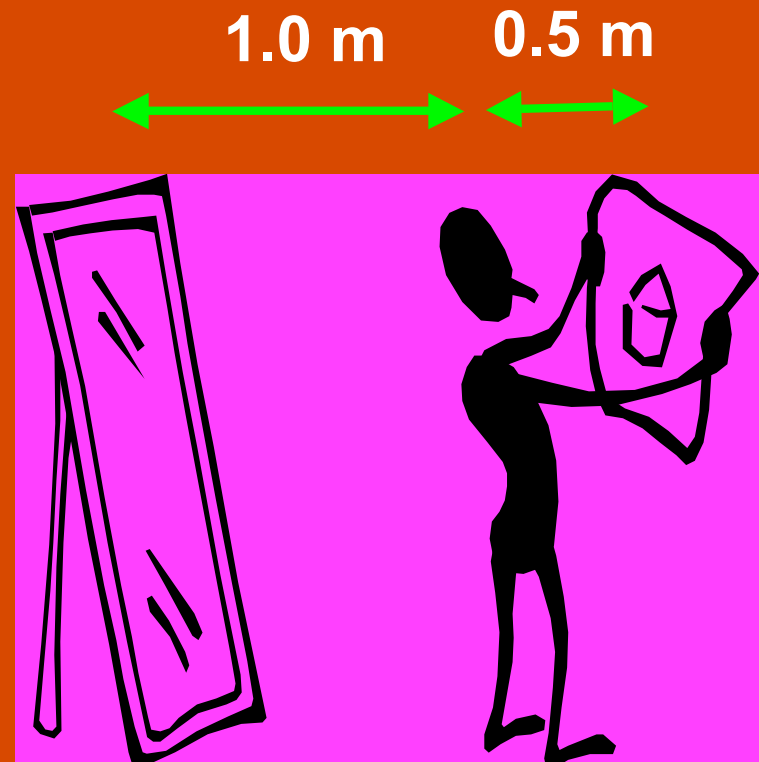


## ConceptTest 23.3

## All Smoke and Mirrors

You hold a hand mirror **0.5 m** in front of you and look at your reflection in a full-length mirror **1 m** behind you. **How far in back of the big mirror do you see the image of your face?**

- 1) 0.5 m
- 2) 1.0 m
- 3) 1.5 m
- 4) 2.0 m
- 5) 2.5 m



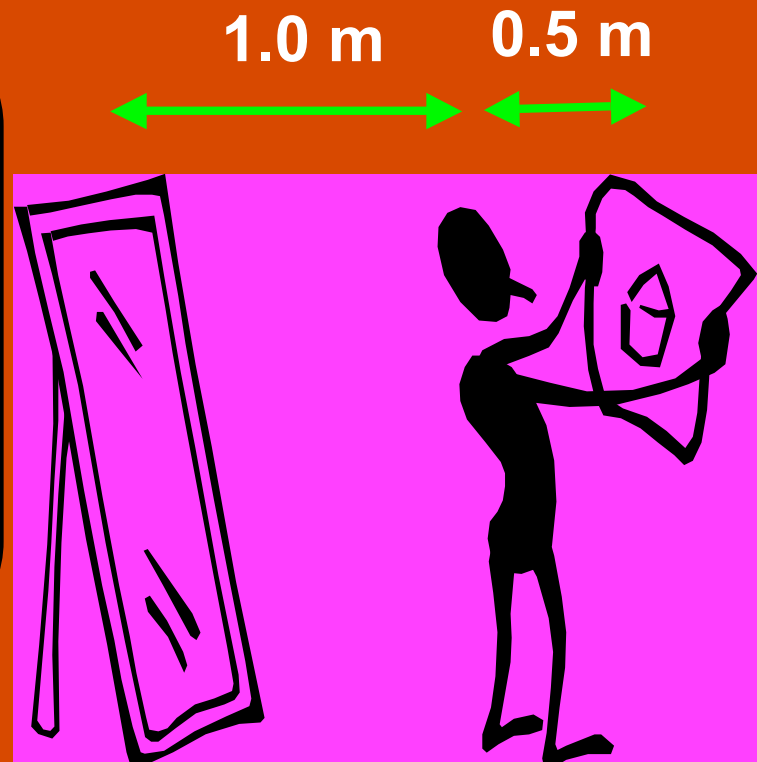
## ConceptTest 23.3

## All Smoke and Mirrors

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- 2) 1.0 m
- 3) 1.5 m
- 4) 2.0 m
- 5) 2.5 m

The image of the face reflected in the small mirror appears **0.5 m** behind the small mirror. This image (which is the *object* for the big mirror) is **2.0 m** away from the big mirror. The final image is **2.0 m** behind the big mirror.

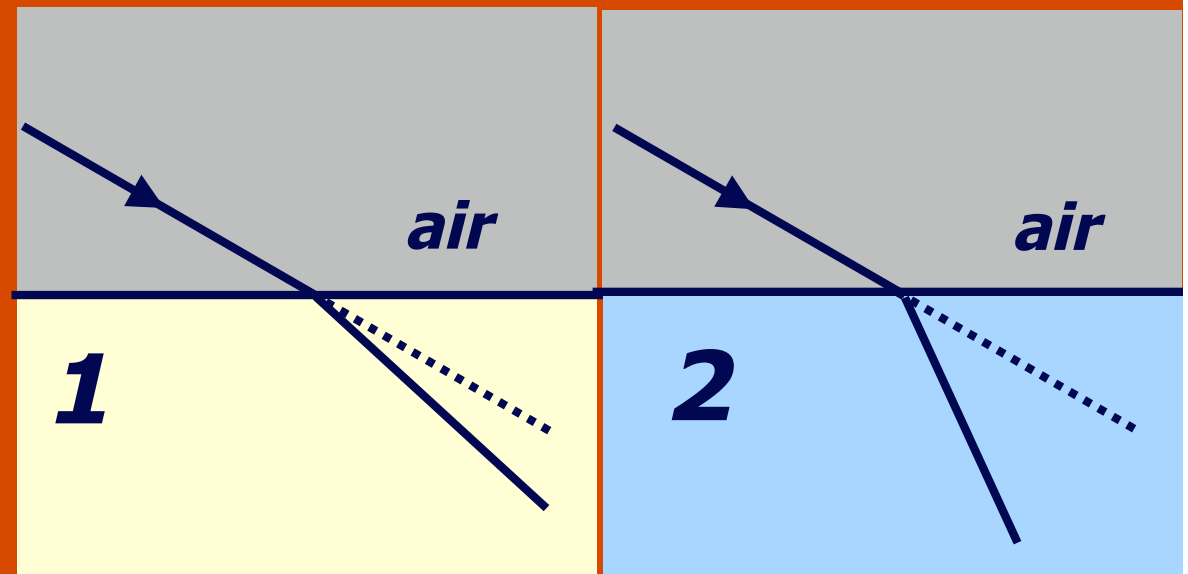


## ConceptTest 23.4a

## Refraction I

Parallel light rays cross interfaces from air into two different media, **1** and **2**, as shown in the figures below. In which of the media is the light traveling **faster**?

- 1) medium 1
- 2) medium 2
- 3) both the same



## ConceptTest 23.4a

## Refraction I

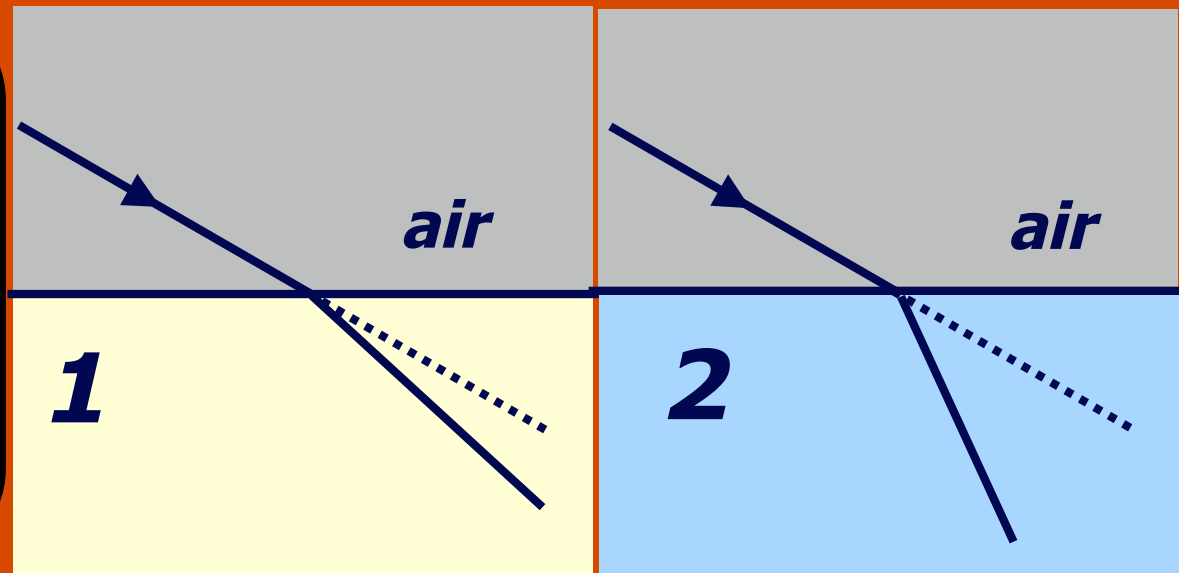
Parallel light rays cross interfaces from air into two different media, **1** and **2**, as shown in the figures below. In which of the media is the light traveling **faster**?

1) medium 1

2) medium 2

3) both the same

The greater the difference in the speed of light between the two media, the greater the bending of the light rays.



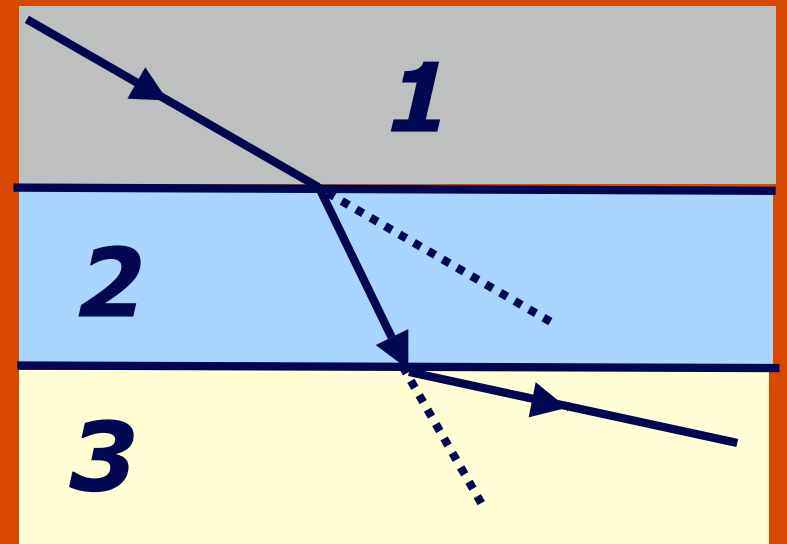
Follow-up: How does the speed in **air** compare to that in **1** or **2**?

## ConceptTest 23.4b

Parallel light rays cross interfaces from medium 1 into medium 2 and then into medium 3. What can we say about the relative sizes of the index of refraction of these media?

## Refraction II

- 1)  $n_1 > n_2 > n_3$
- 2)  $n_3 > n_2 > n_1$
- 3)  $n_2 > n_3 > n_1$
- 4)  $n_1 > n_3 > n_2$
- 5) none of the above



## ConceptTest 23.4b

Parallel light rays cross interfaces from medium 1 into medium 2 and then into medium 3. What can we say about the relative sizes of the index of refraction of these media?

## Refraction II

1)  $n_1 > n_2 > n_3$

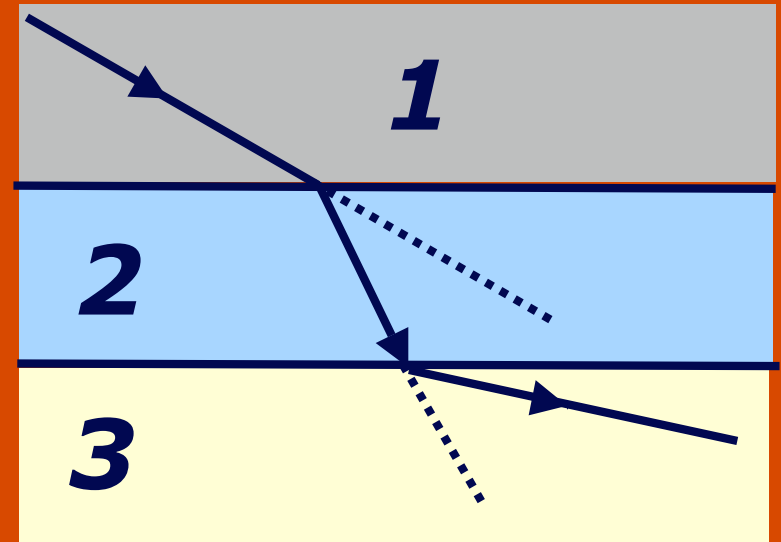
2)  $n_3 > n_2 > n_1$

3)  $n_2 > n_3 > n_1$

4)  $n_1 > n_3 > n_2$

5) none of the above

The rays are bent toward the normal when crossing into #2, so  $n_2 > n_1$ . But rays are bent away from the normal when going into #3, so  $n_3 < n_2$ . How to find the relationship between #1 and #3? Ignore medium #2! So the rays are bent away from the normal if they would pass from #1 directly into #3. Thus, we have:  $n_2 > n_1 > n_3$ .

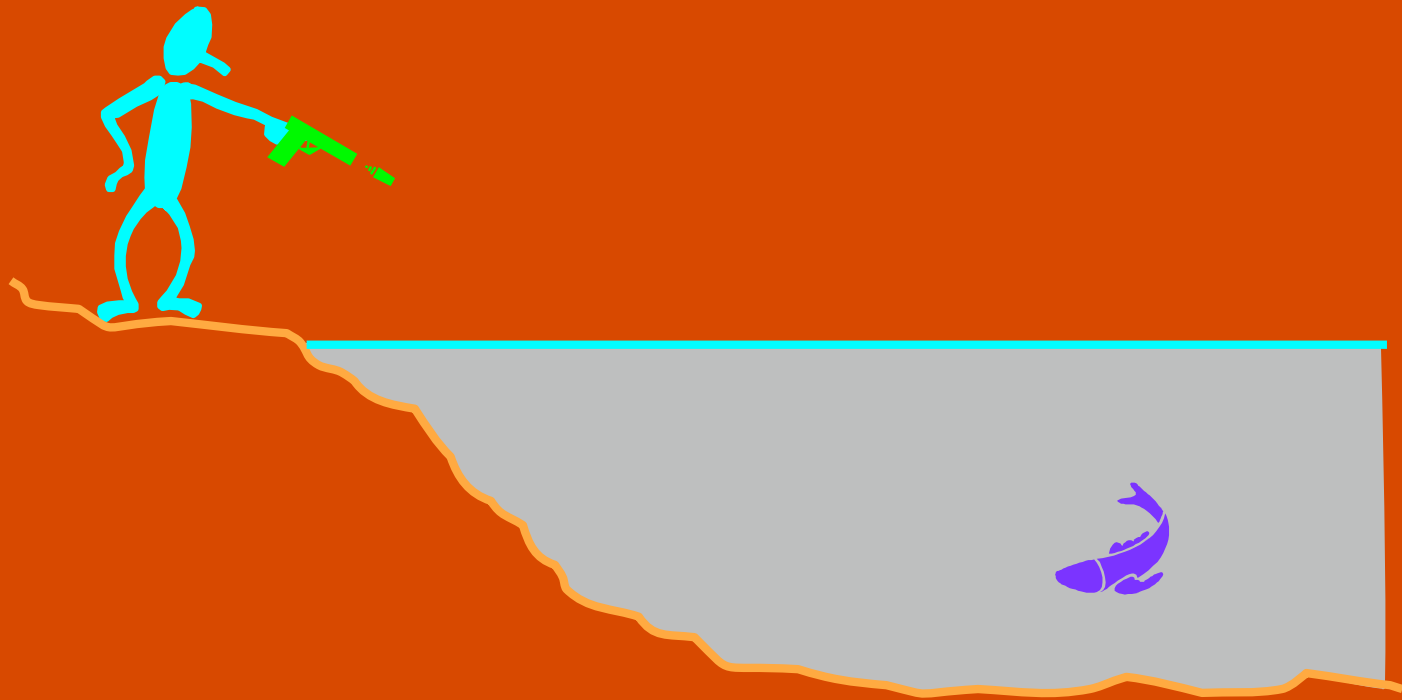


## ConceptTest 23.5a

## Gone Fishin' I

To shoot a fish with a gun, should you aim directly at the image, slightly above, or slightly below?

- 1) aim directly at the image
- 2) aim slightly above
- 3) aim slightly below



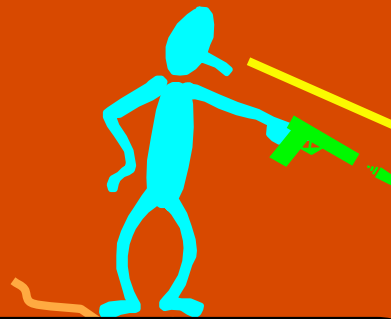


## ConceptTest 23.5a

## Gone Fishin' I

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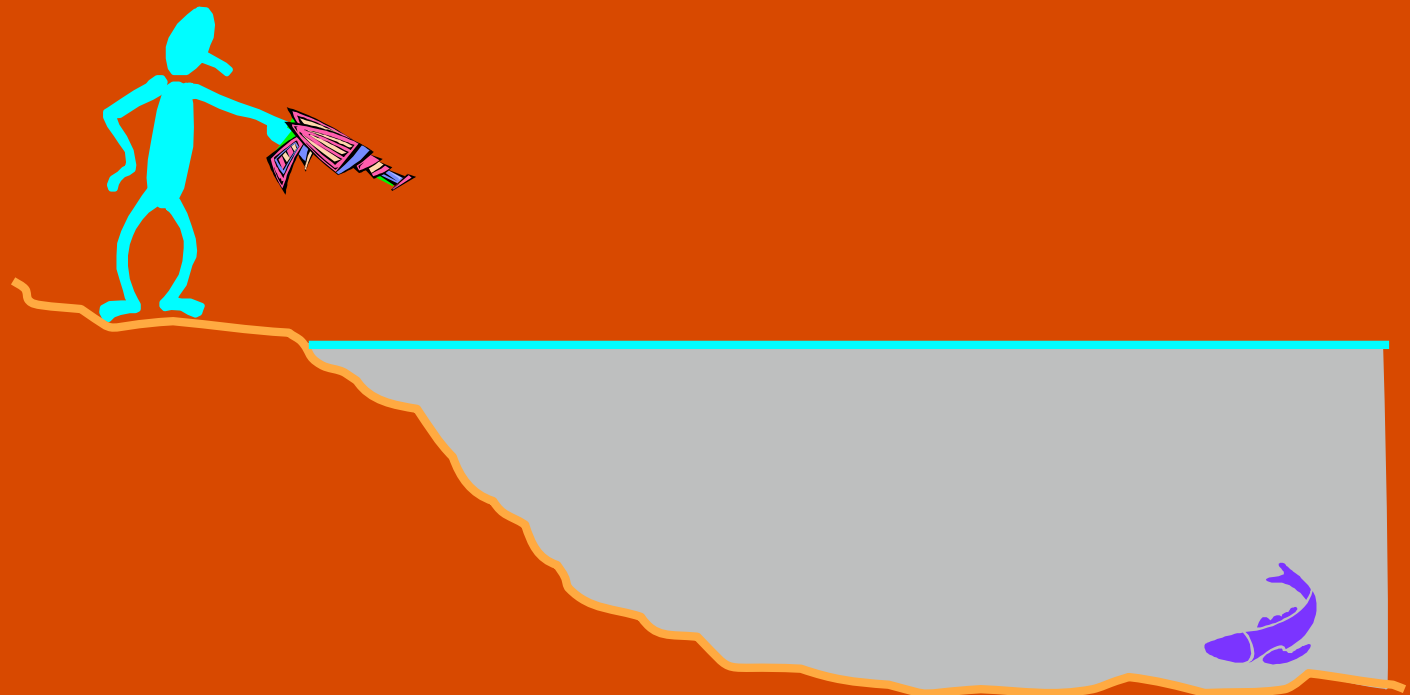
Due to refraction, the image will appear higher than the actual fish, so you have to aim lower to compensate.

## ConceptTest 23.5b

## Gone Fishin' II

To shoot a fish with a *laser gun*, should you aim directly at the image, slightly above, or slightly below?

- 1) aim directly at the image
- 2) aim slightly above
- 3) aim slightly below

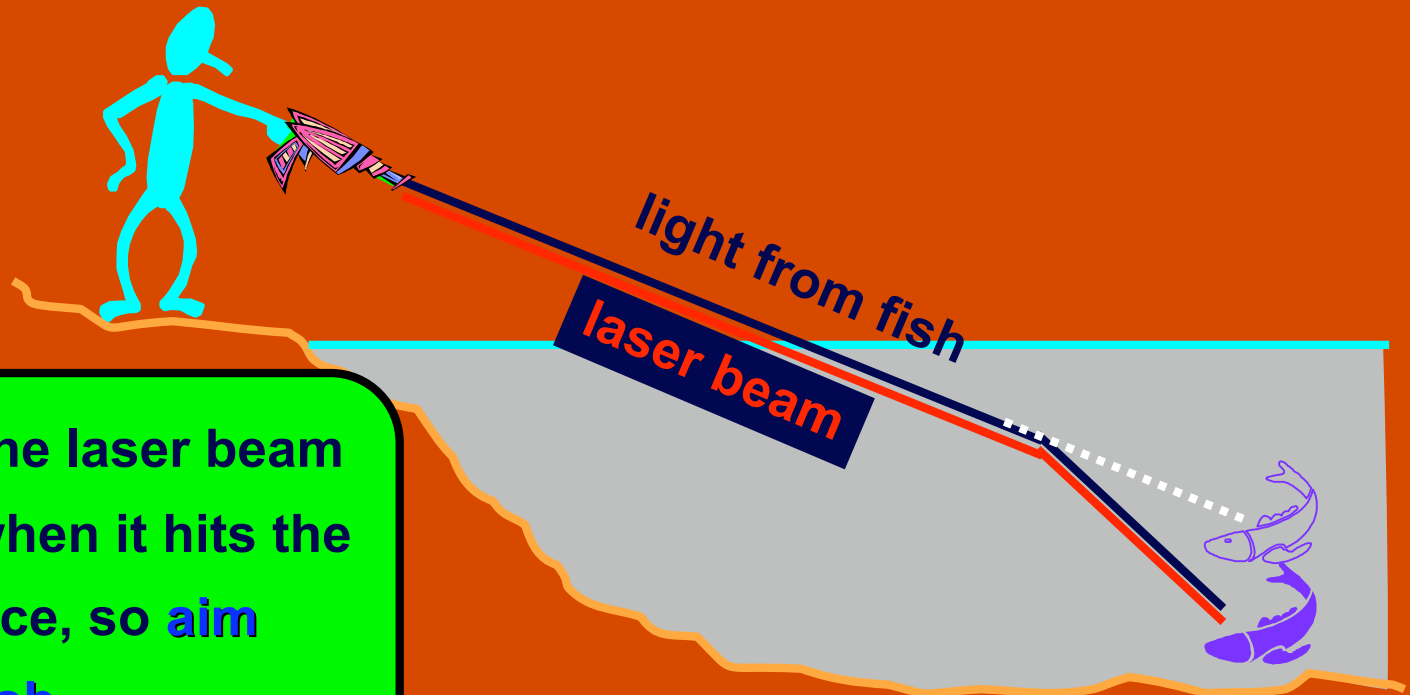


## ConceptTest 23.5b

## Gone Fishin' II

To shoot a fish with a *laser gun*, should you aim directly at the image, slightly above, or slightly below?

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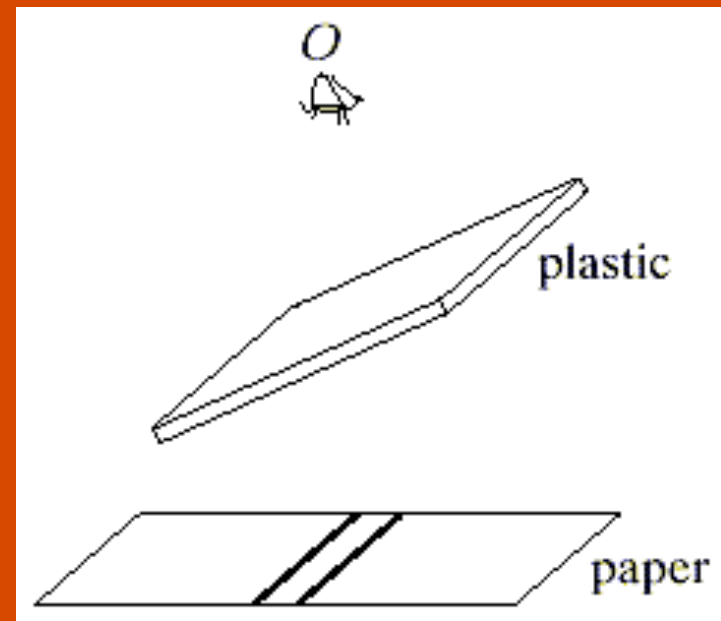
The light from the laser beam will also bend when it hits the air-water interface, so aim directly at the fish.

## ConceptTest 23.6

## Parallel Lines

An observer views two closely spaced lines through an angled piece of glass. To the observer, the lines appear:

- 1) shifted to the right
- 2) shifted to the left
- 3) spaced farther apart
- 4) spaced closer together
- 5) no change – same as before



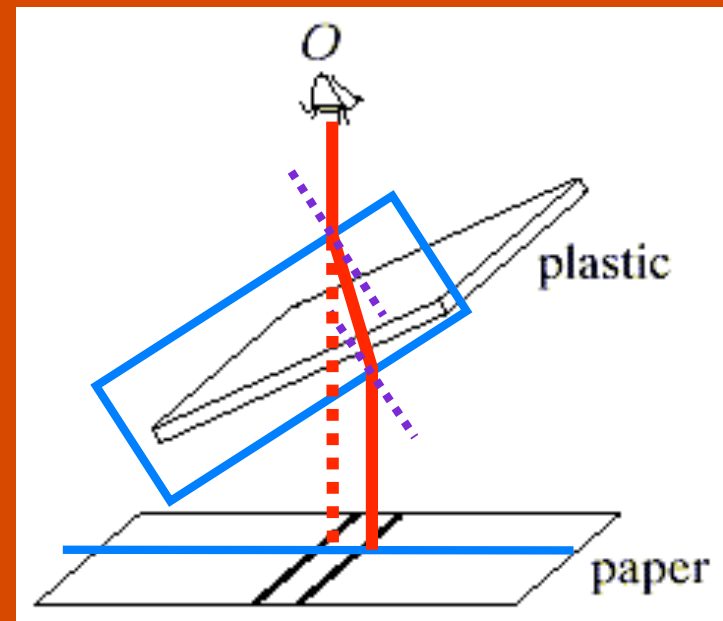
## ConceptTest 23.6

## Parallel Lines

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- 5) no change – same as before

The light rays get refracted twice, so they remain parallel, but they shift to the left, as seen in the figure. Their relative spacing does not change, just the overall position.



**Follow-up:** What happens when the top glass moves toward the bottom glass?