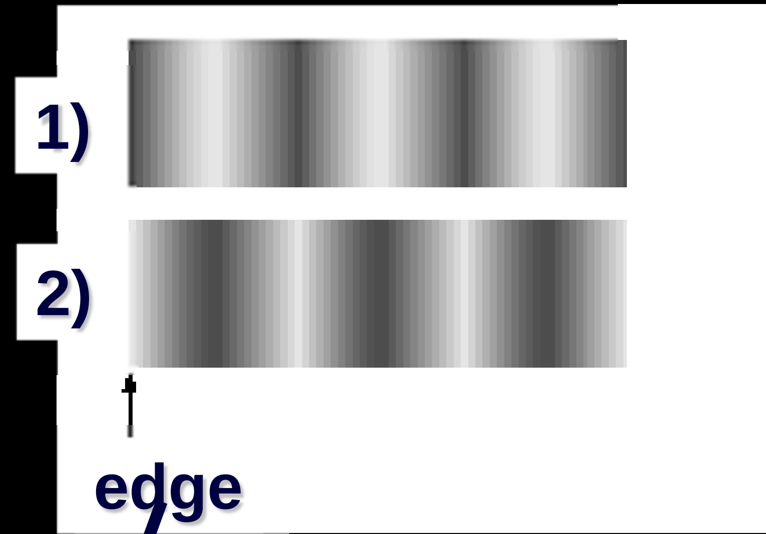
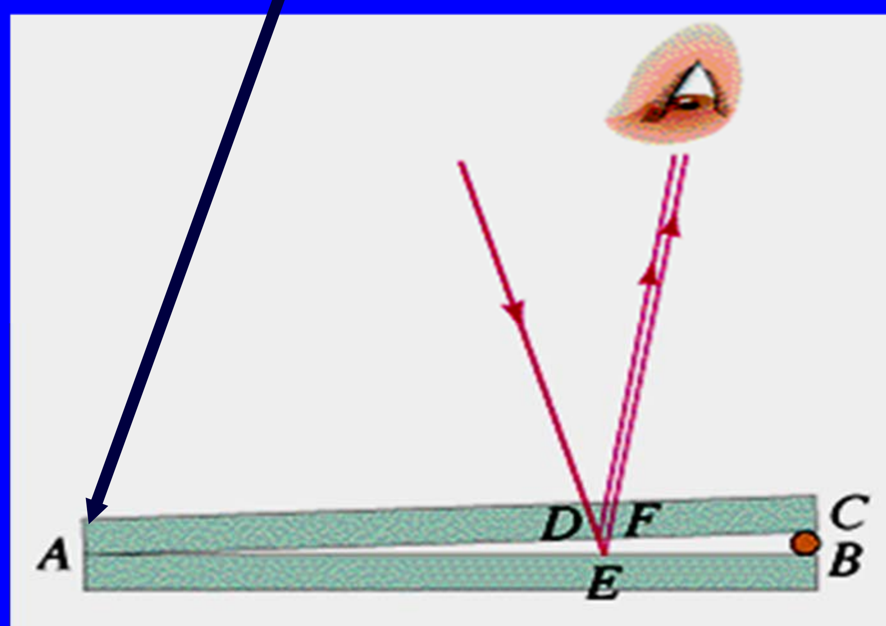
ConcepTest 34.6b Parallel Slides II

A laser shines on a pair of identical glass microscope slides that form a very narrow edge. The waves reflected from the top and the bottom slide interfere. What is the interference pattern from top view?





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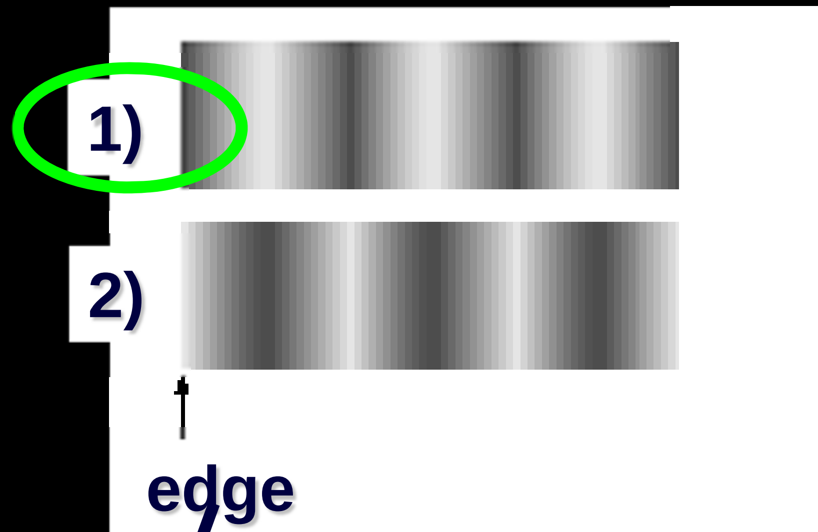
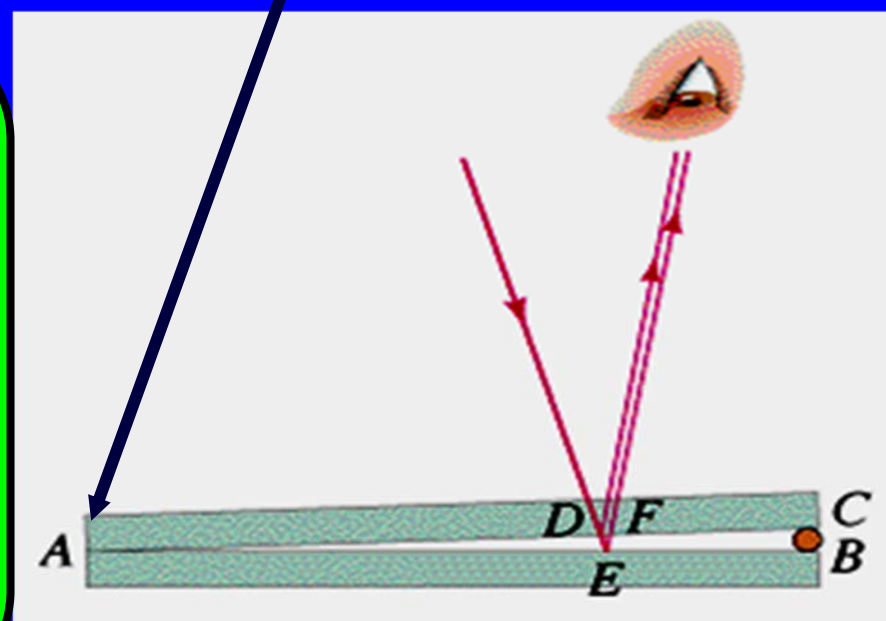


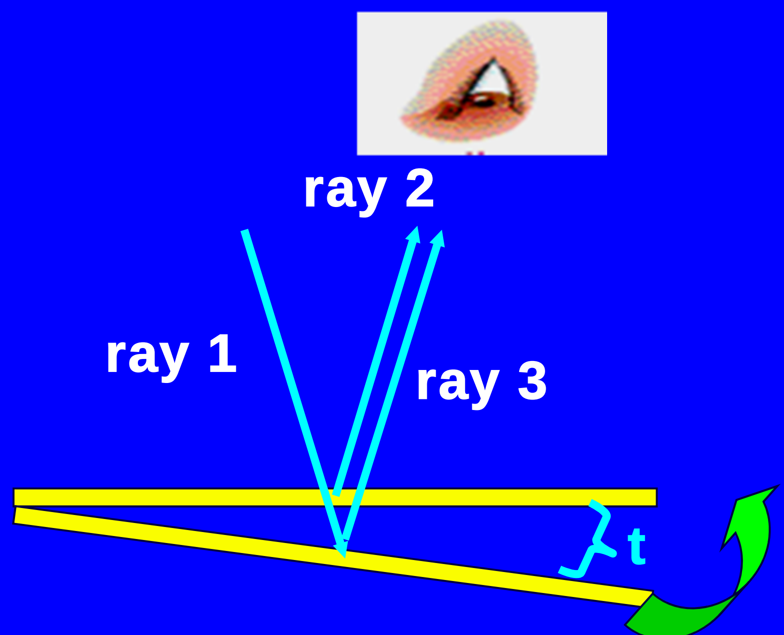
Right at the edge, the two reflected rays have ***no path length difference*** and therefore should interfere ***constructively***. However, the light ray reflected at the lower surface (point E) ***changes phase by λ/2*** because the index of refraction of glass is larger than that of air.



ConcepTest 34.6c Parallel Slides III

Consider two identical microscopic slides in air illuminated with light from a laser. The bottom slide is rotated upward so that the wedge angle gets a bit smaller. What happens to the interference fringes?

1) spaced farther apart
2) spaced closer together
3) no change



ConcepTest 34.6c Parallel Slides III

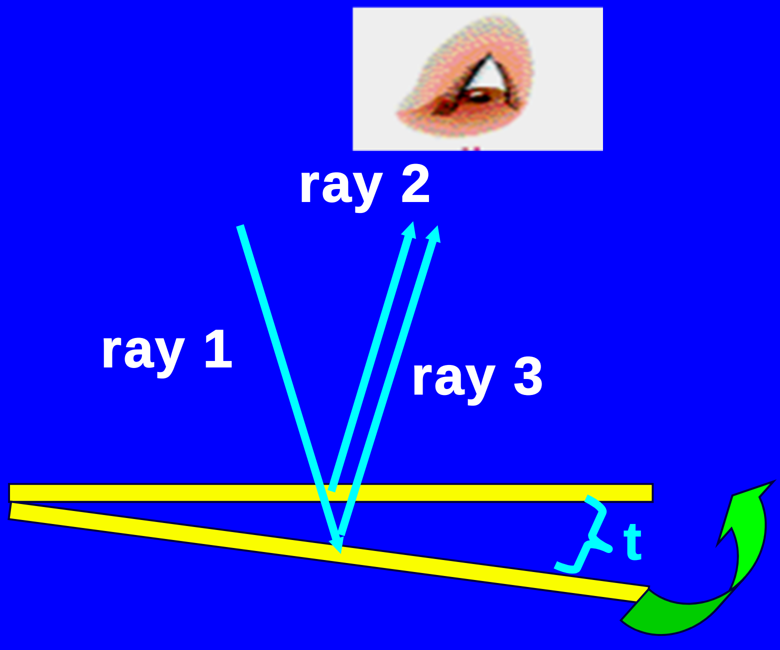
Consider two identical microscopic slides in air illuminated with light from a laser. The bottom slide is rotated upward so that the wedge angle gets a bit smaller. What happens to the interference fringes?

1) spaced farther apart
2) spaced closer together
3) no change

The path difference between ray 2 and ray 3 is $2t$ (in addition, ray 3 experiences a phase change of 180°). Thus, the dark fringes will occur for:

$$2t = m\lambda \qquad m = 0,1,2,\ldots$$

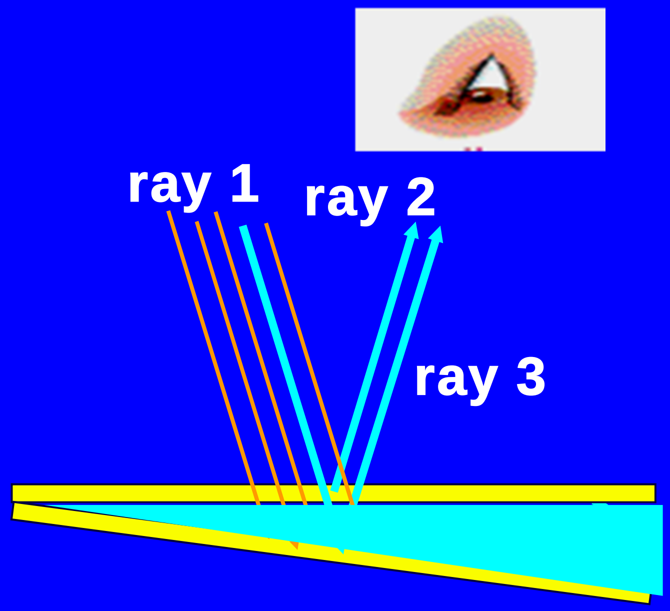
If t gets smaller, ray 2 and ray 3 have to be farther apart before they can interfere, so the fringes move apart.



ConcepTest 34.6d Parallel Slides IV

Two identical microscope slides in air illuminated with light from a laser are creating an interference pattern. The space between the slides is now filled with water (*n* = 1.33). What happens to the interference fringes?

1) spaced farther apart
2) spaced closer together
3) no change



ConcepTest 34.6d Parallel Slides IV

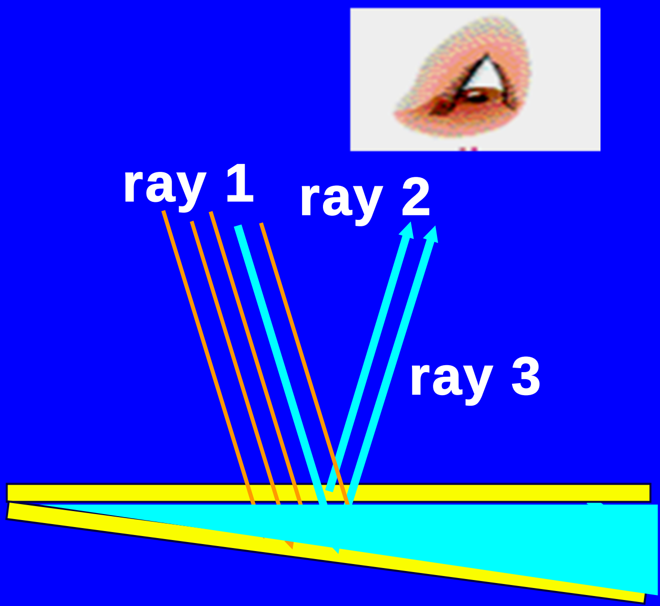
Two identical microscope slides in air illuminated with light from a laser are creating an interference pattern. The space between the slides is now filled with water (n=1.33). What happens to the interference fringes?

1) spaced farther apart
2) spaced closer together
3) no change

The path difference between ray 2 and ray 3 is $2t$ (in addition, ray 3 experiences a phase change of 180°). Thus, the dark fringes will occur for:

$$2t = m\lambda_{water} \quad \text{where } \lambda_{water} = \lambda_{air}/n$$

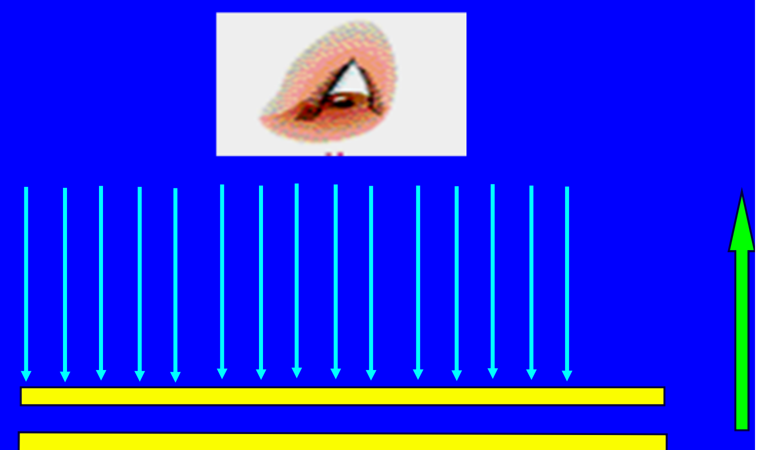
Thus, the water has decreased the wavelength of the light.



ConcepTest 34.6a Parallel Slides I

Consider two identical microscope slides in air illuminated with light from a laser. The slides are exactly parallel, and the top slide is moving slowly upward. What do you see when looking from the top view?

1) all black
2) all white
3) fringes moving apart
4) alternately all black, then all bright



ConcepTest 34.6a Parallel Slides I

Consider two identical microscope slides in air illuminated with light from a laser. The slides are exactly parallel, and the top slide is moving slowly upward. What do you see when looking from the top view?

1) all black
2) all white
3) fringes moving apart
4) alternately all black, then all bright

As the distance between the two slides decreases, the path difference between the interfering rays changes. Thus, the phase between the interfering rays keeps changing, alternately ***in phase (constructive)*** and ***out of phase (destructive)*** as the top slide moves.