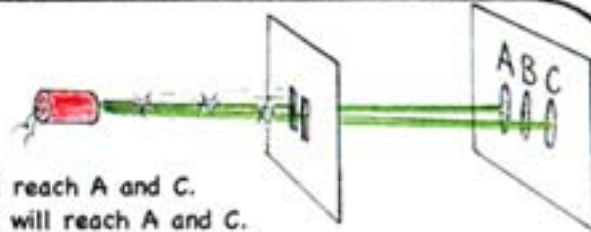


FIGURING PHYSICS



A few thousand photons are fired one at a time from a monochromatic light source at a pair of closely spaced slits. The target area has three photo detectors, A, B, and C. Detectors A and C are in the line of sight of the source and slits, with B midway between. Which of the following can be stated with certainty or near-certainty?

- A. All photons will reach A and C.
- B. Lots of photons will reach A and C.
- C. None will reach A and C.
- D. All photons will reach B.
- E. Lots of photons will reach B.
- F. None will reach B.
- G. None of the above.

Answer E.

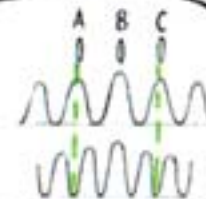
If photons traveled like bullets they'd certainly reach detectors A and C, but not B. But photons travel as waves. The wave character of each individual photon passing through both slits is evident in the interference pattern of light and dark fringes produced on the screen behind. Without more information about distances and wavelength, we can't say whether A and C will be in fringes of light (constructive interference) or in fringes of dark (destructive interference), or in between. How many photons reach A and C is uncertain. What *is* certain* is that lots of photons reach B. Why? Because B is equidistant from the two slits where constructive interference occurs, regardless of wavelength. So only E is a valid answer.

*Or "near-certain" because a quantum statistical fluke could result in no photons at B.

Interestingly, no photons at all may arrive where classical physics says they all should arrive: Light travels as a wave and hits like a particle.



Two possible intensity patterns:
(Top one) Light nicely reaches A and C.
(Below) Almost no light reaches A and C.
B is always at maximum intensity.



Hewitt
Drew it!