

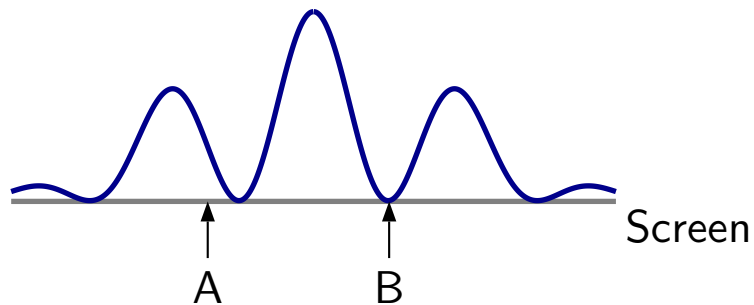
# Warm Up Question 1

Two beams of electromagnetic radiation (similar to beams of light), one ultraviolet light and the other infrared light, have the same power. Each of these are incident upon the same type of molecule. The bonds in the molecule can only be separated if the energy of an incident photon exceeds the bond energy of the molecule. Which beam of light (ultraviolet or infrared) is more likely to be able to split the molecule? Explain your answer.

1. Ultraviolet. It has a shorter wavelength and  $E = hc/\lambda$ .
2. Infrared. It has the smaller frequency.

# Question 1

Photons are fired toward a double slit arrangement. The probability distribution for arrival at various locations on a screen is as illustrated. Consider the two illustrated locations.

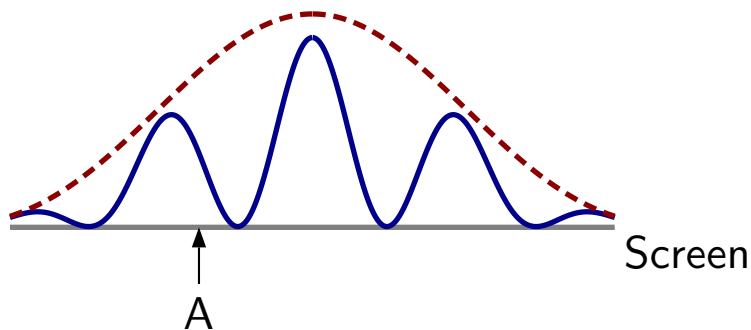


Which of the following is true?

1. Photons will never arrive at A but will sometimes arrive at B.
2. Photons will never arrive at B but will sometimes arrive at A.
3. Photons could arrive at either A or B; they are more likely to arrive at A.
4. Photons could arrive at either A or B; they are more likely to arrive at B.
5. Photons will always arrive at B.

## Question 2

Neutrons are fired toward a barrier/slit arrangement and arrive at a screen. The probability distribution for arrival at various locations depends on the barrier/slit arrangement. A double slit produces the solid dark blue probability distribution. A single slit produces the dashed dark red distribution.

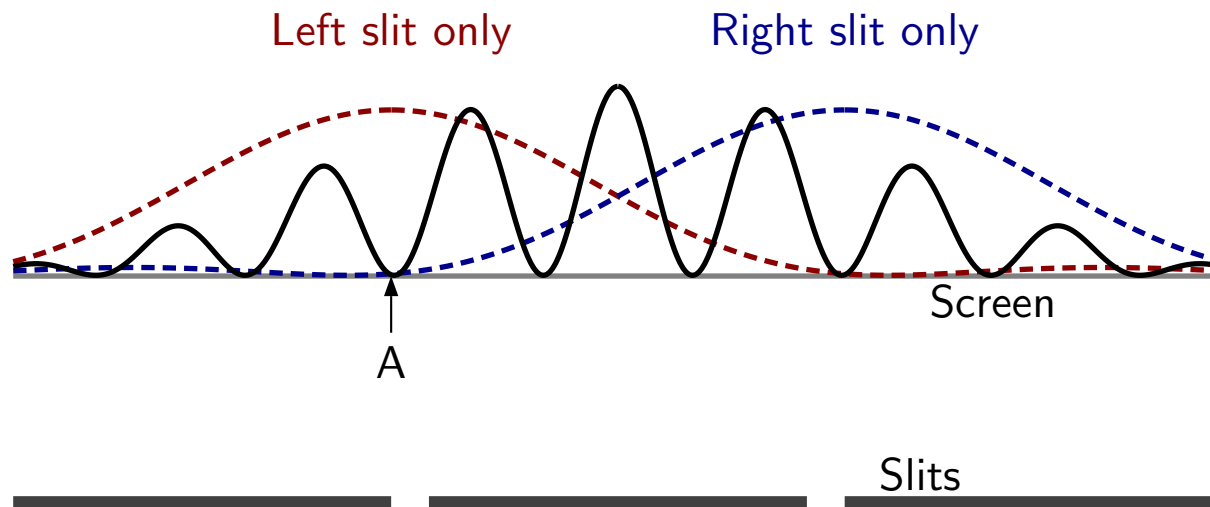


Which of the following is true?

1. Single slit  $\Rightarrow$  neutron definitely arrives at A.  
Double slit  $\Rightarrow$  neutron definitely arrives at A.
2. Single slit  $\Rightarrow$  neutron could arrive at A.  
Double slit  $\Rightarrow$  neutron could arrive at A.
3. Single slit  $\Rightarrow$  neutron never arrives at A.  
Double slit  $\Rightarrow$  neutron never arrives at A.
4. Single slit  $\Rightarrow$  neutron could arrive at A.  
Double slit  $\Rightarrow$  neutron never arrives at A.

# Particle Interference

Compare probabilities when both slits are open (solid curve) versus when only one slit is open (dashed curves).



Opening a second slit can reduce the arrival probability!

## Warm Up Question 2

Electrons and neutrons are each fired, with the same speed, through a barrier with two slits. The particles strike a screen which produces a pattern such as that of Fig 28.14. This pattern is identical to that produced by light passing through a similar barrier and the locations of the bright bands are found by using a equation 17.8 (this works for any kind of wave). For which type of particle are the bright bands spread out more? Explain your answer.

1. Electrons. Smaller mass means larger wavelength:  $\lambda = \frac{h}{mv}$ .
2. Electrons. They are negatively charged and repel.
3. Same for either.
4. Neutrons. These have a larger wavelength.