Multiple Choice

17.1 Understanding Diffraction and Interference 14.

Which remains unchanged when a monochromatic beam of light passes from air into water?

a. the speed of the light
b. the direction of the beam
c. the frequency of the light
d. the wavelength of the light

15.

Two slits are separated by a distance of 3500 nm . If light with a wavelength of 500 nm passes through the slits and produces an interference pattern, the m = _____ order minimum appears at an angle of 30.0°.

a. 0
b. 1
c. 2
d. 3

16.

In the sunlight, the shadow of a building has fuzzy edges even if the building does not. Is this a refraction effect? Explain.

a. Yes, this is a refraction effect, where every point on the building acts as the origin for a new wavefront.
b. Yes, this is a refraction effect, where the whole building acts as the origin for a new wavefront.
c. No, this is a diffraction effect, where every point on the edge of the building's shadow acts as the origin for a new wavefront.
d. No, this is a diffraction effect, where the whole building acts as the origin for a new wavefront.

17.2 Applications of Diffraction, Interference, and Coherence 17.

Two images are just resolved when the center of the diffraction pattern of one is directly over _____ of the diffraction pattern of the other.

a. the center
b. the first minimum
c. the first maximum
d. the last maximum

18.

Two point sources of 500\, \text{nm} light are just resolvable as they pass through a small hole. The angle to the first minimum of one source is 0.100\,\text{rad}. What is the diameter of the hole?

a.
b.
c.
d.

19.

Will a beam of light shining through a 1-mm hole behave any differently than a beam of light that is 1 mm wide as it leaves its source? Explain.?

a. Yes, the beam passing through the hole will spread out as it travels, because it is diffracted by the edges of the hole, whereas the 1 -mm beam, which encounters no diffracting obstacle, will not spread out.
b. Yes, the beam passing through the hole will be made *more parallel* by passing through the hole, and so will not spread out as it travels, whereas the unaltered wavefronts of the 1-mm beam will cause the beam to spread out as it travels.
c. No, both beams will remain the same width as they travel, and they will not spread out.
d. No, both beams will spread out as they travel.

20.

A laser pointer emits a coherent beam of parallel light rays. Does the light from such a source spread out at all? Explain.

a. Yes, every point on a wavefront is not a source of wavelets, which prevent the spreading of light waves.
b. No, every point on a wavefront is not a source of wavelets, so that the beam behaves as a bundle of rays that travel in their initial direction.
c. No, every point on a wavefront is a source of wavelets, which keep the beam from spreading.
d. Yes, every point on a wavefront is a source of wavelets, which cause the beam to spread out steadily as it moves forward.