Name: _____ Date: _____

___ **1.** If we increase the wavelength of the light used to form a double-slit diffraction pattern:
- **A)** the width of the central diffraction peak increases and the number of bright fringes within the peak increases
- **B)** the width of the central diffraction peak increases and the number of bright fringes within the peak decreases
- **C)** the width of the central diffraction peak decreases and the number of bright fringes within the peak increases
- **D)** the width of the central diffraction peak decreases and the number of bright fringes within the peak decreases
- **E)** the width of the central diffraction peak increases and the number of bright fringes within the peak stays the same

___ **2.** When a highly coherent beam of light is directed against a very fine wire, the shadow formed behind it is not just that of a single wire but rather looks like the shadow of several parallel wires. The explanation of this involves:
- **A)** refraction
- **B)** diffraction
- **C)** reflection
- **D)** the Doppler effect
- **E)** an optical illusion

___ **3.** A diffraction grating of width W produces a deviation θ in second order for light of wavelength λ. The total number N of slits in the grating is given by:
A) $2W\lambda/\sin\theta$ **B)** $(W/\lambda)\sin\theta$ **C)** $\lambda W/2\sin\theta$ **D)** $(W/2\lambda)\sin\theta$ **E)** $2\lambda/\sin\theta$

___ **4.** The dispersion of a diffraction grating indicates:
- **A)** the resolution of the grating
- **B)** the separation of lines of the same order
- **C)** the number of rulings in the grating
- **D)** the width of the lines
- **E)** the separation of lines of different order for the same wavelength

___ **5.** A student wishes to produce a single-slit diffraction pattern in a ripple tank experiment. He considers the following parameters:
1. frequency
2. wavelength
3. water depth
4. slit width

Which two of the above should be decreased to produce more bending?
A) 1, 3 **B)** 1, 4 **C)** 2, 3 **D)** 2, 4 **E)** 3, 4

___ **6.** At the first minimum adjacent to the central maximum of a single-slit diffraction pattern the phase difference between the Huygens wavelet from the top of the slit and the wavelet from the midpoint of the slit is:
A) $\pi/8$ rad **B)** $\pi/4$ rad **C)** $\pi/2$ rad **D)** π rad **E)** $3\pi/2$ rad

___ **7.** A light beam incident on a diffraction grating consists of waves with two different wavelengths. The separation of the two first order lines is great if:
A) the dispersion is great
B) the resolution is great
C) the dispersion is small
D) the resolution is small
E) none of the above (line separation does not depend on either dispersion or resolution)

___ **8.** Two slits in an opaque barrier each have a width of 0.020 mm and are separated by 0.050 mm. When coherent monochromatic light passes through the slits the number of interference maxima within the central diffraction maximum:
A) is 1
B) is 2
C) is 4
D) is 5
E) cannot be determined unless the wavelength is given

___ **9.** Consider a single-slit diffraction pattern caused by a slit of width a. There is a maximum if $\sin\theta$ is equal to:
A) slightly more than $3\lambda/2a$
B) slightly less than $3\lambda/2a$
C) exactly $3\lambda/2a$
D) exactly $\lambda/2a$
E) very nearly $\lambda/2a$

___ **10.** In a double-slit diffraction experiment the number of interference fringes within the central diffraction maximum can be increased by:

A) increasing the wavelength
B) decreasing the wavelength
C) decreasing the slit separation
D) increasing the slit width
E) decreasing the slit width

___ **11.** A diffraction grating just resolves the wavelengths 400.0 nm and 400.1 nm in first order. The number of slits in the grating is:

A) 400 **B)** 1000 **C)** 2500 **D)** 4000 **E)** not enough information is given

___ **12.** What is the minimum number of slits required in a diffraction grating to just resolve light with wavelengths of 471.0 nm and 471.6 nm?

A) 99 **B)** 197 **C)** 393 **D)** 786 **E)** 1179

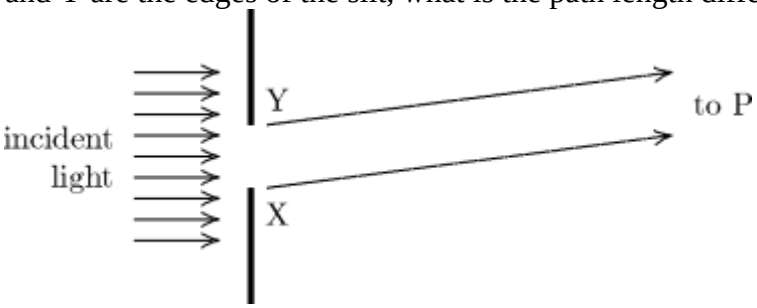
___ **13.** Radio waves are readily diffracted around buildings whereas light waves are negligibly diffracted around buildings. This is because radio waves:

A) are plane polarized
B) have much longer wavelengths than light waves
C) have much shorter wavelengths than light waves
D) are nearly monochromatic (single frequency)
E) are amplitude modulated (AM).

___ **14.** In the equation $\sin\theta = \lambda/a$ for single-slit diffraction, θ is:

A) the angle to the first minimum
B) the angle to the second maximum
C) the phase angle between the extreme rays
D) $N\pi$ where N is an integer
E) $(N + 1/2)\pi$ where N is an integer

___ **15.** The diagram shows a single slit with the direction to a point P on a distant screen shown. At P, the pattern has its second minimum (from its central maximum). If X and Y are the edges of the slit, what is the path length difference (PX) - (PY)?



A) λ/2 **B)** λ **C)** 3λ/2 **D)** 2λ **E)** 5λ/2

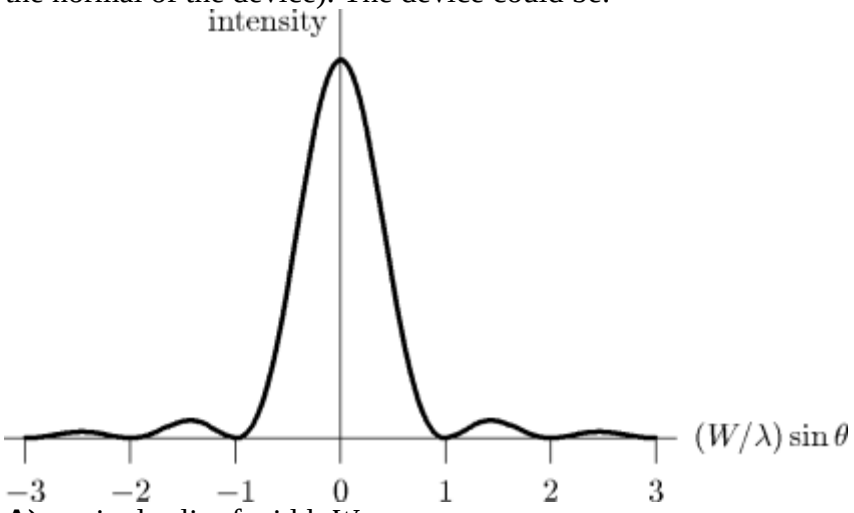
___ **16.** 600-nm light is incident on a diffraction grating with a ruling separation of 1.7×10^{-6} m. The second order line occurs at a diffraction angle of:
A) 0 **B)** 10º **C)** 21º **D)** 42º **E)** 45º

___ **17.** When 450-nm light is incident normally on a certain double-slit system the number of interference maxima within the central diffraction maximum is 5. When 900-nm light is incident on the same slit system the number is:
A) 2 **B)** 3 **C)** 5 **D)** 9 **E)** 10

___ **18.** The rainbow seen after a rain shower is caused by:
A) diffraction **B)** interference **C)** refraction **D)** polarization **E)** absorption

___ **19.** In the equation $\phi = (2\pi a/\lambda) \sin \theta$ for single-slit diffraction, ϕ is:
A) the angle to the first minimum
B) the angle to the second maximum
C) the phase angle between the extreme rays
D) $N\pi$ where N is an integer
E) $(N + 1/2)\pi$ where N is an integer

___ **20.** Light of wavelength λ is normally incident on some plane optical device. The intensity pattern shown is observed on a distant screen (θ is the angle measured from the normal of the device). The device could be:



A) a single slit of width W
B) a single slit of width $2W$
C) two narrow slits with separation W
D) two narrow slits with separation $2W$
E) a diffraction grating with slit separation W

Answer Key

1. E
Origin: Chapter 37- Diffraction, 29
2. B
Origin: Chapter 37- Diffraction, 5
3. D
Origin: Chapter 37- Diffraction, 47
4. B
Origin: Chapter 37- Diffraction, 60
5. B
Origin: Chapter 37- Diffraction, 12
6. D
Origin: Chapter 37- Diffraction, 17
7. A
Origin: Chapter 37- Diffraction, 61
8. D
Origin: Chapter 37- Diffraction, 31
9. B
Origin: Chapter 37- Diffraction, 23
10. E
Origin: Chapter 37- Diffraction, 33
11. D
Origin: Chapter 37- Diffraction, 64
12. C
Origin: Chapter 37- Diffraction, 65
13. B
Origin: Chapter 37- Diffraction, 2
14. A
Origin: Chapter 37- Diffraction, 9
15. D
Origin: Chapter 37- Diffraction, 15
16. E
Origin: Chapter 37- Diffraction, 41
17. C
Origin: Chapter 37- Diffraction, 32
18. C
Origin: Chapter 37- Diffraction, 4
19. C
Origin: Chapter 37- Diffraction, 10
20. A
Origin: Chapter 37- Diffraction, 53