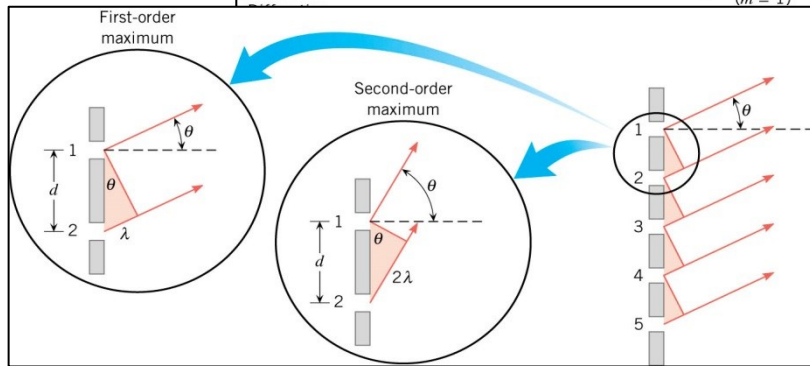
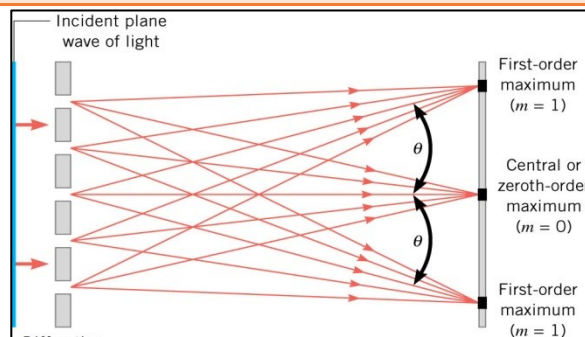


Diffraction Grating

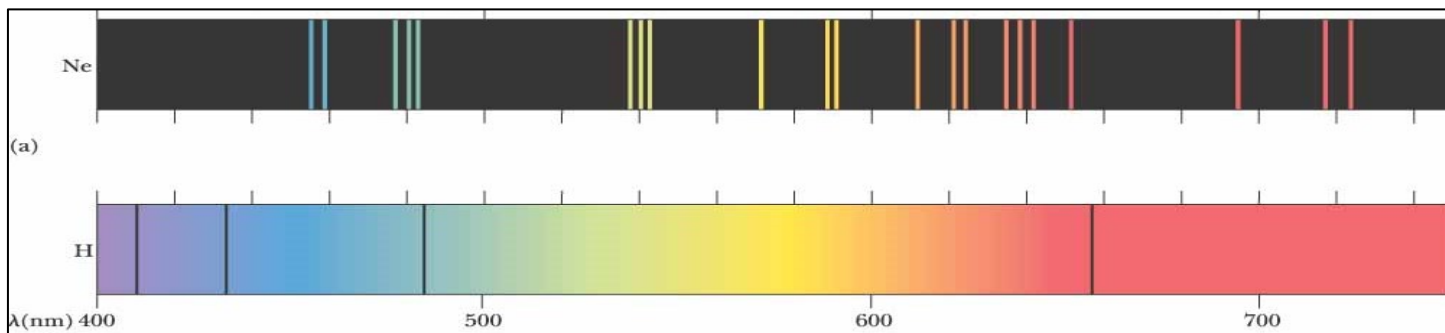
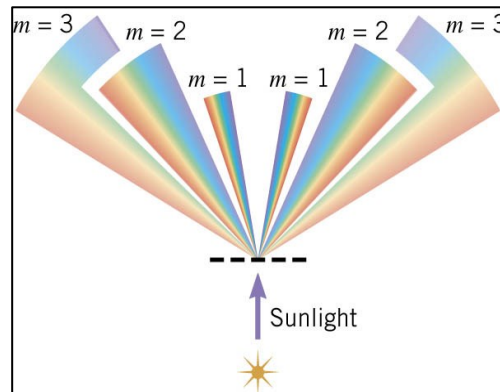
- Arrangement of many _____ spaced _____
- As many as _____ slits per cm
- Produces _____ patterns
- The light _____ are essentially _____.
- The principal _____ occur when light from one slit travels _____ more to meet light from a _____ slit producing _____ interference.
- Principal _____

$$\sin \theta = m \frac{\lambda}{d}$$

A laser which produces 650 nm light shines through a diffraction grating. An interference pattern is produced on a screen 50 cm away. The distance on the screen between the second order maxima and the center is 13.5 cm. What is the slit separation in the grating?



- Diffraction gratings produce _____, more _____ maxima, but have small _____ maxima in _____.
- Splitting colors
 - Each _____ of light is a different _____, so each color bends a different _____.
 - Which color bends the most? _____
 - Which color bends the least? _____
- Application - Determining Elements in Stars
 - Each _____ in a hot gas _____ or _____ certain _____ of light.
 - By using a diffraction _____ the light can be _____ and the wavelengths _____.



Practice Work

1. What is the advantage of a diffraction grating over a double slit in dispersing light into a spectrum?
2. What are the advantages of a diffraction grating over a prism in dispersing light for spectral analysis?
3. A diffraction grating has 2000 lines per centimeter. At what angle will the first-order maximum be for 520-nm wavelength green light? (OpenStax 27.21) **5.97°**
4. Find the angle for the third-order maximum for 580-nm wavelength yellow light falling on a diffraction grating having 1500 lines per centimeter. (OpenStax 27.22) **15.1°**
5. How many lines per centimeter are there on a diffraction grating that gives a first-order maximum for 470-nm blue light at an angle of 25.0°? (OpenStax 27.23) **8.99×10^3 lines/cm**
6. What is the distance between lines on a diffraction grating that produces a second-order maximum for 760-nm red light at an angle of 60.0°? (OpenStax 27.24) **1.76×10^{-6} m**
7. Calculate the wavelength of light that has its second-order maximum at 45.0° when falling on a diffraction grating that has 5000 lines per centimeter. (OpenStax 27.25) **707 nm**
8. What is the maximum number of lines per centimeter a diffraction grating can have and produce a complete first order spectrum for visible light? (OpenStax 27.28) **13300 lines/cm**
9. What is the spacing between structures in a feather that acts as a reflection grating, given that they produce a first order maximum for 525-nm light at a 30.0° angle? (OpenStax 27.30) **1.05×10^{-6} m**
10. A He-Ne laser beam is reflected from the surface of a CD onto a wall. The brightest spot is the reflected beam at an angle equal to the angle of incidence. However, fringes are also observed. If the wall is 1.50 m from the CD, and the first fringe is 0.600 m from the central maximum, what is the spacing of grooves on the CD? (OpenStax 27.38) **1.70×10^{-6} m**