20-2. An excited state of the lasing material is pumped to a high population by light, an electric discharge, or other means. Photons emitted when the excited state decays to a less populated lower state stimulate emission from other excited molecules. The stimulated emission has the same energy and phase as the incident photon. In the laser cavity most light is retained by reflective end mirrors. Some light is allowed to escape from one end.

20-5. To remove higher order diffraction (different wavelengths) at the same angle as the desired diffraction.

20-10. (a) $\text{Resolution} = \dfrac{\lambda}{\Delta\lambda} = \dfrac{512.245}{0.03} = 1.7 \times 10^4$

(b) $\Delta\lambda = \dfrac{\lambda}{10^4} = \dfrac{512.23}{10^4} = 0.05 \text{ nm}$

(c) $\text{Resolution} = nN = (4)(8.00 \text{ cm} \times 1\,850 \text{ cm}^{-1}) = 5.9 \times 10^4$

(d) $250 \text{ lines/mm} = 4 \text{ μm/line} = d$

$$\frac{\Delta\phi}{\Delta\lambda} = \frac{n}{d \cos \phi} = \frac{1}{(4 \text{ μm}) \cos 3^\circ} = 0.250 \frac{\text{radians}}{\text{μm}} = 14.3^\circ/\text{μm}$$

For $\Delta\lambda = 0.03$ nm, $\Delta\phi = (14.3^\circ/\text{μm})(3 \times 10^{-5} \text{ μm}) = 4.3 \times 10^{-4}$ degrees

For 30th order diffraction, the dispersion will be 30 times greater, or 0.013°.