QUESTION:

Calculate the least width that a grating must have to resolve the components of D lines (5890 and 5896 A) in the second order. The grating has 800 lines per cm

SOLUTION:

Resolvance or "chromatic resolving power" for a device used to separate the wavelengths of light is defined as

$$R = \frac{\lambda}{\Delta\lambda}$$

Where

$$\lambda = \frac{\lambda_1 + \lambda_2}{2}$$

$$\Delta\lambda = \lambda_2 - \lambda_1$$

For grating resolvance is

$$R = mN$$

where N is the total number of slits illuminated and m is the order of the diffraction.

Hence

$$R = \frac{\lambda}{\Delta\lambda} = mN$$

$$N = \frac{\lambda}{m\Delta\lambda} = 491$$

Hence, the width that a grating must have is $l = \dfrac{N}{d} = \dfrac{491}{800} = 0.614\ cm$

ANSWER:
0.614 cm