675.

Problem 47.13 (RHK)

A grating has 315 rulings/mm. *We have to find the wavelengths in the visible spectrum which can be seen in the fifth-order diffraction.*

Solution:

As there are 315 rulings/mm, the grating distance *d* is

$$d = \frac{10^{-3}}{315}\ \text{m} = 3.175\times10^{-6}\ \text{nm} = 3175\ \text{nm}.$$

The range of visible spectrum is $(400-700)$ nm. The grating equation is

$$d\sin\theta = m\lambda.$$

The maximum wavelength that can be seen in the fifth order is determined by substituting $m=5$ and $\sin\theta=\pi/2$ in the grating equation. We note that

$$\lambda_{\max} < \frac{d}{5} = \frac{3175}{5}\ \text{nm} = 635\ \text{nm}.$$

Therefore, we conclude that wavelengths in the range $400\ \text{nm} < \lambda < 635\ \text{nm}$ can be seen in the fifth-order diffraction using the given grating.