Another Way :

Diffraction condition : $\Delta\vec{k} = \vec{G}$

$\Rightarrow |\vec{k}' - \vec{k}| = |\vec{G}|$, $\vec{G} = \frac{2\pi}{a}\hat{x} + \frac{2\pi}{a}\hat{y} + \frac{2\pi}{a}\hat{z}$ in this case ((111) plane)

$$k'^2 - 2|\vec{k}||\vec{k}'|\cos 2\theta + k^2 = G^2 \quad , \quad |\vec{k}| = |\vec{k}'| = k = \frac{2\pi}{\lambda}$$

$$2k^2 - 2k^2\cos 2\theta = \frac{(2\pi)^2}{a^2} \times 3$$

$$2k^2(1 - \cos 2\theta) = 3 \times \frac{(2\pi)^2}{a^2}$$

$$2k^2 \cdot 2\sin^2\theta = 3 \times \frac{(2\pi)^2}{a^2}$$

$$\Rightarrow \sin^2\theta = \frac{3 \times (2\pi)^2}{a^2 \times 4k^2} = \frac{3 \times (2\pi)^2}{4a^2 \times (2\pi)^2/\lambda^2} = \frac{3\lambda^2}{4a^2}$$

$$\Rightarrow \theta = \sin^{-1}\left(\frac{\sqrt{3}\lambda}{2a}\right) = \sin^{-1}\left(\frac{\sqrt{3} \times 1.54}{2 \times 5}\right) \sim 15.5^\circ$$

The angle between $\vec{k}$ and $\vec{k}'$ $= 2\theta \sim 31^\circ$