

Exercise set 4 (due Thursday March 5th)

- 1 Kittel, Chap. 6, p.159, ex. 6
- 2 Kittel, Chap. 6, p.159, ex. 10
- 3 Kittel, Chap. 8, p.218, ex. 1
- 4 Kittel, Chap. 8, p.218, ex. 2
- 5 Kittel, Chap. 8, p.218, ex. 3
- 6 Consider a 2D square lattice of parameter $a = 1$, but the crystal potential is zero. (So this is really a free electron problem.)

Use the plane wave method to calculate its band structure along the $\Gamma \rightarrow X \rightarrow M \rightarrow \Gamma$ direction. (In k-space $\Gamma(0,0)$, $X(\pi/a,0)$ and $M(\pi/a,\pi/a)$). Draw the first 9 bands. (*Hint: for each considered k vector, write down the Hamiltonian matrix in the plane wave basis, which cutoff should you choose in order to get the first 9 bands?*).