Exercise Solid-State Physics (ET2908 and 8027) 2009-20010Q1: dr. R. Ishihara, DIMES-TC00.0044, r.ishihara@tudelft.nl

# Exercise-sheet 6

## I. Electrical Conduction in Solids

**(I.1)** Figure 1 shows the parabolic $E$ versus $k$ relationship in the conduction band for an electron in two particular semiconductor materials. Determine the effective mass (in units of the free electron mass $m$) of the two electrons.

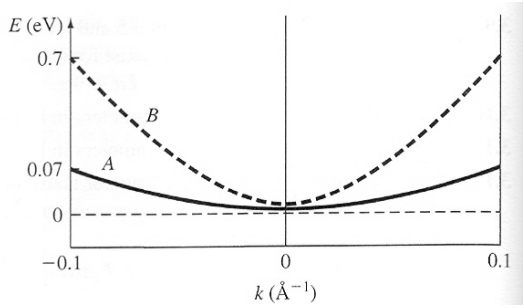


Figure 1: The E-k diagram

**(I.2)** The $E$ versus $k$ diagram for a particular allowed energy band is shown in Figure 2. Determine (a) the sign of the effective mass and (b) the direction of velocity for a particle at each of the four positions shown.

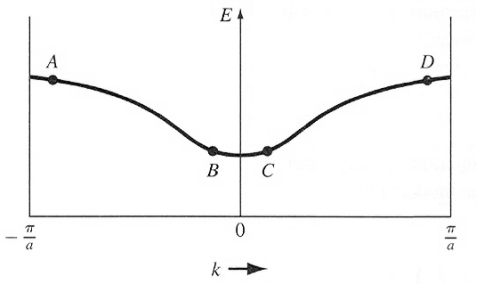


Figure 2: The E-k diagram in a band

**(I.3)** The $E$ versus $k$ diagram for a free electron (curve A) and for an electron in a semiconductor (curve B) are shown in Figure 3. Sketch (a) $dE/dk$ versus $k$, (b) $d^2E/dk^2$ versus $k$, (c) the effective mass versus $k$ for each curve.

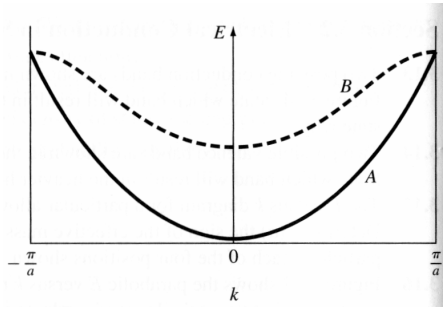


Figure 3: The E-k diagram