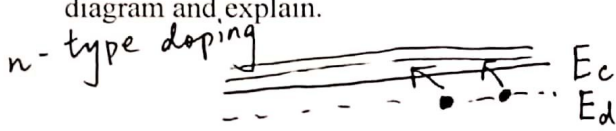


Name:

Student ID:

1. What does n-type doping and p-type doping mean for Si, respectively? Please draw the energy band diagram and explain.



Group-5 dopant donate electrons to conduction band.

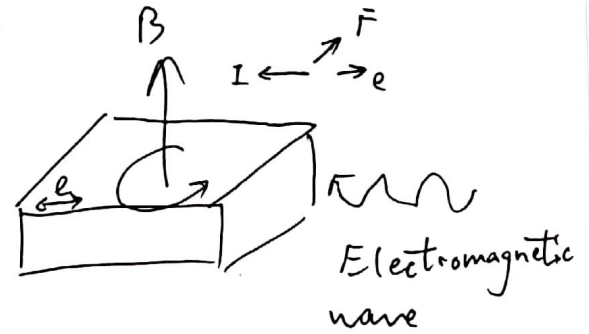
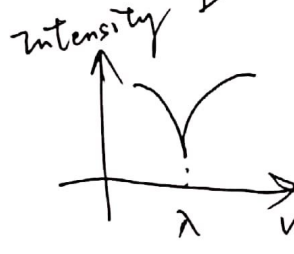
Group-3 dopant accept electrons from those in valence band.

2. How to determine the effective mass of electron in silicon, in theoretical calculation and using experiments, respectively?

$$\frac{1}{m^*} = \frac{d^2 E}{dk^2} \times \frac{1}{\hbar^2}$$

$$\text{So } m^* = \hbar^2 \cdot \frac{1}{\left(\frac{d^2 E}{dk^2}\right)}$$

Absorption spectrum detector



Since $F = m^* \omega^2 r$
 $v = \omega r, \omega = 2\pi f$
 $F_{\text{mag}} = ev \times B$
 $m^* = \frac{eB}{\omega}$

then $m^* = \frac{eB\lambda}{2\pi v}$

3. What type of charge does the hole carrier have in a semiconductor? Which part of the energy band is it in?

positive charge

① valence band (in p-type & acceptor state during)

② when n-type doping, hole carrier is in donate energy state.

