Quiz ANSWERS Week 7
ECE 656: Electronic Conduction In Semiconductors
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1) Why is the BTE harder to solve in the presence of a B-field?

a) Because we are no longer near equilibrium.
b) Because non-degenerate statistics must be used.
c) Because the cross product makes the math more difficult.
d) Because the gradient in momentum space can no longer be approximated by the gradient of f_S.
e) Because the gradient in position space can no longer be approximated by the gradient of f_S.

2) In this equation, $\vec{J}_n = \sigma_S \vec{\mathcal{E}} - \sigma_S \mu_H \left(\vec{\mathcal{E}} \times \vec{B} \right)$, what is μ_H?

a) The mobility.
b) The effective mobility.
c) The conductivity mobility.
d) The chemical potential.
e) The Hall mobility.

3) What is the quantity, $\left\langle \left\langle \tau_m^2 \right\rangle \right\rangle \Big/ \left\langle \left\langle \tau_m \right\rangle \right\rangle^2$, called?

a) The Hall mobility.
b) The Hall coefficient.
c) The Hall factor.
d) The Hall concentration.
e) The Hall parameter.

4) What quantity does a Hall effect measurement find?

a) The Hall mobility.
b) The mobility.
c) The Hall concentration.
d) The carrier concentration.
e) The Hall resistivity.

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5) What does the criterion $\omega_c \tau_m << 1$ imply?

a) Electrons scatter many times before completing a cyclotron orbit.
b) The magnetic field is low.
c) Shubnikov-deHaas oscillations will not be observed.
d) **All of the above.**
e) None of the above.

6) Assume that $\vec{B} = B_z \hat{z}$ what is J_y according to $J_i = \sigma_S \mathcal{E}_i - \sigma_S \mu_H \varepsilon_{ijk} \mathcal{E}_j B_k$?

a) $J_y = \sigma_S \mathcal{E}_y$
b) $J_y = -\sigma_S \mu_H \mathcal{E}_x B_z$
c) $J_y = +\sigma_S \mu_H \mathcal{E}_x B_z$
d) $J_y = \sigma_S \mathcal{E}_y - \sigma_S \mu_H \mathcal{E}_x B_z$
e) $J_y = \sigma_S \mathcal{E}_y + \sigma_S \mu_H \mathcal{E}_x B_z$

7) We have seen that for parabolic bands in 2D with non-degenerate conditions, $\langle\langle \tau_m \rangle\rangle = \tau_0 \Gamma(s+2)/\Gamma(2)$. What is the Hall coefficient, $r_H \equiv \langle\langle \tau_m^2 \rangle\rangle / \langle\langle \tau_m \rangle\rangle^2$ in 2D?

a) $r_H = \Gamma(2s+2)/[\Gamma(2)]$.
b) $r_H = \Gamma(2s+2)\Gamma(2)/[\Gamma(s+2)]^2$
c) $r_H = \Gamma(2s+2)\Gamma(s+2)/[\Gamma(2)]^2$
d) $r_H = \Gamma(s+2)\Gamma(2)/[\Gamma(2s+2)]^2$
e) $r_H = \Gamma(3s+2)\Gamma(2)/[\Gamma(2s+2)]^2$.