Assignment 4

The date due for submitting this assignment has passed.

As per our records you have not submitted this assignment.

Due on 2021-03-17, 22:59:07.

1. Radius of the electron orbitals in $\text{se}^{-2}$ under the action of a perpendicular magnetic field $B$ is [1 point]
   - Proportional to $B$
   - Inversely proportional to $B$
   - Proportional to $B^2$
   - Independent of $B$

2. Are all electrons in a real-space under the action of a perpendicular magnetic field $B$ [1 point]
   - Inversely proportional to $B$;
   - Enclose one magnetic flux quantum (0);
   - Inversely proportional to $B$;
   - All of these

3. The product of the areas of electron orbitals in $\text{se}^{-2}$ and real-space for the 4th Landau level in a perpendicular magnetic field $B$ [1 point]
   - Proportional to $B$
   - Independent of $B$
   - Proportional to $B^2$
   - Inversely proportional to $B$

4. Number of states in the Landau level with $m = 0$ [1 point]
   - In general it is the number of magnetic flux quanta enclosed by $B$,
   - Half of the number of magnetic flux quanta enclosed by $B$.
   - Independent of the field and depending on the details of the material system.
   - Proportional to the area $S$.

5. Number of fully occupied Landau level to a system with an electron density of $10^{19}$ cm$^{-2}$ [1 point]
   - $\alpha$
   - $\beta$
   - $\gamma$
   - $\delta$

6. Observation of the longitudinal resistance flow for a 2D system in the quantum Hall regime [1 point]
   - Proportional to $B$
   - Proportional to $B^2$
   - Proportional to $B^3$
   - Independent of $B$

7. Resistance plateaus in the quantum Hall effect occur when [1 point]
   - The Landau levels cross the Fermi level.
   - The Fermi level is between two adjacent Landau levels.
   - The Fermi level is at the bottom of the Landau band.
   - The Fermi level is at the top of the Landau band.

8. The longitudinal resistance exhibits a dip [1 point]
   - When the Fermi level lies between two adjacent Landau levels.
   - Whenever the longitudinal resistance exhibits a dip.
   - When the longitudinal resistance exhibits a dip.
   - Independent of the Fermi level.

9. Write on a Quantum Hall resistance plateaus the block of the sample [1 point]
   - Including Boring
   - Conducitivity
   - Superconductivity
   - Insulating

10. Quantum Hall effect can be explained by [1 point]
    - One-dimensional transport formula
    - Two-dimensional transport formula
    - Single particle quantum mechanical picture
    - Pauli's exclusion principle

11. Why do the edge channels in a quantum Hall system exhibit zero resistance? [1 point]
    - Three-dimensional symmetry broken
    - Edge state channel splitting is negligible not allowed
    - Fermi surface intersects 2D subbands
    - All of these

12. Two probe resistances of a quantum Hall system is [1 point]
    - Identically, longitudinal resistance $R_{xx}$
    - Identical, transverse resistance $R_{xy}$
    - Identical, magnetic field $B$
    - Independent of the magnetic field $B$

13. How does the transverse resistance $R_{xy}$ [1 point]
    - Identical, longitudinal resistance $R_{xx}$
    - Identical, magnetic field $B$
    - Identical, transverse resistance $R_{xy}$
    - Independent of the magnetic field $B$