

Conceptual Questions 6.5-6.8 Solutions

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Complete the following statements using the following: $T_c < T$, $T_c > T$, $d = 3$, $d \neq 3$, $d \geq 3$, $B = 0$, $B \neq 0$, $A > 0$, $A < 0$, under real circumstances, and if you're a particle theorist working in too many dimensions. (Note, not all choices must be used and no choice can be used more than once.)

Consider the following equation for free energy density in Landau Field Theory:

$$\mathcal{V} = \frac{A}{2}|\phi|^2 + \frac{B}{4}|\phi|^4.$$

1. Under certain circumstances, the free energy density can be simplified by considering the quartic term negligible. This is only valid when $T_c < T$ or $T_c > T$ and when $d \geq 3$.
2. The free energy density will break symmetry when $A < 0$ or under real circumstances, which will cause the graph to change from parabolic to 'mexican hat' shape.
3. When $d = 3$, the critical exponents for the correlation function of the magnetization density are $\eta = 0$ and $\nu = \frac{1}{2}$. If $d \neq 3$ the critical exponents are $\eta = \frac{3-d}{2}$ and $\nu = \frac{1}{2}$ instead.