5.34 a) Consider yourself at a point just below the solid-liquid phase boundary in fig. 5.13.

By arguments already presented, at that point, $G_e < G_s$.

Now, keep temperature fixed but increase the pressure, the system solidifies, so now $G_s < G_e$. But from equation 5.41, we know that the way in which $G$ changes with pressure is related to the volume. Since to get the curve in $G$'s described above $\Delta G_e > \Delta G_s$ over the range $\Delta P \Rightarrow V_e > V_s \Rightarrow p_e < p_s$. So the liquid is actually more dense than the solid.

The Clausius-Clapeyron equation can help us with the entropy question. Modifying eqn 5.41:

$$\frac{dP}{dT} = \frac{S_s - S_e}{V_s - V_e}.$$  

At $T < 0.3K$, $dP < 0 \Rightarrow \Delta S$ and $dV$ have opposite signs.

So our conclusion above was that $V_s - V_e < 0 \Rightarrow S_s - S_e > 0 \Rightarrow S_s > S_e$. Thus, the rather surprising results that the entropy of the solid is larger than the entropy of the liquid (for $T < 0.3K$).
b) There is no reason why $\Delta V \to 0$ as $T \to 0$, so expect $\Delta V \to$ constant as $T \to 0$. As $T \to 0$ both $S_s$ and $S_l \to 0$ separately, so $\Delta S \to 0$ as $T \to 0 \Rightarrow \frac{dP}{dT} = \frac{\Delta S}{\Delta V} \to 0$ as $T \to 0$.

c) If you compress the He liquid "quickly" so no heat can enter and reversibly so no new entropy is created, then compression is "isentropic." Since the liquid has greater entropy than the solid (at a given temperature) the solid must cool to keep entropy from changing.

Actually this technique is used in low temperature physics to approach temperatures of ~1 mK. Called "Pomeranchuk cooling" after its inventor.