9.50 This problem asks us to consider various aspects of 3.5 kg of austenite containing 0.95 wt% C that is cooled to below the eutectoid.

(a) The proeutectoid phase will be $\text{Fe}_3\text{C}$ since 0.95 wt% C is greater than the eutectoid composition (0.76 wt% C).

(b) For this portion of the problem, we are asked to determine how much total ferrite and cementite form. Application of the appropriate lever rule expression yields

$$W_\alpha = \frac{C_{\text{Fe}_3\text{C}} - C_0}{C_{\text{Fe}_3\text{C}} - C_\alpha} \frac{6.70 - 0.95}{6.70 - 0.022} = 0.86$$

which, when multiplied by the total mass of the alloy, gives $(0.86)(3.5 \text{ kg}) = 3.01 \text{ kg}$ of total ferrite.

Similarly, for total cementite,

$$W_{\text{Fe}_3\text{C}} = \frac{C_0 - C_\alpha}{C_{\text{Fe}_3\text{C}} - C_\alpha} \frac{0.95 - 0.022}{6.70 - 0.022} = 0.14$$

And the mass of total cementite that forms is $(0.14)(3.5 \text{ kg}) = 0.49 \text{ kg}$.

(c) Now we are asked to calculate how much pearlite and the proeutectoid phase (cementite) form. Applying Equation 9.22, in which $C_1^\prime = 0.95 \text{ wt% C}$

$$W_p = \frac{6.70 - C_1^\prime}{6.70 - 0.76} = \frac{6.70 - 0.95}{6.70 - 0.76} = 0.97$$

which corresponds to a mass of $(0.97)(3.5 \text{ kg}) = 3.4 \text{ kg}$. Likewise, from Equation 9.23

$$W_{\text{Fe}_3\text{C}^\prime} = \frac{C_1^\prime - 0.76}{5.94} = \frac{0.95 - 0.76}{5.94} = 0.03$$

which is equivalent to $(0.03)(3.5 \text{ kg}) = 0.11 \text{ kg}$ of the total 3.5 kg mass.

(d) Schematically, the microstructure would appear as: