1. The superconductor tin has $T_c = 3.7$ K and $B_c = 30.6$ mT at $T = 0$. Calculate the critical current for a tin wire of diameter 1 mm at $T = 2$ K. What diameter of wire would be required to carry a current of 100 A?

2. Use the London equation to show that the penetration depth of a parallel magnetic field into a superconducting film of thickness d in the xy plane is

$$B = B_0 \frac{\cosh(z/\lambda)}{\cosh(d/2\lambda)}$$

   where B_0 is the applied field and the centre of the film is at $z = 0$. Calculate the field at which the Gibbs free energies of the normal and superconducting states are equal for the film.

3. Explain the following:

   (a) At $T = 1$K tin strongly absorbs electromagnetic radiation of wavelength 0.9 mm but only weakly absorbs radiation of wavelength 1.1 mm.

   (b) Superconductors are poor conductors of heat for $T \ll T_c$.

   (c) The critical field at $T = 0$ of different superconductors is approximately proportional to T_c.

   (d) For different isotopes of the same element T_c depends on the isotopic mass.