4. (a)   A well-lagged uniform cylindrical rod is 20.0 cm long and has a diameter of 2.00 cm. One end of it is in thermal contact with a hot reservoir maintained at a temperature of $150°C$ while the other end is in thermal contact with a very large block of ice at temperature $0°C$.

   (i)   It is found that the ice block is melting at a rate of 0.1683 kg min^{-1}. What is the thermal conductivity of the material of the rod?

   [400 W m^{-1}K^{-1}]

   (ii) Calculate the rate of change of the entropy of the system comprising the hot and cold reservoirs and the rod.

   [0.1224 J K^{-1}]

                                                                    [5 marks]

   [Latent heat of fusion of ice $= 3.36 \times 10^4$ J kg^{-1}]

4. (b)   A spherical blackbody has a diameter of 10.0 m and is placed in an environment with constant temperature of $27.0°C$. A **parallel beam** of thermal radiation having intensity 2400 Wm^{-2} is incident onto the blackbody continuously. What is the final equilibrium temperature of the blackbody?

                                                                    [4 marks]

   [369.7 K]