PHYSICS OF MATERIALS

Physics School Autumn 2024

Series 9 **22 November 2024**

Exercise 1 Creep

a) Show that when Frank-Read sources are activated, the density of dislocations varies as $\Lambda = \left(\frac{\sigma}{\mu b}\right)^2$.

b) Show that the climb velocity of dislocations is given by :

$$\mathbf{v}_c = C_j \frac{\sigma b^2}{kT} D$$

where C_j is the jog concentration and D is the coefficient of diffusion.

c) Show that in the case of dislocation climb, we have $\dot{\varepsilon} \sim \sigma^3$.