

Department of Materials Science and Engineering  
Massachusetts Institute of Technology  
3.14 Physical Metallurgy – Fall 2003

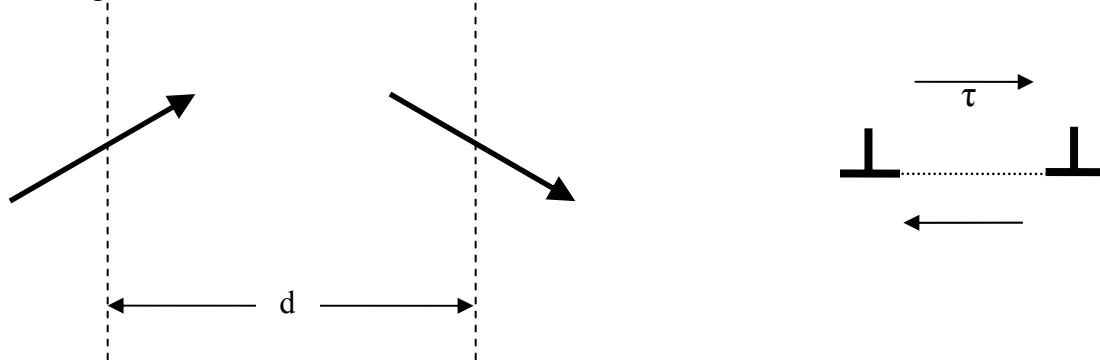
Quiz #1

September 24, 2003

**The Rules:** 30 minutes, no calculators, props or crutches of any kind. Complete both problems with answers of the highest quality.

Problem #1:

On your homework, you considered the forces associated with the splitting of a full dislocation into two partials separated by a stacking fault. The partial dislocations are the dashed lines, with the Burger's vectors shown as arrows:



Imagine now that you apply a shear stress to such a split dislocation, as shown above at the right.

Part A: Briefly describe what would happen on loading and unloading if the leading partial (the one at the right) were pinned in place (due to, e.g., the presence of an obstacle). **(2 pts)**

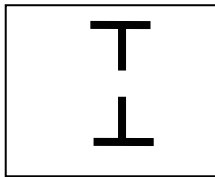
Part B: Briefly describe what would happen on loading and unloading if the trailing partial (the one at the left) were pinned in place. **(2 pts)** Is this case symmetric to the one in Part A? Why or why not? **(1 pt)**

Problem #2:

An edge dislocation dipole looks like this:



Part A: Give a simple physical reason why this configuration is of lower energy than other competing configurations like these: **(2.5 pts)**



It may help to draw a picture or two...

Part B: Despite being of opposite sign, these edge dislocations do not annihilate. Explain why not. **(1 pt)**

Part C: Explain why this dipole is unstable if the dislocations are screw-type instead of edge-type. **(1.5 pts)**