

**Prob. 20.10**

Yield stresses (in MPa) have been measured at various strain rates and temperatures as follows:

	$10^{-3}$	$10^{-1}$
0C	54.1	62.7
40C	42.3	52.1

Determine the activation volume for the yield process. What physical significance might this parameter have?

From Eq. 20.4, the slope of any line on a  $\sigma_y / T$  v.  $\ln \dot{\epsilon}$  plot is  $k / V^*$ . Using the 0C data (the 40C data give the same result), define the points on the line:

**with(geometry);point(p1\_0, ln(1e-3),54.1e6/273); point(p2\_0, ln(.1),62.7e6/273);**

Get the slope:

**Digits:=4;s1:=slope(p2\_0,p1\_0);**

$$s1 := 6840.$$

Divide into Boltzman's constant  $k$  to get  $V^*$ :

**V:=1.38e-23/s1;**

$$V := .2018 \cdot 10^{-26}$$

In cubic Angstroms this is:

**(V\*1e30);**

2018.

Assigning physical meaning to the activation parameters is somewhat conjectural, but in some cases it can provide insight to the physics of the mechanism. Activation volumes for yield processes are sometimes interpreted as the volume of a "slip unit," and could be used to compute how many atoms are involved in the process.