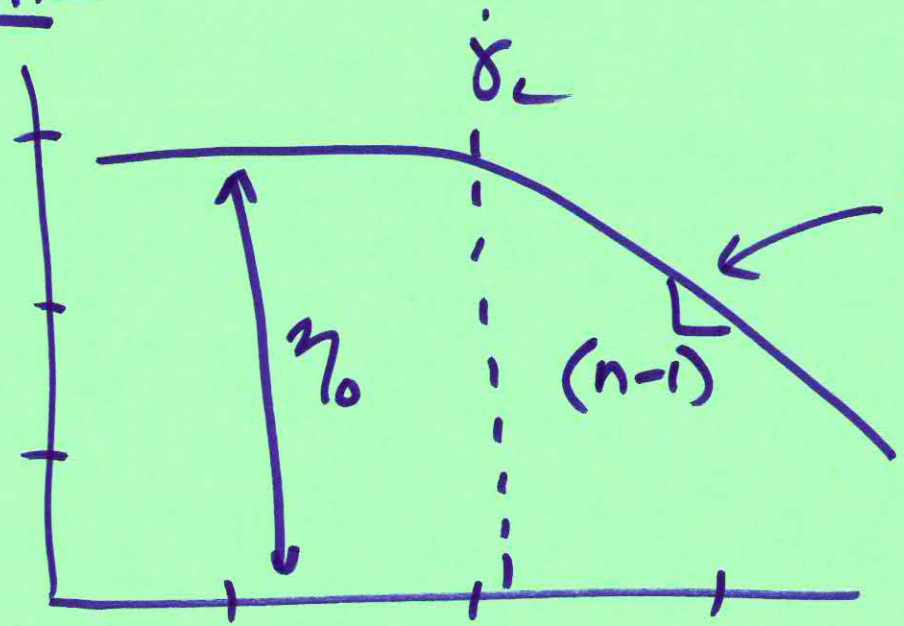
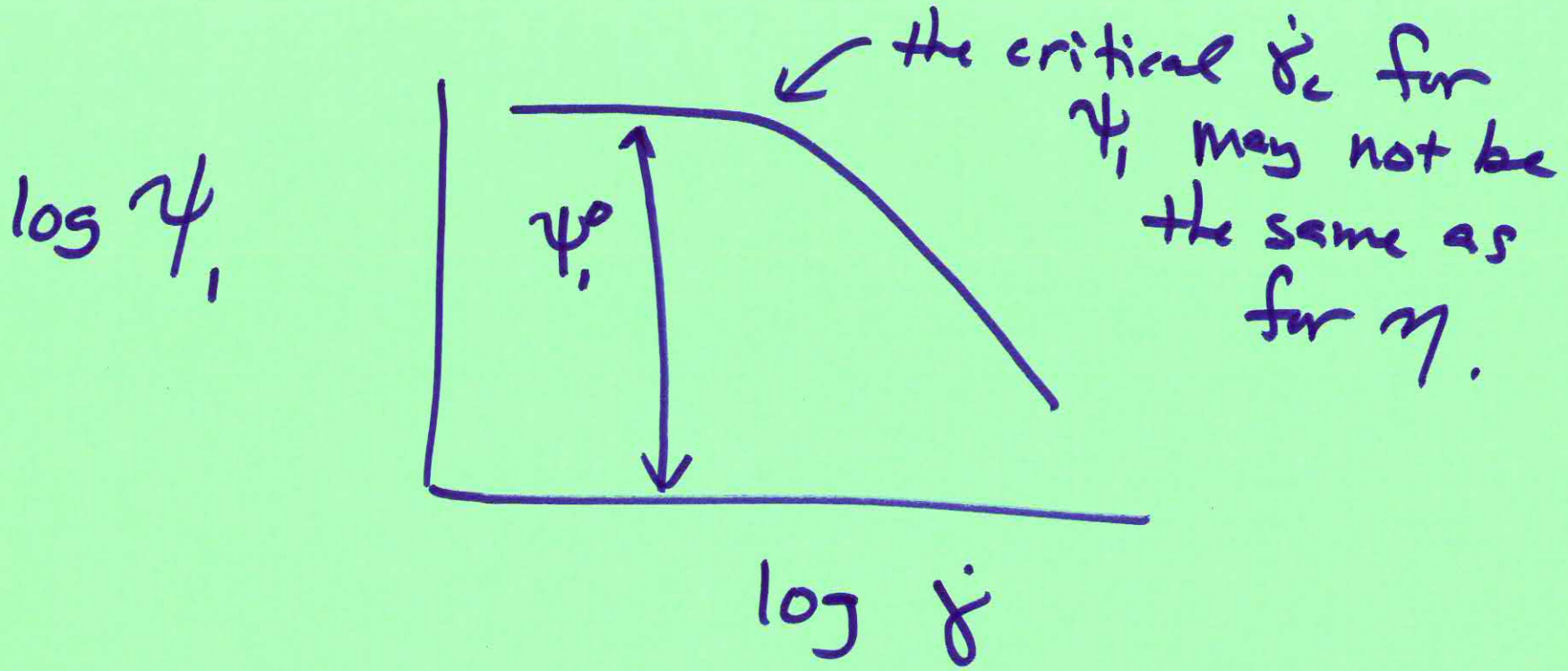
CHAPTER 6: MATERIAL BEHAVIOR

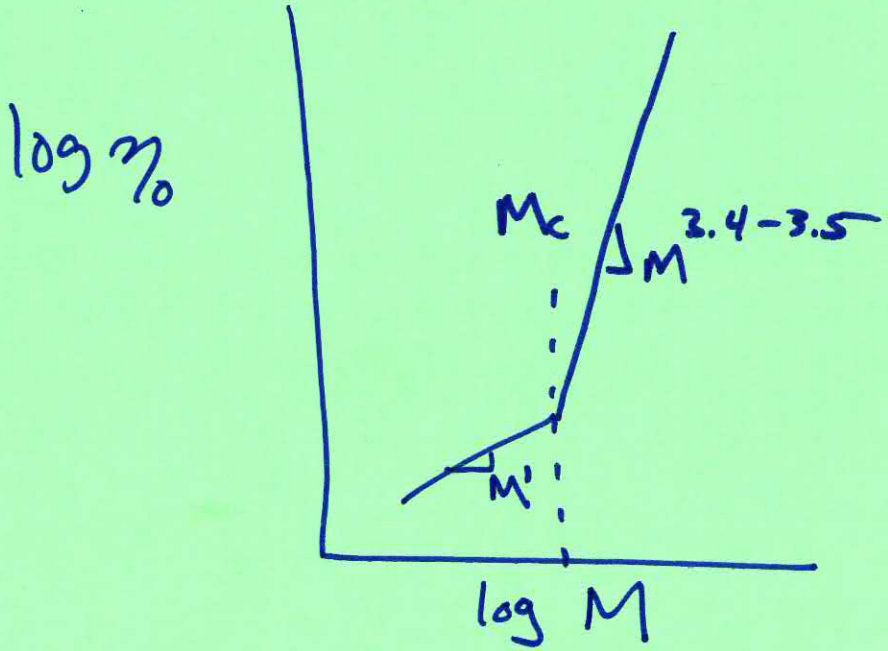
STEADY SHEAR



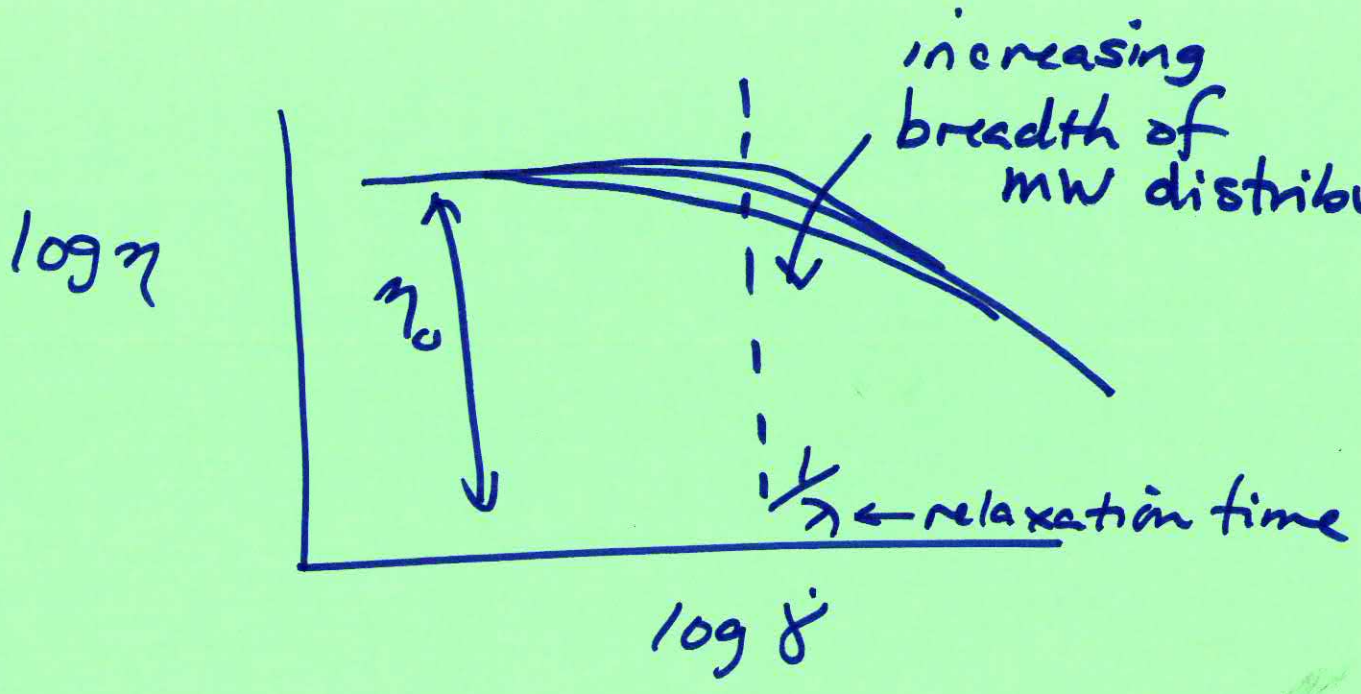
n = power-law index

Zero shear viscosity $\lim_{\dot{\gamma} \to 0} \eta(\dot{\gamma}) = \eta_0$



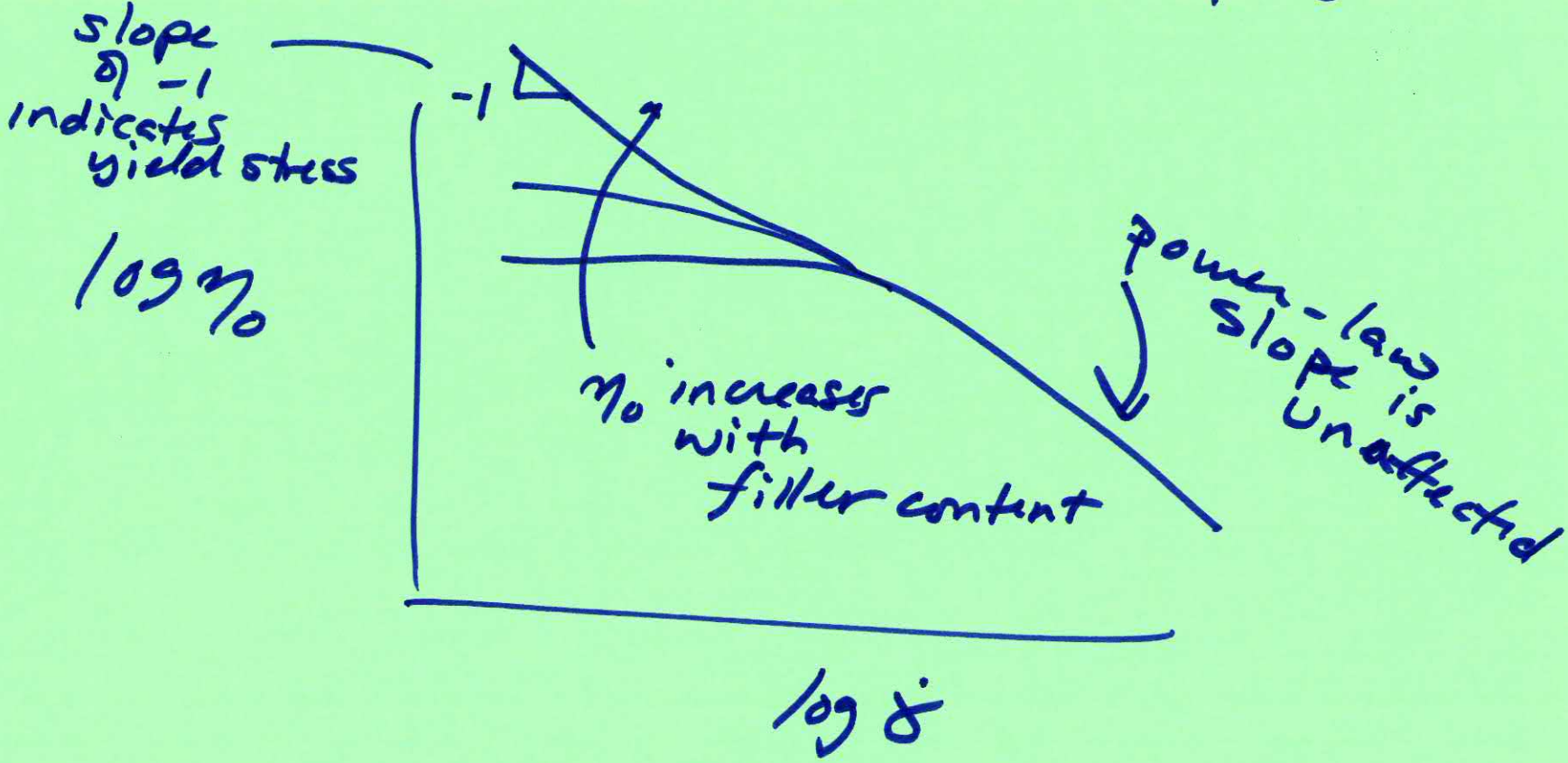


M_c - critical molecular weight for entanglement


increasing
breadth of
MW distribution
log η
η₀
1/λ ← relaxation time
log γ̇

EFFECT OF FILLER

powder added to polymer



EFFECT OF TEMP

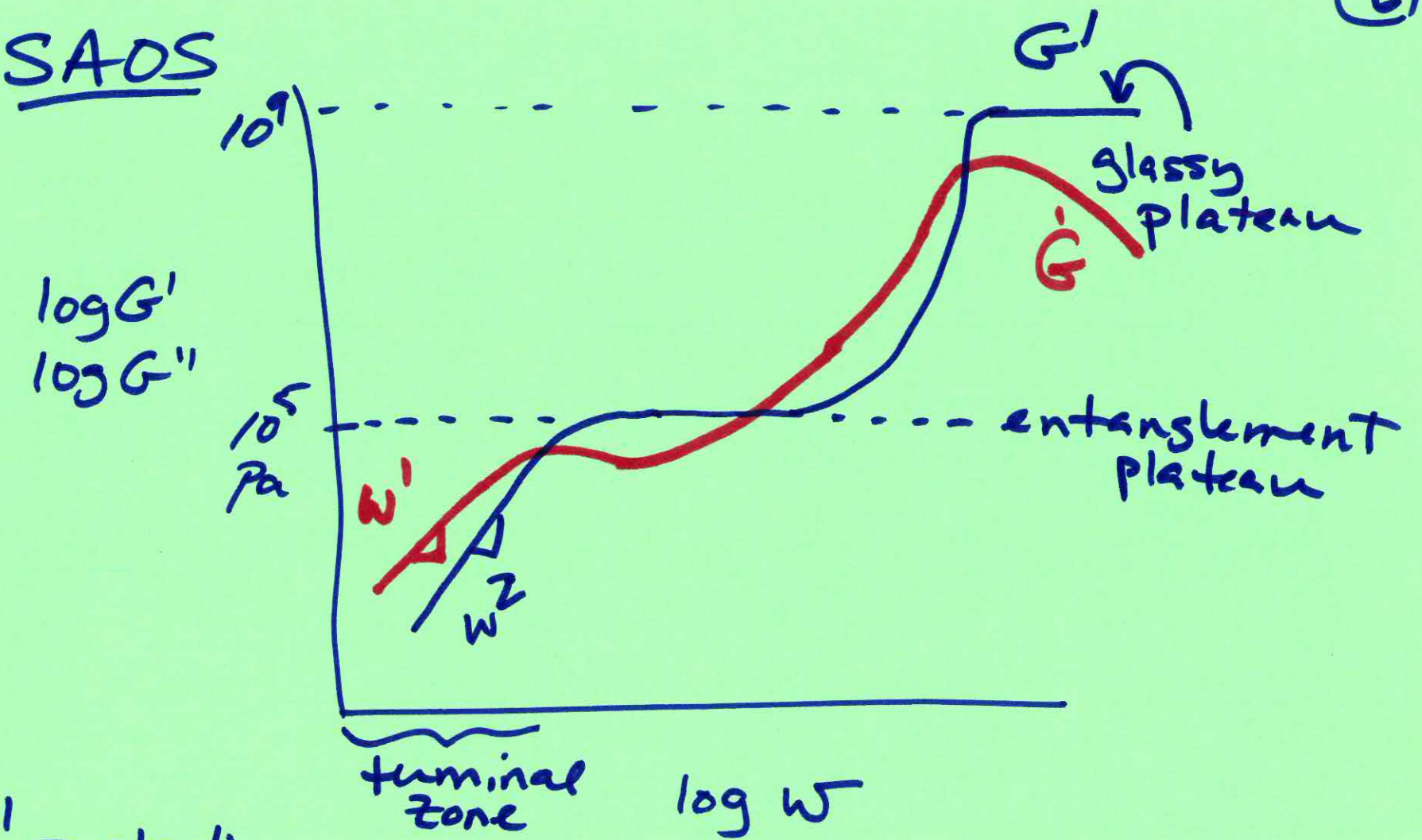
η_0 decreases sharply w/ T

$\dot{\gamma}_c = 1/\lambda$ increases with T

EFFECT OF PRESSURE

- strongly material dependent
- only important at v. high P

SAOS



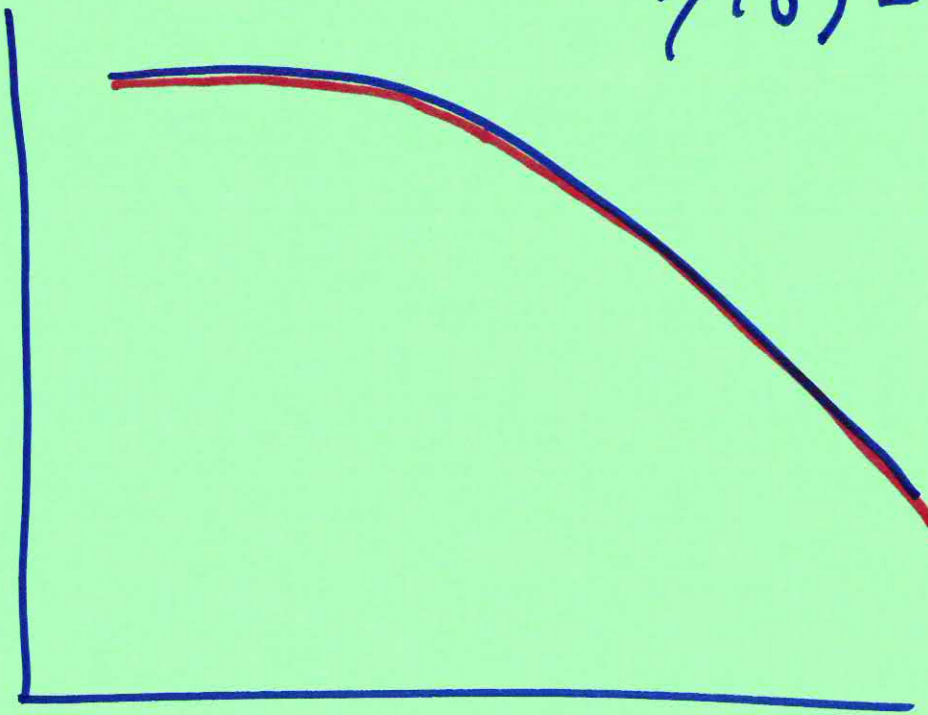
G' = elastic modulus

G'' = viscous modulus

solids have constant G'

Cox Merz Rule

$$\eta(\dot{\gamma}) = \eta^*(\omega)\Big|_{\dot{\gamma}=\omega}$$



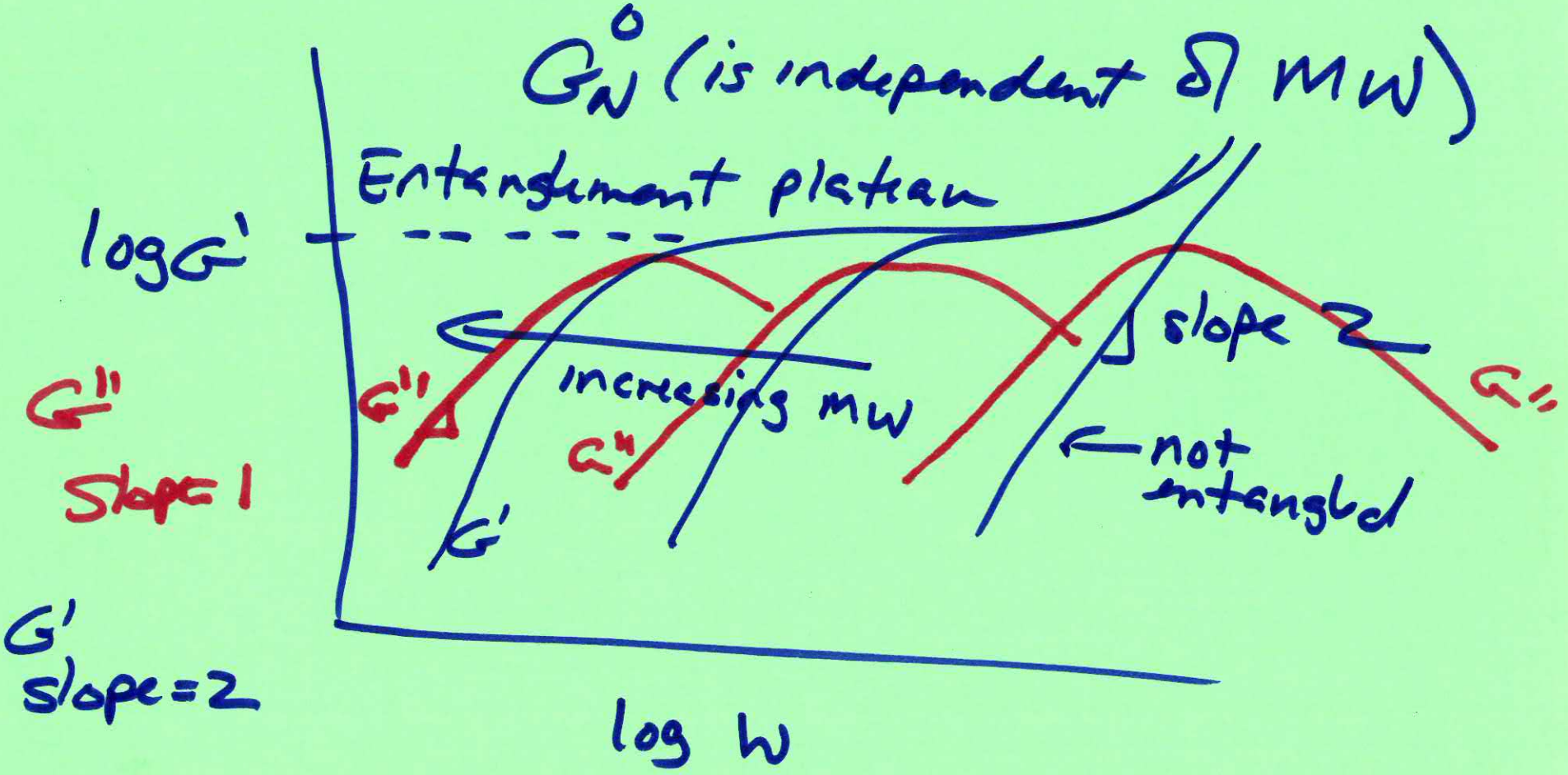
$\omega [=] \frac{rad}{s}$

$f [=) \frac{cycles}{sec} \cdot \frac{2\pi Rad}{cycle}$

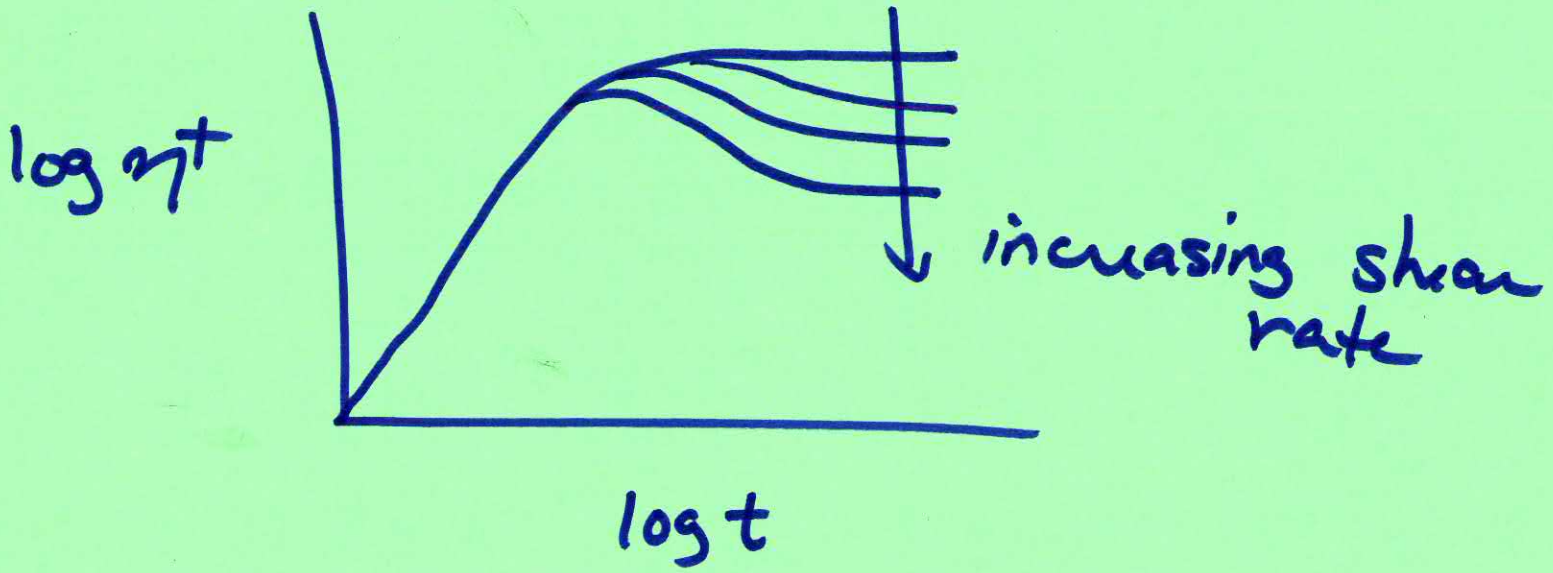
$2\pi f = \omega$

(caution: not for complex materials)

Entanglement Plateau

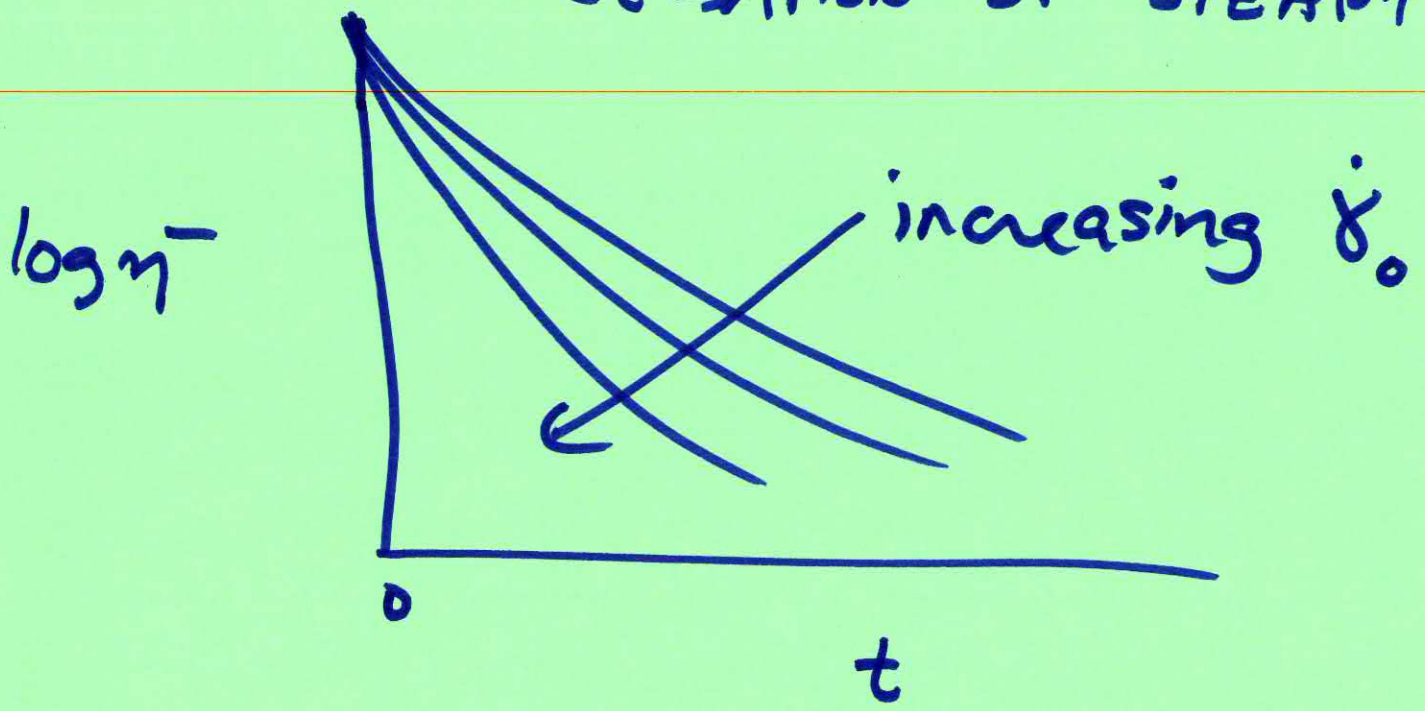


START UP OF steady Shearing

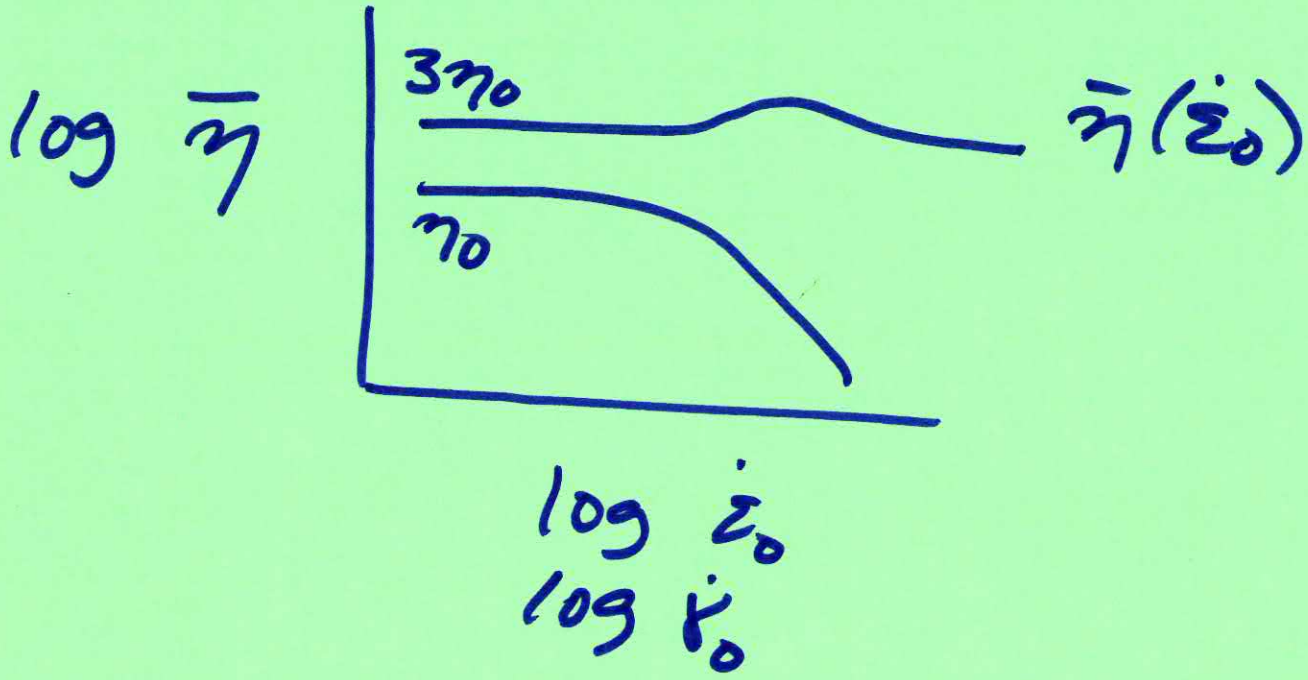


Same shape for ψ_1^+

CESSATION OF STEADY SHEAR



ELONGATIONAL FLOW



Trouton's Rule $\Rightarrow$ $3 = \dfrac{\bar{\eta}}{\eta_0} = T_r$

Elongational Start up