

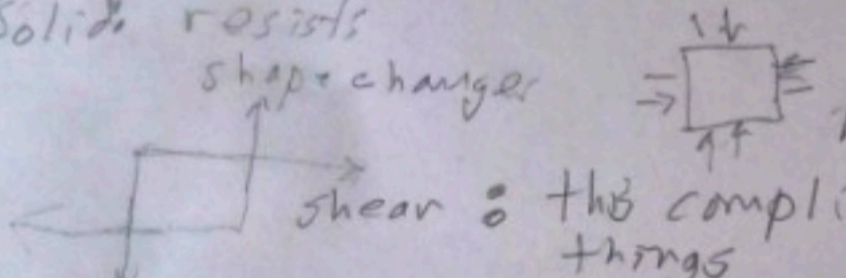



gas:  P liquids:  gravity
always a P
has its own volume; strongly resists volume reduction

Solids resists shape change
 pressure
shear: the complicating things
ignore solids

$$E = E(b, q; V) \quad \lambda \rightarrow V$$

gas  displace piston by dL
 $F = P \cdot A$ dif. work: dR

Work: $dR = F \cdot dL$

pressure: $\frac{F}{A} = P$ force/area

$$dR = \frac{F}{A} A dL = P \cdot A dL$$

$$A dL = -dV$$

$$dR = -P dV$$

$$E = E(S, V)$$

$$dE = \frac{\partial E}{\partial S} dS + \frac{\partial E}{\partial V} dV$$

$$dE = T dS - P dV : P = - \left(\frac{\partial E}{\partial V} \right)_S$$

thermodynamic identity
valid for reversible changes
only; also called
combined 1st & 2nd laws