Partial derivative aside

$$f(x,y) \Rightarrow \frac{df}{dx} = \lim_{x \to 0} \frac{f(x+h,y) - f(x,y)}{h}$$

$$df = f(x+dx, y+dy) - f(x,y)$$

$$df = dx\frac{\partial f}{\partial x} + dy\frac{\partial f}{\partial y}$$

Lecture 9 proving there is only T dependence on U
(use with slides)
(Joule's second law)

$U(P,V)$ but $P = \frac{nRT}{V}$

$$U(T,V)$$

$$dU = \partial T\frac{\partial U}{\partial T} + dV\frac{\partial U}{\partial V}$$

$$\cancel{\Delta U}^{\,0} = \cancel{\Delta T}^{\,0}\frac{\partial U}{\partial T} + \Delta V\frac{\partial U}{\partial V}$$

$$\therefore 0 = \underbrace{\Delta V}_{\text{non-zero}}\frac{\partial U}{\partial V} \qquad \therefore \frac{\partial U}{\partial V} = 0$$

$$U(T,\cancel{V}) \Rightarrow U(T)$$

No volume dependence, hence just temperature dependence