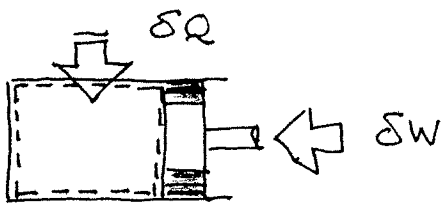
CONSIDER A CLOSED SYSTEM UNDERGOING A

________ PROCESS OVER TIME ____.




$\delta W =$

## CONSERVATION of ENERGY

$$\frac{d}{dt}(E)_{sys} = \dot{Q} + \dot{W} + \underbrace{\angle_0 - \angle_0}_{\text{CLOSED}}$$

$d \quad =$ $\underbrace{\qquad\qquad}$ (NO KE OR PE)

$d \quad =$ (1)

## ACCOUNTING of ENTROPY

$$\frac{d}{dt}(S)_{sys} = \sum \frac{\dot{Q}}{T_b} + \angle_0 - \angle_0 + \dot{S}_{GEN}$$

$dS =$

$\therefore \ \delta Q = \qquad\qquad =$

SUBSTITUTING INTO (1)

SOLVE FOR $T ds$

$$\boxed{T ds = \qquad\qquad}$$

THE 1ST $T ds$ RELATION

FROM DEF'N of $h$

$h \equiv u + pv \quad \therefore \quad dh =$

SOLVING FOR $du$

$du =$

SUB INTO 1ST $T\,ds$ RELATION

$$T\,ds = \qquad\qquad\qquad + P\,dv$$

$$\boxed{T\,ds = \qquad\qquad\qquad}$$ SECOND $T\,ds$ RELATION


TRUE! BUT THESE EQN'S ARE GOOD *for any substance and any process!*

NOW FOR AN IDEAL GAS

$$ds = \frac{dh}{T} - \underbrace{\frac{v}{T}\,dP}$$

$$= \qquad\qquad -$$

$$s_2 - s_1 =$$

$$\underbrace{\qquad\qquad}$$

$$\parallel$$

$$\boxed{s_2 - s_1 = \overbrace{\qquad\qquad\qquad}}$$

IF YOU USE 1ST $T$-$ds$ RELATION

$$s_2 - s_1 = \underbrace{\int_{T_1}^{T_2} c_v \frac{dT}{T}} + R \ln\left(\frac{v_2}{v_1}\right)$$

IFF $c_v$ = CONST & $c_p$ = CONST

$$s_2 - s_1 = c_p \ln(T_2/T_1) - R \ln P_2/P_1$$

$$= c_v \ln(T_2/T_1) + R \ln(v_2/v_1)$$

*GET IT? *Tedious*? HA!