

Process to be Modeled



State 0

Fly High!

Rocket secured on stand

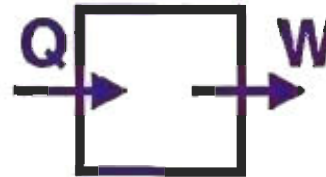
Dynamics

$$P_c T_c V_0$$

$$F=ma$$

$$a=0$$

Thermo



ideal gas

$$Q_{\text{in}} = 0$$

$$W = 0$$

$$\Delta E = 0$$

Fluids

water
incomp.



- Force balance
- Energy balance

Process to be Modeled



State 1

Fly High!

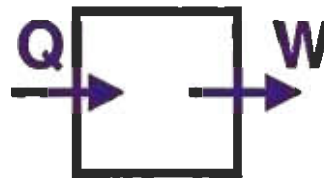
A volume of air is placed inside isothermally

Dynamics

$$F=ma$$

$$a=0$$

Thermo



$$Q \neq 0$$

$$\Delta E = Q - W = 0$$

$$Q = W$$

$$W = \int_{V_0}^V P dV$$

$$PV = \text{const.}$$

$$\Rightarrow P_1 V_1 = P_0 V_0$$

$$P = \frac{P_0 V_0}{V}$$

Fluids

Water incomp.

I don't know



- Force balance
- Energy balance



State 2

Fly High!

Retainer released! Bottle begins to clear tower

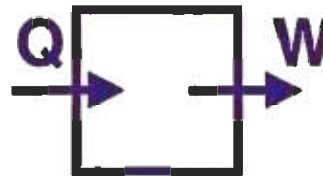
Dynamics

$$F=ma$$

$$a \neq 0$$

$$F = T - W - D$$

Thermo



$$Q = 0$$

$$\Delta Q = 0 \quad ?$$

$$\Delta E = -W$$

~~$$(P_2 V_2) - (P_1 V_1) \delta$$~~

$$P_2 V_2 \delta = P_1 V_1 \delta$$

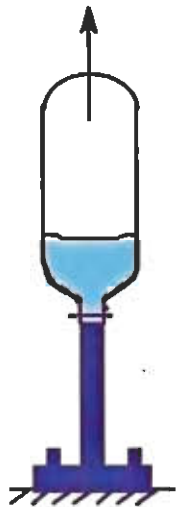
$$T_2 = \frac{P_2 V_2}{nR}$$

$$W = \int P \, dV$$

Fluids

$$D = 0$$

Water incomp.



- Force balance
- Energy balance



Cheat Sheet

	P	V	T	W	Q	ΔE
State 0	$P_0 = 1 \text{ atm}$ 101 kPa	$V_0 = V_B - V_w$ $-V_R$	$T_0 = 298 \text{ K}$			
State 1	$P_1 = P_0 \frac{V_0}{V_1}$ $\frac{P_0 V_0}{R T_0}$	$V_1 = V_B - V_w$ $-V_R$				
State 2						
State 3						