Lecture 16

- Wrap-up "discharge" analysis
- HW#7 (due next tuesday)
- Exam overview

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* Isothermal vs. adiabatic

Continue with the examples

Find the time duration δt takes for density to reach 40%

of its initial value!

Adiabatic Analysis Handout

$$\rho^+ = \left[1 + \frac{\gamma - 1}{2} t^+\right]^{-\frac{2}{(\gamma-1)}}$$

$$\rho^+ = \frac{\rho(t)}{\rho_i} = 0.4 = \left[1 + 0.2 t^+\right]^{-\frac{2}{0.4}}$$

$$\boxed{t^+ = 1.006} = \frac{t}{t_{char}}$$

$$1.006 = \frac{t}{\dfrac{\forall}{K A^{*} (R T_i)^{1/2}}}$$

$\gamma = 1.4$ (Fliegner) → $K = 0.6847$

$A^{*} = \frac{\pi}{4}(0.02)^2$

T_i: $15^{\circ}C = 288K$

$$\Rightarrow t = 272{,}464 \text{ s}$$

$$= \underline{3 \text{ days}, 41 \text{ min}, 4.2 \text{ s.}}$$

(c) Does the answer fit the analysis & its assumptions!

(d) Isothermal

$$p^+ = \rho^+ = e^{-t^+}$$

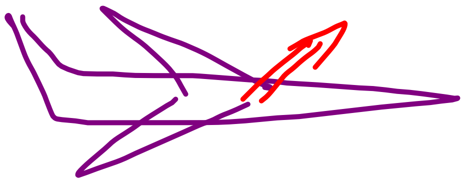
$$t = -\frac{V}{KA^*(RT)^{1/2}} \ln \rho^+$$

($\rho^+ \uparrow$ 0.4)

$= 248{,}167$ s

$= 68$ hr, ...

(e) How long will it take to unchoke? [∞]



20 kPa

$t=0 \Rightarrow \frac{20}{101} = 0.2$

t° 20

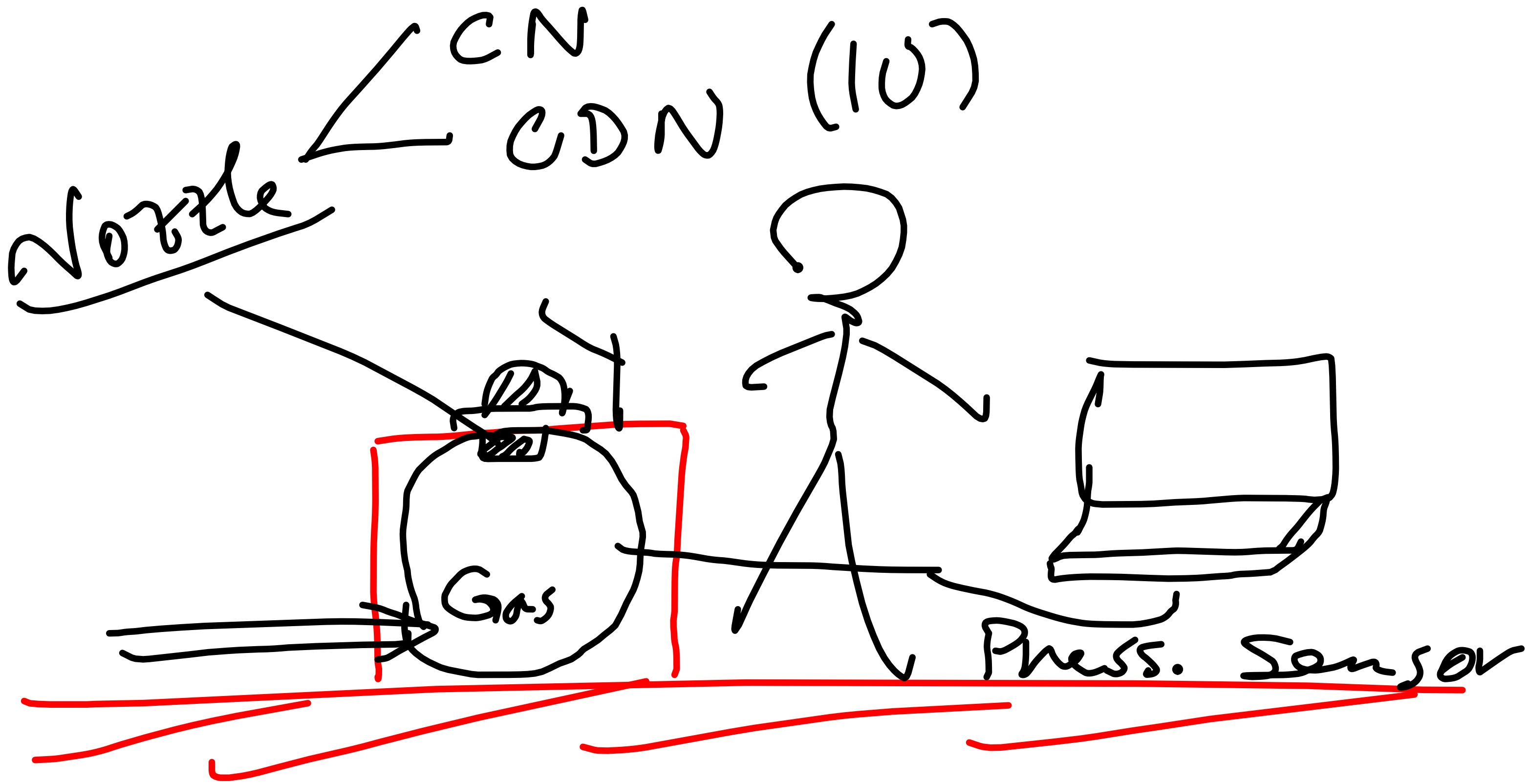
$$P^t = \frac{P}{P_i}$$

When will

$$\frac{P_B}{P_0} = 0.5283$$

?

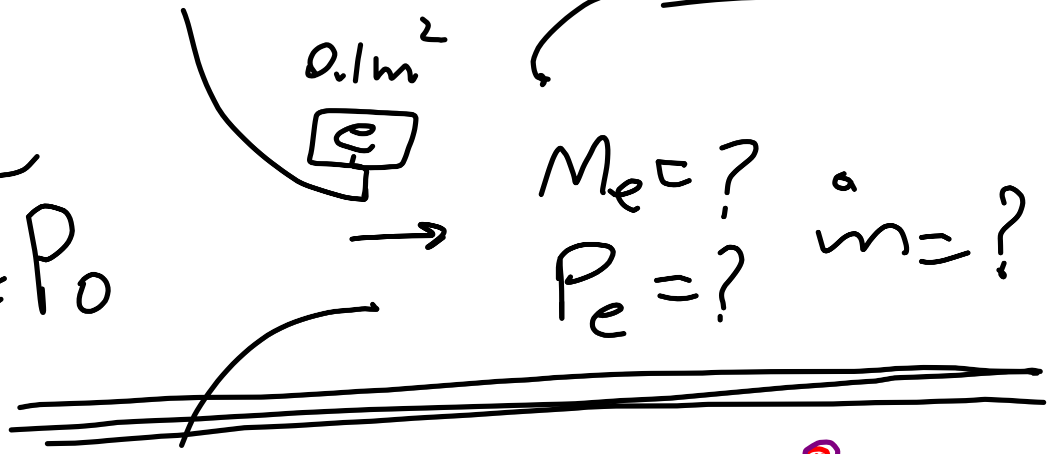
$$\Rightarrow P^t \Rightarrow t^t \, !$$


CN
CDN (10)
Nozzle
Gas
Press. Sensor

⇒ Exam 1

Prob 1

$P_B = 100\,kPa$

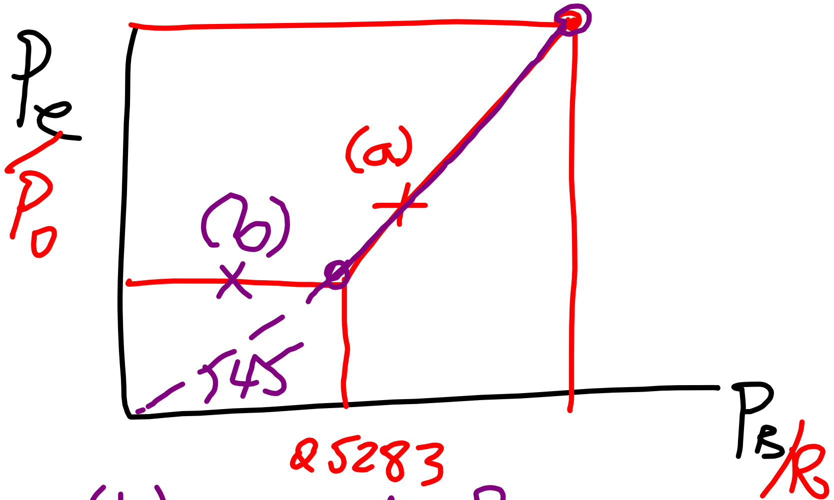


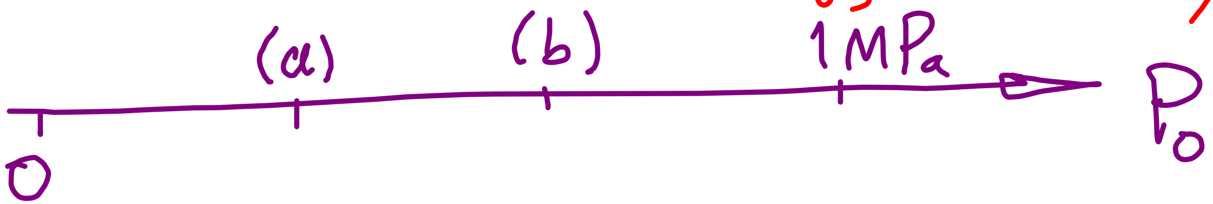
$150 \\ 300 \Big\} = P_0$

$M_e = ?$

$P_e = ?$

$\dot{m} = ?$

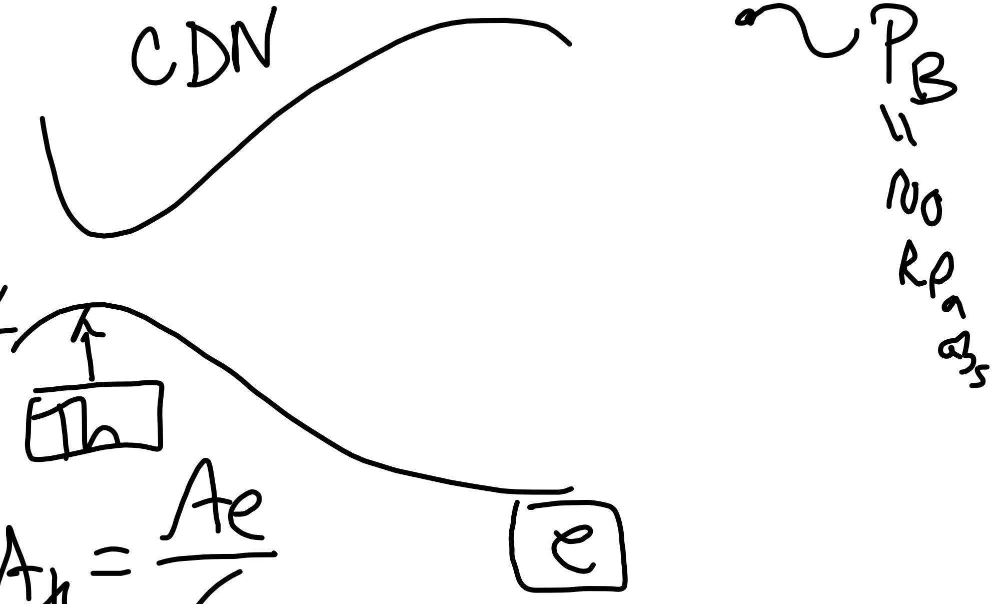




Prob. 2

air

$T_0 = 300K$



$A_{th} = \frac{A_e}{6}$

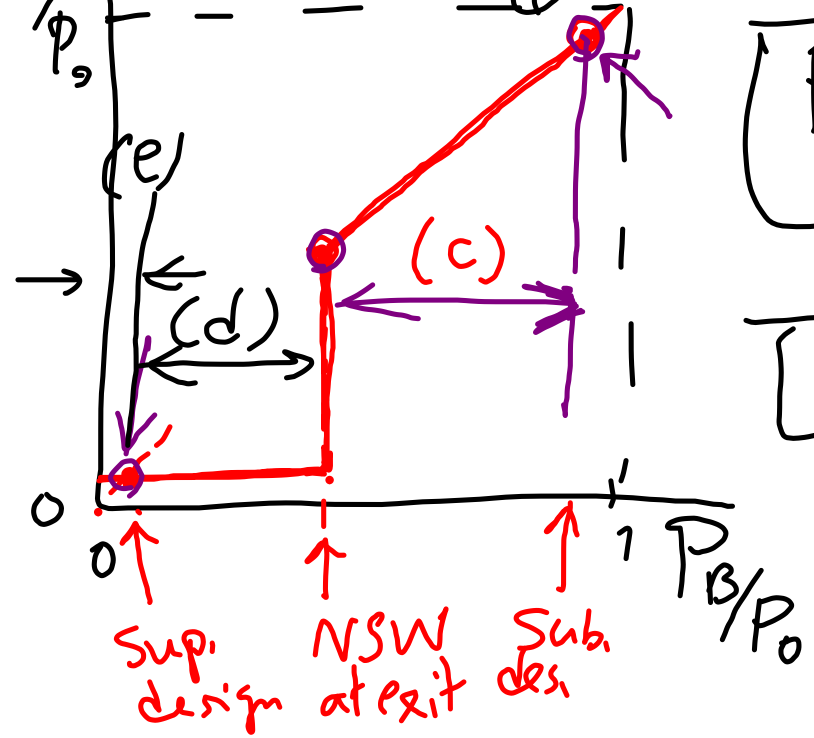


Fig. 4.19