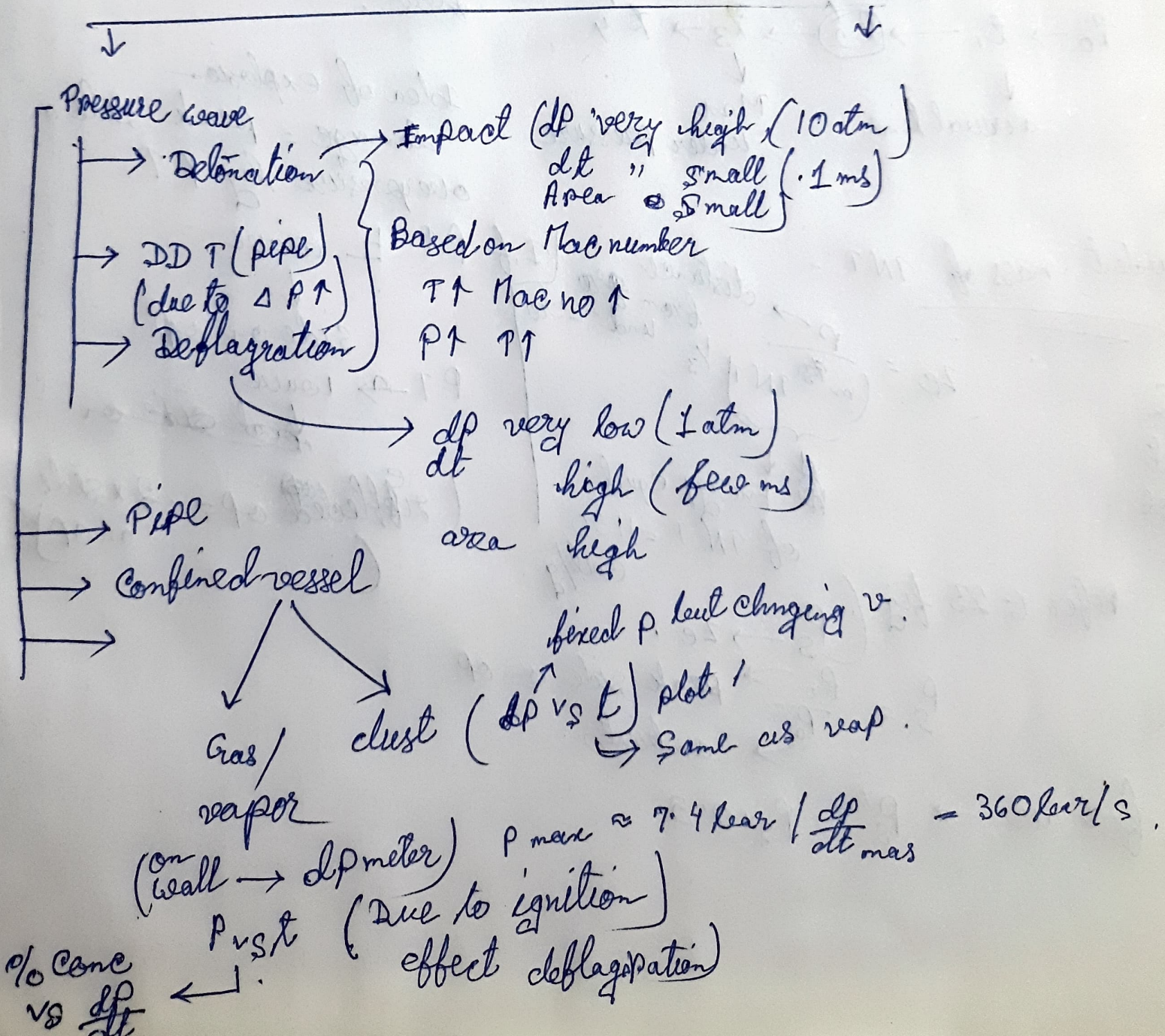


# Explosion





for deflagration:-

$$\left(\frac{dp}{dt}\right)_{\max} V^{1/3} = K_G \rightarrow \text{Gas}$$

$$\left(\frac{dp}{dt}\right)_{\max} V^{1/3} = K_{St} \rightarrow \text{dust}$$

$K_G \uparrow$  &  $K_{St} \uparrow$  when explosion robustness  $\uparrow$ .

Table 6.7-2 & 6.8  $\rightarrow P_m, K_G, K_{St}$  data

~~lowest types~~

$K_G$  &  $K_{St} \rightarrow$  Dependencies

v. composition of mixture,  
thickness in vessel,  
Shape of reaction vessel,  
Energy of ignition source.

Dust explosion char

i) Particles below min size.

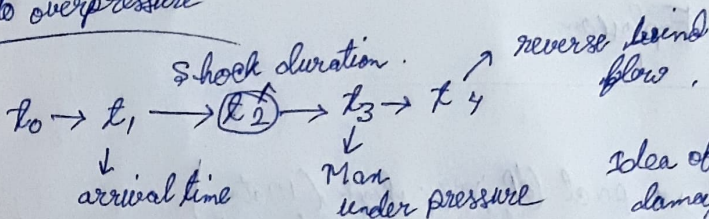
ii) loading between limit.

iii) " reasonably uniform

Lower explosion limit  $\rightarrow 20 \text{ g/m}^3 - 60 \text{ g/m}^3$

upper " "  $\rightarrow 2 \text{ kg/m}^3 - 6 \text{ kg/m}^3$

Due to overpressure



Idea of explosion damage = peak side on overpressure by PT.

Equivalent mass of TNT:-

$$Z_e = \frac{P}{(m_{TNT})^{1/3}}$$

distance from zero

Energy equil of TNT = 1120 cal/g

For explosion on flat surface.

If PT  $\perp$  wave  $\downarrow$  side on op.  
PT  $\rightarrow$  wave  $\rightarrow$  peak side on (reflected op = 2x side on op)

Refer 6-23 fig

$P_s \rightarrow Z_e$

$P_s = \frac{P_o}{P_a} \rightarrow$  peak side on op

$P_a \rightarrow$  ambient

for air  $\rightarrow P_s' = P_s \times 0.5$



$$\frac{P_0}{P_s} = \frac{1616 \left[ 1 + \left( \frac{ze}{4.5} \right)^2 \right]}{\sqrt{1 + \left( \frac{ze}{0.048} \right)^2} \cdot \sqrt{\left( 1 + \left( \frac{ze}{0.832} \right)^2 \right) \left( 1 + \left( \frac{ze}{1.35} \right)^2 \right)}}$$

at ground

TNT equivalency :-

$$m_{TNT} = \frac{m \Delta H_c}{E_{TNT}} \quad (1-10\%)$$

Chemical explosion :-

Calculate by Gibbs free energy  
due to change in moles due to reaction  
with air

Mechanical explosion :-

4 types

$E = \frac{E_{total}}{2}$

Then Mass of TNT then  
by Fig 6-26  
find distance

$$E = \frac{(P_2 - P_1)V}{\gamma - 1} \rightarrow \text{for Near field}$$

Greater distance

$$E = \frac{P_2 V}{(\gamma - 1)} \left( 1 - \left( \frac{P_1}{P_2} \right)^{\frac{\gamma - 1}{\gamma}} \right)$$

Isentropic

$$E = R_g T \ln \left( \frac{P_2}{P_1} \right)$$

isothermal

$$= P_2 V \ln \left( \frac{P_2}{P_1} \right)$$

$$E_b = P_2 V \left[ \ln \left( \frac{P_2}{P_1} \right) - \left( 1 - \frac{P_1}{P_2} \right) \right]$$

Batch Thermo

Predict max explosion