Week 2 (1)

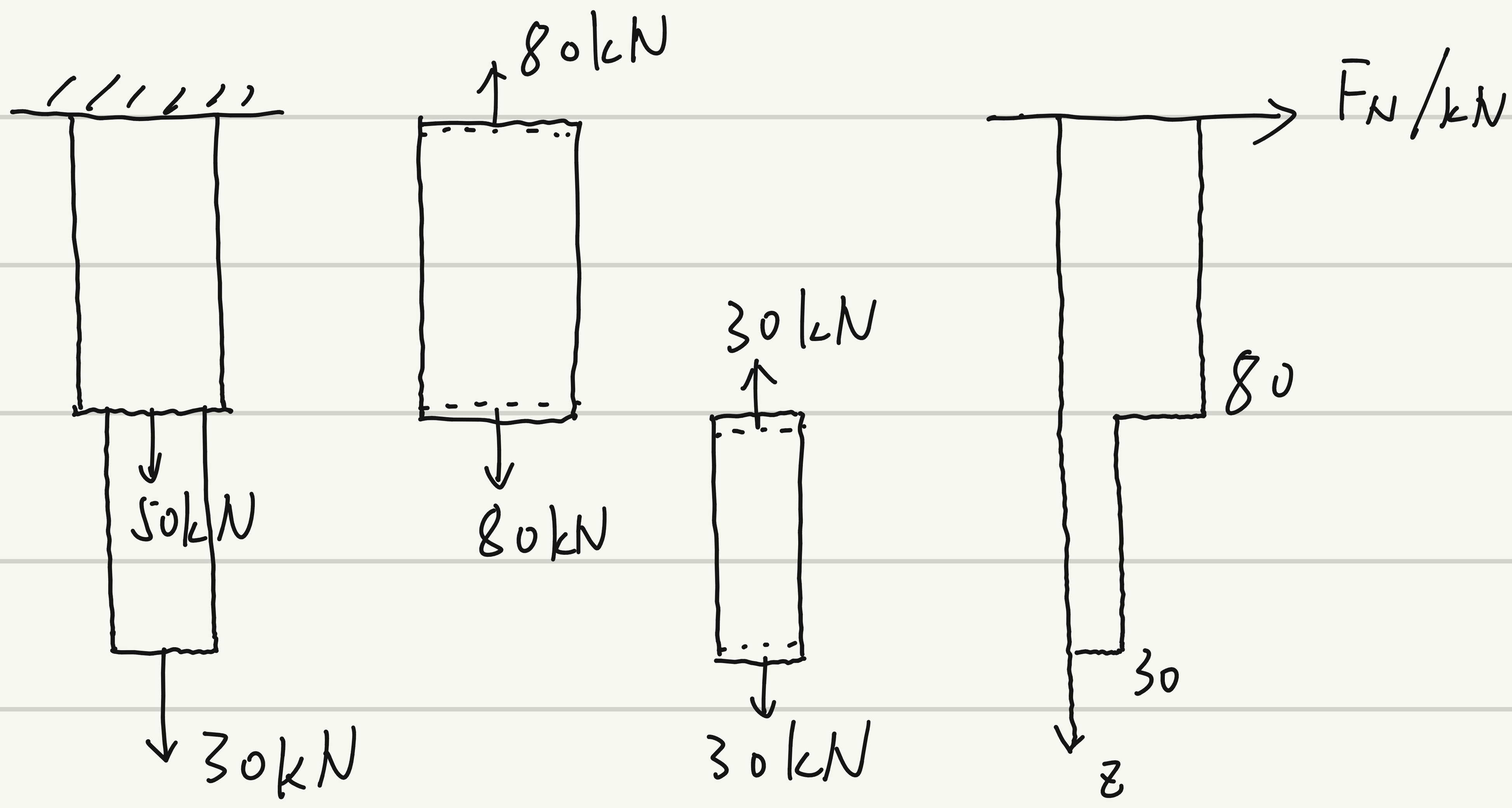
1-6

C 合理:

- x方向受合外力为0 ⇒ AB错
- 形变连续 ⇒ 应力在yz平面连续 ⇒ D错

2-1

a)

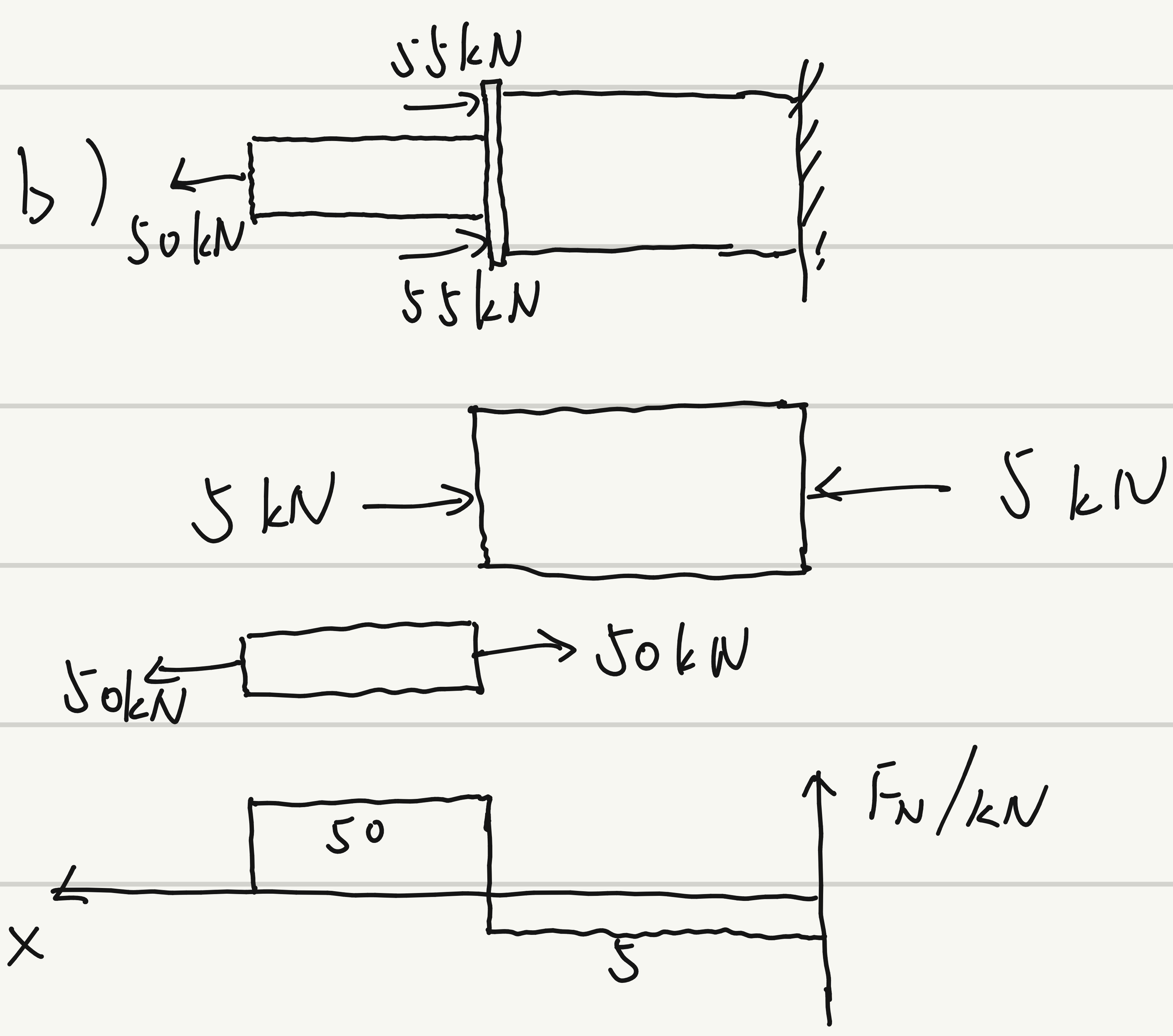


$$\sigma_1 = \frac{F_{N1}}{\frac{1}{4}\pi d_1^2} = 113.18\,MPa$$

$$\sigma_2 = \frac{F_{N2}}{\frac{1}{4}\pi d_2^2} = 95.49\,MPa$$

$$\Delta x = \frac{\sigma_1}{E}\cdot l_1 + \frac{\sigma_2}{E}\cdot l_2 = 1.06\,mm$$

b)



$$\sigma_1 = \frac{F_{N1}}{\frac{1}{4}\pi d_1^2} = -1.51\,MPa$$

$$\sigma_2 = \frac{F_{N2}}{\frac{1}{4}\pi d_2^2} = 44.09\,MPa$$

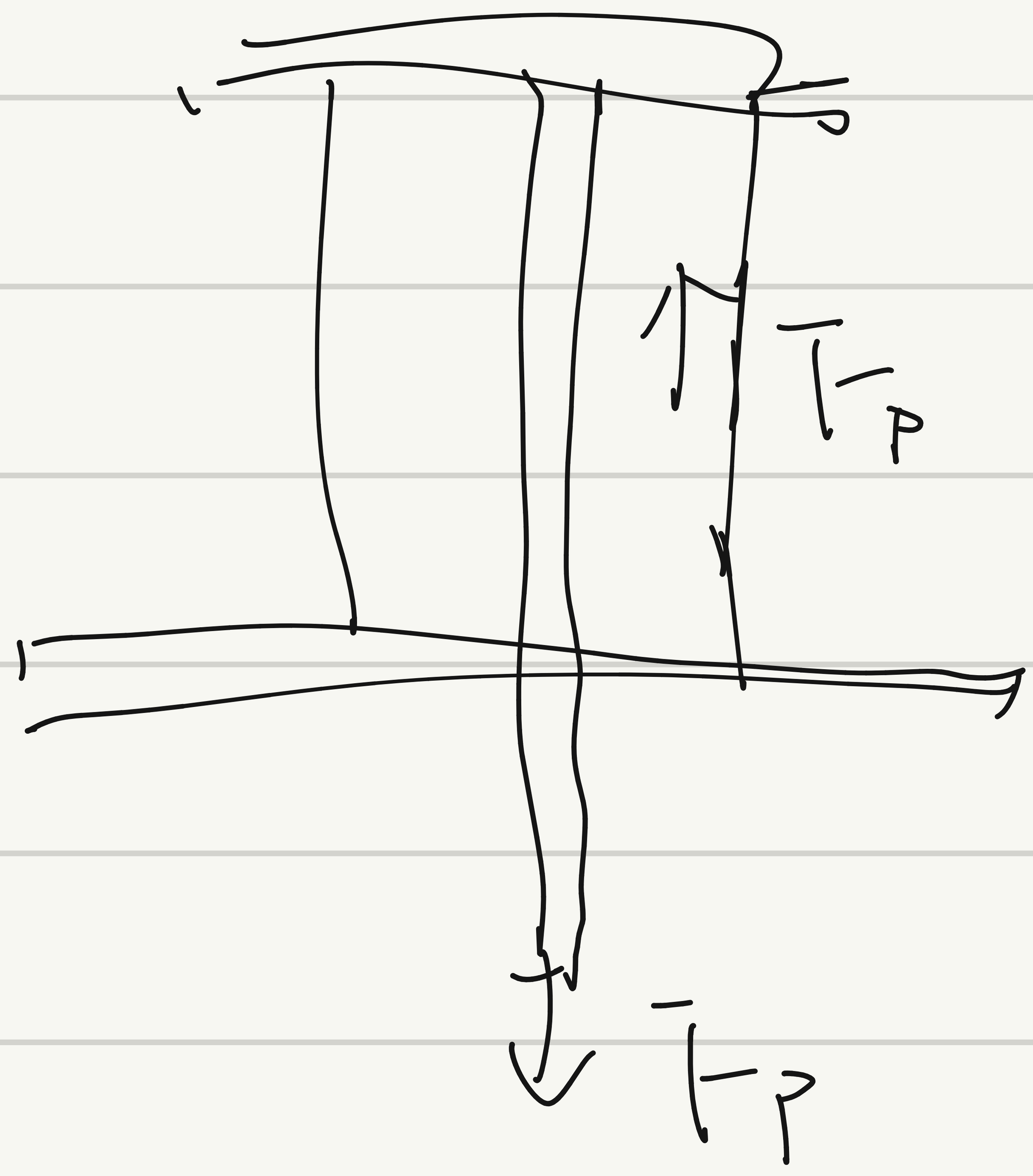
$$\Delta x = \frac{\sigma_1}{E}\cdot l_1 + \frac{\sigma_2}{E}\cdot l_2 = 0.19\,mm$$

Week 2 (2)

2-3

$$\sigma_1 = \frac{F_P}{A} = 54.5\,MPa$$

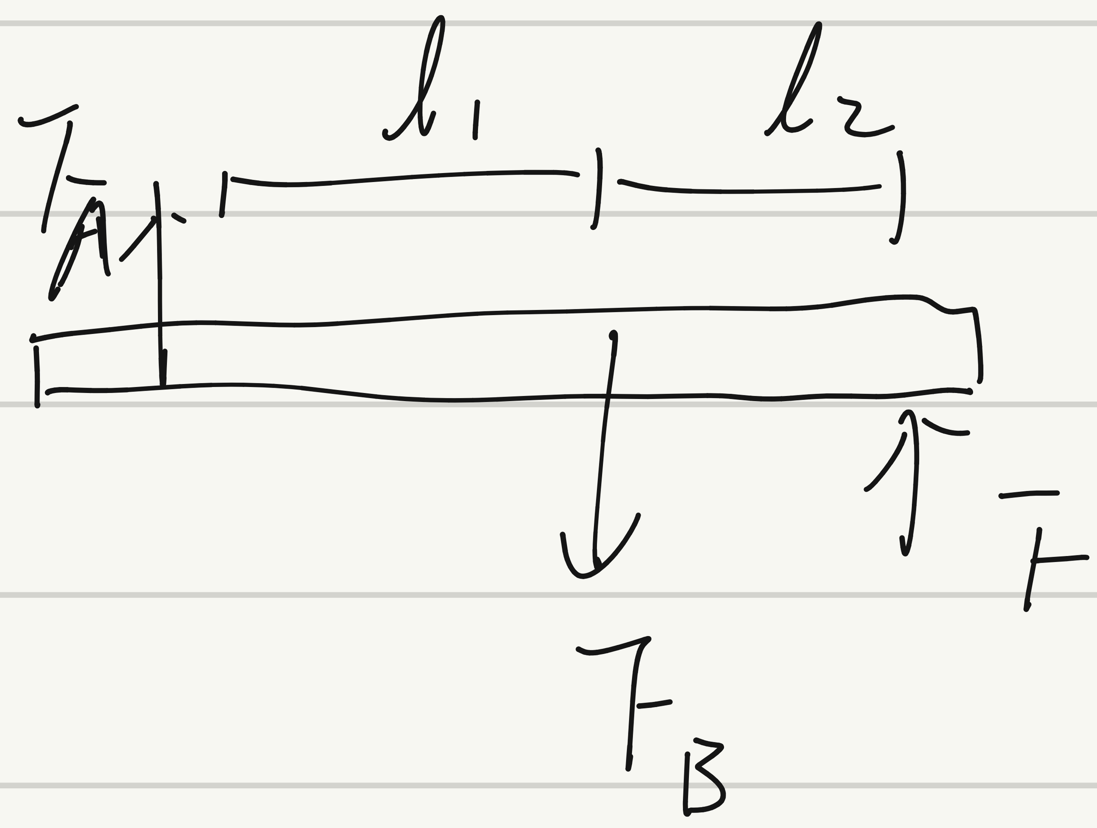
$$\sigma_2 = \frac{F_P}{\frac{1}{4}\pi d^2} = 339.5\,MPa$$



$$x_1 = \frac{\sigma_1 l_1}{E_1} = 0.94\,mm$$

$$x_2 = \frac{\sigma_2 l_2}{E_2} = 3.57\,mm$$

$\Rightarrow \Delta x = x_1 + x_2 = 4.50mm$



2-5

$$F_A = F \cdot \frac{l_2}{l_1} = 2kN$$

$$F_B = F \cdot \frac{l_1 + l_2}{l_1} = 6kN$$

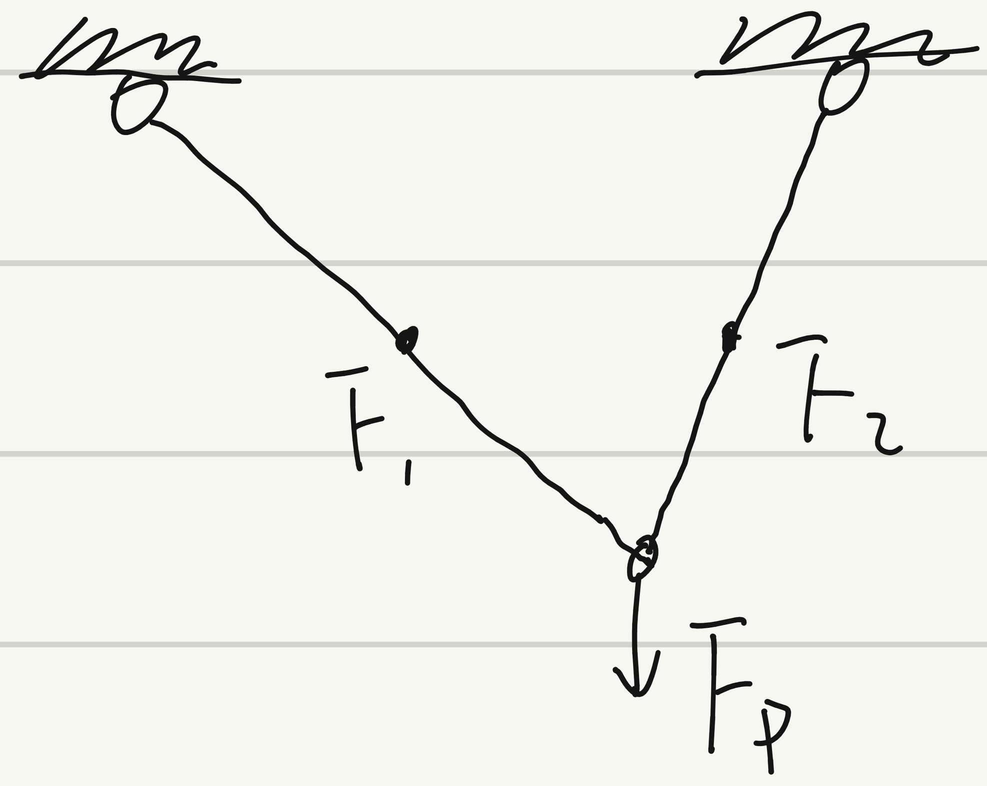
$$\sigma_A = \frac{F_A}{\frac{1}{4}\pi d_1^2} = 13.3MPa < \sigma$$

$$\sigma_B = \frac{F_B}{\frac{1}{4}\pi d_2^2} = 25.8MPa < \sigma$$

$\Rightarrow$ 安全

2-7

$$\begin{cases} F_1 \cos 45^\circ + F_2 \cos 30^\circ = F_P \\ F_1 \sin 45^\circ = F_2 \sin 30^\circ \end{cases}$$

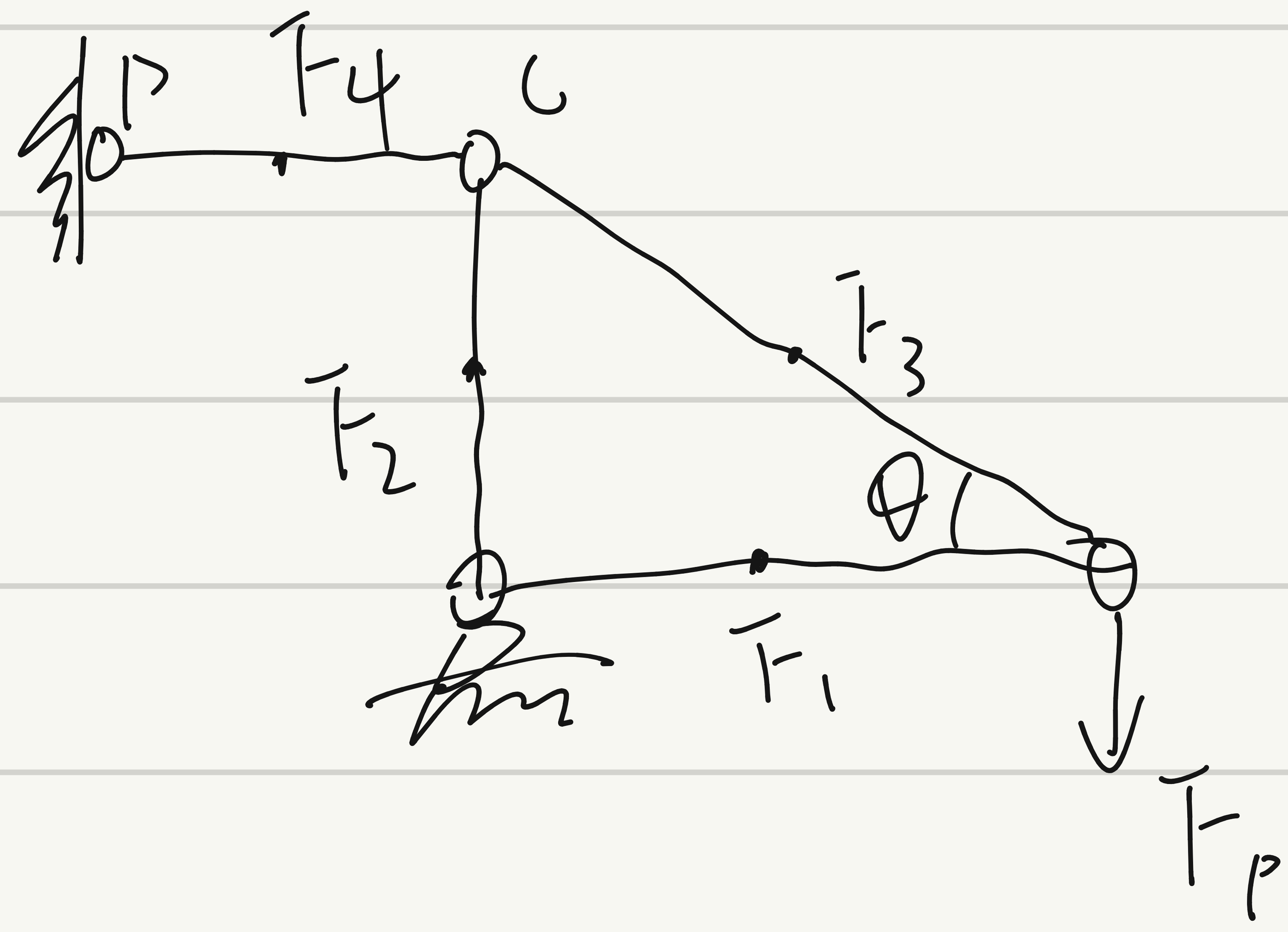


$$\Rightarrow \begin{cases} F_1 = \frac{\sqrt{2}}{1+\sqrt{3}} F_P \\ F_2 = \frac{2}{1+\sqrt{3}} F_P \end{cases}$$

$$F_2 > F_1 \Rightarrow \quad F_2 = \sigma \cdot \frac{1}{4}\pi d^2$$

$$\Rightarrow F_P = \frac{1+\sqrt{3}}{2} \cdot \sigma \cdot \frac{1}{4}\pi d^2 = 67.38\ kN$$

2-8



$$\begin{cases} F_P = F_3 \sin\theta \\ F_3 \cos\theta = F_1 \end{cases}$$

$$\begin{cases} F_3 \cos\theta = F_4 \\ F_3 \sin\theta = F_2 \end{cases}$$

$$\Rightarrow \begin{cases} F_1 = \frac{4}{3} F_P \\ F_2 = F_P \\ F_3 = \frac{5}{3} F_P \\ F_4 = \frac{4}{3} F_P \end{cases}$$

$F_1 > F_2$

$120 \times 10^6 \times 800$

$F_3 > F_4$

$$\begin{cases} \sigma_1 = \frac{F_1}{A_1} = \frac{1000}{3} F_P / m^2 \\ \sigma_3 = \frac{F_3}{A_3} = \frac{6250}{3} F_P / m^2 \end{cases}$$

$$\frac{\sigma_1}{\sigma_W} < \frac{\sigma_3}{\sigma_S}$$

$$\Rightarrow F_P = \frac{3}{5} \cdot F_3 = \frac{3}{5} \cdot \sigma_W \cdot A_3 = 57.6\ kN$$

2-9

设铝上有力F_1，钢上F_2

$$\frac{F_1}{F_2}=\frac{E_1S_1}{E_2S_2}=\frac{7}{15}$$

又：$F_1+F_2=F=385kN$

$$\Rightarrow\begin{cases}F_1=122.5kN\\F_2=262.5kN\end{cases}$$

$$\Rightarrow\begin{cases}\sigma_1=-\frac{F_1}{S_1}=-61.25MPa\\\sigma_2=-\frac{F_2}{S_2}=-175MPa\end{cases}$$

2-11

$$\frac{F_1}{F_2}=\frac{E_1}{E_2}=2$$

有：$F_1\frac{b}{2}+F_2\cdot\frac{3}{2}b=(F_1+F_2)x$

$\Rightarrow x=\frac{5}{6}b$

2-12 B. 屈服应力是材料固有性质，不变；出现塑性形变后，弹性模量↓，韧性↓

2-13 A 脆：压时使其结构紧致，拉则相反

2-14 B 此为屈服强度定义

2-15 B 强：σ最大处；弹：斜率；延：截止处应变

2-16 C. 屈服时：σ不咋变，ε继续变

2-17 C 定义

2-18 D B已屈服⇒沿与OA平行的BD卸去.