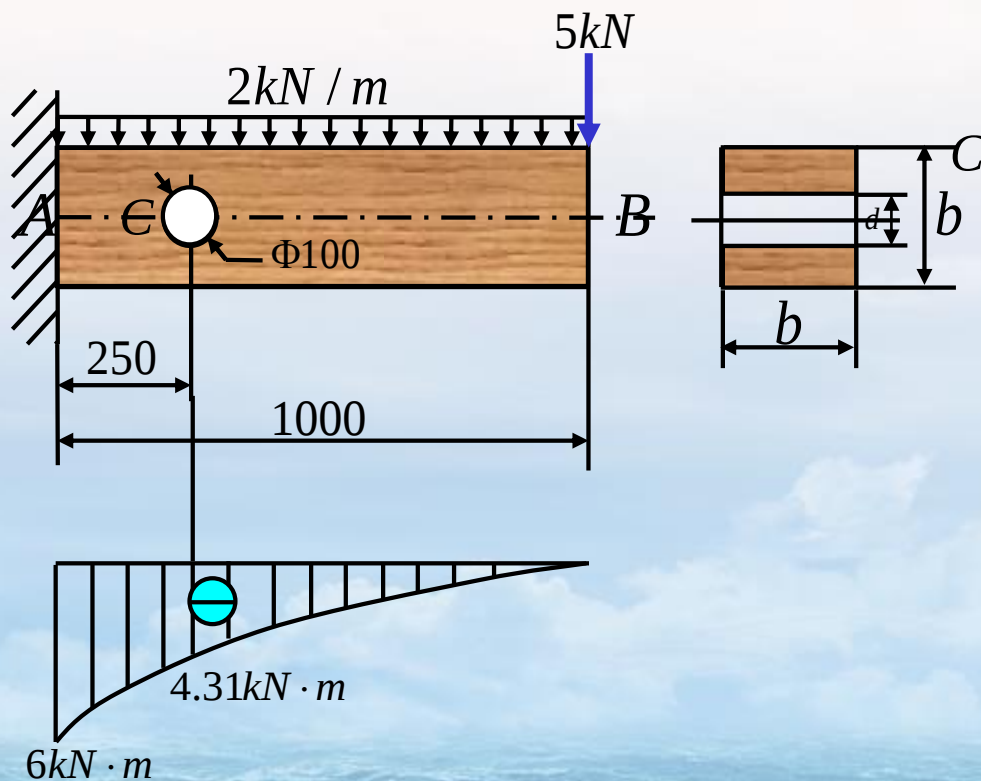


例题一



梁的应力 例题

一正方形截面木梁如图所示。在截面C的中性轴处钻一圆孔，直径为100mm，木梁的许用应力 $[\sigma]=10\text{MPa}$ ，求正方形的边长。



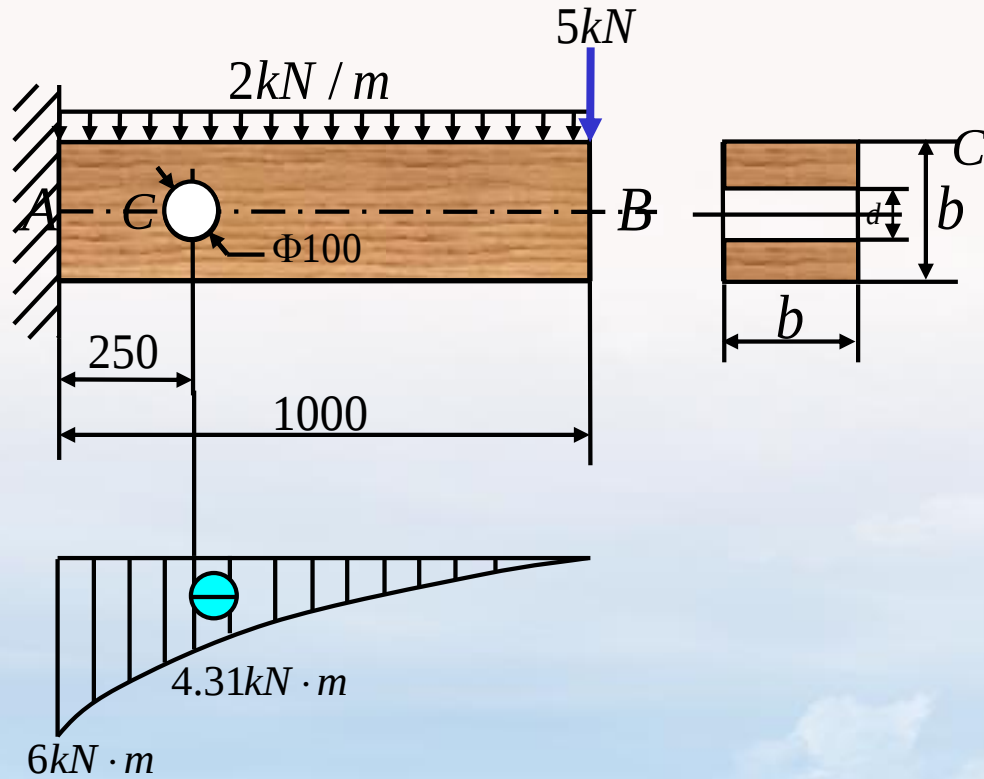
解:
$$M = -Px - \frac{1}{2}qx^2 \quad (0 \leq x \leq l)$$

$$\begin{aligned} M_c &= -5 \times 0.75 - \frac{1}{2} \times 2 \times 0.75^2 \text{ kN} \cdot \text{m} \\ &= -4.31 \text{ kN} \cdot \text{m} \end{aligned}$$

$$\begin{aligned} M_A &= -5 \times 1 - \frac{1}{2} \times 2 \times 1^2 \text{ kN} \cdot \text{m} \\ &= -6 \text{ kN} \cdot \text{m} \end{aligned}$$



梁的应力 例题



A截面:

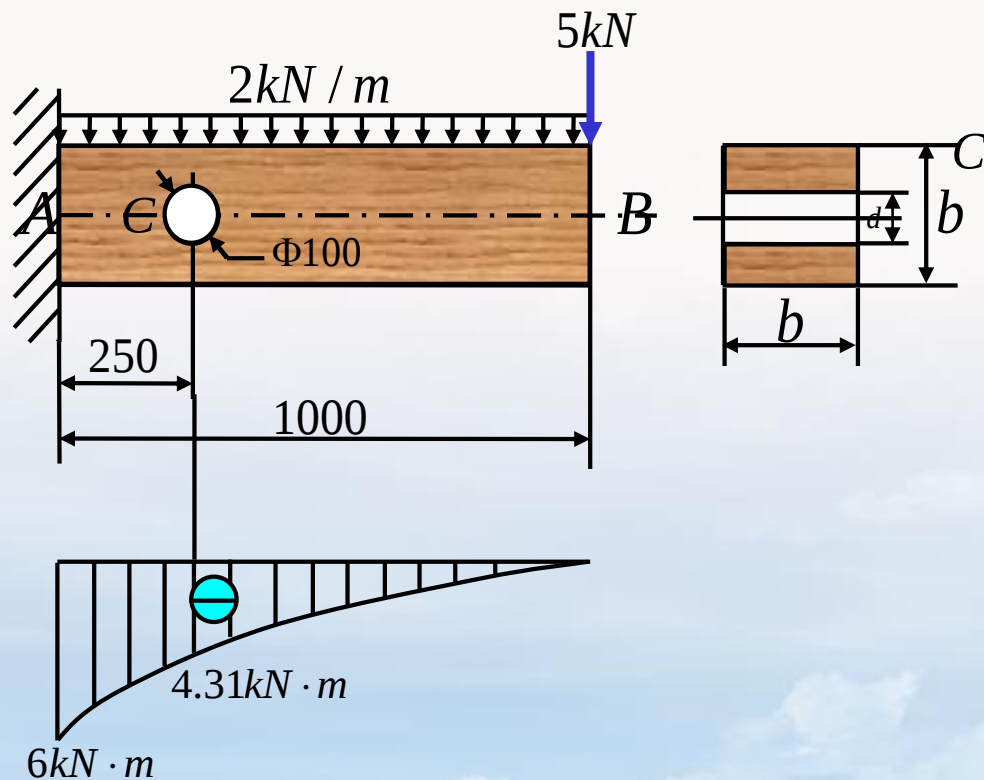
$$\frac{M_A}{W_z} \leq [\sigma] \rightarrow W_z \geq \frac{M_A}{[\sigma]}$$

$$\frac{b^3}{6} \geq \frac{6 \times 10^6 \text{ N} \cdot \text{mm}}{10 \text{ MPa}}$$

$$b \geq 153.3 \text{ mm}$$



梁的应力 例题



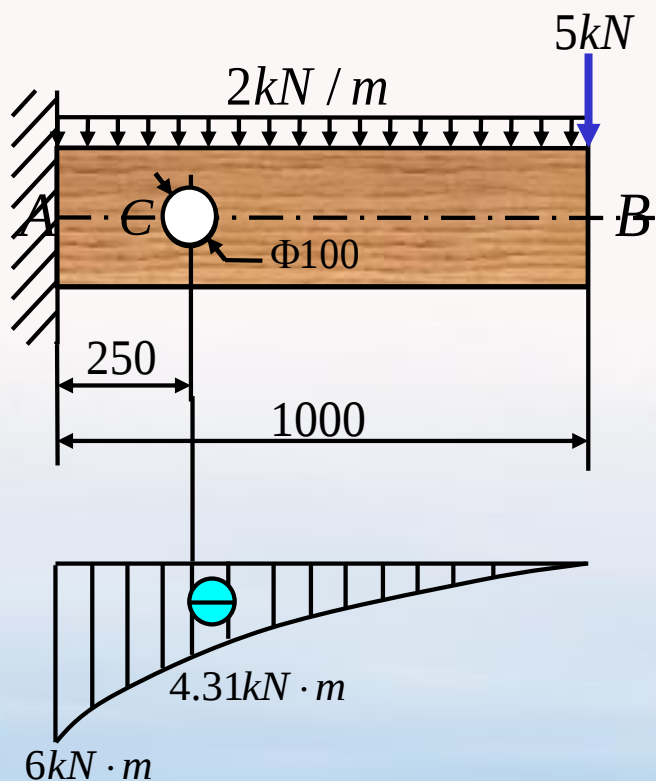
C截面:

$$\frac{M_c}{W_z} \leq [\sigma] \rightarrow W_z \geq \frac{M_c}{[\sigma]}$$

$$\begin{aligned} W_z &= \frac{J_z}{b/2} \\ &= \frac{\frac{b}{12} \cdot b^3 - \frac{b}{12} d^3}{b/2} \\ &= \frac{(b^3 - d^3)}{6} \end{aligned}$$



梁的应力 例题



$$W_z = \frac{(b^3 - d^3)}{6}$$

$$W_z \geq \frac{M_C}{[\sigma]}$$

$$\frac{(b^3 - d^3)}{6} \geq \frac{4.31 \times 10^6 \text{ N} \cdot \text{mm}}{10 \text{ MPa}}$$

$$b^3 \geq \frac{6 \times 4.31 \times 10^6 \text{ N} \cdot \text{mm}}{10 \text{ MPa}} + 100^3 \text{ mm}^3$$

$$b \geq 153.1 \text{ mm}$$

$\therefore b$ 取较大值, 即 153.3 mm, 圆整得 $b = 154 \text{ mm}$

