

MECHANICS

锚链与单吊杆的受力平衡分析

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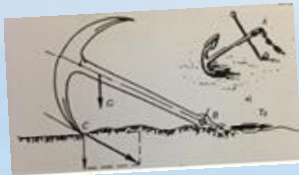
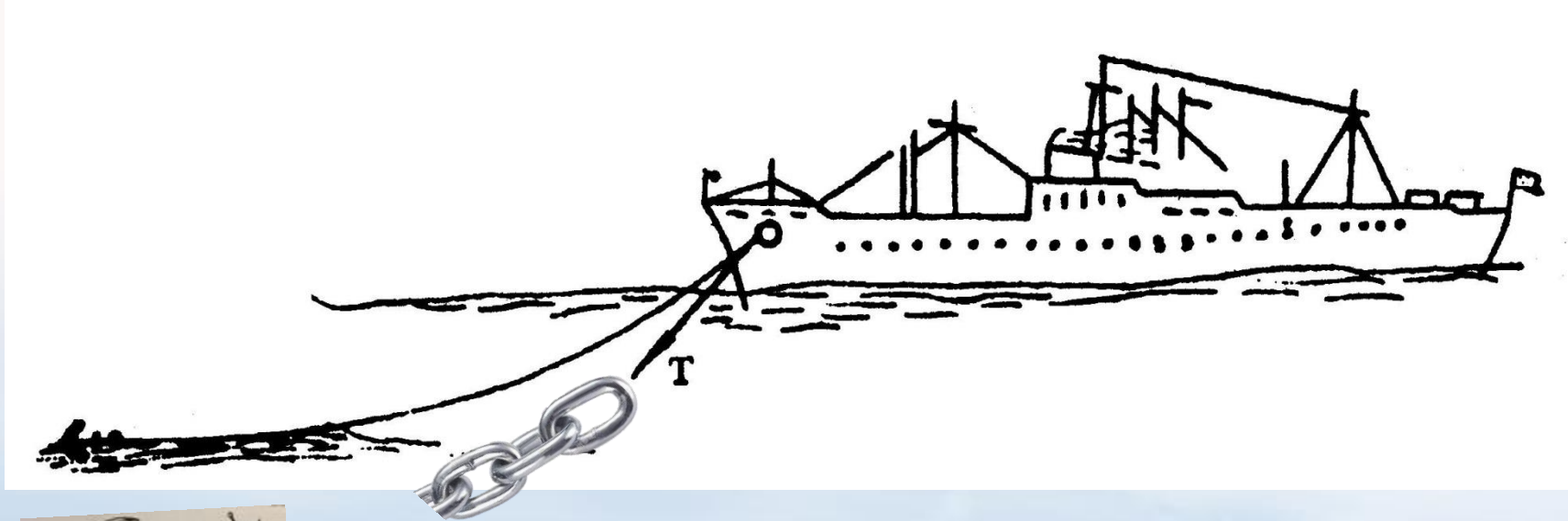


锚链的受力平衡分析



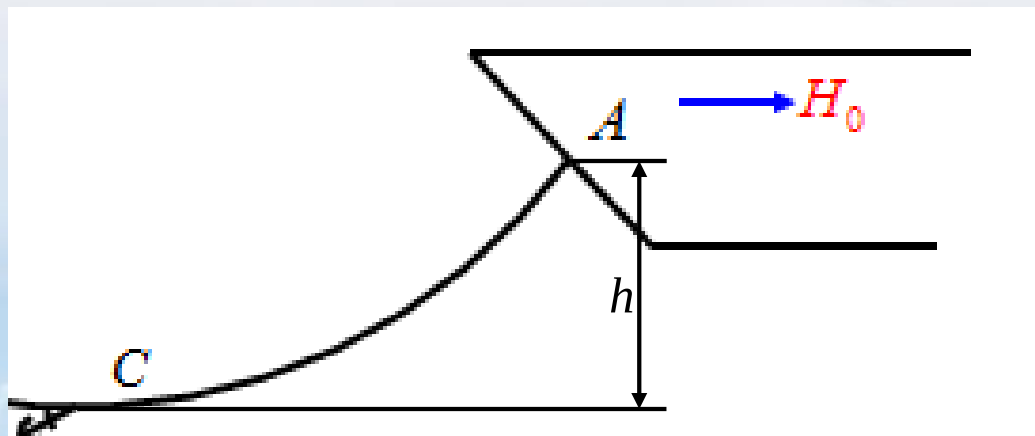


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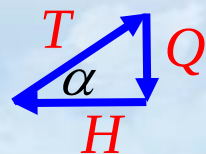
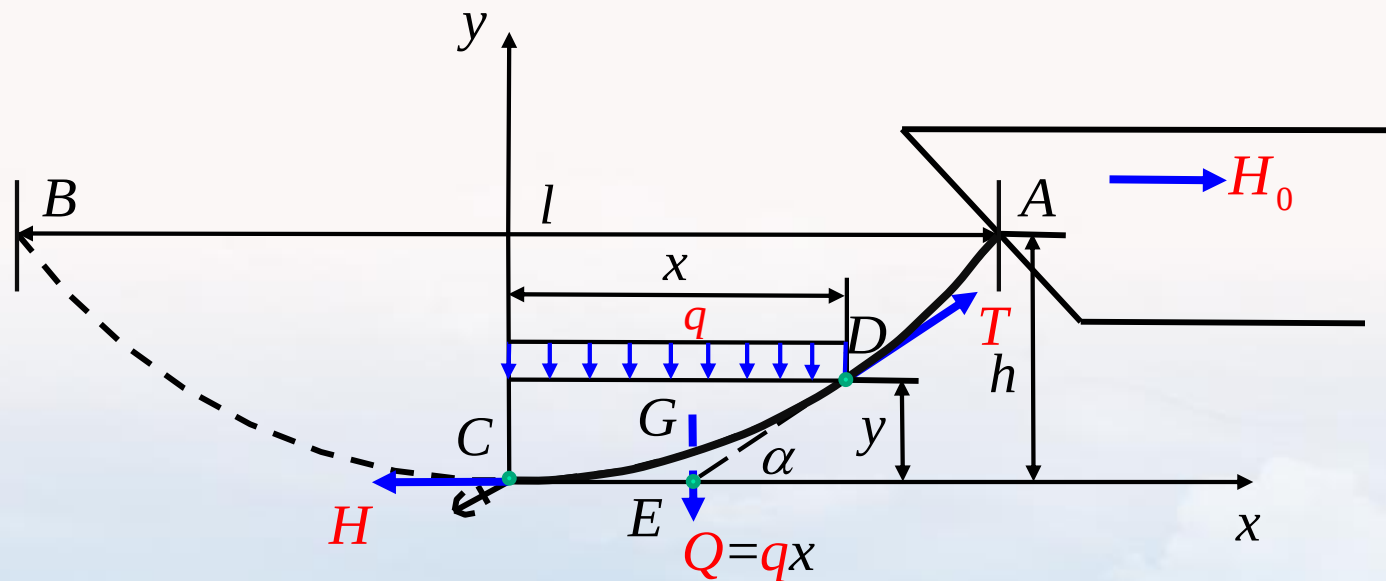


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船舶在锚泊时，受到风、流的水平力 H_0 的作用，当船舶平衡时，锚链的形状如图示。如已知锚链孔到海底的距离为 h ，单位长锚链重为 q ，试分析锚链形状及锚链的受力。



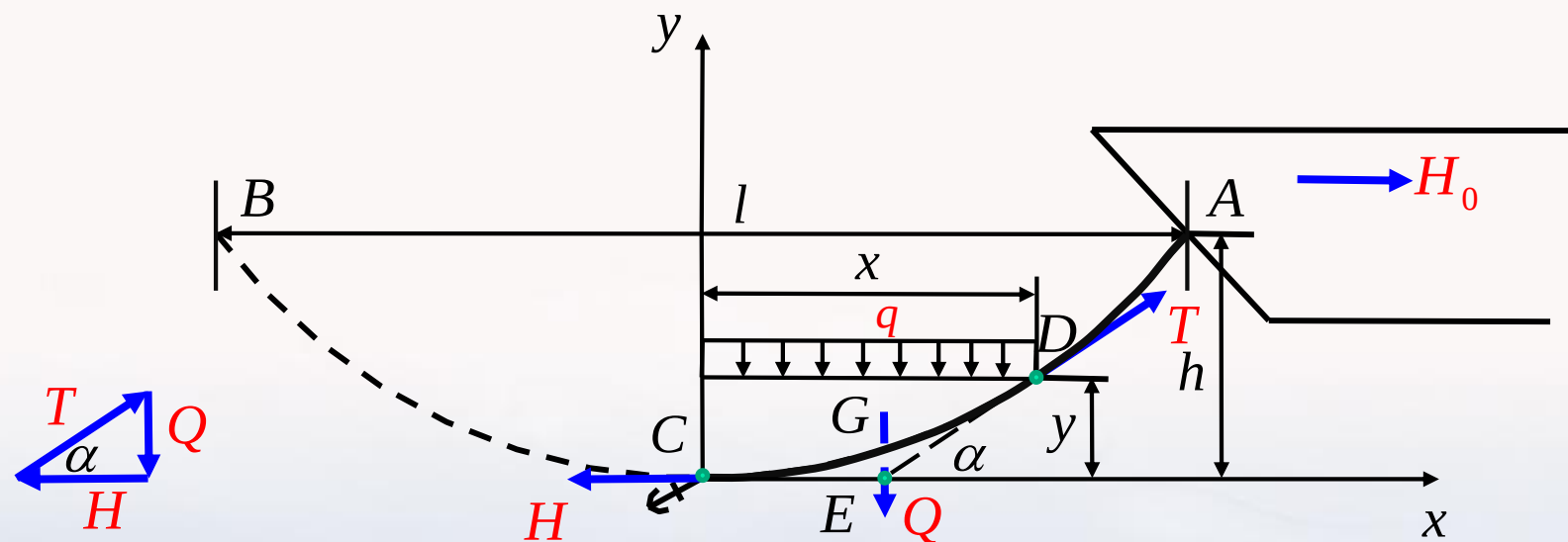
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$$\tan \alpha = \frac{Q}{H} = \frac{qx}{H}$$



锚链与单吊杆的受力平衡分析



$$\tan \alpha = \frac{dy}{dx} = \frac{Q}{H} = \frac{qx}{H}$$

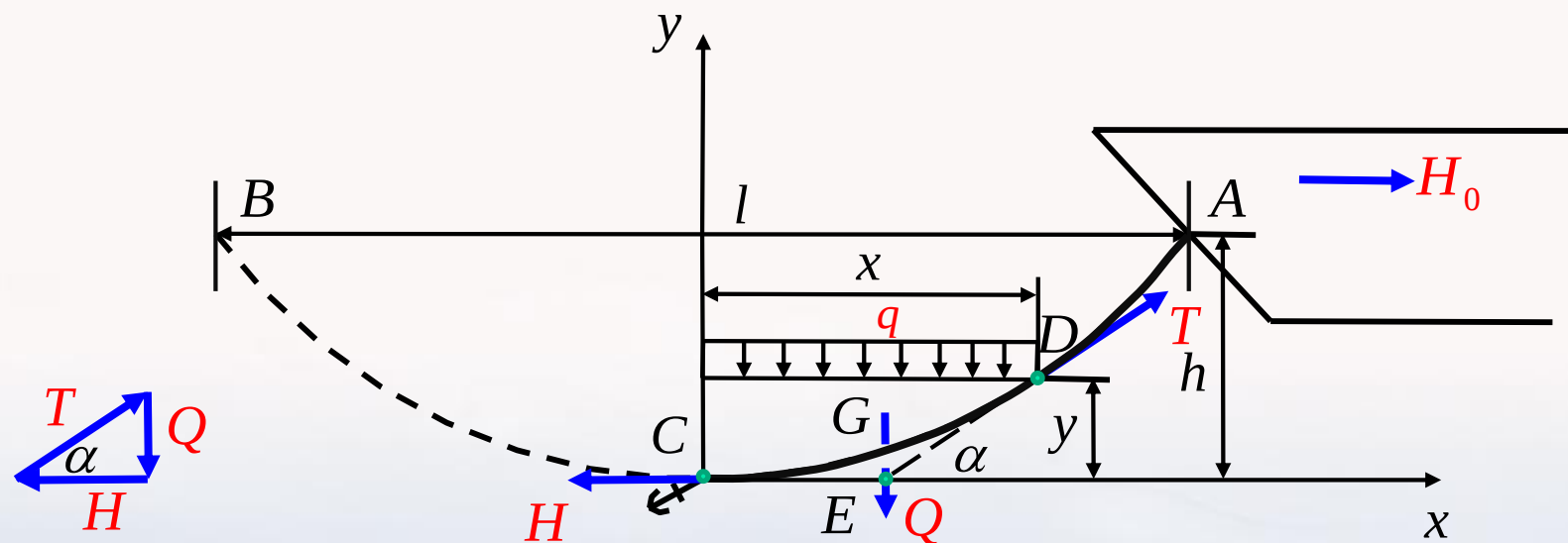
$$y = \frac{ql^2}{8h} \quad (1)$$

$$x = l/2, y = h$$

$$H = \frac{ql^2}{8h} \quad (2)$$



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$$T = \sqrt{H^2 + q^2 x^2}$$

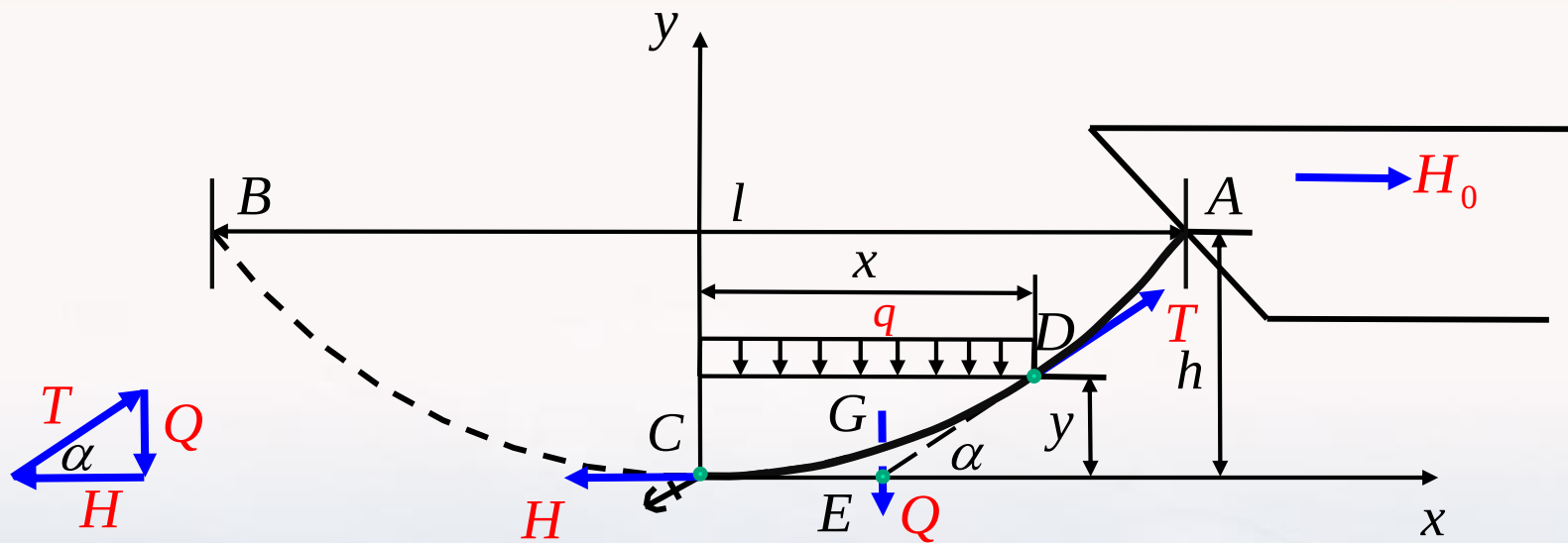
$$\downarrow x = l / 2$$

$$T_{\max} = \sqrt{H^2 + q^2 l^2 / 4}$$

$$s = \sqrt{h^2 + \left(\frac{l}{2}\right)^2}$$



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$$s = \sqrt{h^2 + \left(\frac{l}{2}\right)^2}$$

$$H = \frac{ql^2}{8h} \quad (2) \quad \Rightarrow \quad l^2 = 8Hh / q$$

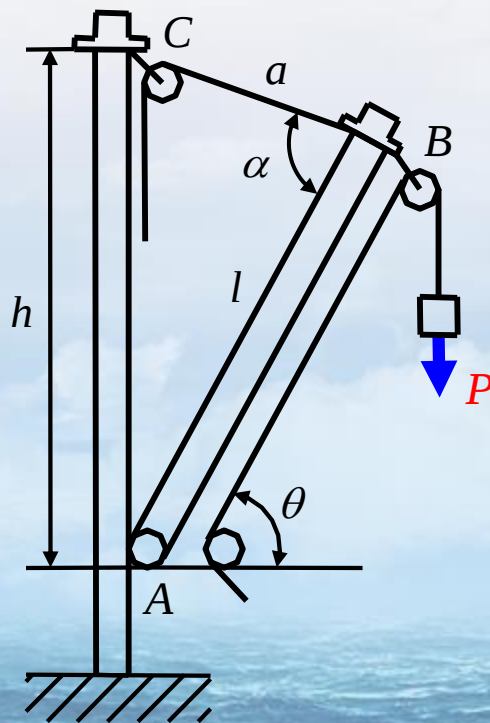
$$s = \sqrt{h(h + 2H / q)}$$

$$H = H_0$$

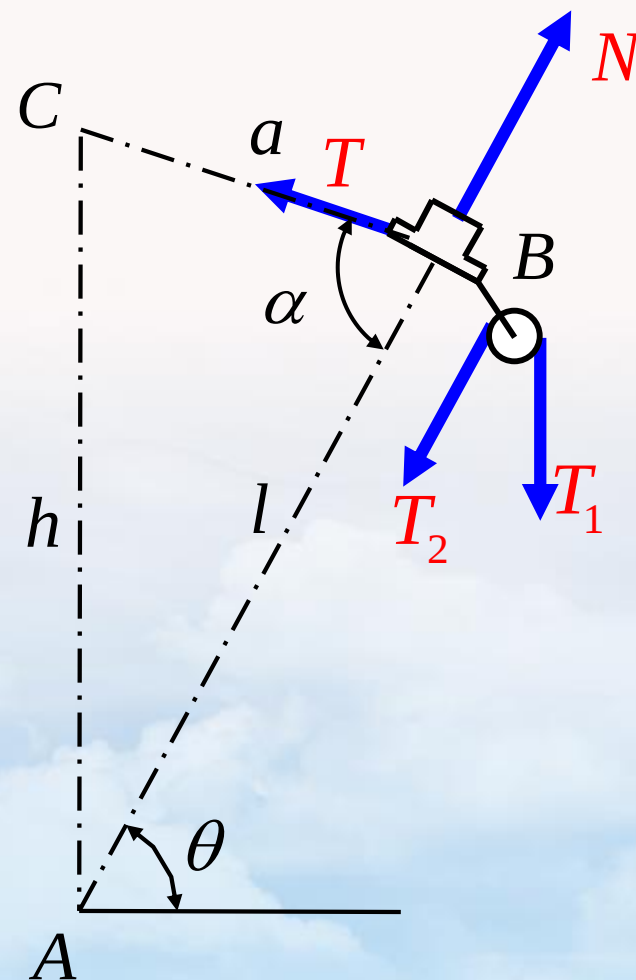
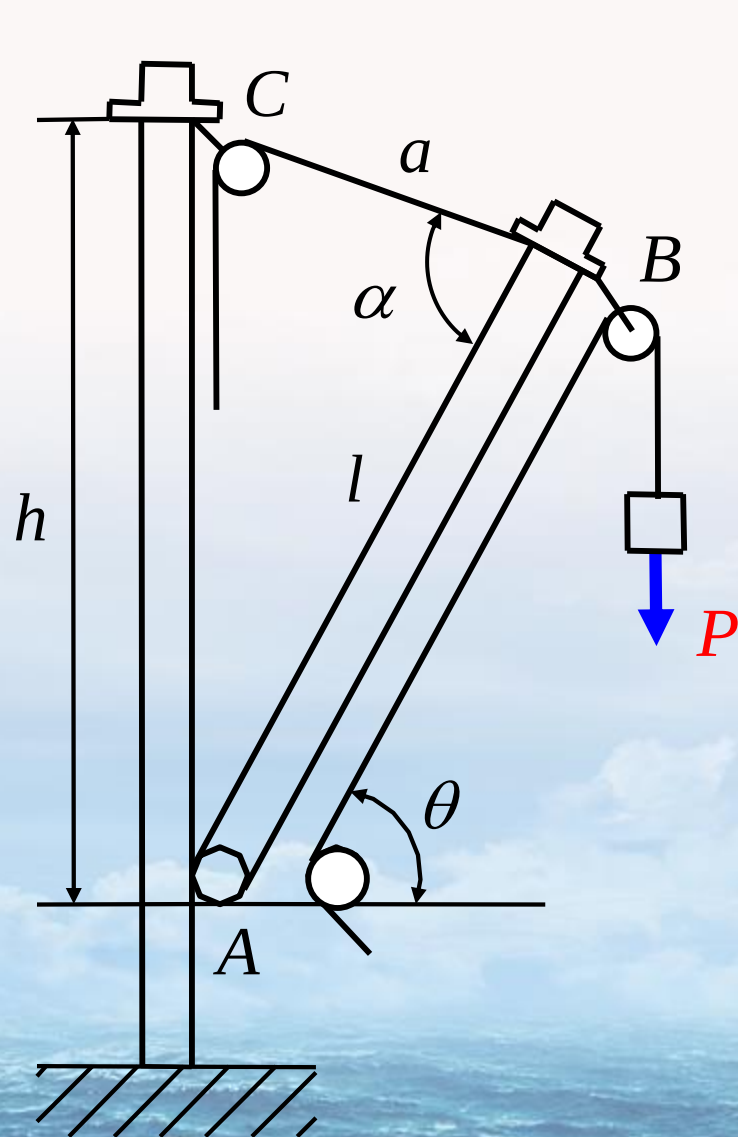


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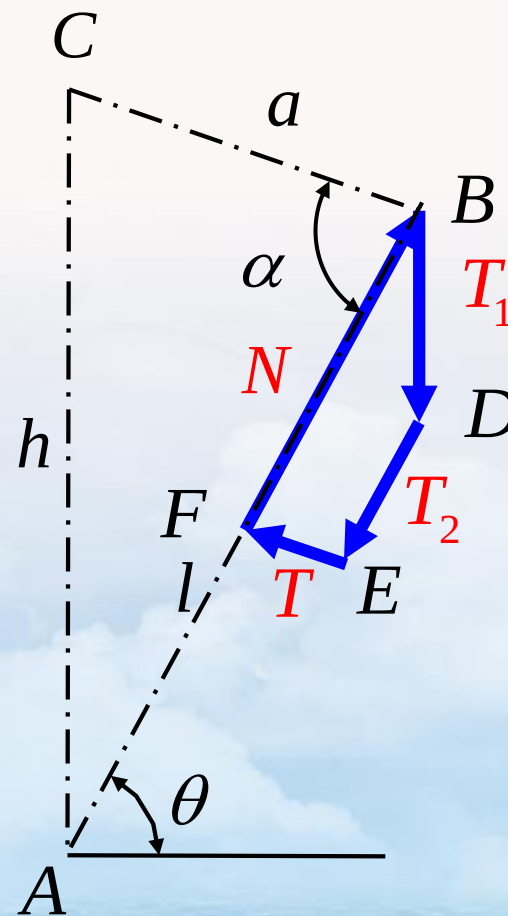
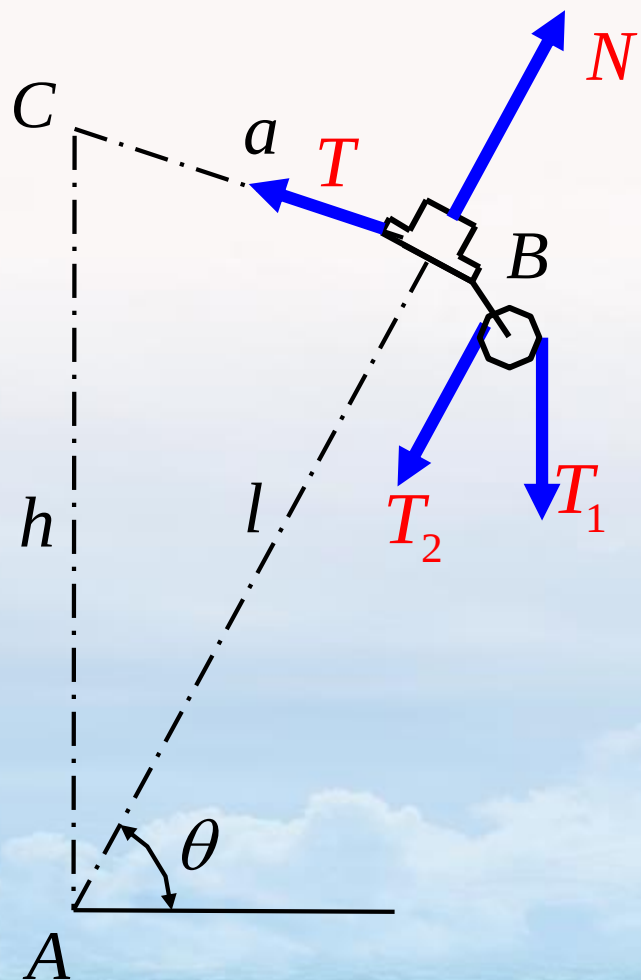
某船单吊杆长 $l=12m$ ，千斤索顶攀在桅上的高度 $h=10.5m$ ，货物重 $P=50kN$ ，吊货索后手拉力 P' （考虑滑车摩擦）等于 $1.05P$ 。试求吊杆所受的压力及千斤索所受的张力。



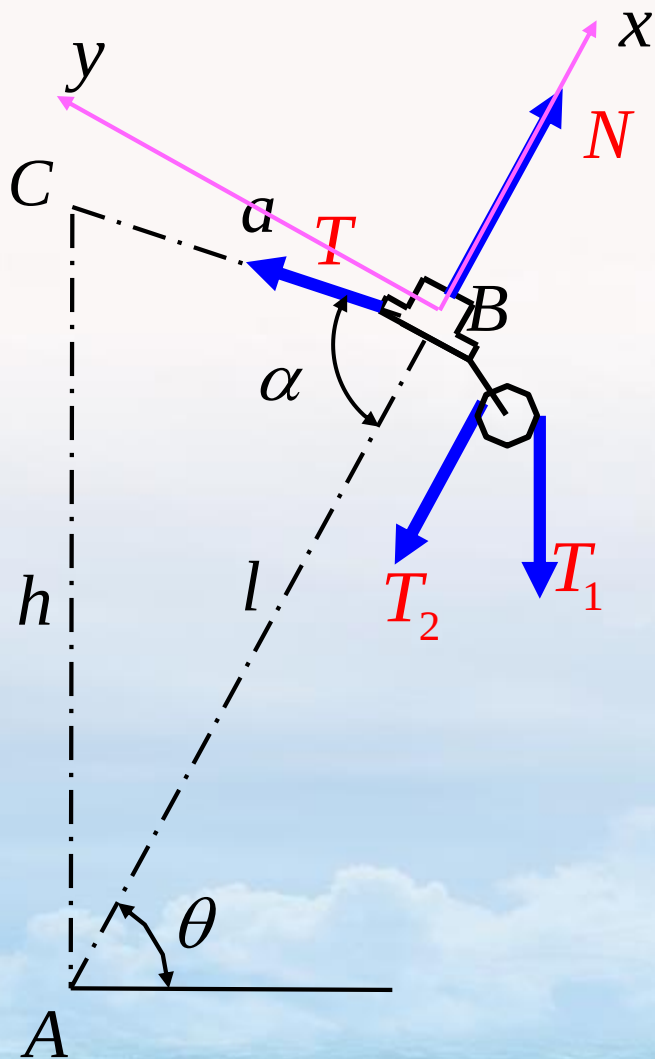
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$$\Sigma F_x = 0, N - T \cos \alpha - T_2 - T_1 \sin \theta = 0$$

$$\Sigma F_y = 0, T \sin \alpha - T_1 \cos \theta = 0$$

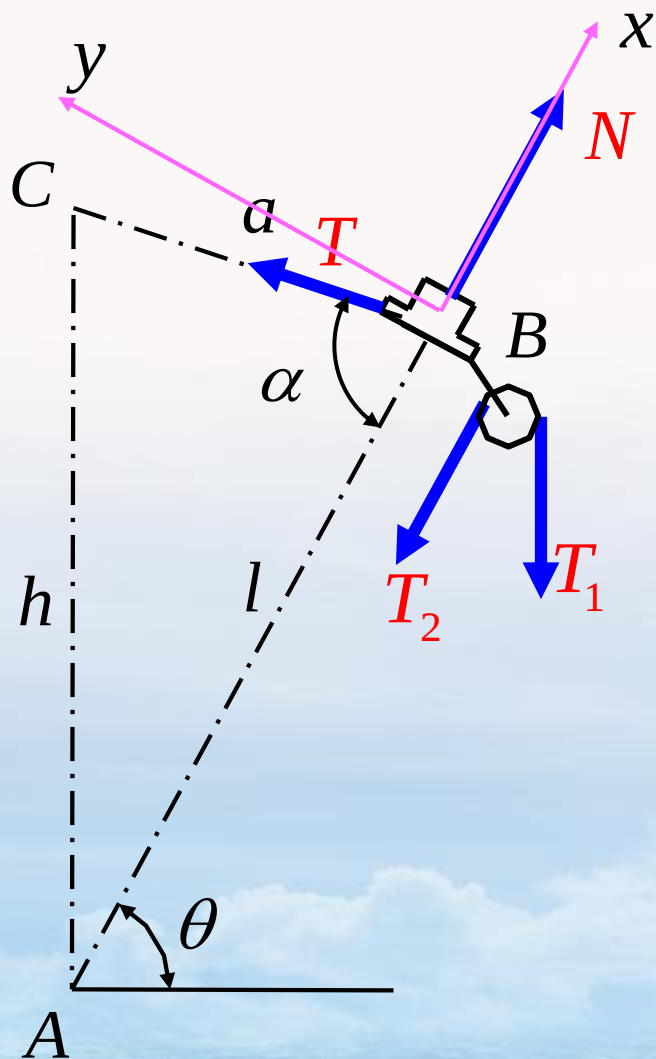
$$T_1 = P, T_2 = 1.05P$$

$$a = \sqrt{l^2 + h^2 - 2lh \sin \theta}$$

$$\sin \alpha = \frac{h}{a} \cos \theta$$



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$$N = P(1.05 + l / h) \quad (1)$$

$$T = P \sqrt{1 + \left(\frac{l}{h}\right)^2 - 2 \frac{l}{h} \sin \theta} \quad (2)$$

