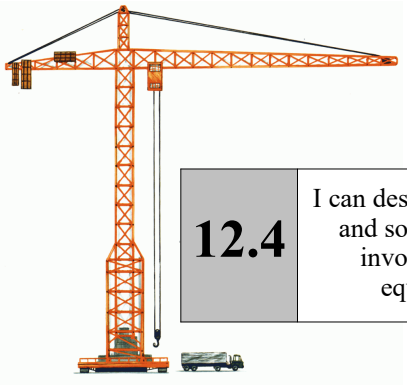
Announcements

PRACTICE	LABS	TESTS
Unit 12 Problems (1-25)	Balancing Act Corrections	Unit 12 Test Thursday (4/4/19)

Zero Torque and Static Equilibrium



12.4	I can describe, interpret, and solve problems involving static equilibrium.

Conditions For Equilibrium

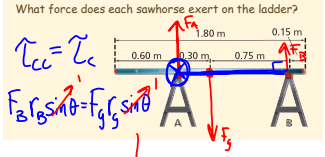
1.) Translational Equilibrium — Net Force = 0

2.) Rotational Equilibrium — Net Torque = 0

★ Define axis of rotation

Static Equilibrium

A 5.8 kg ladder, 1.80 m long, is resting on two sawhorses. Sawhorse A is 0.60 m from one end of the ladder, and sawhorse B is 0.15 m from the other end of the ladder. What force does each sawhorse exert on the ladder?



$\tau_{cc} = \tau_c$

$F_B r_B \sin\theta = F_g r_g \sin\theta$

$F_A + F_B = F_g = mg$

$F_B r_B = mgr_g$

$F_A + F_B = 56.84\,N$

$F_B(1.05) = (5.8\,kg)(9.8\,m/s^2)(0.3)$

$F_B = 16\,N$

$F_A = 56.84 - 16$

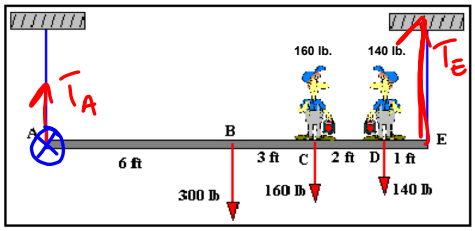
$F_A = 41\,N$

Scaffolding

SCAFFOLDS

In this example, two painters are standing on a 300 lb. scaffolding (beam) which is 12 ft. long. One painter weighs 160 lb. and the second painter weighs 140 lb. The scaffolding is supported by two cables, one at each end. As they paint, the painters begin wondering what force (tension) is in each cable.

The question is, what is the force (tension) in each cable when the painters are standing in the positions shown. Notice that for a uniform beam or bar, as far as equilibrium conditions are concerned, the beam weight may be considered to act at the center (of mass) of the bar.



$T_A + T_E = F_{g,B} + F_{g,C} + F_{g,D}$

UNIT 12 IN CLASS PROBLEMS

19. A 5.00 m long diving board of negligible mass is supported by two pillars. One pillar is at the left end of the diving board and the other is 1.50 m away. Find the forces, in Newton's, exerted by the pillars when a 90.0 kg diver stands at the far end of the board.

20. A banner is suspended from a horizontal, pivoted pole, as shown in **Figure 8-30**. The pole is 2.10 m long and weighs 175 N. The banner, which weighs 110 N, is suspended 1.80 m from the pivot point or axis of rotation. What is the tension in the cable supporting the pole?

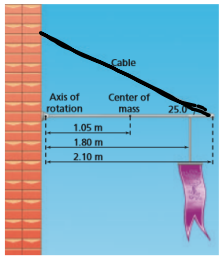


Figure 8-30

UNIT 12 IN CLASS PROBLEMS

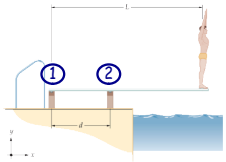
22. A 5.00 m long diving board of negligible mass is supported by two pillars. One pillar is at the left end of the diving board and the other is 1.50 m away. Find the forces, in Newton's, exerted by the pillars when a 90.0 kg diver stands at the far end of the board.

$\tau_{cc} = \tau_c$

$F_2 r_2 \sin\theta = F_m r_m \sin\theta$

$F_2 r_2 = m_m g r_m$

$F_2 = 2940\ N$



$F_2 = m_m g + F_1$

$F_1 = 2060\ N$

UNIT 12 IN CLASS PROBLEMS

23. A banner is suspended from a horizontal, pivoted pole, as shown in **Figure 8-30**. The pole is 2.10 m long and weighs 175 N. The banner, which weighs 110 N, is suspended 1.80 m from the pivot point or axis of rotation. What is the tension in the cable supporting the pole?

$\tau_{cc} = \tau_c$

$T_c r_c \sin\theta = F_p r_p \sin\theta + F_B r_B \sin\theta$

$T_c (2.10\ m) \sin 25° = (175\ N)(1.05\ m) + (110\ N)(1.80\ m)$

$T_c = 430\ N$

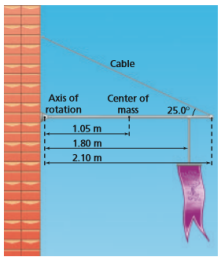


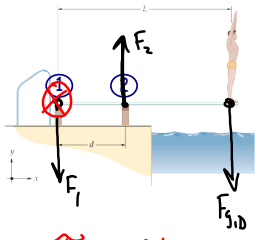
Figure 8-30

UNIT 12 IN CLASS PROBLEMS

22. A 5.00 m long diving board of negligible mass is supported by two pillars. One pillar is at the left end of the diving board and the other is 1.50 m away. Find the forces, in Newton's, exerted by the pillars when a 90.0 kg diver stands at the far end of the board.

$F_{net} = 0$

$F_1 + F_{g,D} = F_2$



$\tau_{cc} = \tau_c$

$F_2 r_2 \sin\theta = F_{g,D} r_D \sin\theta$

$F_2 (1.5\ m) = m_p g (5.0\ m)$

UNIT 12 IN CLASS PROBLEMS

23. A banner is suspended pivoted pole, as shown pole is 2.10 m long and banner, which weighs 1 1.80 m from the pivot p rotation. What is the ten supporting the pole?

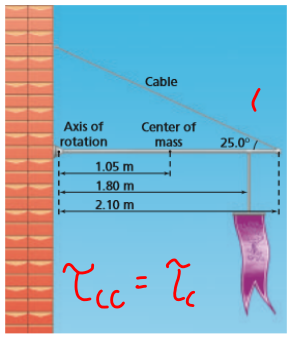


Figure 8-30

$\tau_{cc} = \tau_c$

$T_c r_c \sin\theta = F_{g,P} r_P \sin\theta + F_{g,B} r_B \sin\theta$

$T_c (2.1\ m)(\sin 25) = m_p g (1.05) + m_B g (1.8)$

Practice Matters!

UNIT 12 PROBLEMS

(26-27)