Physics 3204

Static Equilibrium Worksheet 2 : Rotational Equilibrium

1. At which point on a uniform object can the force of gravity be considered to act?

   (A) centre of mass
   (B) centre of rotation
   (C) moment of force
   (D) moment of torque

2. Which defines static equilibrium?

   (A) $F_{net} \neq 0$, $\tau_{net} \neq 0$
   (B) $F_{net} \neq 0$, $\tau_{net} = 0$
   (C) $F_{net} = 0$, $\tau_{net} \neq 0$
   (D) $F_{net} = 0$, $\tau_{net} = 0$

3. Which condition will produce rotational equilibrium?

   (A) $\vec{F}_{net} = 0$
   (B) $\vec{F}_{x} = 0$
   (C) $\vec{\tau}_{net} = 0$
   (D) $\vec{\tau}_{x} = 0$

4. What is torque?

   (A) $rF_{\perp}$
   (B) rF_{ll}
   (C) $r\cos\theta$
   (D) $r\sin\theta$

5. Which best explains why a doorknob is located far away from the hinge?

   (A) Friction
   (B) Gravity
   (C) Tension
   (D) Torque

6. Which best defines torque?

   (A) J / m
   (B) $kg \bullet m / s^2$
   (C) $N \bullet m$
   (D) $N \bullet m^2$

7. What is the unit for torque?

(A) $\frac{J}{s}$

(B) $kg \cdot \frac{m}{s^2}$

(C) J

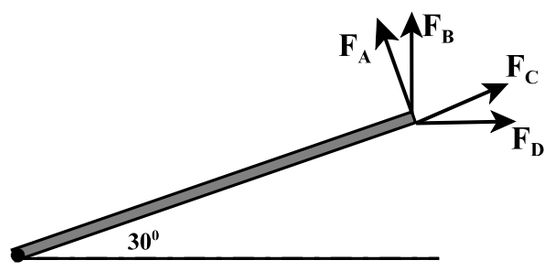
(D) $N \cdot m$

8. What is the ability to turn a body about a pivot?

(A) centripetal force
(B) net force
(C) orbit
(D) torque

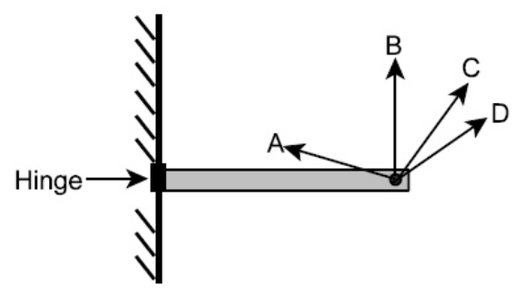
9. Which force in the diagram below would produce the largest torque on the lever arm?

(A) F_A
(B) F_B
(C) F_C
(D) F_D



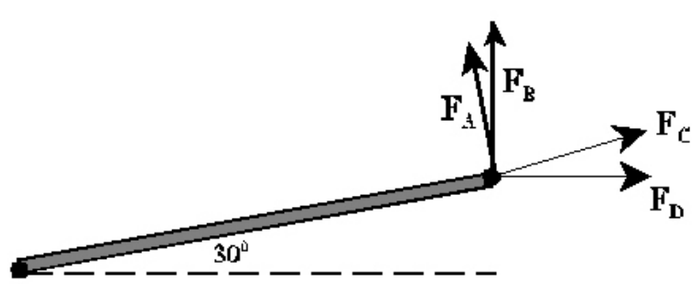
10. The diagram below shows a force applied on a beam in different directions. In which direction will the force produce the smallest torque about the hinge?

(A) A
(B) B
(C) C
(D) D



11. Which force in the diagram below would produce the most torque on the lever arm?

(A) F_A
(B) F_B
(C) F_C
(D) F_D

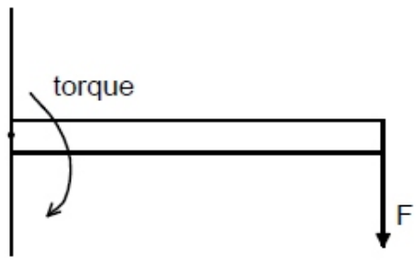


12. Which is an expression of torque?

(A) $\tau = F \cdot r \cdot \sin\theta$
(B) $\tau = ma$
(C) $\tau = m\Delta v$
(D) $\tau = v \sin\theta$

13. Which applied force, F, creates a torque on the beam in the direction indicated

(A)



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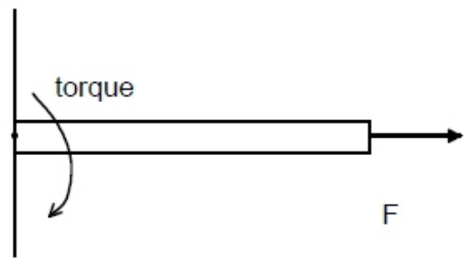

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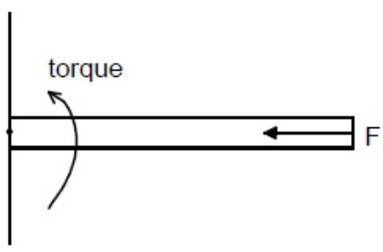

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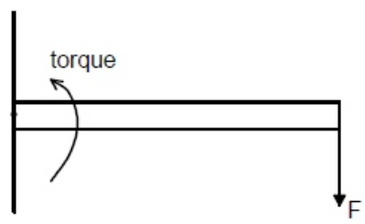
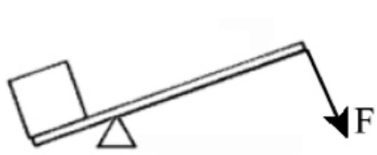


14. If a board was used to lift a box, in which case would the greatest torque be exerted on the board?

(A)



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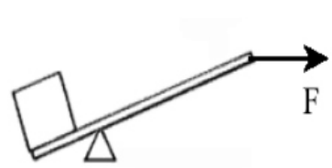
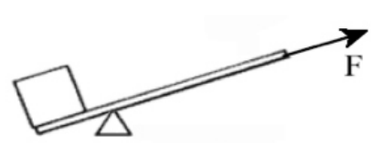


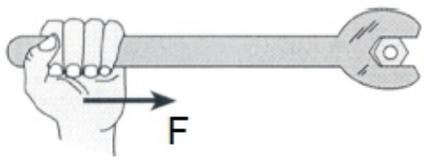
(C)

(D)



15. In which situation would the greatest torque be exerted on the bolt?

(A)



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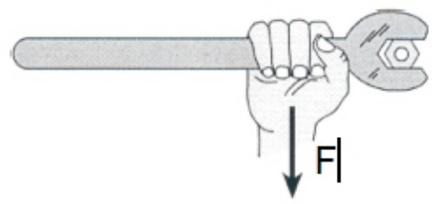

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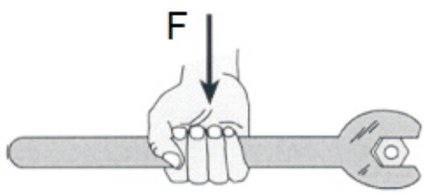

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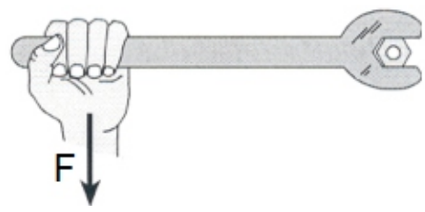


16. Which expression gives the torque about the pivot produced by the force, F, in the diagram below?

(A) $\tau = FL$

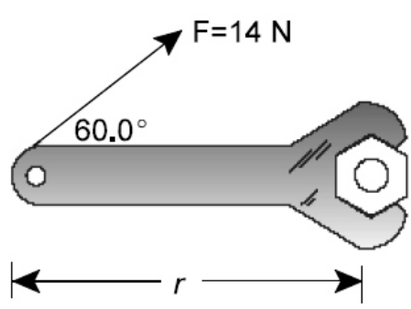
(B) $\tau = \dfrac{F}{L}$

(C) $\tau = FL\cos\theta$

(D) $\tau = FL\sin\theta$

17. A plumber applies a force of 14 N to a wrench at an angle of 60.0° as shown. What is the length, r, if the plumber produces a torque of 4.6 N·m?

(A) 0.33 m
(B) 0.38 m
(C) 0.66 m
(D) 0.72 m

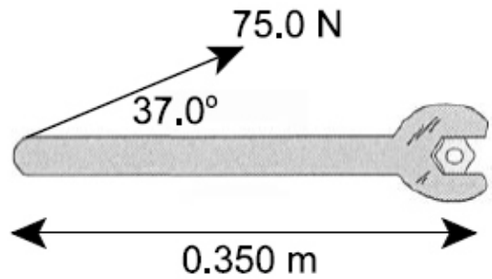


18. A 45 N force is applied at an angle of 35° to a door at a distance of 0.75 m from the hinge. What is the magnitude of the torque produced by this force?

(A) 19 N•m
(B) 28 N•m
(C) 34 N•m
(D) 45 N•m

19. How much torque is produced by the 75.0 N force exerted on the wrench below?

(A) 15.8 N•m
(B) 21.0 N•m
(C) 161 N•m
(D) 214 N•m



20. What torque is provided by a 60.0 kg person standing on a diving board 1.4 m from the pivot?

(A) 84 N·m
(B) 420 N·m
(C) 590 N·m
(D) 820 N·m

21. What is the magnitude of the torque exerted on a door when a perpendicular force of 80.0 N is applied 1.5 m from the hinge?

(A) 5.3×10^1 N·m
(B) 8.0×10^1 N·m
(C) 1.2×10^2 N·m
(D) 2.4×10^2 N·m

22. A door is opened by a 25.0 N force acting on the door knob at a 30.0° angle to the door's surface. If the door knob is 0.800 m from the hinge, what is the magnitude of the torque about the hinge?

(A) 10.0 N
(B) 12.5 N
(C) 17.4 N
(D) 21.7 N

23. A 4.0 N force is applied tangent to the outer edge of a bicycle wheel with radius 0.50 m. What is the torque applied to the wheel?

(A) 2.0 N•m
(B) 3.5 N•m
(C) 4.5 N•m
(D) 8.0 N•m

24. A 45.0 kg boy and a 35.0 kg girl are trying to balance a 3.00 m long seesaw which is supported in the center. If the girl sits at one end, how far from the center must the boy sit?

(A) 1.17 m
(B) 1.40 m
(C) 1.50 m
(D) 1.93 m

25. Two students are balanced on a uniform seesaw that is supported at the center. If student X with mass 65 kg is 1.2 m from the pivot point on one side of the seesaw, how far from the pivot point is student Y with mass 55 kg?

(A) 0.71 m
(B) 1.0 m
(C) 1.2 m
(D) 1.4 m

26. A heavy boy and a light girl are balanced on a uniform seesaw. If they both move forward so that they are one half of their original distance from the pivot point, what will happen to the seesaw?

(A) The boy's side will tilt downward.
(B) The girl's side will tilt downward.
(C) The seesaw will contiuously oscillate.
(D) The seesaw will remain balanced.

27. If a 75.0 kg boy sits 2.0 m from the pivot point on one side of a seesaw, where must a 50.0 kg girl sit on the other side of the pivot in order to balance the seesaw?

(A) 0.33 m
(B) 0.75 m
(C) 1.5 m
(D) 3.0 m

28. A 6.2 kg mass rests on a beam at 1.6 m from the pivot point. What mass must rest at 2.3 m on the opposite side of the pivot in order to balance the beam?

(A) 0.11 kg
(B) 0.23 kg
(C) 4.3 kg
(D) 8.9 kg

29. Two students are balanced on a uniform seesaw. Student A has a mass of 75.0 kg and student B has a mass of 85.0 kg. If student A is 1.5 m from the pivot point on one side of the seesaw, how far is student B from the pivot point?

(A) 0.59 m
(B) 0.76 m
(C) 1.3 m
(D) 1.7 m

30. A perpendicular force of 14 N is applied at 2.0 m from the pivot point of a seesaw. What is the magnitude of the torque about the pivot?

(A) 0.14 N•m
(B) 7.0 N•m
(C) 12 N•m
(D) 28 N•m

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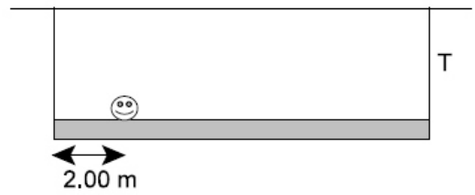
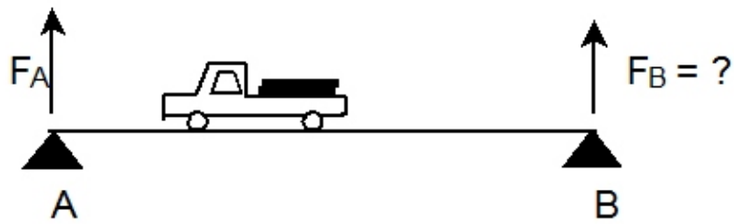
31. An 8.50 m long uniform beam of weight 126 N is supported by a rope at each end. If a 433 N person sits 2.00 m from the left end, what is the tension, T, in the rope on the right?

(A) 102 N
(B) 165 N
(C) 228 N
(D) 559 N

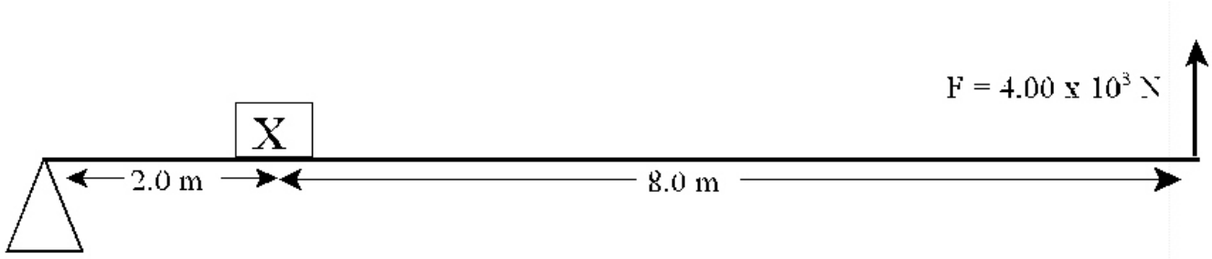


32. The diagram below shows a 2.0×10^3 kg truck on a 20.0 m long uniform bridge that has a mass of 8.0×10^3 kg. If the truck is 6.0 m from support A, what is the magnitude of the upward force at support B?

(A) 4.6×10^3 N
(B) 5.9×10^3 N
(C) 4.5×10^4 N
(D) 8.4×10^4 N



33. The structure shown below is in static equilibrium. What is the mass of object X? (Assume beam to be of negligible mass.)



(A) 408 kg
(B) 1630 kg
(C) 2040 kg
(D) 4080 kg

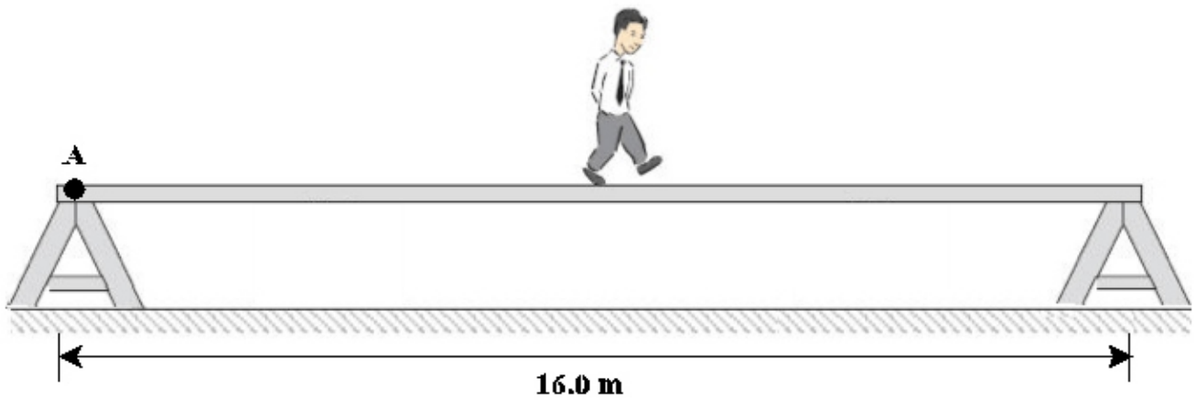
34. A 1.0×10^2 N uniform beam, 10.0 m in length, is supported by a rope at each end. If a 4.0×10^2 N person sits 2.0 m from the left end of the beam, what is the magnitude of the tension in the rope supporting the right end of the beam?

(A) 1.3×10^2 N
(B) 2.5×10^2 N
(C) 3.7×10^2 N
(D) 5.0×10^2 N

35. A 4.00×10^3 N force is applied on one end of a 5.00 m lever. If an object on the other end of the lever is 1.00 m from the pivot point, what is the maximum weight that the object can be to balance the lever?

(A) 8.00×10^1 N
(B) 1.00×10^2 N
(C) 1.60×10^4 N
(D) 2.00×10^4 N

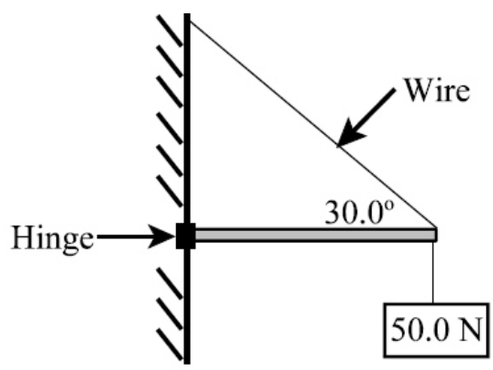
36. In the diagram below, a uniform 16.0 m long plank weighing 3.5×10^2 N rests on supports at each end of the plank. If a 8.5×10^2 N person stands in the middle of the plank, what is the magnitude of the normal force acting at A?



(A) 1.8×10^2 N
(B) 4.3×10^2 N
(C) 6.0×10^2 N
(D) 1.2×10^3 N

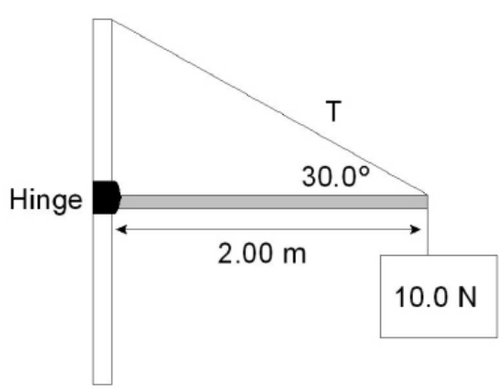
37. The wire below supports a horizontal massless beam. What is the tension in the wire?

(A) 2.89×10^1 N
(B) 5.00×10^1 N
(C) 5.77×10^1 N
(D) 1.00×10^2 N



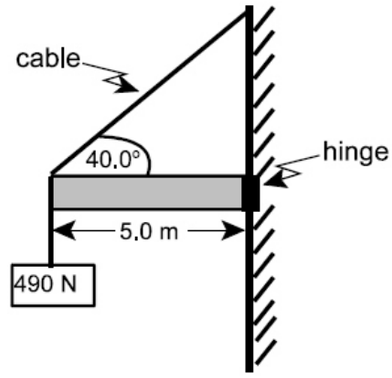
38. What is the tension, T, in the cable when a 10.0 N sign is suspended from the end of the massless beam as shown?

(A) 20.0 N
(B) 23.0 N
(C) 40.0 N
(D) 98.0 N



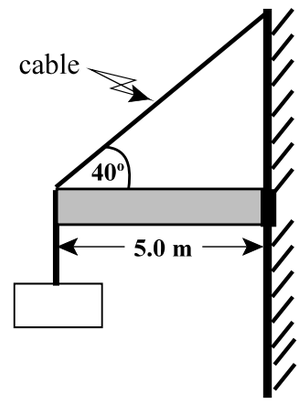
39. What is the tension in the cable below if a 490 N object is suspended from the end of a 5.0 m long uniform beam? Assume the beam is massless.

(A) 490 N
(B) 590 N
(C) 760 N
(D) 4800 N



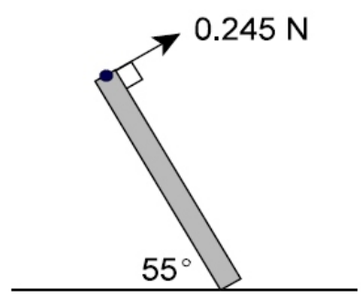
40. What is the tension of the cable in the diagram below if a 25.0 kg mass is suspended from the end of a 5.0 m long uniform beam that is 10.0 kg?

(A) 330 N
(B) 380 N
(C) 460 N
(D) 530 N



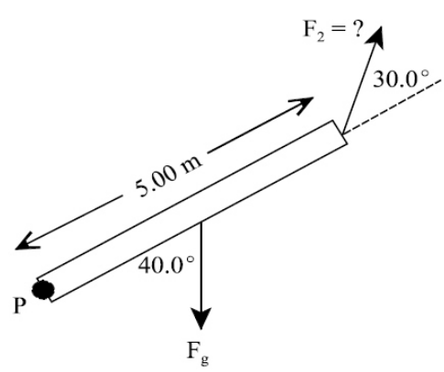
41. The uniform beam shown below is 1.0 m long and is held stationary by a force of 0.245 N as shown. What is the mass of the beam?

(A) 0.044 kg
(B) 0.050 kg
(C) 0.061 kg
(D) 0.087 kg



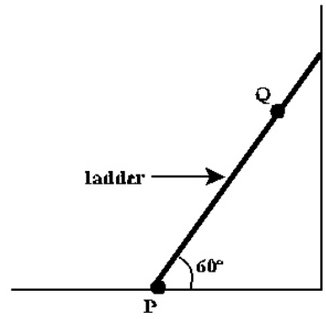
42. If the 3.20 kg uniform beam shown is in static equilibrium, what is the magnitude of F_2?

(A) 13.9 N
(B) 20.2 N
(C) 40.3 N
(D) 80.6 N

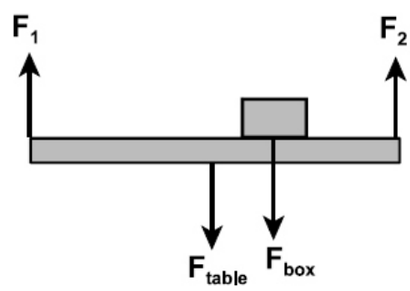


43 In the diagram below a 65.0 kg person is 3.0 m up a ladder at Q. What is the magnitude and direction of the torque produced by the person about point P?

	magnitude	direction
(A)	1.7×10^3 N•m	clockwise
(B)	1.7×10^3 N•m	counterclockwise
(C)	9.6×10^2 N•m	clockwise
(D)	9.6×10^2 N•m	counterclockwise



44. A 75 kg box is placed 0.60 m from the right edge of a uniform 25 kg table that is 2.0 m long. How much force is required (F_1 and F_2) to lift the table from both ends?
AUGUST 2006 **[3]**



16. In the diagram below, a 10.0 m uniform horizontal beam, weighing 1.00×10^2 N is supported by a rope at each end. If a 4.00×10^2 N box is positioned 2.0 m from the left end of the beam, what is the tension in each of the support ropes (T_1 and T_2)?
JUNE 2005 **[4]**