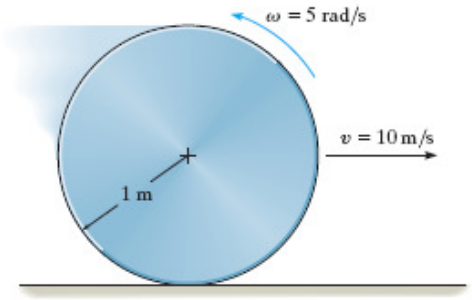
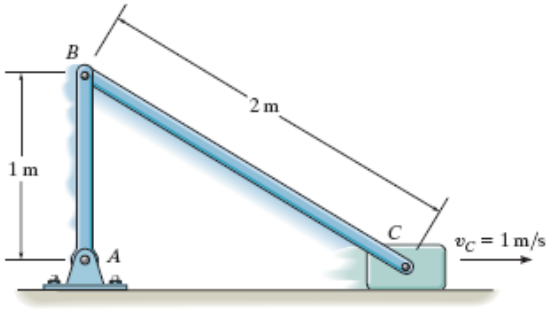
Exercise 8: Work and Energy

1. [Prob. 18-3] At the instant shown, the 30-kg disk has an anticlockwise angular velocity of 5 rad/s when its centre has a velocity of 10 m/s. Determine the kinetic energy of the disk at this instant.

2. [Prob. 18-7] The mechanism consists of two rods, AB and BC, which weigh 10 kg and 20 kg, respectively, and a 4 kg block at C. Determine the kinetic energy of the system at the instant shown, when the block is moving at 1 m/s.



Prob. 18–3

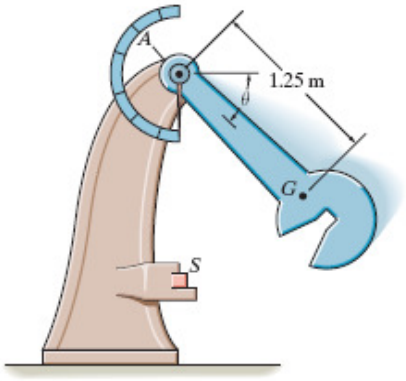


Prob. 18–7

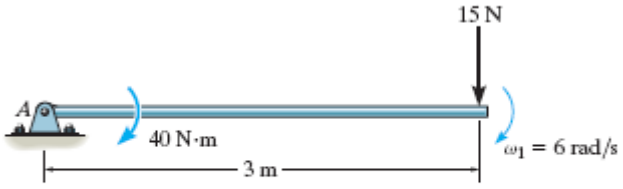
3. [Prob. 18-13] The pendulum of the Charpy impact machine has a mass of 50kg and a radius of gyration of $k_A = 1.75m$. If it is released from rest when $\theta = 0^o$, determine its angular velocity just before it strikes the specimen S at $\theta = 90^o$.

4. [Prob. 18-35] Solve problem 3, using the conservation of energy equation.

5. [Prob. 18-16] The 4-kg slender rod is subjected to the force and couple moment. When it is in the position shown it has an angular velocity $\omega_1 = 6\ rad/s$. Determine its angular velocity at the instant it has rotated downward 90°. The force is always applied perpendicular to the axis of the rod. Motion occurs in the vertical plane.



Prob. 18–13

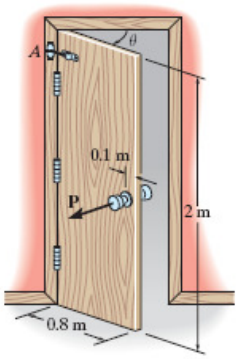


Prob. 18–16

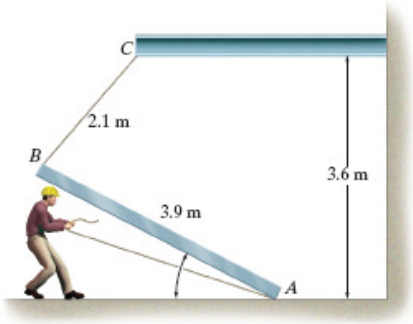
6. [Prob. 18-31] The uniform door has a mass of 20 kg and can be treated as a thin plate having the dimensions shown. If it is connected to a torsional spring at A, which has a stiffness of $k = 80 N \cdot m/rad$, determine the required initial twist of the spring in radians so that the door has an angular velocity of 12 rad/s when it closes at $\theta = 0^o$ after being opened at $\theta = 90^o$ and released from rest.

7. [Prob. 18-34] The beam has a weight of 750kg and is being raised to a vertical position by pulling very slowly on its bottom end A. If the cord fails when $\theta = 60^o$ and the beam is essentially at rest, determine the speed of A at the instant cord BC becomes vertical. Neglect friction and the mass of the cords, and treat the beam as a slender rod.

8. [Prob. 18-39] Solver problem 7, using the conservation of energy equation.



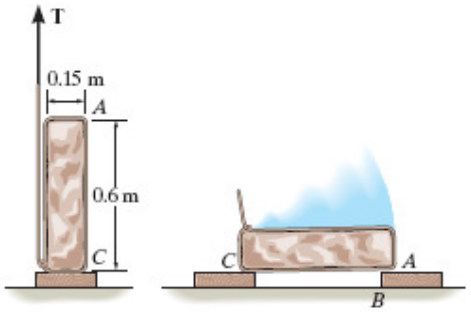
Prob. 18–31



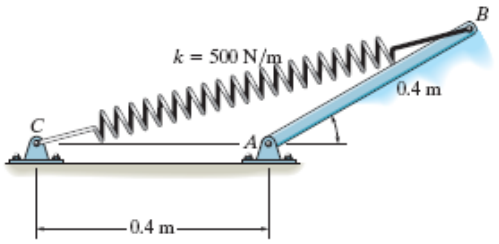
Prob. 18–34

9. [Prob. 18-49] The uniform 75 kg stone (rectangular block) is being turned over on its side by pulling the vertical cable slowly upward until the stone begins to tip. If it then falls freely (T=0) from an essentially balanced at-rest position, determine the speed at which the corner A strikes the pad at B. The stone does not slip at its corner C as it falls.

10. [Prob. 18-52] The 25 kg slender rod AB is attached to a spring BC which, has an unstretched length of 0.4 m. If the rod is released from rest when $\theta = 30^o$, determine its angular velocity at the instant $\theta = 90^o$.



Prob. 18–49



Prob. 18–52