

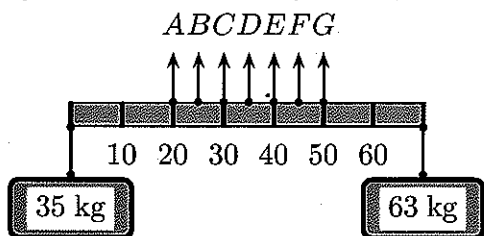
This print-out should have 15 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering. The due time is Central time.

AP B 1993 MC 57

12:04, trigonometry, multiple choice, < 1 min, wording-variable.

001

Two objects, of masses 35 kg and 63 kg, are hung from the ends of a stick that is 70 cm long and has marks every 10 cm, as shown.



If the mass of the stick is negligible, at which of the points indicated should a cord be attached if the stick is to remain horizontal when suspended from the cord?

1. *F*
2. *G*
3. *A*
4. *B*
5. *C*
6. *D*
7. *E*

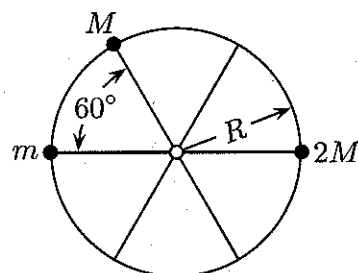
AP B 1998 MC 58

12:02, trigonometry, multiple choice, < 1 min, fixed.

002

A wheel of radius R and negligible mass is mounted on a horizontal frictionless axle so that the wheel is in a vertical plane. Three small objects having masses m , M , and $2M$, respectively, are mounted on the rim of the

wheel, as shown.



If the system is in static equilibrium, what is the value of m in terms of M ?

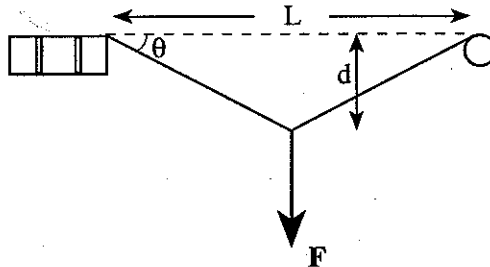
1. $m = \frac{M}{2}$
2. $m = M$
3. $m = \frac{3M}{2}$
4. $m = 2M$
5. $m = \frac{5M}{2}$

Car in Snow Drift

12:02, trigonometry, numeric, > 1 min, normal.

003

A student gets her car stuck in a snow drift. Not at a loss, having studied physics, she attaches one end of a rope to the vehicle and the other end to the trunk of a nearby tree, allowing for a small amount of slack. The student then exerts a force F on the center of the rope in the direction perpendicular to the car-tree line as shown in the figure below. Assume equilibrium conditions and that the rope is inextensible.



How does the magnitude of the force exerted by the rope on the car compare to that of the force exerted by the rope on the tree?

1. $|F_t| = |F_c| = T$
2. $|F_t| > |F_c|$
3. $|F_t| = 2|F_c|$
4. $|F_t| < |F_c|$
5. cannot be determined

004

What is the magnitude of the force on the car?
 Let $L = 12$ m, $d = 0.5$ m and $F = 500$ N.
 Answer in units of N.

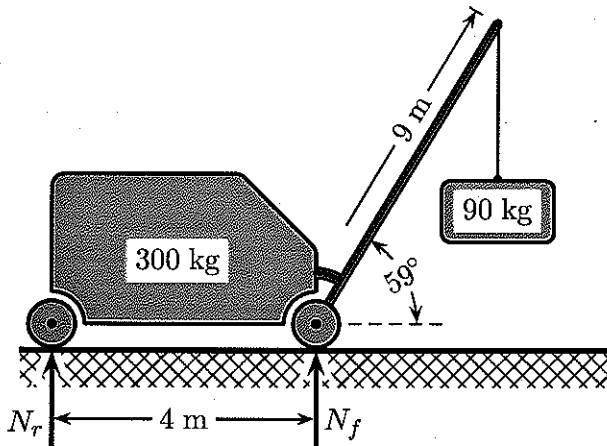
Crane and a Weight

12:04, trigonometry, numeric, > 1 min, wording-variable.

005

A crane of mass 300 kg supports a load of 90 kg. The crane's boom is 9 m long and the angle it makes with the horizontal is 59° . The distance between the front and rear wheels is 4 m.

The acceleration of gravity is 9.8 m/s².



Assume: The center-of-mass of the crane is half-way between the wheels (in the middle of the crane's body). Call the forces from the ground N_r at the rear wheels and N_f at the front wheels.

What is the total normal force N_{total} from the ground? Answer in units of N.

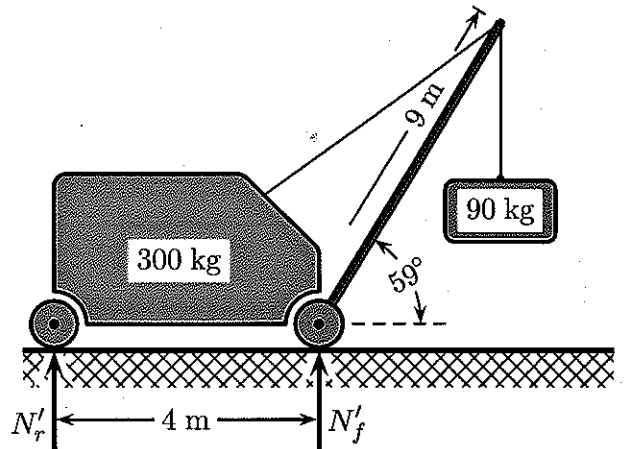
006

Find the force N_r from the ground at the rear wheels. Answer in units of N.

007

Neglect the mass of the support wire.

If the front axel acts as a hinge between the crane's body and its boom, and a support wire is added between the crane and the top of the crane's boom as in the figure, how does the force N_r' from the ground at the rear wheels change?



1. The crane tips over
2. It increases: $N_r' > N_r$
3. It decreases: $N_r' < N_r$
4. It vanishes: $N_r' = 0$
5. It stays the same: $N_r' = N_r$
6. Not enough information

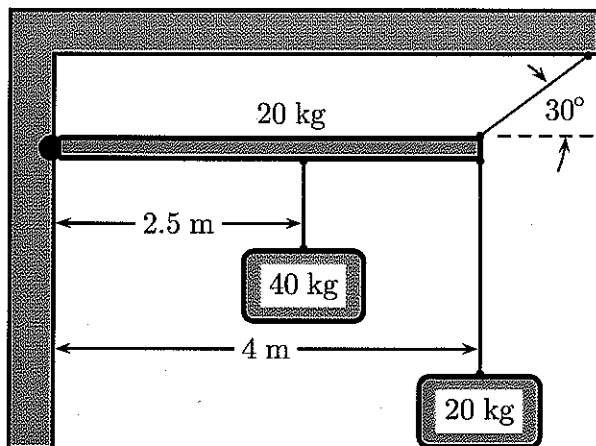
Beam with Pin and Cable

12:04, trigonometry, numeric, > 1 min, normal.

008

Two weights attached to a uniform beam of mass 20 kg are supported in a horizontal position by a pin and cable as shown in the figure.

The acceleration of gravity is 9.8 m/s².



What is the tension in the cable which supports the beam? Answer in units of kN.

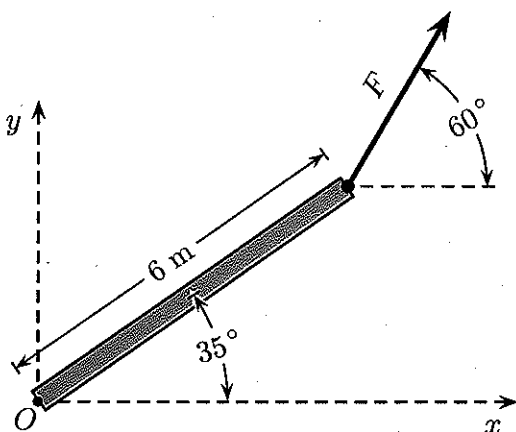
Equilibrium of Hinged Lever 03

12:04, trigonometry, numeric, > 1 min, normal.

009

A uniform rod pivoted at one end "point O" is free to swing in a vertical plane in a gravitational field. However, it is held in equilibrium by a force F at its other end.

The rod makes an angle 35° with the horizontal. The length of the rod is 6 m. The force makes an angle 60° with the horizontal. The weight of the rod is 8.3 N.



What is the magnitude of the force F ? Answer in units of N.

010

What is the magnitude of the force the pivot exerts on the rod at point O? Answer in units of N.

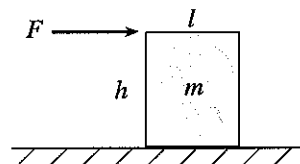
Tilting a Block

12:03, trigonometry, numeric, > 1 min, normal.

011

Consider the rectangular block of mass $m = 40$ kg height $h = 1$ m, length $l = 0.6$ m. A force F is applied horizontally at the upper edge.

The acceleration of gravity is 9.8 m/s^2 .



What is the minimum force required to start to tip the block? Answer in units of N.

012

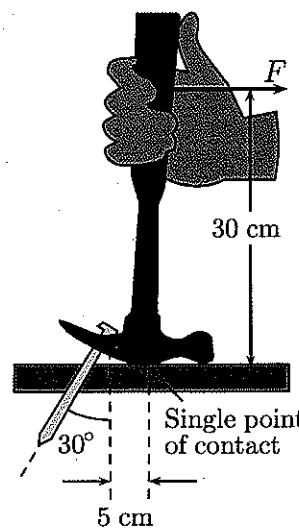
What is the minimum coefficient of static friction required for the block to tip with the application of a force of this magnitude?

Serway CP 08 58 A

12:04, trigonometry, numeric, > 1 min, normal.

013

The figure shows a claw hammer as it pulls a nail out of a horizontal board.



If a force of magnitude 150 N is exerted horizontally as shown, find the force exerted

by the hammer claws on the nail. (Assume that the force the hammer exerts on the nail is parallel to the nail). Answer in units of kN.

014

Find the force exerted by the surface on the point of contact with the hammer head. Assume that the force the hammer exerts on the nail is parallel to the nail. Answer in units of N.

015

At what angle is this force applied? Answer between, -180° and 180° , with right 0° and counterclockwise positive. Answer in units of $^\circ$.