An Accelerating Hockey Puck

Friday, 29 January, 2021 21:33

Lecturer: Mustafa Al-Zyout, Philadelphia University, Jordan.

R. A. Serway and J. W. Jewett, Jr., *Physics for Scientists and Engineers*, 9th Ed., CENGAGE Learning, 2014.

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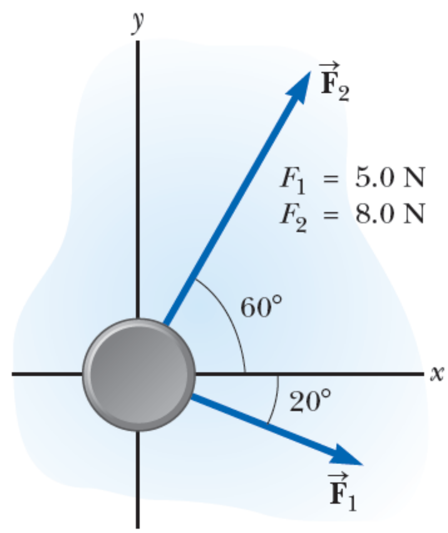
A hockey puck having a mass of (0.3 kg) slides on the frictionless, horizontal surface of an ice rink. Two hockey sticks strike the puck simultaneously, exerting the forces on the puck shown. The force $\vec{F}_1$ has a magnitude of (5 N), and the force $\vec{F}_2$ has a magnitude of (8 N). Determine both the magnitude and the direction of the puck's acceleration.



One - and two - dimensional forces

Saturday, 30 January, 2021 12:30

Lecturer: Mustafa Al-Zyout, Philadelphia University, Jordan.
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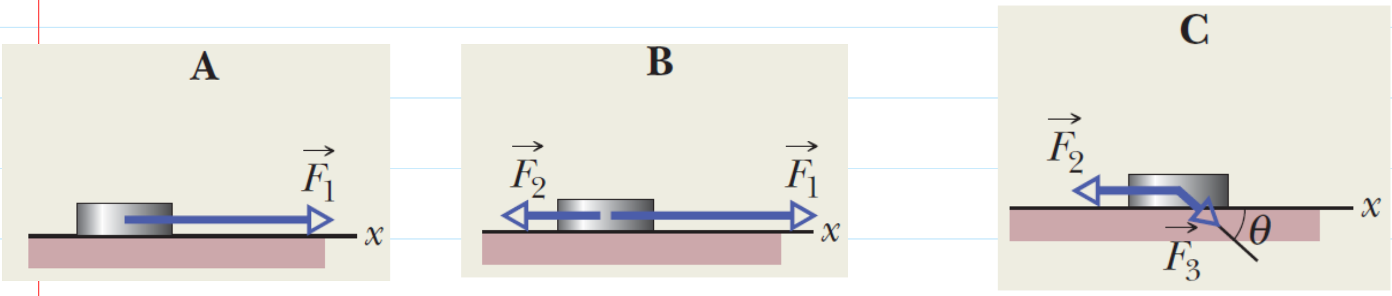
Parts A, B, and C of the figure show three situations in which one or two forces act on a puck that moves over frictionless ice along an x axis. The puck's mass is $m = 2\ kg$. Forces $\vec{F}_1$ and $\vec{F}_2$ are directed along the axis and have magnitudes $F_1 = 4\ N$ and $F_2 = 2\ N$. Force $\vec{F}_3$ is directed at angle $\theta = 30^\circ$ and has magnitude $F_3 = 1\ N$. In each situation:

- what is the acceleration of the puck,
- what is the normal force?



A Traffic Light at Rest

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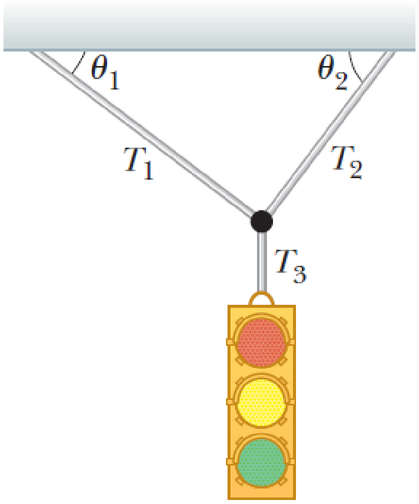
A traffic light weighing (122 N) hangs in equilibrium from a cable tied to two other cables fastened to a support as in Figure. The upper cables make angles of (37°) and (53°) with the horizontal. Find the magnitude of the tension in each cable.



The Runaway Car

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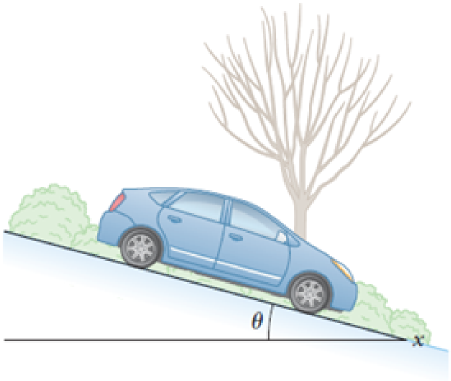
A car of mass (m) is on an icy driveway inclined at an angle θ as in the figure.

- Find the acceleration of the car, assuming the driveway is frictionless.
- Suppose the car is released from rest at the top of the incline and the distance from the car's front bumper to the bottom of the incline is (d). How long does it take the front bumper to reach the bottom of the hill, and
- what is the car's speed as it arrives there?
- Determine the normal force.



One Block Pushes Another

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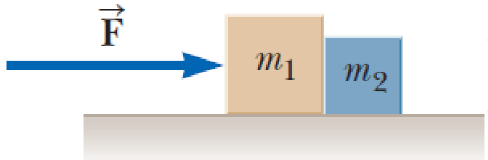
Two blocks of masses m_1 and m_2 , with $m_1 > m_2$, are placed in contact with each other on a frictionless, horizontal surface as shown. A constant horizontal force $\vec{F}$ is applied to m_1 .



- Find the magnitude of the acceleration of the system.
- Determine the magnitude of the contact force between the two blocks.

The Atwood Machine

Saturday, 30 January, 2021 12:38

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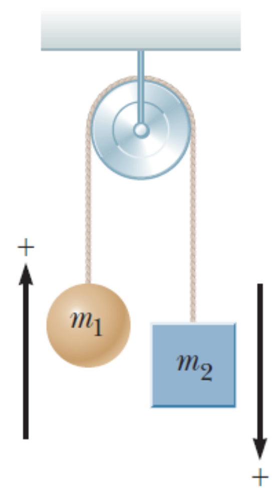
When two objects of unequal mass are hung vertically over a frictionless pulley of negligible mass as in the Figure, the arrangement is called an Atwood machine. Determine:

- the magnitude of the acceleration of the two objects and
- the tension in the lightweight cord.



Block on table, block hanging

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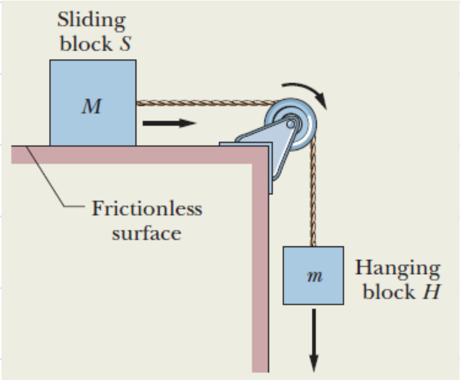
The figure shows a block S (the sliding block) with mass $M = 3.3\ kg$. The block is free to move along a horizontal frictionless surface and connected, by a cord that wraps over a frictionless pulley, to a second block H (the hanging block), with mass $m = 2.1\ kg$. The cord and pulley have negligible masses compared to the blocks. The hanging block H falls as the sliding block S accelerates to the right. Find:

- the acceleration of block S or H,
- the tension in the cord.



Weighing a Fish in an Elevator

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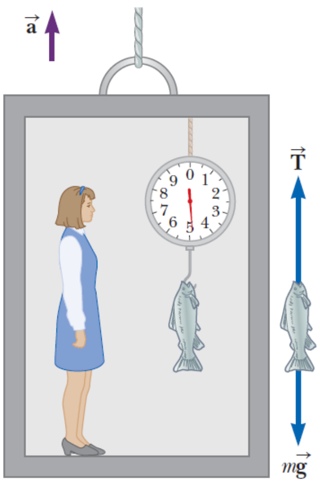
A person weighs a fish of mass m on a spring scale attached to the ceiling of an elevator.

- Show that if the elevator accelerates **upward**, the spring scale gives a reading that is different from the weight of the fish.
- Show that if the elevator accelerates **downward**, the spring scale gives a reading that is different from the weight of the fish.
- Evaluate the scale readings for a (40 N) fish if the elevator moves with an acceleration $a = 2\ m/s^2$.



Cord accelerates box up a ramp

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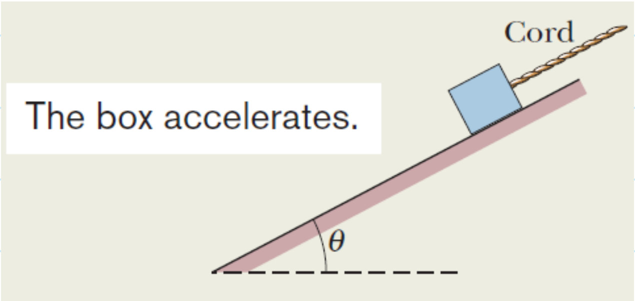
In the figure, a cord pulls on a box of sea biscuits up along a frictionless plane inclined $\theta = 30^{\circ}$. The box has mass $m = 5\ kg$ and the force from the cord has magnitude $T = 25\ N$. What is the box's acceleration component along the inclined plane?



Acceleration of Two Objects Connected by a Cord

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A ball of mass m_1 and a block of mass m_2 are attached by a lightweight cord that passes over a frictionless pulley of negligible mass as in the figure. The block lies on a frictionless incline of angle θ . Find:

- the magnitude of the acceleration of the two objects and
- the tension in the cord.