Mechanics & Relativity

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Week 6: Problems

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Most Hated AP 6.1

A $3.0 - kg$ block is thrown downward from a point $37\ m$ above the Earth's surface. At what height above Earth's surface will the gravitational potential energy of the Earth-block system have decreased by $290\ J$?

- $7.0\ m$
- $27\ m$
- $10\ m$
- $47\ m$
- $37\ m$

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Most Hated AP 6.2

A $2.66\ kg$ block starts from rest on a rough inclined plane that makes an angle of 60° with the horizontal. The coefficient of kinetic friction is 0.25 . As the block goes $2.73\ m$ down the plane, the mechanical energy of the Earth-block system changes by

J

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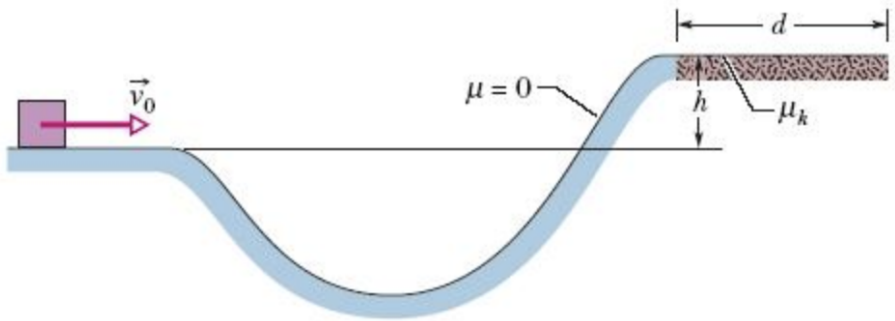
Most Hated AP 6.3

In the figure, a $8.17\ kg$ block slides along a track from one level to a higher level after passing through an intermediate valley. The track is frictionless until the block reaches the higher level. There a frictional force stops the block in a distance d. The height difference is $h = 1.01\ m$, and $\mu_k = 0.570$. If the initial speed of the block is $5.12\ {}^{m}/_{s}$, find the amount of mechanical energy that is converted to heat.

$\Delta E_{th} =$ $\qquad$ J



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Problems

An object, with mass m and speed v relative to an observer, explodes into two pieces, one three times as massive as the other; the explosion takes place in deep space. The less massive piece stops relative to the observer. How much kinetic energy is added to the system during the explosion, as measured in the observer's reference frame?

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Problems

A uniform soda can of mass 0.10 kg is 10.0 cm tall and filled with 200 g of soda. Then small holes are drilled in the top and bottom (with negligible loss of metal) to drain the soda. What is the height h of the com of the can and contents (a) initially and (b) after the can loses all the soda?

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Problems

A 700 g block is released from rest at height h_0 above a vertical spring with spring constant k = 400 N/m and negligible mass. The block sticks to the spring and momentarily stops after compressing the spring 19.0 cm. How much work is done (a) by the block on the spring and (b) by the spring on the block? (c) What is the value of h_0? (d) If the block were released from height $2h_0$ above the spring, what would be the maximum compression of the spring?

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Problems

A completely inelastic collision occurs between two balls of wet putty that move directly toward each other along a vertical axis. Just before the collision, one ball, of mass 3.0 kg, is moving upward at 20 m/s and the other ball, of mass 2.0 kg, is moving downward at 12 m/s. How high do the combined two balls of putty rise above the collision point? (Neglect air drag.)

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