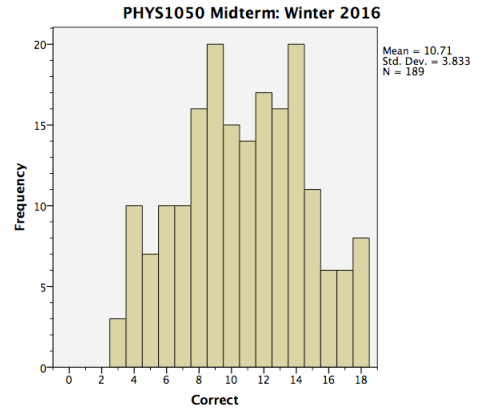
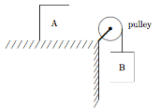


2015: 12.0/18

7. Block A, with a mass of 50 kg, rests on a horizontal table top. The coefficient of static friction is 0.40. A horizontal string is attached to A and passes over a massles frictionless pulley as shown. The smallest mass of block B, attached to the dangling end, that will start A moving when it is attached to the other end of the string is:

(a) 20 kg
(b) 30 kg
(c) 40 kg
(d) 50 kg
(e) 70 kg



20 kg is the maximum value of m_B that can be supported before slipping, and is the intended correct answer. (152/189)

Because of the wording, some of you interpreted this as a "trick question" and chose 30 kg because it is the smallest value of the listed choices that will guarantee slipping. (31/189)

Both answers were accepted.

Projectile motion revisited

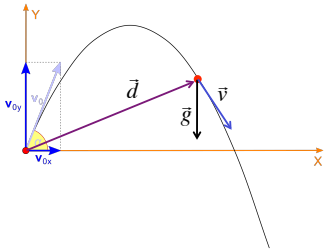
Kinematic approach:

$\sum F_x = 0 \quad \therefore v_x = v_{0x}$

$\sum F_y = -mg = ma_y \quad \therefore a_y = -g$

$\therefore v_y^2 = v_{0y}^2 - 2g\Delta y$

$$v^2 = v_x^2 + v_y^2 = v_{0x}^2 + v_{0y}^2 - 2g\Delta y$$
$$= v_0^2 - 2g\Delta y$$

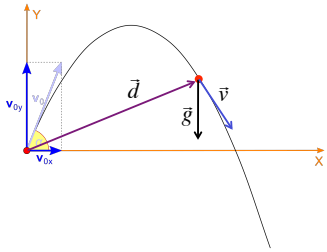


Projectile motion revisited

Work-energy approach:

$\vec{F} = m\vec{g} = -mg\hat{j}$

$\vec{d} = \Delta x\hat{i} + \Delta y\hat{j}$



Work done by gravity:

$W_g = \vec{F} \cdot \vec{d} = -mg\Delta y$

$\Delta K = W_g \quad \therefore \frac{1}{2}mv^2 - \frac{1}{2}mv_0^2 = -mg\Delta y$

$\therefore v^2 = v_0^2 - 2g\Delta y$

Example

A block of mass m slides a distance d down a frictionless plane inclined at an angle θ to the horizontal. How much kinetic energy does the block gain?

Example

A crate of mass 15 kg is pulled up a ramp of length 5.7 m that makes an angle of 26° to the horizontal. The crate starts and ends at rest.

(a) What is the work done by gravity?
(b) What is the work done in pulling the crate up the ramp (*e.g.* by a rope parallel to the ramp)?