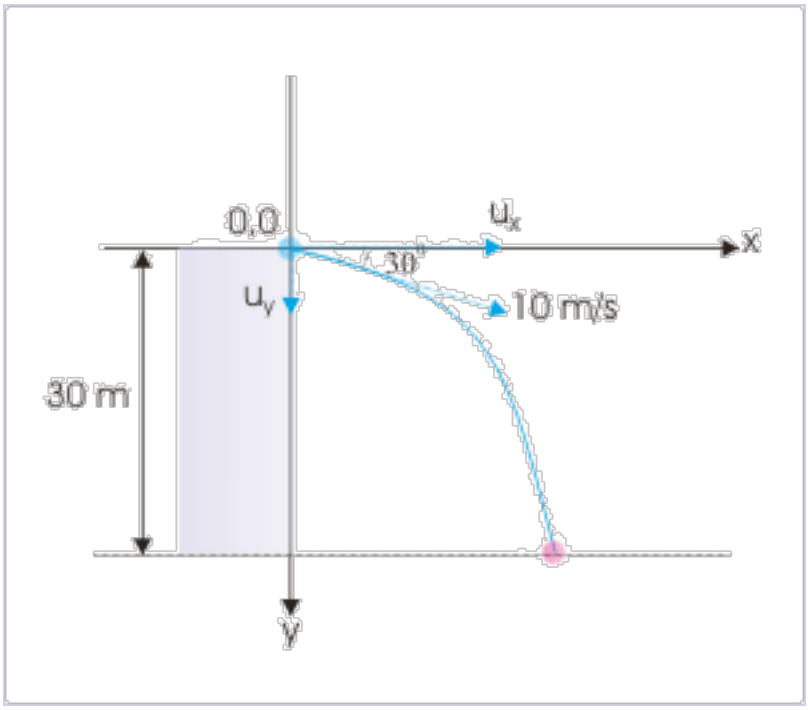
Closed book. No work needs to be shown for multiple-choice questions.

1. A ball from a tower of height 30 m is projected down at an angle of 30° from the horizontal with a speed of 10 m/s. How long does ball take to reach the ground?.



a. 1.0 s.
b. 1.5s.
c. 2.0s.
d. 2.5s.
e. 3.0s.

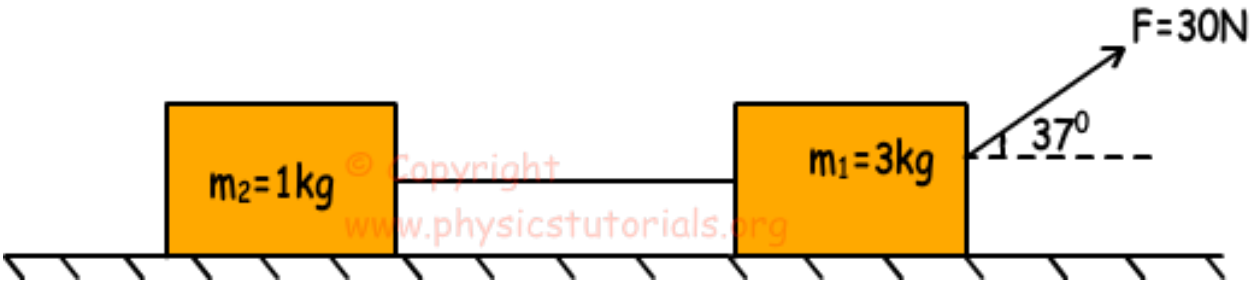
2. A motorboat traveling across a river at speed 4 m/s, East but encounters a downstream current traveling 7.0 m/s, North. If the width of the river is 80 meters wide, what distance downstream does the boat reach the opposite shore?

a. 50 m.
b. 170 m.
c. 80 m.
d. 110 m.
e. 140 m.

3. A ball is launched from ground level at a speed 30 m/s at an angle of 35° above the horizontal. How far away will the ball land? Assume it lands at ground level.

a. 14 m.
b. 21 m.
c. 43 m.
d. 86 m.
e. 92 m.

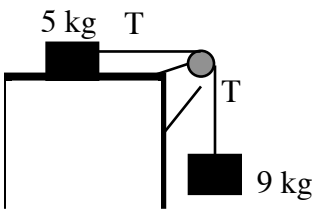
4. Picture given below shows the motion of two boxes under the effect of applied force. There is no friction constant between the box and the surface. Find the tension on the rope.



a. 30 N.
b. 24 N.
c. 18 N.
d. 8 N.
e. 6 N.

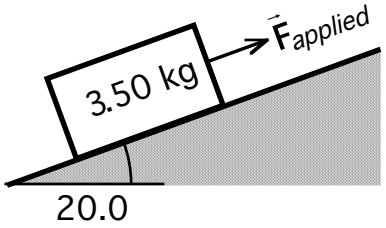
5. A 9.0-kg hanging weight is connected by a string over a pulley to a 5.0-kg block sliding on a flat table. If there is no friction between the block and the table, find the tension in the string.

a. 19 N
b. 24 N
c. 32 N
d. 38 N
e. 43 N



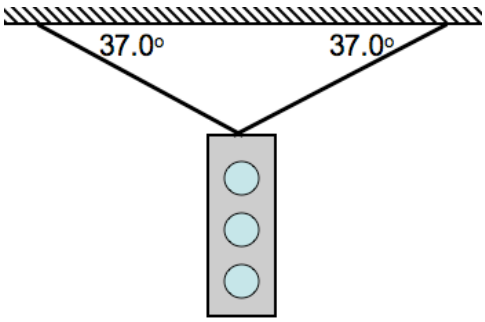
6. Consider an applied force exerted on a box with mass 3.50 kg, on a frictionless ramp that makes an angle of 20.0° with respect to the horizontal, as shown to the right. Which one of the following choices best corresponds to the magnitude of the applied force, if the box slides up the ramp at a constant speed of 0.500 m/s?

a. 1.75 N.
b. 11.7 N.
c. 32.2 N.
d. 34.3 N.
e. 15.0 N.



7. A traffic light hangs from two wires as shown to the right. The mass of the light is 35.0 kg. Calculate the tension in one of the cables.

a. 285 N.
b. 429 N.
c. 142 N.
d. 215 N.
e. 570 N.



8. A 9,000 N automobile is pushed along a level road by four students who apply a total forward force of 500 N. Neglecting friction, the acceleration of the automobile is:

a. 0.056 m/s^2.
b. 0.54 m/s^2.
c. 1.8 m/s^2.
d. 9.8 m/s^2.
e. 18 m/s^2.

Equations and constants:

$$\left\{\begin{array}{l} x = r\cos\theta \\ y = r\sin\theta \end{array}\right\};\quad \left\{\begin{array}{l} r = \sqrt{x^2 + y^2} \\ \theta = \tan^{-1}\left(\dfrac{y}{x}\right) \end{array}\right\};\quad \left\{\begin{array}{l} v_x = v_{ox} + a_x t \\ \Delta x = \frac{1}{2}\left(v_{ox} + v_x\right)t \\ \Delta x = v_{ox}t + \frac{1}{2}a_x t^2 \\ v_x^2 = \left(v_{ox}\right)^2 + 2a_x\Delta x \end{array}\right\};\quad \left\{\begin{array}{l} v_y = v_{oy} + a_y t \\ \Delta y = \frac{1}{2}\left(v_{oy} + v_y\right)t \\ \Delta y = v_{oy}t + \frac{1}{2}a_y t^2 \\ v_y^2 = \left(v_{oy}\right)^2 + 2a_y\Delta y \end{array}\right\};$$

$$\left\{\begin{array}{l} \Delta x = x_f - x_i \\ \\ speed_{avg} = \dfrac{d}{\Delta t} \end{array}\right\};$$

$\vec{v}_{AE} = \vec{v}_{AB} + \vec{v}_{BE}$ - relative motion

$\vec{a} = \vec{a}_r + \vec{a}_t$ where $a_r = v^2/r$ - circular motion

$range = v_o^{\,2}\sin(2\theta_o)/g$

$\max - height = v_o^{\,2}\sin^2(\theta_o)/2g$ - projectile motion when initial and final height are the same

$$\left\{\begin{array}{l} a_{avg} = \dfrac{\Delta v}{\Delta t} \\ \\ v_{avg} = \dfrac{\Delta x}{\Delta t} \end{array}\right\};\quad \left\{\begin{array}{l} a = \lim\limits_{\Delta t\to 0}\dfrac{\Delta v}{\Delta t} \\ \\ v = \lim\limits_{\Delta t\to 0}\dfrac{\Delta x}{\Delta t} \end{array}\right\};\quad \left\{\begin{array}{c} \sum \vec{\mathbf{F}} = 0;\ \vec{\mathbf{a}} = 0 \\ \sum \vec{\mathbf{F}} = m\vec{\mathbf{a}} \\ \vec{\mathbf{F}}_{2on1} = -\vec{\mathbf{F}}_{1on2} \end{array}\right\};\quad \left\{\begin{array}{l} F = G\dfrac{Mm}{r^2} \\ G = 6.67\times 10^{-11}\ \mathrm{N\cdot m^2/kg^2} \end{array}\right\};;$$

$\vec{\mathrm{v}}_{\mathrm{AC}} = \vec{\mathrm{v}}_{\mathrm{AB}} + \vec{\mathrm{v}}_{\mathrm{BC}};$

$g = 9.80\ \mathrm{m/s^2};\ 100\ \mathrm{cm} = 1\ \mathrm{m};\ 1{,}000\ \mathrm{m} = 1\ \mathrm{km};\ 60\ \mathrm{s} = 1\ \mathrm{min};\ 60\ \mathrm{min} = 1\ \mathrm{hr};\ 2.54\ \mathrm{cm} = 1\ \mathrm{in};$

$12\ \mathrm{in} = 1\ \mathrm{ft};\ 5{,}280\ \mathrm{ft} = 1\ \mathrm{mi};\ 1{,}609\ \mathrm{m} = 1\ \mathrm{mi};\ 0.3048\ \mathrm{m} = 1\ \mathrm{ft}.$