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

1. A soccer ball is kicked horizontally off a 22.0-meter high hill and lands a distance of 35.0 meters from the bottom of the hill. Determine the initial horizontal velocity of the soccer ball.

a. 1.6 m/s.
b. 12.5 m/s.
c. 20.5 m/s.
d. 16.5 m/s.
e. 35.0 m/s.

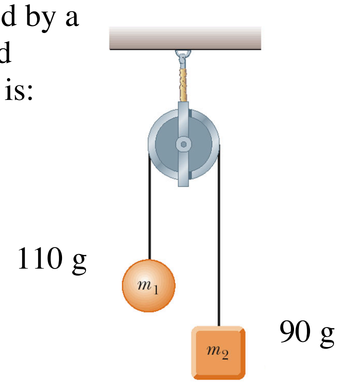
2. A ball thrown horizontally at 17.8 m/s from the roof of a building lands 36 m from the base of the building. How tall is the building?

a. 15 m.
b. 18 m.
c. 20 m.
d. 23 m.
e. 30 m.

3. A motorboat traveling 6 m/s, East encounters a current traveling 3.8 m/s, South. What is the resultant velocity of the motorboat?

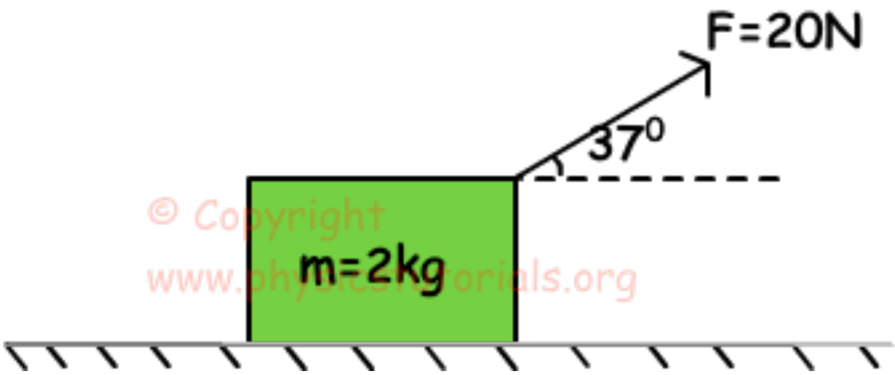
a. 2.2 m/s.
b. 6 m/s.
c. 8.6 m/s.
d. 7.1 m/s.
e. 9.8 m/s.

4. Two objects, with masses 90 g and 110 g, respectively, are connected by a string that passes over a pulley as shown. Assume that the string and pulley are massless, the magnitude of the acceleration of each block is:



a. 0.049 m/s^2.
b. 0.020 m/s^2.
c. 0.0098 m/s^2.
d. 0.54 m/s^2.
e. 0.98 m/s^2.

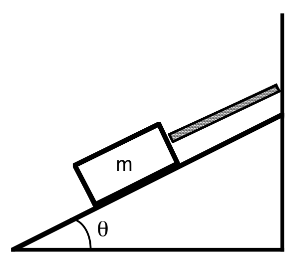
5. A box is pulled with 20N force. Mass of the box is 2kg and surface is frictionless. Find the acceleration of the box.



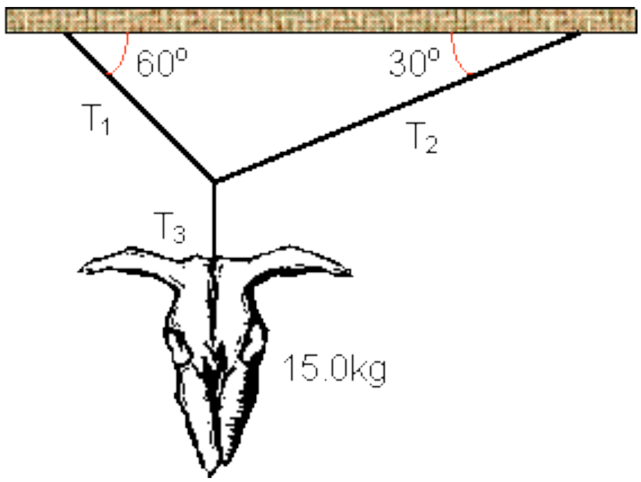
a. 8 m/s.
b. 6 m/s.
c. 10 m/s.
d. 5 m/s.
e. 12 m/s.

6. A 25 N crate is held at rest on a frictionless incline by a force that is parallel to the incline. If the incline is 25° above the horizontal, the magnitude of the normal force of the incline on the crate is:

a. 4.1 N.
b. 4.6 N.
c. 8.9 N.
d. 11 N.
e. 23 N.



7. Find the tension T_2 in the figure below. (skull's mass is 15.0 kg).



a. 74 N.
b. 127 N.
c. 147 N.
d. 128 N.
e. 96 N.

8. An astronaut applies a force of 500 N to an asteroid, and it accelerates at 7.00 m/s^2. What is the asteroid's mass?

a. 71 kg
b. 135 kg
c. 441 kg
d. 3,500 kg
e. 223 kg

Equations and constants:

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

$$\begin{cases} \Delta x = x_f - x_i \\ speed_{avg} = \frac{d}{\Delta t} \end{cases};$$

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

$$\begin{cases} a_{avg} = \frac{\Delta v}{\Delta t} \\ v_{avg} = \frac{\Delta x}{\Delta t} \end{cases}; \quad \begin{cases} a = \lim_{\Delta t \to 0} \frac{\Delta v}{\Delta t} \\ v = \lim_{\Delta t \to 0} \frac{\Delta x}{\Delta t} \end{cases}; \quad \begin{cases} \sum \vec{\mathbf{F}} = 0;\ \vec{\mathbf{a}} = 0 \\ \sum \vec{\mathbf{F}} = m\vec{\mathbf{a}} \\ \vec{\mathbf{F}}_{2on1} = -\vec{\mathbf{F}}_{1on2} \end{cases}; \quad \begin{cases} F = G\frac{Mm}{r^2} \\ G = 6.67 \times 10^{-11}\ \mathrm{N \cdot m^2/kg^2} \end{cases};;$$

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

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

12 in = 1 ft; 5,280 ft = 1 mi; 1,609 m = 1 mi; 0.3048 m = 1 ft.