1.

A sphere has a radius of 21 cm and a mass of 1.9 kg. Its mass density is about:

A. $2.0 \times 10^{-6}\,\mathrm{kg/m^3}$
B. $2.0 \times 10^{-2}\,\mathrm{kg/m^3}$
C. $1.4\,\mathrm{kg/m^3}$
D. $14\,\mathrm{kg/m^3}$
E. $49\,\mathrm{kg/m^3}$

2.

The number of significant figures in 0.00150 is:

A. 2
B. 3
C. 4
D. 5
E. 6

3.

Suppose $A = B^n C^m$, where A has dimensions LT, B has dimensions $\mathrm{L^2T^{-1}}$, and C has dimensions $\mathrm{LT^2}$. Then the exponents n and m have the values:

A. 2/3; 1/3
B. 2; 3
C. 4/5; −1/5
D. 1/5; 3/5
E. 1/2; 1/2

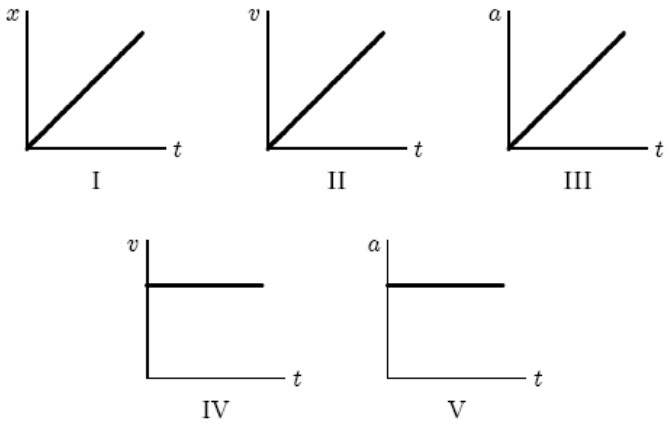
4.

The coordinate of an object is given as a function of time by $x = 4t^2 - 3t^3$, where x is in meters and t is in seconds. Its average acceleration over the interval from $t = 0$ to $t = 2$ s is:

A. $-4\,\mathrm{m/s^2}$
B. $4\,\mathrm{m/s^2}$
C. $-10\,\mathrm{m/s^2}$
D. $10\,\mathrm{m/s^2}$
E. $-13\,\mathrm{m/s^2}$

5.

Consider the following five graphs (note the axes carefully). Which of these represents motion at constant speed?



A. IV only
B. IV and V only
C. I, II, and III only
D. I and II only
E. I and IV only

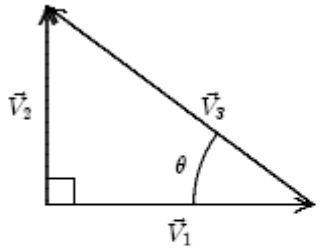
6.

An object is thrown vertically upward at 35 m/s. Taking $g = 10\ \text{m/s}^2$, the velocity of the object 5 s later is:

A. 7.0 m/s up
B. 15 m/s down
C. 15 m/s up
D. 85 m/s down
E. 85 m/s up

7.

The vector $\vec{V}_3$ in the diagram is equal to:



A. $\vec{V}_1 - \vec{V}_2$
B. $\vec{V}_1 + \vec{V}_2$
C. $\vec{V}_2 - \vec{V}_1$
D. $\vec{V}_1 \cos\theta$
E. $\vec{V}_1/(\cos\theta)$

8.

If $\vec{A} = (2\,\text{m})\,\hat{\text{i}} - (3\,\text{m})\,\hat{\text{j}}$ and $\vec{B} = (1\,\text{m})\,\hat{\text{i}} - (2\,\text{m})\,\hat{\text{j}}$, then $\vec{A} - 2\vec{B} =$

A. $(1\,\text{m})\,\hat{\text{j}}$
B. $(-1\,\text{m})\,\hat{\text{j}}$
C. $(4\,\text{m})\,\hat{\text{i}} - (7\,\text{m})\,\hat{\text{j}}$
D. $(4\,\text{m})\,\hat{\text{i}} + (1\,\text{m})\,\hat{\text{j}}$
E. $(-4\,\text{m})\,\hat{\text{i}} + (7\,\text{m})\,\hat{\text{j}}$

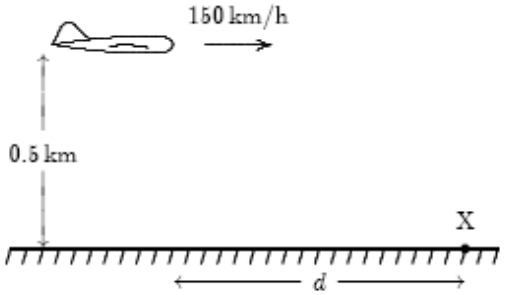
9.

Vectors $\vec{A}$ and $\vec{B}$ each have magnitude L. When drawn with their tails at the same point, the angle between them is 60°. The magnitude of the vector product $\vec{A} \times \vec{B}$ is:

A. $L^2/2$
B. L^2
C. $\sqrt{3}L^2/2$
D. $2L^2$
E. none of these

10.

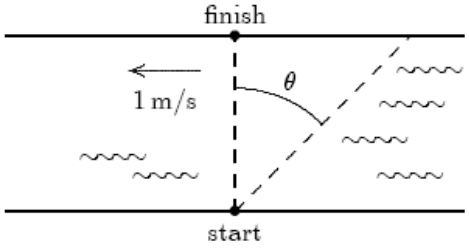
The airplane shown is in level flight at an altitude of 0.50 km and a speed of 150 km/h. At what distance d should it release a heavy bomb to hit the target X? Take $g = 10\,\mathrm{m/s^2}$.



A. 150 m
B. 295 m
C. 420 m
D. 2550 m
E. 15,000 m

11.

A girl wishes to swim across a river to a point directly opposite as shown. She can swim at 2 m/s in still water and the river is flowing at 1 m/s. At what angle θ with respect to the line joining the starting and finishing points should she swim?



A. 30°
B. 45°
C. 60°
D. 63°
E. 90°

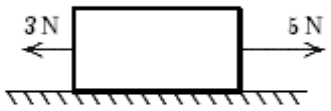
12.

A girl jogs around a horizontal circle with a constant speed. She travels one fourth of a revolution, a distance of 25 m along the circumference of the circle, in 5.0 s. The magnitude of her acceleration is:

A. $0.31\,\mathrm{m/s^2}$
B. $1.3\,\mathrm{m/s^2}$
C. $1.6\,\mathrm{m/s^2}$
D. $3.9\,\mathrm{m/s^2}$
E. $6.3\,\mathrm{m/s^2}$

13.

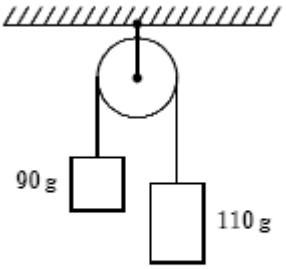
The block shown moves with constant velocity on a horizontal surface. Two of the forces on it are shown. A frictional force exerted by the surface is the only other horizontal force on the block. The frictional force is:



A. 0
B. 2 N, leftward
C. 2 N, rightward
D. slightly more than 2 N, leftward
E. slightly less than 2 N, leftward

14.

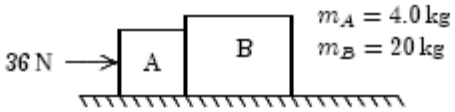
Two blocks are connected by a string and pulley as shown. Assuming that the string and pulley are massless, the magnitude of the acceleration of each block is:



A. $0.049\ \mathrm{m/s^2}$
B. $0.020\ \mathrm{m/s^2}$
C. $0.0098\ \mathrm{m/s^2}$
D. $0.54\ \mathrm{m/s^2}$
E. $0.98\ \mathrm{m/s^2}$

15.

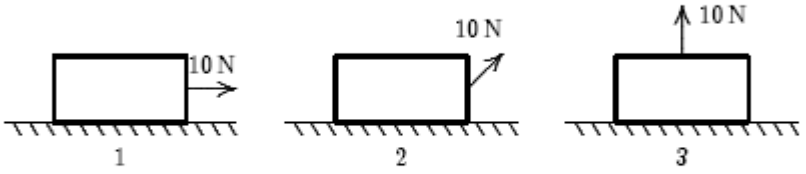
Two blocks (A and B) are in contact on a horizontal frictionless surface. A 36-N constant force is applied to A as shown. The magnitude of the force of A on B is:



A. 1.5 N
B. 6.0 N
C. 29 N
D. 30 N
E. 36 N

16.

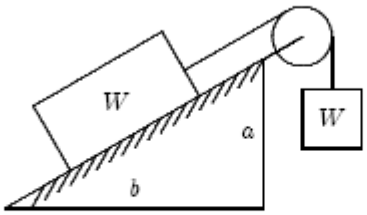
A crate rests on a horizontal surface and a woman pulls on it with a 10-N force. No matter what the orientation of the force, the crate does not move. Rank the situations shown below according to the magnitude of the frictional force of the surface on the crate, least to greatest.



A. 1, 2, 3
B. 2, 1, 3
C. 2, 3, 1
D. 1, 3, 2
E. 3, 2, 1

17.

The system shown remains at rest. Each block weighs 20 N. The force of friction on the upper block is:



$W = 20\,\text{N}$
$a = 3\,\text{m}$
$b = 4\,\text{m}$

A. 4 N
B. 8 N
C. 12 N
D. 16 N
E. 20 N

18.

The iron ball shown is being swung in a vertical circle at the end of a 0.7-m long string. How slowly can the ball go through its top position without having the string go slack?

A. 1.3 m/s
B. 2.6 m/s
C. 3.9 m/s
D. 6.9 m/s
E. 9.8 m/s