Name_____ CWID_____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) Two identical objects *A* and *B* fall from rest from different heights to the ground and feel no appreciable air resistance. If object *B* takes TWICE as long as object *A* to reach the ground, what is the ratio of the heights from which *A* and *B* fell? 1) _____

A) $h_A/h_B = 1/4$ B) $h_A/h_B = 1/8$

C) $h_A/h_B = 1/\sqrt{2}$ D) $h_A/h_B = 1/2$

2) In a perfectly ELASTIC collision between two perfectly rigid objects 2) _____

A) both the momentum and the kinetic energy of the system are conserved.
B) the kinetic energy of each object is conserved.
C) the momentum of each object is conserved.
D) the kinetic energy of the system is conserved, but the momentum of the system is not conserved.
E) the momentum of the system is conserved but the kinetic energy of the system is not conserved.

3) As a tile falls from the roof of a building to the ground its momentum is conserved. 3) _____

A) True B) False

4) A toy rocket is launched vertically from ground level ($y = 0.00$ m), at time $t = 0.00$ s. The rocket engine provides constant upward acceleration during the burn phase. At the instant of engine burnout, the rocket has risen to 86 m and acquired a velocity of 80 m/s. The rocket continues to rise in unpowered flight, reaches maximum height, and falls back to the ground with negligible air resistance. The speed of the rocket upon impact on the ground is closest to 4) _____

A) 100 m/s B) 110 m/s C) 83 m/s D) 90 m/s E) 74 m/s

5) Two ice skaters push off against one another starting from a stationary position. The 45.0−kg skater acquires a speed of 0.375 m/s. What speed does the 60.0−kg skater acquire? Assume that any other unbalanced forces during the collision are negligible. 5) _____

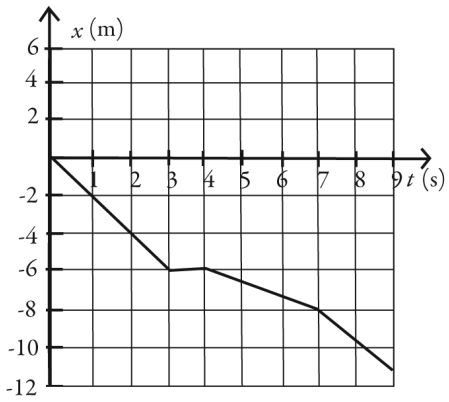
A) 0.000 m/s
B) 0.500 m/s
C) 0.281 m/s
D) 0.375 m/s
E) 0.750 m/s

6) A 2.3−kg object traveling at 6.1 m/s collides head−on with a 3.5−kg object traveling in the opposite direction at 4.8 m/s. If the collision is perfectly elastic, what is the final speed of the 2.3−kg object? 6) _____

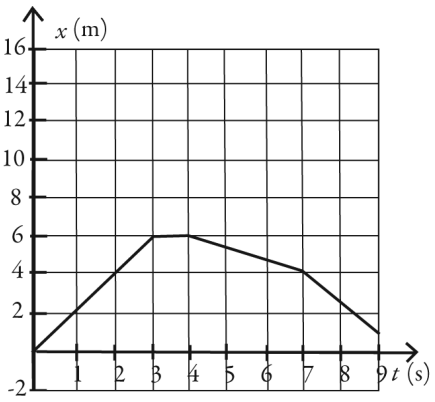
A) 3.8 m/s B) 4.3 m/s C) 6.6 m/s D) 0.48 m/s E) 7.1 m/s

7) An object starts its motion with a constant velocity of 2.0 m/s toward the east. After 3.0 s, the object stops for 1.0 s. The object then moves toward the west a distance of 2.0 m in 3.0 s. The object continues traveling in the same direction, but increases its speed by 1.0 m/s for the next 2.0 s. Which graph below could represent the motion of this object? 7) _____

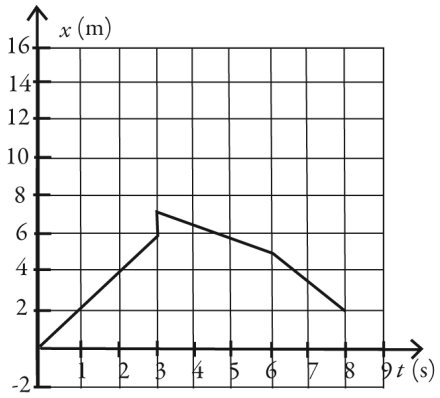
A)



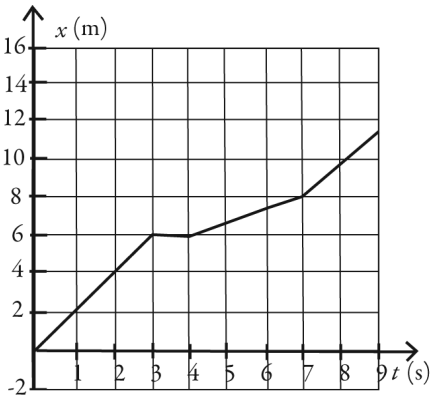
B)



C)

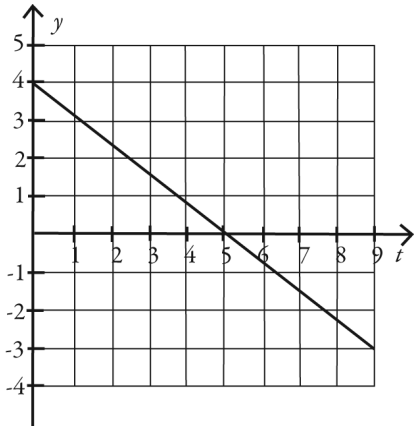


D)

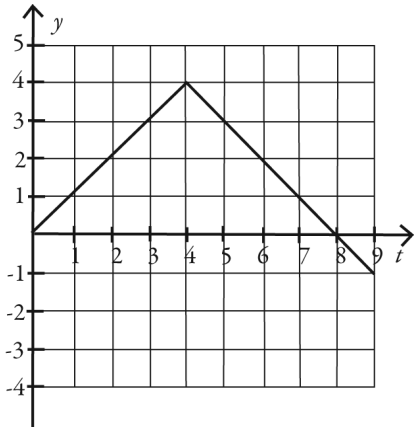


8) Which one of the following graphs could possibly represent the vertical position as a function of time for an object in free fall? 8) _____

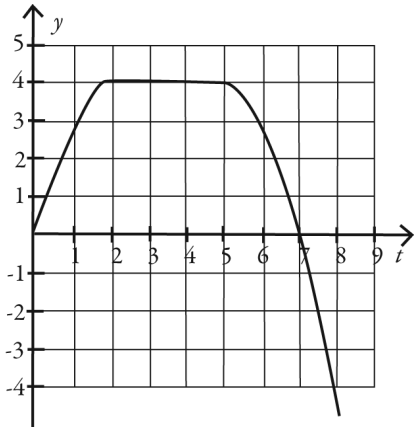
A)



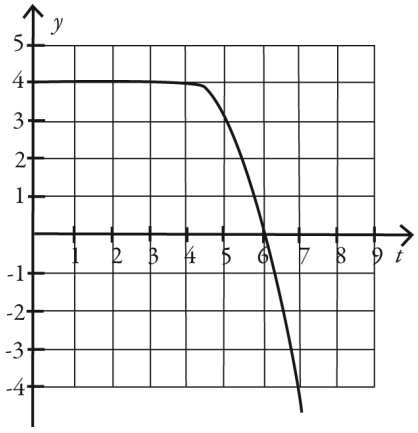
B)


y
5
4
3
2
1
-1
-2
-3
-4
1 2 3 4 5 6 7 8 9 t

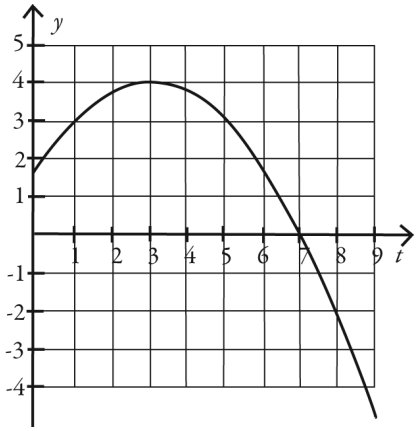
C)


y
5
4
3
2
1
-1
-2
-3
-4
1 2 3 4 5 6 7 8 9 t

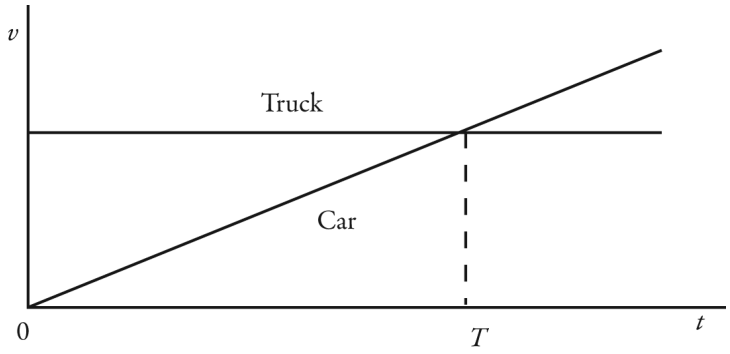
D)


y
5
4
3
2
1
-1
-2
-3
-4
1 2 3 4 5 6 7 8 9 t

E)

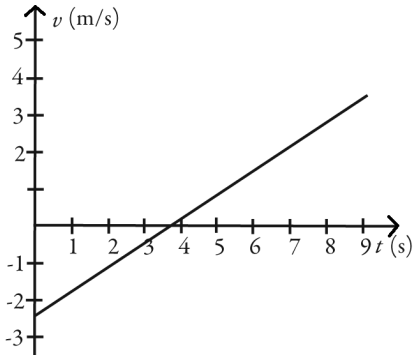


9) The motions of a car and a truck along a straight road are represented by the velocity-time graphs in the figure. The two vehicles are initially alongside each other at time $t = 0$. At time T, what is true about these two vehicles since time $t = 0$? 9) _____



A) The truck will have traveled further than the car.
B) The car will have traveled further than the truck.
C) The car will be traveling faster than the truck.
D) The truck and the car will have traveled the same distance.

10) The motion of a particle is described in the velocity versus time graph shown in the figure. We can say that its speed 10) _____

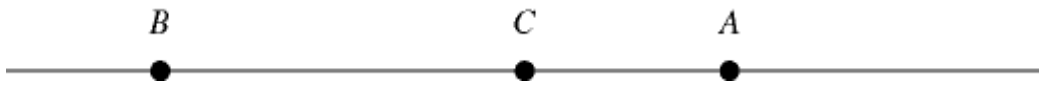


A) decreases.
B) increases.
C) increases and then decreases.
D) decreases and then increases.

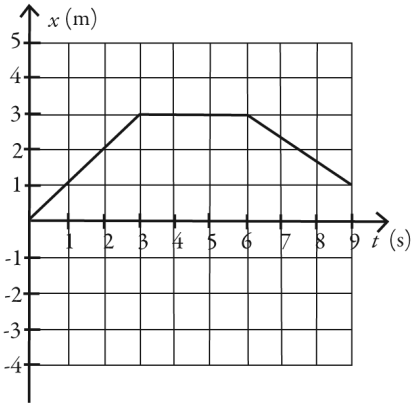
SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

11) A soccer ball is released from rest at the top of a grassy incline. After 2.0 seconds, the ball travels 50 meters and 1.0 s after this, the ball reaches the bottom of the incline.
(a) What was the magnitude of the ball's acceleration, assume it to be constant?
(b) How long was the incline? 11) _____

12) A cat runs along a straight line (the x–axis) from point A to point B to point C, as shown in the figure. The distance between points A and C is 5.00 m, the distance between points B and C is 10.0 m, and the positive direction of the x–axis points to the right. The time to run from A to B is 20.0 s, and the time from B to C is 8.00 s. As the cat runs along the x–axis between points A and C
(a) what is the magnitude of its average velocity?
(b) what is its average speed? 12) _____



13) The figure shows the position of an object as a function of time. During the time interval from time t = 0.0 s and time t = 9.0 s
(a) what is the length of the path the object followed?
(b) what is the displacement of the object? 13) _____



14) A 2.50–kg stone is dropped from rest at a height of 3.75 m. What impulse does gravity impart to this stone from the instant it is dropped until it hits the ground, assuming negligible air resistance? 14) _____

15) A 620–g object traveling at 2.1 m/s collides head–on with a 320–g object traveling in the opposite direction at 3.8 m/s. If the collision is perfectly elastic, what is the change in the kinetic energy of the 620–g object? 15) _____

Formula sheet

$$g = |\vec{a}_{\text{free fall}}| = 9.81\,\text{m/s}^2 \quad \text{near earth's surface}$$

$$0 = ax^2 + bx^2 + c \Longrightarrow x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$1\,\text{J} = 1\,\text{kg} \cdot \text{m}^2/\text{s}^2 = 1\,\text{N} \cdot \text{m}$$

$$\Delta\vec{r} = \vec{r}_f - \vec{r}_i$$

$$d \equiv |x_1 - x_2|$$

$$b \equiv |\vec{b}| = |b_x| \quad \text{one dimension}$$

$$\vec{r} = x\,\hat{\boldsymbol{\imath}} \quad \text{one dimension}$$

$$\vec{b} = b_x\,\hat{\boldsymbol{\imath}} \quad \text{one dimension}$$

$$\text{speed} = v = |\vec{v}|$$

$$\vec{v}_{av} \equiv \frac{\Delta\vec{r}}{\Delta t}$$

$$\vec{v} = \lim_{\Delta t \to 0} \frac{\Delta\vec{r}}{\Delta t} \equiv \frac{d\vec{r}}{dt}$$

$$a_{x,av} \equiv \frac{\Delta v_x}{dt}$$

$$a_x = \lim_{\Delta t \to 0} \frac{\Delta v_x}{\Delta t} \equiv \frac{dv_x}{dt} = \frac{d}{dt}\left(\frac{dx}{dt}\right) = \frac{d^2x}{dt^2}$$

$$x_f = x_i + v_{x,i}\Delta t + \frac{1}{2}a_x\,(\Delta t)^2$$

$$v_{x,f} = v_{x,i} + a_x\Delta t$$

$$x(t) = x_i + v_{x,i}t + \frac{1}{2}a_x t^2$$

$$v_x(t) = v_{x,i} + a_x t$$

$$v_{x,f}^2 = v_{x,i}^2 + 2a_x\Delta x$$

$$\Delta\vec{p} = \vec{0} \quad \text{isolated system}$$

$$\vec{p}_f = \vec{p}_i \quad \text{isolated system}$$

$$\vec{p} \equiv m\vec{v}$$

$$m_u = -\frac{\Delta v_{s,x}}{\Delta v_{u,x}} m_s$$

$$\vec{J} = \Delta\vec{p}$$

$$v_{1f} = \left(\frac{m_1 - m_2}{m_1 + m_2}\right) v_{i1} + \left(\frac{2m_2}{m_1 + m_2}\right) v_{2i} \quad \text{1D elastic}$$

$$v_{2f} = \left(\frac{2m_1}{m_1 + m_2}\right) v_{1i} + \left(\frac{m_2 - m_1}{m_1 + m_2}\right) v_{2i} \quad \text{1D elastic}$$

$$\Delta E = 0 \quad \text{isolated system}$$

$$K = \frac{1}{2}mv^2$$

$$\vec{v}_{12} = \vec{v}_2 - \vec{v}_1 \quad \text{relative velocity}$$

$$v_{12} = |\vec{v}_2 - \vec{v}_1| \quad \text{relative speed}$$

Power	Prefix	Abbreviation
10^{-12}	pico	p
10^{-9}	nano	n
10^{-6}	micro	μ
10^{-3}	milli	m
10^{-2}	centi	c
10^{3}	kilo	k
10^{6}	mega	M
10^{9}	giga	G
10^{12}	tera	T

1) A
2) A
3) B
4) D
5) C
6) E
7) B
8) E
9) A
10) D
11) a) 25 m/s^2 b) 110 m
12) (a) 0.179 m/s (b) 0.893 m/s
13) (a) 5.0 m (b) 1.0 m
14) 21.4 N · s
15) It loses 0.23 J.