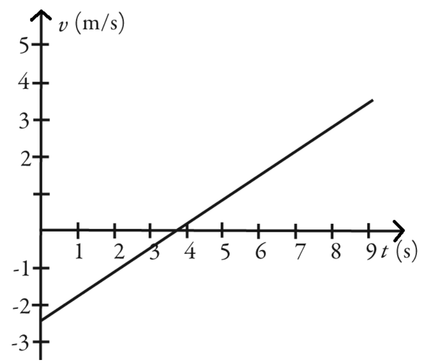
Exam

Name___________________________________

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

1) The motion of a particle is described in the velocity versus time graph shown in the figure. We can say that its speed 1) _______



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

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

2) As part of an exercise program, a woman walks south at a speed of 2.00 m/s for 60.0 minutes. She then turns around and walks north a distance 3000 m in 25.0 minutes 2) _______________
(a) What is the woman's average velocity during her entire motion?
A) 0.824 m/s south
B) 1.93 m/s south
C) 2.00 m/s south
D) 1.79 m/s south
E) 800 m/s south

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

3) The position of an object as a function of time is given by $x = bt^2 - ct$, where $b = 2.0\ \text{m/s}^2$ and $c = 6.7\ \text{m/s}$, and x and t are in SI units. What is the instantaneous velocity of the object when $t = 2.2$? 3) _______
A) 2.3 m/s B) 2.7 m/s C) 1.7 m/s D) 2.1 m/s

4) When can we be certain that the average velocity of an object is always equal to its instantaneous velocity? 4) _______
A) always
B) never
C) only when the acceleration is changing at a constant rate
D) only when the velocity is constant
E) only when the acceleration is constant

5) A child on a sled starts from rest at the top of a 15° slope. If the trip to the bottom takes 15.2 s how long is the slope? Assume that frictional forces may be neglected. 5) _______
A) 147 m B) 293 m C) 586 m D) 1130 m

6) A car is 200 m from a stop sign and traveling toward the sign at 40.0 m/s. At this time, the driver suddenly realizes that she must stop the car. If it takes 0.200 s for the driver to apply the brakes, what must be the magnitude of the constant acceleration of the car after the brakes are applied so that the car will come to rest at the stop sign? 6) _______

A) 3.89 m/s^2
B) 4.17 m/s^2
C) 2.89 m/s^2
D) 3.42 m/s^2
E) 2.08 m/s^2

7) A ball is projected upward at time $t = 0.0$ s, from a point on a roof 90 m above the ground. The ball rises, then falls and strikes the ground. The initial velocity of the ball is 36.2 m/s if air resistance is negligible. The time when the ball strikes the ground is closest to 7) _______

A) 9.0 s B) 8.7 s C) 10 s D) 9.7 s E) 9.4 s

8) A car accelerates from 10.0 m/s to 30.0 m/s at a rate of 3.00 m/s^2. How far does the car travel while accelerating? 8) _______

A) 226 m B) 133 m C) 399 m D) 80.0 m

9) The position of an object is given by $x = at^3 - bt^2 + ct$, where $a = 4.1\ m/s^3$, $b = 2.2\ m/s^2$, $c = 1.7$ m/s, and x and t are in SI units. What is the instantaneous acceleration of the object when $t = 0.7$ s? 9) _______

A) 2.9 m/s^2 B) –13 m/s^2 C) 4.6 m/s^2 D) 13 m/s^2

10) Two objects are dropped from a bridge, an interval of 1.0 s apart, and experience no appreciable air resistance. As time progresses, the DIFFERENCE in their speeds 10) _______

A) remains constant.
B) increases.
C) decreases at first, but then stays constant.
D) increases at first, but then stays constant.
E) decreases.

11) Two objects are thrown from the top of a tall building and experience no appreciable air resistance. One is thrown up, and the other is thrown down, both with the same initial speed. What are their speeds when they hit the street? 11) _______

A) They are traveling at the same speed.
B) The one thrown up is traveling faster.
C) The one thrown down is traveling faster.

12) Suppose that a car traveling to the west (the $-x$ direction) begins to slow down as it approaches a traffic light. Which statement concerning its acceleration in the x direction is correct? 12) _______

A) Its acceleration is positive but its velocity is negative.
B) Its acceleration is negative but its velocity is positive.
C) Both its acceleration and its velocity are positive.
D) Both its acceleration and its velocity are negative.

13) You are standing on a skateboard, initially at rest. A friend throws a very heavy ball towards you. You can either catch the object or deflect the object back towards your friend (such that it moves away from you with the same speed as it was originally thrown). What should you do in order to MINIMIZE your speed on the skateboard? 13) ______

A) Deflect the ball.
B) Catch the ball.
C) Your final speed on the skateboard will be the same regardless whether you catch the ball or deflect the ball.

14) 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? 14) ______

A) $h_A/h_B = 1/4$
B) $h_A/h_B = 1/8$
C) $h_A/h_B = 1/\sqrt{2}$
D) $h_A/h_B = 1/2$

15) In a collision between two objects having unequal masses, how does magnitude of the impulse imparted to the lighter object by the heavier one compare with the magnitude of the impulse imparted to the heavier object by the lighter one? 15) ______

A) Both objects receive the same impulse.
B) The lighter object receives a larger impulse.
C) The heavier object receives a larger impulse.
D) The answer depends on the ratio of the masses.
E) The answer depends on the ratio of the speeds.

16) A 480-kg car moving at 14.4 m/s hits from behind a 570-kg car moving at 13.3 m/s in the same direction. If the new speed of the heavier car is 14.0 m/s, what is the speed of the lighter car after the collision, assuming that any unbalanced forces on the system are negligibly small? 16) ______

A) 10.5 m/s
B) 5.24 m/s
C) 13.6 m/s
D) 19.9 m/s

17) 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. 17) ______

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

18) A 1000.0 kg car is moving at 15 km/h. If a 2000.0 kg truck has 18 times the kinetic energy of the car, how fast is the truck moving? 18) ______

A) 36 km/h
B) 54 km/h
C) 45 km/h
D) 63 km/h

19) A shell explodes into two fragments, one fragment 25 times heavier than the other. If any gas from the explosion has negligible mass, then 19) ______

A) the kinetic energy change of the heavier fragment is 25 times as great as the kinetic energy change of the lighter fragment.
B) the momentum change of the lighter fragment is exactly the same as the momentum change of the heavier fragment.
C) the kinetic energy change of the lighter fragment is 25 times as great as the kinetic energy change of the heavier fragment.
D) the momentum change of the lighter fragment is 25 times as great as the momentum change of the heavier fragment.
E) the momentum change of the heavier fragment is 25 times as great as the momentum change of the lighter fragment.

20) A car of mass 1689 kg collides head-on with a parked truck of mass 2000 kg. Spring mounted bumpers ensure that the collision is essentially elastic. If the velocity of the truck is 17 km/h (in the same direction as the car's initial velocity) after the collision, what was the initial speed of the car? 20) ______

A) 19 km/h B) 10 km/h C) 38 km/h D) 29 km/h

$$g = |\vec{\mathbf{a}}_{\text{free fall}}| = 9.81\,\text{m/s}^2 \quad \text{near earth's surface}$$
$$0 = ax^2 + bx^2 + c \Longrightarrow x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$
$$1\,\text{J} = 1\,\text{kg}\cdot\text{m}^2/\text{s}^2 \ = 1\,\text{N}\cdot\text{m}$$
$$\Delta\vec{\mathbf{r}} = \vec{\mathbf{r}}_f - \vec{\mathbf{r}}_i$$
$$d \equiv |x_1 - x_2|$$
$$b \equiv |\vec{\mathbf{b}}| = |b_x| \quad \text{one dimension}$$
$$\vec{\mathbf{r}} = x\,\hat{\boldsymbol{\imath}} \quad \text{one dimension}$$
$$\vec{\mathbf{b}} = b_x\,\hat{\boldsymbol{\imath}} \quad \text{one dimension}$$
$$\text{speed} = v = |\vec{\mathbf{v}}|$$
$$\vec{\mathbf{v}}_{av} \equiv \frac{\Delta\vec{\mathbf{r}}}{\Delta t}$$
$$\vec{\mathbf{v}} = \lim_{\Delta t\to 0}\frac{\Delta\vec{\mathbf{r}}}{\Delta t} \equiv \frac{d\vec{\mathbf{r}}}{dt}$$
$$a_{x,av} \equiv \frac{\Delta v_x}{dt}$$
$$a_x = \lim_{\Delta t\to 0}\frac{\Delta v_x}{\Delta t} \equiv \frac{dv_x}{dt} = \frac{d}{dt}\left(\frac{dx}{dt}\right) = \frac{d^2x}{dt^2}$$
$$x_f = x_i + v_{x,i}\Delta t + \frac{1}{2}a_x\left(\Delta t\right)^2$$
$$v_{x,f} = v_{x,i} + a_x\Delta t$$
$$x(t) = x_i + v_{x,i}t + \frac{1}{2}a_x t^2$$
$$v_x(t) = v_{x,i} + a_x t$$
$$v_{x,f}^2 = v_{x,i}^2 + 2a_x\Delta x$$

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

$$\Delta\vec{\mathbf{p}} = \vec{\mathbf{0}} \quad \text{isolated system}$$
$$\vec{\mathbf{p}}_f = \vec{\mathbf{p}}_i \quad \text{isolated system}$$
$$\vec{\mathbf{p}} \equiv m\vec{\mathbf{v}}$$
$$m_u = -\frac{\Delta v_{s,x}}{\Delta v_{u,x}}m_s$$
$$\vec{\mathbf{J}} = \Delta\vec{\mathbf{p}}$$
$$v_{1f} = \left(\frac{m_1 - m_2}{m_1 + m_2}\right)v_{i1} + \left(\frac{2m_2}{m_1 + m_2}\right)v_{2i} \quad \text{1D elastic}$$
$$v_{2f} = \left(\frac{2m_1}{m_1 + m_2}\right)v_{1i} + \left(\frac{m_2 - m_1}{m_1 + m_2}\right)v_{2i} \quad \text{1D elastic}$$
$$\Delta E = 0 \quad \text{isolated system}$$
$$K = \frac{1}{2}mv^2$$
$$\vec{v}_{12} = \vec{\mathbf{v}}_2 - \vec{\mathbf{v}}_1 \quad \text{relative velocity}$$
$$v_{12} = |\vec{\mathbf{v}}_2 - \vec{\mathbf{v}}_1| \quad \text{relative speed}$$

Answer Key
Testname: EXAM1

1) B
2) (a) A (b) C
3) D
4) D
5) B
6) B
7) E
8) B
9) D
10) A
11) A
12) A
13) B
14) A
15) A
16) C
17) C
18) C
19) B
20) A