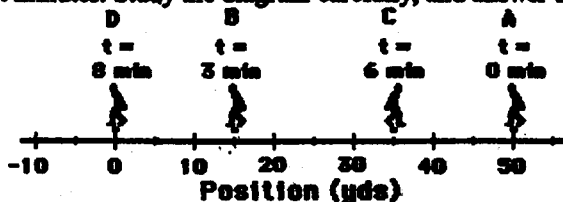


FIRST YEAR PHYSICS
JANUARY 10, 2002

DIRECTIONS: For each question or statement fill in the appropriate space on the answer sheet. Use the letter preceding the word, phrase, or quantity which best completes or answers the question. Each of the 25 questions is worth 4 points.
Use: $g = 10 \text{ m/s}^2$

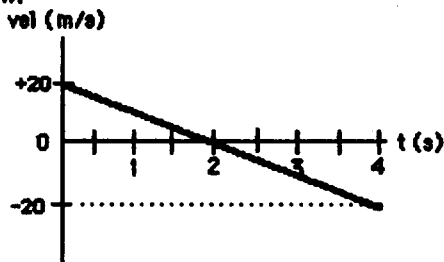
#1-2: Use the following information.

While waiting for the results of the NJSL January 2002 Physics I Exam, a student nervously paces back and forth. The diagram below shows several of the student's positions and times. At each marked position, the student makes a "U-turn" and moves in the opposite direction. That is, the student walks from position A to position B to position C to position D in a total time of eight minutes. Study the diagram carefully, and answer the questions.



- What is the distance walked by the student during the eight minutes?
a. 0 yds b. 50 yds c. 60 yds d. 90 yds
- What is the student's displacement during the eight minutes?
a. 0 yds b. 50 yds c. -50 yds d. 90 yds
- Sammy Sosa (Chicago Cub's baseball player) hits a pop-up. It leaves his bat traveling straight up at a speed of 40.0 m/s. If the baseball is moving upwards and slowing down, then what are the directions (up or down) of the velocity vector and the acceleration vector?

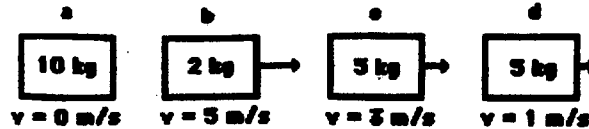
<u>Velocity</u>	<u>Acceleration</u>
a. Up	Down
b. Down	Up
c. Up	Up
d. Down	Down
- Rotten Johnny throws his mother's glass vase straight upward into the air with an initial velocity of 20 m/s. The velocity-time plot is shown below.



The vase travels upwards, reaches its peak and then falls back downwards. At what time does the vase reach the peak of its trajectory?

- 0 sec b. 1 sec c. 2 sec d. 4 sec
- A 4.0-kg object is moving across a frictionless surface with a constant velocity of 2 m/s. Which one of the following horizontal forces, measured in Newtons (N), is necessary to maintain this state of motion?
a. 0 b. 0.5 c. 8 d. Depends on the speed

6. The velocities and masses of four objects are shown. Which one of the following objects has the greatest inertia?



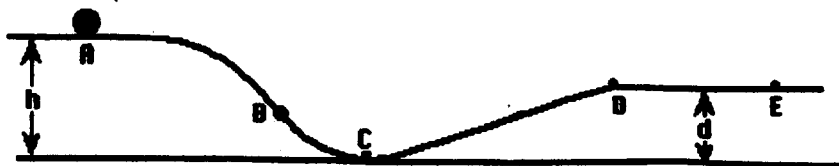
7. Big Bad Bob weighs 1000 N on Earth. The acceleration of gravity on the moon is one-sixth of the value on Earth. What is Big Bubba's mass on the moon?
- a. 0 kg b. 100 kg c. 166 kg d. 1000 kg
8. If the forces acting upon an object are balanced, then the object
- a. must not be moving.
b. must be moving with a constant velocity.
c. must not be accelerating.
d. none of these
9. If an elephant and a feather are dropped from a tall building on the earth, the elephant reaches the ground first. Which one of the following statements is the best description of why?
- a. The amount of air resistance which the elephant experiences is greater than the feather's, yet it makes little impact on the elephant's motion due to its large inertia.
b. The elephant reaches the ground first because it experiences a greater acceleration of gravity than the feather.
c. The feather reaches the ground last because it experiences more air resistance than the elephant.
d. The elephant falls faster simply because it has more mass than the feather.

For Questions #10-12: Use the following information.

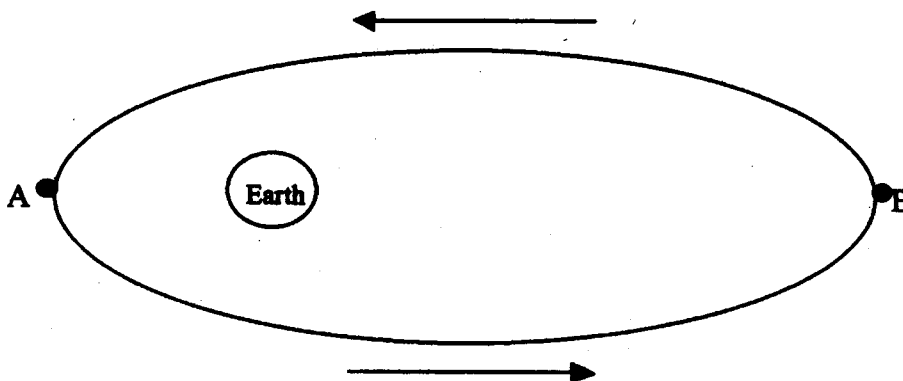
A ball is projected into the air at an angle to the horizontal. The ball subsequently undergoes projectile motion, rising towards its peak and subsequently landing at the same vertical position a horizontal distance of 20-m away.

10. Which of the following describe the horizontal velocity of a projectile?
- a. constant magnitude
b. changes by 10 m/s every second
c. initially directed in one direction and later in the opposite direction
d. is 0 m/s at the peak of the trajectory
11. Which of the following describe the vertical velocity of a projectile?
- a. constant magnitude
b. constant direction
c. the same at the beginning as at the end
d. is 0 m/s at the peak of the trajectory
12. Which of the following describe the vertical acceleration of a projectile?
- a. has a magnitude of 10 m/s^2
b. changing magnitude
c. is always directed in the direction which the object moves
d. initially directed in one direction and later in the opposite direction

#13 & 14: Use the following information. Neglect the effect of friction and air resistance.



13. As the object moves from point A to point D across the frictionless surface, the sum of its potential and kinetic energies
- Decreases only
 - Decreases then increases
 - Increases then decreases
 - Remains the same
14. The object will have a minimum gravitational potential energy at point
- A
 - B
 - C
 - D
15. A satellite in elliptic orbit about the earth, as shown below, travels from point A to point B in it's orbit. Which pair correctly describes the linear velocity and the total mechanical energy the satellite has while moving from A to B?

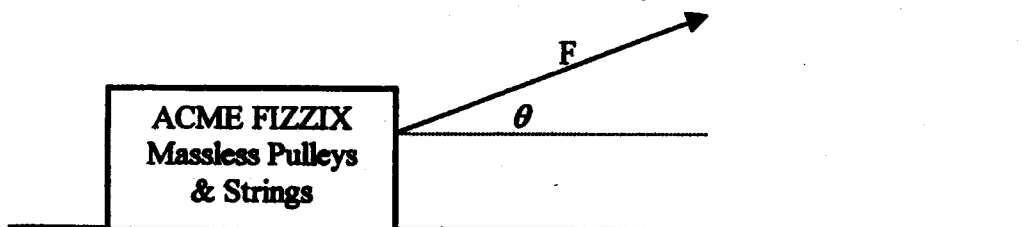


- | | <u>Velocity</u> | <u>Total Energy</u> |
|----|------------------|---------------------|
| a. | Remains the same | Remains the same |
| b. | Increases | Increases |
| c. | Decreases | Increases |
| d. | Decreases | Remains the same |
16. The density of ice in kg/m^3 is
- 0.917
 - 9.17
 - 91.7
 - 917
17. While on a family trip, you must average 90 km/hr for the entire trip in order to get to Granny's on time. You note at the halfway point, you have averaged only 45 km/hr. What must your average speed be for the second half of the trip in order to get to Granny's on time?
- 90 km/hr
 - 135 km/hr
 - 180 km/hr
 - Can't be done.
18. An automobile of mass 1000 kg is proceeding around the Exit 14 circular ramp of radius 40 m. The surface of the ramp is horizontal and provides a coefficient of friction to the tires of 0.50. The maximum speed this car can safely negotiate this exit ramp without slipping is
- 10 m/s
 - 14 m/s
 - 20 m/s
 - 40 m/s

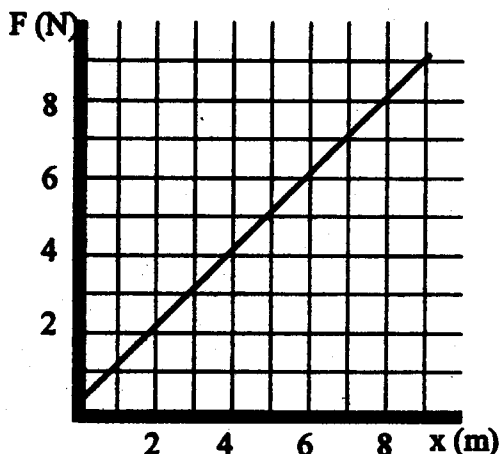
19. Ball *A* is dropped from rest from a window. At the same instant, ball *B* is thrown downward; and ball *C* is thrown upward from the same window. Which statement concerning the balls is necessarily true if air resistance is neglected? All three balls are released from the same place on the window.
- At some instant after it is thrown, the acceleration of ball *C* is zero.
 - All three balls strike the ground at the same time.
 - All three balls have the same acceleration at any instant.
 - All three balls reach the ground with the same velocity.
20. An object of mass *M* rests on a plane inclined to the horizontal at an angle θ . As the plane is lifted causing the angle to increase, which of the following forces increases?
- F_N , the Normal Force
 - F_P , the Perpendicular Force
 - F_{\parallel} , the Parallel Force
 - None, they all remain constant
21. A block of mass *M* starting from rest slides down a frictionless inclined plane of length *L*. When the block has attained $\frac{1}{2}$ its final speed, the distance it has traveled along the plane is
- $L/4$
 - $L/2$
 - $L/\sqrt{2}$
 - $3L/4$

#22 & 23: Use the following information and diagram.

A crate from Acme® Fizzix Supplies with a mass *M* accelerates along a frictionless surface as the crate is pulled with a force *F* directed at an angle θ as shown in the drawing.



22. The magnitude of F_N , the Normal force, exerted on the block is
- Mg
 - $Mg - F\cos\theta$
 - $Mg + F\cos\theta$
 - $Mg - F\sin\theta$
23. If *F* is 14.5 N, θ is 19° , and the crate weighs 225 N, what is the horizontal acceleration of the crate?
- 1.40 m/s^2
 - 1.29 m/s^2
 - 0.609 m/s^2
 - 0.644 m/s^2
24. A warehouse worker uses a forklift to lift a crate of frictionless pulleys on a platform to a height 2.75 m above the floor. The combined mass of the platform and the crate is 207 kg. If the power expended by the forklift is 1440 W, how long does it take to lift the crate?
- 37.9 s
 - 5.93 s
 - 3.95 s
 - 18.9 s
25. The graph shows the force component along the displacement as a function of the magnitude of the displacement. Determine the work done by the force during the interval from 2 to 8 m.



- 1 J
- 30 J
- 32 J
- 64 J