FIRST YEAR PHYSICS
JANUARY, 2006

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 m/s^2. Please PRINT your name, school, area, and which test you are taking on the scan-tron. This Exam is for not for AP level students.

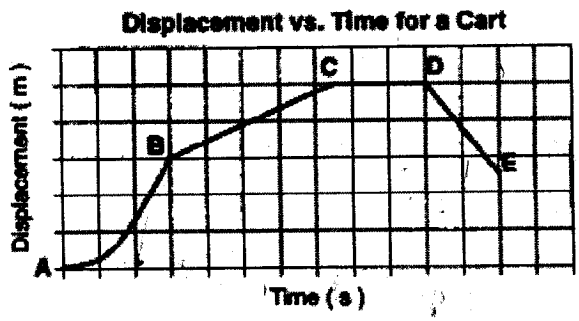
1. Given the definitions of *1 Angstrom* ($\mathring{A}$) = 10^{-10}m and *1 luntometer* (***lm***) = 10^{-63}m, what is the relationship between these two units?
   a. 1 $\mathring{A}$ = 53 ***lm*** b. 1 ***lm*** = 53 $\mathring{A}$ c. 1 $\mathring{A}$ = 10^{53} ***lm*** d. 1 ***lm*** = $10^{53}\mathring{A}$ e. 1 ***lm*** = $10^{-73}\mathring{A}$

2. What is the total displacement of a physics student who walks 3 blocks East, 2 blocks North, 1 block West, and then 2 blocks South, if each block is a square measuring 100 m on a side?
   a. Zero b. 200m West c. 200m East d. 800m e. 100m West

3. The length of a typical United States physics classroom is closest to which of the following?
   a. 10^{-2} m b. 10^{-1} m c. 10^{0} m d. 10^{1} m e. 10^{2} m

4. A stone is dropped from a bridge 45 meters above the surface of a river. Approximately how long does the stone take to hit the water? Ignore air resistance.
   a. 1 s b. 3 s c. 5 s d. 10 s e. 22 s

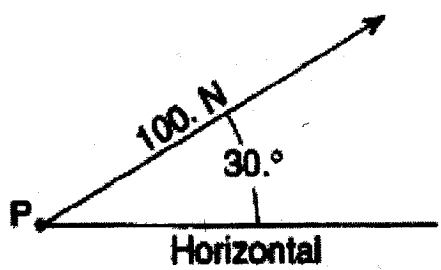
Use the following information for Questions 5 & 6: The displacement-time graph below represents the motion of a cart following a straight line on a physics Lab table.



5. During which interval is the cart accelerating?
   a. None b. AB c. BC d. CD e. DE

6. During which interval is the cart experiencing negative velocity?
   a. None b. AB c. BC d. CD e. DE

7. A 100-Newton force acts on an object at point P as shown.



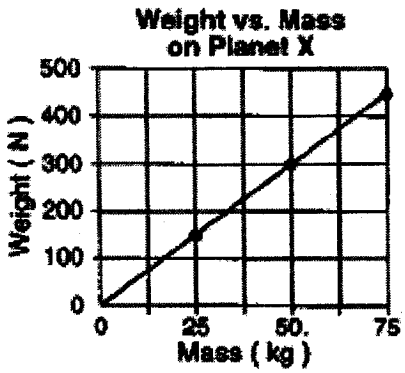
The magnitude of the vertical component of the force is approximately
a. 30N b. 50N c. 71N d. 87N e. 100N

Use the following information for Questions 8 & 9: A 1000-Kg car traveling with a velocity of 20m/s decelerates uniformly at $-5 m/s^2$ and comes to rest.

8. What total distance will the car travel as it decelerates?
   a. 10m b. 20m c. 40m d. 80m e. 100m

9. At what time after applying the brakes will this car have a speed of 5m/s during this stopping phase?
   a. 1 s b. 2 s c. 3 s d. 4 s e. 5 s

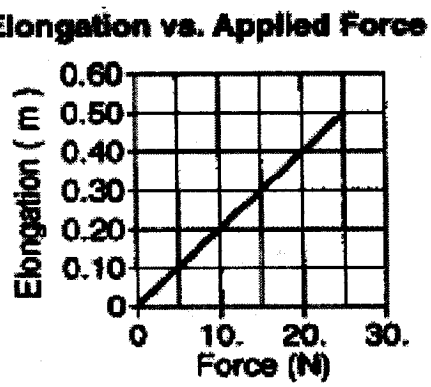
10. The graph below shows a physics student's data from a visit to '***Planet Jersey***', the mysterious 10th planet of our solar system that some refer to as '***Planet X***'. The acceleration due to gravity on ***Planet Jersey*** is approximately



   a. $0.17 m/s^2$ b. $6 m/s^2$ c. $10 m/s^s$ d. $50 m/s^2$ e. Can't tell without further data.

11. Which of the following reduced units is paired with its corresponding abbreviation?
   a. *Newton* and $\frac{Kg \cdot m^2}{s}$ b. *Newton* and $\frac{Kg \cdot m}{s}$ c. *Joule* and $\frac{Kg \cdot m^2}{s^3}$
   d. *Watt* and $\frac{Kg \cdot m^2}{s^2}$ e. *Watt* and $\frac{Kg \cdot m^2}{s^3}$

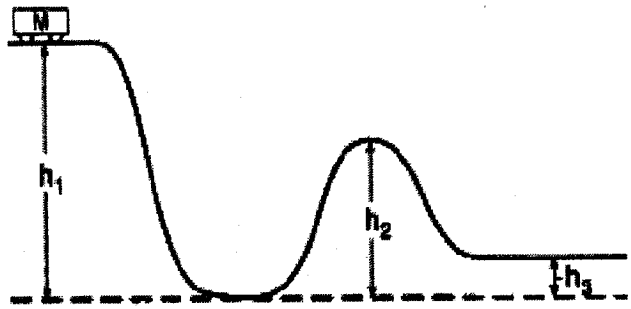
12. A physics student creates the graph below to represent data taken while using an ideal spring. What is the spring constant of the spring used?



   a. 0.2 N/m b. 2.0 N/m c. 25 N/m d. 50 N/m e. 100 N/m

13. A motor having a maximum power rating of 81,000 W is used to operate an elevator that weighs 18,000 N empty. What is the maximum weight this motor can lift at an average speed of 3 m/s?
   a. 6,000N b. 1,200N c. 18,000N d. 24,000N e. 27,000N

Use the following information for Questions 14 - 16: A cart of mass ***M*** on a frictionless track starts at the top of a hill of height, h_1, as shown.



14. If the cart starts from rest, what is its kinetic energy when it reaches the 2nd hill at height h_2?

a. Zero b. Mgh_1 c. $Mg(h_1 - h_2)$ d. $Mg(h_2 - h_1)$ e. Mgh_2

15. If the cart starts at the top of h_1 with a speed of v_o, what is its kinetic energy when it reaches the 2nd hill at height h_2?

a. Zero b. $Mgh_1 + \frac{1}{2}Mv_o^2$ c. $Mg(h_1 - h_2) + \frac{1}{2}Mv_o^2$ d. $Mgh_2 + \frac{1}{2}Mv_o^2$ e. $\frac{1}{2}Mv_o^2$

16. If the cart starts at rest at the top of hill h_1 on an identically shaped track that has friction and has just enough "umph" to make it to the top of hill h_2 where it stops, what is the amount of energy "lost" due to friction?

a. Zero b. Mgh_1 c. $Mg(h_1 - h_2)$ d. $Mg(h_2 - h_1)$ e. Mgh_2

Use the following information for Questions 17 & 18: Shown is the path of a projectile on Earth. Ignore air resistance.

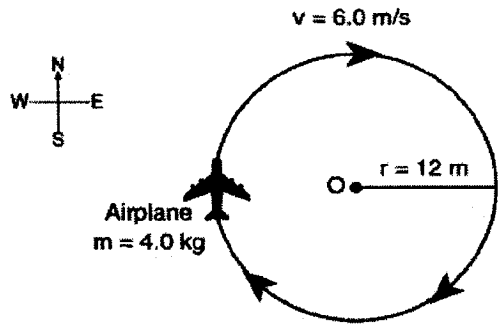
17. At point ***P***, which vector represents the direction of the acceleration acting on the projectile?

a.  b.  c.  d.  e. 

18. At point ***P***, which vector represents the direction of the net force acting on the projectile?

a.  b.  c.  d.  e. 

Use the following information for Questions 19 – 21: A 4.0-Kg model airplane is constrained to move in a horizontal circle of radius 12m at a constant speed of 6 m/s as shown. Ignore the effects of air resistance.



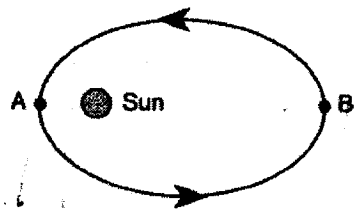
19. At the position of the plane in the diagram, what is the direction of the net force acting on the plane?
    a. North b. South c. West d. East e. Can't tell.

20. What is the magnitude of the centripetal acceleration of the airplane?
    a. 0.5 m/s^2 b. 2.0 m/s^2 c. 3.0 m/s^2 d. 4.0 m/s^2 e. 12 m/s^2

21. If the speed of the plane is doubled and the radius of the path is doubled, the magnitude of the centripetal force needed to keep the plane traveling in the same path would be

    a. half as much. b. one-fourth as much. c. the same d. 4 times as much e. twice as much.

22. The following diagram shows an exaggerated elliptic path of the earth as it travels around the sun.



As the earth moves from point ***A*** to point ***B***, what changes occur in its speed and potential energy?
a. Both decrease b. Both increase c. Speed increases and PE decreases
d. Speed decreases and PE increases e. Both speed and PE remain the same

23. A physics book weighing 20N slides at constant speed down a ramp inclined at 30° to the horizontal. What is the force of friction acting on the book?
    a. 10N up the ramp b. 10N down the ramp c. 17N up the ramp
    d. 17N down the ramp e. 20N up the ramp

24. A juggler throws two balls up to the same height so that they pass each other halfway up when A is rising and B is descending. Ignore air resistance and buoyant forces. Which statement is true of the two balls at the point where they pass each other?
    a. There is a residual upward force from the hand on each ball.
    b. There is a greater residual force from the hand on A than there is on B.
    c. Only gravity acts on B but there is an additional residual force from the hand on A.
    d. There is an additional downwards force besides gravity on each ball.
    e. The only force acting on each ball is the gravitational force.

25. A constant force F is applied to a body of mass m that initially is headed east at velocity v_o until its velocity becomes $-v_o$. The total time of travel is $2t$. The total distance the body travels in that time is

    a. $\frac{Ft^2}{2m}$ **b.** $\frac{Ft^2}{m}$ **c.** $v_o t - \frac{1}{2}\frac{Ft^2}{m}$ **d.** $v_o t + \frac{1}{2}\frac{Ft^2}{m}$ **e.** $2\left(v_o t + \frac{1}{2}\frac{Ft^2}{m}\right)$