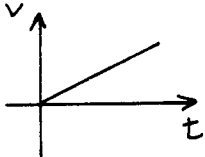
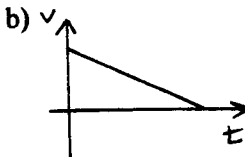
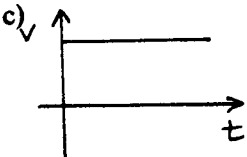
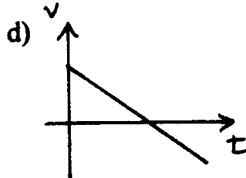


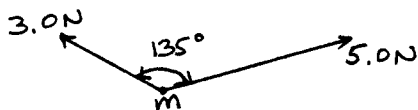
FIRST-YEAR PHYSICS EXAM

JANUARY, 1999

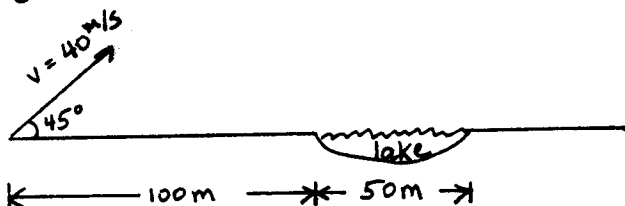
DIRECTIONS: For each statement or question fill in the appropriate space on the answer sheet completely. Use the letter preceding the word or phrase which best completes or answers the question. Each question is worth 4 points.

CONSTANTS: g (Earth) = 10 m/s^2

1. Which of the following is an example of a scalar quantity?
a) acceleration due to gravity b) velocity c) energy d) force
2. The following graphs show velocity versus time for an object moving in a straight line. Which graph shows the object changing direction during the time interval shown?
a)  b)  c)  d) 
3. A stone is thrown horizontally from a cliff on a different planet with speed of 10 m/s . The cliff has height of 200 m , and it takes 4.0 s for it to hit the ground. Assume that there is no air friction, and the ground below the cliff is level. What is the acceleration due to gravity on this planet?
a) 2.5 m/s^2 b) 5 m/s^2 c) 10 m/s^2 d) 40 m/s^2
4. The two forces shown in the diagram below combine to act on an object of 1.5 kg mass which is placed on a frictionless surface. The acceleration of the object will be
a) 5.3 m/s^2 b) 1.3 m/s^2 c) 2.4 m/s^2 d) 3.6 m/s^2



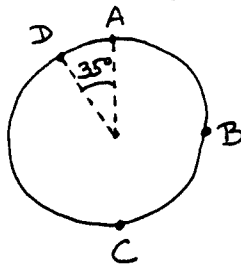
5. A wooden block of 0.50 kg mass slides down a ramp (inclined plane) at constant speed. The coefficient of kinetic friction between the block and the ramp is 0.65 . The angle of incline (between the ground and the ramp) of the ramp is
a) 33° b) 41° c) 50° d) 23°
6. A golfer hits a golf ball so that it flies off with initial velocity of 40 m/s at an angle of 45° . Directly in the path of the ball, 100 m away, is a lake, 50 m wide (see the diagram below). Where does the golf ball land, assuming that if it hits the ground it does not bounce or roll into the lake?
a) the ground before the lake b) in the lake c) the ground past the lake



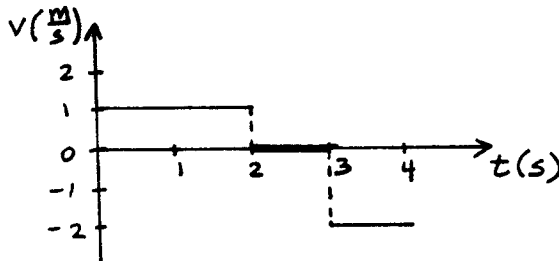
7. An irregularly shaped object of 300 g mass is dropped into a cylindrically shaped beaker containing some water. The beaker has diameter of 10 cm , and the object is immersed into the water completely. The water level rises by 2.0 cm . What is the density of the object?
a) 1.1 g/cm^3 b) 1.9 g/cm^3 c) 2.5 g/cm^3 d) 4.8 g/cm^3
8. The MKS unit of power is
a) $\frac{\text{kg m}}{\text{s}}$ b) $\frac{\text{kg m}}{\text{s}^2}$ c) $\frac{\text{kg m}^2}{\text{s}^2}$ d) $\frac{\text{kg m}^2}{\text{s}^3}$

9. A train is moving East at 15 mph. A man walks toward the back of the train with speed of 5 mph relative to the train. What is the velocity of the man relative to the ground?
 a) 10 mph East b) 10 mph West c) 20 mph East d) 20 mph West
10. A duck attempts to paddle straight across a brook which flows at a rate of 0.5 m/s. The duck paddles with speed of 0.2 m/s (Note: the duck's actual speed is greater, because the brook is sweeping it downstream). The width of the brook is 3.0 m. How far downstream from its target does the duck arrive?
 a) 3.0 m b) 5.0 m c) 7.5 m d) 10 m

For problems 11-15 refer to the figure below:

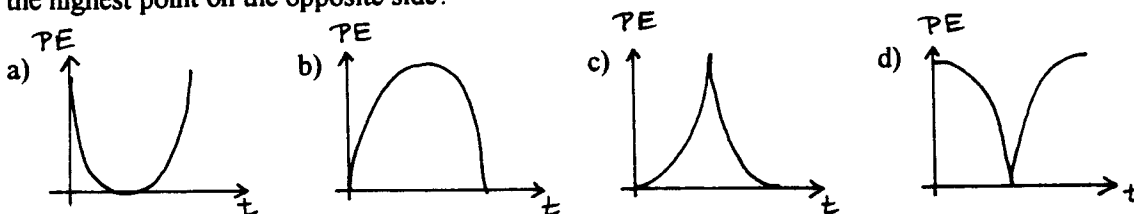


11. The figure above shows a ball with 1.0 kg mass tied to a string, being twirled in a vertically oriented circle. It is closest to the ground at point C, and furthest from the ground at point A. The radius of the circle is 0.8 m, and the ball is twirled at a frequency of 100 revolutions per minute. What is the period of revolution of the ball?
 a) 0.01 s b) 0.6 s c) 60 s d) 100 s
12. What is the centripetal force on the ball at point C?
 a) 10 N b) 32 N c) 56 N d) 88 N
13. At which point during the ball's path is the tension in the string highest?
 a) A b) B c) C d) D
14. What is the tension in the string when the ball is at point A?
 a) 78 N b) 80 N c) 88 N d) 98 N
15. What is the tension in the string when the ball is at point D?
 a) 78 N b) 80 N c) 88 N d) 98 N
16. A 20 kg box is pushed 5.0 m along an incline of 15° elevation. How much work was done, assuming that friction is negligible?
 a) 100 J b) 200 J c) 260 J d) 1000 J
17. If the box in problem 16. was pushed the given 5.0 m in 2 minutes, how much power was used?
 a) 1 Watts b) 2 Watts c) 4 Watts d) 8 Watts
18. During the time interval shown, what is the displacement of the object with the following velocity versus time graph?

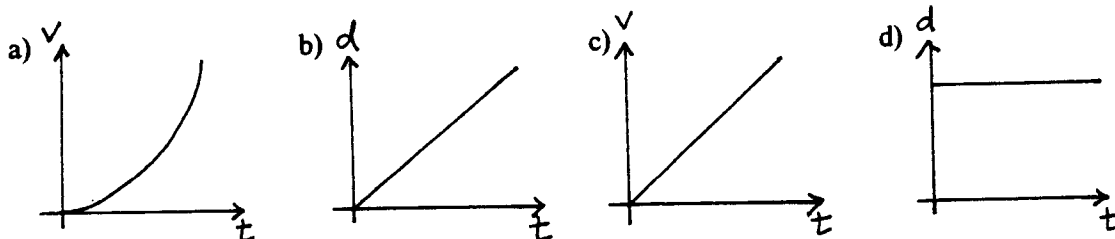


- a) -2 m b) 0 m c) +2 m d) +4 m

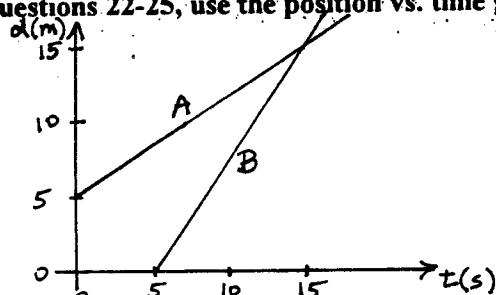
19. A pendulum object such as a playground swing moves such that its highest point is always at the same height above the ground. What is the the graph of its potential energy as it moves from its highest point on one side to the highest point on the opposite side?



20. A box slides down a 4.0 m long ramp with its center of mass at an initial height of 2.5 m. The coefficient of sliding friction between the ramp and the block is 0.45. If the box starts moving at the top of the ramp, what is its speed when it reaches the bottom of the ramp?
 a) 8.9 m/s b) 22 m/s c) 2.8 m/s d) 4.7 m/s
21. Which of the following graphs represents an object moving in a straight line with constant acceleration?



For questions 22-25, use the position vs. time graph below. The positions of object A and B are shown.



22. Select the correct statement.
 a) Object A starts moving before object B, and object A is moving faster.
 b) Object A starts moving before object B, and object B is moving faster.
 c) Object B starts moving before object A, and object A is moving faster.
 d) Object B starts moving before object A, and object B is moving faster.
23. Select the false statement.
 a) Object A starts moving at $t = 5$ sec.
 b) Object B has initial position of 0 m.
 c) Object B starts moving at $t = 5$ sec.
 d) Object A has initial position of 5 m.
24. At $t = 25$ sec, the speed of object B is
 a) 1.0 m/s b) 0.67 m/s c) 0.33 m/s d) 1.5 m/s
25. At $t = 25$ sec, the position of object B is
 a) 15 m b) 30 m c) 40 m d) 45 m

SCIENCE LEAGUE

PHYSICS I

ANSWER KEY

MONTH OF JANUARY, 1999

EACH QUESTION IS WORTH 4 POINTS

- | | |
|-------|-------|
| 1. C | 14. A |
| 2. D | 15. B |
| 3. B | 16. C |
| 4. C | 17. B |
| 5. A | 18. B |
| 6. C | 19. A |
| 7. B | 20. D |
| 8. D | 21. C |
| 9. A | 22. B |
| 10. C | 23. A |
| 11. B | 24. D |
| 12. D | 25. B |
| 13. C | |