Physics 53 Exam 1 Dr. Alward Friday, February, 6, 2009

1. A car traveling at 48 m/s begins decelerating at the rate of -6 m/s^2. How far in meters will it have traveled by the time its speed has been reduced to 16 m/s?

(a) 139.83
(b) 116.41
(c) 102.96
(d) 170.67
(e) None of the above

2. At t = 0, an object on the x-axis at x = 11 m is moving to the right at a speed of 20 m/s. At that moment, it begins to accelerate at 3 m/s^2. At what time in seconds will the object be at x = 92 m?

(a) 3.26
(b) 4.02
(c) 3.57
(d) 3.94
(e) None of the above

3. An automobile's speed is increased from 20 m/s to 58 m/s. During this time period, the car travels 429 m. Assuming the automobile's acceleration remains constant, how much farther in meters will it travel as its speed increases from 58 m/s to 70 m/s?

(a) 217.83
(b) 222.32.
(c) 240.75
(d) 297.64
(e) None of the above

4. At a certain instant of time, two cars are racing toward each other. The car on the left is moving to the right at a speed of 36 m/s, and the car on the right is moving to the left, toward the other car, at a speed of 42 m/s. At time t = 0 s, the cars are 3100 m apart, and then both cars begin to accelerate. The acceleration of the car on the left is 3 m/s^2, while the other car's acceleration is 5 m/s^2. How far in meters will the car on the left travel before it collides with the other car?

(a) 1296
(b) 1408
(c) 1315
(d) 1185
(e) None of the above

5. An object's velocity varies according to the equation, $v = 2 + 3t^2\ln(t)$, where v is in m/s, and t is in seconds. How far will this object travel during a time period that begins at t = 2s and ends at t = 4 s?

(a) 68.51
(b) 102.91
(c) 85.26
(d) 23.95
(e) None of the above

6. An object's position on the x-axis is given by the equation, $x = 20 + 4t + (t^4/8)\,e^{-0.2t}$, where x is in meters, and t is in seconds. What will be the object's speed in m/s at time t = 3.0 s?

(a) 21.86
(b) 10.30
(c) 31.13
(d) 16.92
(e) None of the above

7. An arrow is fired upward at an initial speed of 40 m/s. What maximum height will be reached by the arrow, in meters?

(a) 49.23
(b) 163.27
(c) 78.42
(d) 103.98
(e) None of the above

8. An object is thrown at speed 25 m/s straight upward from the top of a 30-m tall building. How many seconds does it take the object to strike the ground, assuming the object misses the building on its way down?

(a) 6.10
(b 5.92
(c) 6.43
(d) 7.05
(e) None of the above

9. An object at rest begins accelerating at time t = 0 along the x-axis according to the equation, $a = 3 + 2t$, where a is in m/s^2, and t is in seconds. What will be the x-coordinate (in meters) of the object when t = 5 seconds?

(a) 68.43
(b) 79.17
(c) 40.26
(d) 96.31
(e) None of the above

10. A group of hikers begin their journey at their campsite, first traveling 500 meters along a heading of 220 degrees, then 400 meters along a heading of 40 degrees. How far in meters are they from the campsite at this point? Assume headings are measured relative to north, rotating clockwise, with north being zero degrees.

(a) 114
(b) 100
(c) 121
(d) 108
(e) None of the above

11. The coordinates of an object moving in a plane are $x = 240t - 11t^2e^t$, and $y = 480t$, where x and y are in meters, and t is in seconds. What is the speed (in m/s) of the object when t = 2 seconds?

(a) 774.29
(b) 696.58
(c) 740.86
(d) 631.42
(e) None of the above

12. The components of velocity of an object moving in two dimensions are 40 m/s westward, and 28 m/s southward. What is the object's heading, in degrees? Assume headings are measured relative to north, rotating clockwise, with north being zero degrees.

(a) 121.87
(b) 132.45
(c) 116.80
(d) 130.08
(e) None of the above

13. The x, y, and z components of a vector **A** are <-3, 2, 1>, and the components of a vector **B** are <2, -2, 4>. What is the angle between these two vectors?

(a) 112.62
(b) 99.03
(c) 104.86
(d) 109.11
(e) None of the above

14. What is the magnitude (length) of the vector **C** in the equation, **C** = **A x B**, where **A** = 3**i** - 2**j** + **k**, and **B** = -2**i** + 4**j** ?

(a) 11.29
(b) 9.17
(c) 7.35
(d) 8.42
(e) None of the above

15. An object accelerating at 3 m/s^2 has a speed of 40 m/s after it has traveled 400 m. What was its initial speed, in m/s?

(a) 11.42
(b) 4.65
(c) 8.39
(d) 10.00
(e) None of the above

16. A rock is thrown with speed 30 m/s from the top of a 50-m tall cliff. The angle of the throw is 20 degrees above the horizontal. After how many seconds will the rock strike the ground?

(a) 4.41
(b) 5.63
(c) 9.85
(d) 7.42
(e) None of the above

17. The velocity of a stream of water with respect to the ground is 6 m/s to the east. A blue boat in the water is traveling at 4 m/s to the west with respect to the water. A red boat is traveling at a velocity of 5 m/s to the east with respect to the ground. What is the speed of the red boat with respect to the blue boat, in m/s?

(a) 3
(b) 1
(c) 2
(d) 5
(e) None of the above

18. An object traveling in a circular path at the end of a string of length 0.4 m executes 400 revolutions per minute. What is the object's centripetal acceleration, in m/s^2?

(a) 455.57
(b) 409.88
(c) 128.67
(d) 145.90
(e) None of the above

19. An arrow is fired at speed 120 m/s at an angle of 29 degrees above the horizontal. What will be the speed of the arrow 4 seconds after it reaches maximum height?

(a) 123.58
(b) 112.04
(c) 165.82
(d) 196.34
(e) None of the above

20. An artillery cannon is 300 meters away from the side of a tall cliff. Projectiles fired from the cannon have a speed of 100 m/s. At what angle above the horizontal, in degrees, should a projectile be fired in order to strike a point on the cliff 70 meters up the side of the cliff?

(a) 34.59
(b) 23.45
(c) 19.43
(d) 22.02
(e) None of the above