

Physics 53

Exam # 1

September 19, 2012

(100 points)

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Last Name

First Name

- Sharing calculators and using communication devices is strictly forbidden
- Tear off this answer sheet before beginning.
- Write your name on this sheet twice; once above, and again on the back of this sheet.
- Please do not circle your answers. Use a pencil to darken the letter of your choice.
- Each question is worth five points.
- Exam ends at 12:15 p.m.
- When you're done, place the answer sheet in the plastic box on the lecture table.
- Keep the questions sheets.

1. (a) (b) (c) (d) (e)

11. (a) (b) (c) (d) (e)

2. (a) (b) (c) (d) (e)

12. (a) (b) (c) (d) (e)

3. (a) (b) (c) (d) (e)

13. (a) (b) (c) (d) (e)

4. (a) (b) (c) (d) (e)

14. (a) (b) (c) (d) (e)

5. (a) (b) (c) (d) (e)

15. (a) (b) (c) (d) (e)

6. (a) (b) (c) (d) (e)

16. (a) (b) (c) (d) (e)

7. (a) (b) (c) (d) (e)

17. (a) (b) (c) (d) (e)

8. (a) (b) (c) (d) (e)

18. (a) (b) (c) (d) (e)

9. (a) (b) (c) (d) (e)

19. (a) (b) (c) (d) (e)

10. (a) (b) (c) (d) (e)

20. (a) (b) (c) (d) (e)

1. A hiker leaves the campsite and travels in a straight line for 300 meters along a direction  $70^\circ$  east of south. The hiker then changes direction, moving 500 meters along a direction that is 30 degrees west of north, and arrives at his final destination.

What is the approximate "heading" along which a second hiker could travel along a single straight line path to meet the first hiker. Note: headings are measured clockwise relative to the north direction; for example, the east direction has a heading of 90 degrees. (A quick sketch will be quicker than using the component method.)

Answers below are rounded to the nearest 10 degrees.

- a) 10
- b) 20
- c) 30
- d) 40
- e) None of these

2. The x-coordinate of an object moving along the x-axis is given in meters by the equation  $x(t) = 200 - 6t + 3e^t$ , where t is measured in seconds. What will be the object's acceleration (in  $m/s^2$ ) at  $t = 1.2$  seconds?

- a) 1.43
- b) 4.44
- c) 2.65
- d) 9.96
- e) None of these

3. The velocity of an object is  $v(t) = 4t^2e^t$ , where v is in m/s, and t is in seconds. When  $t = 0$ , the object's x-coordinate was 12 m. What will be the object's x-coordinate (in meters) when  $t = 1.4$  s?

- a) 20.33
- b) 10.58
- c) 22.82
- d) 19.89
- e) None of these

4. The acceleration of an object is  $a(t) = 20t^2e^{-t}$ , where a is in  $m/s^2$ , and t is in seconds. The velocity of the object at  $t = 0$  was 10 m/s. What will be its velocity (in m/s) at  $t = 1.5$  seconds?

- a) 1.89
- b) 1.95
- c) 8.76
- d) 17.65
- e) None of these

5. The position function of an object is  $x(t) = 2t + 4t^3 \ln(t)$  where  $x$  is in meters and  $t$  is in seconds. What will be the object's velocity (in m/s) when  $t = 1.3$  s?

- a) 28.78
- b) 13.34
- c) 14.08
- d) 11.07
- e) None of these

6. What angle (in degrees) does the vector  $\mathbf{A} = 3\mathbf{i} - 2\mathbf{j}$  make with respect to the vector  $\mathbf{B} = -\mathbf{i} + 5\mathbf{j}$

- a) 133
- b) 131
- c) 135
- d) 137
- e) None of these

7. Given  $\mathbf{A} = 3\mathbf{i} - 2\mathbf{j} + \mathbf{k}$ , and  $\mathbf{B} = -\mathbf{i} + 2\mathbf{j}$ , what is the magnitude of  $\mathbf{A} \times \mathbf{B}$ ?

- a) 8.85
- b) 8.31
- c) 9.55
- d) 4.46
- e) None of these

8. An object travels at a speed of 64 m/s for 18 minutes, 47 seconds, and then at 44 m/s for 4 minutes, 13 seconds. How far (in kilometers, km) did the object travel during this time? Answers below are rounded to the nearest kilometer.

- a) 83
- b) 59
- c) 53
- d) 57
- e) None of these

9. An object slows down at the rate of  $-4 \text{ m/s}^2$ . It travels 450 meters before coming to rest. What must have been its initial velocity (in m/s)?

- a) 20
- b) 18
- c) 42
- d) 60
- e) None of these

10. During a certain period of time the velocity of an object moving along the x-axis increased uniformly over a 60-second period from an initial velocity of -30 m/s to its final velocity, and during this time its displacement is 2700 m. What was the final velocity, in m/s?

- a) 90
- b) 60
- c) 80
- d) 120
- e) None of these

11. An object at the origin on the x-axis is moving to the right at 120 m/s. At a certain moment, it begins to decelerate at  $-3.0 \text{ m/s}^2$ . It slows down, comes to a momentary rest, then reverses direction. At what time (in seconds) will the object be at  $x = 500 \text{ m}$  for the second time?

- a) 22.4
- b) 52.5
- c) 75.6
- d) 41.7
- e) None of these

12. A bullet is fired vertically upward with a certain large initial speed. What will be the distance (in m) traveled downward during the four seconds after it reaches maximum height?

- a) 78.4
- b) 98.1
- c) 111.2
- d) 36.8
- e) None of these

13. An object accelerating from rest along the x-axis experiences a 140 m displacement during a certain period of time, T. What will be the displacement (in meters) that occurs during the next T seconds?

- a) 220
- b) 420
- c) 360
- d) 400
- e) None of these

14. A bomber pilot flying horizontally at 200 m/s at an elevation of 4900 m drops a bomb over level ground. How far horizontally (in meters) will the bomb travel before striking the ground?

- a) 1800
- b) 3860
- c) 1790
- d) 1600
- e) None of these

15. Two automobiles are initially 4000 m apart and traveling in the same direction on the same straight road, one chasing the other. The car that is chasing the other is initially traveling at 30 m/s and accelerating at  $4 \text{ m/s}^2$ , and the other is initially traveling at 36 m/s, and accelerating at  $3 \text{ m/s}^2$ . How far (in kilometers) will the chased car have traveled by the time it is caught?

- a) 12.3
- b) 28.4
- c) 17.2
- d) 13.6
- e) None of these

16. A golf ball resting on level ground is struck by a golf club and leaves the club face at a speed of 110 m/s, and at an angle of  $40^\circ$  above the horizontal. What will be the speed (in m/s) of the ball when it strikes the ground?

- a) 110
- b) 150
- c) 144
- d) 98
- e) None of these

17. An artillery projectile is fired from level ground toward the face of a tall vertical cliff 1000 meters away. The initial speed of the projectile is 500 m/s, and the firing angle is 60 degrees above the horizontal. At what height (in meters) up the face of the cliff does the projectile land?

- a) 292
- b) 415
- c) 355
- d) 468
- e) None of these

18. An object moving in a circular path at the end of a string has a centripetal acceleration of  $17.00 \text{ m/s}^2$ . If the speed is doubled and the length of the string reduced to one-third of the original length, what would be the new centripetal acceleration (in  $\text{m/s}^2$ )?

- a) 204
- b) 125
- c) 186
- d) 92
- e) None of these

19. Car A is traveling east at 30 m/s. Car B is moving south at 40 m/s. What is the heading of Car A relative to Car B, i.e., along what direction (angle in degrees relative to north, measured clockwise) does Car B say Car A is traveling?

- a) 35
- b) 28
- c) 54
- d) 37
- e) None of these

20. An object initially moving at 5 m/s at the origin at time  $t = 0$  begins to accelerate according to the equation,  $a(t) = 4t$ . What will be the object's x-coordinate (in m) at time  $t = 3.00$  s?

- a) 33
- b) 16
- c) 20
- d) 21
- e) None of these

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