

There are 20 equally-weighted problems on this test. There is only one correct answer per question. Questions must be answered with your iclicker. Feel free to write on the test, though it will not affect your score.

KEY

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USEFUL INFORMATION:

1 m = 3.281 ft

1 mile = 1609 m

$g = 9.8 \text{ m/s}^2$

$v = v_0 + at$

$\Delta x = v_0t + \frac{1}{2}at^2$

$v^2 = v_0^2 + 2a(x - x_0)$

$x = x_0 + v_{avg}t$

$\sin \theta = \text{opp/hyp}, \cos \theta = \text{adj/hyp}, \tan \theta = \text{opp/adj}, V^2 = V_x^2 + V_y^2$

1 kg = 2.2 pounds

quadratic:  $ax^2 + bx + c = 0$

$x = \frac{-b \pm (b^2 - 4ac)^{1/2}}{2a}$

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1. When you are having trouble figuring out how to start a problem, what is the **first** strategy Professor Holcomb recommends that you take? (And you might want to do it during this test.)

9% Correct

94%

- a) List what you know (and are looking for) *in variable form* 5%
- b) List all of the equations you know that might be relevant 1%
- c) Label your frame of reference, such as what direction is positive and the origin
- d) Draw a picture of the situation**
- e) Panic and search on Google

2. Suppose a ball is thrown straight up. The velocity vector and the acceleration vector have the same direction during which part of the motion?

70%

- a) When the ball is moving up. 9%
- b) When the ball is at the highest point. 9
- c) When the ball is moving down.**
- d) They never have the same direction. 8
- e) They always have the same direction. 4

3. In a braking test, a car is observed to come to rest in 3.0 s. Its initial speed was 27 m/s.

What was the acceleration of the car?

94%

- a) -18 m/s<sup>2</sup>
- b) -3.0 m/s<sup>2</sup>
- c) -4.5 m/s<sup>2</sup>
- d) -9.0 m/s<sup>2</sup>**

$$a = \frac{v_f - v_0}{t} = \frac{0 - 27}{3 \text{ s}}$$

4. A ball is thrown straight up. The ball's total time in the air is 2.80 seconds. Ignore air resistance. What was its initial speed?

44%

- a) 27.4 m/s 51%
- b) 13.7 m/s**
- c) 7.0 m/s
- d) 3.5 m/s

$v_f = v_0 + at$

$v_0 = -at$

$t = 1.4 \text{ s}$   
Time!

$a = -9.8 \text{ m/s}^2$

$$\Delta x = \cancel{v_0 t} + \frac{1}{2} a t^2 \quad \text{time squared}$$

5. A car starts from rest and moves in a straight line with constant acceleration. Consider its displacements after 2 seconds and after 4 seconds. Which one of the following statements is correct?

- 75% a) The displacement after 4 s is twice the displacement after 2 s.  $\Delta x$
- 25% b) The displacement after 4 s is three times the displacement after 2 s.
- 1% c) The displacement after 4 s is four times the displacement after 2 s.
- 1% d) The displacement after 4 s is eight times the displacement after 2 s.

6. Find the closest answer. Estimate the volume of our heads in cubic meters.  $\sim 1 \text{ ft} \times .5 \text{ ft} \times .5 \text{ ft} \sim .25 \text{ ft}^3$

- 19%! a) 0.008 m<sup>3</sup>    43% b) 0.08 m<sup>3</sup>    33% c) 0.8 m<sup>3</sup>    4% d) 8.0 m<sup>3</sup>    1% e) 80 m<sup>3</sup>     $.25 \text{ ft}^3 \left(\frac{1 \text{ m}}{3.28 \text{ ft}}\right)^3$

7. Two cars are initially stopped side-by-side at a red light. The light turns green and they both move forward. The acceleration of car A is twice that of car B. After they have each moved 100 m (note that this occurs in different time intervals), which one of the following statements is true?  $v_0 = 0$

- 16% 14% a) The speed of car A is 4.00 times greater than the speed of car B.  $v_f = ?$
- 1% b) The speed of car A is 3.00 times greater than the speed of car B.
- 69% c) The speed of car A is 2.00 times greater than the speed of car B.
- d) The speed of car A is 1.41 times greater than the speed of car B.  $v_f^2 = v_i^2 + 2(a)\Delta x$

8. In real world problems, multiple unit conversions may be necessary to solve a problem. In that spirit, solve this next problem. A sports car has a maximum acceleration of 12 m/s<sup>2</sup>. If it starts from rest, what answer is closest to its maximum speed after 50 feet.

- 47% 12% 16% 17% 49% 6% a) 20.6 mph    b) 24.5 mph    c) 30.3 mph    d) 44.4 mph    e) 65.0 mph

9. A garbage truck driver estimates that 50% of his 4 hour shift he spends stopped and the other 50% he travels at 20 mph. If this estimate is accurate, what is his average velocity for the roundtrip (starting and ending at the same location)?

- 48% a) 0 mph    2% b) 2.5 mph    15% c) 5 mph    33% d) 10 mph    2% e) 20 mph

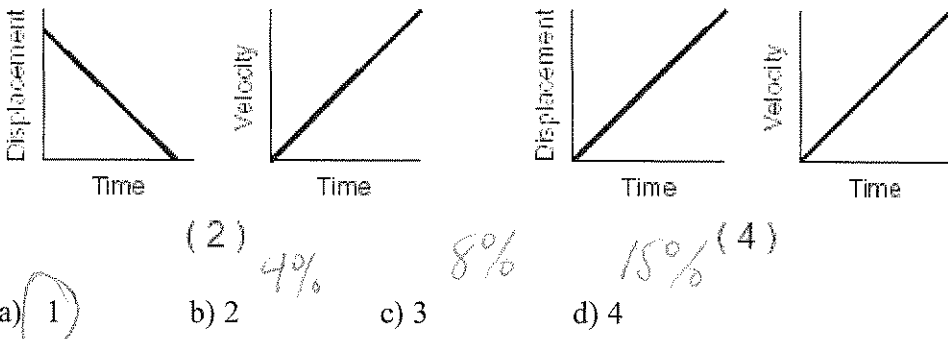
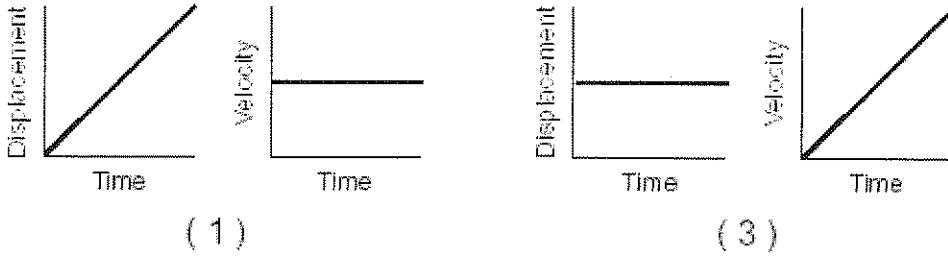
10. A position versus time graph shows a straight line (constant slope) segment. Which of the following **could not be accurate** according to this segment of the graph?

- 51% a) constant nonzero velocity    30%
- b) constant nonzero speed    1%
- c) constant nonzero acceleration
- d) constant nonzero displacement    9%
- e) constant, zero velocity    31%

11. Find the closest answer. **Estimate** the number of heartbeats in an average lifespan.

- 67%  
 a)  $2 \times 10^7$     b)  $3 \times 10^8$     c)  $5 \times 10^9$     d)  $7 \times 10^{10}$     e)  $4 \times 10^{11}$

12. Which pair of graphs below correctly represents the same motion?



13. Which one of these things is **not** accelerating?

- 42%  
 a) the Moon orbiting the Earth    10%  
 b) a ball dropped down a cliff or well    3%  
 c) a car going around a curve at a constant speed    32%  
 d) all of the above    13%  
 e) none of the above

14. An object speeds up, moving in the negative direction. What are the signs of the velocity and acceleration?

- 44%  
 a)  $v > 0, a > 0$     3%  
 b)  $v > 0, a < 0$     13%  
 c)  $v < 0, a > 0$     40%  
 d)  $v < 0, a < 0$   
 e) more information is needed in order to determine

15. An astronaut drops a hammer from 2.0 meters above the surface of the Moon. If the acceleration due to gravity on the Moon is 1.62 meters per second<sup>2</sup>, how long will it take for the hammer to fall to the Moon's surface?

- 71%  
 a) 0.62 s    b) 1.2 s    c) 1.6 s    d) 2.5 s

$\Delta x = \frac{1}{2} a t^2$

$$\Delta x = \frac{1}{2} a t^2$$

$$v_0 = 0$$

$$\Delta x$$

69%

16. A rocket initially at rest on the ground lifts off vertically with a constant acceleration of  $2.0 \times 10^1 \text{ m/s}^2$ . How long will it take the rocket to reach an altitude of  $9.0 \times 10^3$  meters?  $t = ?$

- a)  $9.5 \times 10^0 \text{ s}$    b)  $3.0 \times 10^1 \text{ s}$    c)  $4.5 \times 10^2 \text{ s}$    d)  $9.0 \times 10^2 \text{ s}$

80%

17. What is the speed of a 2.5 kilogram mass after it has fallen freely from rest through a distance of 12 meters?

- a) 4.8 m/s   b) 15 m/s   c) 30 m/s   d) 235 m/s   e) 470 m/s

$$v_f = ?$$

$$a = 9.8$$

$$v_f^2 = 2(9.8)(12)$$

$$\Delta x = 12$$

13%

18. If you toss a ball upward with a certain initial speed, it falls freely and reaches a maximum height  $h$ . By what factor must you increase the initial speed of the ball for it to reach a maximum height  $2h$ ?

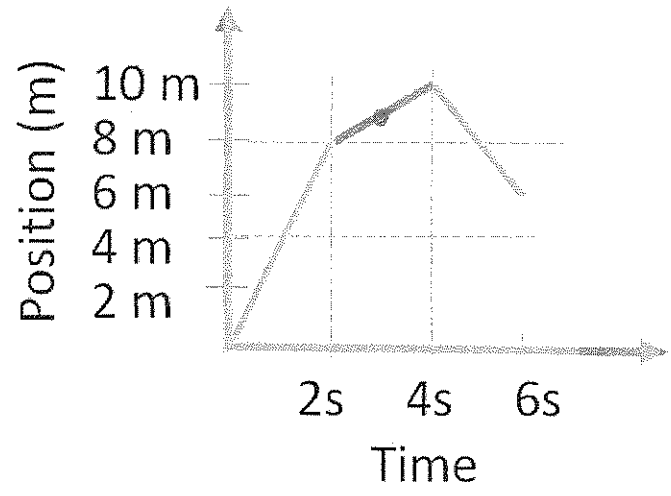
- a)  $\sqrt{2}$    b) 2   c) 4   d) 8   e) 16

Very similar to divider question

66%

19. The position of a car is shown in the graph below. What is the instantaneous velocity of the car at a time of 3 seconds?

- a) 1 m/s   b) 2 m/s   c) 3 m/s   d) 4.5 m/s   e) 9 m/s



$$v = \frac{10 - 8}{2.5} = \frac{2}{2.5}$$

63%

20. A ball is thrown ( $v \neq 0$ ) straight downward with a speed of 0.50 meter per second from a height of 4.0 meters. What is the speed of the ball 0.70 second after it is released? [Neglect friction.]

- a) 8.0 m/s   b) 6.9 m/s   c) 9.8 m/s   d) 15 m/s   e) 7.4 m/s

$$v_0 = -.5$$

~~$$v_f = v_0 + at$$~~

$$v_f = v_0 + at$$

⑧  $a = 12 \text{ m/s}^2$   
 $v_0 = 0$   
 $\Delta x = 50 \text{ ft}$   
 $v_f = ?$

A couple ways to do this.

Can convert early

$$v_f^2 = \cancel{v_0^2} + 2a\Delta x$$

$$= 2(12 \frac{\text{m}}{\text{s}^2})(50 \text{ ft})$$

unit issues, need to convert

$$= 2(12 \frac{\text{m}}{\text{s}^2})(50 \text{ ft}) \left( \frac{1 \text{ mile}}{5280 \text{ ft}} \right)^2 \left( \frac{3.28 \text{ ft}}{1 \text{ m}} \right) \left( \frac{3600 \text{ s}}{1 \text{ hour}} \right)^2$$

$$= 42.8$$

$$a = 12 \frac{\text{m}}{\text{s}^2} \xrightarrow{\text{mile/hr}^2} \left( \frac{1 \text{ mile}}{1609 \text{ m}} \right) \left( \frac{3600 \text{ s}}{1 \text{ hour}} \right)^2 = 96,656 \frac{\text{mi}}{\text{hr}^2}$$

$$\Delta x \xrightarrow{\text{miles}} 50 \text{ ft} \left( \frac{1 \text{ mile}}{5280 \text{ ft}} \right) = 0.00947 \text{ miles}$$

$$\sqrt{v_f^2 = 2(96,656 \frac{\text{mi}}{\text{hr}^2})(0.00947 \text{ miles})}$$

$$= 42.8$$