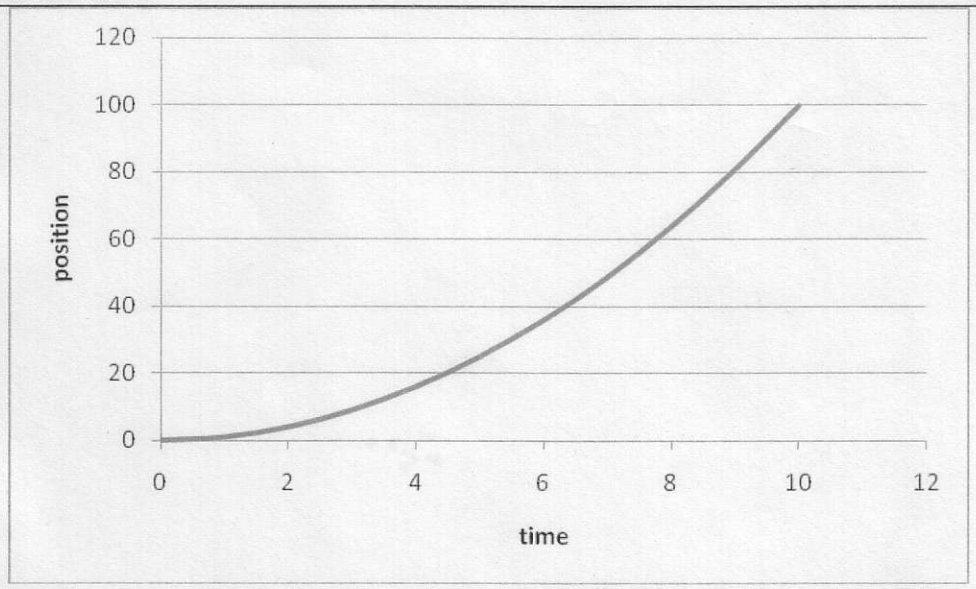
Exam 1 on FEB 09. 2010 - Physics 105 – R. Schad

YOUR NAME solutions A/B

1.	**IMPORTANT - This is to identify the exam version you have** **Mark the A**
2.	**IMPORTANT - This is to identify the exam version you have** **Mark the B**
3. A	 A train car moves along a long straight track. The graph shows the position as a function of time. The graph shows that the train: a) speeds up all the time. b) slows down all the time. c) speeds up part of the time and slows down part of the time. d) moves at a constant velocity.
4. B	A ball is thrown up into the air. While the ball is in free fall, what does its acceleration do? a) decreases b) remains constant c) increases and then decreases d) increases

95

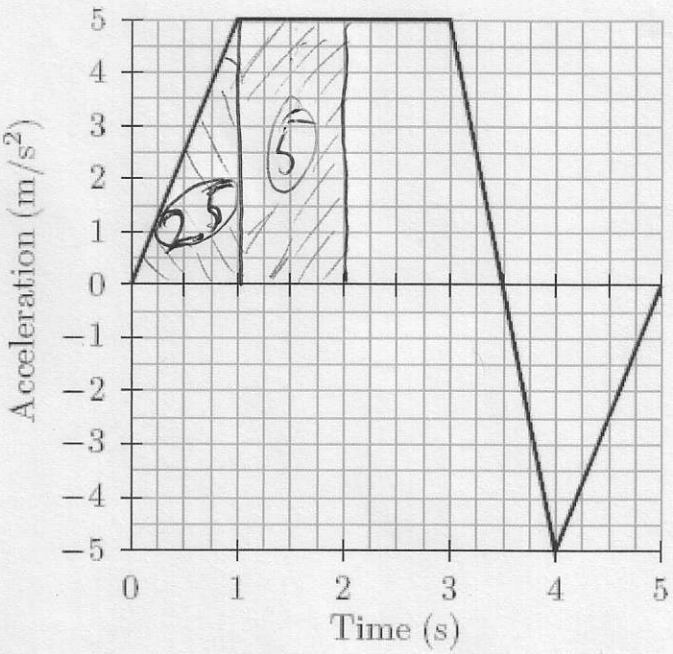
90

5. C

A race car accelerated from rest.

When was the velocity of the car 7.5 m/s?

74



1. **At t = 3 s and t = 4.5 s**
2. **At no time on this graph**
3. **2.0 s**
4. **5.0 s**
5. **3.5 s**

6. D

An electron, starting from rest and moving with a constant acceleration, travels 100 cm in 5 ms.
What is the magnitude of this acceleration?

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a) 4 m/s^2
b) 8 m/s^2
c) 4 x 10^4 m/s^2
d) 8 x 10^4 m/s^2
e) none of these

$$x_f = x_i + v_i t + \frac{a}{2} t^2$$

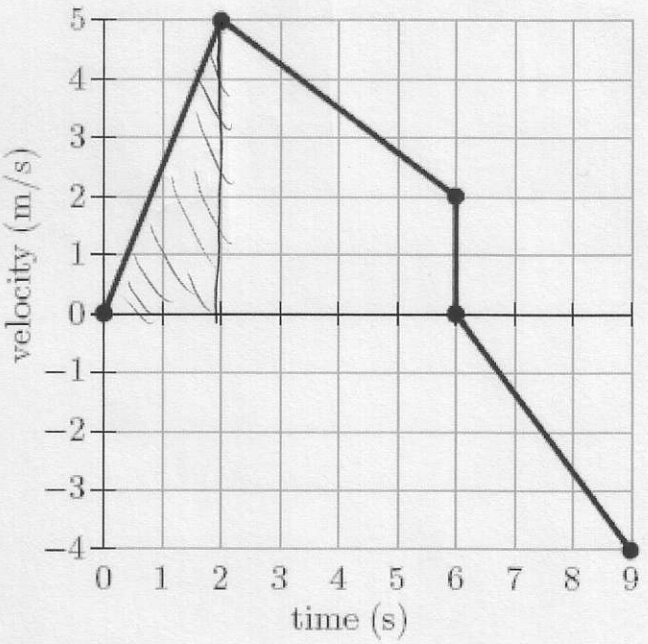
$$a = \frac{2\Delta x}{t^2} = \frac{2 \times 1m}{(5 \times 10^{-3} s)^2}$$

7.

D

A something moves according to the shown velocity profile.
[it started moving from $x_i = 0$]
What is the position at 2 seconds?

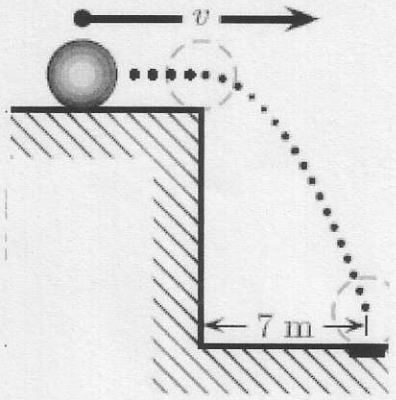
100



$\Delta x = v_{AVE} \cdot t$

1. 10 m
2. 14.1 m
3. 20 m
4. 5 m
5. none of these

8. E



A target lies flat on the ground 7 m from the side of a building, as shown below.
[The acceleration of gravity is 10 m/s^2. Air resistance is negligible.]
A student rolls a 7 kg ball off the horizontal roof of the building in the direction of the target with a [horizontal] initial speed of 3 m/s, which is just right to hit the target.
How tall is the building?

a) None of the below
b) 10 m
c) 34.2 m
d) 7.0 m
e) 27.2 m

$y_f = y_i + v_{yi} t + \frac{a}{2} t^2$ ($y_f = 0$, $v_{yi} = 0$)

$y_i = -\frac{a}{2} t^2$ / $t = \frac{\Delta x}{v_x}$

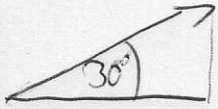
$= +\frac{g}{2}\left(\frac{\Delta x}{v_x}\right)^2$

90

9. C

A projectile is fired with a speed of 40 m/s at angle of 30° with respect to the horizontal.
What is its speed when it reaches its maximum elevation?

a) zero
b) 40 m/s
c) 35 m/s
d) 20 m/s
e) none of these



$V_x = V_0 \cos 30°$

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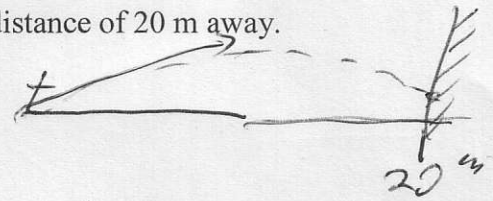
10. C

A snowball is fired from ground with an initial velocity of 20 m/s at an angle of 30° above ground.
Finally, it hits a wall which is a horizontal distance of 20 m away.

How long was the snowball in the air?



A. 2.00 s
B. 6.48 s
C. 1.15 s
D. 1.53 s
none of the above

$V_x = V_0 \cos\alpha$

$t = \frac{\Delta x}{V_x} = \frac{\Delta x}{V_0 \cos\alpha}$

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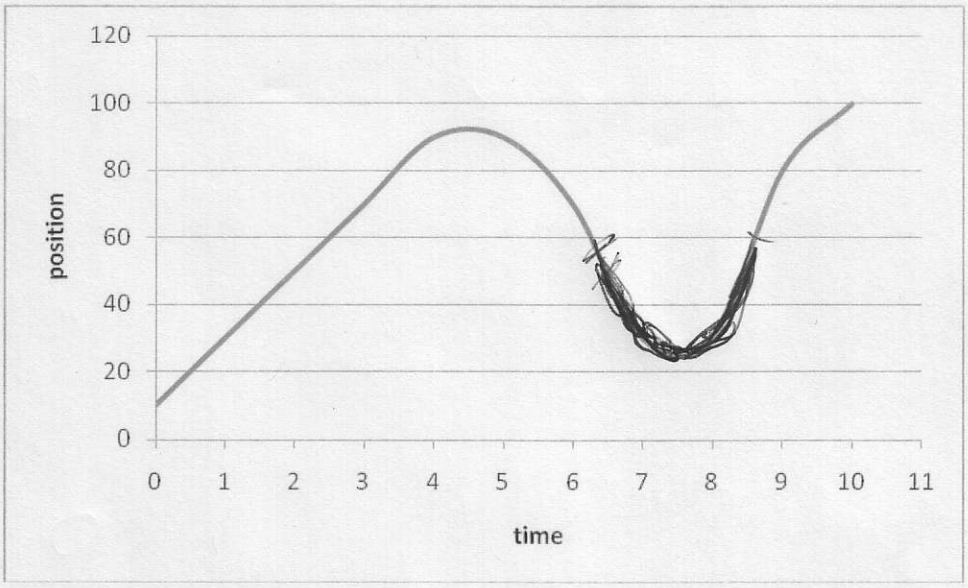
11. A	A projectile is fired from ground with an initial velocity of 20 m/s at an angle of 30° above ground. Finally, it hits a wall which is a horizontal distance of 20 m away. At which height above ground does it hit the wall? (A) 5. m B. 18 m C. 0.40 m D. 3.83 m E. none of the above $y_f = y_i + v_{y,i} t + \frac{a}{2} t^2$
12. B	A ball is thrown straight up with a speed of 10 m/s from the edge of a 50 m tall building so that it hits the ground below. What is the speed of the ball just before it hits the ground? a) 21.3 m/s (b) 32.9 m/s c) 41.3 m/s d) 10 m/s e) none of these $v_f^2 = v_i^2 + 2a(\Delta y)$

13. The position of a particle is given in the graph below as a function of time.

Over what time interval is the acceleration positive?



a) 0 – 3.5 sec
b) 3.5 – 6.5 sec
c) 6.5 – 8.5 sec
d) 9 - 10 sec
e) none of these

14. Two balls are thrown vertically upwards.
The first ball is thrown with an initial speed of 10 m/s.
The second ball reaches twice the height of the first ball.

With which initial speed was the second ball thrown?

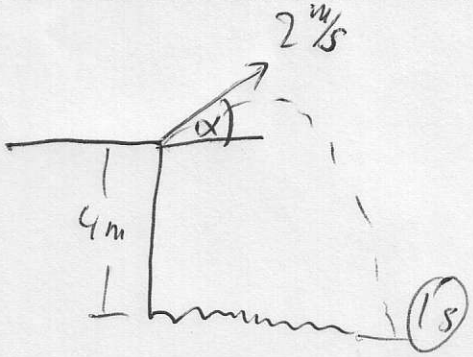
a) 10.0 m/s
b) 14.1 m/s
c) 20.0 m/s
d) 40 m/s
e) None of these

$V_f^2 = V_i^2 + 2a(\Delta y)$

$0 = V_i^2 + 2(-g)\,\Delta y$

$\times(\sqrt{2})^2$ same $\times 2$

15. D	Two balls are thrown vertically upwards. The first ball is thrown with an initial speed of 10 m/s. The second ball needs twice as long before it hits ground. With which initial speed was the second ball thrown? a) 5 m/s b) 10 m/s c) 14.1 m/s d) 20 m/s e) None of these $v_f = v_i + at$ $\times 2 \qquad \times 2$
16. B	Two balls are thrown off a building, the first vertically upwards, the second horizontally. Both have the same initial speed. Which ball hits ground first? a) The ball that was thrown vertically b) The ball that was thrown horizontally c) Both hit ground simultaneously d) [Both stay in air forever] e) None of these
17. B	Janet jumps off a diving platform with an initial speed of 2 m/s and lands in the water 1 s later. The platform is 4 m high. The acceleration of gravity is 10 m/s^2. At which angle with respect to the horizontal did she jump of the platform? a) Just horizontal b) 30 deg above the horizontal c) 45 deg above the horizontal d) 45 deg below the horizontal e) None of these

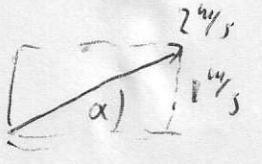


Find a component of $\vec{v}_i$

$y_f = y_i + v_{yi} t + \frac{a}{2} t^2$

0

$v_{yi} = \frac{-y_i + \frac{g}{2} t^2}{t} = 1 \text{ m/s}$

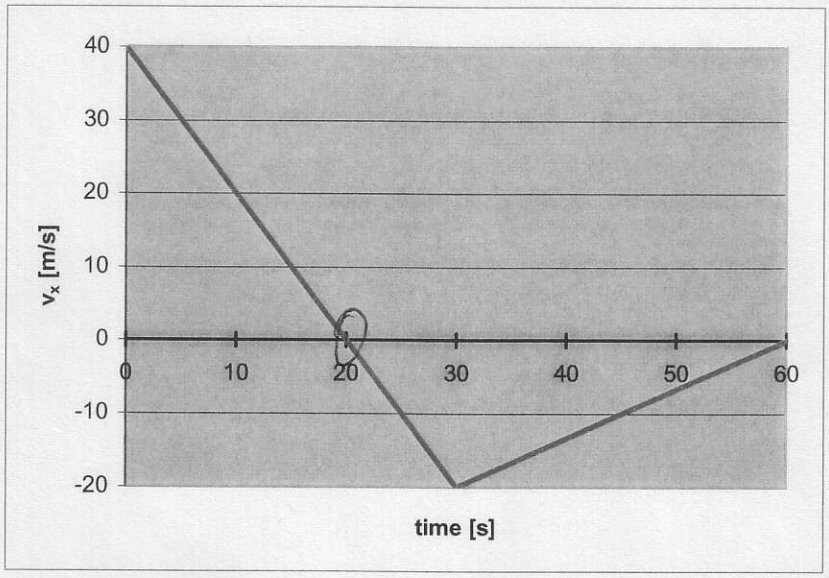


$\sin x = \frac{1 \text{ m/s}}{2 \text{ m/s}}$

18. V_x is the velocity of a particle moving along the *x-axis* as shown.

What is the acceleration of the particle at $t = 20$ s?

B

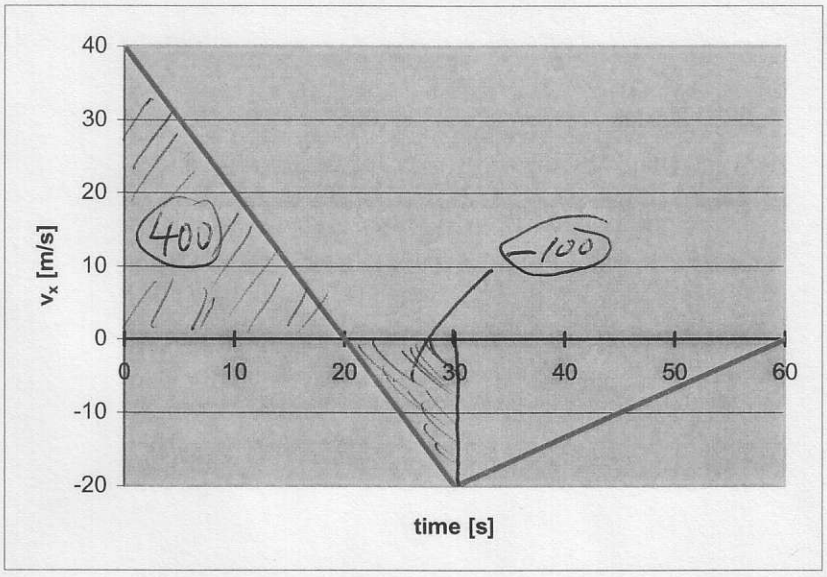


a. $+2.0\ m/s^2$
b. $-2.0\ m/s^2$
c. $+1.0\ m/s^2$
d. $-1.0\ m/s^2$
e. $0\ m/s^2$

19. B

V_x is the velocity of a particle moving along the x axis as shown.

If $x = 0$ m at $t = 0$ s, what is the position of the particle at $t = 30$ s?



a. 0 m
b. + 300 m
c. - 300 m
d. – 20.0 m
e. + 400 m

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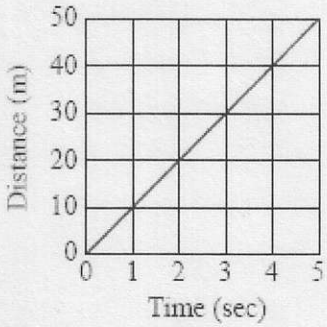
20. C

The graph indicates

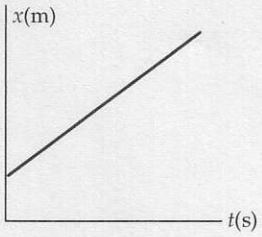


1. increasing velocity.
2. constant position.
3. constant velocity.
4. no motion.
5. decreasing velocity.

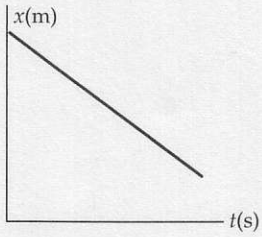
95

21. C

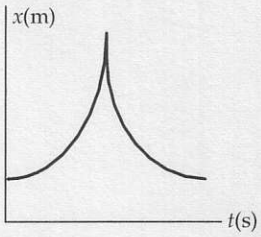
An object moves in the positive x-direction, first quickly, then gradually slower, finally speeding up again.
which graph below correctly represents position versus time for this object?



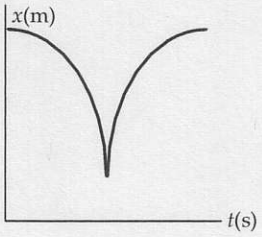
(a)



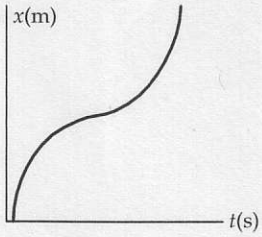
(b)



(c)



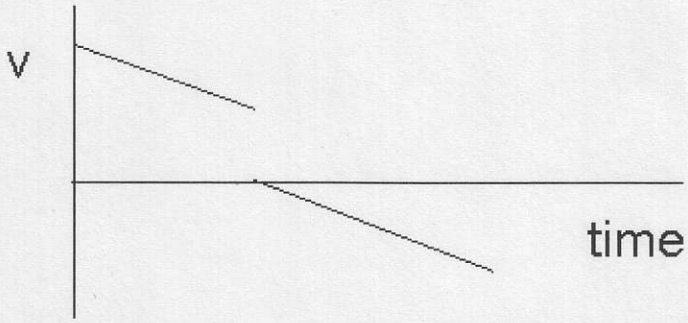
(d)



(e)

22. E

The graph below shows the velocity versus time graph for a ball. Which explanation best fits the motion of the ball as shown by the graph?



a. The ball is falling, is caught, and is thrown down with greater speed.
b. The ball is rolling, stops, and then continues rolling.
c. The ball is rising, hits the ceiling, and falls down.
d. The ball is falling, hits the floor, and bounces up.
e. The ball is rising, is caught, and then is allowed to fall.