AP Physics 1 Name: _____

Unit 1: 1D Kinematics Test Period: _____

Part 1: Multiple Choice - Choose the answers that best answers the questions below. If an exact answer is not present, chose the closest available answer. In the event of a water landing, your calculator may be used as a floatation device. (4 points each)

1. Which one of the following situations is *not* possible?
   A) A body has an instantaneous velocity of zero and non-zero acceleration.
   B) A body travels with a positive velocity and a positive acceleration.
   C) A body travels with a positive velocity and a negative acceleration.
   D) A body travels with a constant velocity and a time-varying acceleration.

2. Starting from rest, a particle is accelerated at a constant rate of 5.0 m/s^2. Which one of the following statements accurately describes the motion of this particle?
   A) The particle travels 5.0 m during each second.
   B) The particle has a constant speed of 5.0 m/s.
   C) The velocity of the particle increases by 5.0 m/s during each second.
   D) The acceleration of the particle increases by 5.0 m/s^2 during each second.

3. A fast llama walks 12 km north, then 16 km east. The journey takes him 2 hours. Determine the llama's average velocity.
   A) 14 km/h B) 28 km/h C) 20 km/h D) 10 km/h

4. An elevator is moving upward with a speed of 11 m/s. Three seconds later, the elevator is still moving upward, but its speed has been reduced to 5.0 m/s. What is the average acceleration of the elevator during the 3.0 s interval?
   A) 2.0 m/s^2 upward B) 2.0 m/s^2 downward
   C) 5.3 m/s^2 upward D) 5.3 m/s^2 downward

5. A tennis ball approaches a tennis racket at 32 m/s. The tennis ball rebounds in the opposite direction at 24 m/s. The ball is in contact with the racket for .1 s. What is the acceleration of the ball while it is in contact with the racket?

   A) 280 m/s^2 B) 80 m/s^2 C) 560 m/s^2 D) 154 m/s^2

6. A fighter jet lands on an aircraft carrier at a velocity of v. The jet requires a distance, D, to stop on the aircraft carrier. How long does it take the jet to stop after it lands?

   A) $\frac{D}{2v}$ B) $\frac{D^2}{v}$ C) $\frac{D}{v}$ D) $\frac{2D}{v}$

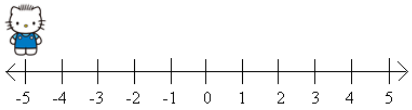
7. Johan just goes and throws his physics textbook in the air at speed v. Wow, what a rebel. He finds that the book reaches a maximum height of H. How high would the book go if he instead were able to throw the book upwards with a speed of 4v?

   A) 8H B) 4H C) H D) 16H

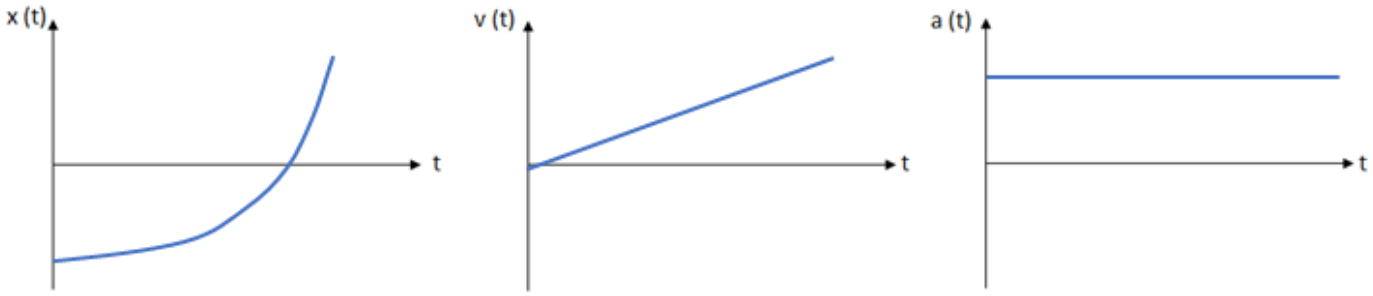
8. In order to train to fight Vegeta, Goku trains on King Kai's planet, a planet with ten times Earth's gravity; meaning the planet has an acceleration due to gravity of $10g$. Goku drops a dragon ball King Kai's planet (which has 10 times gravity) and the dragon ball falls a height H in one second. How long would the same dragon ball fall in 1 second on Earth?

A) H B) 10H C) H/100 D) H/10

9. A cat starts at position x = -5 as shown. The cat is initially at rest. He runs with *constant speed* to x = 5. Which of the following sets of kinematic graphs best describe his position, velocity, and acceleration as functions of time?



A)



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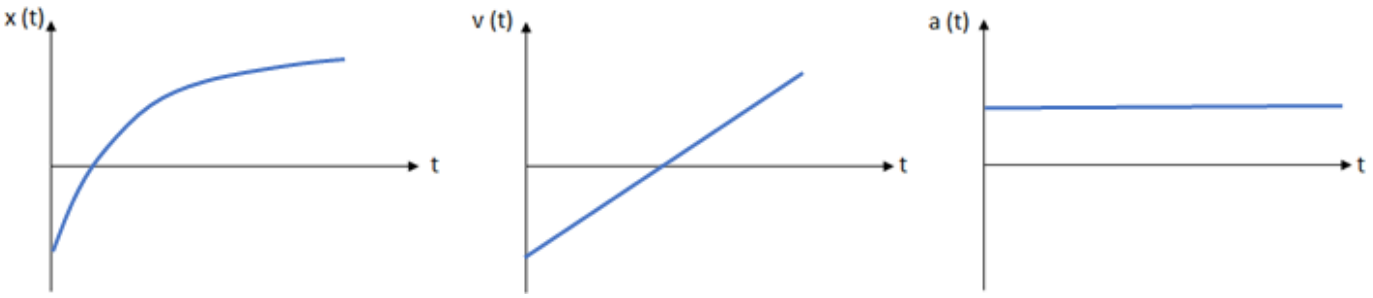
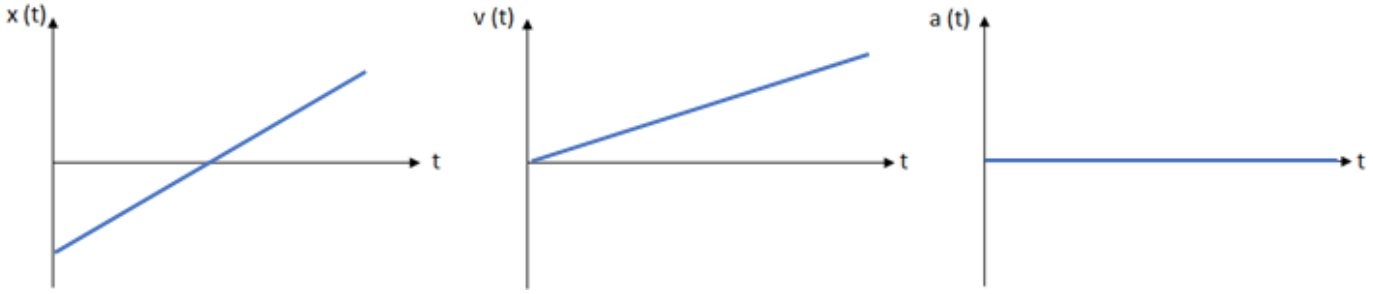
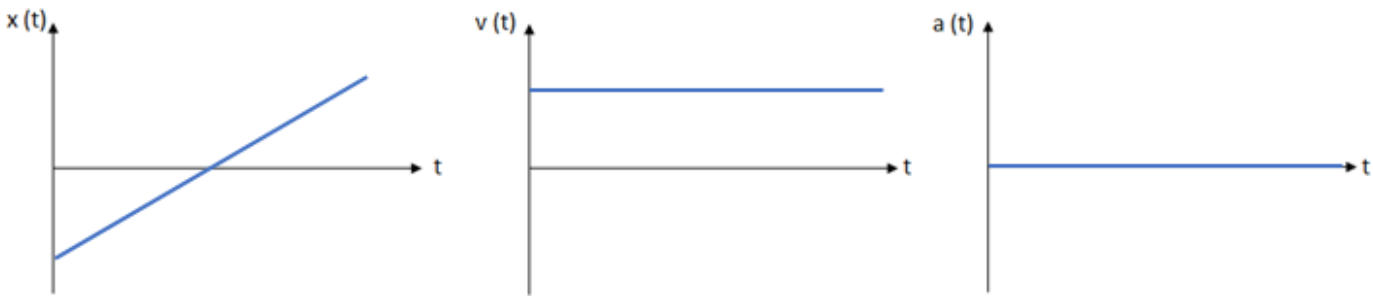


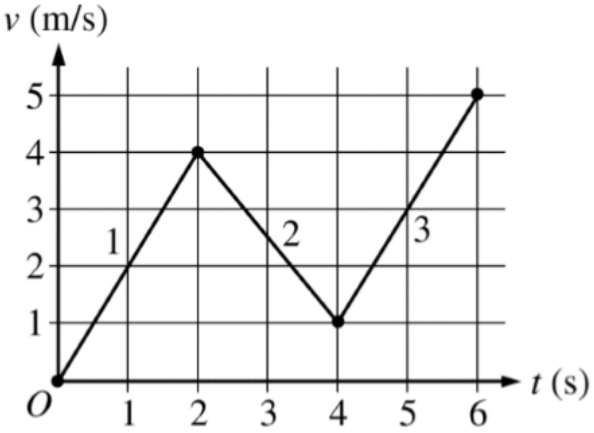
C)



D)



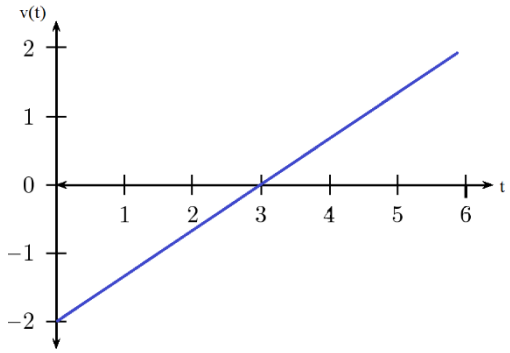
10. The graph below shows the velocity v as function of time t for a 1.0 kg object traveling in a straight line. Which of the following correctly ranks the displacement, Δx, for the three labeled segments of the object's motion?

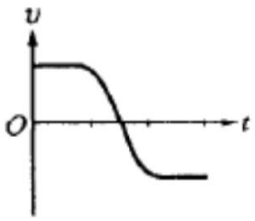


A) $\Delta x_3 > \Delta x_2 > \Delta x_1 > 0$
B) $(\Delta x_1 = \Delta x_3) > \Delta x_2 > 0$
C) $\Delta x_1 = \Delta x_2 = \Delta x_3 > 0$
D) $(\Delta x_1 = \Delta x_3) > 0 > \Delta x_2$

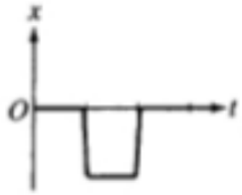
11. The graph provided is a velocity vs. time graph for thing that can move and is indeed moving. Which of the following is true about the speed of the object during the time interval from 0 to 8 s.

A) It increases during the entire interval.
B) It remains the same.
C) It first increases and then decreases.
D) It first decreases and then increases.

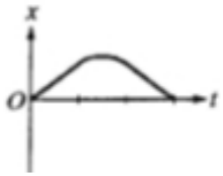




12. The graph above shows velocity vs. time an object moving. Which of the following is a possible position vs. time graph for this object?

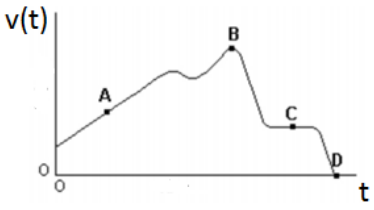
A) 

B) 

C) 

D) 

13. Given the graph of the velocity vs. time of a penguin flying due south for the winter. At what point did the penguin stop its forward motion?

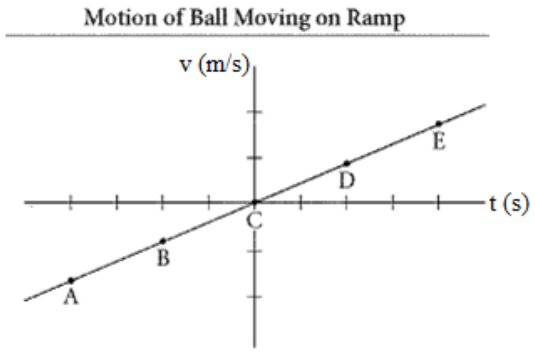


A) A B) B C) C D) D

14. In which of the following cases would an airplane have an eastward acceleration?

A) The airplane travels eastward at constant speed.
B) The airplane travels westward and slows down.
C) The airplane travels westward and speeds up.
D) The airplane travels eastward and slows down.

15. Refer to the graph below which plots velocity vs. time for a ball on a ramp. At which point is that speed of the ball equal to its speed at A?



A) B B) D C) E D) all of these

Part 2: Free Response. **You must show all steps** required to arrive at the correct answer for the problem below, including any diagrams.

16. Ball A is thrown directly upwards out a window. Ball B is dropped out the same window.

a) Sketch a graph of the velocity vs. time for i. ball A and ii. Ball B

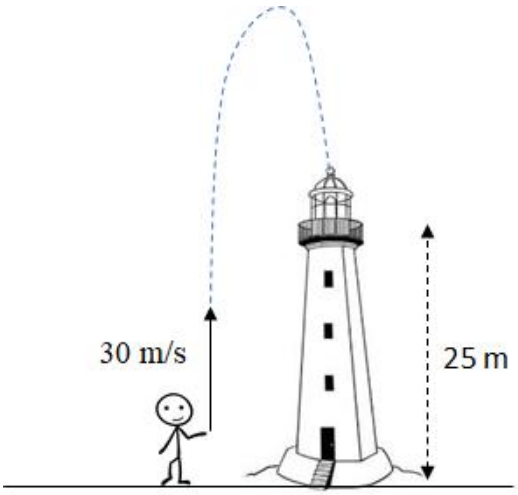
i.

ii.

b) A student claims "Both balls have the same acceleration so they both hit the ground going at the same speed". What, if anything, is wrong with the student's statement? Explain why the student is correct or incorrect. Justify your answer in a single sentence.

17. Rather than studying for physics, Brian decides to throw a stapler upwards at an initial speed of 30 m/s.

a) Find the time(s) when the stapler is 30 feet above Brian.



b) As the stapler is traveling downwards, it hits the roof of the Jupiter lighthouse, which is 25 m above the ground. Find the speed with which the stapler hits the roof.

c) i. At what part of its path does the stapler have its minimum velocity? No justification needed.

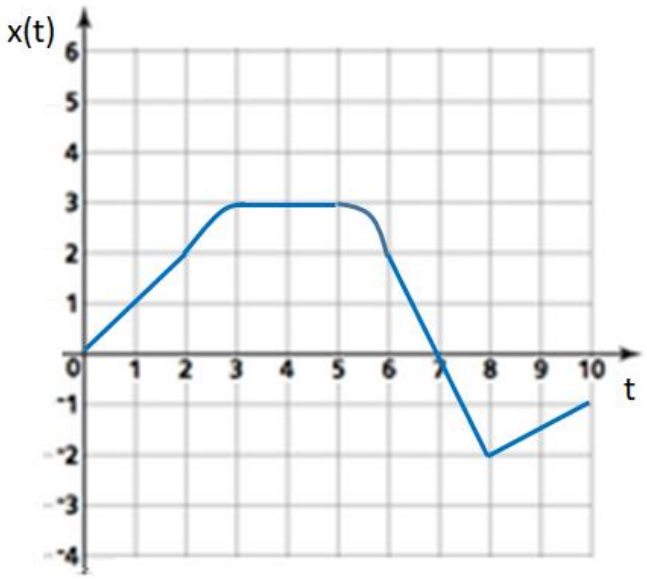
ii. At what part of its path does the stapler have its minimum speed? No justification needed.

d) Suppose that Brian had instead thrown the stapler up at 60 m/s, double the speed from before.

i. How would the time in which the stapler is in the air compare (increase/decrease/remain the same)? Briefly justify your answer.

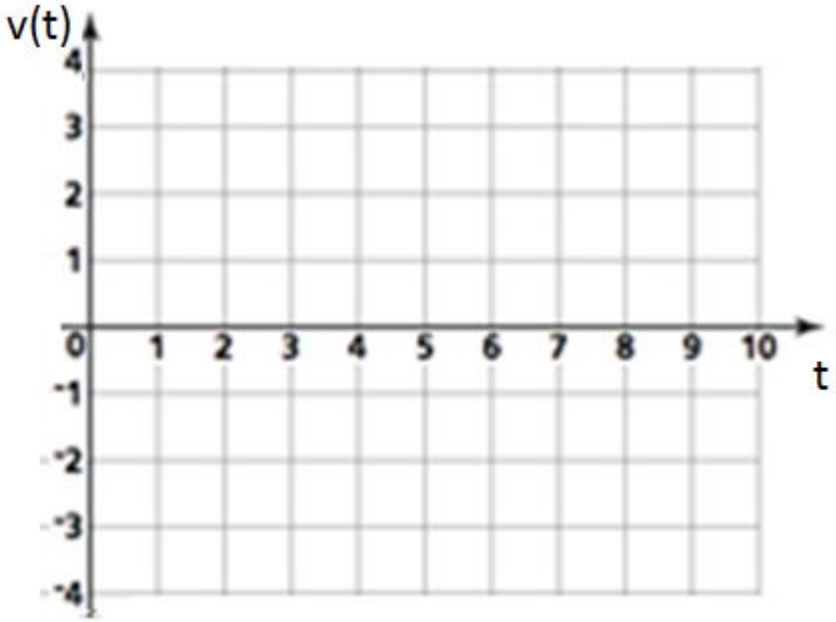
ii. How would the displacement of the stapler compare (increase/decrease/remain the same)? Briefly justify your answer.

18. The displacement vs. time for a Panda is given in the graph on the right.



a) What is the average *speed* of the Panda in the 10 seconds? (hint: distance/time)

b) Fill in the velocity vs. time graph below.



c) i. Determine an interval when Panda is at rest.

ii. During which interval is the speed of the Panda a maximum?

iii. Determine an interval when Panda has non-zero acceleration.

Bonus (3 points), DO THIS LAST: A baseball is dropped off a building 150 m high. How fast downward should a second baseball be thrown downward 3.0 s later so that both baseballs hit the ground at the same time?