Motion Test Review (Projectiles, Freefall & Horizontal) **Name:** Key

1. A racecar comes to a stop with a constant acceleration of –11.0 m/s^2. If the car was going +55 m/s, how many meters will the car travel as it comes to a complete stop?

	Δx
v_i	+55 m/s
v_f	0 m/s
a	-11.0 m/s^2
t	

$v_f^2 = v_i^2 + 2a\Delta x$

$0^2 = 55^2 + 2(-11)\Delta x$

$\Delta x = 137.5\text{ m}$

Δx = 140m

2. A ball is thrown vertically with a velocity of +25.0 m/s.

	up	down
Δx		
v_i	+25	0
v_f	0	
a	-9.8	-9.8
t		

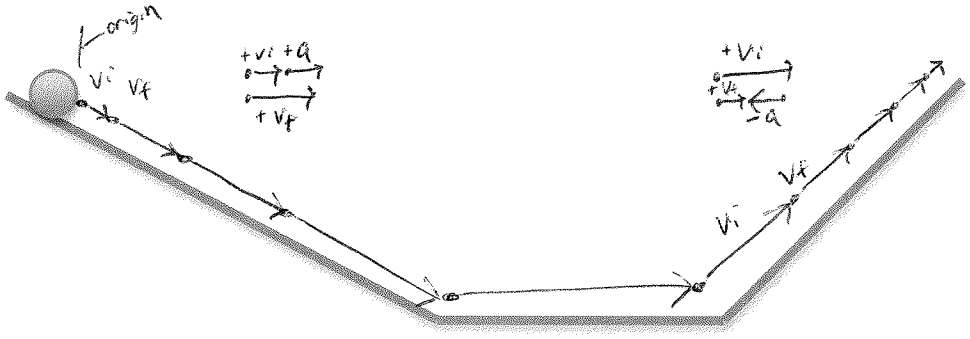
a. How high does it rise? $v_f^2 = v_i^2 + 2a\Delta x$ $0^2 = 25^2 + 2(-9.8)\Delta x$ $\Delta x = 31.9\text{m}$

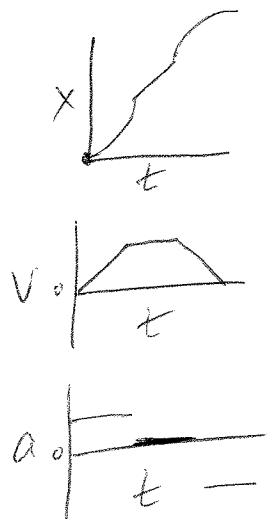
b. How much time does it take to reach its highest point? $v_f = v_i + at$ $0 = 25 + -9.8t$ $t = 2.55\text{s}$

c. ~~How~~ long does it take to reach original height AFTER it reaches its highest point? t=2.55s $t_{up} = t_{down}$ because it will travel same distance up and down and is only affected by gravity

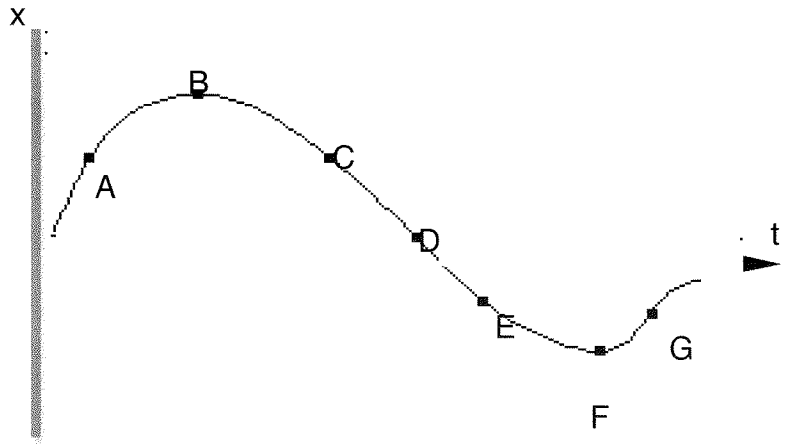
d. What is the velocity ~~of the~~ ball when it returns to the level from which it was thrown? V = -25m/s Same as initial velocity, except negative (moving down) because the ball moves the same distance while affected by gravity

3. The ball in the diagram below starts at origin from rest and rolls through the frictionless course as shown below, coming to rest at the far right on the diagram.
   a. Draw a motion map on the diagram for movement of the ball from beginning to end of motion.
   b. An acceleration vector diagram for any part of the motion the object accelerates.
   c. The three motion graphs.





4. The graph below represents the motion of an object.



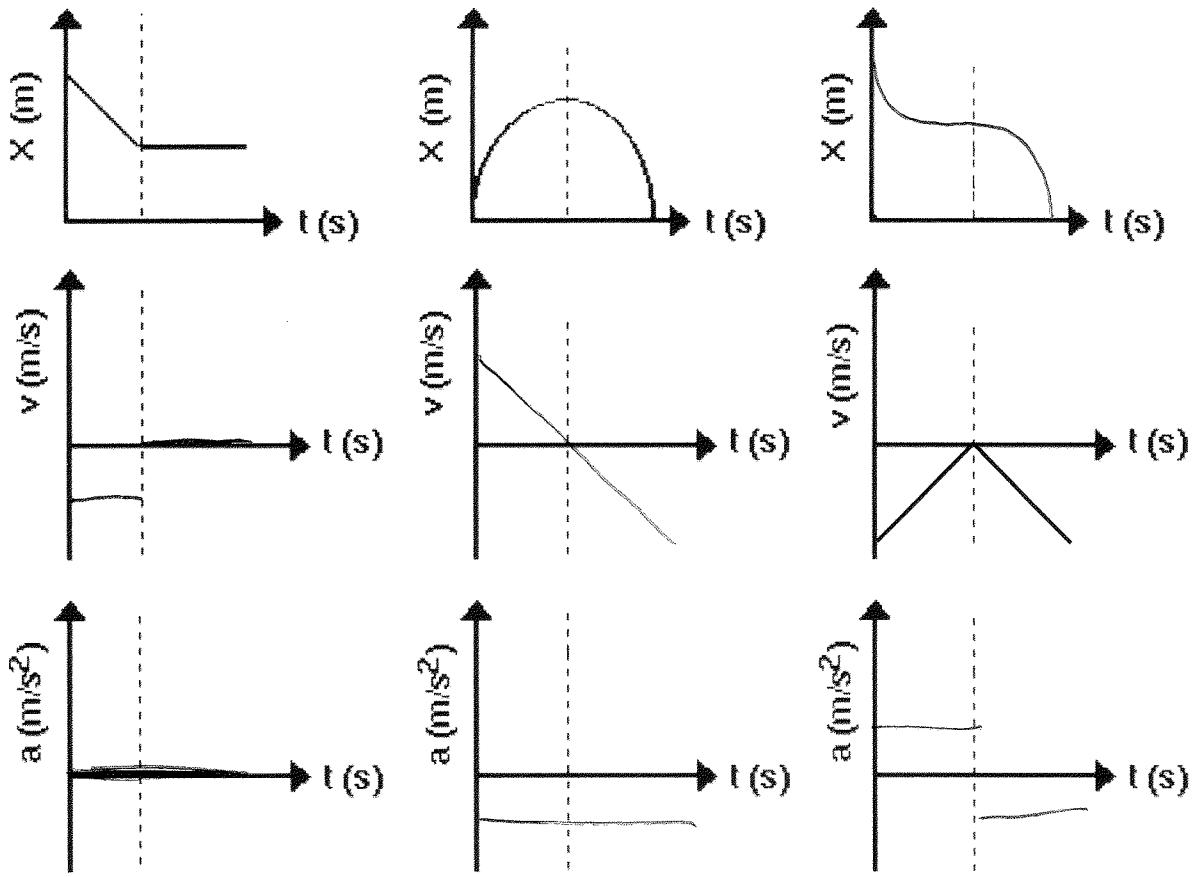
a. At what point(s) on the graph above is the velocity of the object zero? Explain.
B, F slope is zero.

b. Over what intervals on the graph above is the object's velocity increasing? Explain.
From E to G the graph has a negative slope (velocity) at E and it changes to zero slope at F and positive at G

c. Over what intervals on the graph above is the object's velocity decreasing? Explain.
From A to C Positive to zero to negative slope

d. At what point(s) on the graph above is the object changing direction? Explain.
At B and F was moving away from the origin and then towards origin for B, opposite for F

5. For each of the graphs shown below, draw the corresponding motion graphs. Then, write a brief statement the accurately summarizes the motion of the object



True/False: Determine if each is True or False and give a brief explanation of why?

T 6. The horizontal velocity of a projectile is constant No horizontal acceleration

F 7. The vertical acceleration of a projectile is 0 m/s² vertical acceleration due to gravity, $-9.8 m/s^2$

F 8. When 2 bullets are simultaneously fired horizontally and dropped from the same height, the fired bullet remains in the air for more time Both affected by gravity vertically in the same way

T 9. The magnitude of vertical displacement of a projectile launched horizontally is equivalent to its height Yes, but vertical displacement would be negative

T 10. The curved path of a projectile is parabolic vertical acceleration but no horizontal acceleration

F 11. Gravity affects both the vertical and horizontal motion of a projectile Only vertical

T 12. Projectiles move vertically and horizontally simultaneously shown in parabolic path

T 13. When air resistance is ignored, the mass of a projectile does not impact its motion Similar to objects in free fall (vacuum tube)

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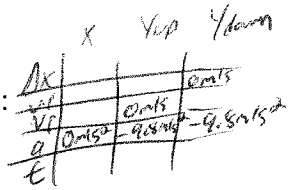
14. Draw and complete a kinematic chart (2 columns) for a projectile launched horizontally:

x	y
Δx	Δy
v_x	v_y
0 m/s	0 m/s
a	a
0 m/s²	$-9.8 m/s^2$

15. Draw and complete a kinematic chart (3 columns) for a projectile launched at an angle:



16. A student rides in a wagon that is moving forward at a constant velocity. The student throws a tennis ball straight up into the air. Where does the tennis ball land?
    a. In front of the wagon
    (b.) In the wagon
    c. Behind the wagon
    d. Cannot be determined

Explain your reasoning:
Both the wagon and tennis ball are moving with the same initial horizontal velocity and they continue to move forward at a constant rate So they will have moved forward the same distance

17. Two golf balls of identical mass are rolled off of the edge of a 1.5 m tall table. One of the golf balls lands 0.5 m from the edge of the table while the other lands 1.0 m from the edge of the table. How could this have occurred? The one that lands 1.0m from the table was moving at a higher horizontal speed (twice as fast)

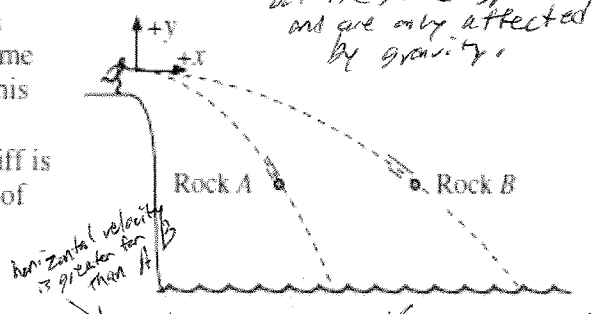
18. A bowling ball and a tennis ball are both rolled off the edge of a table and land on the floor. If both objects roll of the edge of the table at 4.5 m/s. Compare the values for each of the following variables and explain your reasoning:

	Bowling Ball	Tennis Ball
a. Horizontal displacement:	Based on time in air	
b. Vertical displacement:	-Height of table	-Height of table
c. Vertical acceleration:	$-9.8 m/s^2$	$-9.8 m/s^2$
d. Horizontal acceleration:	$0 m/s^2$	$0 m/s^2$
e. Time of fall:	Based on height of table	
f. Final vertical velocity:	Based on height of table	
g. Final horizontal velocity:	4.5m/s	4.5m/s

The Bowling ball and tennis ball would both have identical values for all aspects because the mass is irrelevant. They both rolled off the same table at the same speed and are only affected by gravity.

19. Observe the diagram below and answer:

Two students throw two rocks horizontally from a cliff with different velocities. Both rocks hit the water below at the same time but Rock *B* hits farther from the base of the cliff. For this exercise, you should ignore air resistance. Use coordinates where up is the positive vertical direction, away from the cliff is the positive horizontal direction, and the origin is at the top of the cliff at the point of release.



Sketch below velocity vs. time graphs for each rock.