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

1. A race car comes to a stop with a constant acceleration of –11.0 m/s². If the car was going +55 m/s, how many meters will the car travel as it comes to a complete stop?

#1

Δx	?
v_i	+55 m/s
v_f	0 m/s
a	-11.0 m/s²
Δt	?

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

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

$-3025 = -22\Delta x$

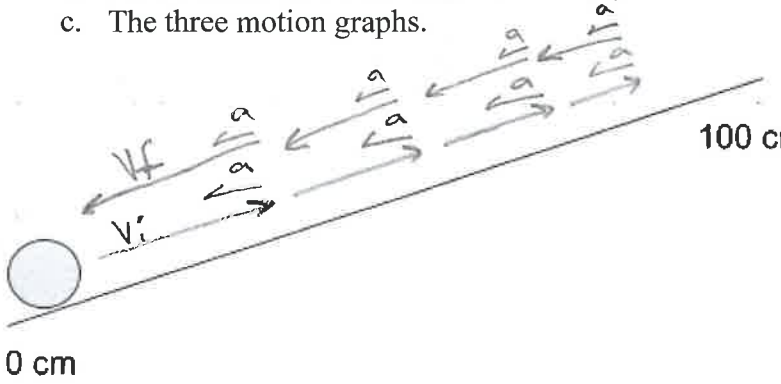
$\Delta x = 140\,m$

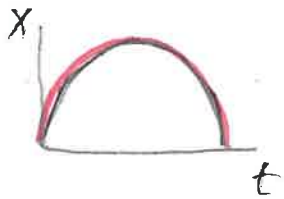
#2

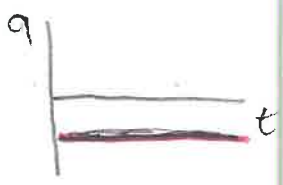
Δx	?
v_i	+25 m/s
v_f	0 m/s
a	-9.8 m/s²
Δt	?

2. A ball is thrown vertically with a velocity of +25.0 m/s.
   a. How high does it rise? $v_f^2 = v_i^2 + 2a\Delta x$
   $0^2 = 25^2 + 2(-9.8)\Delta x$ $\Delta x = 31.9\,m$
   b. How much time does it take to reach its highest point?
   $v_f = v_i + a\Delta t$ $0 = 25 + (-9.8)\Delta t \rightarrow \frac{-25}{-9.8} = \Delta t = 2.55\,s$
   c. How long does it take to reach original height AFTER it reaches its highest point?
   2.55 s, $t_{up} = t_{down}$ because it will travel the same distance up & down
   d. What is the velocity of the ball when it returns to the level from which it was thrown?
   $-25\ m/s$ Same as initial velocity just negative. Affected by gravity the same.

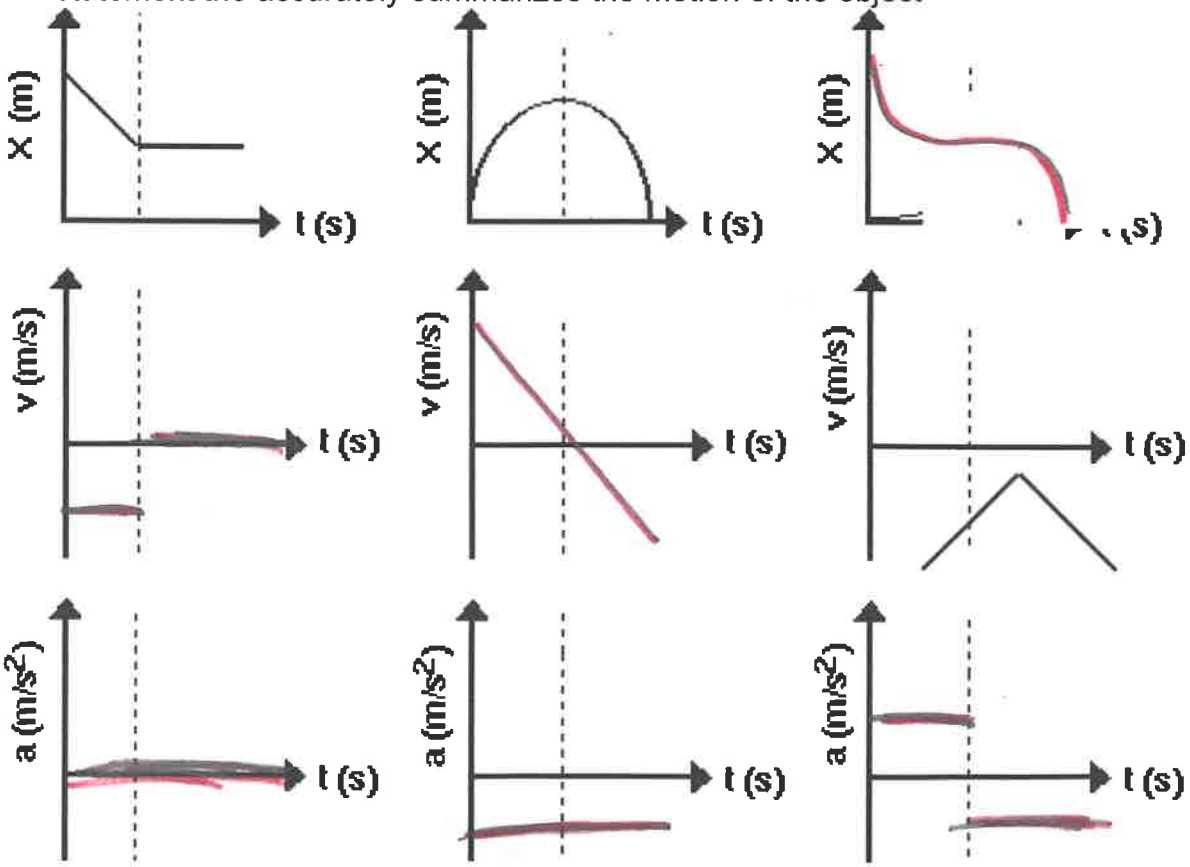
3. The ball in the diagram below starts at origin from rest and rolls up the ramp as shown below. The ball is allowed to travel up and back down the ramp.
   a. Draw a motion map on the diagram for movement of the ball from beginning to end of motion.
   b. An acceleration vector diagram for any part of the motion the object accelerates.
   c. The three motion graphs.



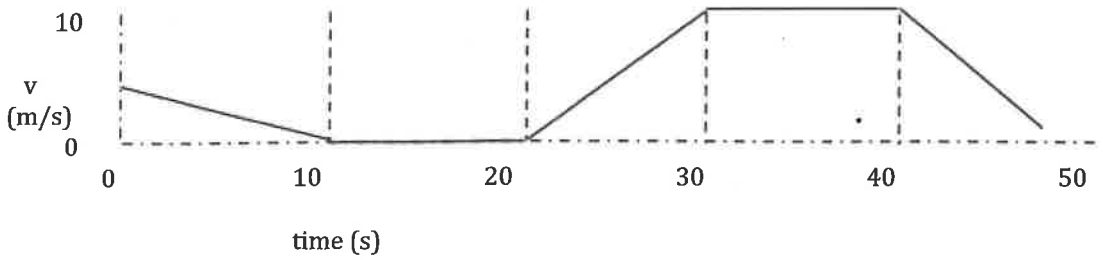




4. For each of the graphs shown below, draw the corresponding motion graphs. Then, write a brief statement the accurately summarizes the motion of the object



Use the velocity-time graph of a moving van to answer questions 6 through 9:



B 6. At which time is the displacement constant?

a. 0-10 s
b. 10-20 s
c. 20-30 s
d. 30-40 s

0 m/s → at rest, no motion

E 7. At t = 8 s, which letter best describes velocity and acceleration of the van?

	Velocity	Acceleration
e.	Positive	Negative
f.	Positive	Positive
g.	Negative	Positive
h.	Negative	Negative

-slope = -acceleration

C 8. At which time does the van have a positive acceleration?

a. 5 s
b. 13 s
c. 23 s
d. 46 s

From 20s–30s, positive slope on a V vs. t graph indicates +a

A 9. At which time does the van have a negative acceleration?

a. 3 s
b. 12 s
c. 27 s
d. 36 s

-slope = -acceleration

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

T 10. The horizontal velocity of a projectile is constant No horizontal acceleration

F 11. The vertical acceleration of a projectile is 0 m/s^2 Vertical acceleration due to gravity, -9.8 m/s^2

F 12. 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 13. The magnitude of vertical displacement of a projectile launched horizontally is equivalent to its height

T 14. The curved path of a projectile is parabolic Vertical acceleration, -9.8 m/s^2, but no horizontal a.

F 15. Gravity affects both the vertical and horizontal motion of a projectile

X

only vertical

T 16. Projectiles move vertically and horizontally simultaneously Shown by Parabolic Motion

T 17. When air resistance is ignored, the mass of a projectile does not impact its motion Similar objects in freefall (Vacuum)

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

18.	X	Y
ΔX		
V_i		0 m/s
V_f		
$\vec{a}$	0 m/s²	-9.8 m/s²
Δt		

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

19.	X	Y up	Y down
ΔX			
V_i			0 m/s
V_f		0 m/s	
$\vec{a}$	0 m/s²	-9.8 m/s²	-9.8 m/s²
Δt			

B 20. 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: No horizontal acceleration, the ball is Moving in the horizontal direction Constantly

21. 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? Both balls experience the same acceleration $-9.81 \frac{m}{s^2}$ (Gravity)

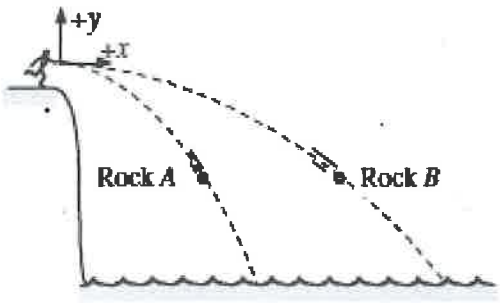
22. A bowling ball and a tennis ball are both rolled off the edge of a table and land on the floor. If both objects roll of the edge of the table at 4.5 m/s. Compare the values for each of the following variables and explain your reasoning:

	Bowling Ball	Tennis Ball
a. Horizontal displacement:	Based on time in air	
b. Vertical displacement:	-height of table	-height of table
c. Vertical acceleration:	$-9.81 \frac{m}{s^2}$	$-9.81 \frac{m}{s^2}$
d. Horizontal acceleration:	None, $0 \frac{m}{s^2}$	None, $0 \frac{m}{s^2}$
e. Time of fall:	Based on the height of table	
f. Final vertical velocity:	Based on the height of table	
g. Final horizontal velocity:	$4.5 \frac{m}{s}$	$4.5 \frac{m}{s}$

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

23. 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.

Rock A

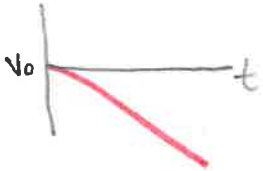
horizontal

Rock B

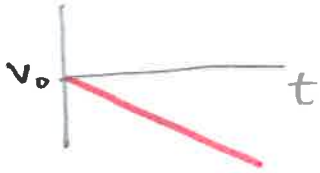
horizontal

horizontal velocity is greater for B than A

vertical



Vertical



Identical vertical velocity Graphs