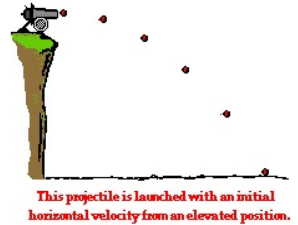**Physics 3204**
Projectile Motion

Worksheet 2: Launched Horizontally

PART A: MULTIPLE CHOICE

1.   Which illustrates projectile motion?

        (A)   Driving a car around a banked curve
        (B)   Dropping a rock from a building
        (C)   Juggling
        (D)   Running

2.   A rock is thrown horizontally from the top of a hill. If air friction were negligible, which best represents the horizontal and vertical accelerations?

	Horizontal Acceleration (m/s^2)	Vertical Acceleration (m/s^2)
(A)	0	-9.8
(B)	0	0
(C)	9.8	-9.8
(D)	9.8	0

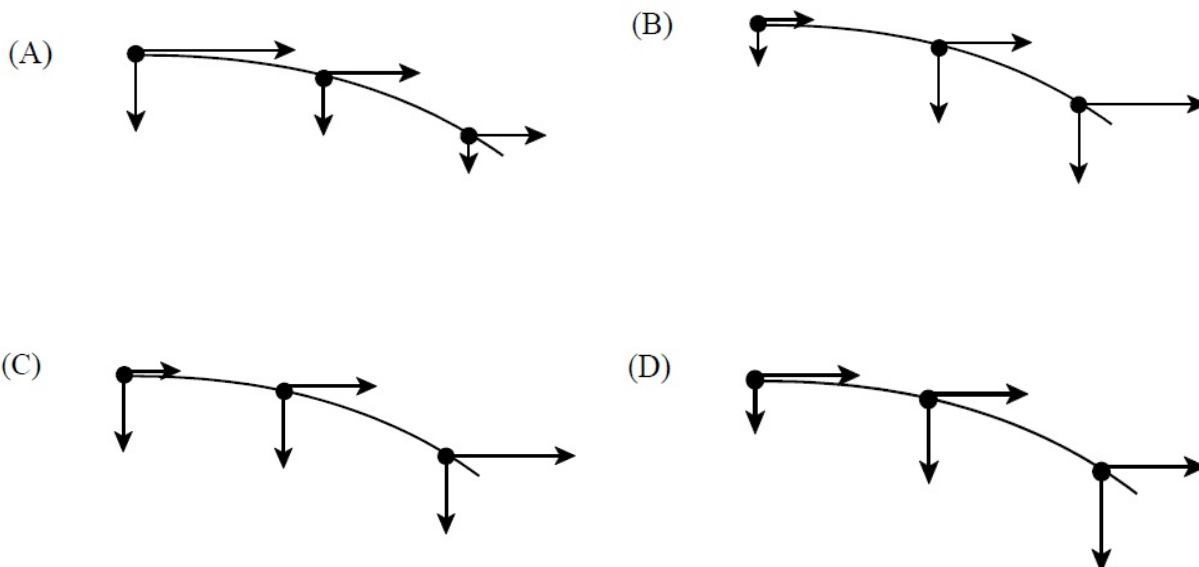3.   What is the range of a ball thrown horizontally at 12 m/s if its time of flight is 3.0 s?

        (A)   0.25 m
        (B)   4.0 m
        (C)   12 m
        (D)   36 m

4.   Which represents the vertical component of the velocity at points X, Y and Z for the object following the parabolic path shown below?
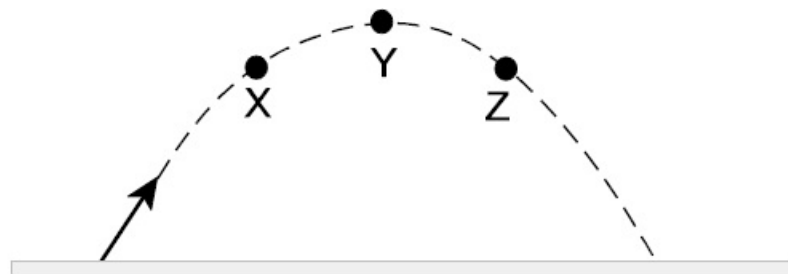
	x	y	z
(A)	downward	downward	downward
(B)	downward	zero	0
(C)	upward	upward	upward
(D)	upward	zero	downward

5. An arrow is shot horizontally with a velocity of 12 m/s. If the range is 24 m, how long is the arrow in the air?

(A) 0.50 s
(B) 2.0 s
(C) 12 s
(D) 24 s

6. A person runs horizontally off the end of a cliff and lands in the water 1.3 s later. How high is the cliff?

(A) 1.6 m
(B) 6.4 m
(C) 8.3 m
(D) 13 m

7. A marble is launched horizontally from a table at 12 m/s and lands on the floor 0.25 s later. What is the range of the marble?

(A) 0.021 m
(B) 0.31 m
(C) 3.0 m
(D) 48 m

8. A marble is launched horizontally from the top of a building. How far has the marble fallen when the vertical component of its velocity is 16 m/s [down]?

(A) 0.82 m
(B) 1.6 m
(C) 13 m
(D) 26 m

9. A stone is thrown horizontally from the edge of a cliff and lands in the water below. If the stone is in the air for 2.8 s, how high is the cliff?

(A) 14 m
(B) 27 m
(C) 38 m
(D) 77 m

10. A swimmer runs horizontally off the end of a wharf at 1.2 m/s and lands in the water 2.4 s later. How far does she have to swim to get back to the wharf?

(A) 0.50 m
(B) 2.0 m
(C) 2.9 m
(D) 5.8 m

11. What is the direction of acceleration for any projectile?

(A) Up
(B) Down
(C) Left
(D) Right

12. Which diagram best represents the vertical and horizontal velocity components shortly after a ball is kicked from a cliff?

(A)

(B)

(C)

(D)

13. A rock is thrown horizontally off the roof of a building at 18 m/s. What is the horizontal component of the velocity just before the rock hits the ground?

(A)   -18 m/s
(B)   -9.8 m/s
(C)   9.8 m/s
(D)   18 m/s

14. A ball is thrown horizontally with a speed of 10.0 m/s. If it hits the ground 4.0 s later, what is the magnitude of the y-component of its velocity just before it hits the ground?

(A)   0 m/s
(B)   39 m/s
(C)   49 m/s
(D)   98 m/s

15. If a coin is pushed horizontally from a 1.2 m high table and lands 0.68 m from the base, what was the speed at which it left the table?

(A)   1.4 m/s
(B)   1.9 m/s
(C)   2.8 m/s
(D)   5.7 m/s

16. A projectile is shot horizontally at 40.0 m/s from a cannon located on a cliff 155 m high. How many seconds is the projectile in the air?

(A)   0.258 s
(B)   5.62 s
(C)   11.0 s
(D)   31.6 s

17. If a steel ball was launched horizontally from a height of 90.0 cm and lands 1.3 m from the base, what was the initial velocity?

 (A) 0.30 m/s
 (B) 2.7 m/s
 (C) 3.0 m/s
 (D) 7.1 m/s

18. A ball is thrown horizontally at 10.0 m/s. If it hits the ground 2.00 s later, what is the magnitude of the x-component of its velocity just before it hits the ground?

 (A) 0 m/s
 (B) 10.0 m/s
 (C) 20.0 m/s
 (D) 30.0 m/s

19. An object is projected horizontally from a 0.95 m high table at a velocity of 12 m/s. How far from the base of the table will the object hit the floor?

 (A) 2.3 m
 (B) 5.3 m
 (C) 11 m
 (D) 27 m

20. A stone is thrown horizontally from the edge of a cliff and lands in the water below. If the stone is in the air for 2.8 s, how high is the cliff?

 (A) 14 m
 (B) 27 m
 (C) 38 m
 (D) 77 m

21. A swimmer runs horizontally off the end of a wharf at 1.2 m/s and lands in the water 2.4 s later. How far does she have to swim to get back to the wharf?

 (A) 0.50 m
 (B) 2.0 m
 (C) 2.9 m
 (D) 5.8 m

22. A plane flying horizontally with a speed of 50.0 m/s at a height of 161 m, drops a package when it is directly over a tent. How far from the tent will the package land?

 (A) 161 m
 (B) 169 m
 (C) 287 m
 (D) 1640 m

PART B: WRITTEN RESPONSE

1. In a laboratory activity, students launch a toy car horizontally off a table with a speed of 3.6 m/s as shown. If a 0.25 m wide target is placed 1.0 m from the base of the table, determine whether the car will hit the target. **AUGUST 2007**
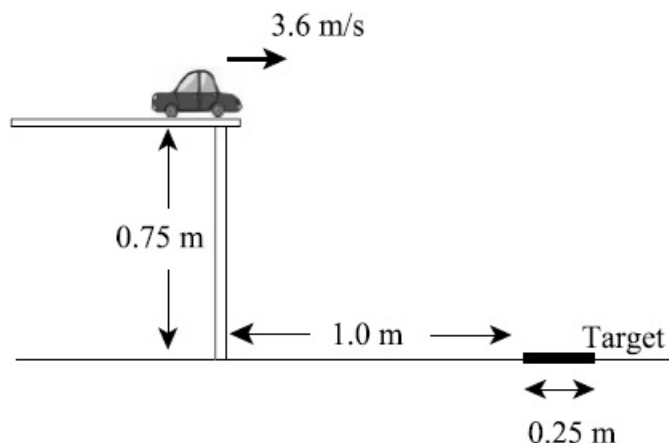
2. As a plane flies horizontally at 65.0 m/s, it releases a package from a height of 1.20×10^3 m. **JUNE 2005**

    (i)   What is the horizontal distance the package travels after it is released?
    (ii) What is the final velocity of the package?

3. If a rock is thrown horizontally from a 45.0 m high cliff with a velocity of 20.0 m/s, how far from the base of the cliff does the rock hit the ground? **JUNE 2004**

4.   An object is thrown horizontally at a velocity of 10.0 m/s from the top of a 90.0 m building. Calculate the distance from the base of the building that the object will hit the ground.

5.   An object is thrown horizontally at a velocity of 18.0 m/s from the top of a cliff. If the object hit the ground 100.0 m from the base of the cliff, how high is the cliff?

6. An object is thrown horizontally from the top of a building at a velocity of 15.0 m/s. If the object takes 5.50 s to reach the ground, how high is the building?

7.   An object is thrown horizontally from the top of a cliff at a velocity of 20.0 m/s. If the object takes 4.20 s to reach the ground, how far from the base of the cliff did the object hit the ground?

8. An object is thrown horizontally from the top of a 85.0 m building. If the object hits the ground 67.8 m from the base of the building, what was the horizontal velocity of the object?

9. A parcel is dropped from a plane flying overhead with a constant horizontal speed of 75 m/s. If the range is 1.2×10^3 m, from what height was the parcel dropped? Assume air resistance is negligible. Show workings. JUNE 2006