Name

Date Pd

**Model for Projectile Motion**

We have discovered that projectiles have a constant downward acceleration (neglecting friction) and their vertical velocity changes by -10 m/s each second.

|  |  |  |
| --- | --- | --- |
| time(s) | velocity (m/s | y-position (m) |
| 0 | 0 | 0 |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |

A stone was dropped from the top of a cliff**.** Fill in the values for the velocity for the first 5 seconds. Use the relationship Δy=1/2at2 to determine the y-position at these times.

Mark these positions on the y-axis below.

**Use a scale of 1.0 cm = 10 m for your drawing.**

Suppose that you could **“turn off”** gravity. When you throw the ball horizontally from the cliff at 30 m/s it would travel
30 m each second in a straight line. Mark these positions on the x-axis below.

The motion of the thrown ball has both horizontal and vertical components. At each second, draw a vertical line down from the horizontal position, then draw a horizontal line from the dropped ball position to determine the actual position of the stone. Sketch a smooth curve to describe the path of the projectile.

Determine the vertical distance the stone would fall m. Use your drawing to estimate the following:

Time in the air: **\_ \_** s Horizontal distance: **\_ \_** m

**You will now build a physical model that can be used to show the projectile path for any angle. Suppose that you use the scale (1.0 cm = 1.0 m). Speed of throw is 20m/s.**

**= metal washer**

**0 20 40 60 80**

**80**

**45**

**20**

**5**

**Use lengths of thin string to attach the washers to the meterstick.**

**The length of each string represents Δy.**

Place a WB on the table and lift it up so that is vertical. Now put the meterstick directly next to the WB to represent a projectile thrown at different angles. Carefully mark the positions of the centers of the washers that show the x and y values of the projectile each second. Record the values into the data tables below. Finally, draw a smooth curve on the WB to show the path of the projectile in each situation.

1. **Angle is 90 degrees from horizontal (straight up) at 20 m/s.**

|  |  |  |
| --- | --- | --- |
| **time (s)** | **x (m)** | **y (m)** |
| 0 |  |  |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |

Maximum height is \_\_\_\_\_ m

Time to reach max height is: \_\_\_\_\_\_ s

Total time in air is  **\_\_**\_**\_\_\_ s**

1. **Angle is 30 degrees above horizontal at 20 m/s.**

|  |  |  |
| --- | --- | --- |
| **time (s)** | **x (m)** | **y (m)** |
| 0 |  |  |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |

Maximum height is \_\_\_\_\_ m

 Time to reach max height is \_\_\_\_\_ s

 Total time in air is \_\_\_\_\_ s

 Horizontal (x) distance  **\_**\_\_**\_\_** m

1. **Angle is 45 degrees above the horizontal at 20 m/s.**

|  |  |  |
| --- | --- | --- |
| **time (s)** | **x (m)** | **y (m)** |
| 0 |  |  |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |

Maximum height is \_ m

Time to reach max height is \_ s

 Total time in air is \_ s

 Horizontal (x) distance\_  **m**

**4. Angle is 60 degrees above the horizontal at 20 m/s.**

|  |  |  |
| --- | --- | --- |
| **time (s)** | **x (m)** | **y (m)** |
| 0 |  |  |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |

Maximum height is **\_** m

Time to reach max height is **\_** s

 Total time in air is **\_**  s

 Horizontal (x) distance **\_**  m