Projectile Motion Lab (Throwing a Ball)

You'll need:

- Stopwatch (for timing flight)
- Measuring tape (for vertical displacement and horizontal displacement)
- A soft, bouncy ball (like a soccer ball)
- A partner to help measure and time

Part 1: The High Throw Challenge

Goal: Investigate what happens when you throw straight up.

1. Stand in an open area and **throw the ball straight upward**.
2. Have a partner time how long the ball stays in the air until it comes back down.

Record:

- Time in air (s): _____

Tasks:

a) Sketch the ball's motion and label the key points (start, top, end).
b) Calculate the **time** it takes for the ball to reach the peak.
b) Calculate the **vertical velocity** of the ball when it left your hand.
c) Calculate the **maximum height** it reached.
d) Calculate the **velocity** of the ball just before it hits the ground again.

Part 2: The Far Throw Challenge

Goal: Find out how the ball travels when you throw it for distance.

1. **Find an open space** (a field works great).
2. **Throw a ball as far as you can.** Have a partner time how long it stays in the air using a stopwatch.
3. **Measure the horizontal distance** from where you threw it to where it lands.

Record:

- Time in air (s): _____
- Distance travelled (m): _____

Tasks:

a) Sketch the path of the ball, labeling the starting point, highest point, and landing point.
b) Calculate the **horizontal velocity** of the ball.
c) Calculate the **vertical velocity** of the ball when it left your hand.
d) Calculate the **maximum height** reached by the ball.
e) Calculate the **initial velocity** (total speed when thrown).

Part 3: Raised Throw Challenge

Goal: Investigate what happens when a ball is thrown **upward at an angle** from a raised position (like a balcony, stair landing, or bleachers) and lands on flat ground below.

Find a **safe raised area** overlooking a clear landing zone.

What to Measure

- **Vertical drop (*H*)** – _____.
- **Time in air (*T*)** – _____.
- **Horizontal distance (*X*)** – _____.

Tasks:

a) Sketch the setup: show the raised platform, trajectory, and landing point.
b) Calculate the **horizontal velocity** of the ball.
c) Calculate the **vertical velocity** of the ball when it was thrown.
d) Calculate the **launch angle** of the throw.
e) Calculate the **initial speed** of the ball.
f) Calculate the **maximum height** of the ball above the release point.
g) Calculate the **velocity** of the ball when it hits the ground.

Reflection Questions

1. How does the launch angle affect how far the ball traveled?

2. Which was harder to measure accurately — distance or time? Why?

3. If you could design this experiment again, what would you change to reduce error?