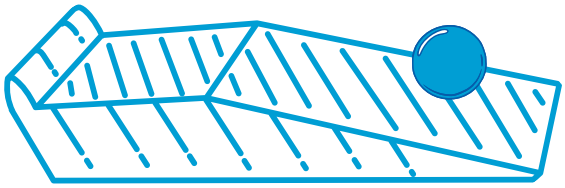
ACTIVITY 3: INVESTIGATING ACCELERATED MOTION

The purpose of this activity is to explore and understand the concept of accelerated linear motion by observing the motion of rolling balls on inclined ramps.



Materials

- Inclined ramps (can be constructed or obtained pre-made)
- Stopwatch
- Meter stick or ruler
- Steel balls (marbles or ball bearings)
- Chart paper or butcher paper
- Markers

First, inform students that they will be investigating the motion of a ball rolling down an inclined plane. Have them form groups of 3-4 and gather their materials.

Next, have students set up the ramps. They should have a low gradient, e.g., a small height to length ratio. They should be 1-2 meters in length. Run paper along one side of the ramp so that marks can be made with the marker as the ball rolls down the ramp. It's crucial that the ramp is long enough and has a low enough gradient for the ball to take at least 3-5 seconds to roll down it.

Then, give students time to perform several trials of their experiments. The procedure should have them releasing the ball at the same time they start the stop watch. Every time 1 second of time passes, the time keeper should say so, calling out something like "now" or counting each whole second as it passes, e.g., "1...2...3..." so that the student in the group who is dabbing the paper with the marker to mark where the ball is each second will know when to make their mark.

Last, have groups make a data table and graph to represent the position v. time of the ball on the ramp during each trial.

Experimental Trials

1. Have students vary the height of the ramp to increase the gradient to provide three different gradients to measure
2. Students should repeat their measurements 3 times at each gradient to ensure consistency and the proper measurement of position of the ball

Data Analysis and Debrief

1. After marking the paper for each repeated measurement of each gradient trial, students should measure the position from the starting line of their ramp (e.g., the 0 meter line) in centimeters to each dot.
2. To account for variability in their measurements, they can take the average of the measurements they got for each second of time in each trial.
3. They should make a data table that has time in seconds (s) and position in centimeters (cm) for each trial based on the average position measurements.
4. Create a graph that shows the position and time of the ball for each trial based on the averages for each measurement. Use different colors for each trial.
5. Lead a class discussion focusing on interpreting the graphs, including analyzing the slopes of the graph for each time interval (e.g., 0s-1s, 1s-2s, 2s-3s, etc.) and understanding the physical significance of these slopes (their units). Emphasize that cm/s represents the velocity of the ball, e.g., how many cm it travels for every one second, and discuss how the graph's changing shape demonstrates changing velocity, e.g., acceleration with units cm/s/s.