Physics lab report

Purpose Determine the acceleration in a quick sprint. Question What would the participant’s acceleration be if he/she sprints forward in a positive direction? Hypothesis/Prediction When a person sprints forward, it means he/she speeds up. Consequently, the acceleration should be positive. When the velocity accelerates at a constant rate, the acceleration should remain constant. Therefore, if the participant is moving toward a positive direction and the speed increases, then the acceleration should be positive and constant. Materials * Ticker Tape Machine * Ticker Tape * Tape * Ruler * Pencil * Graph paper Carbon paper Procedure * A piece of Ticker Tape and a Ticker Tape machine were taken. * Ticker Tape machine was plugged in. * One side of the Ticker Tape was attached to the back of a participant. * The other side of the Ticker Tape was inserted through the Ticker Tape machine. * A piece of carbon paper was placed on top of the Ticker Tape and was pinned on the machine. * The machine was started. * The participant sprinted forward. * The machine was stopped. * The used Ticker Tape was collected. * The machine was unplugged. * Using a ruler, a pencil and the Ticker Tape, all the data were recorded on a Data Table. Using the Data Table the position versus time graph and the velocity (instantaneous) versus time graph were plotted. Analysis There were in total of 37 dots recorded on the piece of the Ticker Tape. Every sixth dots represented the 1/60th of one second. Because of the lack of the information, as shown on the Data Table, every third dots were used to expand the amount of data for the more accurate results. Thus, every third dots were used to represent the half of 0. 1 second. Therefore, on both of the position versus time and velocity (instantaneous) versus time graphs, the x-axis value (the time value) went up by 0. 5 seconds. On the position versus time graph, a curved line was drawn due to the increase of the runner’s speed for each 0. 05 seconds. The runner started at 0 second from 0 centimeters and then stopped when the runner’s position was at 0. 65 seconds and 80. 1 centimeters. Also, the curved line on the graph continuously rose upward which meant that the runner never moved backward or slowed down. As evidenced by the velocity (instantaneous) versus time graph, the velocity was the lowest when it was 0 cm/s at 0 second and the highest when it reached positive196 cm/s at 0. 5 seconds. The difference of the velocities was the greatest between 0. 05 seconds and 0. 1 second. Also, the difference was the smallest between 0. 45 seconds and 0. 5 seconds. The two lines of best fit were used for more accuracy due to the scattered dots - which showed the calculated velocities of the specific time intervals - that were plotted on the graph. The first line was illustrated to show the readers the time interval of 0 second to 0. 275 seconds. The second line was used to show the time interval of 0. 275 seconds to 0. 65 seconds.

Compared to the second line, the first line was drawn steeper due to the larger differences of the velocities of the specific time intervals. For the answer of this report’s question as listed above, when the runner sprinted forward toward a positive direction, the acceleration was able to be calculated from the velocity (instantaneous) versus time graph. In fact, there were two different accelerations during the whole time of 0. 65 seconds. Acceleration could be calculated by measuring the slopes of the velocity (instantaneous) versus time graph which were represented by the two lines of best fit.

As shown on the graph, the first line was marked as and the second line was marked as . As seen on the Determination of the Acceleration page of this report, the following mathematical solutions were processed for the solution of the question. * Line * V2 = 134. 2 cm/s * V1 = 0 cm/s * t 2 = 0. 275 s * t 1 = 0 s * Acceleration = (134. 2 cm/s – 0 cm/s) / (0. 275 s – 0 s) = 488 cm / s2 * Line * V2 = 196 cm/s * V1 = 134. 2 cm/s * t 2 = 0. 65 s * t1 = 0. 275 s * Acceleration = (196 cm/s – 134. 2 cm/s) / (0. 65 s - 0. 275 s) = 165 cm / s2

With these two accelerations, it can be analyzed that the runner ran faster during the last 0. 375 seconds than he did during the first 0. 275 seconds. Evaluation This experiment examined the acceleration of a runner when sprinted toward a positive direction. Supported by the evidences and the results of this experiment, one of the two hypotheses stated above was proven false. The runner sped up in a positive direction in a straight line. Hypothetically, the velocity should have been accelerated at a constant rate so that the result could be a constant acceleration.

However, according to the data collected, the runner’s first acceleration was 488 cm / s 2 from 0 second to 0. 275 seconds and the second one was 165 cm / s 2 from 0. 275 seconds to 0. 65 seconds. Since there were two different accelerations for 0. 65 seconds, there could not be a constant acceleration. Thus, the prediction of the acceleration being constant was falsified. On the other hand, the other part of the hypothesis was proven true. Theoretically, the acceleration of the runner should be positive because the runner sprinted in a positive direction.

As evidenced by the two lines of best fit on the velocity (instantaneous) versus time graph, the slopes were positive due to their upward direction.

Hence, since the slopes of the velocity versus time graph represented the person's acceleration, the runner's resulting accelerations were positives. To conclude, when the original hypotheses were compared to the calculated results, the first part – " there should be constant acceleration" – was rejected, on the contrary, the second part – " there should be a positive acceleration" – was accepted.

There were several difficulties when this experiment was performed. For example, the Ticker Tape was so fragile that when the runner started to dart, the tape sometimes got ripped. Thus, it was a challenge to gather enough information to observe and analyze the results. Also, because of the rapid motion of the pin on the Ticker Tape machine, the carbon paper that was placed on top of the Ticker Tape continuously fell off from the machine. In addition, the loud noise produced from the machine created disturbingenvironment.

To improve this lab, advanced technologies such as motion sensors could be used to keep the quiet atmosphere. Lastly, hand-drawn graphs and hand-measured values aren't always correct. Consequently, they can lead the observers to the wrong conclusions. Therefore, using advanced graphing programs such as Graph 4. 4 could be used for more valid results. To summarize, to avoid miscalculations, advanced technologies and softwares must be used for more precise and accurate products.