REPORT

Goal of the project: Analysis of impact of an inclined plane's angle of inclination on moving object's acceleration.

Plan:

1. Setting a date for the experiment
2. Planning stages of the experiment
3. Carrying out the experiment and noting the results
4. Describing the results in the presentation and doing calculations
5. Presenting data on charts
6. Translating the presentation to English
7. Writing a report
8. Adding finishing touches
9. Sending the presentation to the teacher for verification
10. Doing corrections
11. Handing in the final product and the report

Experiment:

- an air track set wit a pump
- a glider
- a sponge

1. Preparing the equipment, attaching the pump to the air track and connecting photogates to the timer
2. Inclining the air track and measuring angle
3. Turning on the timer and placing the glider on the track
4. Letting go of the glider and stopping it with a sponge after it goes past both photogates
5. Reading and writing down the time
6. Repeating with various angles

Measurement equipment:

Angle – a mobile phone application
Distance – scale on the air track
Time – a photogate timer system

Transforming formulas

$s = v_0 t + \frac{1}{2} at^2$
when $v_0 = 0$, then $s = \frac{1}{2} at^2$
$2s = at^2$
$a = 2s/t^2$

Error

I made a significant mistake during the experiment. I hadn't realized how important it was until I made the calculations and noticed that in some cases the acceleration is larger than gravitational acceleration, which is physically impossible.
The problem was that I I left space between the first photogate and the glider when I let it go, while I should have put the glider just by the photogate. The result of this mistake was that the glider elaborated speed before it crossed the sensor. What is more, the distance between the

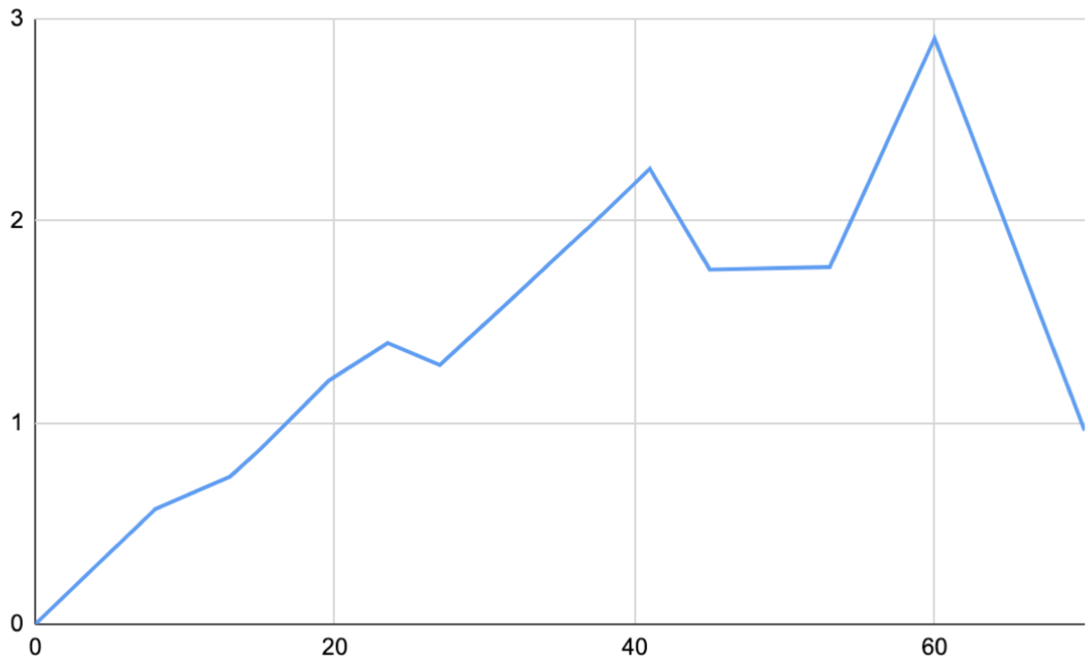
glider and the first photogate varied during every measurement.
Trying to fix this, I needed to calculate v_0, so I transformed the formula for potential energy.

$mgh = mv_0^2/2$ $_0gh = v_0^2/2$
$2gh = v_0^2$
$v_0 = \sqrt{(2gh)}$
$h = \sin\alpha * s_0$
$v_0 = \sqrt{(2g * \sin\alpha * s_0)}$

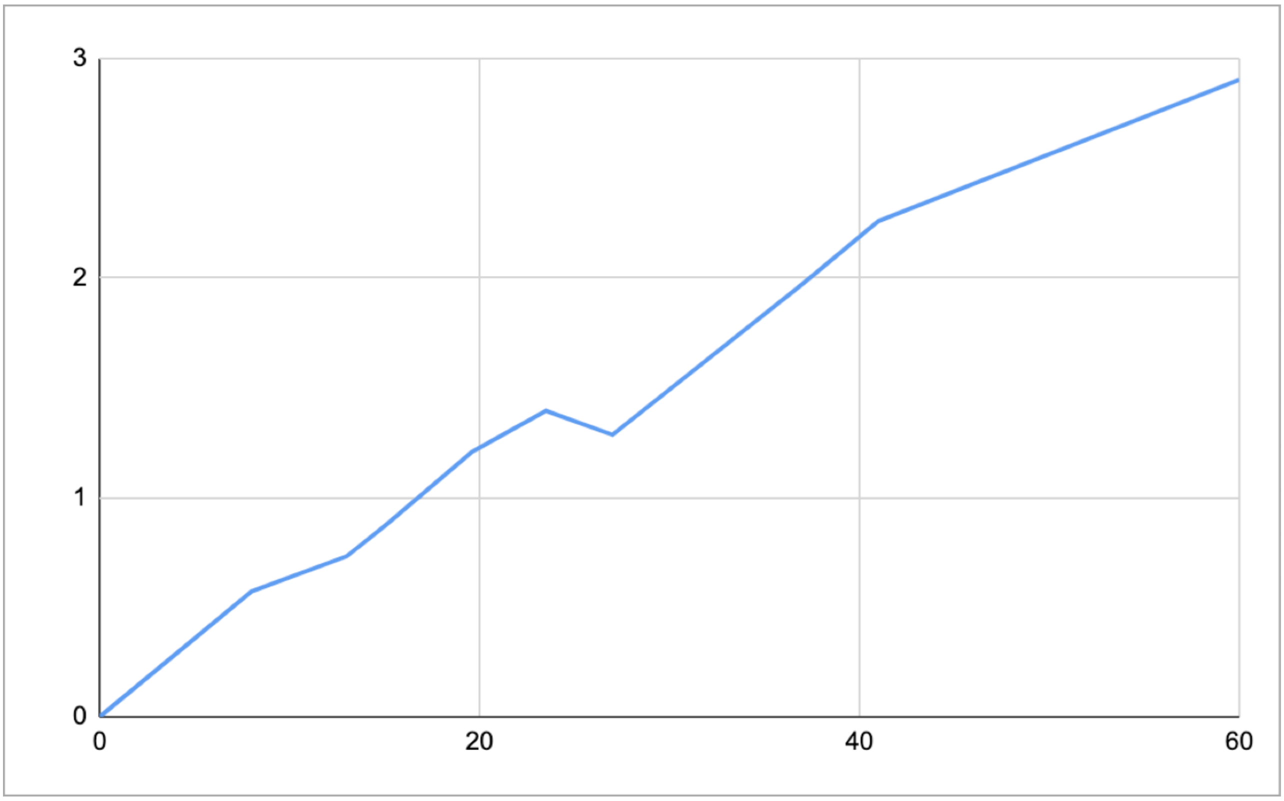
This mistake also means I cannot assume that $v_0 = 0$, so the formula $a = 2s/t^2$ is irrelevant. To calculate acceleration, I needed to modify this formula having regard to v_0. In that case:
$a = 2s/t^2 - 2v_0/t$
$a = 2s/t^2 - 2 [\sqrt{(2g * \sin\alpha * s_0)}] / t$

angle	sinus	2g [m/s²]	s_o [m]	v_o [m/s]	time [s]	t²	2s [m]	a
0	0	19,62	0,164	0	0	0	0,6	0
8	0,1392	19,62	0,164	0,669254104	0,385	0,148225	0,6	0,571255455
13	0,225	19,62	0,164	0,850868968	0,311	0,096721	0,6	0,731583649
15	0,2588	19,62	0,164	0,91254347	0,289	0,083521	0,6	0,868642312
19,6	0,342	19,62	0,164	1,049021716	0,25	0,0625	0,6	1,207826274
23,5	0,4067	19,62	0,164	1,14395387	0,23	0,0529	0,6	1,394730056
27	0,454	19,62	0,164	1,208646648	0,222	0,049284	0,6	1,285627957
37	0,6018	19,62	0,164	1,39154584	0,19	0,0361	0,6	1,972647671
41	0,6561	19,62	0,164	1,452969321	0,181	0,032761	0,6	2,25954964
60	0,866	19,62	0,164	1,669284541	0,158	0,024964	0,6	2,90442577

Diagram – impact of rake angle on acceleration



Analyzing the diagram, I realized that the measurement taken when inclination angle was 70° is a gross error and I need to skip it.
Also, survey points 45° and 53° do not fit within acceptable measurement uncertainties and they also need to be skipped.
After eliminating these points, this is how the chart looks like:



Conclusion
Acceleration increases as angle of inclination gets larger. It will rise until the angle is 90° - then motion will be described as free fall and acceleration is going to equal 9,81 m/s^2.