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Force and Newton's Law

Title: Force and Newton's Law

Purpose: To study Newton's Law.

Background: Anything that has mass acted on by a force will move. The heavier the mass the more force needed to move. This can be found in the formula **F=MA.**

Materials: Roller Cart, Ramp, Books, Computer with Logger Pro, Note Card, Tape, Weight, Fan Cart with Sail, Go! Motion Radar with cable, and a Digital Balance.

Procedure: Part 1-Fan Cart:

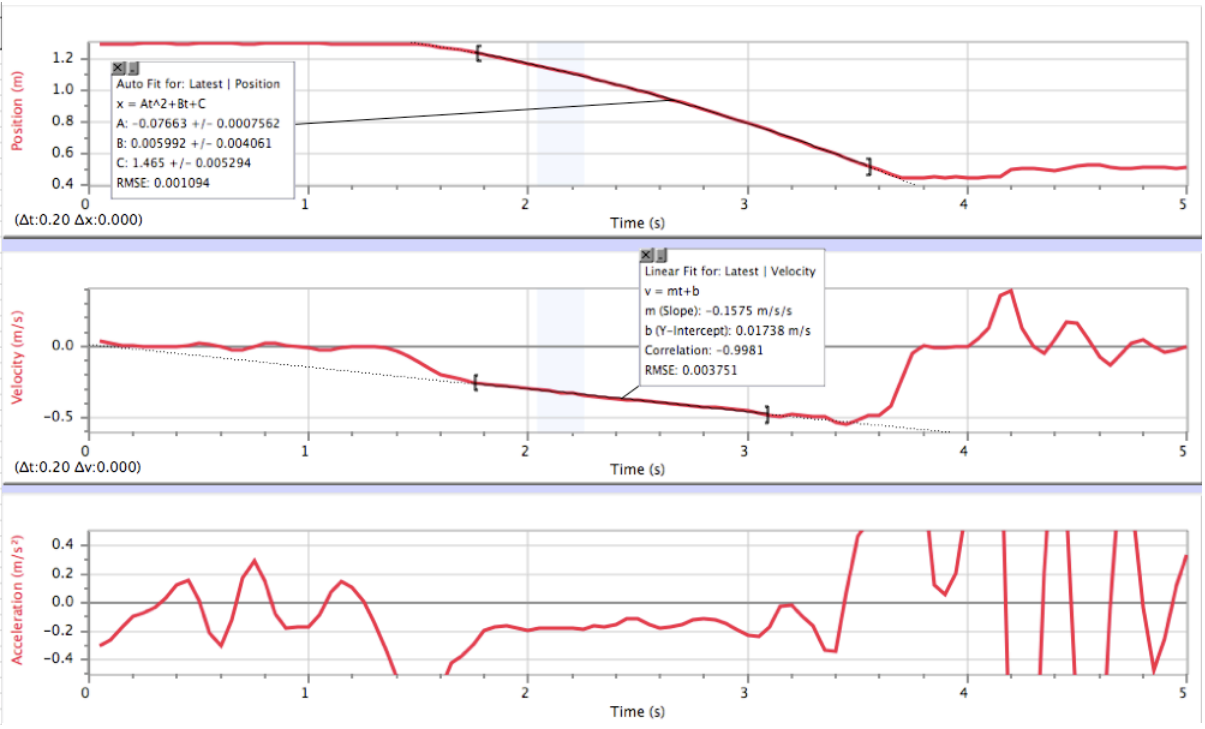
1. Set up the motion radar pointing at the fan cart's sail.
2. Turn on the cart on low about 150 centimeters away and turn on the motion radar.
3. Record the data on the logger pro and auto scale your graphs. (note: if the cart gets to close to the motion radar or too far away the radar will not record it.)
4. Repeat steps 1-3 with the fan cart on high power.
5. Now Repeat steps 1-4 with weight on fan cart.

Part 2-Roller Cart:

1. Setup the ramp at 8 centimeters high by using the books.
2. Using the tape mount a note card on the roller cart.
3. Setup the motion radar facing the roller cart.
4. Let the cart go at 100 centimeters distance from the bumper.
5. Keep the motion ranger on while it hits the bumper and bounces back and forth.
6. Now do this experiment again moving the hight of the ramp up to 12 centimeters.

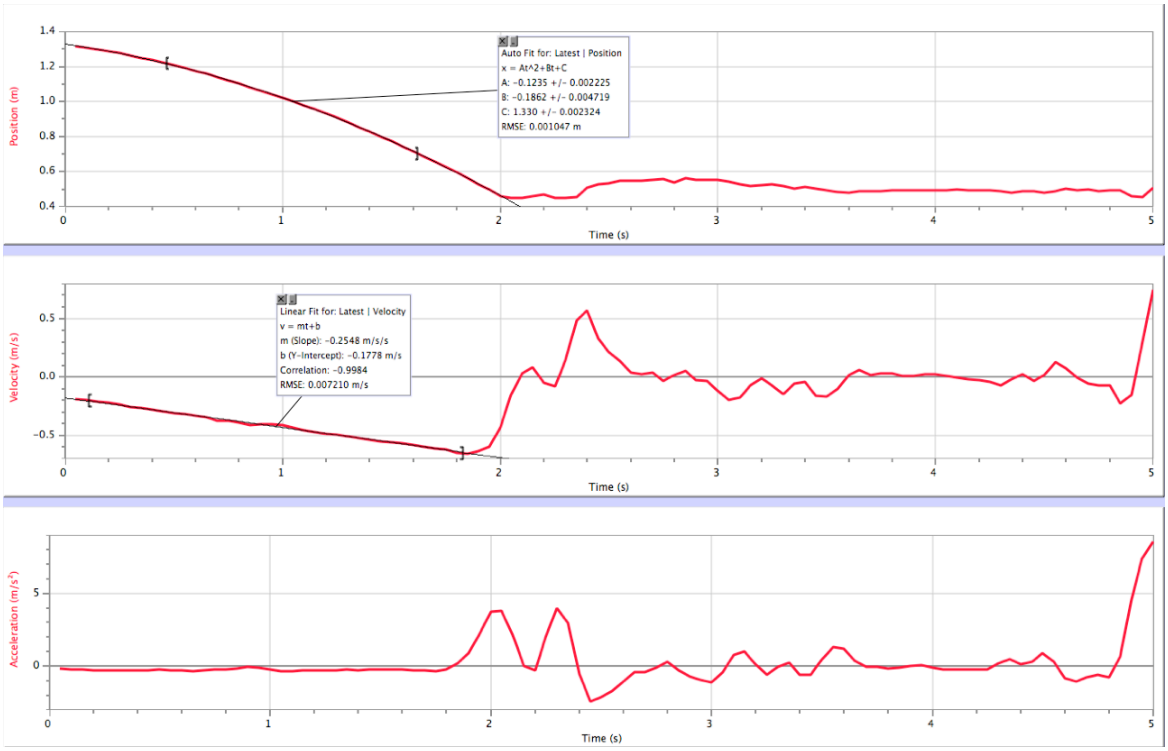
Data: Part 1 Fan Cart

	Latest			
	Time (s)	Position (m)	Velocity (m/s)	acc (m/s²)
21	1.05	1.299	−0.023	−0.090
22	1.10	1.296	−0.023	0.076
23	1.15	1.296	−0.010	0.146
24	1.20	1.295	−0.003	0.105
25	1.25	1.295	0.002	0.007
26	1.30	1.296	0.000	−0.142
27	1.35	1.296	−0.011	−0.318
28	1.40	1.295	−0.030	−0.529
29	1.45	1.293	−0.063	−0.740
30	1.50	1.289	−0.109	−0.852
31	1.55	1.283	−0.156	−0.801
32	1.60	1.273	−0.196	−0.600
33	1.65	1.262	−0.214	−0.427
34	1.70	1.252	−0.232	−0.377
35	1.75	1.239	−0.254	−0.290
36	1.80	1.226	−0.262	−0.194
37	1.85	1.213	−0.270	−0.170
38	1.90	1.199	−0.278	−0.162
39	1.95	1.185	−0.285	−0.177
40	2.00	1.171	−0.296	−0.193
41	2.05	1.155	−0.306	−0.182
42	2.10	1.140	−0.314	−0.175
43	2.15	1.124	−0.323	−0.176
44	2.20	1.107	−0.331	−0.182
45	2.25	1.091	−0.342	−0.182
46	2.30	1.073	−0.350	−0.166
47	2.35	1.056	−0.357	−0.166
48	2.40	1.038	−0.368	−0.150
49	2.45	1.019	−0.374	−0.110
50	2.50	1.000	−0.376	−0.115
51	2.55	0.982	−0.383	−0.157
52	2.60	0.962	−0.393	−0.174
53	2.65	0.942	−0.402	−0.169
54	2.70	0.922	−0.411	−0.153
55	2.75	0.901	−0.418	−0.120
56	2.80	0.880	−0.422	−0.110
57	2.85	0.859	−0.428	−0.124
58	2.90	0.837	−0.434	−0.144
59	2.95	0.816	−0.441	−0.188
60	3.00	0.793	−0.453	−0.227
61	3.05	0.770	−0.464	−0.236
62	3.10	0.747	−0.480	−0.170
63	3.15	0.722	−0.486	−0.023



Fan Cart At Low Speed Without Weight

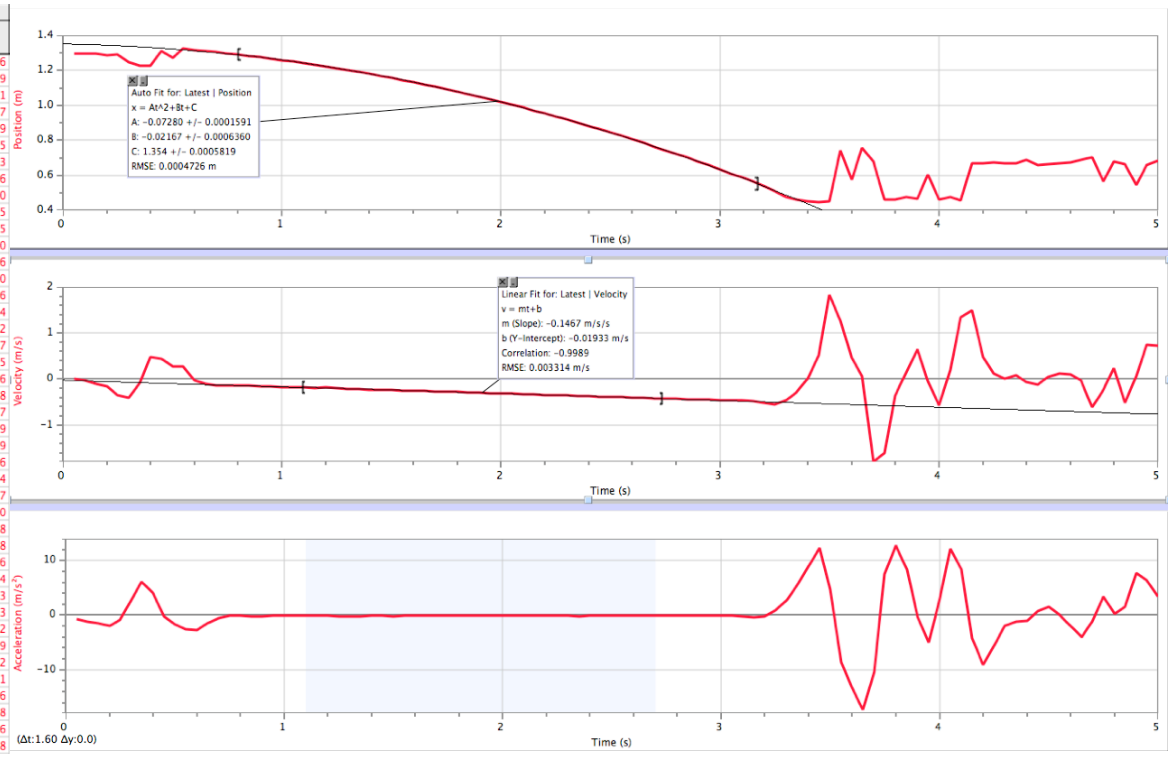
	Latest			
	Time (s)	Position (m)	Velocity (m/s)	acc (m/s²)
1	0.05	1.317	−0.192	−0.170
2	0.10	1.307	−0.199	−0.199
3	0.15	1.297	−0.210	−0.238
4	0.20	1.286	−0.223	−0.276
5	0.25	1.275	−0.239	−0.292
6	0.30	1.263	−0.254	−0.279
7	0.35	1.249	−0.266	−0.266
8	0.40	1.236	−0.279	−0.272
9	0.45	1.222	−0.294	−0.265
10	0.50	1.206	−0.306	−0.245
11	0.55	1.191	−0.317	−0.264
12	0.60	1.175	−0.331	−0.311
13	0.65	1.158	−0.348	−0.358
14	0.70	1.140	−0.373	−0.309
15	0.75	1.120	−0.379	−0.246
16	0.80	1.103	−0.392	−0.256
17	0.85	1.081	−0.412	−0.138
18	0.90	1.060	−0.406	−0.044
19	0.95	1.041	−0.407	−0.119
20	1.00	1.020	−0.415	−0.243
21	1.05	1.000	−0.433	−0.346
22	1.10	0.977	−0.455	−0.352
23	1.15	0.954	−0.471	−0.305
24	1.20	0.930	−0.484	−0.277
25	1.25	0.906	−0.497	−0.270
26	1.30	0.880	−0.511	−0.258
27	1.35	0.854	−0.523	−0.254
28	1.40	0.828	−0.536	−0.262
29	1.45	0.801	−0.550	−0.248
30	1.50	0.773	−0.561	−0.221
31	1.55	0.744	−0.571	−0.213
32	1.60	0.716	−0.581	−0.237
33	1.65	0.687	−0.595	−0.269
34	1.70	0.656	−0.609	−0.292
35	1.75	0.626	−0.622	−0.316
36	1.80	0.595	−0.645	−0.215
37	1.85	0.560	−0.656	0.197
38	1.90	0.528	−0.634	0.904
39	1.95	0.498	−0.599	2.229
40	2.00	0.461	−0.430	3.736
41	2.05	0.449	−0.156	3.767
42	2.10	0.449	0.031	2.119
43	2.15	0.459	0.085	0.022
44	2.20	0.468	−0.054	−0.272



Fan Cart At High Speed Without Weight

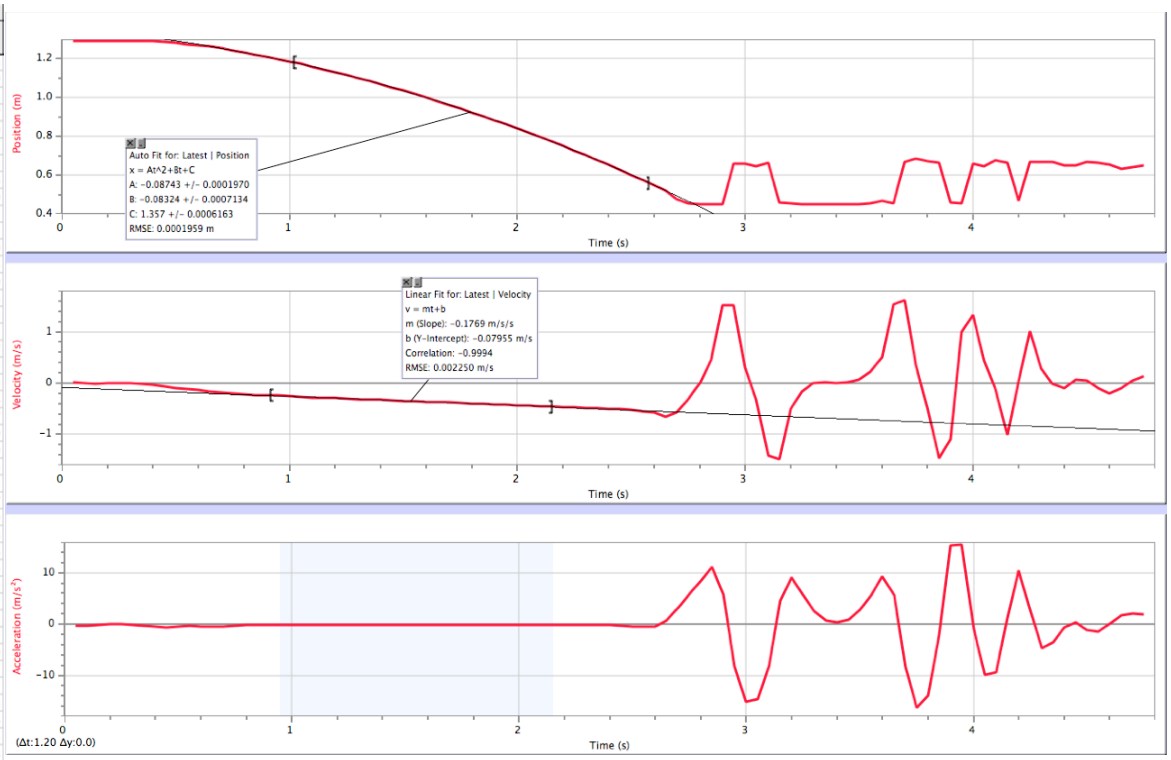
Part 2: Fan Cart With Weights

	Latest			
	Time (s)	Position (m)	Velocity (m/s)	acc (m/s²)
1	0.05	1.295	0.004	−0.796
2	0.10	1.296	−0.022	−1.199
3	0.15	1.297	−0.105	−1.551
4	0.20	1.284	−0.158	−1.927
5	0.25	1.290	−0.351	−0.949
6	0.30	1.245	−0.414	2.745
7	0.35	1.225	−0.077	6.053
8	0.40	1.224	0.486	4.056
9	0.45	1.310	0.439	−0.310
10	0.50	1.272	0.266	−1.715
11	0.55	1.323	0.267	−2.675
12	0.60	1.316	−0.021	−2.810
13	0.65	1.310	−0.098	−1.456
14	0.70	1.304	−0.134	−0.610
15	0.75	1.297	−0.136	−0.166
16	0.80	1.290	−0.137	−0.114
17	0.85	1.283	−0.143	−0.182
18	0.90	1.276	−0.157	−0.217
19	0.95	1.267	−0.170	−0.155
20	1.00	1.259	−0.172	−0.106
21	1.05	1.250	−0.176	−0.118
22	1.10	1.241	−0.185	−0.117
23	1.15	1.232	−0.191	−0.069
24	1.20	1.222	−0.188	−0.089
25	1.25	1.213	−0.196	−0.186
26	1.30	1.202	−0.211	−0.214
27	1.35	1.192	−0.220	−0.187
28	1.40	1.180	−0.230	−0.150
29	1.45	1.169	−0.233	−0.138
30	1.50	1.157	−0.241	−0.168
31	1.55	1.145	−0.255	−0.116
32	1.60	1.131	−0.253	−0.064
33	1.65	1.120	−0.254	−0.133
34	1.70	1.106	−0.268	−0.163
35	1.75	1.093	−0.273	−0.152
36	1.80	1.079	−0.282	−0.159
37	1.85	1.064	−0.289	−0.162
38	1.90	1.050	−0.299	−0.161
39	1.95	1.034	−0.307	−0.136
40	2.00	1.019	−0.311	−0.138
41	2.05	1.004	−0.319	−0.166
42	2.10	0.987	−0.329	−0.158



Fan Cart On Low With Weight

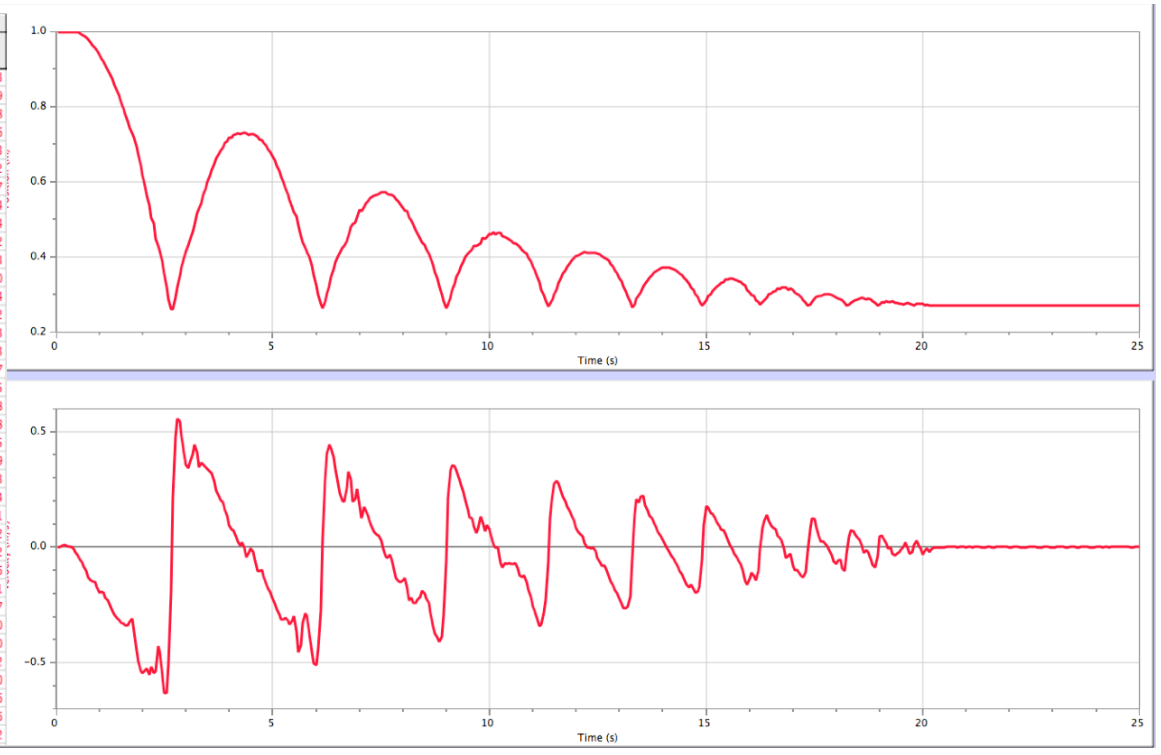
	Latest			
	Time (s)	Position (m)	Velocity (m/s)	acc (m/s²)
1	0.05	1.295	0.004	-0.796
2	0.10	1.296	-0.022	-1.199
3	0.15	1.297	-0.105	-1.551
4	0.20	1.284	-0.158	-1.927
5	0.25	1.290	-0.351	-0.949
6	0.30	1.245	-0.414	2.745
7	0.35	1.225	-0.077	6.053
8	0.40	1.224	0.486	4.056
9	0.45	1.310	0.439	-0.310
10	0.50	1.272	0.266	-1.715
11	0.55	1.323	0.267	-2.675
12	0.60	1.316	-0.021	-2.810
13	0.65	1.310	-0.098	-1.456
14	0.70	1.304	-0.134	-0.610
15	0.75	1.297	-0.136	-0.166
16	0.80	1.290	-0.137	-0.114
17	0.85	1.283	-0.143	-0.182
18	0.90	1.276	-0.157	-0.217
19	0.95	1.267	-0.170	-0.155
20	1.00	1.259	-0.172	-0.106
21	1.05	1.250	-0.176	-0.118
22	1.10	1.241	-0.185	-0.117
23	1.15	1.232	-0.191	-0.069
24	1.20	1.222	-0.188	-0.089
25	1.25	1.213	-0.196	-0.186
26	1.30	1.202	-0.211	-0.214
27	1.35	1.192	-0.220	-0.187
28	1.40	1.180	-0.230	-0.150
29	1.45	1.169	-0.233	-0.138
30	1.50	1.157	-0.241	-0.168
31	1.55	1.145	-0.255	-0.116
32	1.60	1.131	-0.253	-0.064
33	1.65	1.120	-0.254	-0.133
34	1.70	1.106	-0.268	-0.163
35	1.75	1.093	-0.273	-0.152
36	1.80	1.079	-0.282	-0.159
37	1.85	1.064	-0.289	-0.162
38	1.90	1.050	-0.299	-0.161
39	1.95	1.034	-0.307	-0.136
40	2.00	1.019	-0.311	-0.138
41	2.05	1.004	-0.319	-0.166
42	2.10	0.987	-0.329	-0.158



Fan Cart On High With Weight

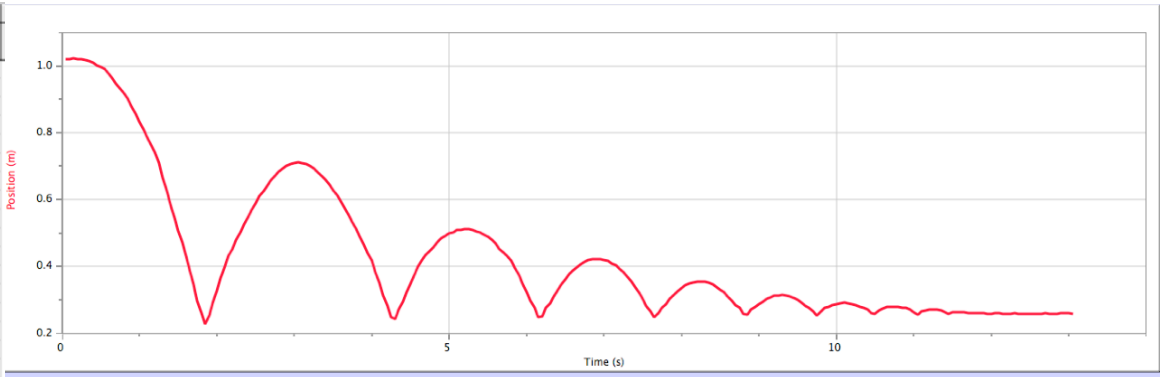
Part 3: Roller Cart

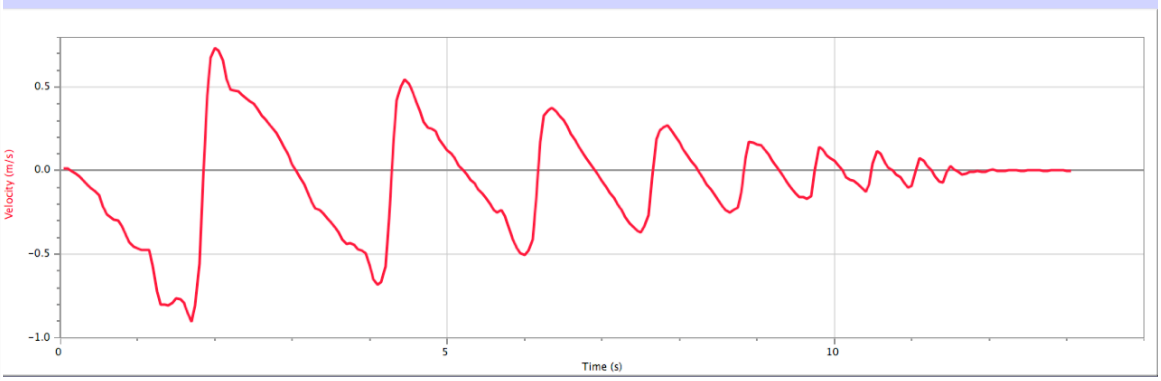
	Latest			
	Time (s)	Position (m)	Velocity (m/s)	acc (m/s²)
1	0.05	0.997	-0.003	0.083
2	0.10	0.997	0.001	0.079
3	0.15	0.997	0.006	0.058
4	0.20	0.998	0.009	0.006
5	0.25	0.998	0.007	-0.043
6	0.30	0.998	0.003	-0.072
7	0.35	0.998	0.000	-0.117
8	0.40	0.999	-0.006	-0.194
9	0.45	0.998	-0.020	-0.264
10	0.50	0.997	-0.035	-0.302
11	0.55	0.995	-0.050	-0.323
12	0.60	0.992	-0.067	-0.340
13	0.65	0.988	-0.084	-0.364
14	0.70	0.983	-0.102	-0.402
15	0.75	0.978	-0.128	-0.363
16	0.80	0.970	-0.144	-0.223
17	0.85	0.963	-0.147	-0.157
18	0.90	0.955	-0.150	-0.255
19	0.95	0.949	-0.173	-0.338
20	1.00	0.938	-0.196	-0.218
21	1.05	0.928	-0.193	-0.125
22	1.10	0.919	-0.198	-0.219
23	1.15	0.909	-0.217	-0.293
24	1.20	0.897	-0.229	-0.334
25	1.25	0.886	-0.248	-0.401
26	1.30	0.873	-0.274	-0.392
27	1.35	0.859	-0.290	-0.322
28	1.40	0.844	-0.304	-0.266
29	1.45	0.828	-0.316	-0.221
30	1.50	0.812	-0.328	-0.157
31	1.55	0.795	-0.331	-0.100
32	1.60	0.779	-0.338	-0.030
33	1.65	0.761	-0.339	0.082
34	1.70	0.744	-0.325	0.040
35	1.75	0.728	-0.309	-0.466
36	1.80	0.717	-0.364	-1.086
37	1.85	0.693	-0.447	-1.162



Roller Cart 8 cm

	Latest			
	Time (s)	Position (m)	Velocity (m/s)	acc (m/s²)
1	0.05	1.019	0.010	-0.055
2	0.10	1.020	0.012	-0.166
3	0.15	1.022	-0.002	-0.279
4	0.20	1.020	-0.019	-0.338
5	0.25	1.020	-0.035	-0.402
6	0.30	1.016	-0.060	-0.441
7	0.35	1.014	-0.081	-0.447
8	0.40	1.009	-0.106	-0.453
9	0.45	1.002	-0.123	-0.542
10	0.50	0.996	-0.148	-0.819
11	0.55	0.990	-0.212	-0.936
12	0.60	0.974	-0.263	-0.659
13	0.65	0.962	-0.277	-0.387
14	0.70	0.947	-0.292	-0.307
15	0.75	0.932	-0.297	-0.446
16	0.80	0.919	-0.328	-0.750
17	0.85	0.900	-0.383	-0.844
18	0.90	0.880	-0.426	-0.665
19	0.95	0.857	-0.451	-0.422
20	1.00	0.834	-0.464	-0.244
21	1.05	0.811	-0.475	-0.148
22	1.10	0.785	-0.471	-0.302
23	1.15	0.763	-0.471	-1.072
24	1.20	0.743	-0.566	-1.987
25	1.25	0.710	-0.724	-1.894
26	1.30	0.666	-0.798	-0.955
27	1.35	0.627	-0.800	-0.254
28	1.40	0.587	-0.805	0.086
29	1.45	0.545	-0.789	0.261
30	1.50	0.508	-0.764	0.098
31	1.55	0.470	-0.770	-0.271
32	1.60	0.431	-0.788	-0.632
33	1.65	0.394	-0.847	-0.527
34	1.70	0.347	-0.905	0.999
35	1.75	0.296	-0.803	3.742
36	1.80	0.261	-0.556	6.811
37	1.85	0.228	-0.063	8.423





Roller Cart 12 cm

Observations: The mass of the cart was
Analysis: The lab for the most part went well. There were a few errors because of motion radar could not pick up the fan cart when it came close. Other than that everything went smoothly.

Analysis: The mass of the weight was 1.115 kg. The mass of the Roller Cart was 1.10 kg. The mass of the Fan Cart was .584 kg. The different heights at which the ramp was inclined was 8 cm and 12 cm. The weight of the cart, multiplied by the acceleration equals the force in newtons.

Conclusions: We used the different carts, with weights and with an incline to find the acceleration. We applied Newton's Law that F=MA to figure this out. Our experiment was extremely successful and encountered little problems.

Questions:

1. How was the acceleration of the inclined cart related to g? How should it be related?--The acceleration of the inclined cart is related to g because you find the acceleration of gravity by multiply 9.8 by sin of the angle. This number will be the acceleration.
2. Determine the force from the fan on low and high speeds.-- The force for the high fan was 0.175 Newtons. The force for the low fan was 0.0584 Newtons.
3. If you allowed the ramp to bounce, what would the v/t graph look like and why?--It was hills decreasing like a wave getting smaller and smaller. This is because every time the cart would hit it would go back less than the time before creating a wave of decreasing humps.
4. If the fan cart had another identical cart hooked to it, what would this do to the three curves: x/t v/t a/t?--It would make them less vertical and more horizontal.