eTwinning	TEAM: 10	
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Smartphone-accelerations into physics situations	Italy	Melissa Elisa
EXPERIMENT: centrifugal acceleration in salad spinner		

We put the phone in the salad spinner. Then we measure angular velocity over the time the spinner is slowing down.

1. ORIENTATION

1.1. **Research question:**

How does the deceleration of the salad spinner affect the angular velocity on the phone?

Sub-questions:

Does the brand of the salad spinner affect the results?

1.2. **Hypothesis**

a) The slower it goes, the lower the deceleration. If it goes slower, there is less force needed to keep it in the circle.

b) The brand will probably affect the results. Salad spinners of different brands are built different, so they will slow down faster/slower.

2. PREPARATION

2.1. **Material**:

- different brands of salad spinners
- phone with phyphox installed

2.2. Method:

- First, the phone is put into the salad spinner with phyphox installed.
- Put an object on the other side of the salad spinner because otherwise the salad spinner will not spin because all the weight is on one side.
- Start spinning the salad spinner for 5 seconds.
- The start of the measurement is delayed 8 seconds and measures for 10 seconds.
- Repeat this experiment 3 times with 3 different salad spinners.

3. DATA ANALYSIS and DISCUSSION

3.1. **Observations and Measurements**:

Experiment 1		
Time (s)	Angular velocity (rad/s)	Acceleration (m/s^2)
0,1	24,3	38,6
0,6	20,6	27,8
1,1	18,2	23,5
1,6	16,0	17,4
2,1	14,5	12,8
2,6	12,9	10,4
3,1	11,4	7,9
3,6	10,3	6,2
4,1	8,9	5,6
4,6	7,4	3,9
5,1	6,3	2,2
5,6	5,2	2,0
6,1	4,1	1,3
6,6	2,9	0,1
7,1	1,6	0,5
7,6	0,4	0,6
8,1	0,1	0,0
9,1	0,0	0,1
9,6	0,3	0,3

Experiment 2		
Time (s)	Angular velocity (rad/s)	Acceleration (m/s^2)
0,2	28,0	58,1
0,7	22,6	35,6
1,2	18,9	26,0
1,7	17,4	23,1
2,2	15,6	17,4
2,7	14,5	14,8
3,2	13,1	11,9
3,7	11,8	9,8
4,2	10,7	7,7
4,7	9,2	5,8
5,2	7,8	5,2
5,7	6,5	2,7
6,2	5,4	2,7
6,7	4,1	0,8
7,2	2,7	0,8
7,7	1,5	0,8
8,2	0,4	0,6
8,7	0,0	0,3
9,2	0,2	0,8

Experiment 3		
Time (s)	Angular velocity (rad/s)	Acceleration (m/s^2)
0,3	36,8	86,1
0,8	28,8	59,4
1,3	22,8	37,1
1,8	19,0	27,6
2,3	16,7	19,8
2,8	14,5	16,1
3,3	12,7	12,6
3,8	11,2	9,9
4,3	9,5	7,0
4,8	7,7	3,7
5,3	6,5	3,9
5,8	5,1	1,3
6,3	4,2	1,9
6,8	2,6	1,0
7,3	1,1	0,4
7,8	0,1	0,4
8,3	0,0	0,3
8,8	0,0	0,2
9,3	0,0	0,2

Experiment

Experiment 4		
Time (s)	Angular velocity (rad/s)	Acceleration (m/s^2)
0,3	21,0	30,2
0,8	16,0	16,3
1,3	13,0	11,4
1,9	11,1	8,4
2,4	10,0	6,2
2,9	8,7	5,2
3,4	7,4	4,5
3,9	6,0	1,4
4,4	4,7	2,0
4,9	3,3	1,0
5,4	2,1	0,3
5,9	1,0	0,6
6,4	0,0	0,4
6,9	0,0	1,1
7,4	0,3	0,8
7,9	0,1	0,1
8,4	0,1	0,3
8,9	1,2	0,4
9,4	1,1	5,0

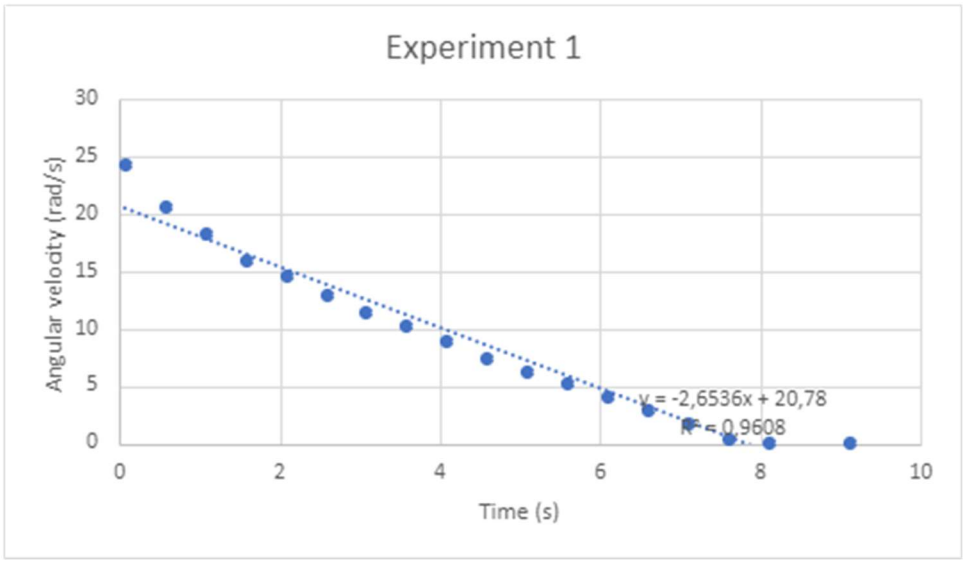
Experiment 5		
Time (s)	Angular velocity (rad/s)	Acceleration (m/s^2)
0,5	20,0	30,6
1,0	17,5	22,9
1,5	15,6	16,6
2,0	13,8	11,8
2,5	12,3	9,6
3,0	11,3	8,3
3,5	10,3	7,6
4,0	8,9	6,0
4,5	7,9	4,0
5,0	6,5	3,0
5,5	5,3	2,1
6,0	3,8	1,2
6,5	3,1	0,4
7,0	2,2	0,5
7,5	0,8	0,7
8,0	0,1	0,1
8,5	0,3	2,3
9,0	0,2	0,0
9,5	0,6	0,6

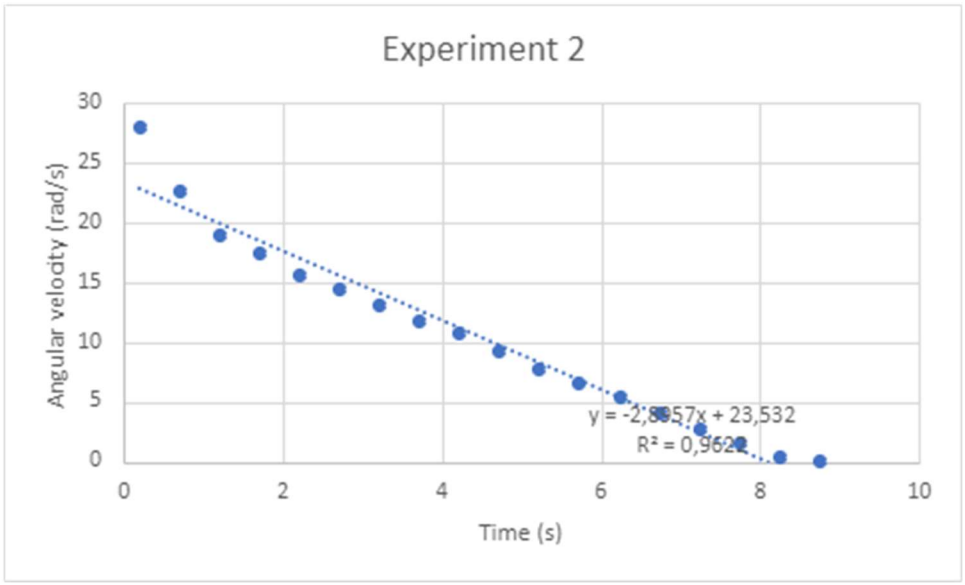
Experiment

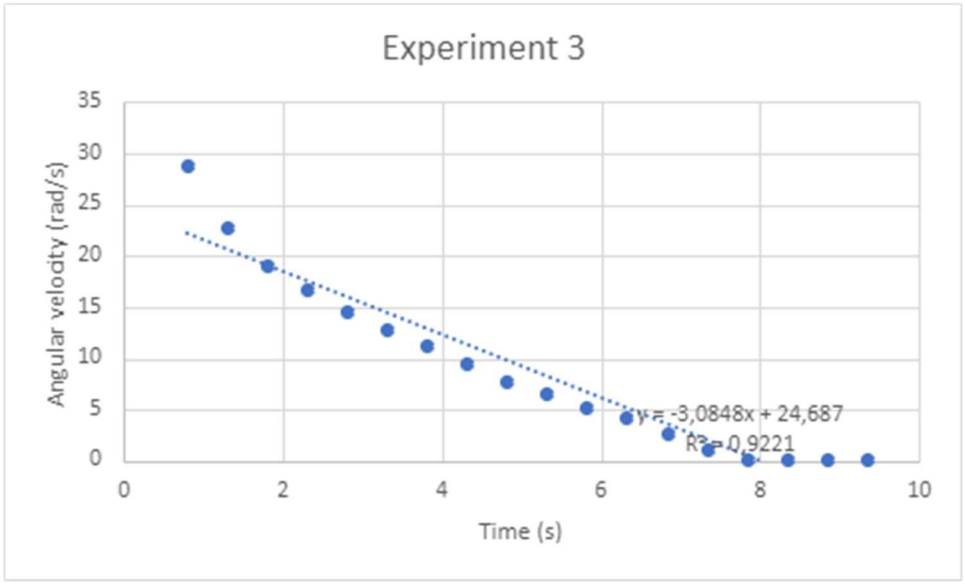
Experiment 6		
Time (s)	Angular velocity (rad/s)	Acceleration (m/s^2)
0,1	27,6	55,1
0,6	20,5	30,7
1,1	17,4	20,8
1,6	14,6	14,9
2,1	12,5	10,2
2,6	11,1	8,7
3,1	9,3	6,6
3,6	8,3	5,3
4,1	7,0	2,5
4,6	5,7	2,9
5,1	4,3	0,8
5,6	3,1	0,8
6,1	1,6	0,7
7,1	0,0	0,1
7,6	0,0	0,1
8,1	0,0	0,1
8,6	0,0	0,0
9,1	0,2	0,2
9,6	0,1	0,0

3.2. Discussion:

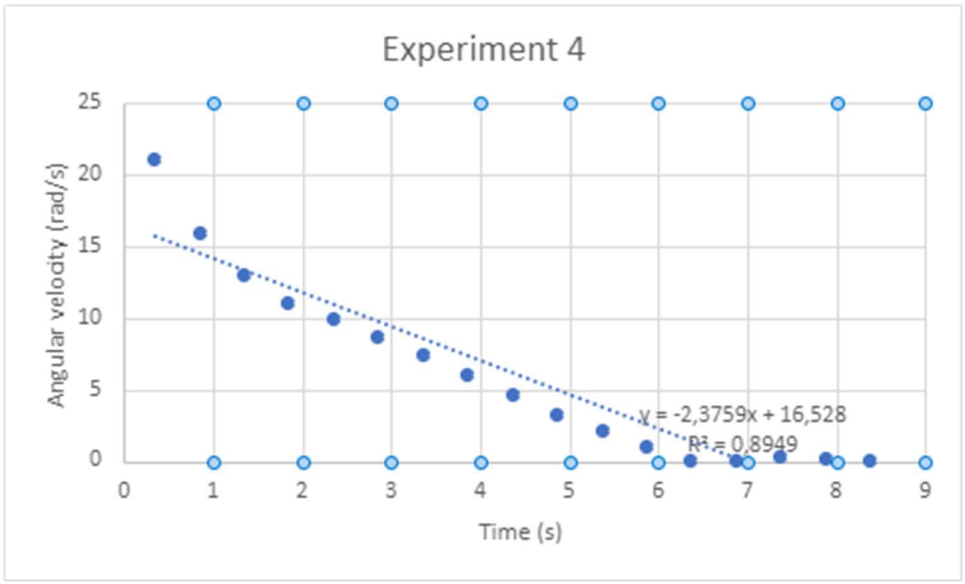
To make the graphs we sometimes didn't use the last few measurements because these can give a wrong interpretation. These wrong measurements can be explained because we sometimes picked up the phone too soon or because the phone fell over before the measurements stopped.

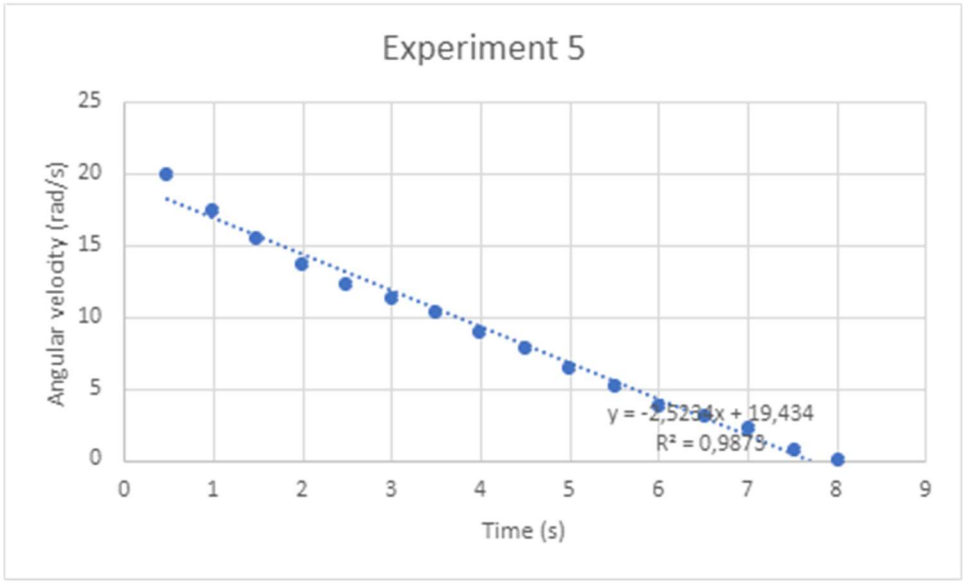

Experiment 1
Angular velocity (rad/s)
Time (s)
y = -2,6536x + 20,78
R² = 0,9608

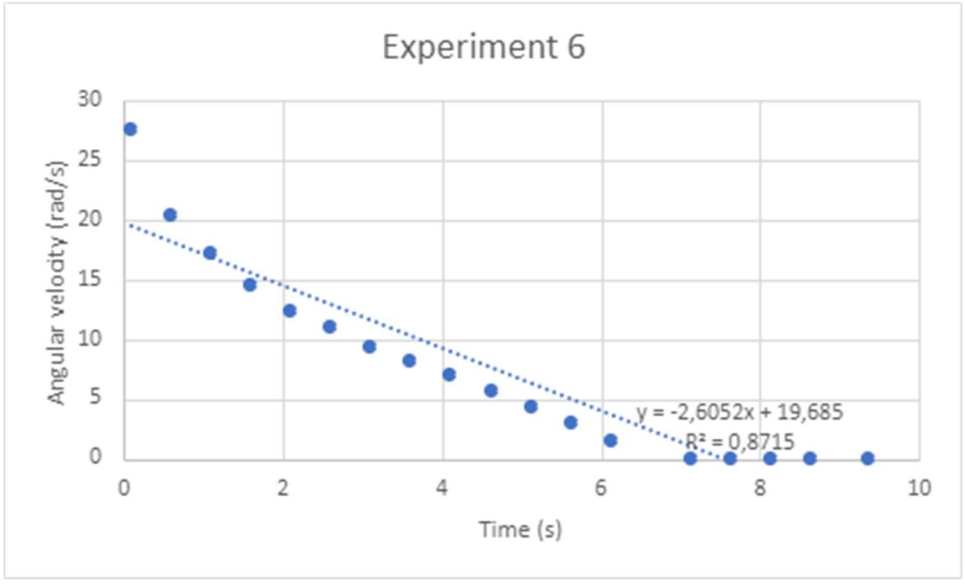

Experiment 2
Angular velocity (rad/s)
Time (s)
y = -2,8857x + 23,532
R² = 0,9628


Experiment 3
Angular velocity (rad/s)
Time (s)
y = -3,0848x + 24,687
R² = 0,9221

Experiment


Experiment 4
Angular velocity (rad/s)
Time (s)
y = -2,3759x + 16,528
R² = 0,8949


Experiment 5
Angular velocity (rad/s)
Time (s)
y = -2,5234x + 19,434
R² = 0,9875


Experiment 6
Angular velocity (rad/s)
Time (s)
y = -2,6052x + 19,685
R² = 0,8715

Experiment

With the measurements we find that the phone measured a uniform circular motion which means we get a linear function of the form y=ax+b. We know that a in this function is the deceleration. We find that for the first salad spinner (experiment 1, 2 and 3) the average deceleration is 2,878 m/s^2 and for the second salad spinner it is 2,5015 m/s^2.

4. REFLECTION

4.1. **Conclusion**:

- The slower the salad spinner spins, the lower the angular velocity and the lower the deceleration.
- We can see that with different salad spinners from different brands, you get different average decelerations because we can see that the average deceleration of one salad spinner is different from the other one.

4.2. **Comparison** of the results of the different countries

4.3. **Reflection:** It was not always easy to make the salad spinner spin in the same way and with the exact same speed. Due to unforeseen circumstances, one of the experimenters was absent on the exciting day of the experiment which forced us to do the experiment using only 2 salad spinners instead of 3.

5. REFERENCES