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Phys111 Report

Experiment #7: **Measurement of g at BZU**

Name:	
Partner:	
Section:	
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(1) Abstract:

- **Aim of the experiment:**

is to measure the gravity's acceleration at our Kingdom "Birzeit university".

- **The main result is:**
  - The acceleration due to gravity at BZU is g =(9,9 ± 0,2) m/s²

(2) Data:

	$S\ (cm)$	$L\ (cm)$	t_1 (sec)	t_2 (sec)	t_3 (sec)	t_{avg} (sec)	$T\ (sec)$	$T^2\ (sec^2)$
1	29.8 cm	30.8 cm	10.66 sec	10.53 sec		10,60 sec	1,06 sec	1,12 sec²
2	39.3 cm	40.3 cm	12.41 sec	12.81 sec		12,61 sec	1,26 sec	1,59 sec²
3	51.2 cm	52.2 cm	14.05 sec	14.12 sec		14,08 sec	1,41 sec	1,99 sec²
4	62.0 cm	63.0 cm	15.55 sec	15.50 sec		15,52 sec	1,55 sec	2,40 sec²
5	71.6 cm	72.6 cm	16.92 sec	16.78 sec		16,85 sec	1,68 sec	2,82 sec²
6	81.2 cm	82.2 cm	17.91 sec	17.82 sec		17,86 sec	1,79 sec	3,20 sec²

$r = \frac{d}{2} =$ 1.0 cm

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(3)Calculations:

Use linear least square as implemented in **Excel** to calculate the slope & uncertainty of the line representing T^2 vs. L.

slope $= (0.0397 \pm 0.0009)\ s^2/cm$.
$g = \frac{4\pi^2 L}{T^2} = \frac{4\pi^2}{slope} = 993.41\ cm/s^2 = 9.934\ m/s^2$.
$\Delta g = \frac{4\pi^2}{(slope)^2} \Delta slope = 22.52\ \frac{cm}{s^2} \approx 0.225\ \frac{m}{s^2} \approx 0.2\ m/s^2$

(4)Results:

- The acceleration due to gravity at BZU is $g = (9.9 \pm 0.2)\ m/s^2$.

(5)Conclusions:

When applying the Discrepancy test. With true value of $9.82\ m/s^2$ We found. $|g_{true} - g_{exp}| \leq 2 \times \sigma g$ → $0.08 \leq 0.4$, that our result accepted.
As we see in the graph, most of the points are on the Line, so its a nice thing to see, which indicates that our result is good.

Possible sources of error:

1) The biggest source of errors is measuring the periods time, so when we use the timer we should be very careful and hurry to get less error.

2) External forces such as the air resistance, the forces that we took into account were the gravity's and tension's force, so the air will affect.

3) in some cases, The ball was Rolling, and when it roll some part of the energy will transfer into rotational kinetic energy, so it shouldn't roll.

4) Giving an initial velocity to the ball will change all things. So we should get the ball to accelerate by the gravitaional force, not by us.

5) the scientists found that ($g = 9.82\ m/s^2$) on the sea level, but BZU is about 788m above sea level, so its supposed to be a bit less than the true value according to the "g" Law of $F_g = \frac{GMm}{r^2}$.

Also, we have to mention that the Period of the Pendulum doesn't depend on the ball's mass due to equation ($T^2 = \frac{4\pi^2 L}{g}$).

to approof that $\sin\theta \approx \theta$ for small angles (less or equal 15°) → $\sin\theta = \frac{O}{H} \approx \frac{O}{A} = \tan\theta = \frac{O}{A} \approx \frac{S}{A} = \frac{A\theta}{A} = \theta$.

L (cm)	T^2 (s^2)
30.8	1.12
40.3	1.59
52.2	1.99
63	2.4
72.6	2.82
82.2	3.2

	Slope	Y-int
Value	0.039709	-0.07077
Error	0.000881	0.052488