**Birzeit University**

**Physics department**

**Physics 211**

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**Experiment number: (2)**

**Experiment name: free falling objects**

**Date: 29/01/2012**

**Instructor: Dr. Wael .Q**

**Main result:**

**The gravitational acceleration at Birzeit university = 11.552 ± 1.75**

**Abstract:**

**The aim of this experiment is to measure the gravitational acceleration by usage of Newton’s law that relates the time with the distance for accelerated movement**

**With help of the falling ball apparatus.**

**Theory:**

**A falling object’s acceleration can be given by** $\frac{d^{2}\vec{h}}{dt^{2}}$ **=**$\vec{g}$ **which is derived from Newton’s second law, a solution to such equation is** $\vec{h}$**(t) =** $\vec{h}$**(t0) +** $\vec{v}$**(t0) +**1/2$\vec{g}$ **t2**

**If the object is dropped from rest, i.e. free falling, the equation above can be expressed as**

$\vec{h}$**(t) =** 1/2$\vec{g}$ **t2**

**Where:**

$\vec{h}$**(t): height of the ball from the pan in meters**

 **.t: the time elapsed for collagen (s)**

$\vec{g}$ **: Gravitational acceleration (m/s2)**

**By plotting log** $\vec{h}$**(t) Vs log t, one can find** $α$ **which is the slope while the y intercept represents log** 1/2$\vec{g}$

**Also** $\vec{g}$ **can be calculated by plotting** $\vec{h}$**(t) vs.** $t^{α}$ **to give** $\vec{g}$ **from its slope which is** $\vec{g}$**/2**

**Procedure:**

1. **Interrupt the current after choosing a certain height.**
2. **Zero the timer by pressing on null before releasing the ball.**
3. **Record the time elapsed.**
4. **Repeat procedure three times for each height.**

**Data:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Height h(cm) | Height h(m) | t1 | t2 | t3 | tavg | t^ἀ | log h | log tavg |
| 30 | 0.3 | 0.279 | 0.279 | 0.28 | 0.279333 | 0.052399 | -0.52288 | -0.55388 |
| 40 | 0.4 | 0.309 | 0.313 | 0.313 | 0.311667 | 0.067501 | -0.39794 | -0.50631 |
| 50 | 0.5 | 0.348 | 0.348 | 0.346 | 0.347333 | 0.086719 | -0.30103 | -0.45925 |
| 60 | 0.6 | 0.375 | 0.373 | 0.375 | 0.374333 | 0.103107 | -0.22185 | -0.42674 |
| 70 | 0.7 | 0.401 | 0.403 | 0.403 | 0.402333 | 0.121821 | -0.1549 | -0.39541 |
| 55 | 0.55 | 0.359 | 0.359 | 0.358 | 0.358667 | 0.093402 | -0.25964 | -0.44531 |

**Data analysis :**

**Log height (m) Vs log t avg**

**Diagram of h Vs tἀ**

**Results and conclusion :**

**Average acceleration gravity** $\vec{g}$ **= (11.482+11.623)/2= 11.552 m/s2**

**Theoretical** $\vec{g}$ **= 9.807 m/s2**

**Percentage error = abs (theoretical value – experimental value)/theoretical value**

 **=17.8%**

**Main result:**

**The gravitational acceleration at Birzeit university = 11.552 ± 1.75**

**Discussion of results:**

**Sources of error:**

* **Air resistance**
* **Friction force between the ball and the apparatus**
* **Random error: The drop position didn’t give the precise time to the timer as we have tried multiple times some of it was very far but we took the three most repeated ones.**