logo

**Birzeit University**

physics 211

**Experiment No.5**

**The Helical Spring**

…………………………………………………………………

Student's Name: Joudeh Joudeh

student's №: *1091341*

Instructor: Nidal Dwekait

Section №: 1

Date: 7/2/2011

**-Abstract:**

\* The aim of the experiment:

To find the force constant **k** for the soft spring.

\* Tools :

A long helical spring, meter stick, and stop watch .

**- Theory :**

We know that the :

F = -ky …… eq(1)

mg = -ky , but g =

m = -ky

m +ky=0

+y = 0

The angular frequency equal then:

ω =

the period T is :

T = = 2π

But we include an "effective mass" for the spring in the period equation then :

T = 2π

If we square the equation become:

T 2 = 4

→ T 2 = 4 + 4 ……………..eq(2)

This equation we can plot T 2vs. m the slope = 4/k , and the intercept is 4 .

The eq(1) :

F = k ∆y = mg

We can plot mg with ∆y , then the slope = k .

- **Procedure :**

\* part 1 :

This part is to find the force constant of the long spring:

1- the spring in a vertical is placed and the pan holder for weights is suspended .

2- mark clearly the lower end of the pan and use it as zero point for the y-axis.

3- started adding loads and record the extension ∆y vs the added mass m.

\* part 2 :

This part is used to study oscillations of the spring :

1-the spring is loaded with a given mass m .

2-stretch it slightly and let is oscillate in small oscillations.

3-the stop watch is used , the time for 10 oscillations is measured then the period T is computed.

**-Data:**

g = 9.8 m/s2.

Mspring = 43.2×10 -3 kg

\*part 1 :

|  |  |  |
| --- | --- | --- |
| ∆y(m) | mg(kg.m/s2) | m(kg) |
| 0.9×10 -2 | 0.784 | 0.08 |
| 2×10 -2 | 1.078 | 0.11 |
| 3.2×10 -2 | 1.372 | 0.14 |
| 4.6×10 -2 | 1.764 | 0.18 |
| 6.6×10 -2 | 2.254 | 0.23 |
| 8.2×10 -2 | 2.744 | 0.28 |
| 11.1×10 -2 | 3.430 | 0.35 |
| 12.8×10 -2 | 3.92 | 0.40 |

\* part 2:

|  |  |  |
| --- | --- | --- |
| T 2(sec 2) | T(sec)(1rotation) | m(kg) |
| 0.178 | 0.422 | 0.10 |
| 0.312 | 0.559 | 0.15 |
| 0.337 | 0.581 | 0.20 |
| 0.391 | 0.625 | 0.25 |
| 0.440 | 0.663 | 0.30 |
| 0.494 | 0.703 | 0.35 |
| 0.563 | 0.750 | 0.40 |

**- Calculations:**

\* part 1:

The slope of curve equal the constant force:

Slope = k = = = = 26.4Kg/s2.

k = 26.4kg/s2

\*part 2:

The slope of the curve (T 2vs. m) is:

Slope = , k =

Slope = = = = 1.46 sec 2/kg.

k = = = 26.9 kg/s 2 .

k = 26.9 kg/s2 .

the spring not use all its mass but some of its mass (meff), to find it :

T = 2𝜋

= m + meff

= 0.25+meff

meff = 0.0167 kg = 16.7 g from 43.2

mremaind = 43.2-16.7 = 26.5 g

**-Result and Conclusion :**

k = 26.4

k2 = 26.9

kavg. = (26.7±0.4) kg/s2

The value of the constant force is acceptable because the 2∆r ≤ d ,then 2(0.4) ≤ (27.1-26.3) , 0.8 =0.8 .

We have systematic errors in the experiment , when we take the reading on the meter stick may be not exactly correct .Then when we take the reference point on the meter stick may be not exactly.

When we made part 2 I think there is errors , when we put more mass on the spring then pull the mass and leave it may be it not parallel so it made angle.

When one of us push on the stop watch may be the push come late or early, while the mass oscillated the count may by is wrong.