# Spring Motion

Name_____ ID_____ TA_____

Partners_____

Date_____ Section_____

**Please treat all springs gently.**

**1. Finding spring constants** (*Use meters, kilograms, and newtons for the units*.)

- Spring 1

| Spring | From the floor to the bottom of hanger, $h_0$ | Hanging mass, $m$ | From the floor to the hanger after putting weight, $h$ | Displacement $s = h_0 - h$ | Spring constant $k_1 = mg/s$ |
|---|---|---|---|---|---|
| #1 | | 0.02 kg | | | |
| #1 | | 0.04 kg | | | |
| #1 | | 0.08 kg | | | |
| #1 | | 0.10 kg | | | |

Average and standard deviation of $k_1$ = (  ±  ) N/m **(1)**

- Spring 2

| Spring | From the floor to the bottom of hanger, $h_0$ | Hanging mass, $m$ | From the floor to the hanger after putting weight, $h$ | Displacement $s = h_0 - h$ | Spring constant $k_2 = mg/s$ |
|---|---|---|---|---|---|
| #2 | | 0.02 kg | | | |
| #2 | | 0.04 kg | | | |
| #2 | | 0.08 kg | | | |
| #2 | | 0.10 kg | | | |

Average and standard deviation of $k_2$ = (  ±  ) N/m **(2)**

- series

| Spring | From the floor to the bottom of hanger, $h_0$ | Hanging mass, $m$ | From the floor to the hanger after putting weight, $h$ | Displacement $s = h_0 - h$ |
|---|---|---|---|---|
| Both 1 & 2 in series | | 0.06 kg | | |

The spring constant for series connection, $k_{series} = mg/s$ = _____ N/m **(3)**

- parallel

| Spring | From the floor to the bottom of hanger, $h_0$ | Hanging mass, $m$ | From the floor to the hanger after putting weight, $h$ | Displacement $s = h_0 - h$ |
|---|---|---|---|---|
| Both 1 & 2 in series | | 0.15 kg | | |

The spring constant for series connection, $k_{parallel} = mg/s$ = _____ N/m **(4)**

☑ Confirmation of the theory

For series,
$k_1 k_2/(k_1 + k_2)$ [from **(1)** & **(2)**] = _____ N/m; $k_{series}$ [from **(3)**] = _____N/m

Are those results close each other considering the standard deviation?

For parallel,
$k_1 + k_2$ [from **(1)** & **(2)**] = _____ N/m; $k_{parallel}$ [from **(4)**] = _____N/m

Are those results close each other considering the standard deviation?

## 2. Periodic spring motion

- Amplitude dependence

Fixed mass, $m$ = 0.10 kg (100 g); Just put a 50-g weight since the hanger has already 50 g.

Fixed spring constant, $k_1$ = _____N/m ⇦ from the previous experiment

| Amplitude | Period |
|---|---|
| 0.02 m | |
| 0.04 m | |
| 0.06 m | |
| 0.08 m | |
| 0.10 m | |
| 0.12 m | |

- Mass dependence

Fixed amplitude, $A$ = 0.06 m (6 cm);

Fixed spring constant, $k_1$ = _____N/m ⇦ from the previous experiment

| Mass<br>Calculate the total mass | Period |
|---|---|
| Nothing + 0.05 kg (mass of the weight hanger) = 0.05 kg | |
| 0.02 kg + 0.05 kg (mass of the weight hanger) = | |
| 0.04 kg + 0.05 kg (mass of the weight hanger) = | |
| 0.06 kg + 0.05 kg (mass of the weight hanger) = | |
| 0.08 kg + 0.05 kg (mass of the weight hanger) = | |
| 0.10 kg + 0.05 kg (mass of the weight hanger) = | |

- Spring constant dependence

Fixed amplitude, $A$ = 0.06 m (6 cm);

Fixed mass, $m$ = 0.10 kg (100 g); Just put a 50-g weight since the hanger has already 50 g.

| Spring Constants | Period |
|---|---|
| $k_1$ = from the first part | |
| $k_{series}$ = from the first part | |
| $k_{parallel}$ = from the first part | |

**Questions & Discussions**

- Does the period of a spring motion depend upon its amplitude of motion? If so, how?
- Does the period of a spring motion depend upon the mass? If so, how?
- Does the period of a spring motion depend upon the spring constants, such as single, series, and parallel cases? If so, how?

**A Few Notes for the Experiment**

1. **Label which is spring 1 or 2 with masking tape.**
2. **For the second part of this lab (period of spring motion), make sure the following things.**

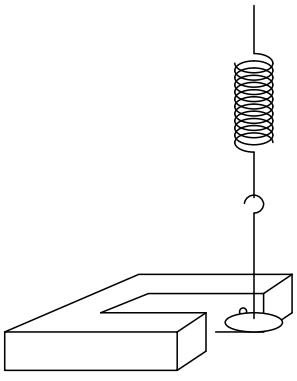

Fig. 1

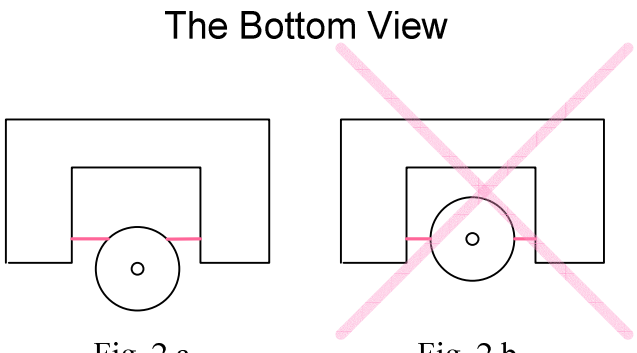


Fig. 2.a Fig. 2.b

The disk part of the weight hanger should be placed in the middle of the photo gate when it does not move (Fig.1). To obtain proper results, the disk part should be placed shown as Fig. 2.a.