Booklet # 46 B

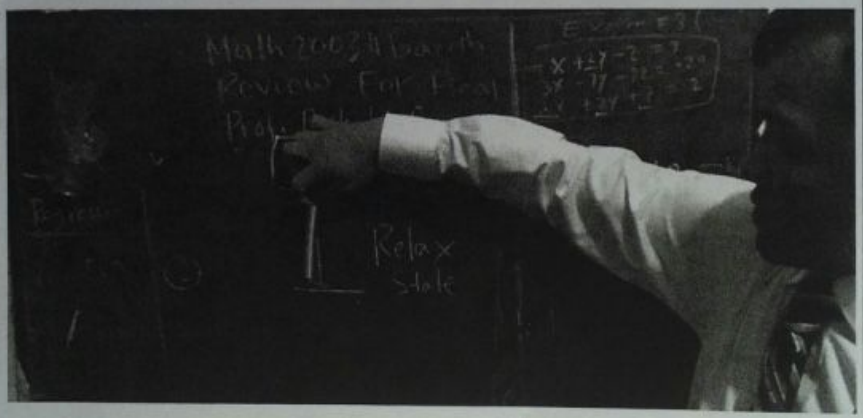
Unit: Work || Topic: Hooke's Law

Date: Dec 16, 2015 || Name: Answer key

Every action has equal & opposite reaction

1	Do-now: What is Newton's Third Law?
ex	Why Mr. Bari's bike moving forward? action B/c his bike wheels move backward & ground push it forward. Reaction $F_{wg} = -F_{gw}$ W = wheel (action) g = ground (Reacting)

2	What is Hooke's Law?

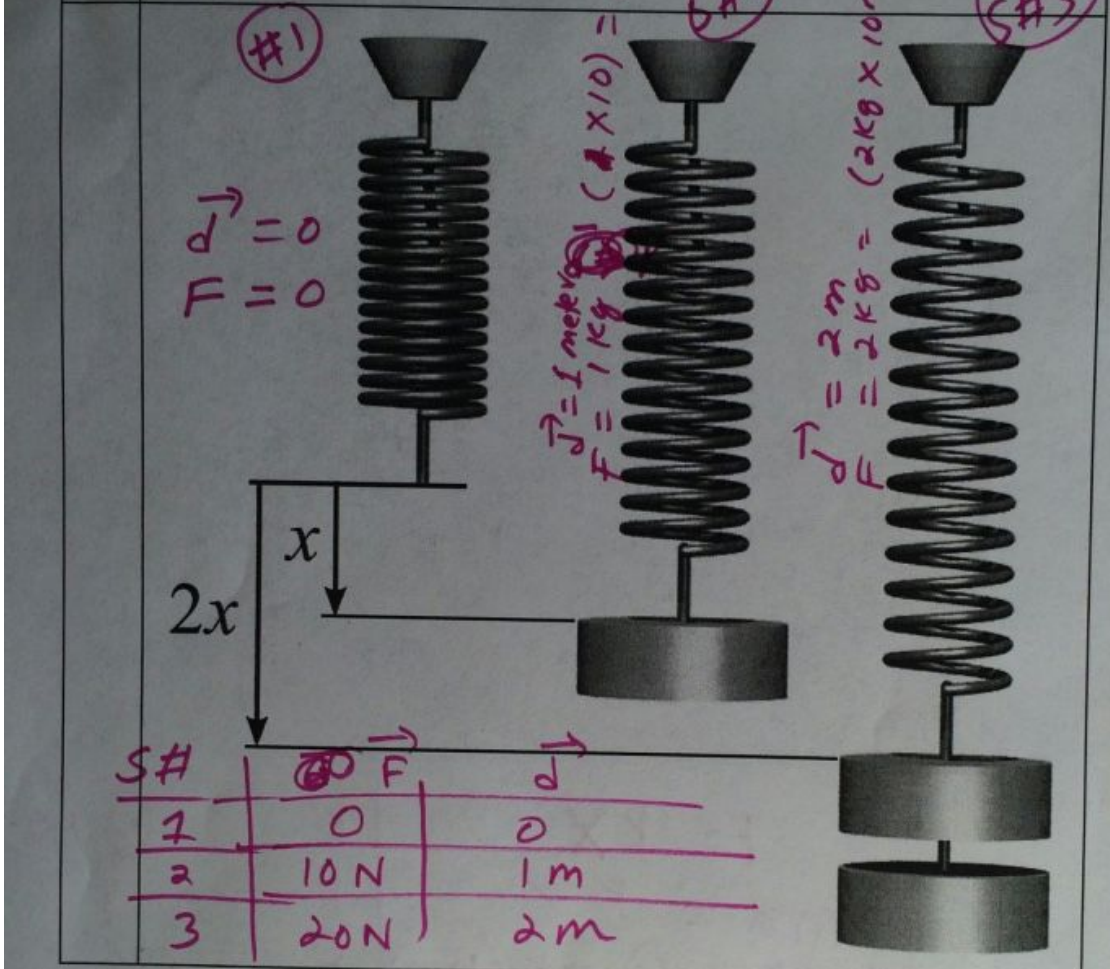


In physics, a force ($\vec{F}$) needed to apply ~~stretch a~~ s to extend/ compress a spring. This phenomena can be describe & explain by Newton 3rd Law. However, we will use the follow equation instead:

$$F = -Kx$$

This is known as Hooke's Law.

#3	Hooke's law: the force is proportional to the extension

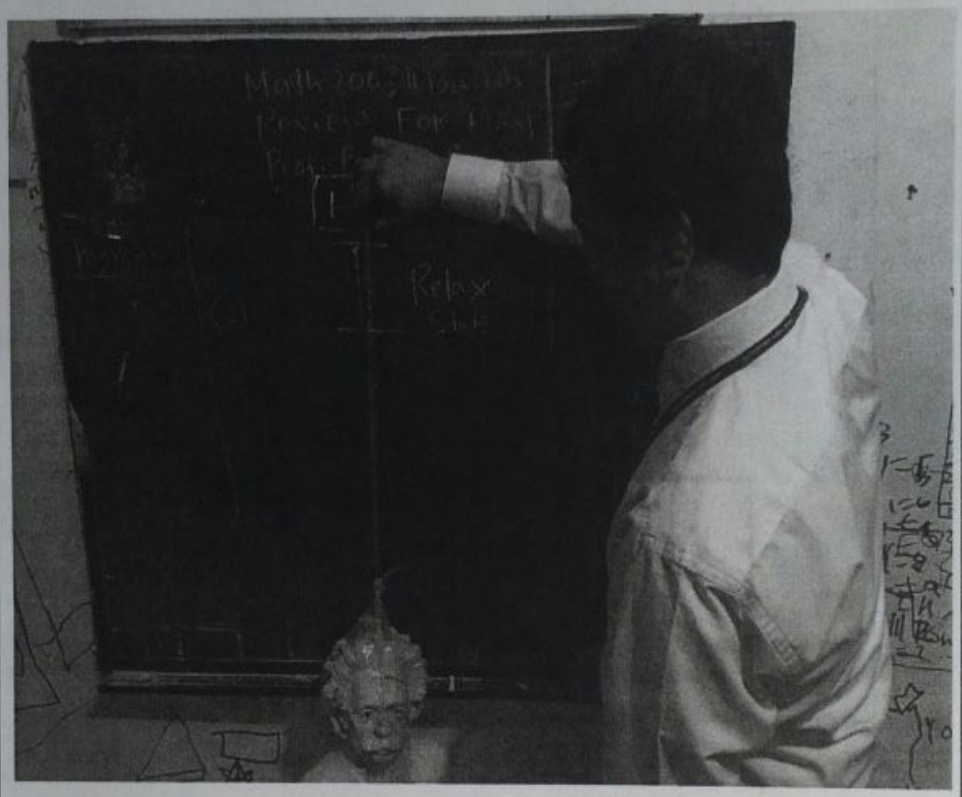


S#	$\vec{F}$	$\vec{d}$
1	0	0
2	10 N	1 m
3	20 N	2 m

#4	Example
	A mass of 1 Kg stretches a spring a distance 1 M. How far will 3 Kg stretch it?

3m

#5	A 200 g mass (Einstein Bust) stretches a spring 50 cm. What is the spring constant?



$F = kx$

$ma = kx$

$(.2\,kg)(10\,m/s^2) = k(.5\,m)$

$2N = k(.2\,m)$

$k = 4\,N/m$

K .2 kg.
H — 2
D — 20
B — 200 gram
D 5
C → 50 cm
M —

#6	How far will a force of 600 N stretches a spring with Spring constant 30000 N/m?

$$F = KX$$

$$600N = \frac{30{,}000N}{m} X$$

$$X = \frac{1}{50}$$

$$\boxed{X = .02}$$

#7	

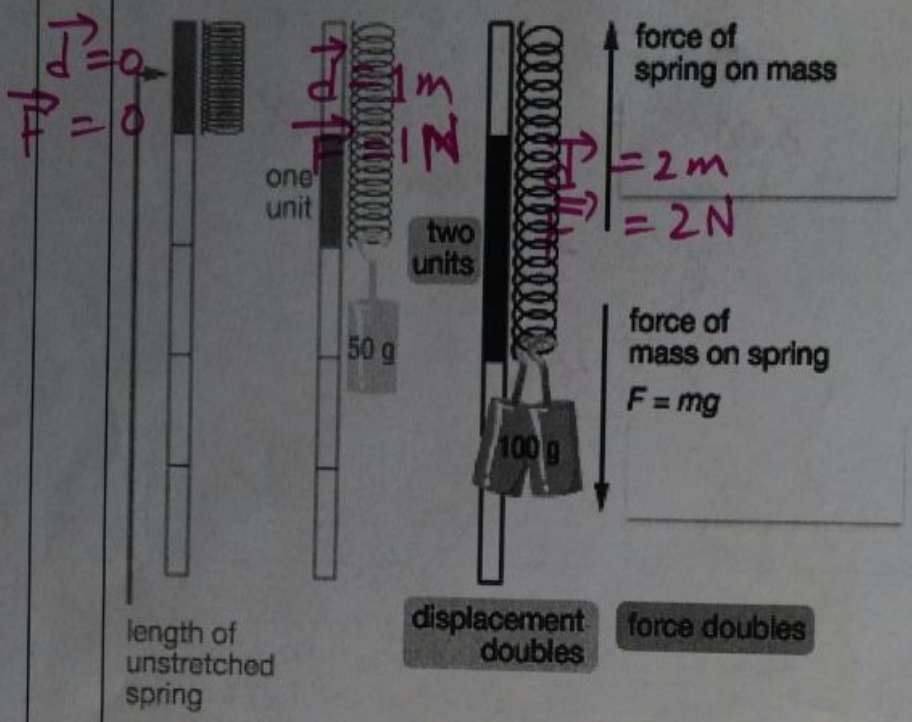
A force of 16 N is required to stretch a spring a distance of 40 cm from its rest position. What force (in Newtons) is required to stretch the same spring …

a. … twice the distance? $16N \times 2 = 32N$

b. … three times the distance? $16N \times 3 = 48N$

c. … one-half the distance? $16N \times \frac{1}{2} = 8N$

#8



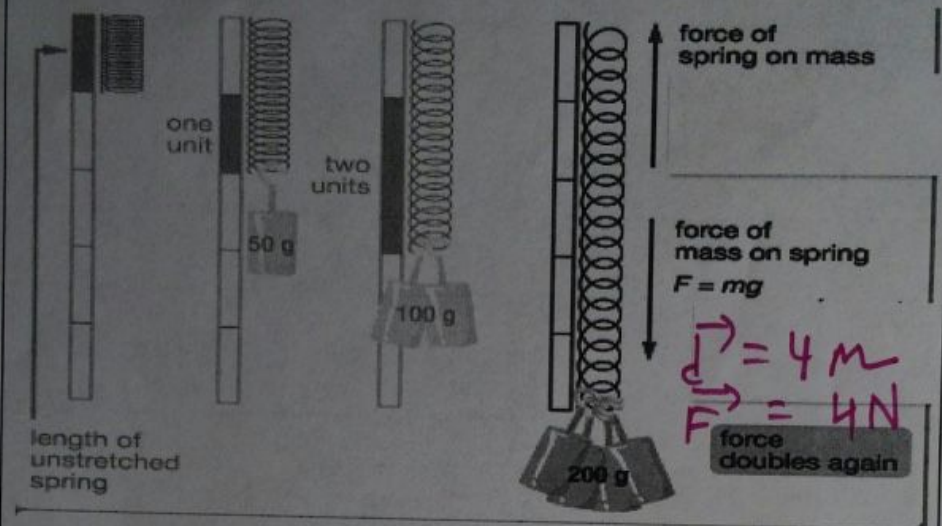
Hooke's law: the force of a spring is $\vec{F} = -k\vec{x}$, where k is the spring constant

Predict

$\vec{d}$ = 4 m

$\vec{F}$ = ?

#9	



Hooke's law: the force of a spring is $\vec{F} = -k\vec{x}$, where k is the spring constant

10	Theoretical Hypothesis

$H_0 = \vec{d} \propto \vec{F}$

Part # 2

#11	Lab Activity
	Take out a laptop Go to Bari Science Lab Click on Work & Energy Find Hook's LAw Simulation Click on it

#12	Lab Activity
	Hooke's Law Lab _____ **Lab Write-up** Purpose Procedure Data Calculations/Graph Questions Name Hour _____

Purpose:

1. To investigate Hooke's Law (The relation between **force** and **stretch** for a spring) F = -kx

2. To re-visit Newton's 3rd Law of Motion.

Discussion:

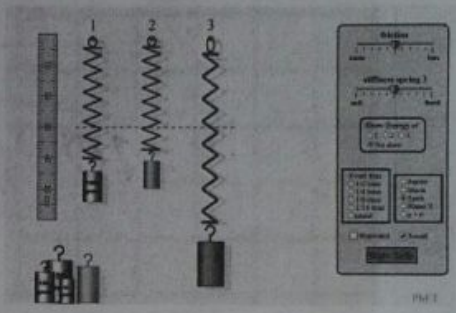
Everybody knows that when you apply a force to a spring or a rubber band, it stretches. A scientist would ask, "How is the force that you apply related to the amount of stretch?" This question was answered by Robert Hooke, a contemporary of Newton, and the answer has come to be called Hooke's Law.

Hooke's Law, believe it or not, is a very important and widely-used law in physics and engineering. Its applications go far beyond springs and rubber bands. You can investigate Hooke's Law by measuring how much known forces stretch a spring. A convenient way to apply a precisely-known force is to let the weight of a known mass be the force used to stretch the spring. The force can be calculated from

W = mg. The stretch of the spring can be measured by noting the position of the end of the spring before and during the application of the force.

Equipment:

Simulation "Springs and Masses" from
http://www.bari-science-lab.com/work-energy-and-momentum



Procedure:

1. Go to Bari Science Lab, Energy and Momentum and run Springs and Masses.

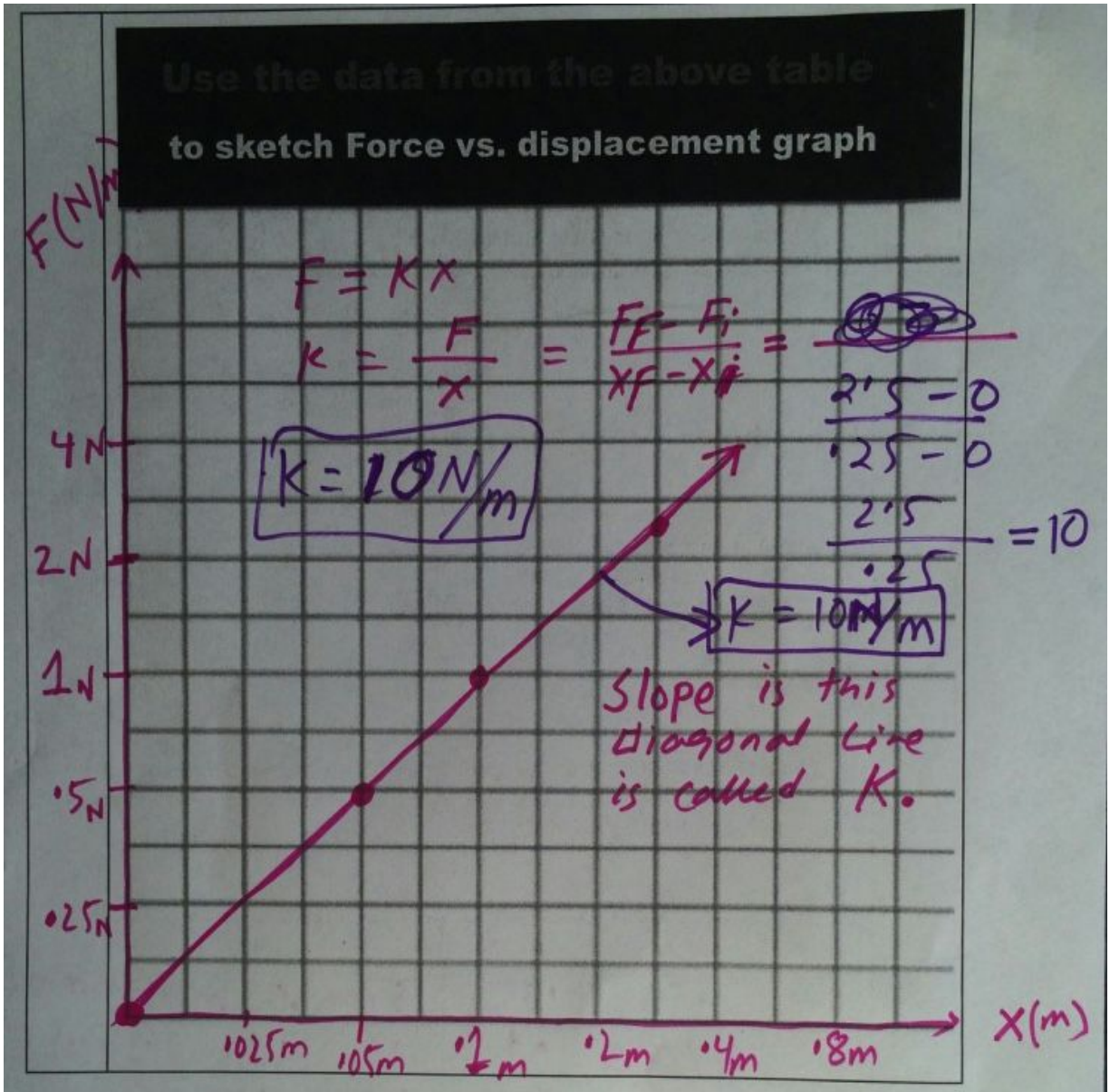
2. Construct a data table in lab book. You will need to record the mass that you hang from the spring and the change in position of the end of the spring before and after the mass is added.

Trial	Mass (g)	Mass(Kg)	D (cm)	D (m)	Force
#1	50 g	.05	5cm	.05 m	F=ma ⇒ (.05)(10) = .5N
#2	100g	.1	10	.1 m	(.1)(10) = 1N
#3	250	.25	25	.25	(25)X10 = 2.5N

K	.05	.1	.25
H	.5	1	2.5
D	5	10	25
B	50	100	250

.25	.1
2.5	1
25	10

D
C
M



X	F
·05	·5N
·1	1N
·25	2·5N
0	0

13	**Homework**

(1) QID: 327

The force applied by a spring is given by Hooke's law, $F = -kx$, where k is the spring constant. The force F is a constant force.

- true
- false

(2) QID: 328

Consider a spring-mass system. The F in Hooke's law, $F = -kx$, indicates _____.

- the force on the spring by the object
- the distance the spring is stretched
- the force by both the spring and the object on each other
- the force on the object by the spring