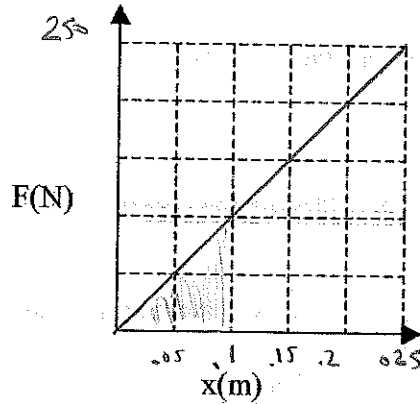


## Energy with Springs

*Answer*

1. Suppose in the lab, a group found that  $F = 1000N/mX$ . Construct a graphical representation of force vs. displacement. (Use the maximum displacement to be 0.25 m)



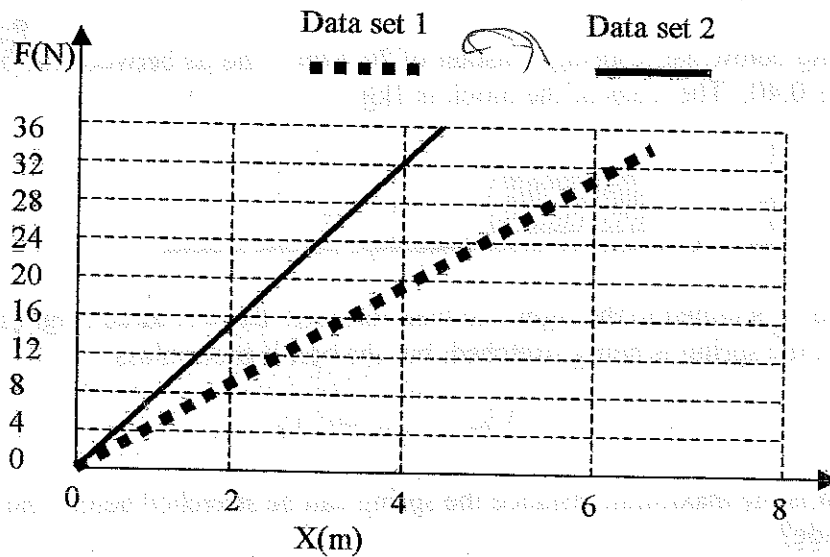
- 2a. Graphically determine the amount of work done while stretching the spring from 0 to 10cm.

$$\frac{1}{2}(100)(0.1)^2 = 5J$$

- 2b. Graphically determine the amount of work done while stretching the spring from 15cm to 25 cm.

20J

The graph below was made from data collected during an investigation of the relationship between the amount two different springs stretched, when different forces were applied.



3. For each spring, determine the spring constant. ( $k \rightarrow$  is the slope)

A 1

A 2

$$\frac{32}{4} = 8N/m$$

$$\frac{32}{4} = 8N/m$$

4. For each spring compare:

a. The amount of force required to stretch the spring 3 meters.

$$F = kx$$

$$F = \frac{15}{15N}$$

$$F = \frac{24}{24N}$$

Remains the same

b. The amount of work done on each spring to stretch it from 0 to 3 meters.

$$W = \frac{1}{2} kx^2$$

$$22.5J$$

$$W = \frac{1}{2} kx^2$$

$$36J$$

c. The amount of energy stored in each spring when stretched 3 meters.

$$22.5J$$

$$36J$$

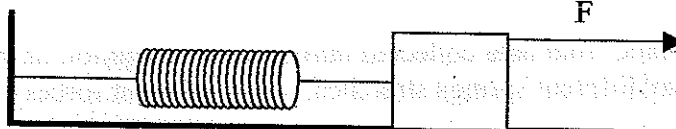
5a. Determine the distance in which spring 2 needs to be stretched in order to store 24 Joules of energy.

$$24 = \frac{1}{2} (8) x^2 \quad x = 2.45m$$

5b. How much work did it take to stretch spring 2 in order to store this energy?

$$24J$$

6. The spring below has a spring constant of 10 N/m. If the block is pulled 0.30 meters horizontally to the right, and held motionless, what force does the spring exert on the block (assume a frictionless surface)?

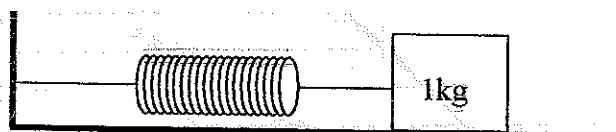


$$F = kx$$

$$(10)(0.3)$$

$$3N$$

7. The spring below has a spring constant of 20 N/m. The  $\mu$ s between the box and the ground is 0.40. The mass of the block is 1kg.



a. The box is pulled to the right and then released. Draw a force diagram of the box while the spring is being stretched, but the box is motionless.



b. What is the maximum distance the spring can be stretched before the block begins to slide?

$$F_f = F_s$$

$$\mu F_n = kx$$

$$(0.4)(9.8) = 20x$$

$$1.96m = x$$