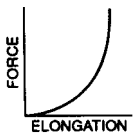
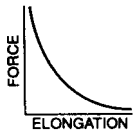
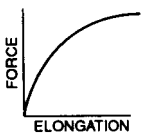
Practice - Springs and Pendula

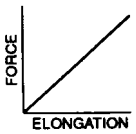
Name: _____ **Date:** _____

1. Which graph best represents the relationship between the elongation of a spring whose elastic limit has not been reached and the force applied to it?

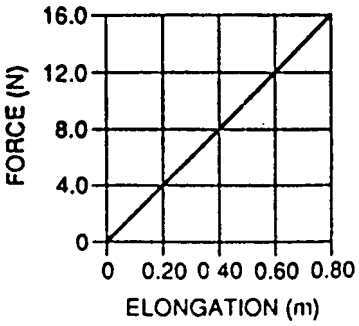
A. 

B. 

C. 

D. 

2. The graph represents the relationship between the force applied to a spring and the elongation of the spring. What is the spring constant?

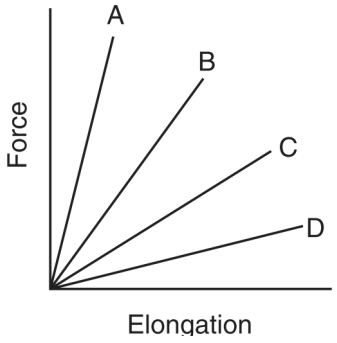


A. 20 N/m B. 9.8 N/kg

C. 0.80 N · m D. 0.050 m/N

3. The graph below represents the relationship between the force applied to a spring and spring elongation for four different springs.

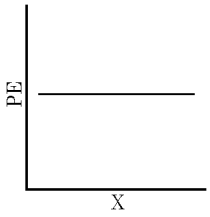
Force vs. Elongation

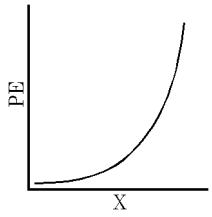


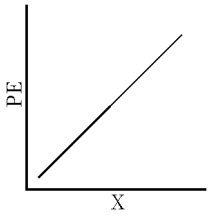
Which spring has the greatest spring constant?

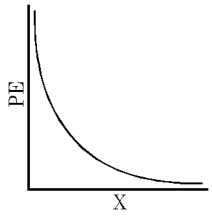
A. *A* B. *B* C. *C* D. *D*

4. Which graph below shown represents the relationship between the potential energy stored in a spring (PE) and the change in the length of the spring from its equilibrium position (*X*)?

A. 

B. 

C. 

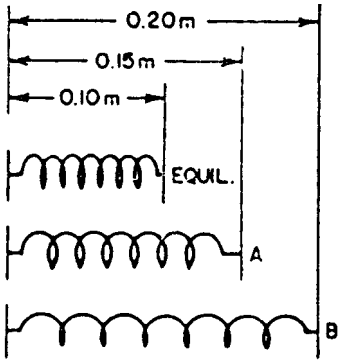
D. 

5. What is the spring constant of a spring of negligible mass which gained 8 joules of potential energy as a result of being compressed 0.4 meter?

A. 100 N/m B. 50 N/m

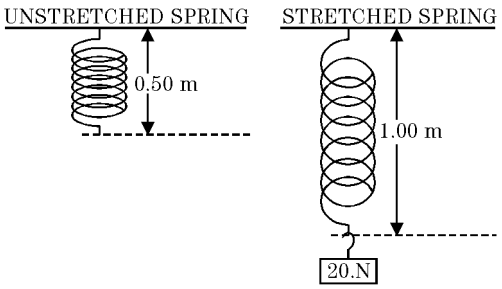
C. 0.3 N/m D. 40 N/m

6. A 0.10-meter spring is stretched from equilibrium to position *A* and then to position *B* as shown in the diagram. Compared to the spring's potential energy at *A*, what is its potential energy at *B*?



A. the same
B. twice as great
C. half as great
D. four times as great

7. A 20-newton weight is attached to a spring, causing it to stretch, as shown in the diagram. What is the spring constant of this spring?

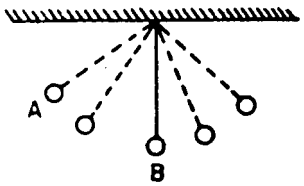


A. 0.050 N/m
B. 0.25 N/m
C. 20 N/m
D. 40 N/m

8. As a pendulum moves from the bottom of its swing to the top of its swing, the

A. kinetic energy of the pendulum increases
B. kinetic energy of the pendulum remains the same
C. potential energy of the pendulum decreases
D. potential energy of the pendulum increases

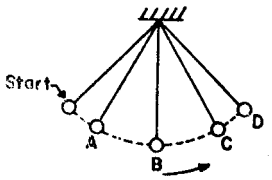
9. As the pendulum swings from position *A* to position *B* as shown in the diagram, what is the relationship of kinetic energy to potential energy? [Neglect friction.]



A. The kinetic energy decrease is more than the potential energy increase.
B. The kinetic energy increase is more than the potential energy decrease.
C. The kinetic energy decrease is equal to the potential energy increase.
D. The kinetic energy increase is equal to the potential energy decrease.

10. A pendulum swings as shown in the diagram. At which position is the kinetic energy of the pendulum bob *least*?

A. *A*
B. *B*
C. *C*
D. *D*



11. A person does 100 joules of work in pulling back the string of a bow. What will be the initial speed of a 0.5-kilogram arrow when it is fired from the bow?

A. 20 m/s
B. 50 m/s
C. 200 m/s
D. 400 m/s

12. When a spring is stretched 0.200 meter from its equilibrium position, it possesses a potential energy of 10.0 joules. What is the spring constant for this spring?

A. 100 N/m
B. 125 N/m
C. 250 N/m
D. 500 N/m

13. Spring *A* has a spring constant of 140 newtons per meter, and spring *B* has a spring constant of 280 newtons per meter. Both springs are stretched the same distance. Compared to the potential energy stored in spring *A*, the potential energy stored in spring *B* is

A. the same
B. twice as great
C. half as great
D. four times as great

14. A force of 0.2 newton is needed to compress a spring a distance of 0.02 meter. The potential energy stored in this compressed spring is

A. 8×10^{-5} J
B. 2×10^{-3} J
C. 2×10^{-5} J
D. 4×10^{-5} J

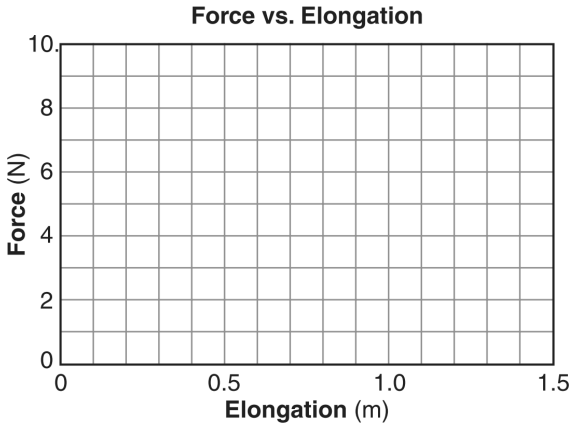
15. A 3.0-kilogram mass is attached to a spring having a spring constant of 30. newtons per meter. The mass is pulled 0.20 meter from the spring's equilibrium position and released. What is the maximum kinetic energy achieved by the massspring system?

A. 2.4 J B. 1.5 J C. 1.2 J D. 0.60 J

16. Base your answer(s) to the following question(s) on the information and data table below.

In an experiment, a student applied various forces to a spring and measured the spring's corresponding elongation. The table below shows his data.

Force (newtons)	**Elongation (meters)**
0	0
1.0	0.30
3.0	0.67
4.0	1.00
5.0	1.30
6.0	1.50



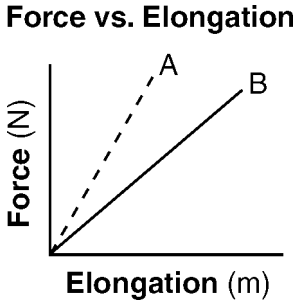
On the grid provided above, plot the data points for force versus elongation.

17. Draw the best-fit line.

18. Using your graph, calculate the spring constant of the spring. [Show all work, including the equation and substitution with units.]

19. Base your answer(s) to the following question(s) on the information and graph below.

The graph represents the relationship between the force applied to each of two springs, *A* and *B*, and their elongations.



What physical quantity is represented by the slope of each line?

20. Base your answer(s) to the following question(s) on the information and data table below

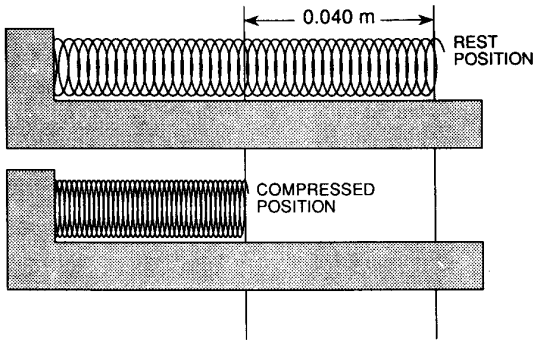
The spring in a dart launcher has a spring constant of 140 newtons per meter. The launcher has six power settings, 0 through 5, with each successive setting having a spring compression 0.020 meter beyond the previous setting. During testing, the launcher is aligned to the vertical, the spring is compressed, and a dart is fired upward. The maximum vertical displacement of the dart in each test trial is measured. The results of the testing are shown in the table below.

Data Table

Power Setting	Spring Compression (m)	Dart's Maximum Vertical Displacement (m)
0	0.000	0.00
1	0.020	0.29
2	0.040	1.14
3	0.060	2.57
4	0.080	4.57
5	0.100	7.10

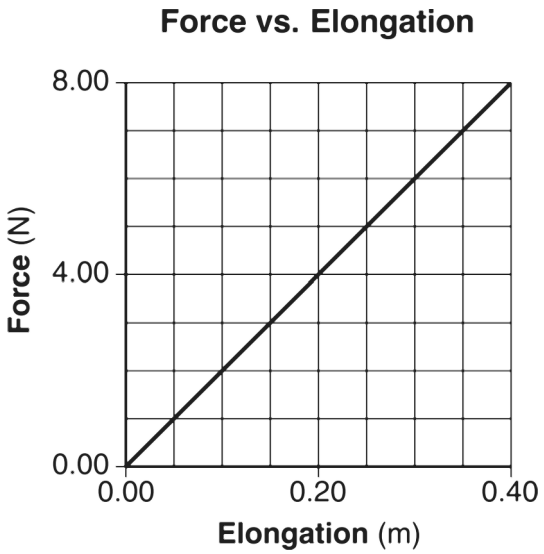
Determine the magnitude of the force, in newtons, needed to compress the spring 0.040 meter.

21. The diagram pictured shows a spring compressed by a force of 6.0 newtons from its rest position to its compressed position. Calculate the spring constant for this spring. [Show all calculations, including equations and substitutions with units.]



22. Base your answer(s) to the following question(s) on the information below.

A student produced various elongations of a spring by applying a series of forces to the spring. The graph below represents the relationship between the applied force and the elongation of the spring.



Determine the spring constant of the spring.

23. Calculate the energy stored in the spring when the elongation is 0.30 meter. [Show all work, including the equation and substitution with units.]

Practice - Springs and Pendula 2/27/2020

1.
Answer: D
Points: 1

2.
Answer: A
Points: 1

3.
Answer: A
Points: 1

4.
Answer: B
Points: 1

5.
Answer: A
Points: 1

6.
Answer: D
Points: 1

7.
Answer: D
Points: 1

8.
Answer: D
Points: 1

9.
Answer: D
Points: 1

10.
Answer: D
Points: 1

11.
Answer: A
Points: 1

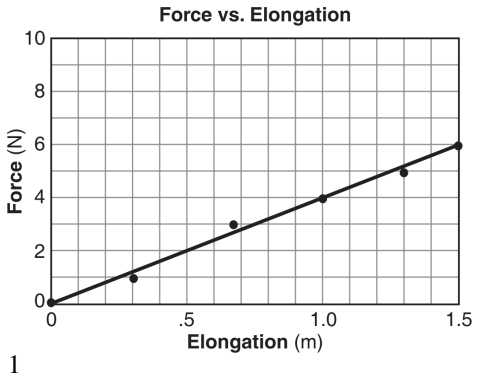
12.
Answer: D
Points: 1

13.
Answer: B
Points: 1

14.
Answer: B
Points: 1

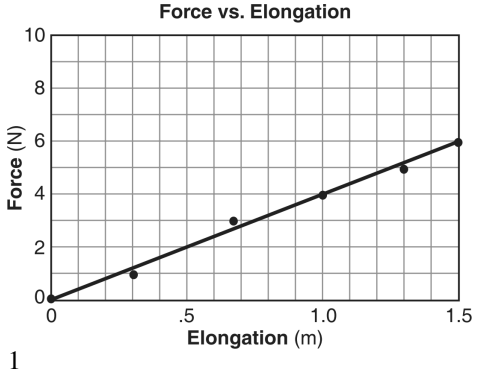
15.
Answer: D
Points: 1

16.
Answer:



Points: 1

17.
Answer:



Points: 1

18.
Answer: k= slope $k = \frac{\Delta F}{\Delta x}$ $k = \frac{4.0\,\text{N} - 2.0\,\text{N}}{1.0\,\text{m} - 0.5\,\text{m}}$
$k = 4.0\,\text{N/m}$
Points: 1

19.
Answer: The quantity represented by the slope of each line is the spring constant.
Points: 1

20.
Answer: 5.6 N
Points: 1

21.
Answer: $F = kx$; $60\,\text{N} = \text{k} \times (0.040)$; $k = 150 N/m$;
Points: 1

22.
Answer: 20. N/m
Points: 1

23.
Answer: PE_8 = Area = $\frac{1}{2}$bh; $PE_8 = 0.90\,\text{J}$
Points: 1