Lesson 11 - Elastic Objects Revision

Physics - KS3

Forces in Action

Mrs Wolstenholme

What are Elastic Objects?

Elastic objects undergo elastic deformation.

When a force is removed they return to their original shape.

Credit: Andy Saville

Why is a spring an elastic object?

Option 1

It changes shape permanently.

Option 2

It breaks.

Option 3

It returns to its original shape when the force is removed.

Option 4

It never changes shape.

What are Elastic Objects?

Explain why dough is not an elastic object?

When a **force** is exerted on the dough, it **changes shape**.

When the force is **removed** it **does not return** to its original shape.

This means it is **not elastic.**

Your Turn: What are Elastic Objects?

Explain why chewing gum is not an elastic object?

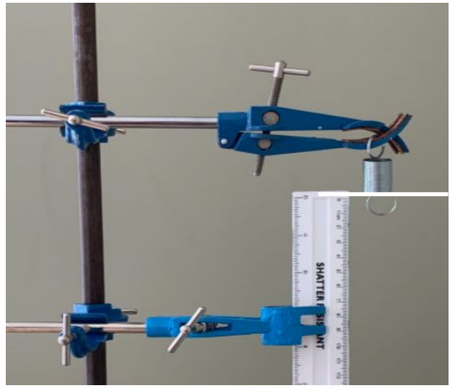
When a _____ is exerted on the chewing gum, it _____ shape.

When the force is removed it _____ return to _____.

This means it is _____.

The practical

Credit: Andy Saville



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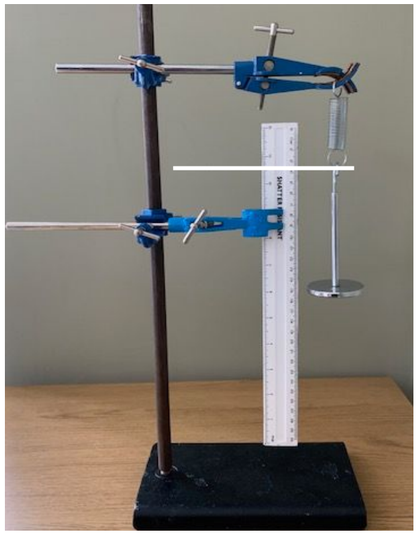
1. **Hang** a spring off a clamp and stand and **clamp** a ruler so the zero line is lined up with the bottom of the spring



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2. **Add** 100 g mass on the bottom of the spring

Force (N)	Extension (cm)			
	1	2	3	Mean
0	0			
10	12			
20	24			
30	36			
40	48			

3

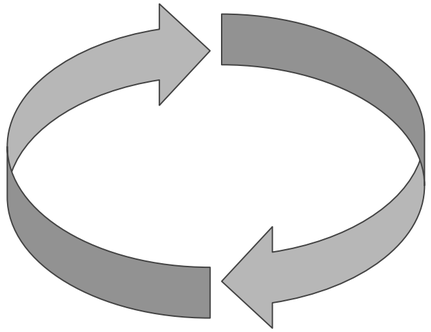
3. **Record** the measurement from the base of the spring

The practical

4

4. **Continue to add** 100 g masses and record the extension until you reach 800 g

5



5. **Remove** the masses and repeat twice

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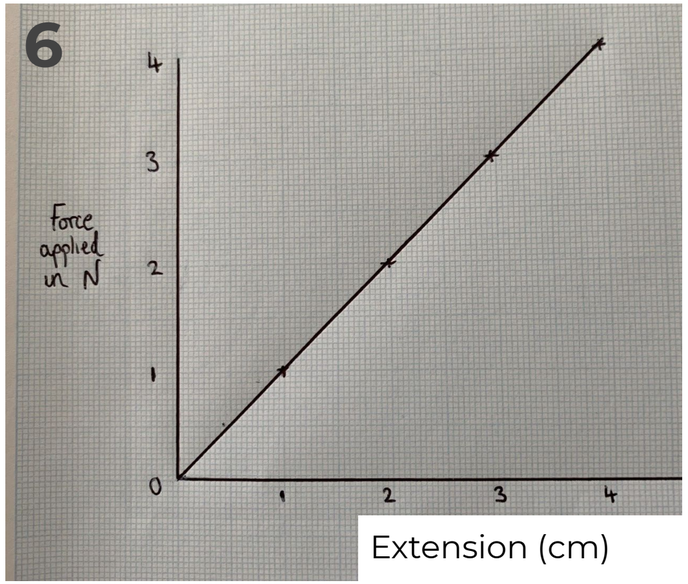


6. **Plot** a force vs Extension graph

Credit: Andy Saville

Put the method in the correct order

A **Add 100 g mass on the bottom of the spring**

B **Continue to add 100 g masses and record the extension until you reach 800 g**

C **Remove the masses and repeat twice**

D **Plot a force vs Extension graph**

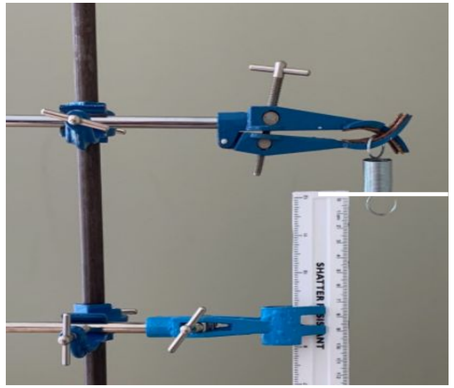
E **Hang a spring off a clamp and stand and clamp a ruler so the zero line is lined up with the bottom of the spring**

F **Record the measurement from the base of the spring**

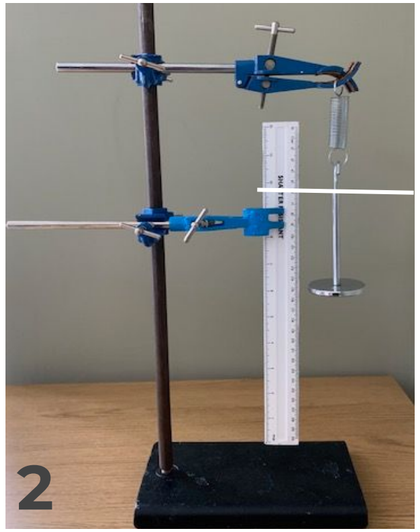
Independent Task: Fix this method

1. I hung my spring on the clamp stand and clamp the rule so that the zero line is lined up to the top of the spring.
2. Add a mass to the bottom of the spring
3. Record the measurement on the ruler
4. Keep adding masses
5. Plot a Force vs extension graph

Practice writing the method independently



1 Credit: Andy Saville



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Force (N)	Extension (cm)			
	1	2	3	Mean
0	0			
10	12			
20	24			
30	36			
40	48			

3

4

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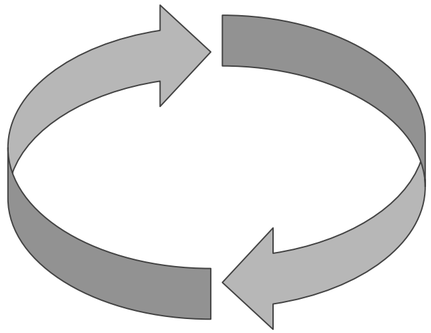

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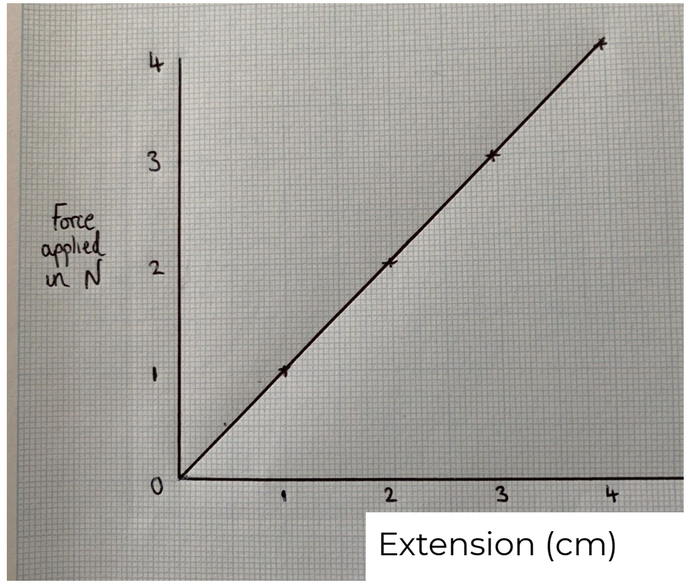
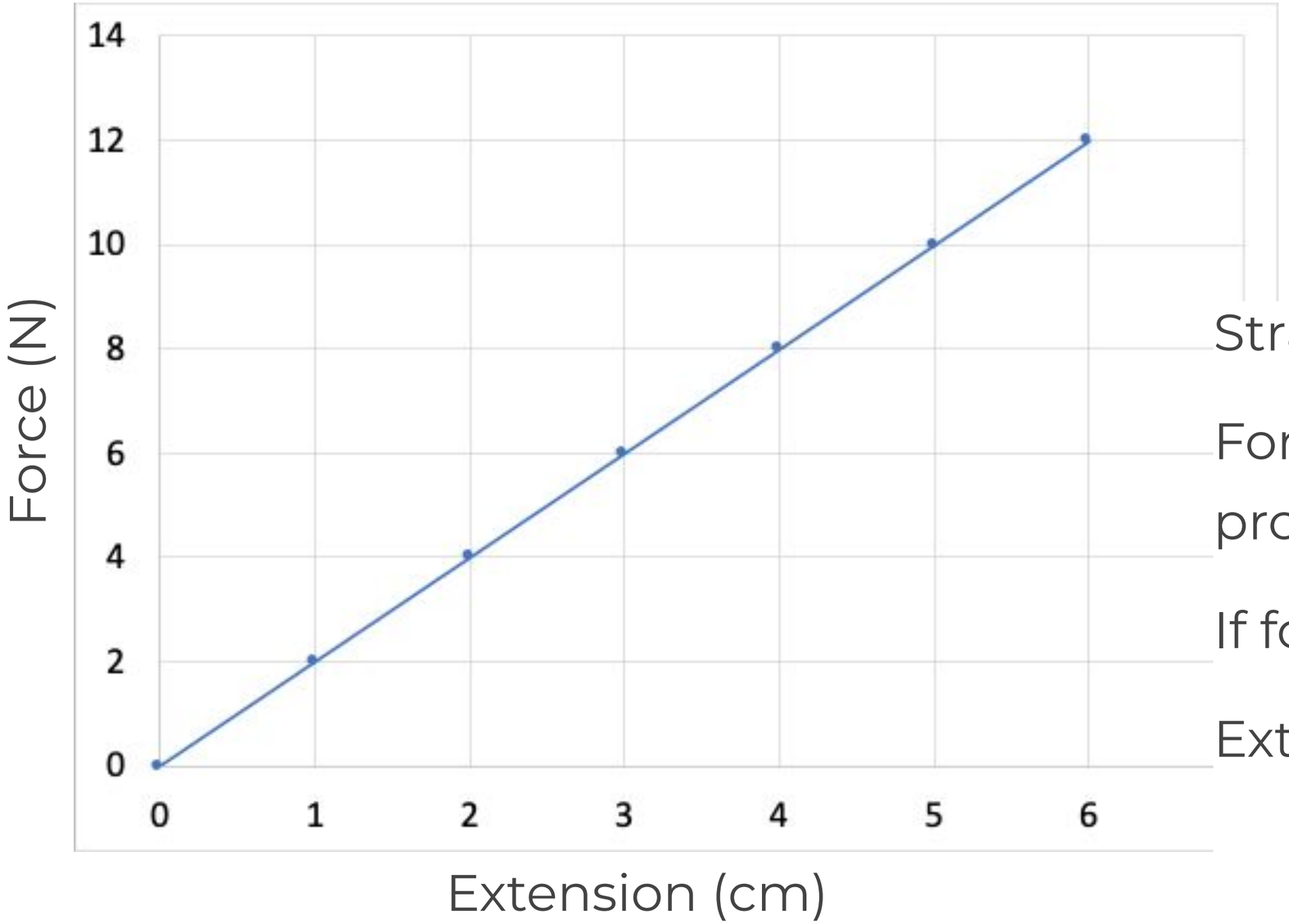




Straight line through the origin

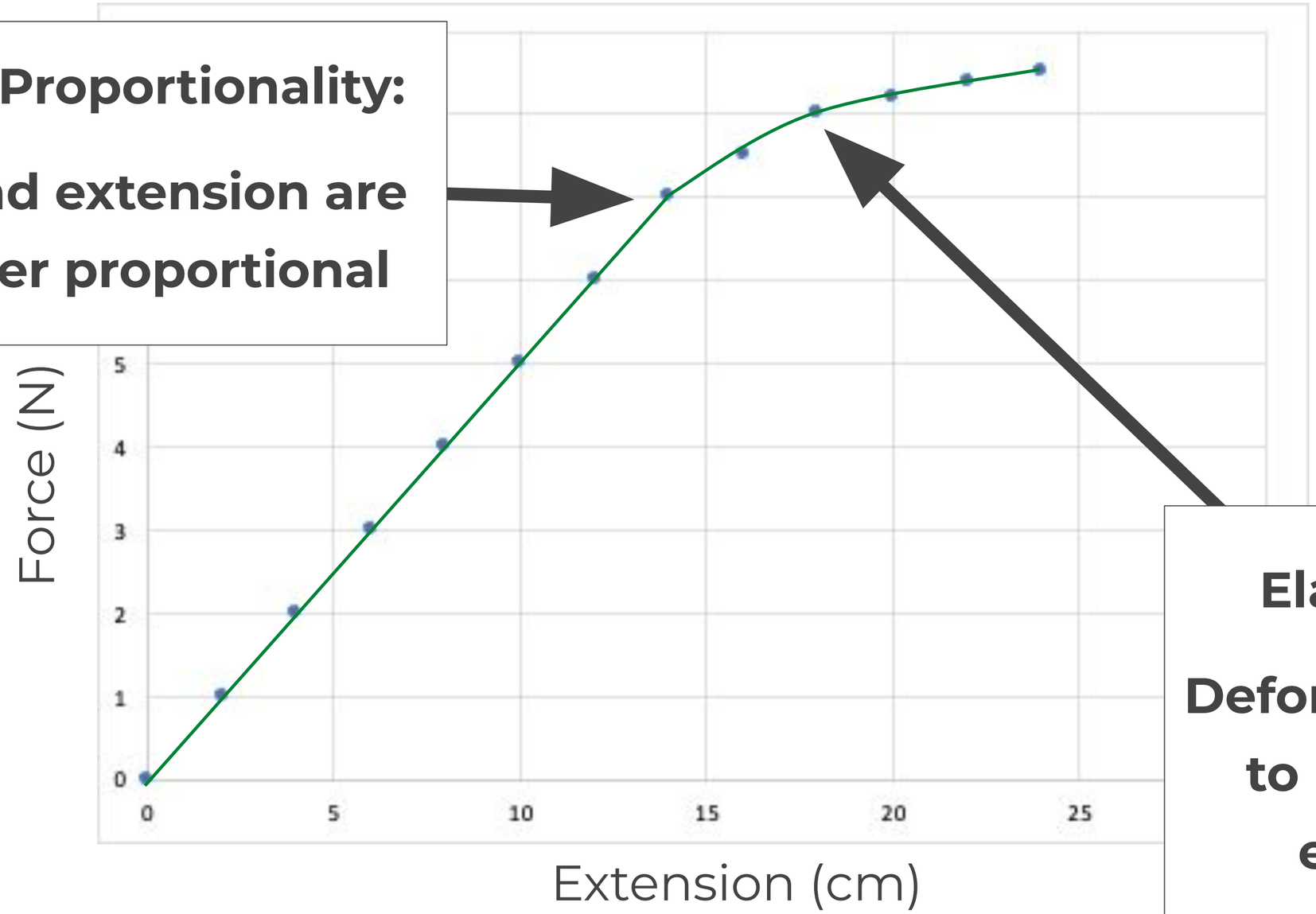
Force and extension are directly proportional

If force **doubles** (x2)

Extension **doubles** (x2)

Limit of Proportionality:

Force and extension are no longer proportional

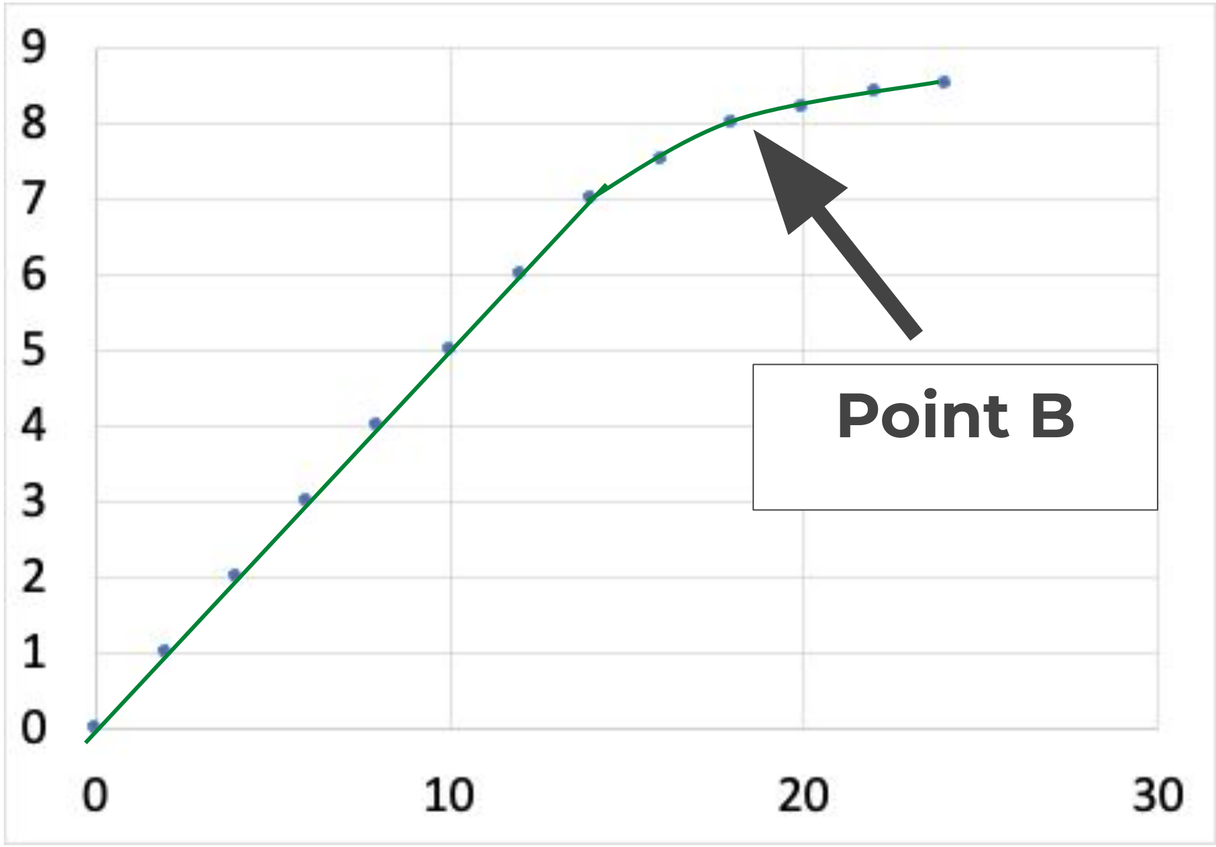


Elastic Limit:

Deformation leads to permanent extension

Independent Task

1. How do we know the object is elastic at the beginning?
2. In the straight line part, what happens to the extension if the force triples?
3. At what force is the limit of proportionality?
4. How can you tell?
5. What is point B?
6. What would happen if I let go of my spring after point B?



The Equation

Force	=	Spring constant	x	Extension
(N)		(N/m) (N/cm)		(m) (cm)

$$F = k \times e$$

Spring constant is the force required to change the length by 1 m.

The larger the force required to change the length, the larger the spring constant.

Write this equation in symbols

Force	=	Spring constant	x	Extension
(N)		(N/m) (N/cm)		(m) (cm)

Write the possible units underneath the words

Force = Spring constant x Extension

$$F = k \times e$$

F = k x e

Steps	Calculating Force Example: Calculate the force applied if there is an extension of 20 cm and the spring constant is 10 N/m
Check Units	Extension = 20 cm ÷ 100 = 0.2 m
Substitute into Equation	F = k x e F = 10 x 0.2
Rearrange	
Answer	F = 2 N

F = k x e

Steps	Calculating Force Example: Calculate the spring constant of a spring if there is an extension of 3 m with a force of 6 N
Check Units	
Substitute into Equation	F = k x e 6= k x 3
Rearrange	6 **÷ 3** = k x 3 **÷ 3** 6 **÷ 3** = k
Answer	k = 2 N/m

F = k x e

Steps	Calculating Force Example: Calculate the extension when an object with spring constant 40 N/m is pulled with a force of 400 N.
Check Units	
Substitute into Equation	F = k x e 400= 40 x e
Rearrange	400 ÷ **40** = 40 x e ÷ **40** 400 ÷ **40** = e
Answer	e=10 m

$F = k \times e$ Steps	Calculating Force: Calculate the force applied if there is an extension of 20 cm and the spring constant is 10 N/m	Calculating Spring Constant: A stress ball has a force of 4 N applied to it and is compressed by 0.01 m. Calculate the spring constant.	Calculating Extension: A spring has a force of 5.5 N applied to it and a spring constant of 11 N/m. Calculate the extension.
Check Units			
Substitute into Equation			
Rearrange			
Answer			

$F = k \times e$ Steps	Calculating Force : Calculate the force applied if there is an extension of 700 cm and the spring constant is 35 N/m	Calculating Spring Constant: A stress ball has a force of 45 N applied to it and is compressed by 0.1 m metres. Calculate the spring constant.	Calculating Extension: A spring has a force of 63 N applied to it and a spring constant of 2 N/m. Calculate the extension.
Check Units			
Substitute into Equation			
Rearrange			
Answer			

Well Done!