Lesson 8 - Hooke’s Law

Physics - KS3

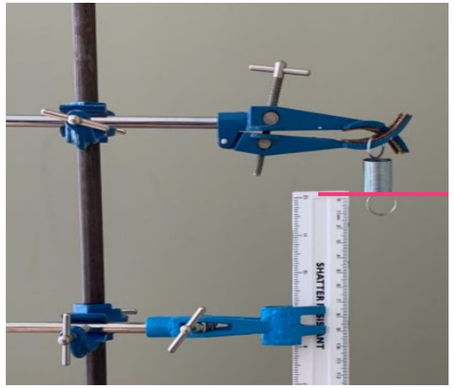
Forces in Action

Mrs Wolstenholme

Reminder

Elastic deformation: an object returns to its original shape when forces are removed

Reminder



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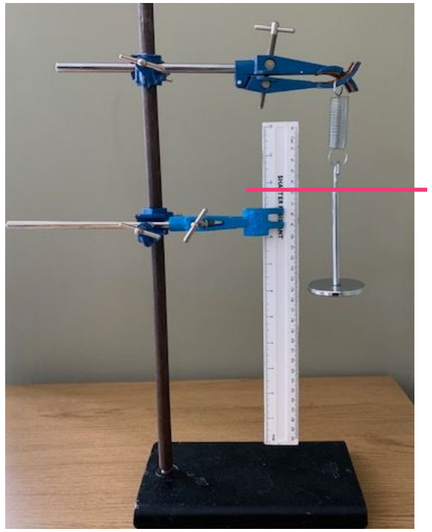


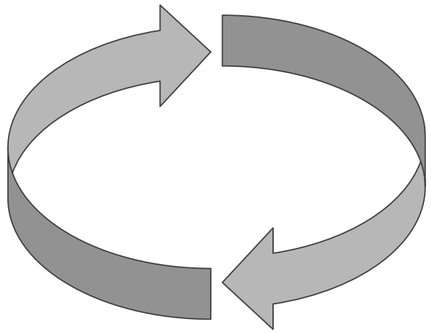
2

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

3

4

5



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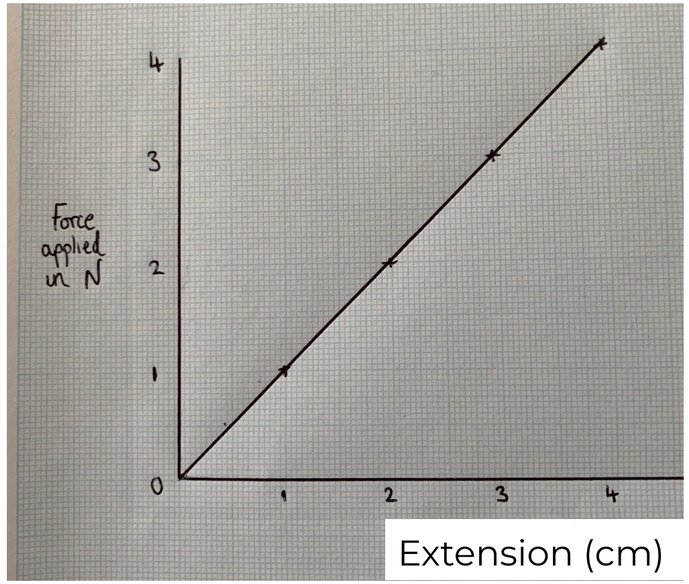
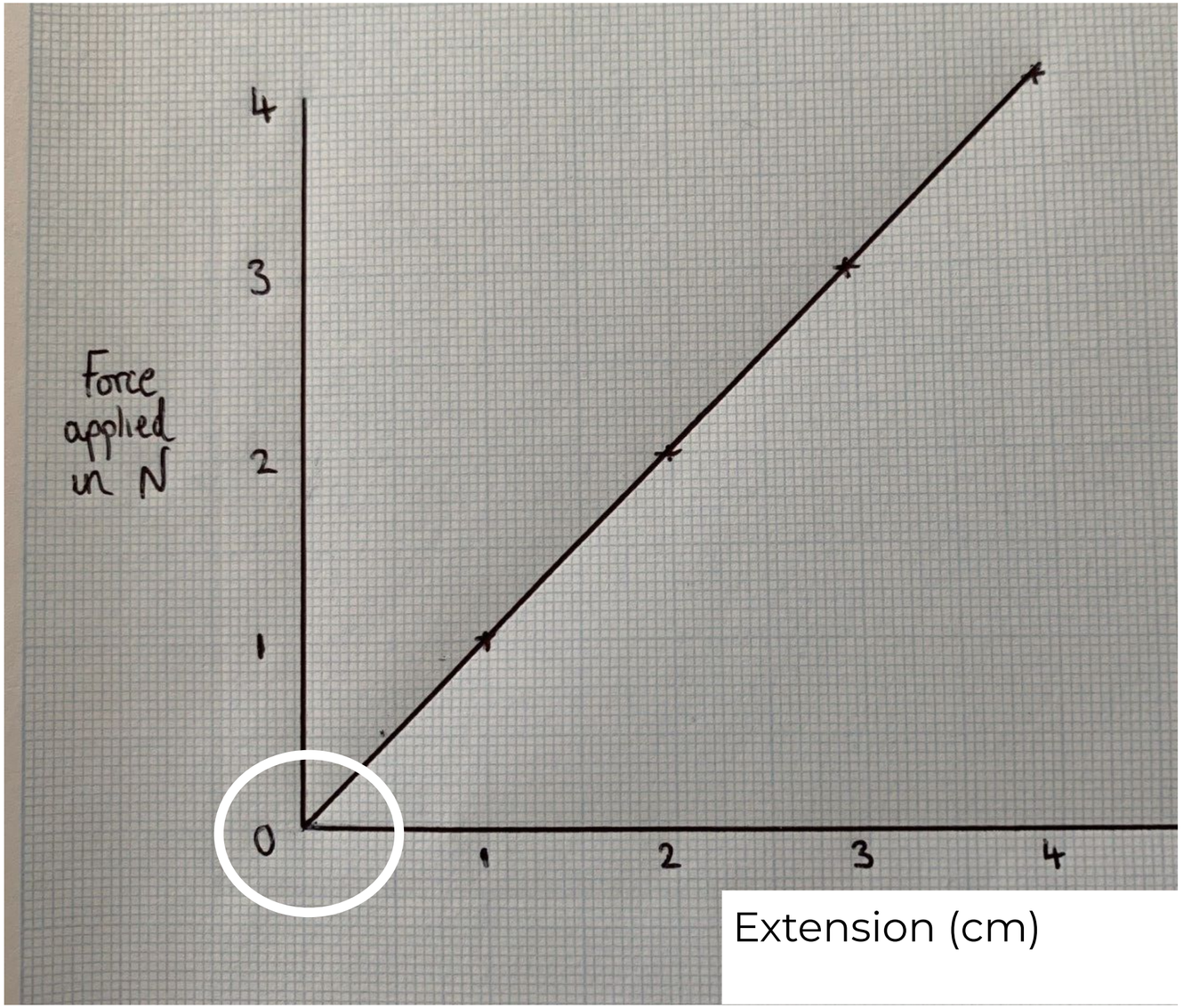


Credit: Andy Saville



Straight line through the origin

Force is Directly Proportional to Extension

And

Extension is Directly Proportional to Force

What does this mean?

If force **doubles** (x2)

Extension **doubles** (x2)

If extension **triples** (x3)

Force **triples** (x3)

If force is **divided by 4**

Extension is **divided by 4**

Fill in the missing number

Force (N)	Extension (cm)
0	0
2	5
4	10
6	?
8	20

Fill in the missing number

Force (N)	Extension (cm)
0	0
3	10
?	20
9	30
12	40

A spring has an extension of 4 cm with a force of 2 N. What will the extension be when the force is 8 N?

32 cm

8 cm

2 cm

16 cm

A spring has an extension of 4 cm with a force of 2 N. What force is needed for the extension to be 12 cm?

6 N

1 N

8 N

4 N

A spring has an extension of 4 cm with a force of 2 N. What force is needed for the extension to be 2 cm?

6 N

1 N

8 N

4 N

Complete the task

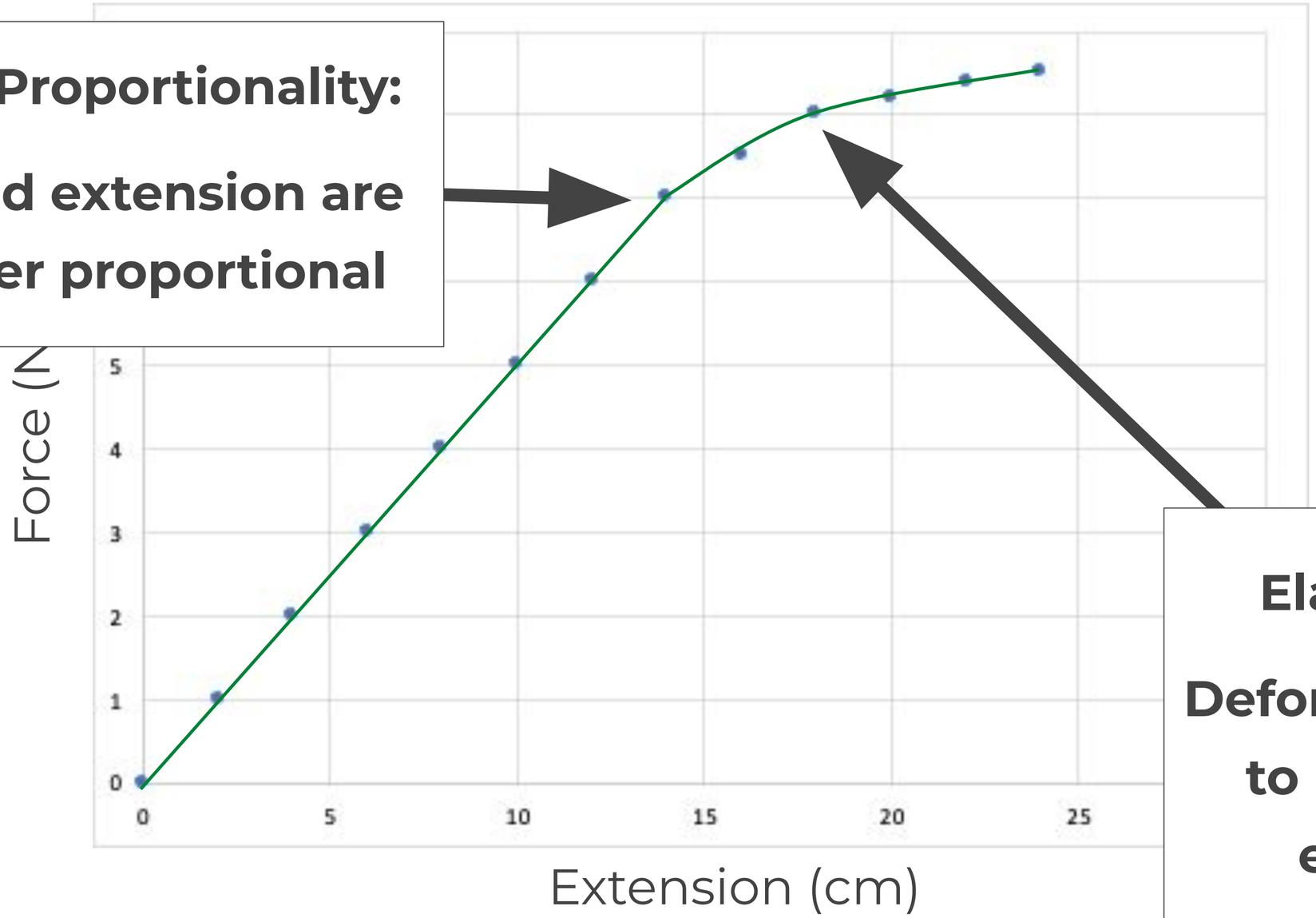
Force and extension

For an elastic object, force and extension are _____ proportional.

This means if force is halved, extension is _____
If extension is doubled, force is _____

Limit of Proportionality:

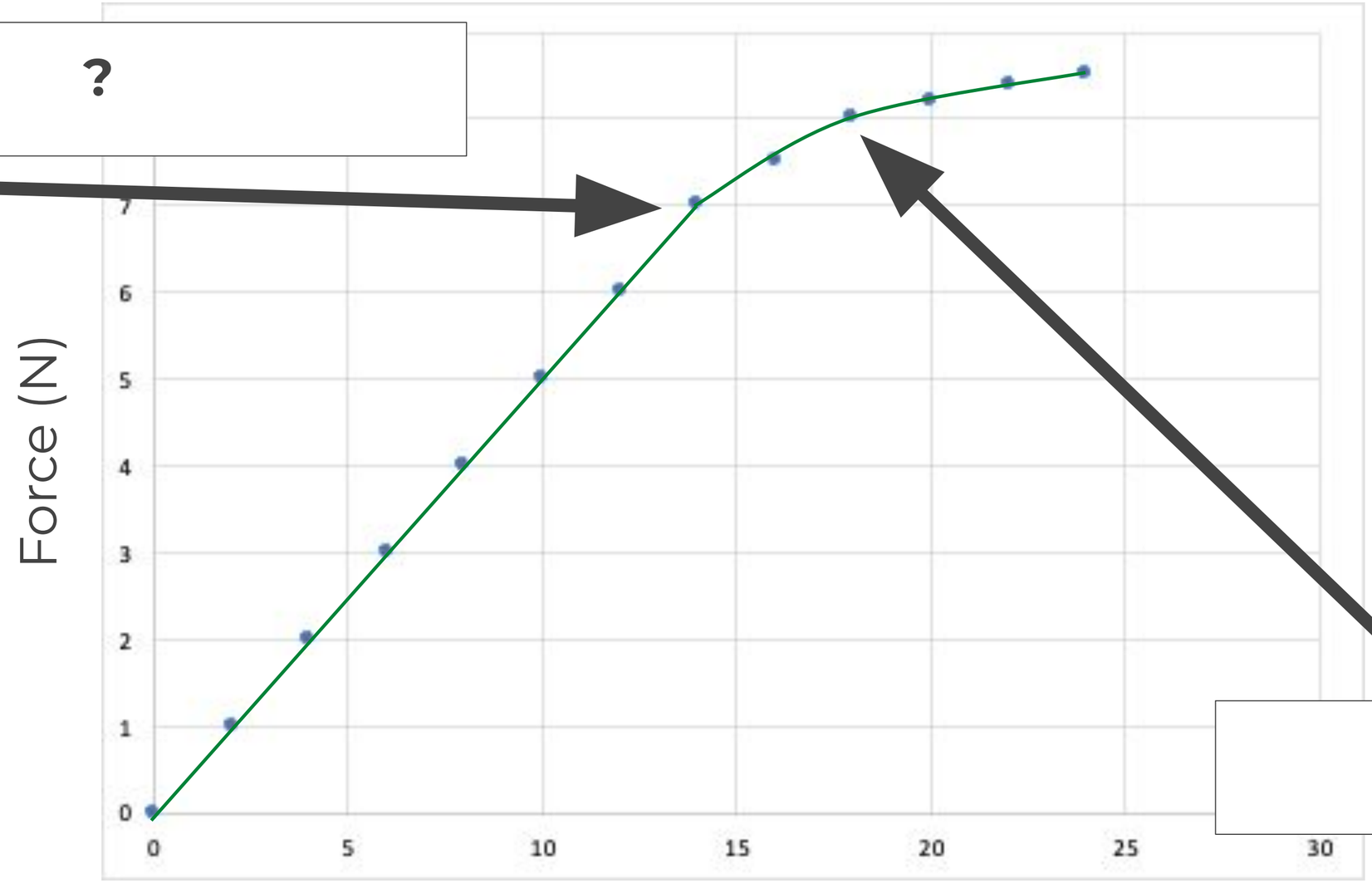
Force and extension are no longer proportional



Elastic Limit:

Deformation leads to permanent extension

?

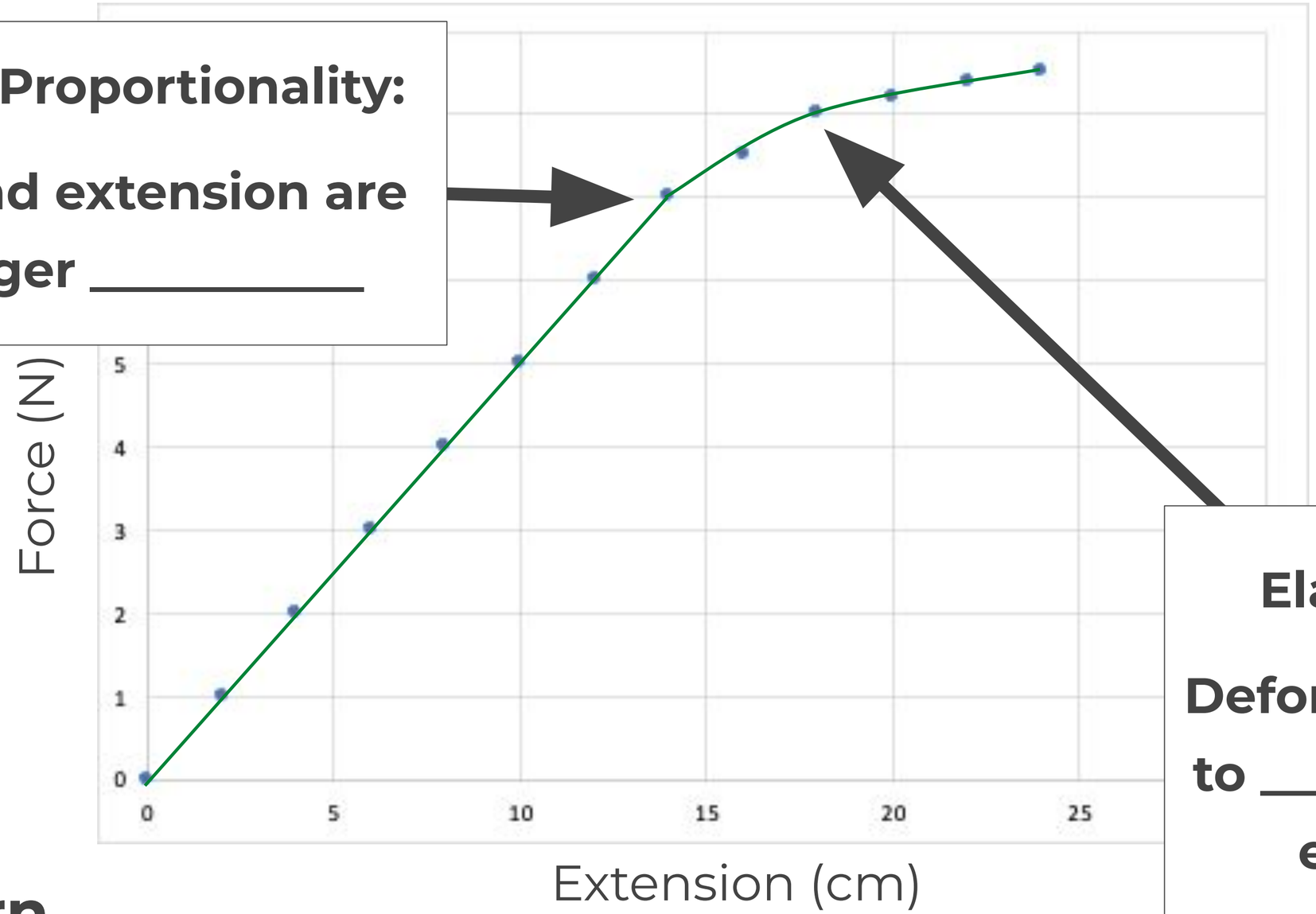


?

Your turn

Limit of Proportionality:

Force and extension are no longer _____



Elastic Limit:

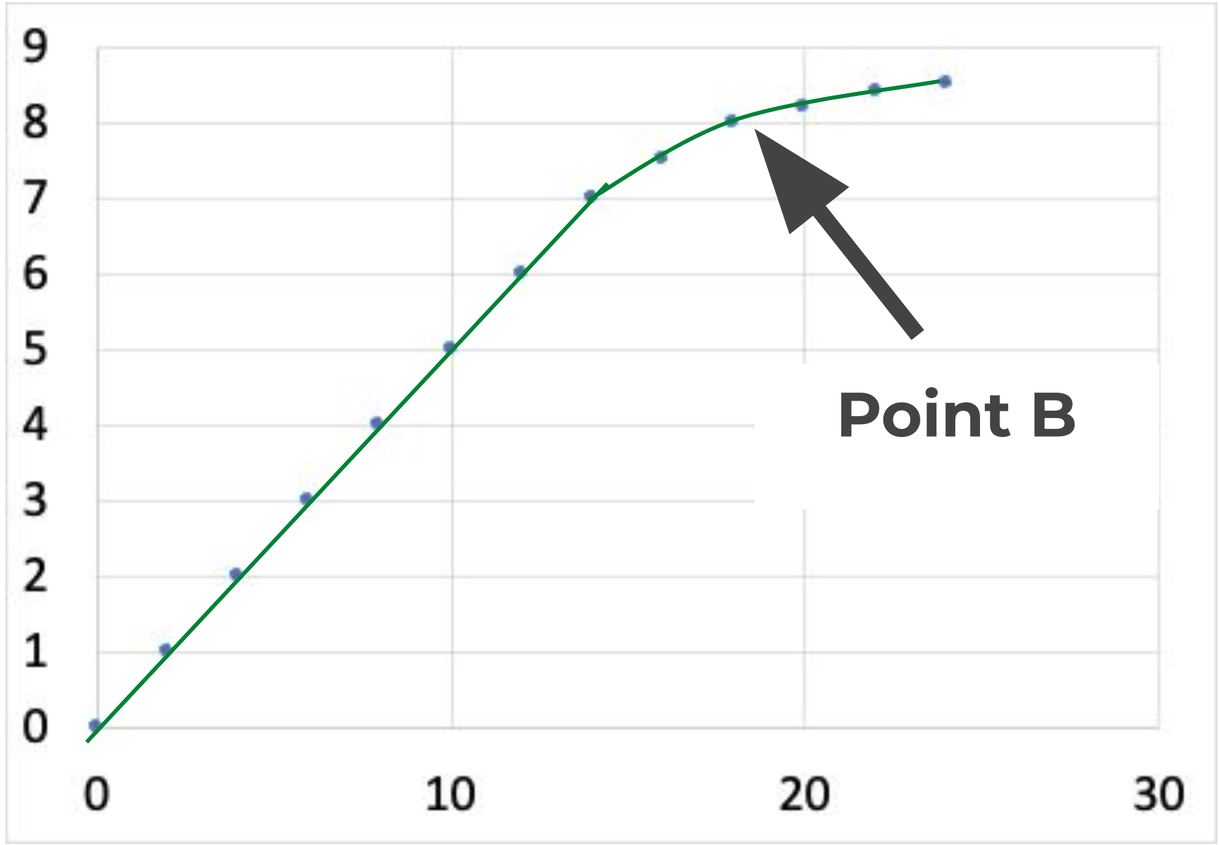
Deformation leads to _____ extension

Your turn

Independent Task

Look at the graph:

1. At what force is the limit of proportionality?
2. How can you tell?
3. What is point B?
4. What would happen if I let go of my spring after point B?



What does F stand for in F = k x e ?

Force

Extension

Feet

Spring constant

What does k stand for in F = k x e ?

Force

Extension

Feet

Spring constant

What does e stand for in F = k x e ?

Force

Extension

Feet

Spring constant

What are the units for spring constant (k)?

N

N/cm

N/m

m

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

Calculate the force applied to a spring that stretched 0.2 m and has a spring constant of 10 N/m

F = k x e

F = 10 x 0.2

F = 2 N

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

Your turn:

Calculate the force applied to stretch a spring with a spring constant of 16 N/m by 0.25 m

$F = k \times e$

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

Calculate the force applied to stretch a spring with a spring constant of 5 N/m by 40 cm.

÷100

cm → m

e = 40 cm ÷ 100 = 0.4 m

F = k x e

F = 5 x 0.4

F = 2 N

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

Your Turn:

Calculate the force applied to stretch a spring with a spring constant of 5 N/m by 20 cm.

Step 1: Change the extension to m

Step 2: Calculate force

÷100

cm → m

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

Your Turn:

Calculate the force applied if there is an extension of 30 cm and the spring constant is 40 N/m

÷100

cm → m

Independent Practice

1. A spring has a spring constant of 5 N/m and extends by 0.3 m. Calculate the force needed to make this happen.

2. A spring has a spring constant of 7.5 N/m and extends by 0.45 m. Calculate the force needed to make this happen.

3. A spring has a spring constant of 13 N/m and extends by 0.7 m. Calculate the force needed to make this happen.

4. An elastic band stretches. It has a spring constant of 10 N / m and extends by 15 cm when a force is applied to it. Calculate the force needed to cause this extension.

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

A spring has a force of 2.1 N applied to it and a spring constant of 0.3 N / m. Calculate the extension.

F = k x e

2.1 **÷ 0.3** = 0.3 x e **÷ 0.3**

7 = e

e = 7 m

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

A rubber ball has a force of 2 N applied to it and is compressed by 0.04 metres. Calculate the spring constant.

$F = k \times e$

$2 \div \mathbf{0.04} = k \times 0.04 \div \mathbf{0.04}$

$50 = k$

$k = 50$ N/m

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

Your Turn:

A spring has a force of 4.6 N applied to it and a spring constant of 4.3 N / m. Calculate the extension.

Independent Practice

1. A spring has a force of 7.3 N applied to it and a spring constant of 2 N / m. Calculate the extension.

2. A spring has a force of 6 N applied to it and is compressed by 0.2 metres. Calculate the spring constant.

3. A spring has a force of 4.5 N applied to it and extends by 0.08 metres. Calculate the spring constant.

Well Done!!