

Force and Extension of a Spring

Aim: investigate how the **force** on a spring affects its **extension**.

Apparatus — tick each item as you add it to your diagram

draw your set-up here

Use these to draw your set-up:

☐ clamp stand

☐ boss & clamp

☐ spring

☐ metre ruler

☐ mass hanger & 50 g masses

☐ set square

Method — fill in the gaps

1. Measure the _____ of the spring with a ruler.

2. Add a 50 g mass onto the spring.

3. Calculate the force: $F = m \times g = 0.050 \text{ kg} \times 9.8 = \text{_____ N}$

4. Measure the _____ of the spring with a ruler.

5. Calculate the extension: extension = _____ - _____

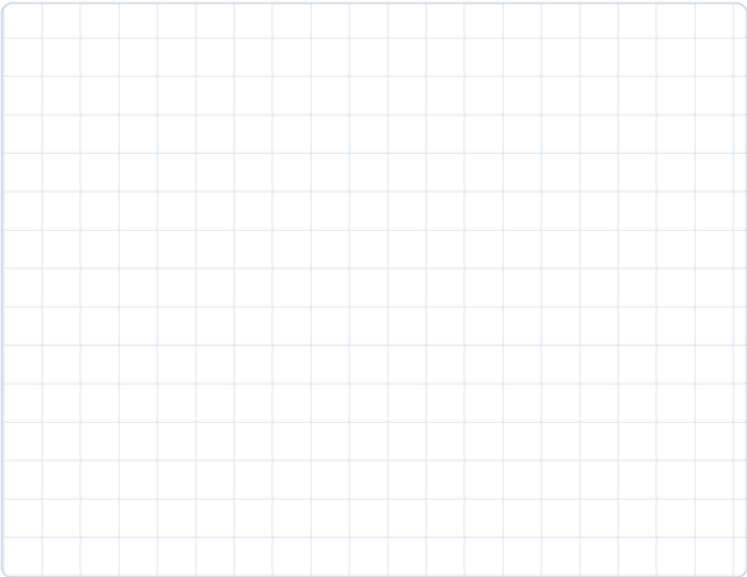
6. Add another 50 g mass onto the spring and repeat steps 2–5, five more times.

7. Plot a graph of _____ (y) against _____ (x).

Results

mass / g	Force / N	original length / cm	stretched length / cm	extension / cm

Graph



Conclusion

SENTENCE STARTER

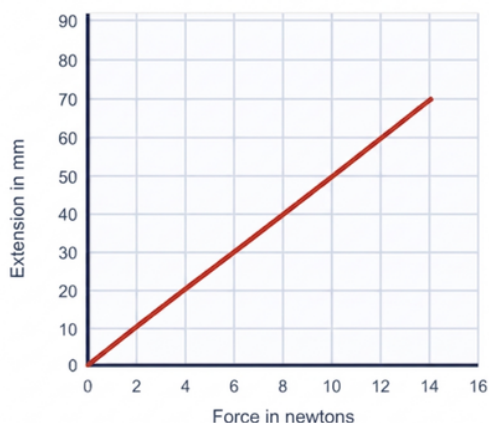
The _____ is / is not directly proportional to the _____, because the graph is / is not a _____ through the _____, up to the limit of proportionality at _____ N.

Calculations and Elastic Potential Energy

Hooke's Law

 F in N · k in N/m · e in m

Elastic Potential Energy

 E_e in J · k in N/m · e in m


Spring constant, k — the gradient

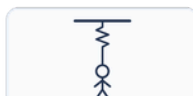
Energy stored — the area under the line

Elastic or Inelastic?

Elastic deformation

Inelastic deformation

Elastic Potential Energy



stretched bungee

☐


bent ruler

☐


springs on a toy

☐

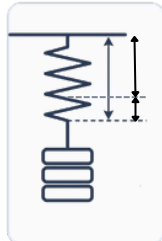

moulded plastic

☐

Tick the ones that store elastic potential energy. Define *elastic*:

☐ used "original length" ☐ used "deforming force"

Exam-Style Questions



Question 1

[4 marks]

The spring above has the force–extension line shown in the graph.

- (a) State Hooke's law. (2)
 (b) Calculate the force needed to give an extension of 50 mm. (2)



Question 2

[3 marks]

A different spring is stretched further. The line begins to curve at point P.

- (a) Name point P. (1)
 (b) Explain what happens to the spring beyond point P. (2)
