STEM SMART Phase One, 2022

Physics Week 9 – Springs & Materials

https://isaacphysics.org/gameboards#smart_p_1_9

Essential GCSE Physics 37.3

GCSE - Practice (P1)
A Level - Practice (P1)

A company is making Newton meters using $150\,\mathrm{N/m}$ springs.

Part A $10\,\mathrm{N}$ mark

How far from the $0.0\,\mathrm{N}$ mark will the $10\,\mathrm{N}$ mark need to be?

Part B Distance between $4.0\,\mathrm{N}$ and $9.0\,\mathrm{N}$

How far apart will the $4.0\,\mathrm{N}$ and $9.0\,\mathrm{N}$ marks will be on the Newton meter?

Essential Pre-Uni Physics B6.4

A Level - Practice (P1)

A brass pin has a cross sectional area of $0.50\,\mathrm{cm}^2$. Brass has a tensile strength of $190\,\mathrm{MPa}$. Calculate the maximum tensile force it ought to be able to withstand without breaking.

Essential Pre-Uni Physics B6.5

A Level - Practice (P1)

Mild steel has a breaking strength of $500\,\mathrm{MPa}$. If you want to support a $200\,\mathrm{kg}$ piano using a single steel wire, what is the minimum diameter of wire you require? Give your answer to 2 significant figures.

Essential Pre-Uni Physics B7.2

GCSE - Practice (P1)
A Level - Practice (P1)

A spring of natural length $10.0\,\mathrm{cm}$ and spring constant $4.00\,\mathrm{N\,cm^{-1}}$ has a load of $22.0\,\mathrm{N}$ placed on it. What is its new length?

Essential Pre-Uni Physics B7.3

GCSE - Practice (P1)
A Level - Practice (P1)

If a spring of natural length $1.50\,\mathrm{cm}$ stretches to $1.65\,\mathrm{cm}$ when a $16\,\mathrm{N}$ force is applied, what is its spring constant?

Essential Pre-Uni Physics B7.7

GCSE - Challenge (C1)
A Level - Challenge (C1)

Part A Tension in series

Two identical springs, each of natural length $2.0\,\mathrm{m}$ and spring constant $80\,\mathrm{N\,m^{-1}}$ are placed in series (that is, one joined to the end of the other), with a weight of $7.5\,\mathrm{N}$ suspended from the bottom spring.

State the tension in each spring.

Part B Total extension in series

Work out the total extension of the system.

Part C Tension in parallel

If the two identical springs were placed in parallel so that they can share the load, with the same weight of $7.5\,\mathrm{N}$ suspended from the combination, work out the tension in each of the springs.

Part D Total length in parallel

What is the total length of the system now? Give your answers to 3 significant figures.

Essential Pre-Uni Physics B7.8

GCSE - Challenge (C1)
A Level - Challenge (C1)

If three identical springs were put in series, how would:

Part A Spring constant

a) the spring constant of the system compare to just one of the springs on its own with the same force applied?

- A quarter of the original
- $\frac{1}{3}$ as much
- The same
- Three times as large

Part B Total extension

b) the total extension of the system compare to just one of the springs on its own with the same force applied?

- The same
- A quarter of the original
- Three times as much
- A third as much

Essential Pre-Uni Physics B9.4

GCSE - Challenge (C2)
A Level - Practice (P1)

Assume that extension is proportional to the tension.

$60\,\mathrm{J}$ of work is done to stretch a spring with spring constant $7.5\,\mathrm{N\,cm^{-1}}$ from its natural length of $0.24\,\mathrm{m}$ to some new length. Work out this new length.

Essential Pre-Uni Physics B9.5

GCSE - Challenge (C2)
A Level - Challenge (C1)

Assume that extension is proportional to the tension.

Calculate how much extra work must be done in order to stretch a spring from $17\,\mathrm{cm}$ to $20\,\mathrm{cm}$, if its spring constant is $300\,\mathrm{N\,m^{-1}}$ and natural length $15\,\mathrm{cm}$.