7.1 Deformation: Stress & Strain

Question Paper

Course	CIE A Level Physics (9702) 2019-2021
Section	7. Deformation of Solids
Topic	7.1 Deformation: Stress & Strain
Difficulty	Hard

Time allowed: **10**

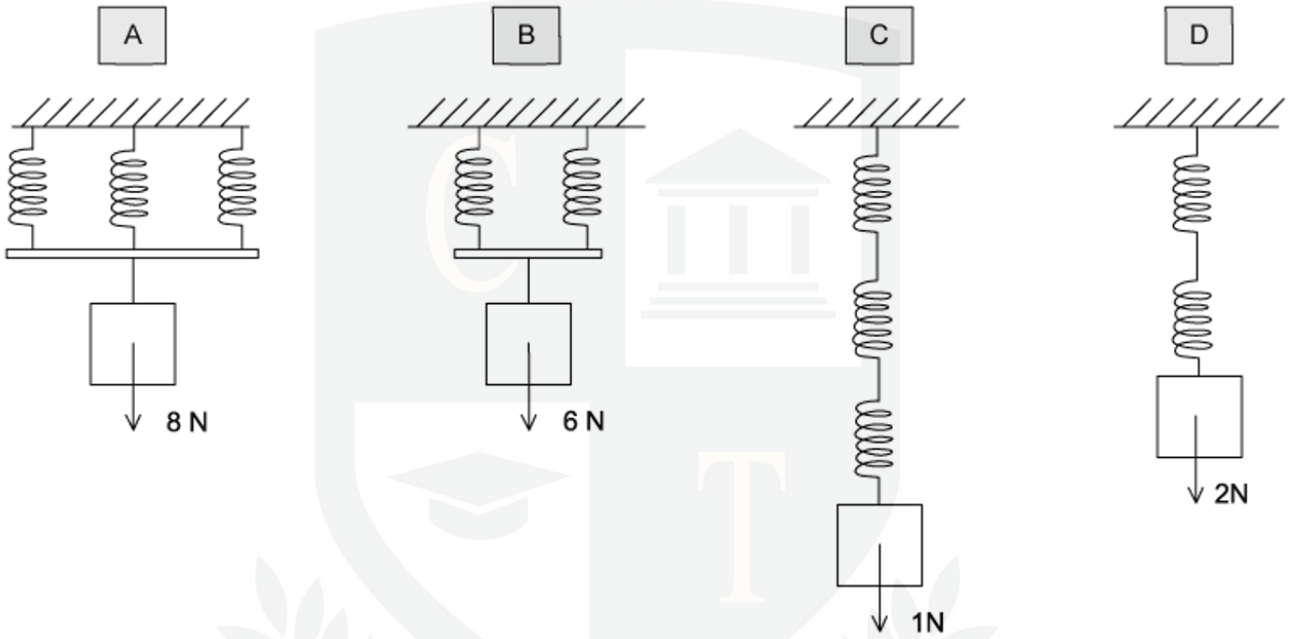
Score: **/10**

Percentage: **/100**

Question 1

The springs in the diagram all have the same spring constant. They were arranged in a different formation with a different load, as shown in the diagram.

Which arrangement has the largest extension?



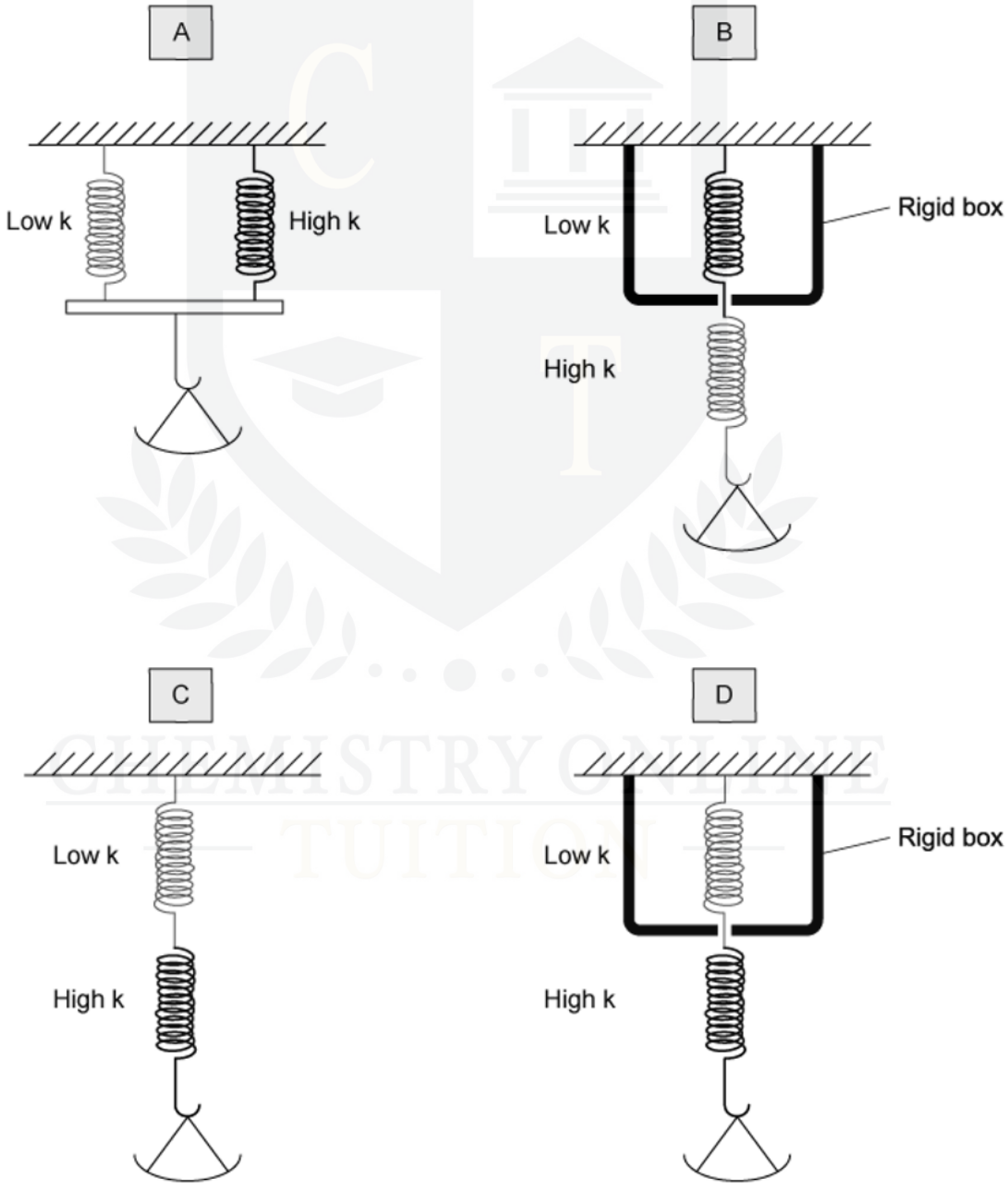
[1 mark]

Question 2

In order to measure the mass of flour a set of scales needs to have high sensitivity for small masses and a low sensitivity with larger masses.

To achieve this two springs are used with different spring constants *k*. One has a lower spring constant than the other.

Which of the following sets of springs would be suitable for this purpose?



[1 mark]

Question 3

Two steel wires X and Y that both obey Hooke's law were used in an experiment. Wire X has a length l, and a cross-sectional area A. Wire Y has a length of $2l$, and cross-sectional area of $\frac{A}{2}$.

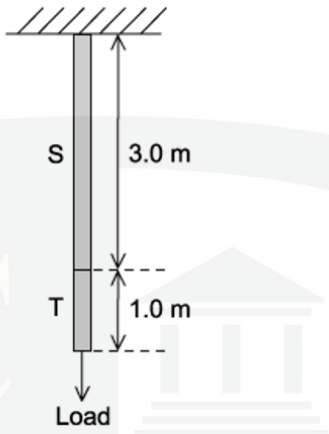
What is the ratio $\frac{\text{tension in X}}{\text{tension in Y}}$ when both wires are stretched to the same extension?

A $\frac{1}{4}$ **B** $\frac{4}{1}$ **C** $\frac{2}{1}$ **D** $\frac{1}{2}$

[1 mark]

Question 4

Two wires S and T is joined, S has a length of 3.0 m and T a length of 1.0 m, both wires have a uniform cross-sectional area.



When a load was hung from the wires S stretched by 1.5 mm and T by 1.0 mm.

The same load is then hung from a second wire of the same cross-section, consisting of 1.0 m of metal S and 3.0 m of metal T.

What is the total extension of this second wire?

A 3.5 mm **B** 2.5 mm **C** 5.0 mm **D** 4.8 mm

[1 mark]

Question 5

A metal wire that is supported vertically from a fixed point has a load of 84 N applied to the lower end. The wire has a cross-sectional area of 0.02 mm^2 and obeys Hooke's law. The length of the wire increases by 0.30%.

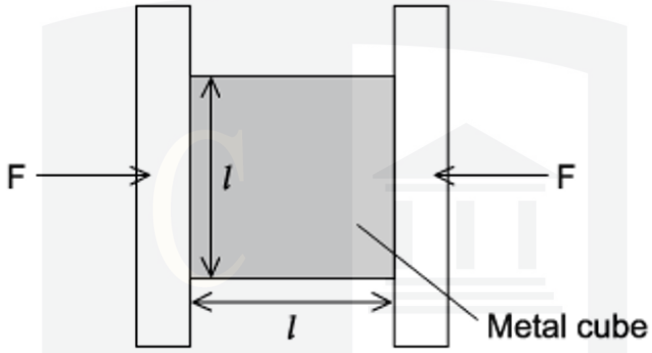
What is the Young modulus of the metal wire?

A 1.4×10^{12} Pa **B** 1.4×10^{9} Pa **C** 1.4×10^{8} Pa **D** 1.4×10^{5} Pa

[1 mark]

Question 6

The diagram shows a metal cube is placed between two board and compressed elastically by two opposing forces *F*. The cube has a length of each side of $\boldsymbol{l}$



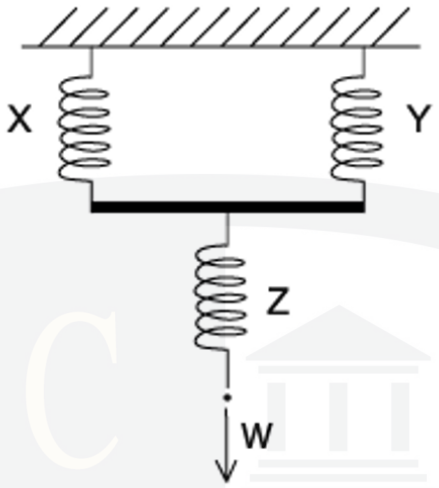
How will Δl, the amount of compression, relate to l ?

A $\Delta l \propto l$ **B** $\Delta l \propto l^2$ **C** $\Delta l \propto \frac{1}{l^2}$ **D** $\Delta l \propto \frac{1}{l}$

[1 mark]

Question 7

Three springs are arranged vertically, as shown.



Springs X and Y are identical and have a spring constant *k*. Spring Z has a spring constant of 3*k*.

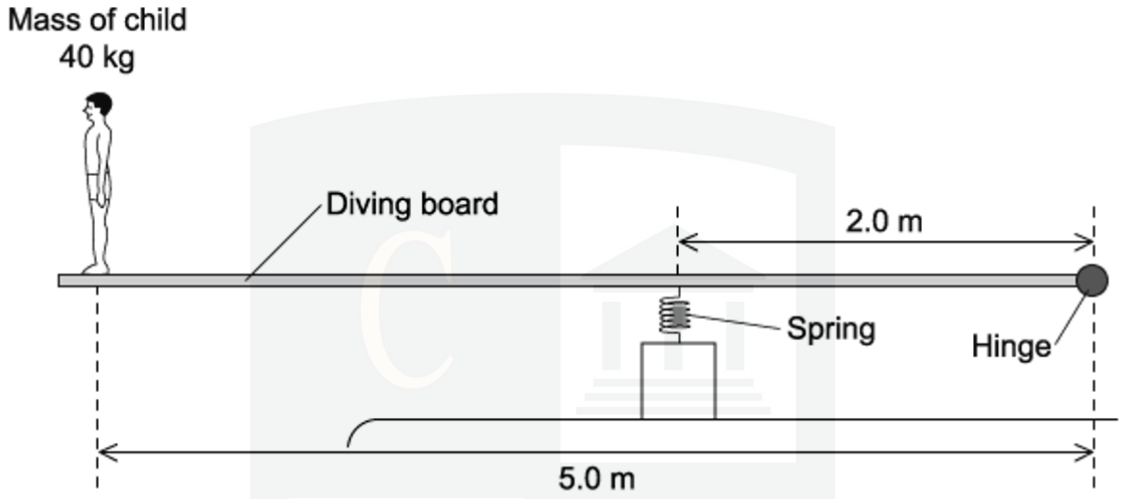
What is the increase in the overall length of the arrangement when a force *W* is applied as shown?

A $\frac{4W}{3k}$ **B** $\frac{5W}{6k}$ **C** $4kW$ **D** $\frac{7kW}{2}$

[1 mark]

Question 8

A child with a mass of 40 kg was standing on a diving board. The diving board has a length of 5.0 m and is hinged at one end then supported by a spring 2.0 m from the hinged end. The spring has a spring constant of 10 kN m^{-1}



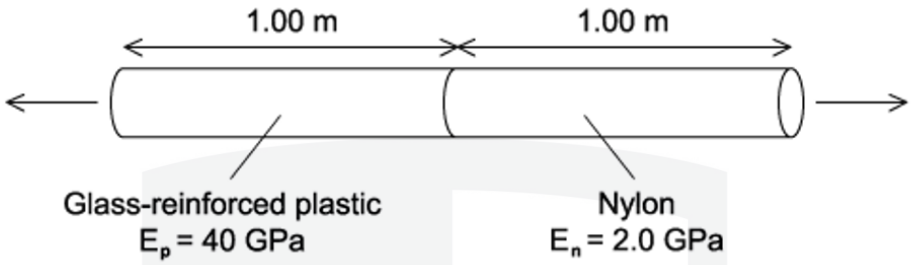
What is the extra compression of the spring caused by the child standing on the end of the board?

A 16 cm **B** 9.8 cm **C** 1.6 cm **D** 1.0 cm

[1 mark]

Question 9

A glass-reinforced plastic rod and a nylon rod attached, as shown, was used to make a composite rod.



Each rod has a length of 1.00 m and the same cross-sectional area. The Young modulus E_n of the nylon is 2.0 GPa, and the Young modulus E_p of the plastic is 40 GPa

The composite rod will break when its total extension reaches 3.0 mm.

What is the greatest tensile stress that can be applied to the composite rod before it breaks?

A 5.7×10^{6} Pa

B 5.7×10^{9} Pa

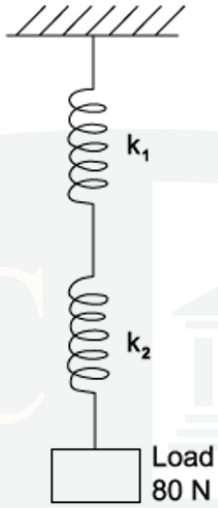
C 7.1×10^{-14} Pa

D 7.1×10^{-2} Pa

[1 mark]

Question 10

A student connected two springs, one with spring constant k_1 = 4 kN m^{-1} and the other with spring constant k_2 = 2 kN m^{-1} as shown in the diagram below.



When a load of 80 N is applied, what is the total extension?

A 60 cm **B** 6 cm **C** 4 cm **D** 1.3 cm

[1 mark]