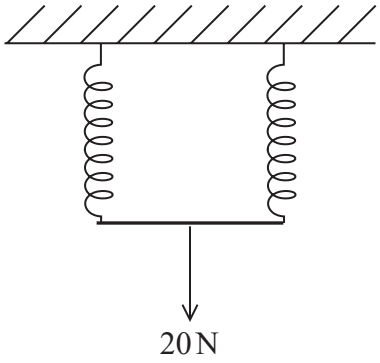
Answer ALL questions.

All multiple choice questions must be answered with a cross ☒ in the box for the correct answer from A to D. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

(Total for Question 1 = 1 mark)

2 Two identical springs are arranged side by side as shown.



When a force of 20 N is applied, an extension of 8 cm is obtained.

A force of 5 N is applied to one of the springs on its own.

Which of the following is the extension obtained?

☒ **A** 2 cm

☒ **B** 4 cm

☒ **C** 8 cm

☒ **D** 16 cm

(Total for Question 2 = 1 mark)

3 A deforming force is applied to a sample of material.

Which row of the table shows the axes of a graph for which the gradient is stiffness k?

	y-axis	*x*-axis
☒ **A**	extension	force
☒ **B**	force	length
☒ **C**	stress	strain
☒ **D**	strain	length

(Total for Question 3 = 1 mark)

13 Raindrops of different sizes fall with different terminal velocities through air.

The table shows the measured value of the terminal velocity for raindrops of different sizes.

Raindrop size	Drop diameter / mm	Terminal velocity / m s^{-1}
small	0.5	2.1
medium	2.0	6.5
large	5.0	9.1

(a) Derive, using Stokes' law, the following expression for the terminal velocity v of a spherical raindrop in terms of its radius r.

$$v = \frac{2g\rho r^2}{9\eta}$$

where ρ is the density of rainwater and η is the viscosity of air.

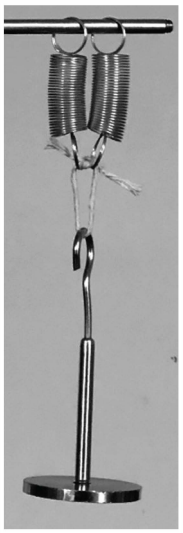
You should ignore upthrust.

(2)

2 A mass is supported by a single spring as shown.

The strain energy stored by the spring is *E*.

The mass is then supported by two springs, each identical to the first spring, as shown.



What is the total strain energy stored with two springs arranged in this way?

- ☐ **A** ¼ *E*
- ☐ **B** ½ *E*
- ☐ **C** *E*
- ☐ **D** 2*E*

(Total for Question 2 = 1 mark)

(Total for Question 7 = 1 mark)

8 An object of volume V made from a material of density ρ_1 is placed into a fluid of density ρ_2.

Which of the following gives the upthrust on the object?

☐ **A** $\rho_1 Vg$

☐ **B** $\rho_2 Vg$

☐ **C** $(\rho_2 - \rho_1)\, Vg$

☐ **D** $\frac{(\rho_2 + \rho_1)}{2} Vg$

(Total for Question 8 = 1 mark)