Lesson M1 Review Questions

Stress and Strain



Answer every question in your jotter. Show your working. Tap a question below to go to it. Tap **Show answer** under a question to mark it.

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Questions

2023 Section 2 Question 8 (b)

1. A force applied to the seatbelt strap results in a stress of 15 $N\,mm^{-2}$. The seatbelt strap has a cross-sectional area of 48 mm^2.

Calculate the force applied. **3**

Show answer ›

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2. A slingshot ride in a fairground is shown.



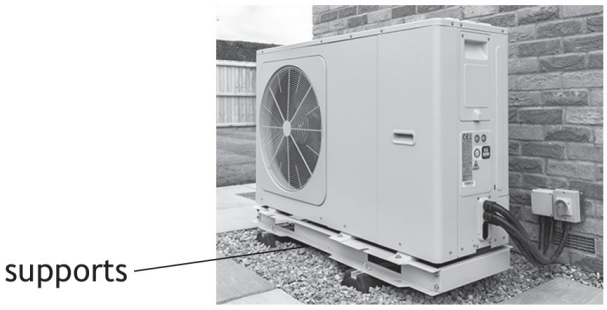
At the start of the slingshot ride a bungee cord is stretched by 6.2 m before it is released.

(a) Calculate the original length of the bungee cord when a strain of 0.17 is experienced. **3**

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3. An air source heat pump used to replace a gas boiler for heating a home is shown.



The air source heat pump sits on four supports.

(a) Calculate the cross-sectional area of one support if a stress of 14 N mm^{-2} acts on it when a force of 220 N is applied. **3**

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2021 Section 1 Question 2

4. Calculate the strain when a 14 m long cable experiences a change in length of 0·0021 m. **2**

Show answer ›

2021 Section 2 Question 11 (b)

5. When a force of 680 N is applied to the cable holding the rider, it experiences a stress of 13 $N\,mm^{-2}$.

Calculate the cross-sectional area of the cable. **3**

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6. The support pole used to hold the data projector has a cross-sectional area of 190 mm^2 and a stress of 0.84 N mm^{-2}.

(a) (i) Calculate the force acting on the support pole. **3**

(ii) State the **nature** of the force in the support pole as the data projector pulls down on it. **1**

The pole supporting the data projector is replaced with one which has a larger cross-sectional area.

(b) Describe the effect this will have on the stress in the support pole. **1**

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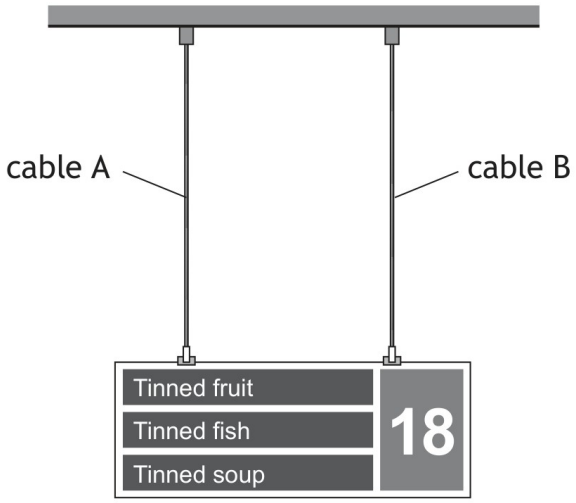
7. When loaded, the lorry trailer's support leg has a strain of 0.00038 and a change in length of 0.46 mm.

Calculate the original length of the support leg. **3**

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8. A sign hanging from a supermarket ceiling is shown.



The sign hangs from the ceiling by two cables.

Cable A has an original length of 4.5 m and is stretched by 0.0013 m.

(a) Calculate the strain in cable A. **2**

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9. A cable with a cross-sectional area of 710 mm^2 is used to pull the lifeboat to the top of the slipway.

(a) Calculate the stress in the cable when a force of 26 kN is applied. **2**

(b) Describe the effect on the stress if the force remains the same and a cable with a **smaller** cross-sectional area is used. **1**

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Answers

Check your understanding (booklet)

1 N mm^{-2} (newtons per square millimetre).
2 The area of the end view of a part.
3 The stress will decrease.
4 Strain has no unit.
5 Put both lengths in the same unit: 2 m = 2000 mm (or 3 mm = 0.003 m).
6 Compression (compressive).

Answer to question 1

2023 Section 2 Question 8 (b)

Marking instructions

Question			Expected response	Max mark	Additional guidance
8.	(b)		$\sigma = \frac{F}{A}$ $15 = \frac{F}{48}$ $F = 15 \times 48$ F = **720 N (2 sf)**	**3**	1 mark for substitution. 1 mark for transposition. 1 mark for correct answer from given working with unit.

‹ Back to question 1

Answer to question 2

2026 Section 2 Question 9 (b)

Marking instructions

Question			Expected response	Max mark	Additional guidance
	(b)		$\epsilon = \frac{\Delta l}{l}$ $0.17 = \frac{6.2}{l}$ $l = \frac{6.2}{0.17}$ $l = 36.47058824$ **l = 36 m (2 sf)**	**3**	**1 mark** for substitution. **1 mark** for transposition. **1 mark** for correct answer from given working with unit.

‹ Back to question 2

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Answer to question 3

2026 Section 2 Question 13 (b)

Marking instructions

Question	Expected response	Max mark	Additional guidance
(b)	$\sigma = \frac{F}{A}$ $14 = \frac{220}{A}$ $A = \frac{220}{14}$ A = 15.71428571 **A = 16 mm^2 (2 sf)**	3	**1 mark** for substitution. **1 mark** for transposition. **1 mark** for correct answer from given working with unit.

‹ Back to question 3

Answer to question 4

2021 Section 1 Question 2

Marking instructions

Question	Expected response	Max mark	Additional guidance
2.	$\varepsilon = \frac{\Delta l}{l}$ $\varepsilon = \frac{0{\cdot}0021}{14}$ **ε = 0·00015 (2 s.f.)**	2	1 mark for substitution. 1 mark for correct answer from given working. Unit should be ignored.

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Answer to question 5

2021 Section 2 Question 11 (b)

Marking instructions

Question			Expected response	Max mark	Additional guidance
	(b)		$Stress = \frac{F}{A}$ $13 = \frac{680}{A}$ $A = \frac{680}{13}$ A = 52·308 mm^2 A = **52 mm^2 (2s.f.)**	**3**	 1 mark for substitution. 1 mark for transposition. 1 mark for correct answer from given working with unit.

‹ Back to question 5

Answer to question 6

2022 Section 2 Question 12 (d)(i), (d)(ii), (e)

Marking instructions

Question			Expected response	Max mark	Additional guidance
	(d)	(i)	$\sigma = \frac{F}{A}$ $0.84 = \frac{F}{190}$ $F = 0.84 \times 190$ $F = 159.6$ F = **160 N (2 sf)**	**3**	 1 mark for substitution. 1 mark for transposition. 1 mark for correct answer from given working with unit.
		(ii)	Tensile/Tension	**1**	Accept Tie. Do not accept pulling force/gravity.
	(e)		The stress will decrease	**1**	

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Answer to question 7

2024 Section 2 Question 14 (b)

Marking instructions

Question	Expected response	Max mark	Additional guidance
(b)	$\in = \frac{\Delta l}{l}$ $0.00038 = \frac{0.46}{l}$ $l = \frac{0.46}{0.00038}$ $l = 1210.526316$ **$l = 1200$ mm (2 sf)**	**3**	1 mark for substitution. 1 mark for transposition. 1 mark for correct answer from given working with unit.

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Answer to question 8

2023 Section 1 Question 4 (b)

Marking instructions

Question	Expected response	Max mark	Additional guidance
(b)	$\varepsilon = \frac{\Delta l}{l}$ $\varepsilon = \frac{0.0013}{4.5}$ $\varepsilon = 0.000288889$ **$\varepsilon = 0.00029$ (2 sf)**	**2**	1 mark for substitution. 1 mark for correct answer from given working. Ignore any units.

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Answer to question 9

2025 Section 2 Question 10 (e), (f)

Marking instructions

Question			Expected response	Max mark	Additional guidance
	(e)		$\sigma = \frac{F}{A}$ $\sigma = \frac{26000}{710}$ $\sigma = 36.61971831$ **$\sigma = 37\,Nmm^{-2}$ $(0.037\,kNmm^{-2})$ (2 sf)**	**2**	1 mark for substitution. 1 mark for correct answer from given working with unit.
	(f)		The stress (on the cable) will increase.	**1**	Descriptive answer relating to the stress increasing.

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