FREE REVISION PACK

Elastic Strain Energy

Pearson Edexcel International Advanced Level Physics · Unit 1 (WPH11) · Specification points 32

Easy | Medium | Multiple choice · past-paper questions

6	6	≈ 10 min
QUESTIONS	TOTAL MARKS	SUGGESTED TIME*

Contents

Q	LEVEL	FOCUS	SOURCE	MARKS
1	Easy	Extension from elastic strain energy	Edexcel IAL January 2024 · Unit 1 · Q3	1 mark
2	Easy	Work done stretching a rubber band	Edexcel IAL October 2022 · Unit 1 · Q6	1 mark
3	Easy	Work done from a force–extension graph	Edexcel IAL June 2023 · Unit 1 · Q4	1 mark
4	Medium	Springs in series and in parallel	Edexcel IAL June 2022 · Unit 1 · Q7	1 mark
5	Medium	Comparing elastic strain energy in two springs	Edexcel IAL October 2021 · Unit 1 · Q3	1 mark
6	Medium	Energy stored in springs in parallel	Edexcel IAL October 2022 · Unit 1 · Q8	1 mark

Key ideas to have ready

- Elastic strain energy = area under the force–extension graph = ½FΔx (in the Hooke's law region).
- Also $E = \frac{1}{2}k\Delta x^2 = F^2/(2k)$, so for one spring energy $\propto F^2$.
- Springs in series each carry the full force; in parallel they share it.
- Loading and unloading curves that differ: the area between them is energy dissipated.

How to use this pack

1. The questions are grouped into levels (Easy and Medium). Work through them in order, and check your answers at the end of each level before moving on.
2. Every question is multiple choice with one correct answer. Write down your working anyway; that is how you find mistakes.
3. The separate mark scheme uses the same numbers and explains every answer.

Levels are based on how students did in Pearson's examiner reports where that information exists, plus our own difficulty rating. *About 1.5 minutes per question.

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Easy

Definitions and one-step ideas. Most students get these right.

Questions 1–3

Choose **one** answer for each question and put a cross in the box next to it.

Edexcel IAL January 2024 · Unit 1 · Q3

1 A spring is stretched by applying a force of 3.0 N. The elastic strain energy stored by the spring is 0.04 J.

Which of the following expressions gives the extension, in m, of the spring?

☒ **A** $\frac{2 \times 0.04}{3.0}$

☒ **B** $\sqrt{\frac{2 \times 0.04}{3.0}}$

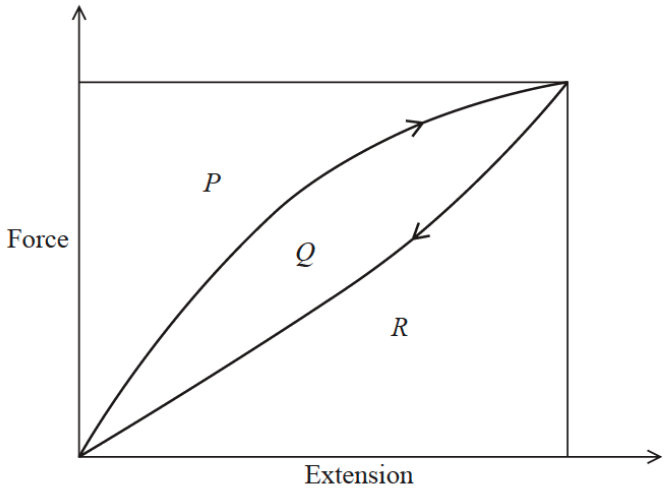
☒ **C** $\sqrt{\frac{3.0}{2 \times 0.04}}$

☒ **D** $\frac{3.0}{2 \times 0.04}$

Edexcel IAL October 2022 · Unit 1 · Q6

2 A rubber band is initially stretched by an increasing force. When the force is gradually decreased, the rubber band returns to its original length.

The force-extension graph for the rubber band is shown.



P, Q and R represent different areas of the graph.

Which of the following gives the work done in stretching the rubber band up to its maximum extension?

☒ **A** $P + Q$

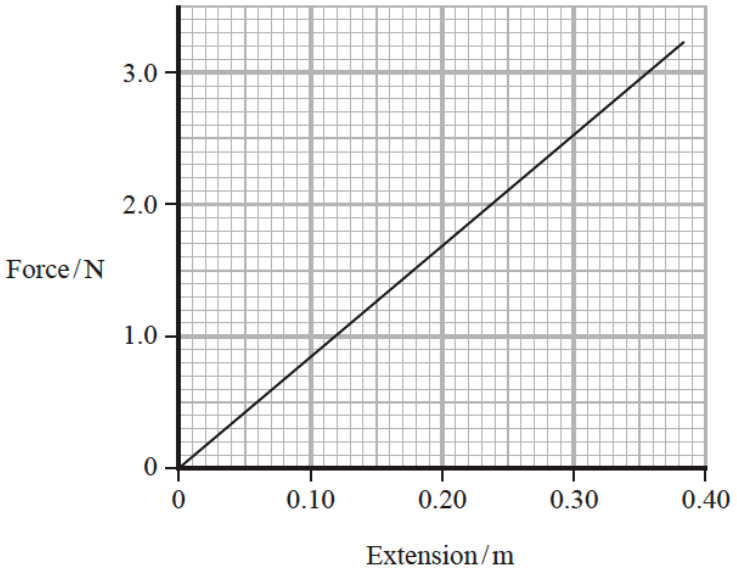
☒ **B** $Q + R$

☒ **C** R

☒ **D** Q

Edexcel IAL June 2023 · Unit 1 · Q4

3 A force-extension graph for a spring is shown.



Which of the following gives the work done, in joules, to extend the spring by 0.30 m from its original length?

☒ **A** 0.30×2.5

☒ **B** $0.5 \times 0.30 \times 2.5$

☒ **C** $\frac{2.5}{0.30}$

☒ **D** $\frac{0.30}{2.5}$

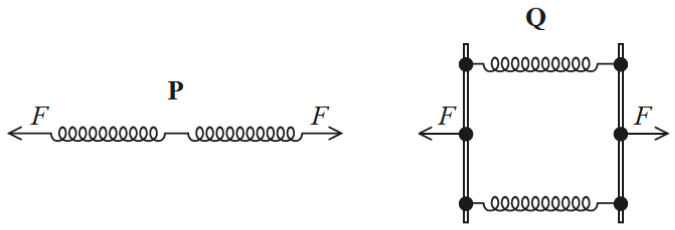
Medium

Two or three steps. Roughly a third to a half of students get these right.

Questions 4–6

Edexcel IAL June 2022 · Unit 1 · Q7

4 Two arrangements, **P** and **Q**, of identical springs are subjected to the same tensile force F as shown.



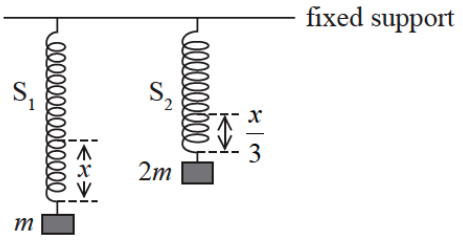
When one spring is subjected to a tensile force F, the elastic strain energy for the spring is E.

Which row of the table gives the total elastic strain energy for each arrangement?

	P	Q
☒ **A**	½E	2E
☒ **B**	½E	½E
☒ **C**	2E	2E
☒ **D**	2E	½E

Edexcel IAL October 2021 · Unit 1 · Q3

5 Two different springs, S_1 and S_2, are suspended from a fixed support. Masses are attached to the bottom of S_1 and S_2 as shown.



The extension of S_1 is x, and the extension of S_2 is $\frac{x}{3}$. The elastic strain energy in spring S_1 is E.

Which of the following is the elastic strain energy in spring S_2?

☒ **A** $6E$

☒ **B** $\frac{3E}{2}$

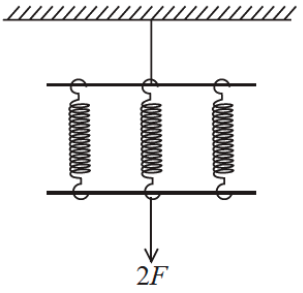
☒ **C** $\frac{2E}{3}$

☒ **D** $\frac{E}{6}$

Edexcel IAL October 2022 · Unit 1 · Q8

6 When a certain spring is stretched by a tensile force F, the elastic energy stored in the spring is E.

Three of these springs are arranged in parallel and stretched by a tensile force of $2F$, as shown.



Which of the following expressions gives the elastic energy stored in the parallel system?

☒ **A** $\frac{1}{3}E$

☒ **B** $\frac{2}{3}E$

☒ **C** $\frac{4}{3}E$

☒ **D** $2E$

End of questions. Check your answers with the matching mark scheme. More free packs and 1-to-1 tuition: **www.getbetteratphysics.co.uk**