Revision Sheet 复习练习卷

A-Level Physics · Unit 6 Deformation of solids

6 vocabulary items · 25 marks of exam questions (8 questions)

Part 1 · Vocabulary review 词汇复习 *(6 items). The terms this unit is examined on most. Mark it yourself from the answer key.* 本单元最常考的词汇，请自行对照答案批改。

Section A · Chinese to English 中译英

Write the English word.

1. 拉伸 _____ [1]

2. 伸长量 _____ [1]

3. 比例极限 _____ [1]

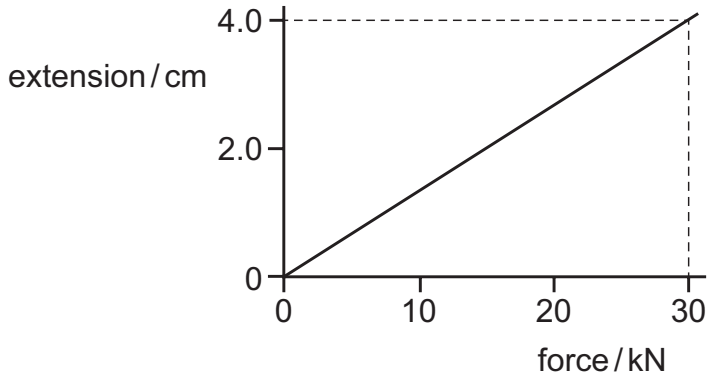
4. 弹性 _____ [1]

5. 应变 _____ [1]

6. 杨氏模量 _____ [1]

Part 2 · Exam questions 考试题 *(25 marks, 8 questions) begins on the next page. They are ordered easy to difficult and none of them has been set before.* 第二部分从下页开始，由易到难。

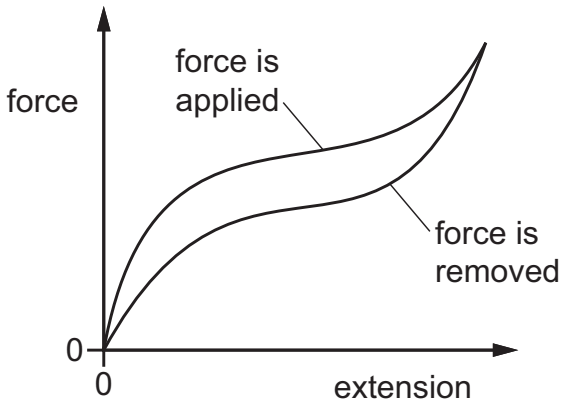
7 The graph shows how the extension of a spring varies with the force used to stretch it.



What is the elastic potential energy of the spring when the extension is 4.0 cm?

A 60 J **B** 120 J **C** 600 J **D** 1200 J

8 The graph shows the variation in extension with force for a sample of rubber.



The top line shows the variation in extension as a force is applied.

The bottom line shows the variation in extension as the force is removed.

What is represented by the area between the two lines?

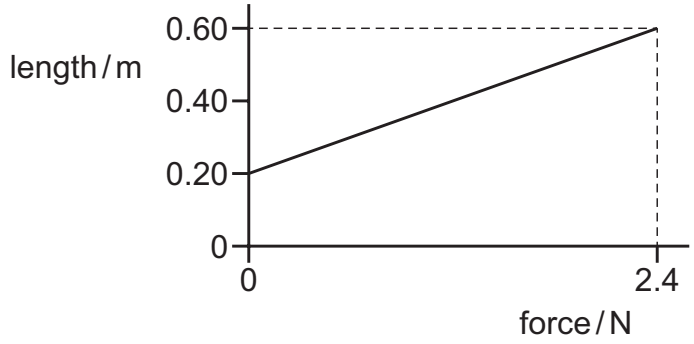
A the work done as the force is applied

B the work done as the force is applied minus the work done as the force is removed

C the work done as the force is removed

D the work done as the force is removed plus the work done as the force is applied

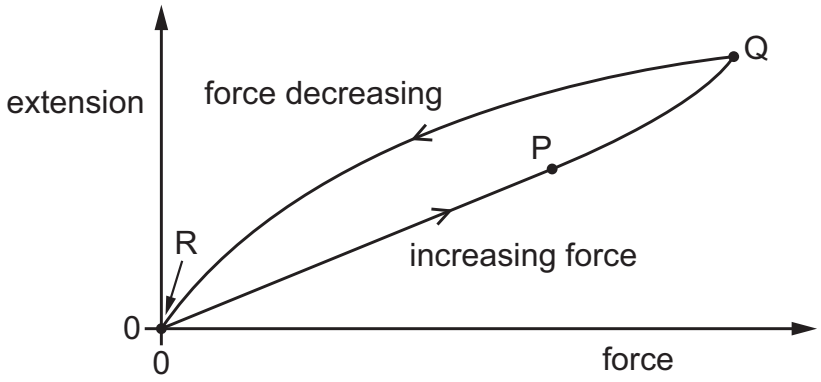
9 A student investigates a spring. The variation of the length of the spring with the force applied to the spring is shown.



What is the spring constant of the spring?

A $0.17\,N\,m^{-1}$ **B** $0.25\,N\,m^{-1}$ **C** $4.0\,N\,m^{-1}$ **D** $6.0\,N\,m^{-1}$

10 The graph shows the variation with force of the extension of a wire.



The force is gradually increased to a maximum at Q and then gradually decreased to zero at R.

Which statement is correct?

A Along the line PQ, the wire obeys Hooke's law.

B Along the line RP, the spring constant is equal to $\frac{\text{extension}}{\text{force}}$.

C The wire has elastic deformation at point Q.

D The work done in stretching the wire to P is equal to (force × extension) at point P.

11 A student has a copper wire and a steel wire with equal lengths and cross-sectional areas.

The student hangs identical loads on the two wires.

The extensions of the two wires are different.

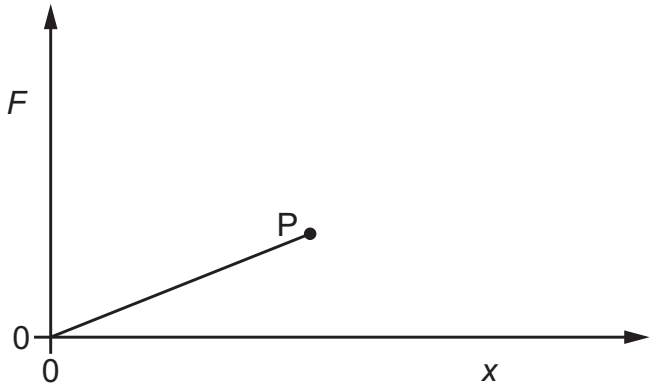
The student calculates the stress, strain and Young modulus of each wire.

Which row identifies with a tick (✓) the calculated values that are equal for both wires?

	stress	strain	Young modulus
A	✓		
B		✓	
C		✓	✓
D	✓		✓

12 A wire of length *L* is stretched to determine its limit of proportionality.

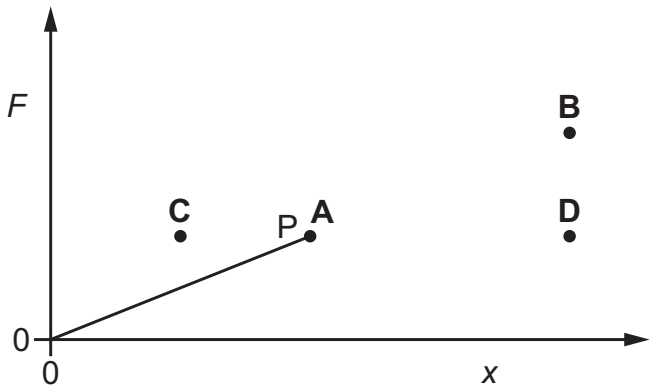
The graph shows the variation of the extension *x* with the force *F* applied to the wire.



The limit of proportionality is shown by point P on the graph.

The experiment is repeated with another wire of length 2*L* but of the same material and same diameter as the first wire.

Which point on the graph shows the limit of proportionality for the new wire?



13 A wire has length L and cross-sectional area A. The wire is made from a metal that has Young modulus E and resistivity ρ.

(a) Define the Young modulus of a material.

.....

..... [1]

(b) **(i)** State an expression, in terms of some or all of L, A, E and ρ, for the resistance R_0 of the wire.

R_0 = ... [1]

(ii) Show that the spring constant k_0 of the wire is given by

$$k_0 = \frac{EA}{L}.$$

[2]

(c) The wire is stretched, within the limit of proportionality, by a tensile force F. Assume that any changes in the cross-sectional area of the wire are negligible.

(i) On Fig. 3.1, sketch the variation with F of the resistance R of the wire.

Fig. 3.1

[1]

(ii) On Fig. 3.2, sketch the variation with F of the spring constant k of the wire.

Fig. 3.2

[1]

(d) Copper has a resistivity of $1.8 \times 10^{-8}\,\Omega\,\text{m}$ and a Young modulus of $1.3 \times 10^{11}\,\text{Pa}$.

A copper wire of diameter 1.6 mm has a resistance of $0.034\,\Omega$.

(i) Show that the length of the wire is 3.8 m.

[1]

(ii) Use the equation in **(b)(ii)** to determine the spring constant of the wire.

spring constant = ... N m^{-1} [2]

[Total: 9]

14 (a) A uniform metal bar, initially unstretched, has sides of length *w*, *x* and *y*, as shown in Fig. 3.1.

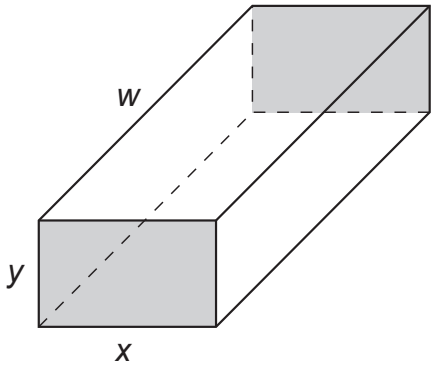


Fig. 3.1

The bar is now stretched by a tensile force *F* applied to the shaded ends. The changes in the lengths *x* and *y* are negligible. The bar now has sides of length *x*, *y* and *z*, as shown in Fig. 3.2.

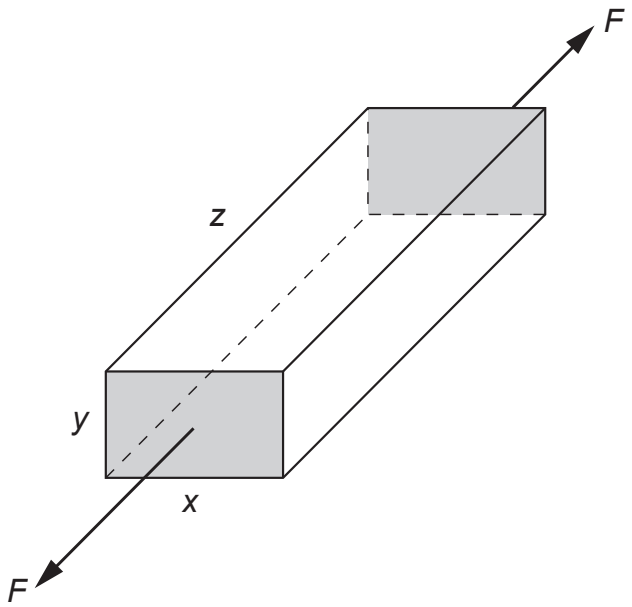


Fig. 3.2

Determine expressions, in terms of some or all of *F*, *w*, *x*, *y* and *z*, for:

(i) the stress σ applied to the bar by the tensile force

σ = ... [1]

(ii) the strain ε in the bar due to the tensile force

ε = ... [1]

(iii) the Young modulus *E* of the metal from which the bar is made.

E = ... [2]

(b) A copper wire is stretched by a tensile force that gradually increases from 0 to 280 N. The variation with extension of the tensile force is shown in Fig. 3.3.

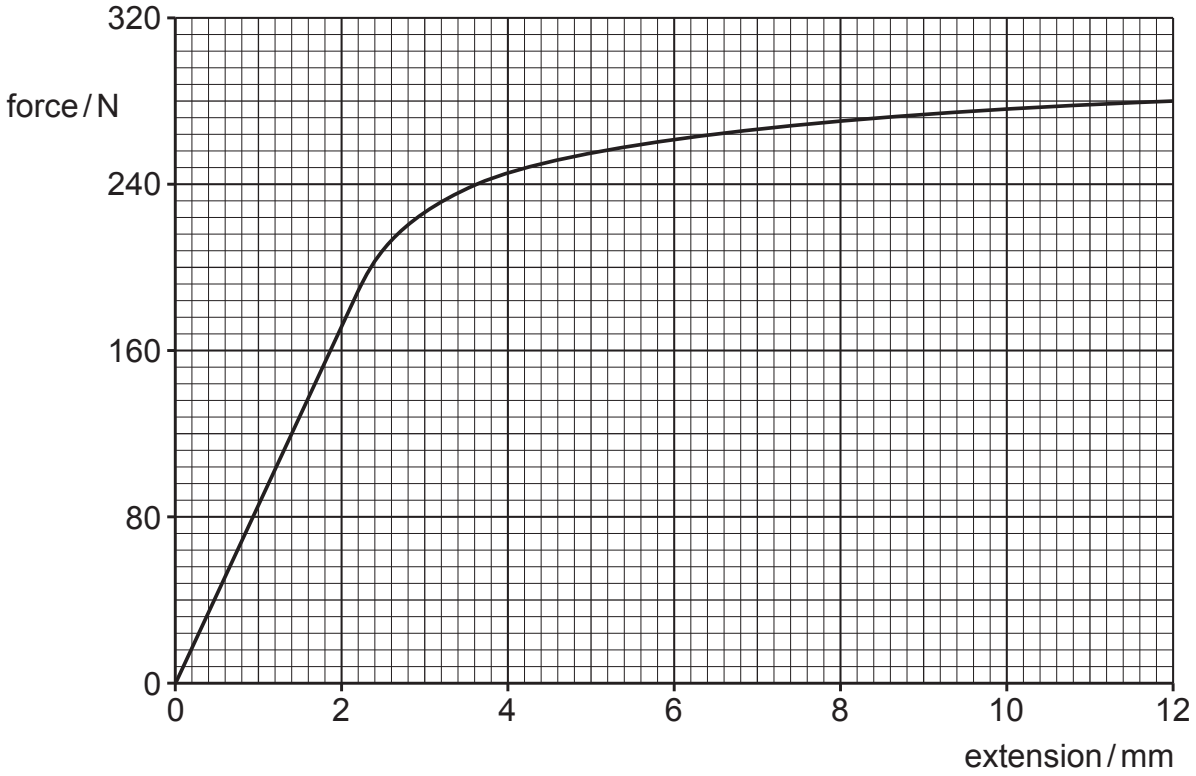


Fig. 3.3

(i) State the maximum extension of the wire for which it obeys Hooke's law.

extension = ... mm [1]

(ii) Use Fig. 3.3 to determine the strain energy in the wire when the tensile force is 120 N.

strain energy = ... J [3]

(iii) Explain why the work done in stretching the wire to an extension of 12 mm is not equal to the energy recovered when the tensile force is removed.

.....

.....

..... [2]

[Total: 10]