

GCSE Physics

Worksheet: Forces and elasticity

TIME 30 min	TOTAL 30 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Forces and elasticity

NAME	CLASS	DATE
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- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

01

01.1

Which of these objects is most likely to show elastic deformation when a small force is applied?
Tick (✓) **one** box.

A steel spring

Wet clay

A lump of putty

A biscuit

☐

☐

☐

☐

[1 mark]

01.2

Complete the sentence.
Work done in stretching a spring is stored as energy, as long as the spring is not permanently stretched.

.....

.....

.....

[1 mark]

0 1 . 3

A student compresses a spring of spring constant 25 N/m by 0.040 m.
Calculate the force needed.
Use the equation:
force = spring constant × extension

.....

.....

.....

.....

Force = N

[2 marks]

0 2

A spring in a door closer has a spring constant of 160 N/m.

0 2 . 1

Calculate the force needed to stretch the spring by 0.22 m. The spring does not go beyond its limit of proportionality.
Use the equation:
force = spring constant × extension

.....

.....

.....

.....

Force = N

[2 marks]

0 3

0 3 . 1

A spring hangs from a clamp. A weight is hung from the bottom of the spring and the spring stretches.

Why must more than one force act on the spring to stretch it?

Tick (✓) **one** box.

A single force would make the spring move instead of changing its shape.

☐

A single force is always too small to stretch a spring.

☐

Two forces are needed to double the extension.

☐

The weight of the spring must be balanced first.

☐

[1 mark]

0 3 . 2

Describe the difference between elastic deformation and inelastic deformation.

.....

.....

.....

.....

[2 marks]

0 3 . 3

A spring has a spring constant of 40 N/m.

Calculate the force needed to stretch the spring by 0.15 m.

Use the equation:

force = spring constant $\times$ extension

.....

.....

.....

.....

Force = N

[2 marks]

0 3 . 4

A diver stands on the end of a diving board and the board changes shape.
Name the type of change of shape that happens to the diving board.

.....

.....

.....

.....

[1 mark]

0 4

A spring in a newtonmeter has a spring constant of 125 N/m.

0 4 . 1

Calculate the force needed to stretch the spring by 0.29 m. The spring does not go beyond its limit of proportionality.
Use the equation:
force = spring constant × extension

.....

.....

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.....

Force = N

[2 marks]

0 5

A student compares two springs, P and Q. Table 1 shows the extension of each spring when the same force is applied to it. Neither spring goes beyond its limit of proportionality.

Table 1

Spring	Force in N	Extension in m
P	4.0	0.080
Q	4.0	0.050

0 5 . 1

Calculate the spring constant of each spring.

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.....

.....

.....
[2 marks]

0 5 . 2

Which spring is stiffer? Give a reason for your answer.

.....

.....

[1 mark]

0 5 . 3

A third spring, R, has a spring constant of 65 N/m. The same 4.0 N force is applied to spring R.

Without calculating, explain how the extension of spring R compares with the extensions of springs P and Q.

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.....

.....

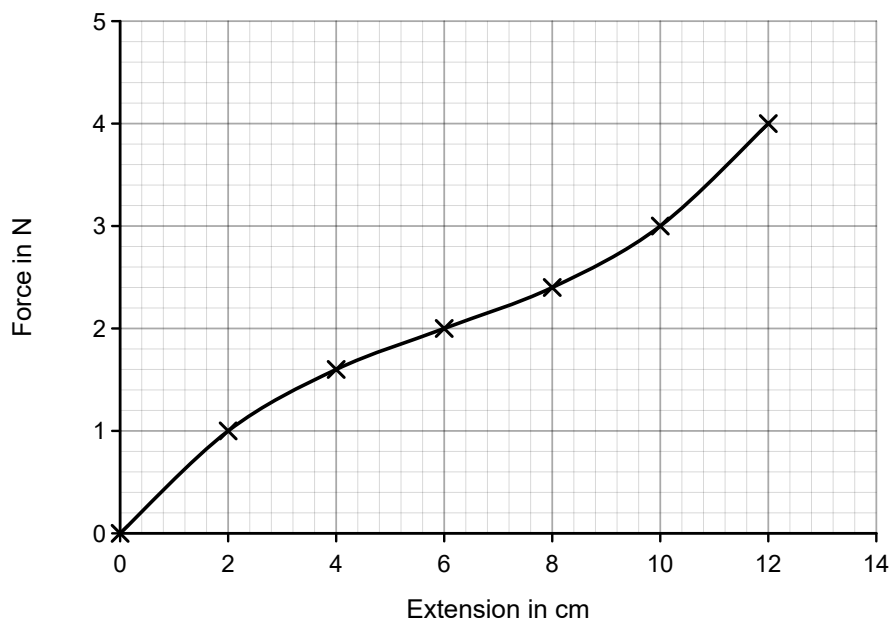
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[2 marks]

0 6

A student measured the extension of a rubber band for different forces. Figure 1 shows the results.

Figure 1



0 6 . 1

Use Figure 1 to determine the extension of the rubber band when the force is 2.0 N.

.....

.....

.....

Extension = cm

[1 mark]

0 6 . 2

A student says:

‘The rubber band obeys the equation force = spring constant $\times$ extension, because the extension increases when the force increases.’

Explain why the student is wrong.

.....

.....

.....

.....

[2 marks]

0 6 . 3

Describe the difference between a linear and a non-linear relationship between force and extension.

.....

.....

.....

.....

[2 marks]

0 6 . 4

A diver stands on the end of a diving board and the board bends.
Name **two** forces that act on the diving board to make it bend.

.....

.....

.....

.....

[2 marks]

0 7

An archer pulls back a bowstring, storing elastic potential energy in the bow.

0 7 . 1

Describe the energy transfer that occurs from the moment the archer releases the bowstring to the moment just after the arrow leaves the bow.

.....

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.....

.....

[2 marks]

0 7 . 2

Explain why the archer must apply a bigger force to pull the bowstring back further.

.....

.....

.....

.....

[2 marks]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Physics · Worksheet: Forces and elasticity · 30 marks

Question 1 (4 marks)

01.1 [1 mark]

Correct: A steel spring

01.2 [1 mark]

Answer: Elastic potential.

- elastic potential (1)
-

01.3 [2 marks]

Answer: 1.0 N

- $F = 25 \times 0.040$ (1)
 - 1.0 (N) (1)
-
-

Question 2 (2 marks)

02.1 [2 marks]

Answer: 35.2 N

- $F = 160 \times 0.22$ (1)
 - 35.2 (N) (1)
-

Question 3 (6 marks)

03.1 [1 mark]

Correct: A single force would make the spring move instead of changing its shape.

03.2 [2 marks]

Answer: Elastic: returns to its original shape when the force is removed. Inelastic: does not return to its original shape.

- elastic deformation: the object returns to its original shape / length when the force is removed (1)
 - inelastic deformation: the object does not return to its original shape / length when the force is removed (1)
-

03.3 [2 marks]

Answer: 6.0 N

- $F = 40 \times 0.15$ (1)
 - 6.0 (N) (1)
-

03.4 [1 mark]

Answer: Bending.

- bending (1)
-

Question 4 (2 marks)

04.1 [2 marks]

Answer: 36.25 N

- $F = 125 \times 0.29$ (1)
 - 36.25 (N) (1)
-

Question 5 (5 marks)

05.1 [2 marks]

Answer: P: 50 N/m; Q: 80 N/m

- $k_P = 4.0 \div 0.080 = 50 \text{ (N/m)}$ (1)
 - $k_Q = 4.0 \div 0.050 = 80 \text{ (N/m)}$ (1)
-

05.2 [1 mark]

Answer: Q: it has the larger spring constant (it extends less for the same force).

- Q, because it has the larger spring constant / it extends less for the same force (1)
-

05.3 [2 marks]

Answer: Between them (between 0.050 m and 0.080 m): for the same force, extension = $F \div k$, and 65 N/m lies between 50 N/m and 80 N/m.

- the extension of R is between the extensions of P and Q (between 0.050 m and 0.080 m) (1)
 - for the same force, a larger spring constant gives a smaller extension (extension = force $\div$ spring constant), and 65 N/m is between 50 N/m and 80 N/m (1)
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Question 6 (7 marks)

06.1 [1 mark]

Answer: 6.0 cm

- 6.0 (cm) (1)

06.2 [2 marks]

Answer: The graph is curved, so extension is not directly proportional to force and there is no constant k .

- the graph is not a straight line (through the origin) / the relationship is non-linear (1)
- so the extension is not directly proportional to the force / force $\div$ extension is not constant (1)

06.3 [2 marks]

Answer: Linear: equal increases in force give equal increases in extension (straight line). Non-linear: they do not (curve).

- linear: a straight-line graph / the extension increases by equal amounts for equal increases in force (1)
- non-linear: a curved graph / the extension does not increase by equal amounts for equal increases in force (1)

06.4 [2 marks]

Answer: The downward force from the diver at one end and the force from the fixing/support at the other end.

- the downward force of the diver on the end of the board / the weight of the diver (1)
 - the force from the support / fixing at the other end of the board (1)
-

Question 7 (4 marks)

07.1 [2 marks]

Answer: From the bow's elastic potential energy store mainly to the arrow's kinetic energy store; some is dissipated to the surroundings by heating and as sound.

- energy is transferred from the elastic potential energy store of the bow mainly to the kinetic energy store of the arrow (1)
- some energy is dissipated to the surroundings: to thermal energy stores (because of friction and vibrations) and as sound (1)

07.2 [2 marks]

Answer: A bigger extension of the bow needs a bigger force (like a spring, $F = k e$).

- pulling the string back further gives the bow a greater extension (deformation) (1)
 - the force needed increases with extension (like a spring, $F = k e$, if the bow stays within its limit of proportionality) (1)
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