

# Forces and Elasticity

## Question Paper

<b>Level</b>	GCSE (9-1)
<b>Subject</b>	Combined Science: Trilogy - Physics
<b>Exam Board</b>	AQA
<b>Topic</b>	6.5 Forces
<b>Sub-Topic</b>	Forces and Elasticity
<b>Difficulty Level</b>	Silver Level
<b>Booklet</b>	Question Paper

**Time Allowed:** 33 minutes

**Score:** /33

**Percentage:** /100

**Grade Boundaries:**

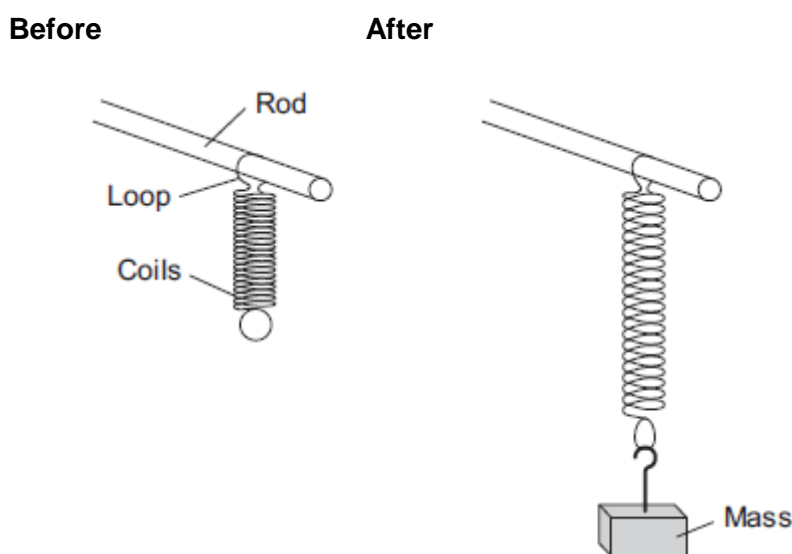
**Q1.** A student investigated the behaviour of springs. She had a box of identical springs.

- (a) When a force acts on a spring, the shape of the spring changes.

The student suspended a spring from a rod by one of its loops. A force was applied to the spring by suspending a mass from it.

**Figure 1** shows a spring before and after a mass had been suspended from it.

**Figure 1**



- (i) State **two** ways in which the shape of the spring has changed.

1 .....

2 .....

(2)

- (ii) No other masses were provided.

Explain how the student could test if the spring was behaving elastically.

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.....  
.....  
.....

(2)

- (b) In a second investigation, a student took a set of measurements of force and extension.

Her results are shown in **Table 1**.

**Table 1**

<b>Force in newtons</b>	0.0	1.0	2.0	3.0	4.0	5.0	6.0
<b>Extension in cm</b>	0.0	4.0		12.0	16.0	22.0	31.0

- (i) Add the missing value to **Table 1**.

Explain why you chose this value.

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(3)

- (ii) During this investigation the spring exceeded its limit of proportionality.

Suggest a value of force at which this happened.

Give a reason for your answer.

Force = ..... N

Reason .....

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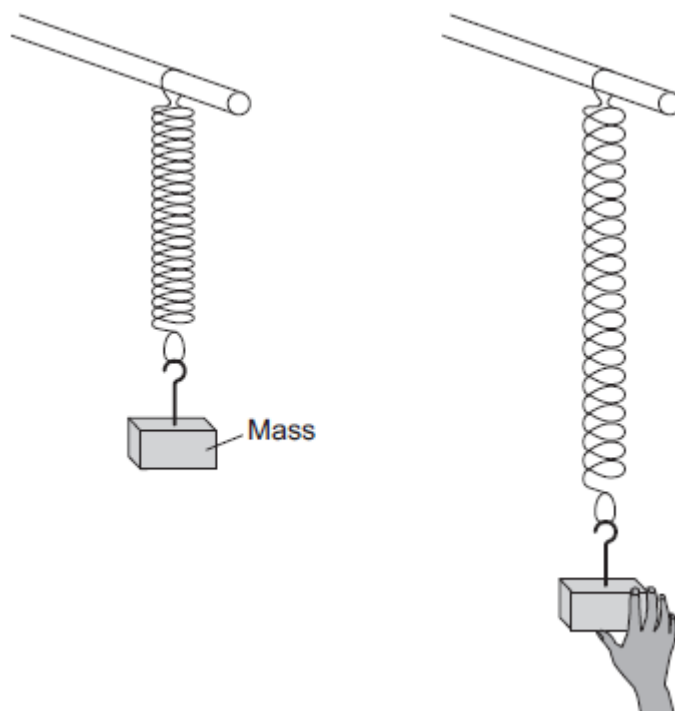
(2)

- (c) In a third investigation the student:

- suspended a 100 g mass from a spring
- pulled the mass down as shown in **Figure 2**
- released the mass so that it oscillated up and down

- measured the time for 10 complete oscillations of the mass
- repeated for masses of 200 g, 300 g and 400 g.

**Figure 2**



Her results are shown in **Table 2**.

**Table 2**

Time for 10 complete oscillations in seconds				
Mass in g	Test 1	Test 2	Test 3	Mean
100	4.34	5.20	4.32	4.6
200	5.93	5.99	5.86	5.9
300	7.01	7.12	7.08	7.1
400	8.23	8.22	8.25	8.2

- (i) Before the mass is released, the spring stores energy.

What type of energy does the spring store?

Tick (✓) **one** box.

	Tick (✓)
Elastic potential energy	
Gravitational potential energy	
Kinetic energy	

(1)

- (ii) The value of time for the 100 g mass in **Test 2** is anomalous.

Suggest **two** likely causes of this anomalous result.

Tick (✓) **two** boxes.

	Tick (✓)
Misread stopwatch	
Pulled the mass down too far	
Timed half oscillations, not complete oscillations	
Timed too few complete oscillations	
Timed too many complete oscillations	

(2)

- (iii) Calculate the correct mean value of time for the 100 g mass in **Table 2**.

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 .....

Mean value = ..... s

(1)

- (iv) Although the raw data in **Table 2** is given to 3 significant figures, the mean

values are correctly given to 2 significant figures.

Suggest why.

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(2)

- (v) The student wanted to plot her results on a graph. She thought that four sets of results were not enough.

What extra equipment would she need to get more results?

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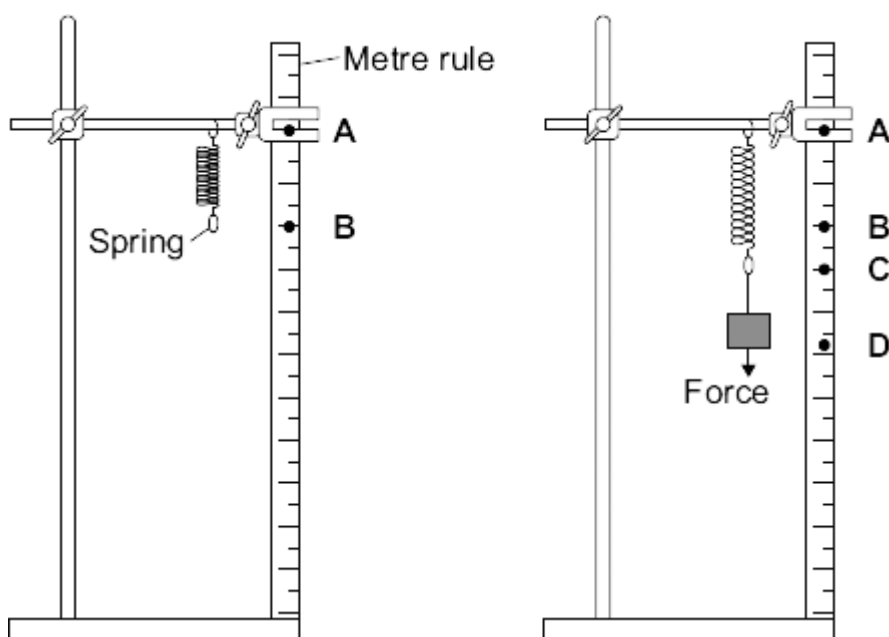
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(2)

(Total 17 marks)

- Q2.** A student investigated how the extension of a spring depends on the force applied to the spring.

The diagram shows the spring before and after a force had been applied.



- (a) (i) Complete the following sentence using letters, **A**, **B**, **C** or **D**, from the diagram.

The extension of the spring is the distance between the positions labelled .....and ..... on the metre rule.

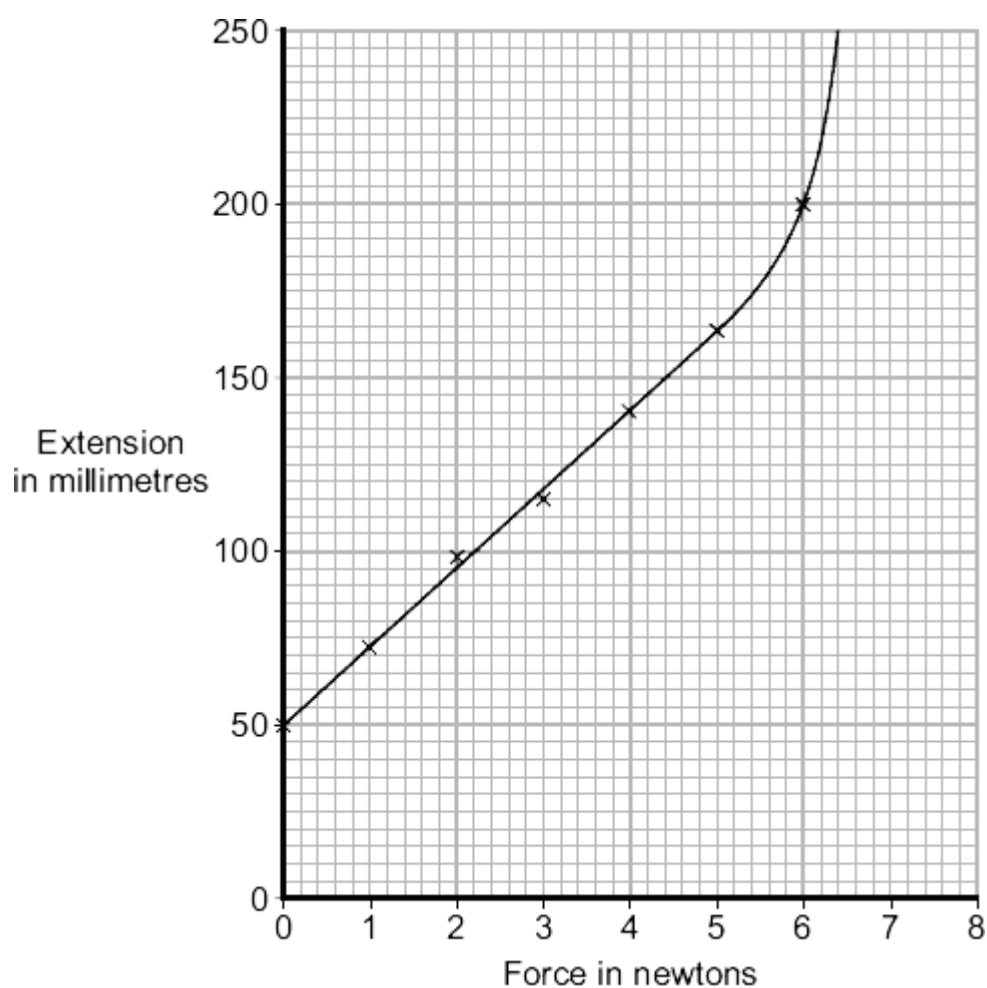
(1)

- (ii) What form of energy is stored in the stretched spring?

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(1)

- (b) The results from the investigation are plotted on the following graph.



- (i) The graph shows that the student has made an error throughout the investigation.

What error has the student made?

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.....

Give the reason for your answer.

.....  
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(2)

- (ii) The student has loaded the spring beyond its *limit of proportionality*.



Mark on the graph line the *limit of proportionality* of the spring. Label the point **P**.

Give the reason for choosing your point **P**.

.....

.....

.....

(2)

- (c) The student uses a different spring as a spring balance. When the student hangs a stone from this spring, its extension is 72 mm.

The spring does not go past the limit of proportionality.

Calculate the force exerted by the stone on the spring.

spring constant = 25 N/m
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Show clearly how you work out your answer.

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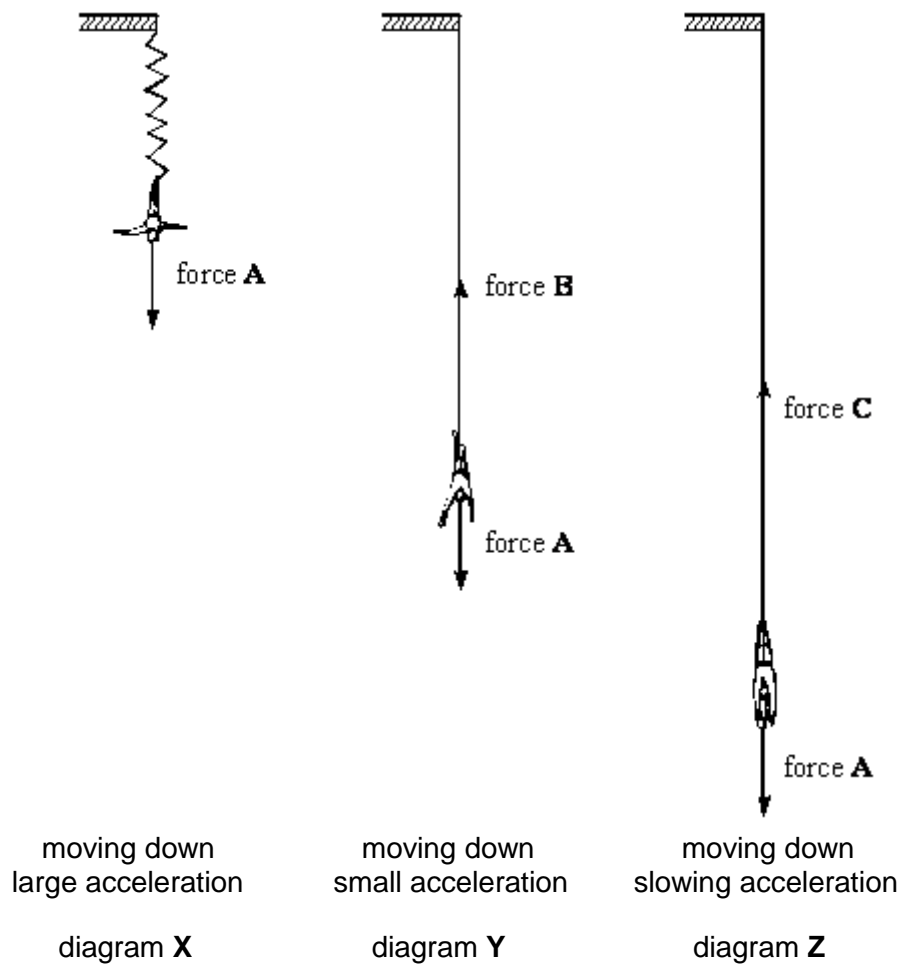
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Force = ..... N

(2)

(Total 8 marks)

- Q3.** When a bungee-jump is made the jumper steps off a high platform. An elastic cord from the platform is tied to the jumper.
- The diagram below shows different stages in a bungee-jump.
- Forces **A**, **B** and **C** are forces acting on the jumper at each stage.



- (a) Name force **A**.

.....

(1)

- (b) The motion of the jumper is shown in the diagrams.  
By comparing forces **A**, **B** and **C**, state how the motion is caused in:

- (i) diagram **X**;

.....

- (ii) diagram **Y**;

.....

(iii) diagram **Z**.

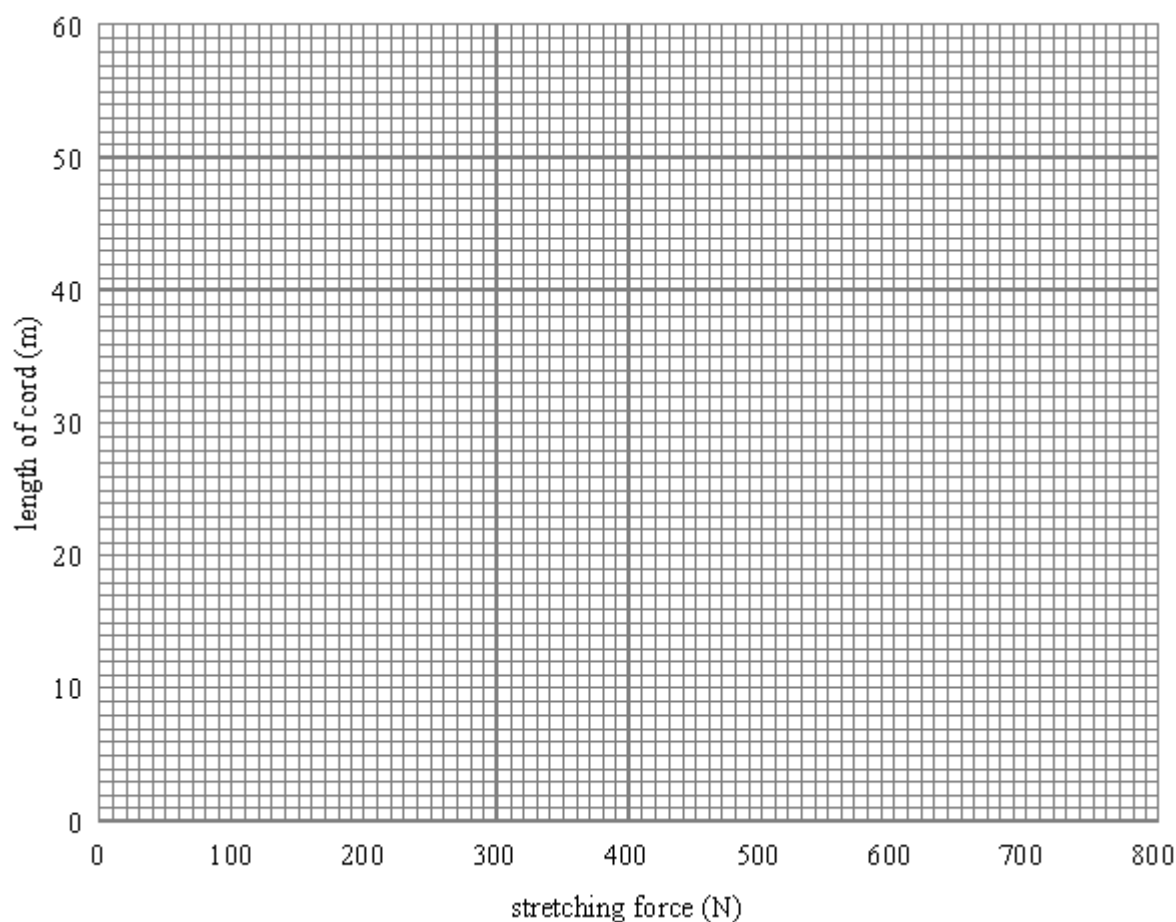
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(3)

(c) The table gives results for a bungee cord when it is being stretched.

STRETCHING FORCE (N)	100	200	400	600	800
LENGTH OF CORD (m)	20	24	32	40	48

(i) Plot a graph of these results on the graph paper.



**(3)**

- (ii) Use the graph to find the length of the cord before it was stretched.

Length ..... m

**(1)**

**(Total 8 marks)**