Force and extension of a spring

Physics required practical | AQA Combined Science 8464 and AQA GCSE Physics 8463 | 14 questions, 36 marks

GCSE science required practicals

This practical online

Name: _____ **Date:** _____ **Score:** _____ / 36

Aim: To find out how the extension of a spring depends on the force stretching it, and to use the results to find the spring constant.

Equipment: Spring with a loop at each end; Clamp stand, two bosses and two clamps; Metre ruler held upright in a clamp; Slotted mass hanger and 50 g slotted masses; Pointer (a strip of card or a splint taped to the bottom of the spring); Set square; Heavy weight or G-clamp to hold the stand to the bench; Safety goggles.

Results

Priya hung 50 g masses on a spring one at a time and read the length of the spring from a metre ruler each time. Her original length reading was 4.0 cm. She took g as 9.8 N/kg.

Mass hung on the spring in g	Weight in N	Length of spring in cm	Extension in cm
0	0.00	4.0	0.0
50	0.49	6.3	2.3
100	0.98	8.4	4.4
150	1.47	10.8	6.8
200	1.96	12.9	8.9
250	2.45	15.0	11.0
300	2.94	18.0	14.0
350	3.43	21.5	17.5

Questions

1 Look at Priya's investigation.

a. Name the independent variable.

b. Name the dependent variable.

c. Give one control variable.

(3 marks)

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2 Priya taped a pointer to the bottom of the spring and read where it lined up on the ruler. Explain why she kept her eye level with the pointer when she took each reading. (2 marks)

3 Give one hazard in this investigation and one way to reduce the risk from it. (2 marks)

4 Show how Priya worked out the extension when the mass on the spring was 200 g. (2 marks)

5 Calculate the weight of a 250 g mass. Gravitational field strength = 9.8 N/kg. (2 marks)

6 Describe the relationship between the weight and the extension for loads up to 250 g. Use data from the table. (2 marks)

7 Priya says the spring went past its limit of proportionality. Use the table to explain how she can tell. (2 marks)

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8 Use the results for 0 g and 200 g to calculate the spring constant of the spring. Give your answer to 2 significant figures. Show your working.

(4 marks)

9 The spring constant is 22 N/m. Calculate the extension, in cm, when a force of 1.20 N stretches the spring. Give your answer to 2 significant figures.

(2 marks)

10 **Higher tier**

The spring constant is 22 N/m. Calculate the energy stored in the spring when the extension is 8.9 cm. Give your answer to 2 significant figures.

elastic potential energy = 0.5 × spring constant × (extension)^2

Show your working.

(3 marks)

11 **Higher tier**

After the 350 g load was removed, the pointer read 4.6 cm instead of 4.0 cm. Explain what this shows about the spring.

(2 marks)

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12 The metre ruler has a resolution of 1 mm. Suggest one improvement to how the length is read, and explain why it helps.

(2 marks)

13 Priya's friend Callum hung a different spring of the same type in the same way and got very similar extensions. Is this repeatable or reproducible? Explain your answer.

(2 marks)

14 A pupil wants to find out whether two identical springs hung side by side (both holding the same hanger) are stiffer than one spring on its own. Describe a method the pupil could use. Include how they would use the results to compare the two arrangements.

(6 marks)

End of questions | Total 36 marks | The answers sheet has the full method as revision notes.

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