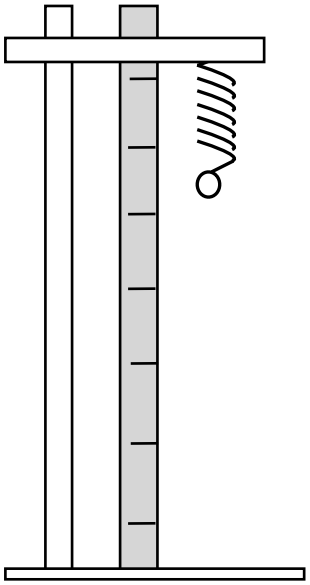
1 A student uses the apparatus below to investigate the extension of a spring for different weights. She adds 4 weights and takes some recordings which are shown in the table.

Weight (N)	Reading (cm)	Extension (cm)
0	10	0
20	25	15
40	40	
60	55	45
80	70	60



1 (a) Complete the table by adding the missing values for the extension. Assume there were no errors in taking the measurement.

(*1 mark)*

1 (b) The student read that 'the extension of the spring is proportional to the weight added'. Based on this idea, what would be the expected extension for a weight of 30 N?

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(1 mark)

1 (c) The extension of the spring is not always proportional to the weight added because of the limit of proportionality. Explain what the limit of proportionality is.

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(2 marks)

1 (d) Suggest a kind of instrument that uses the idea that a spring can extend proportionally?

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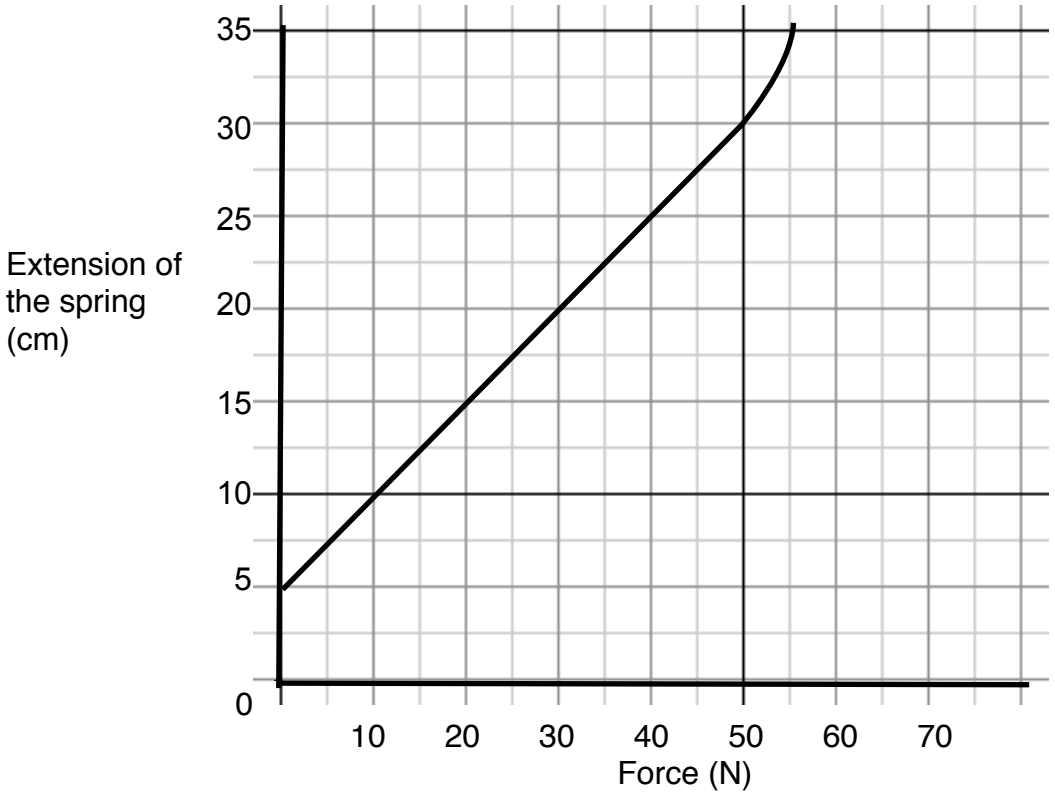
(1 mark)

(Total 5 marks)

2 The graph shows the results of an experiment done to investigate the relationship between the force and extension of a spring.



2 (a) The student made an error in taking the readings for this experiment. What was the error?

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(1 mark)

2 (b) Label the point on the graph where the spring reached its limit of proportionality.

(1 mark)

2 (c) The spring used in a different experiment has a spring constant of 40 N/Kg. Use the correct equation from the equation sheet to calculate the extension of the spring when a weight of 80 N is added.

Show your working.

Extension = …… **cm**

(2 marks)

(Total 4 marks)