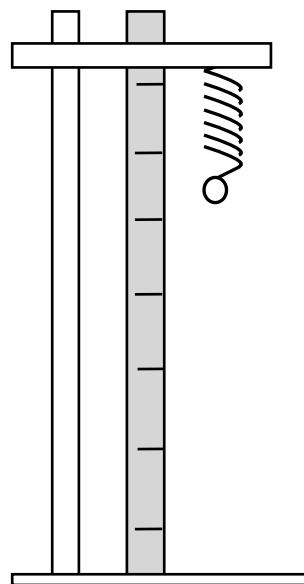


- 1 A student uses the apparatus below to investigate the extension of a spring for different weights. She adds 4 weights and takes some recordings which are shown in the table.

Weight (N)	Reading (cm)	Extension (cm)
0	10	0
20	25	15
40	40	30
60	55	45
80	70	60



- 1 (a) Complete the table by adding the missing values for the extension. (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?

22.5

You shouldn't round off for this, because the value is between 15 and 30 cm

(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.

The **force or weight** or point beyond which [1 mark]

extension of the spring is no longer proportional [1 mark]

the spring does not return to its original shape when released [1 mark]

(maximum 2 marks)

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

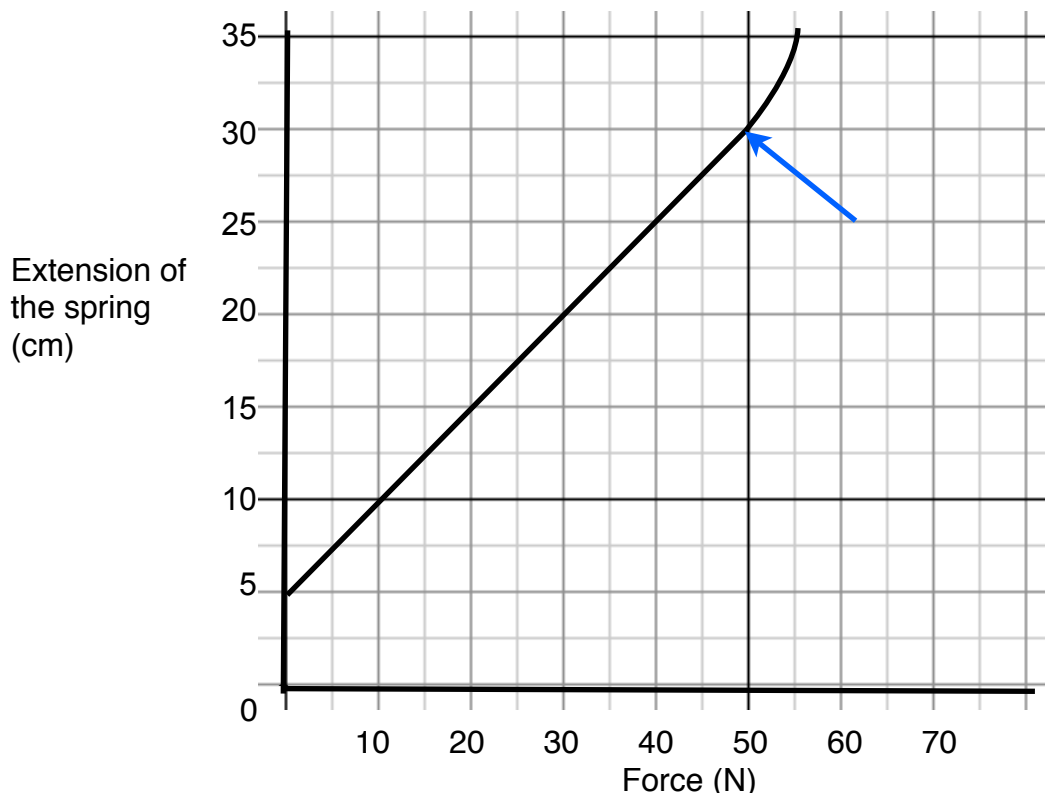
Any suitable instrument, e.g. force meter, newton meter, weighing scales.

(1 mark)

(Total 5 marks)

Hooke's Law (Forces on elastic objects)

- 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?

Measure the reading off the ruler, not the extension or didn't measure the extension.

or Force of zero does not give zero extension.

A common error is that students just read off from the scale and don't look at 'extension' which is how much the spring increases in length.

(1 mark)

- 2 (b) Mark with an arrow, the point on the graph where the spring reached its limit of proportionality.

See graph

Be careful to point the arrow accurately, a circle around the point is not good enough.

(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.

$$80/40 = 2 \text{ [1 mark]}$$

$$2 \text{ [1 mark]}$$

Extension =2..... cm
(2 marks)

(Total 4 marks)