Question : 1

A student uses a digital calliper to measure the length of a spring as shown in Figure 20.
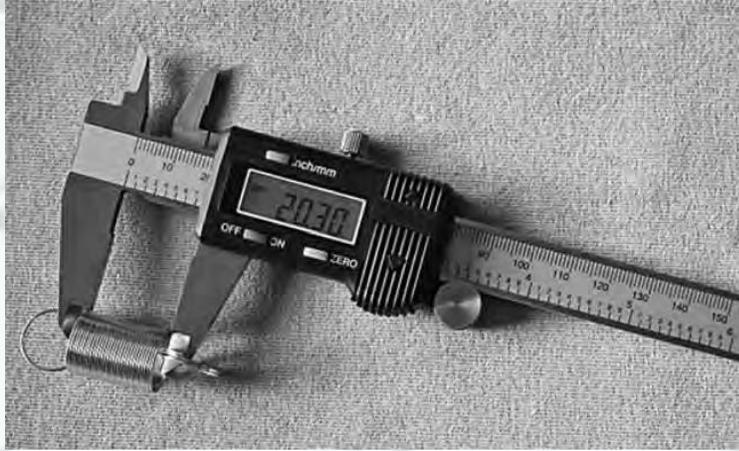

Figure 20

The spring is bendy and difficult to measure.

The student takes the six readings shown in Figure 21.

mm 20.31	mm 20.33
mm 20.44	mm 20.30
mm 20.33	mm 20.30

Figure 21

(a) Calculate the average length of the spring.

(2)

average length = ... mm

(b) The student investigates the stretching of a spring with the equipment shown in Figure 22.
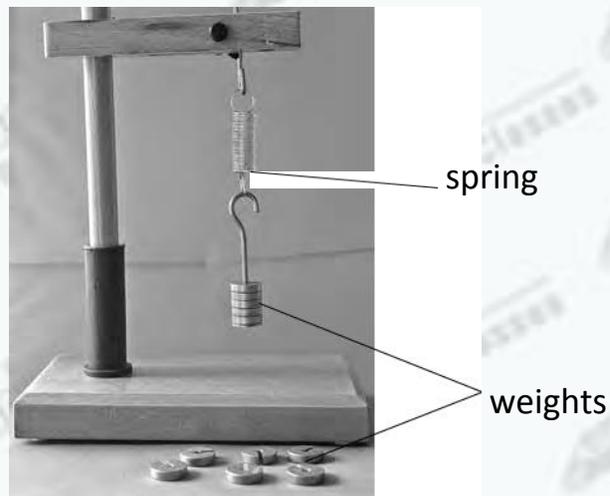

Figure 22

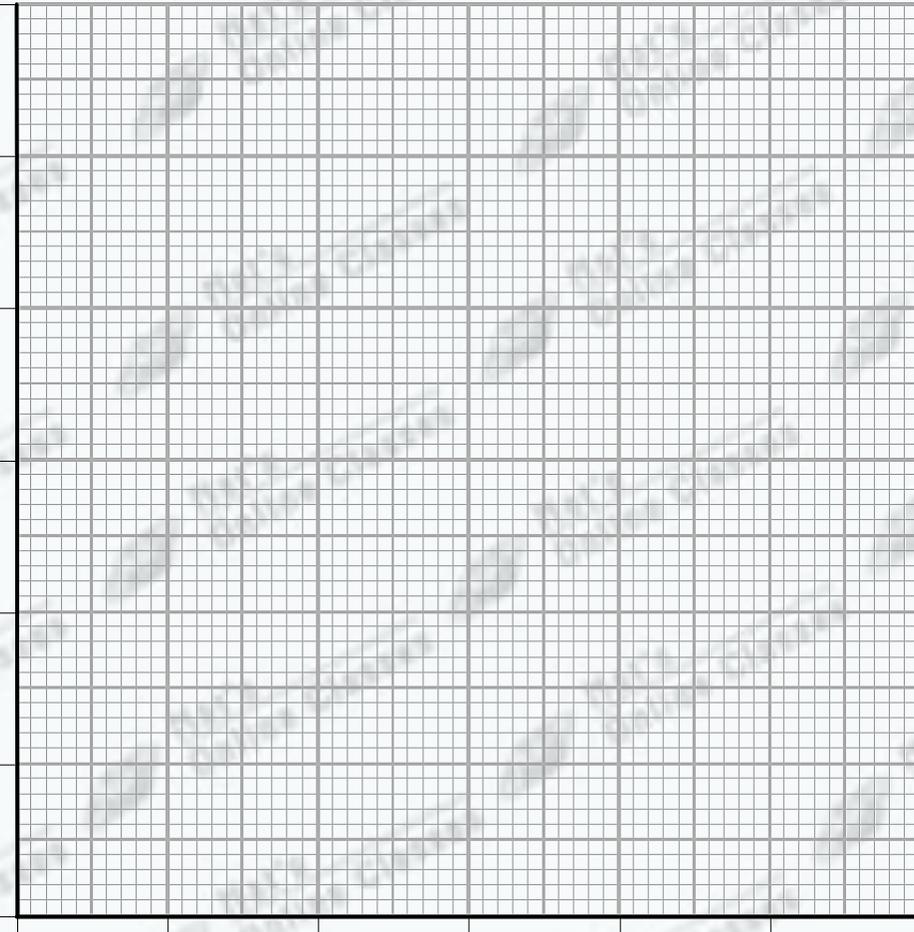The student investigates the extension of the spring using six different weights.

The results are shown in Figure 23.

weight (N)	extension (mm)
0.20	4.0
0.40	8.0
0.60	12.0
0.80	16.0
1.00	20.0
1.20	24.0

Figure 23

(i)   Draw a graph for the readings, using the grid shown.

(3)

(ii) The student writes this conclusion:

'*The extension of the spring is directly proportional to the weight stretching the spring*.'

Comment on the student's conclusion.

(3)

(c) The student extends the investigation by finding information about the stretching of wires.

The student finds the graph shown in Figure 24 for the stretching of a wire.
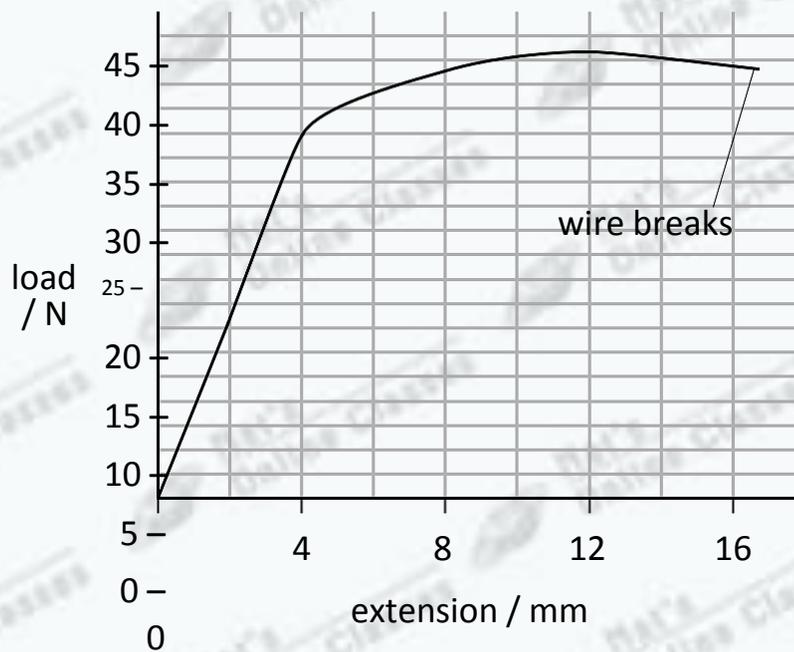

Figure 24

Describe the non-linear stretching of the wire shown in Figure 24.

(3)

(Total for Question = 11 marks)

Mark Scheme

Question number	Answer	Additional guidance	Mark
1(a)	evidence that anomalous reading excluded (1) answer (1) average length = 20.31 (mm)	accept 101.57 (÷5) for first mark accept 20.314 (mm)	(2)

Question number	Answer	Additional guidance	Mark
1(b)(i)	✗ Axes with linear scales that use more than half of each edge of the grid and labelled with units from table (1) ✗ All points correctly plotted to ± half a square (1) ✗ Single straight line passing through all points and the origin (1)	allow 1 mark if only one plotting error and correct line drawn for points plotted	(3)

Question number	Answer	Additional guidance	Mark
1(b)(ii)	A comment that makes reference to the following points: (using table) • idea that equal increments of force/weight/mass cause equal increments of extension (1) • correct reference to figures in the table (1) OR (using graph) • the graph line is straight (1) • the graph line passes through the origin (1) AND therefore the student's conclusion is correct (1)	last marking point can only be achieved if at least one of the other two marks is awarded	(3)

Question number	Answer	Additional guidance	Mark
1.(c)	An answer that combines points of interpretation/evaluation to provide a logical description: • above 37.5 N/4 mm there are large increases of extension for small increases in load (1) • the maximum extension of the wire is about 16.5 mm before it breaks (1) • above 12 mm the wire keeps on extending when the load is reduced below 46 N (1)	accept extension is (much) greater for each 1 N increase in load above 37.5 N	(3)