3 Atoms of an element emit characteristic spectral lines when they are bombarded with a beam of high energy electrons. The spectral lines can be used to identify the element.

(a) The relationship between the atomic number Z and the frequency f of the most intense spectral line is given by

$$Z = k f^n$$

where k and n are constants.

Explain why a graph of log Z against log f would give a straight line.

(2)

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(b) The table shows the frequency of the most intense spectral line for a range of elements.

Element	Z	f / 10^{15} Hz		
Li	3	0.16		
C	6	0.69		
Si	14	4.19		
Mn	25	13.82		
Sr	38	33.98		
Hg	80	154.64		

(i) Plot a graph of log Z against log f on the grid opposite. Use the additional columns for your processed data.

You should **not** convert the values of f from 10^{15} Hz to Hz.

(6)

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(ii) Determine the value of n.

(3)

$n =$ .....

(iii) Determine the value of k using your graph.

(3)

$k =$ .....

(c) A scientist named Henry Moseley suggested that $Z \propto f^{0.5}$

Explain whether the graph supports this suggestion.

(2)

(Total for Question 3 = 16 marks)