

- 1 In 1864 a scientist named John Newlands worked on arranging elements into a table. The table is shown below.

The elements were arranged in order of their relative atomic masses.

Elements with similar properties were placed in vertical columns.

He called this pattern the 'Law of Octaves'

H	Li	Be	B	C	N	O
F	Na	Mg	Al	Si	P	S
Cl	K	Ca	Cr	Ti	Mn	Fe
Co/Ni	Cu	Zn	Y	In	As	Se
Br	Rb	Sr	Ce/La	Zr	Di/Mo	Ro/Ru
Pd	Ag	Cd	U	Sn	Sb	Te
I	Cs	Ba/V	Ta	W	Nb	Au
Pt/Ir	Tl	Pb	Th	Hg	Bi	Os

- 1 (a) (i) Why did he call his pattern the 'Law of Octaves'?

[2 marks]

Elements with similar properties [1 mark]

Seemed to be repeated every eighth element [1 mark]

- 1 (a) (ii) Some scientists did not agree with the way the elements were arranged. Use your knowledge of the chemistry of the elements and examples from the table above to suggest why some scientists did not agree with the arrangement of elements.

[3 marks]

Many elements in the groups have very dissimilar properties [1 mark]
e.g. Cu + K [1 mark]

Two elements in one place on the table [1 mark]
e.g. Ce or La [1 mark]

No distinction between metals & non-metals or metals and non-metals mixed up [1 mark]

Newlands didn't allow spaces for new elements [1 mark]

Octaves are found in music, but not relevant to this answer.

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- 1 (b) Another scientist called Dimitri Mendeleev worked on the arrangement of elements into a table. In Mendeleev's table, most of the elements were put in order of increasing relative atomic mass, and spaces were left for elements that Mendeleev thought would be discovered in the future.

Here is part of Mendeleev's table for group 3 elements, with a gap.

Group 3
Boron
Aluminium
?
Indium
Thallium

Some scientists were critical of Mendeleev's table.

Suggest why scientists might have been critical of Mendeleev's table.

[2 marks]

The elements were put in order of mass or why put them in order of mass. [1 mark]

They did not like the fact that he left gaps or did not complete the table. [1 mark]

There was no evidence for undiscovered elements or they thought all the elements had been discovered [1 mark]

He put metals and non-metals together [1 mark]

You could also say that there are other equally valid orders, e.g. alphabetical. These types of question are sometimes tricky to answer and sometimes students write answers like, 'didn't believe him, they were jealous, didn't like it,' which are not quite going to get the marks. This topic is definitely worth revising carefully using different resources.

- 1 (b) (i) A few years after this table was developed, an element was discovered that fitted into the space in the above group.

Suggest why the discovery of this element convinced other scientists that Mendeleev's table was correct.

[1 mark]

The properties of the element fitted the predictions or predictions were correct or the properties would make it fit in the gap or (properties) would make it fit in group 3 or finding this element proved that there were undiscovered elements. [1 mark]

(Total 8 marks)