Solar Elements   *M015 scoring rubric*

Math Domain

| ✓ Number/Quantity | ☐ Shape/Space | ☐ Function/Pattern |
| ✓ Chance/Data | ☐ Arrangement | |

Math Actions (possible weights: 0 through 4)

| 3 Modeling/Formulating | 1 Manipulating/Transforming |
| 2 Inferring/Drawing Conclusions | 2 Communicating |

Math Big Ideas

☐ Scale	☐ Reference Frame	☐ Representation
☐ Continuity	☐ Boundedness	☐ Invariance/Symmetry
☐ Equivalence	☐ General/Particular	☐ Contradiction
☐ Use of Limits	☐ Approximation	☐ Other

A heavier element will have a larger weight per atom, while a lighter element will have a smaller weight per atom. So, all of the questions can be answered by examining the ratio of the abundance in weight to the abundance in number of atoms.

Element	Abundance (% of total number of atoms)	Abundance (% of total weight)	Ratio of abundance in weight to abundance in number
Silicon	0.0045%	0.0990%	22.000
Magnesium	0.0038%	0.0760%	20.000
Neon	0.0035%	0.0580%	16.571
Oxygen	0.0780%	0.9700%	12.436
Nitrogen	0.0088%	0.0960%	10.909
Carbon	0.0430%	0.4000%	9.302
Helium	8.7000%	27.1000%	3.115
Hydrogen	91.2000%	71.0000%	0.779

This table is sorted with ratios from largest to smallest, meaning that the heaviest atoms are at the top. It shows that

1. Helium atoms are heavier than Hydrogen atoms.

2. Oxygen atoms are heavier than Carbon atoms.

3. Silicon is the heaviest of the listed atoms.

4. All the elements are ranked in the order shown in the table.

	partial level (1 or 2)	full level (3)
Modeling/ Formulating (weight: 3)	Devises a method for comparing the two columns of data that is only partially correct or doesn't work for some of the questions.	Devises a fully effective method for comparing the two columns of data (e.g., using an appropriately chosen ratio).
Transforming/ Manipulating (weight: 1)	Performs only some of the necessary computations correctly.	Performs all necessary computations correctly.
Inferring/ Drawing Conclusions (weight: 2)	Has some correct ideas about ordering but consistently makes the opposite of the correct conclusion (e.g., writes a list in problem **4** that is exactly the reverse of the correct order, and gives answers in **1**–**3** that are consistent with this reversal).	Arranges the elements in the correct order and reaches consistently correct conclusions about which atoms are heavier.
Communicating (weight: 2)	Shows computations clearly but does not explain how the answers were reached.	Provides a clear verbal explanation of the solution method.