

Trends in the Periodic Table

Answer Questions on separate notebook paper!

1. Draw a line in the middle of a piece of graph paper, separating the page into top and bottom. On the top, plot a graph of ionization energy (y-axis) vs. atomic number (x-axis). On the bottom plot a separate graph of atomic radius vs. atomic number. For each graph connect successive dots with straight lines. Also, ensure that identical atomic numbers are plotted on the same vertical position on the sheet (i.e. atomic number 1 in the top graph should be on the same line as atomic number 1 in the bottom graph).
2. Examine your graph of ionization energy (IE) vs. atomic number.
Which elements are found at the main peaks on your graph (there should be 3)?
What do these elements have in common?
Which elements are found at the main valleys on your graph (there should be 3)?
What do these elements have in common?
3. Examine your graph of atomic radius versus atomic number.
Which elements are found at the peaks on your graph?
What do these elements have in common?
Which elements are found at the valleys on your graph?
What do these elements have in common?
4. How are atomic radii and ionization energy related (i.e. as atomic radius increases, what happens to the ionization energy)?
5. Generally, as you go from left to right across a period on the periodic table, what happens to atomic radius? What about IE?
6. Generally, as you go down a group in the periodic table, what happens to atomic radius and IE?
7. When Na forms an ion it loses its outer electron to become Na⁺. Draw Bohr diagrams for Na and Na⁺. What element does Na⁺ resemble (with respect to its electron arrangement)? In general, which group's electron configuration do the alkali metals resemble when they form ions (i.e. lose an outer electron)?
8. Why does radius increase as you go down a group (hint: think of Bohr diagrams)?
Why would an increase in radius make it easier to lose an outer electron (i.e. give a lower ionization energy)?
9. What happens to the number of protons in the nucleus as you go across a period?
Use this to explain the trends in atomic radius and ionization energy across a period.
10. Pages 190 and 194 have diagrams showing trends in the periodic table.
There is one group that is usually ignored because it does not follow these trends. Which group is usually ignored?
11. Define Electronegativity. Where on the periodic table is it highest?
Explain why this is the case.

| Atomic number | Element symbol | First ionization energy (kJ/mol) | Atomic radius (pm) |
|---------------|----------------|----------------------------------|--------------------|
| 1 | H | 1312 | 32 |
| 2 | He | 2372 | 31 |
| 3 | Li | 520 | 123 |
| 4 | Be | 899 | 90 |
| 5 | B | 801 | 82 |
| 6 | C | 1086 | 77 |
| 7 | N | 1402 | 75 |
| 8 | O | 1314 | 73 |
| 9 | F | 1681 | 72 |
| 10 | Ne | 2081 | 71 |
| 11 | Na | 496 | 154 |
| 12 | Mg | 738 | 136 |
| 13 | Al | 578 | 118 |
| 14 | Si | 786 | 111 |
| 15 | P | 1012 | 106 |
| 16 | S | 1000 | 102 |
| 17 | Cl | 1251 | 99 |
| 18 | Ar | 1521 | 98 |
| 19 | K | 419 | 203 |
| 20 | Ca | 590 | 174 |