

Forming Ions

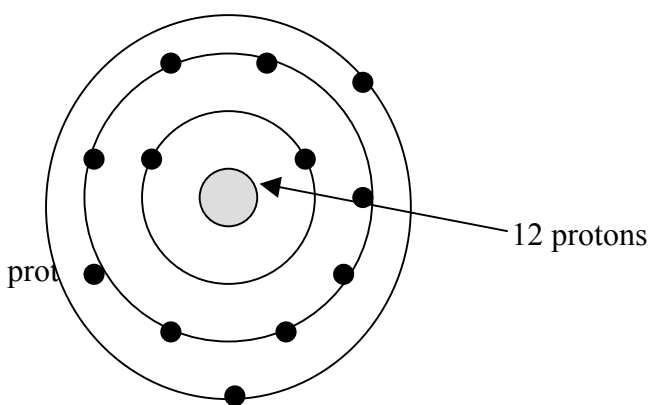
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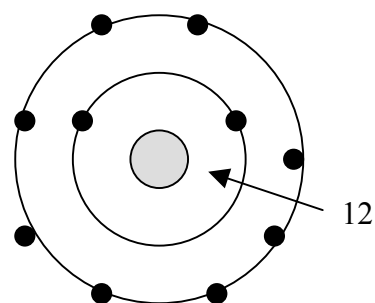
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Information: Ions

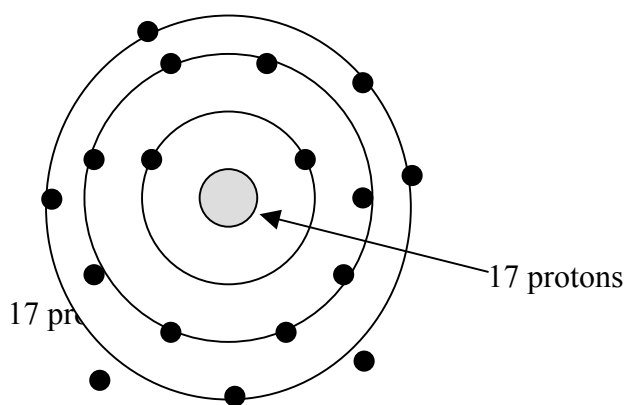
Figure 1: Below are four Bohr diagrams of atoms and ions. The two diagrams on the left are atoms; the two on the right are ions.



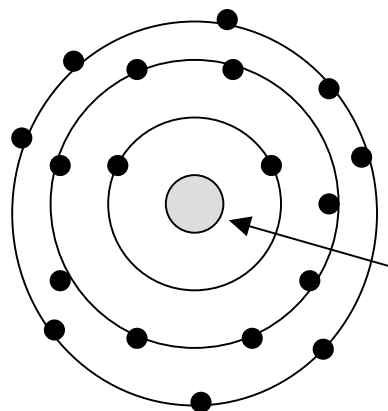
Atom A



Ion of Atom A



Atom B



Ion of Atom B

Critical Thinking Questions

1. Prove that both Atom A and Atom B are neutral (have a charge of zero).

2. What is the identity of Atom A and of Atom B?
3. Given the above diagrams, how does an atom become an ion?
4. What is the charge on Ion A? What is the charge on Ion B?
5. Write the electron configuration (ex: $1s^22s^22p^6 \dots$) for each ion and atom shown in the Bohr diagrams.

Atom A: _____ Ion A:

Atom B: _____ Ion B:

6. Consider the electron configuration that you wrote for Ion A. What atom has the same electron configuration as this ion?
7. Consider the electron configuration that you wrote for Ion B. What atom has the same electron configuration as this ion?
8. Bromine atoms always gain one electron when they become an ion. Which atom has the same number of electrons as a bromine ion?
9. Cesium atoms always lose one electron to become an ion. Which atom has the same number of electrons as a cesium ion?
10. Consider your answers to questions 6-9. What do all of the atoms you named have in common?
11. Knowing what you know about the atoms that you named in questions 6-9, why do you think atoms want to form ions the way they do?

Information: Ions

As you know, all of the noble gases are very stable. Ions form in such a way so that the ion will have the same number of electrons as a noble gas. Take oxygen, for example. Oxygen has 8 electrons. To become like a noble gas it could either gain two to become like neon or it could lose six to become like helium. So what will oxygen do—gain two or lose six? As a general rule, atoms will gain or lose the fewest number of electrons possible.

Critical Thinking Questions

12. What does an oxygen atom do when becoming an ion? (Does it gain or lose electrons and how many?)

13. An oxygen atom has an overall neutral charge because it has an even number of protons and electrons. What is the overall charge on an oxygen ion?

14. Consider an aluminum atom.
 - a) To become like argon, would aluminum have to gain or lose electrons? How many?

 - b) To become like neon, would aluminum have to gain or lose electrons? How many?

 - c) Considering your answers to parts a and b, what does an aluminum atom do to become an ion?

 - d) What is the charge on an aluminum ion?

15. When each of the following atoms becomes an ion, what will the charge be? (Your answer should include the sign and magnitude such as +1, +2, -2, etc...)
 - a) Ca
 - b) Cl
 - c) N
 - d) K
 - e) S
 - f) B
 - g) P