

Answers to Review for Quiz #1: Atomic Structure

- Glossary terms for match-up or multiple choice questions: chemistry, matter, elements, sub-atomic particles, atomic number, protons, neutrons, electrons, mass number, isotope, atom, cation, anion, chemical group (family), period, valence electrons, ion, metal, non-metal, metalloid, stable octet, Alkali metals, Alkaline Earth Metals, Halogens, and Noble Gases.
- Be able to **write** definitions for these terms. The definitions do not need to be word for word. Include enough information so that your definition is complete and clear.
 - atomic number** is the number of protons in the nucleus of an atom. Atomic number determines the identity of an atom (what type of atom it is).
 - mass number** is the number of protons plus the number of neutrons in the nucleus of an atom.
 - isotopes** are atoms of the same element that have different numbers of neutrons. Or, isotopes are atoms with the same atomic number and different mass numbers.
 - ions** are charged atoms. Ions are created when atoms lose or gain electrons so that the number of electrons does not equal the number of protons.
- Be able to compare the properties of metals and non-metals with regard to state at room temperature, colour, lustre (shiny or dull), malleability (malleable or brittle) and electrical conductivity .

Property	Metals	Non-metals
State at room temperature	all are solid except mercury	can be any state
Colour	all are silver-coloured except gold and copper	can be any colour
Lustre	are shiny	are dull in the solid state
Malleability	are malleable	are brittle in the solid state
Electrical Conductivity	are good conductors of electricity	are poor conductors of electricity

- The three sub-atomic particles in an atom: **protons**, **neutrons** and **electrons**
- Which sub-atomic particle distinguishes one element from another? the number of **protons**
- Which two sub-atomic particles are found in the nucleus? **protons** and **neutrons**
- In a neutral atom, the number of **electrons** equals the number of **protons**.
- The **maximum** number of electrons in the first electron shell is 2; the second shell holds 8; the third shell holds 8 and the fourth shell holds 18
- An atom has 30 protons, 28 electrons and 35 neutrons. The total electric charge is 2+ The mass number of this atom is **$(30 + 35) = 65$** . What element is it? **30 protons so the atom is zinc**
- An atom has 7 protons, 10 electrons and 9 neutrons. The total electric charge is 3-. The mass number of this atom is **$(7 + 9) = 16$** . What element is it? **7 protons so the atom is nitrogen**
- The mass number of an atom having 16 protons, 18 electrons and 20 neutrons is **$(16 + 20) = 36$**
- The number of electrons in the outer shell for any element in group VII is 7
- How many valence electrons does an atom of carbon have? 4 An atom of bromine? 7
- What is the charge on a sodium ion? 1+ A calcium ion? 2+ A fluorine ion? 1-
- The elements in a vertical column in the Periodic Table are called a **Group** or **Family**
- A horizontal row of elements in the Periodic Table is called a **Period**
- An atom is in the fourth period and Group VI(B) on the Periodic Table. It is **selenium (Se)**
- The Alkaline Earth Metal in the fifth period is **strontium (Sr)** (the Alkaline Earth Metals are Group II)
- The Halogen in the second period is **fluorine (F)** (the Halogens are Group VII)

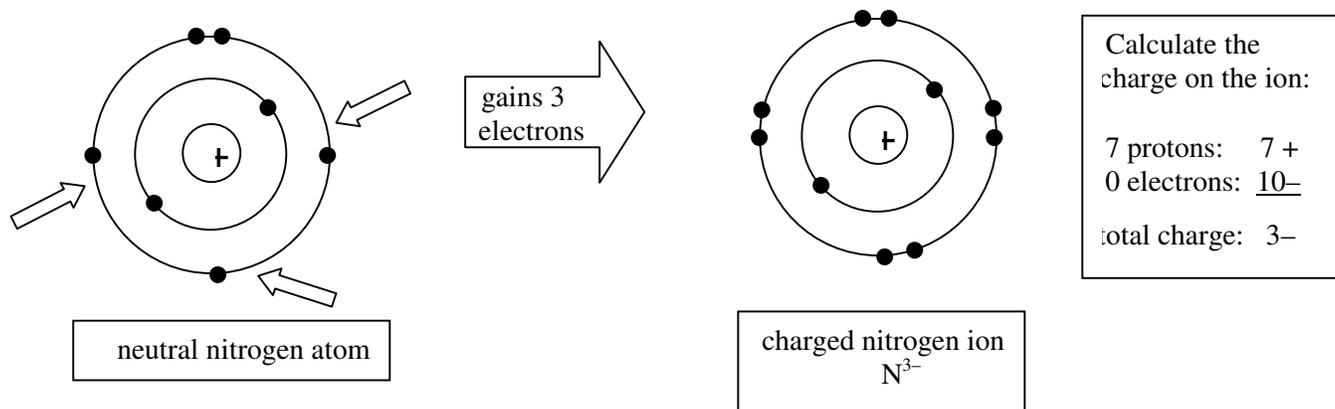
20. In order to become more stable, an atom of phosphorus will (gain/ lose) **gain** electrons. A phosphorus ion has **18** electrons. The charge on a phosphorus ion is **3-**.
21. Metal atoms tend to have 1, 2 or 3 electrons in their outer electron shell. They tend to **lose** these electrons to become **positively** charged ions called **cations**.
22. Many non-metal atoms have 5, 6, or 7 electrons in their outer electron shell. They tend to **gain** electrons to become **negatively** charged ions called **anions**.
23. Complete the following chart. Identify any isotopes of the same element.

Element	Atomic Number	# of Protons	# of Neutrons	Mass Number	Number of Electrons	Total Charge
Magnesium	12	12	13	25	10	2+
Phosphorus	15	15	17	32	18	3-
Oxygen	8	8	8	16	10	2-
Iron	26	26	36	62	24	2+
Magnesium	12	12	12	24	12	0
Helium	2	2	2	4	2	0
Calcium	20	20	22	42	18	2+
Sulfur	16	16	17	33	18	2-
Silver	47	47	60	107	46	1+
Scandium	21	21	25	46	18	3+
Nickel	28	28	31	59	26	2+
Nitrogen	7	7	8	15	10	3-

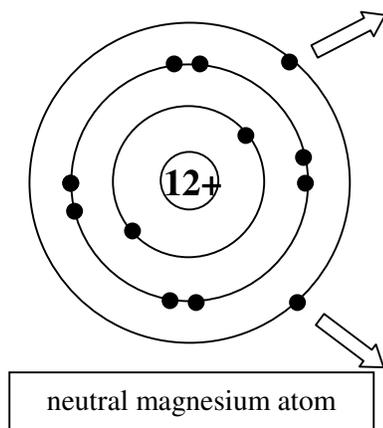
Identify any isotopes of the same element:

- there are two magnesium atoms in the chart – one has 13 neutrons and one had 12 neutrons so these atoms are isotopes of each other
24. Explain why many of the atoms and ions in the chart above have the same number of electrons, but they have different total electric charges.
- the charge on an ion depends on BOTH the number of protons and electrons
 - if an ion has the same number of electrons but different numbers of protons, then the total charge will be different
25. Draw Rutherford-Bohr diagrams to show the following neutral atoms forming their ions and calculate the final charge on each ion: nitrogen, magnesium, chlorine, lithium and sulfur.

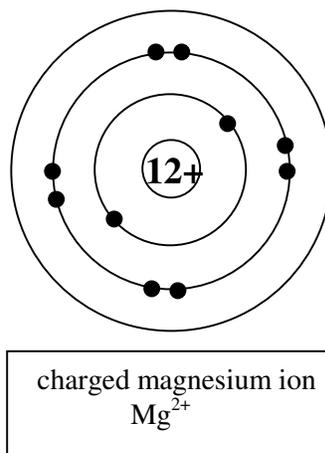
a) nitrogen



b) magnesium



loses 2
electrons



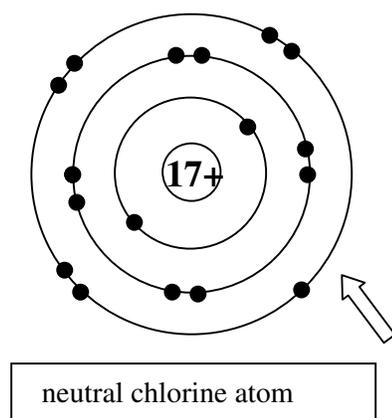
Calculate the charge
on the ion:

12 protons: 12 +

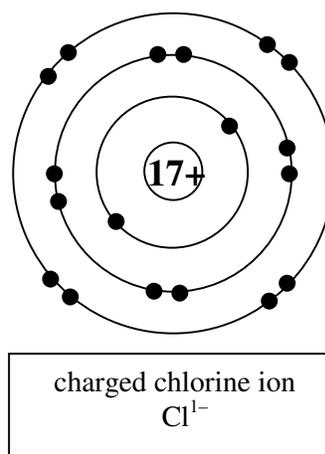
10 electrons: 10-

total charge: 2+

c) chlorine



gains 1
electron



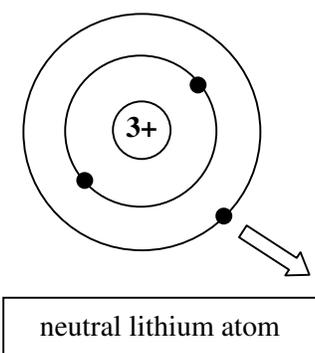
Calculate the charge
on the ion:

17 protons: 17 +

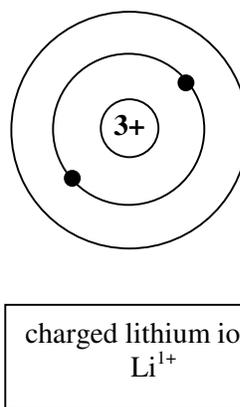
18 electrons: 18-

total charge: 1-

d) lithium



loses 1
electron



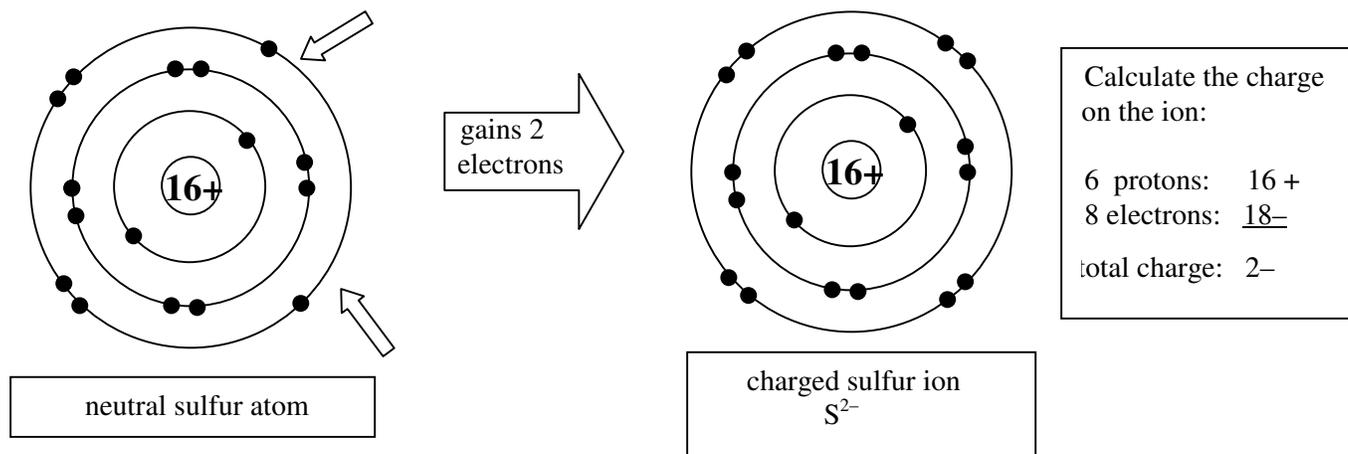
Calculate the
charge on the ion:

3 protons: 3 +

2 electrons: 2-

total charge: 1+

e) sulfur



26. Why don't the Noble Gases form ions?

- the Noble gases have a stable octet electron arrangement, or a full outer shell of electrons. This is very stable so they do not lose or gain electrons, so they don't form ions

27. Why can we use electron dot diagrams (EDDs) to represent atoms instead of Rutherford-Bohr diagrams?

- Rutherford-Bohr diagrams show all of an atom's electrons but it is only the valence electrons that participate in chemical reactions
- electron dot diagrams show only the valence electrons and because it is these electrons that determine how an atom will behave, these are the only electrons that we really need to worry about when we draw atoms