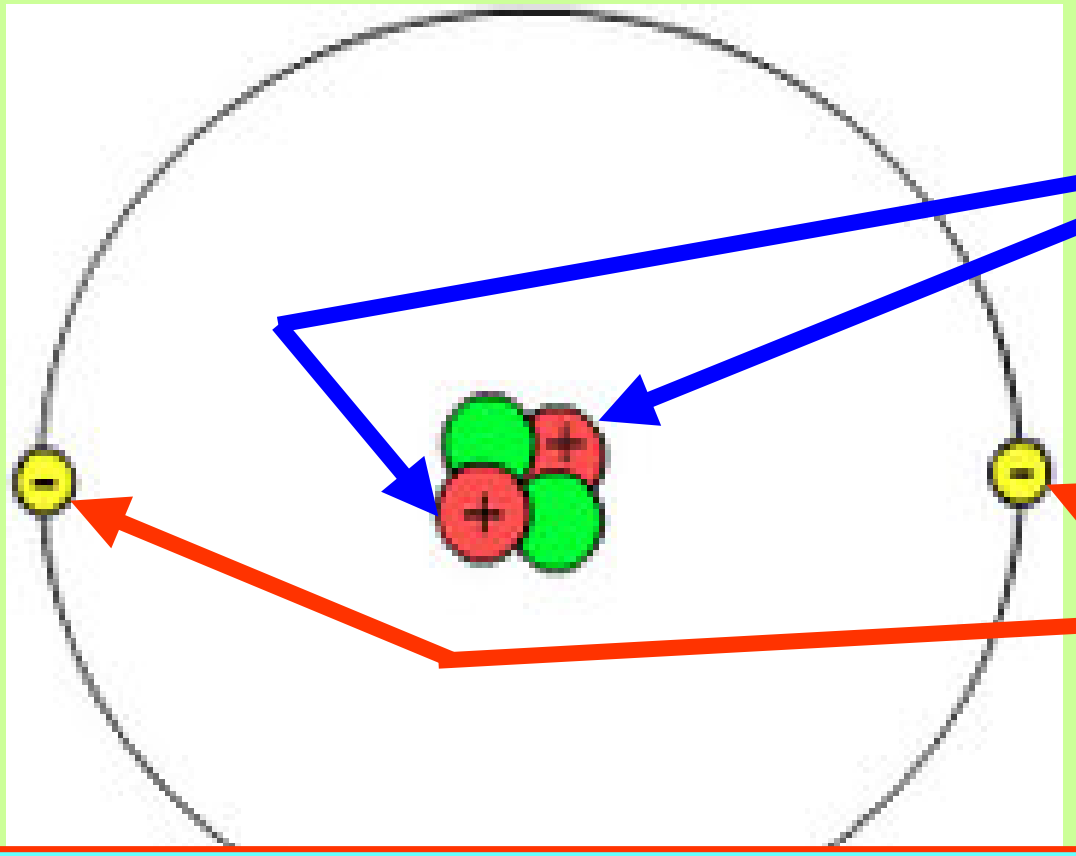
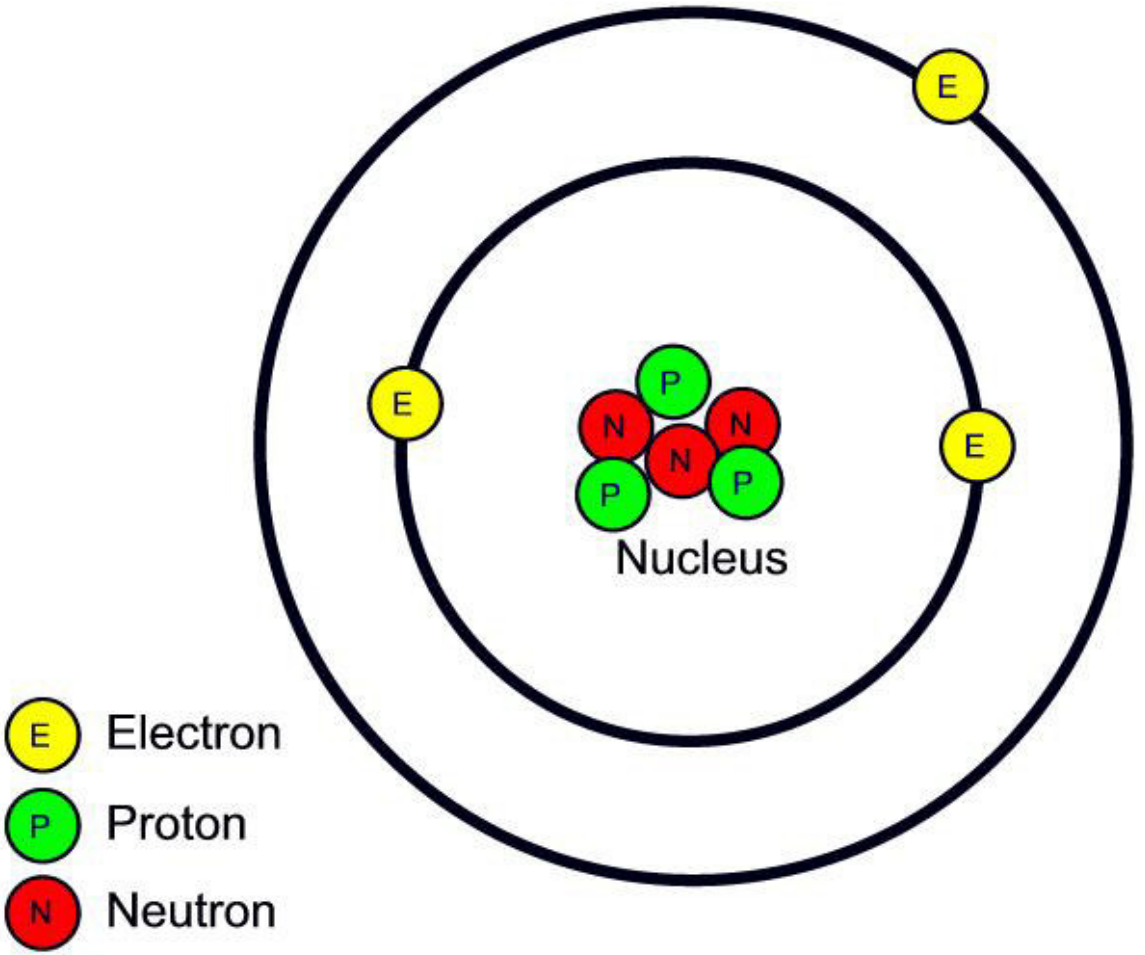
Atoms and Ions

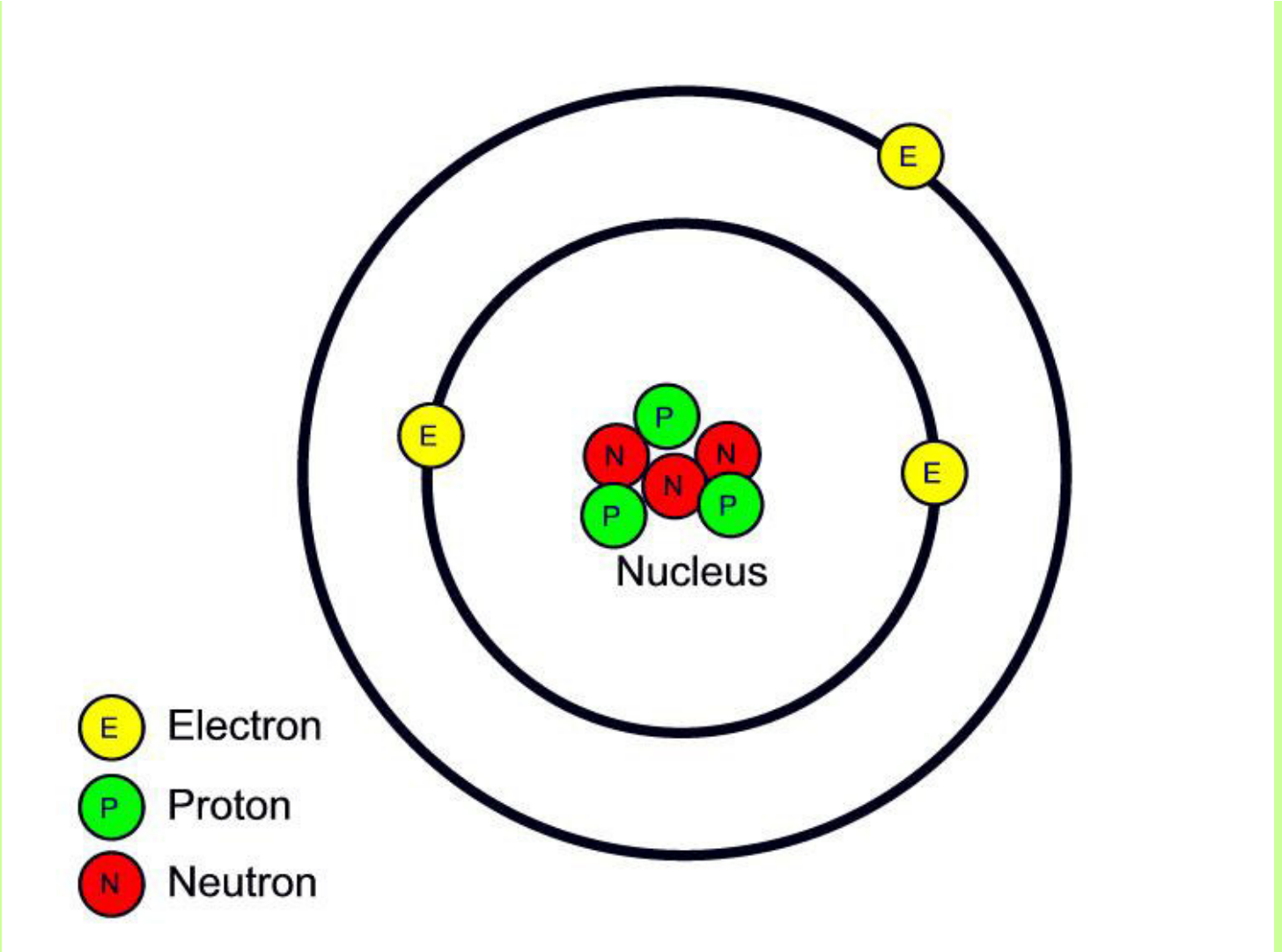


In a Neutral Atom of an Element:

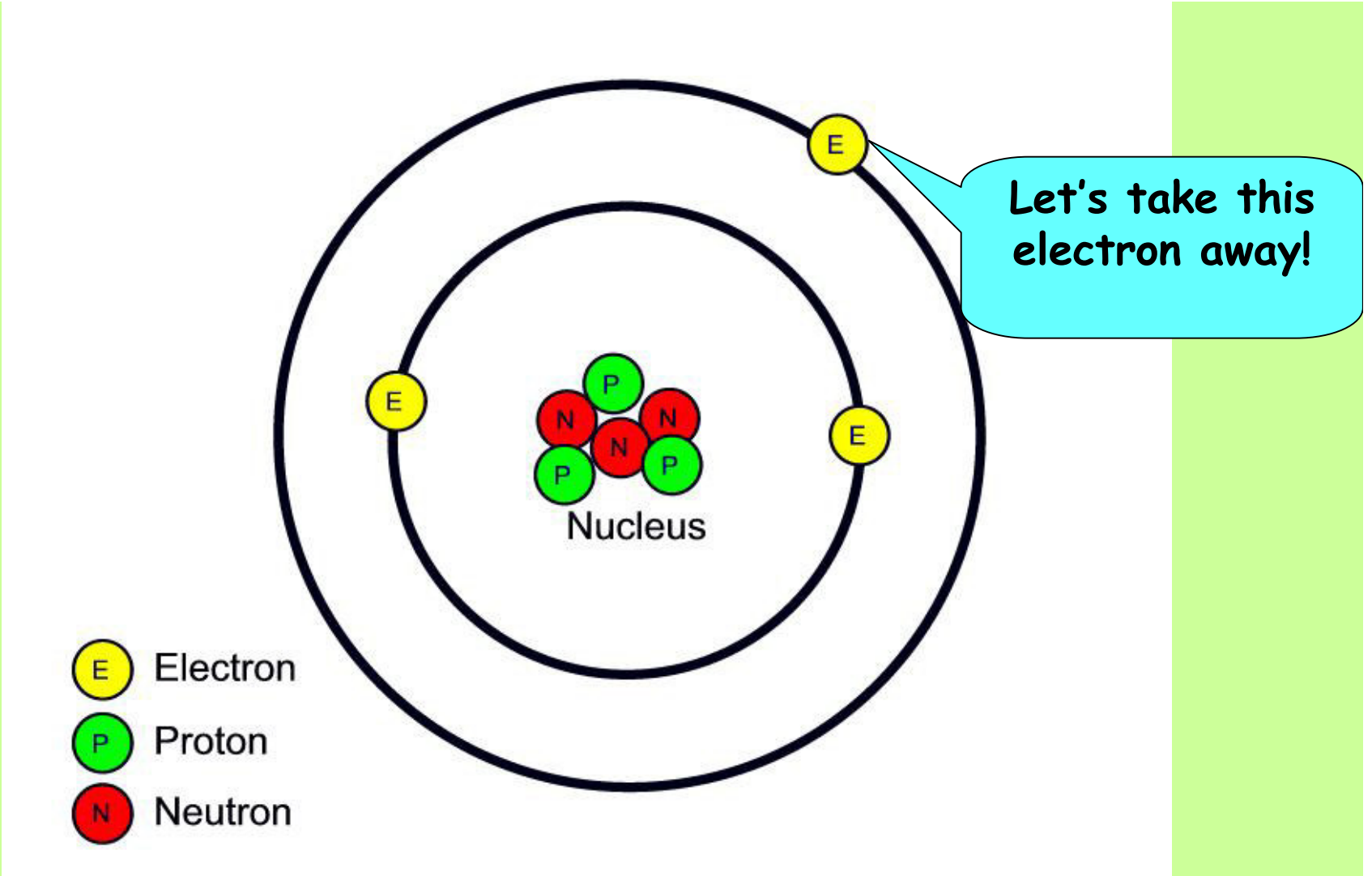
The # of Electrons(-) = The # of Protons(+)



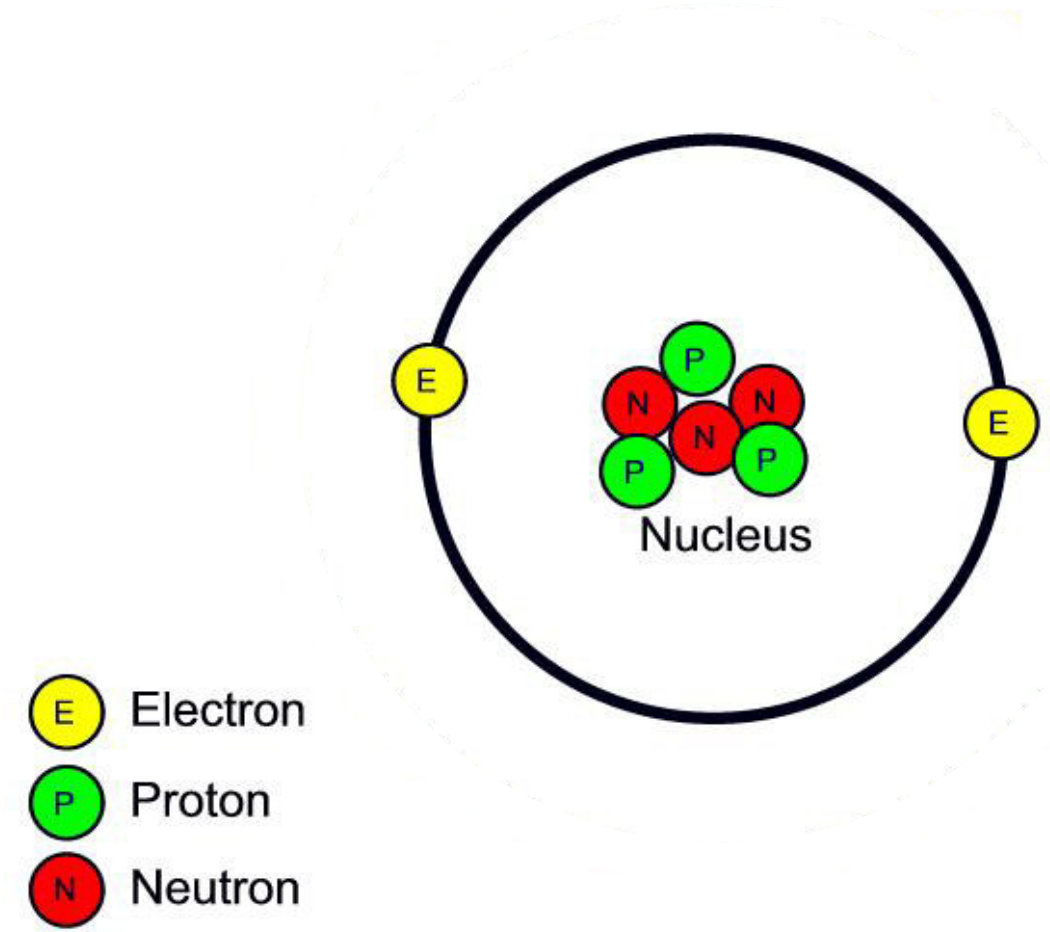
This represents an _____ of the element _____ (__P's & __ e^-'s)



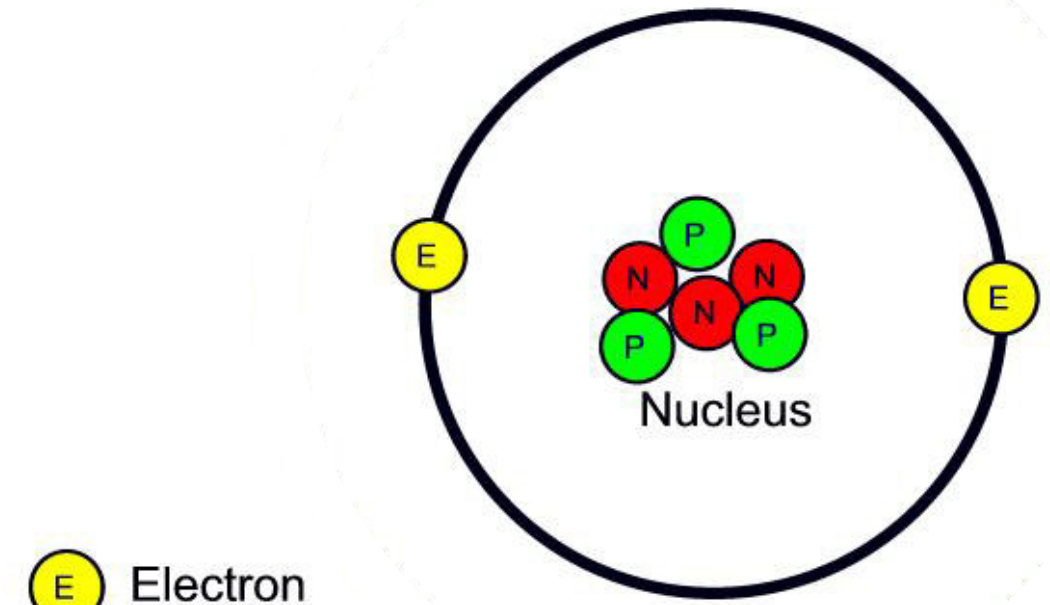
This represents an atom of the element Lithium (3 P's & 3 e^-'s)



This represents an atom of the element Lithium (3 P's & 3 e^-'s)



We have now taken one electron away from Lithium!

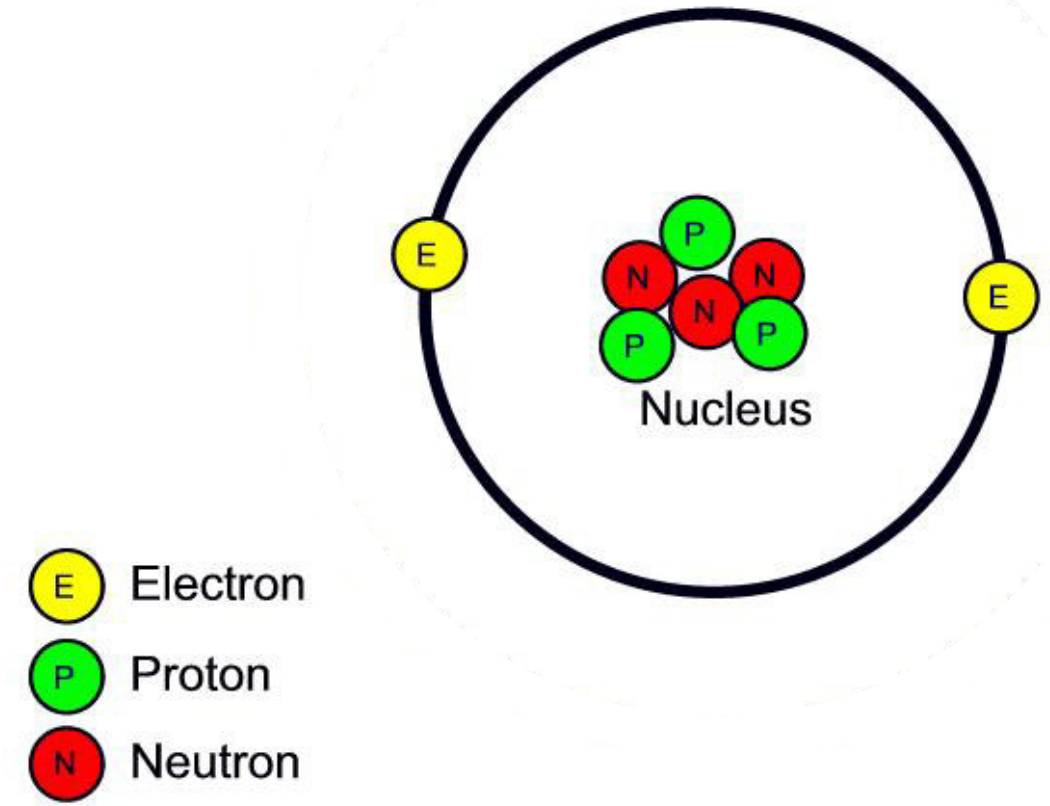


E Electron

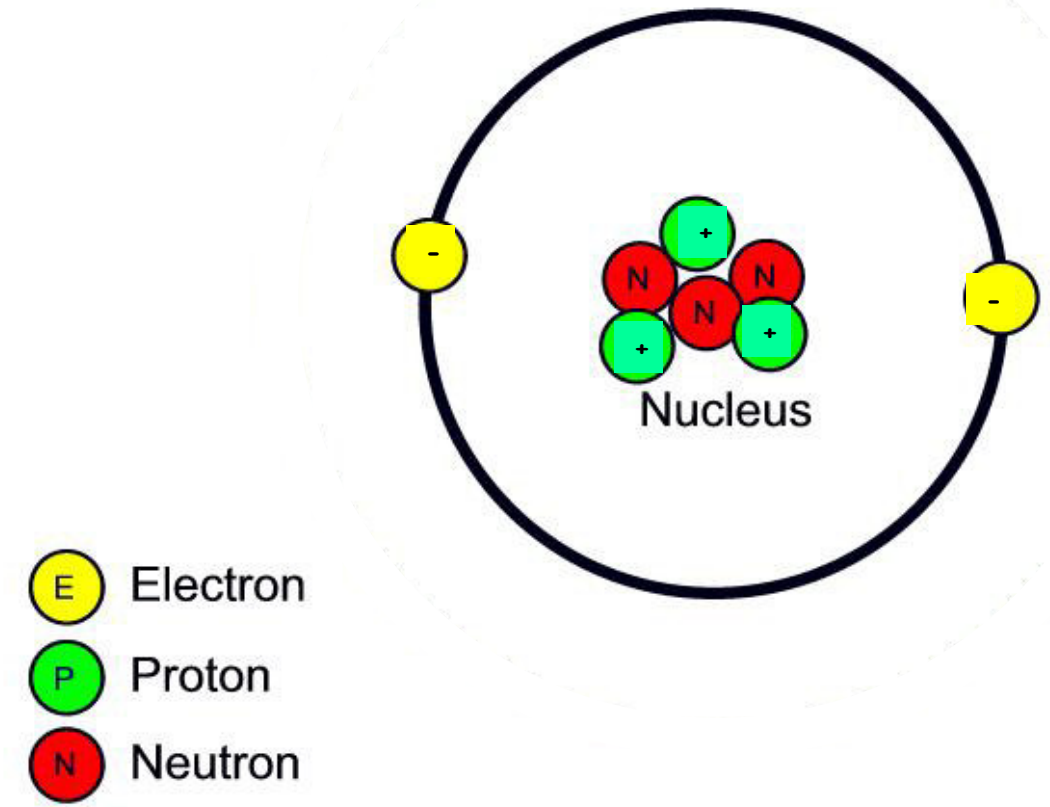
P Proton

N Neutron

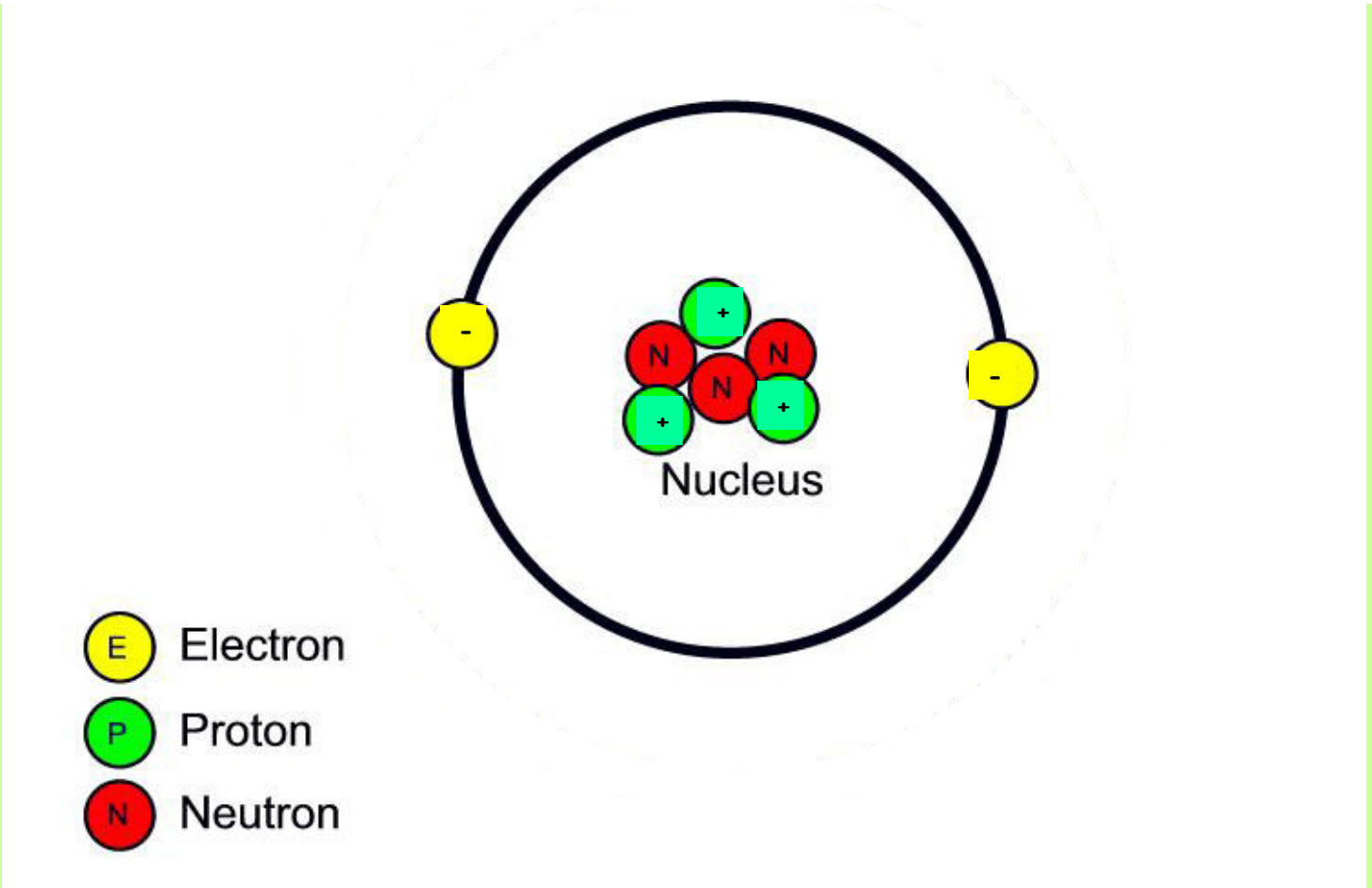
It still has 3 Protons, but now only 2 electrons! (Neutrons haven't changed)



This is no longer called "A Lithium Atom". It is now called a Lithium Ion.



Because Protons are Positive (+) and Electrons are Negative (-), this Lithium Ion has 3+'s and 2 -'s.



Because Protons are Positive (+) and Electrons are Negative (-), this Lithium Ion has 3+'s and 2 –'s. It has a "Net Charge" of +1. (+3 and –2 = +1)

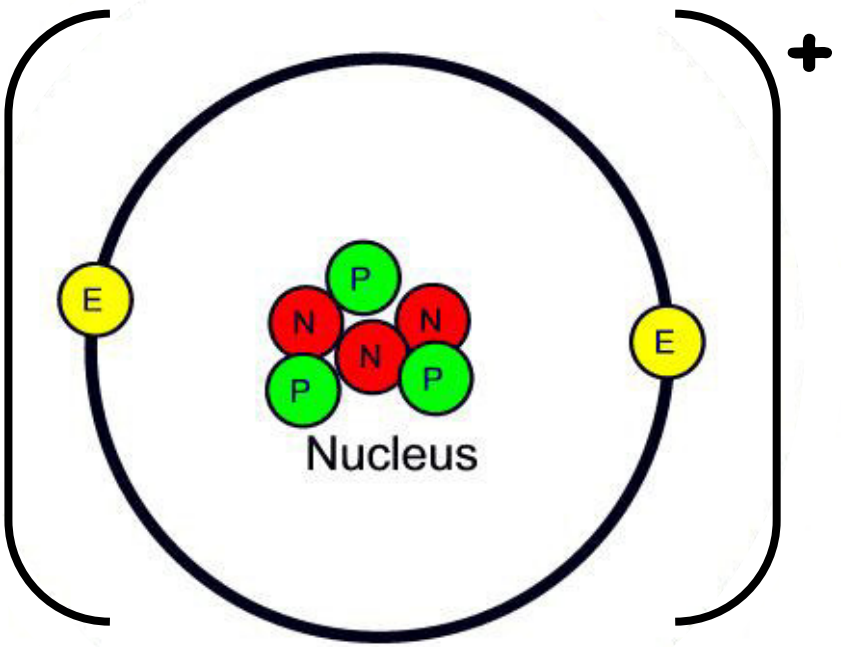
An Ion is an atom in which

# of Electrons ≠ # of Protons

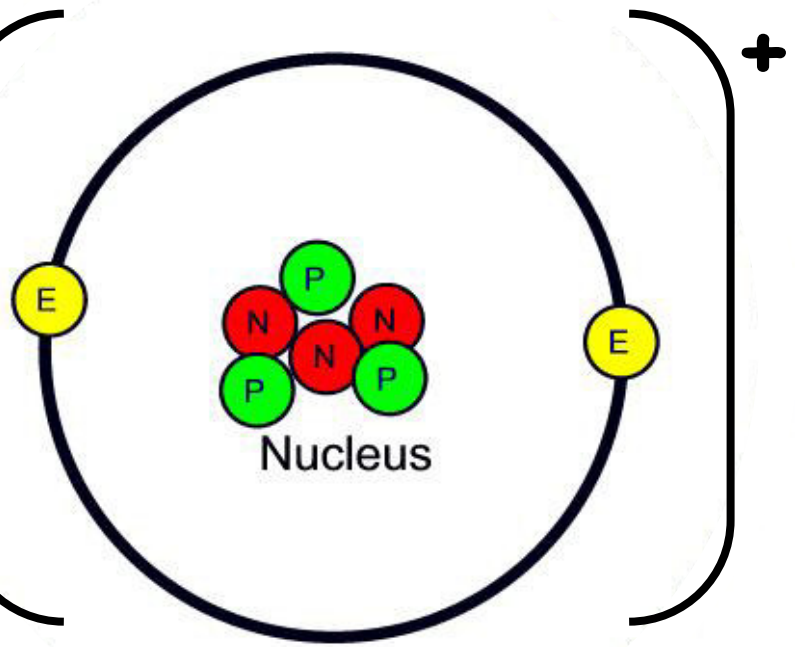
(*Neutrons don't matter here*)

An Ion can also be defined as an atom with a Net Charge

(Protons or Electrons are "left over")



A Lithium Ion is shown as having a net +1 charge.



Li^+

The symbol for a Lithium Ion is Li^+.

(Take out your Periodic Table!)

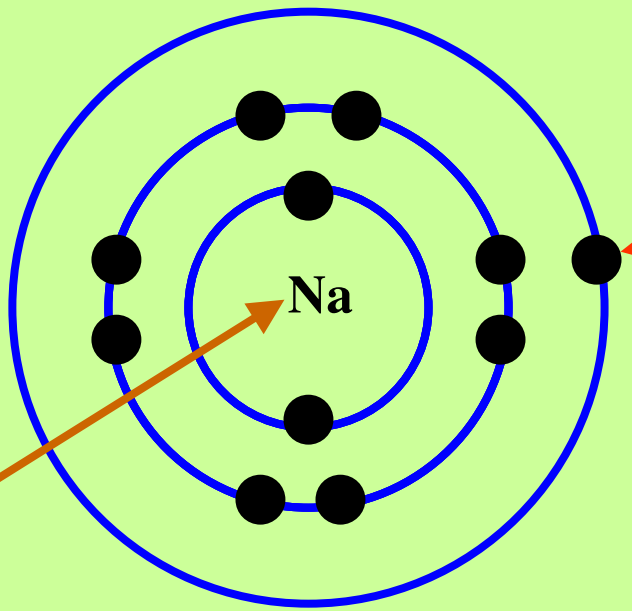
A Neutral Sodium (Na) Atom has

____ Protons(+) and ___ Electrons(-)

(Take out your Periodic Table!)

A Neutral Sodium (Na) Atom has

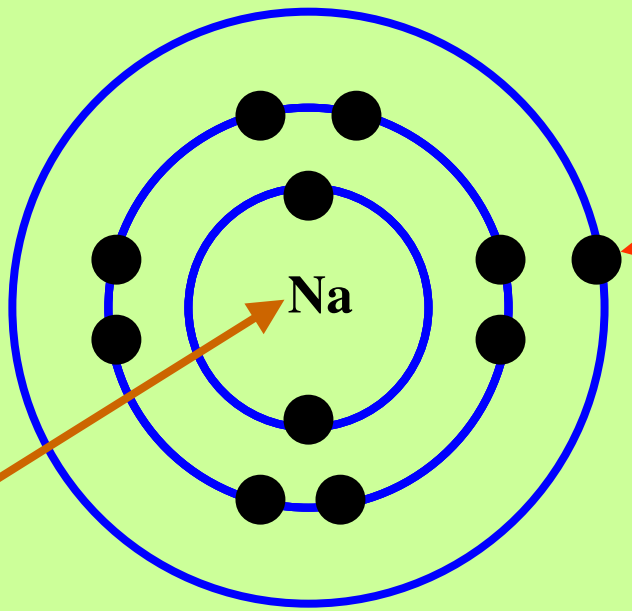
11 Protons(+) and 11 Electrons(-)



Has 11 Protons(+) in the Nucleus

Has 11 Electrons(-) around the outside.

A Neutral Sodium atom has a net charge of _____

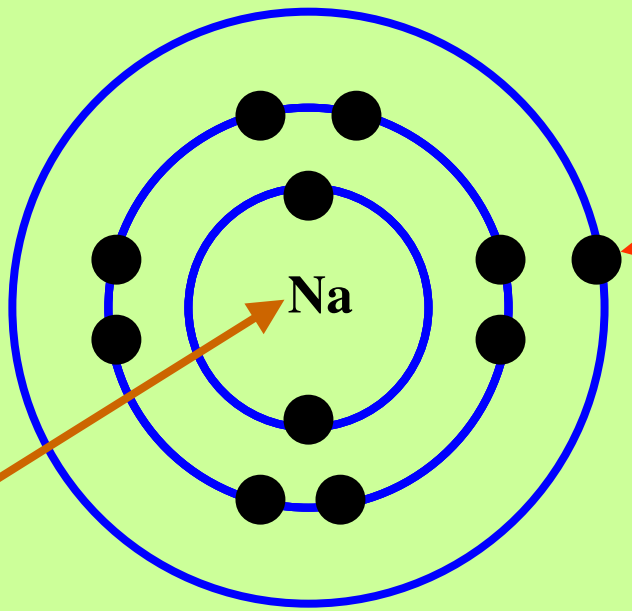


Has 11 Protons(+) in the Nucleus

Has 11 Electrons(-) around the outside.

A Neutral Sodium atom has a net charge of 0

(There are no P's or e^-'s left over!)



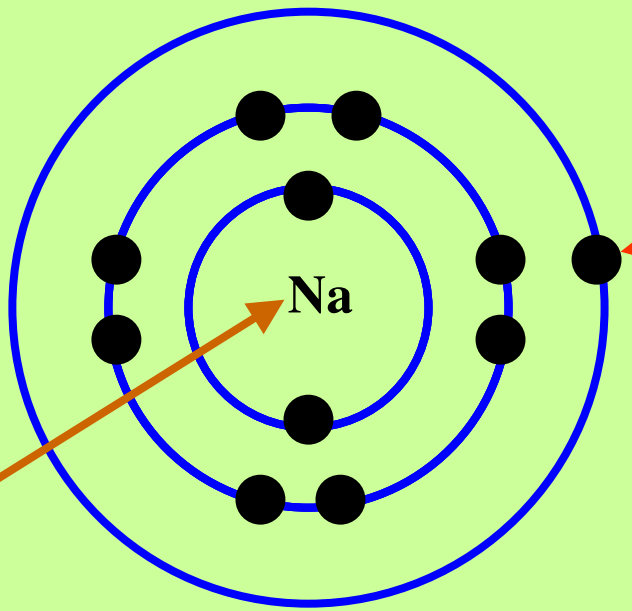
Has 11 Protons(+) in the Nucleus

Has 11 Electrons(-) around the outside.

OKAY. Let's REMOVE an electron from the Sodium Atom!

A Neutral Sodium atom has a net charge of 0

(There are no P's or e^-'s left over!)

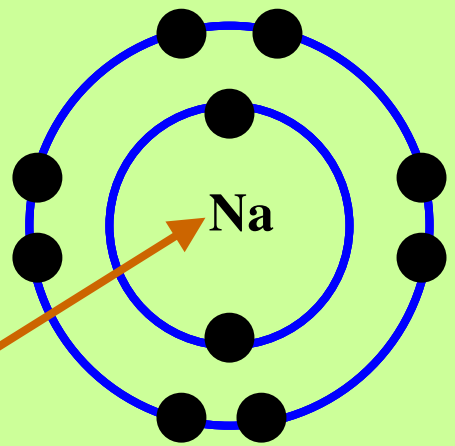


Has 11 Protons(+) in the Nucleus

Has 11 Electrons(-) around the outside.

It still has 11 Protons(+), but now it only has 10 Electrons(-)

(There is ONE P(+) left over!)



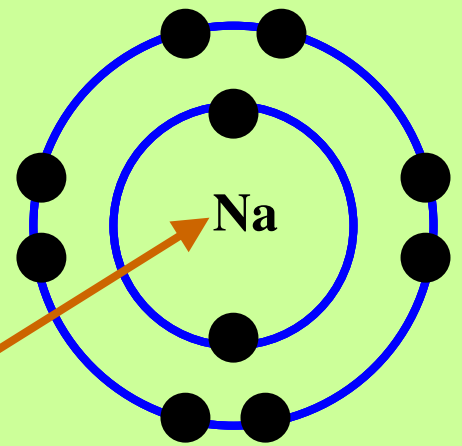
Has 11 Protons(+) in the Nucleus

Has 10 Electrons(-) around the outside.

It still has 11 Protons(+), but now it only has 10 Electrons(-)

(There is ONE P(+) left over!)

The NET CHARGE is +1

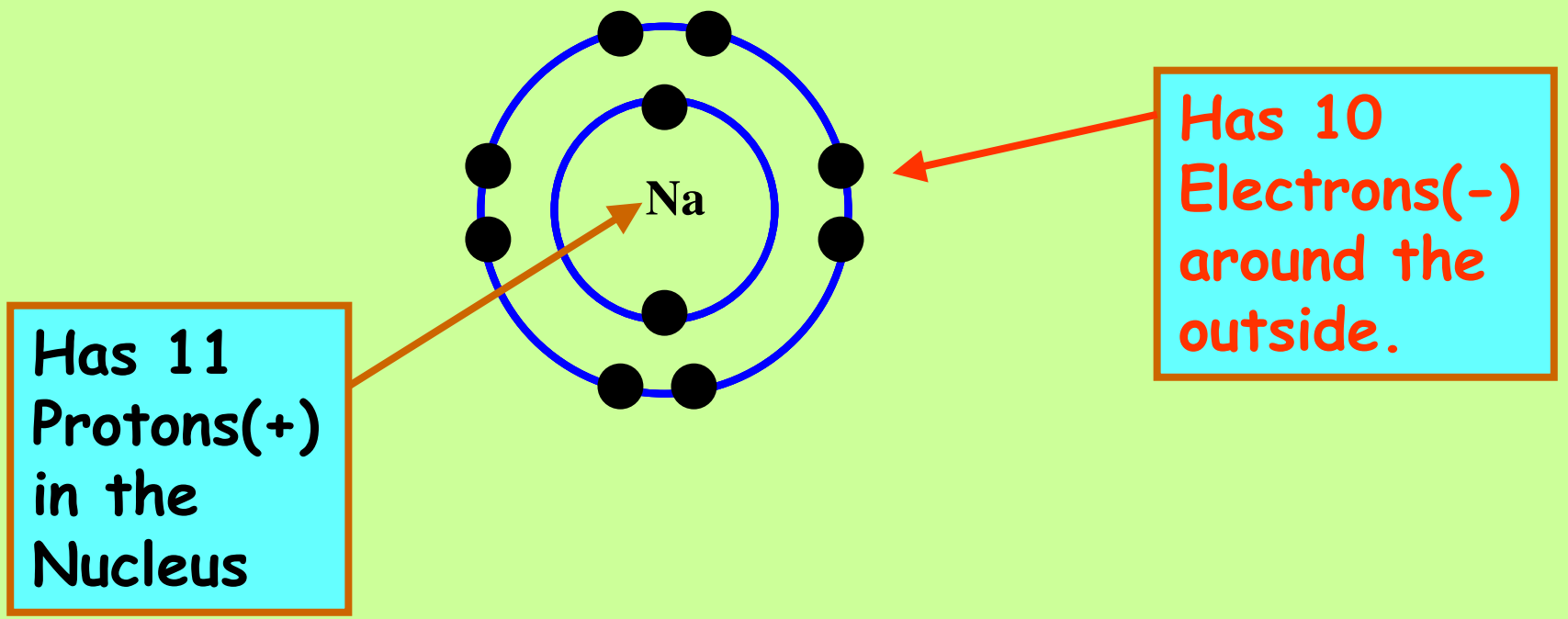


Has 10 Electrons(-) around the outside.

Has 11 Protons(+) in the Nucleus

It still has 11 Protons(+), but now it only has 10 Electrons(-)(*There is ONE P(+) left over!*)The NET CHARGE is +1

A Sodium Ion has the symbol Na^+



(Take out your Periodic Table!)

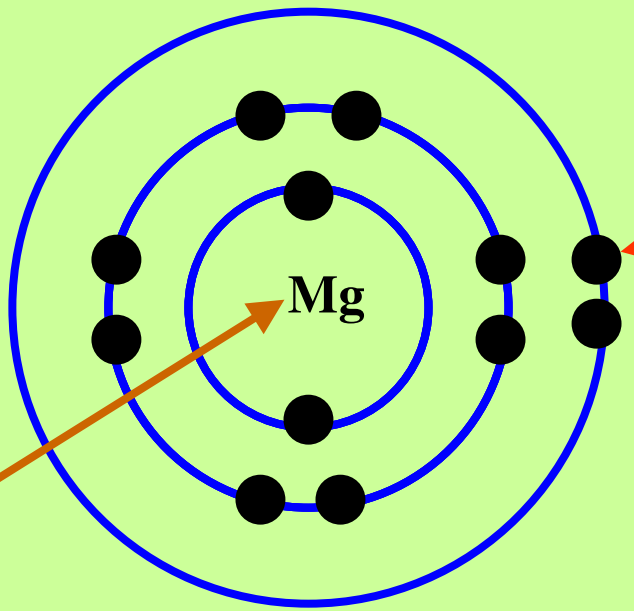
A Neutral Magnesium (Mg) Atom has

____ Protons(+) and ___ Electrons(-)

(Take out your Periodic Table!)

A Neutral Magnesium (Mg) Atom has

12 Protons(+) and 12 Electrons(-)



Has 12 Protons(+) in the Nucleus

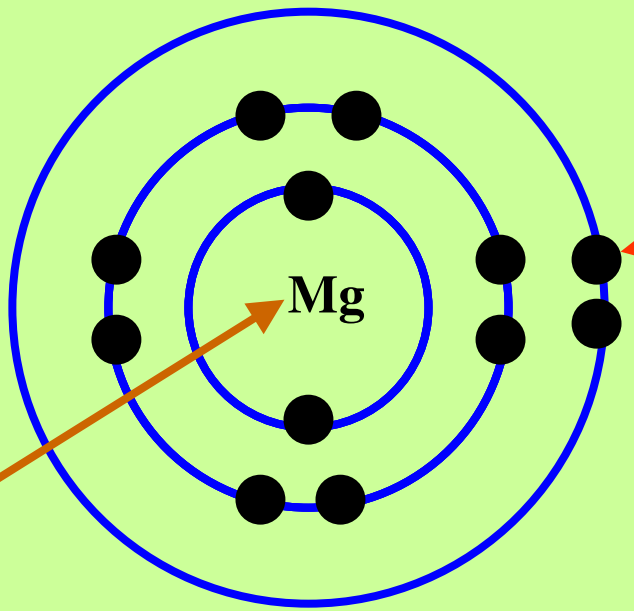
Has 12 Electrons(-) around the outside.

Magnesium tends to easily lose 2 electrons!

(Take out your Periodic Table!)

A Neutral Magnesium (Mg) Atom has

12 Protons(+) and 12 Electrons(-)

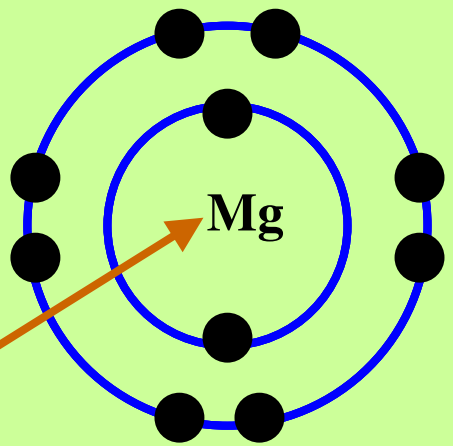


Has 12 Protons(+) in the Nucleus

Has 12 Electrons(-) around the outside.

It now has

12 Protons(+) and 10 Electrons(-)



Has 12 Protons(+) in the Nucleus

Has 10 Electrons(-) around the outside.

The NET CHARGE on this Magnesium ion is now _____

And the symbol for a Magnesium ion is:

_____

The NET CHARGE on this Magnesium ion is now __2+__

And the symbol for a Magnesium ion is:

Mg^{2+}

So an Mg^{2+} ion has

___Protons(+) and ___Electrons(-)

So an Mg^{2+} ion has

12 Protons(+) and 10 Electrons(-)

The ATOMIC NUMBER on the Periodic Table

If the NET CHARGE is 2+, it means it has 2 LESS Electrons than Protons!
(Protons don't change, only Electrons!)

An Al^{3+} ion has

___Protons(+) and ___Electrons(-)

So an Al^{3+} ion has

13 Protons(+) and 10 Electrons(-)

The ATOMIC NUMBER on the Periodic Table

If the NET CHARGE is 3+, it means it has 3 LESS Electrons than Protons!
(Protons don't change, only Electrons!)

Electrons can be ADDED to Neutral Atoms to make IONS. If an Ion has MORE Electrons(-) than Protons(+), the NET CHARGE on that ion is (*positive/negative*) _____

Electrons can be ADDED to Neutral Atoms to make IONS. If an Ion has MORE Electrons(-) than Protons(+), the NET CHARGE on that ion is (*positive/negative*) Negative

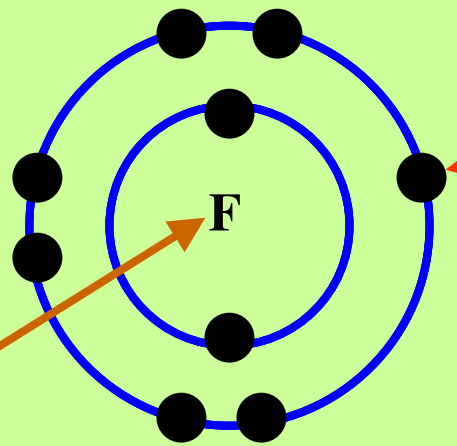
(Take out your Periodic Table!)

A Neutral Fluorine (F) Atom has

____ Protons(+) and ___ Electrons(-)

A Neutral Fluorine (F) Atom has

9 Protons(+) and 9 Electrons(-)



Has 9 Protons(+) in the Nucleus

Has 9 Electrons(-) around the outside.

So a Neutral Fluorine Atom (9P's and $9e^{-}$'s) has a NET CHARGE of

_____

So a Neutral Fluorine Atom (9P's and $9e^{-}$'s) has a NET CHARGE of

0

If we add ONE Electron to a Neutral Fluorine Atom, it will now have ____P's(+) and ____e^-'s(-) and the NET CHARGE on the ion will be ____.

The symbol for a Fluoride Ion is

_____

If we add ONE Electron to a Neutral Fluorine Atom, it will now have _9_P's(+) and 10_e^-'s(-) and the NET CHARGE on the ion will be ____.

The symbol for a Fluoride Ion is

_____

If we add ONE Electron to a Neutral Fluorine Atom, it will now have _9_P's(+) and 10_e^-'s(-) and the NET CHARGE on the ion will be -1.

The symbol for a Fluoride Ion is

_____

If we add ONE Electron to a Neutral Fluorine Atom, it will now have _9_P's(+) and 10_e^-'s(-) and the NET CHARGE on the ion will be -1.

The symbol for a Fluoride Ion is

F^-

The ion O^{2-} has

___Protons and ___Electrons.

The ion O^{2-} has

8 Protons and 10 Electrons.

This is the ATOMIC NUMBER of Oxygen

A NET CHARGE of 2- means it has 2 MORE Electrons(-) than Protons(+)

The ion As^{3-} has

___Protons and ___Electrons.

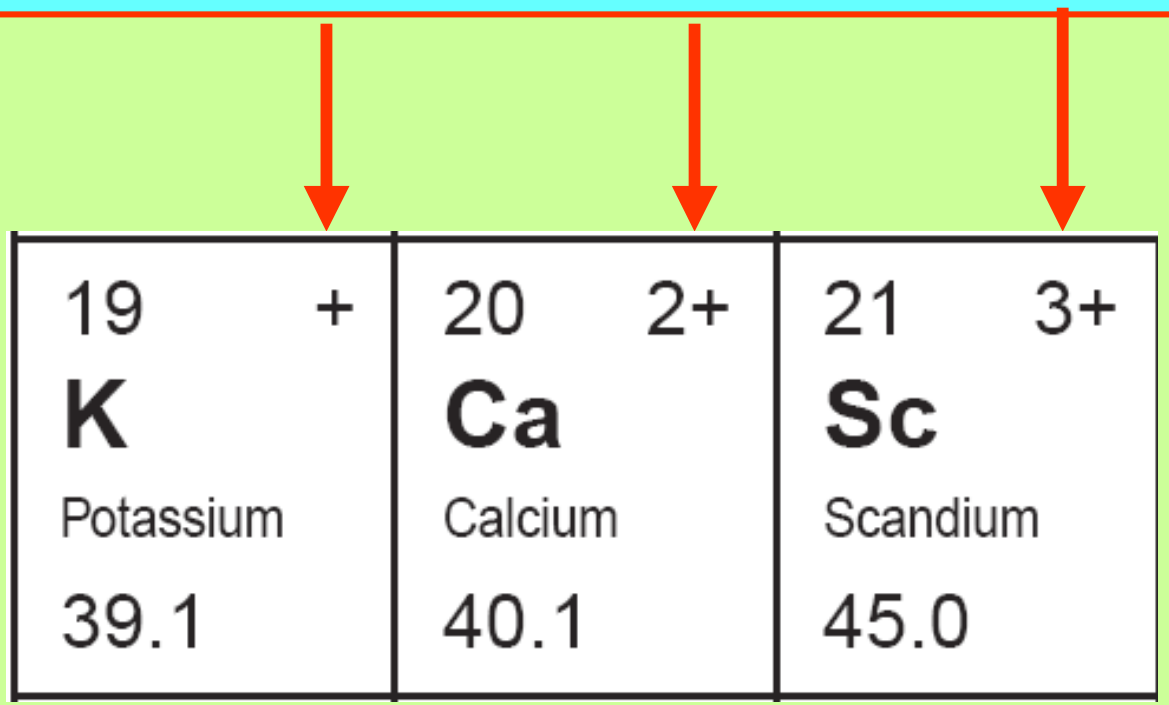
The ion As^{3-} has

33 Protons and 36 Electrons.

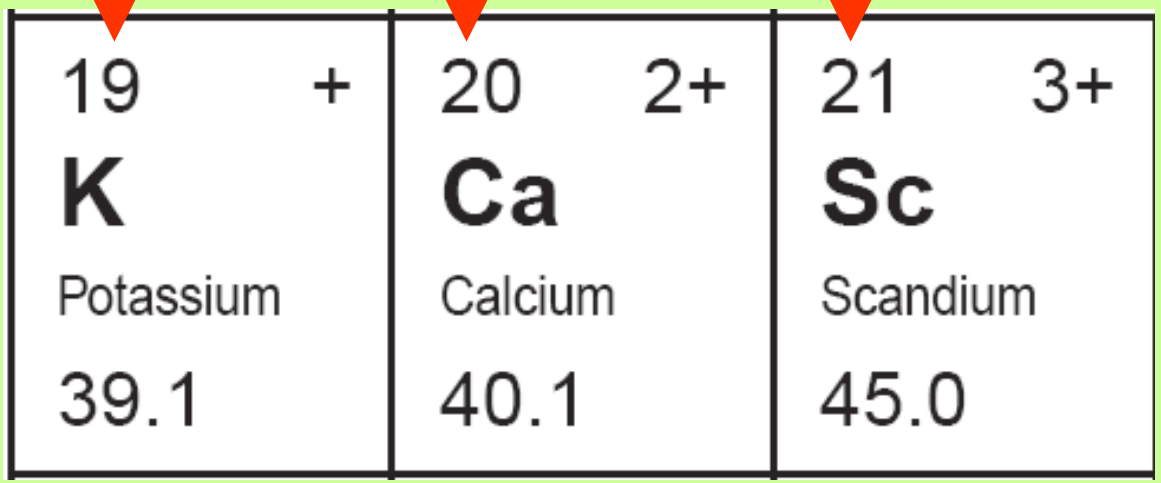
This is the ATOMIC NUMBER of Oxygen

A NET CHARGE of 3- means it has 3 MORE Electrons(-) than Protons(+)

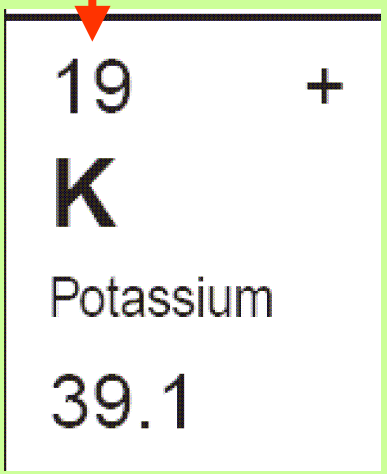
On the top right of each element on the Periodic Table is the NET CHARGE of the most common ion of each element.



The top left on the Periodic Table shows the ATOMIC NUMBER or # of Protons.



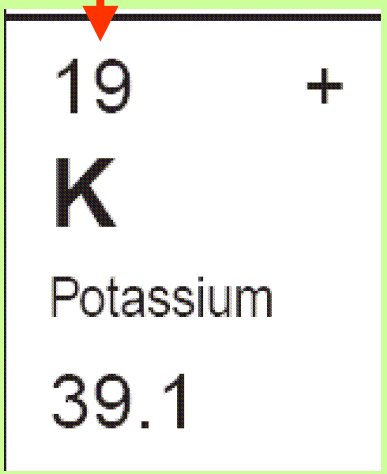
In a Neutral Atom (Atom) of an Element, the # of e^-'s = # of P's



So a (neutral) potassium atom has

___ protons and ___ electrons

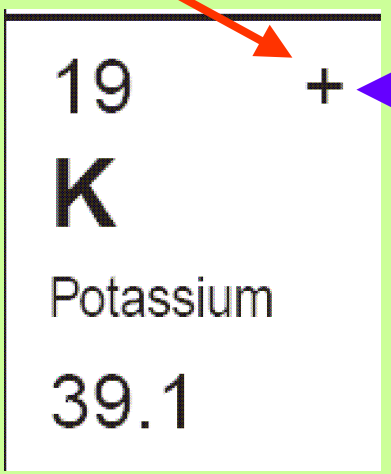
In a Neutral Atom (Atom) of an Element, the # of e^-'s = # of P's



So a (neutral) potassium atom has

19 protons and 19 electrons

The NET CHARGE on a potassium ION is + (*means* +1)

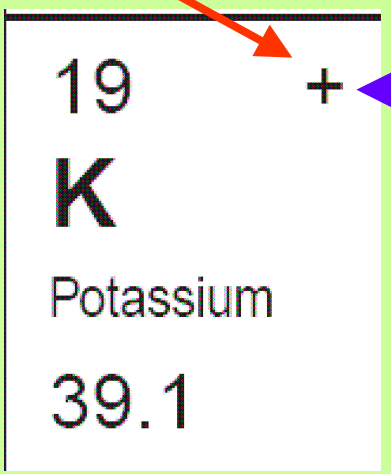


This means that there is ONE LESS electron than protons

So a potassium ION has

___ protons and ___ electrons

The NET CHARGE on a potassium ION is + (*means* +1)

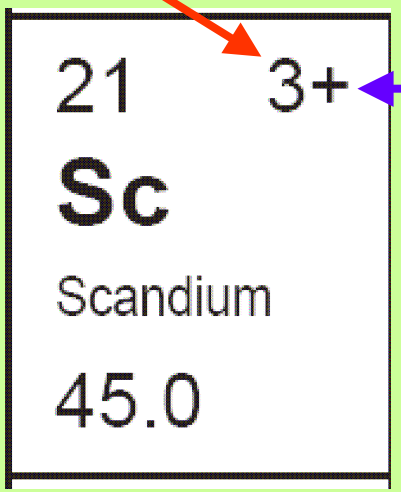


This means that there is ONE LESS electron than protons

So a potassium ION has

19 protons and 18 electrons

The NET CHARGE on a Scandium ION is 3+ (*means* +3)

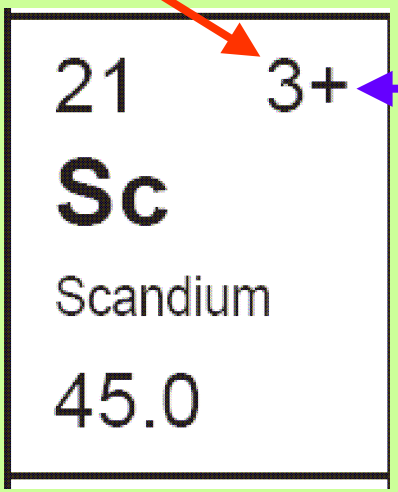


This means that there are THREE LESS electrons than protons

So a Scandium ION has

___ protons and ___ electrons

The NET CHARGE on a Scandium ION is 3+ (*means* +3)

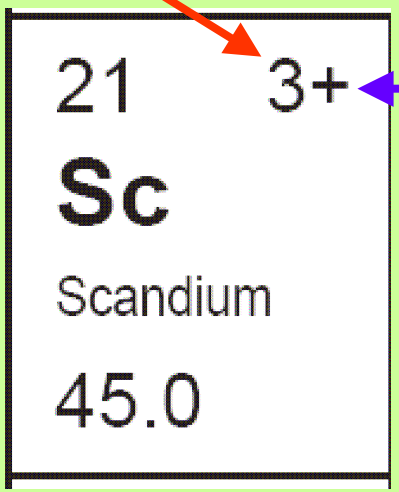


This means that there are THREE LESS electrons than protons

So a Scandium ION has

21 protons and ___ electrons

The NET CHARGE on a Scandium ION is 3+ (*means* +3)

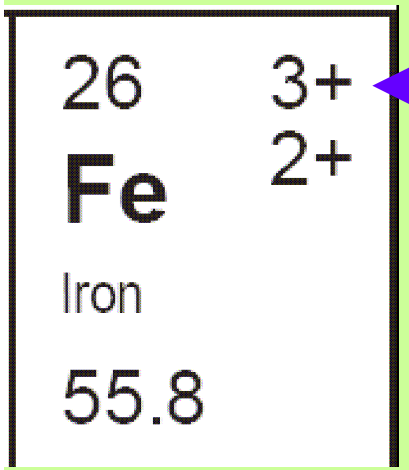


This means that there are THREE LESS electrons than protons

So a Scandium ION has

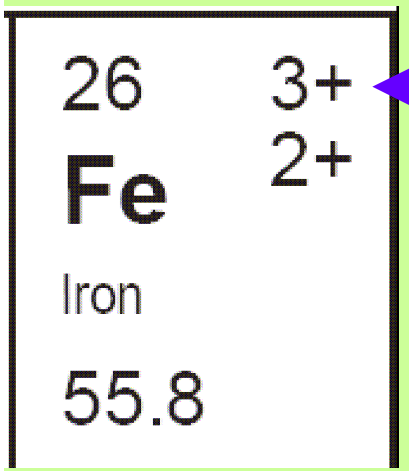
21 protons and 18 electrons

Iron (Fe) can form TWO DIFFERENT ions:



One with a net charge of 3+

Iron (Fe) can form TWO DIFFERENT ions:

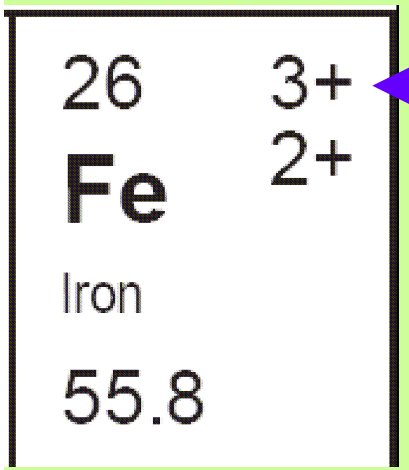


One with a net charge of 3+

This ion Fe^{3+} would have

___ Protons and ___ Electrons

Iron (Fe) can form TWO DIFFERENT ions:

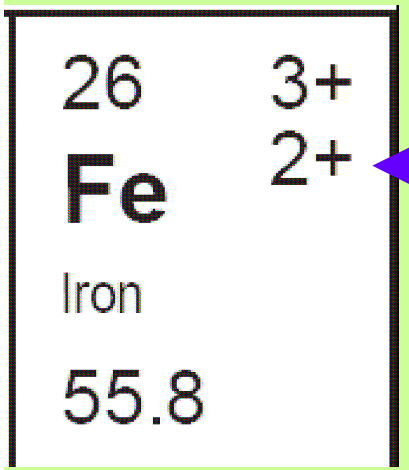


One with a net charge of 3+

This ion Fe^{3+} would have

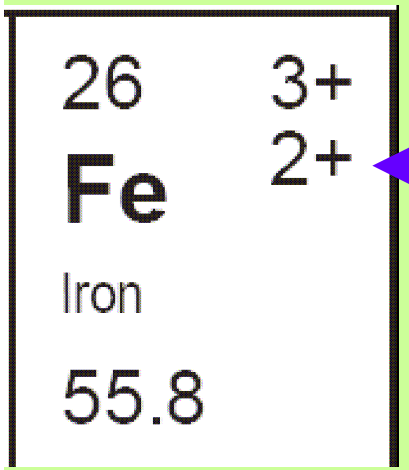
26 Protons and 23 Electrons

Iron (Fe) can form TWO DIFFERENT ions:



The other ion would have a net charge of 2+(*Iron(II)*)

Iron (Fe) can form TWO DIFFERENT ions:

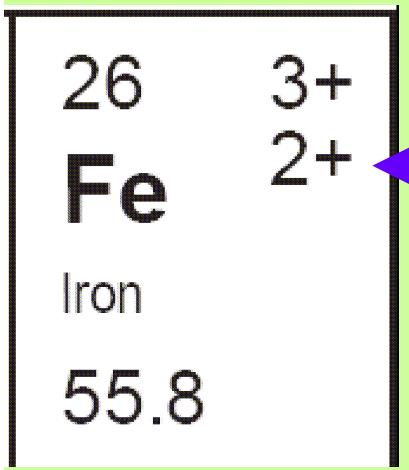


The other ion would have a net charge of 2+(*Iron(II)*)

This ion Fe^{2+} would have

___ Protons and ___ Electrons

Iron (Fe) can form TWO DIFFERENT ions:

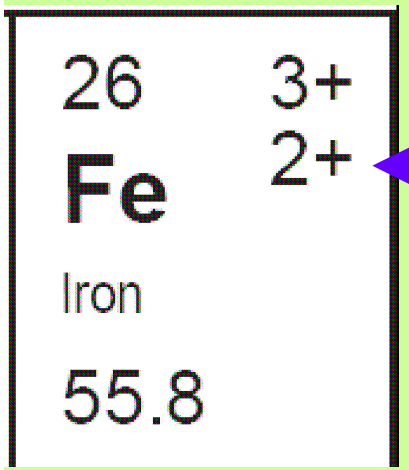


The other ion would have a net charge of 2+(*Iron(II)*)

This ion Fe^{2+} would have

26 Protons and __ Electrons

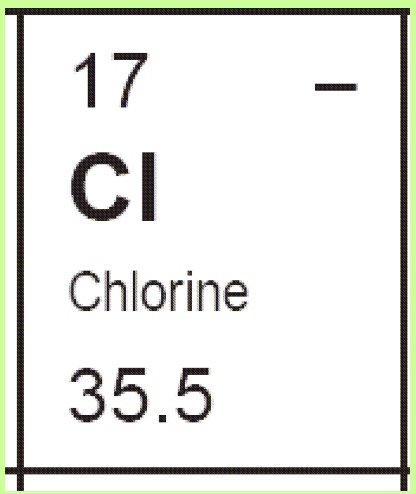
Iron (Fe) can form TWO DIFFERENT ions:



The other ion would have a net charge of 2+(*Iron(II)*)

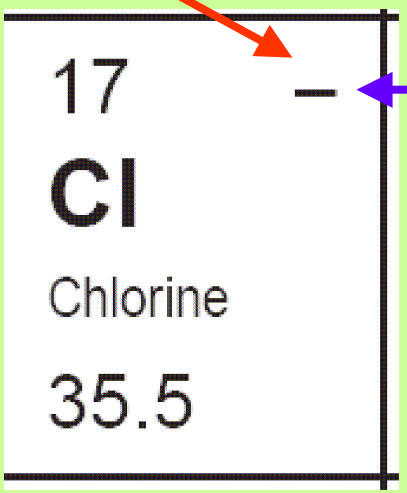
This ion Fe^{2+} would have

26 Protons and 24 Electrons



Negative Ions (Ions of NON-METALS) change the ending of their names to IDE,
So Cl^- is called a CHLORIDE ion.

The NET CHARGE on a Chloride ION is - (*means* -1)

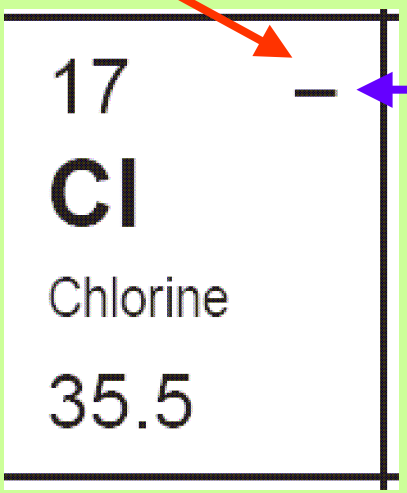


This means that there is ONE MORE electron than protons

So a chloride ION (Cl^-) has

___ protons and ___ electrons

The NET CHARGE on a Chloride ION is - (*means* -1)

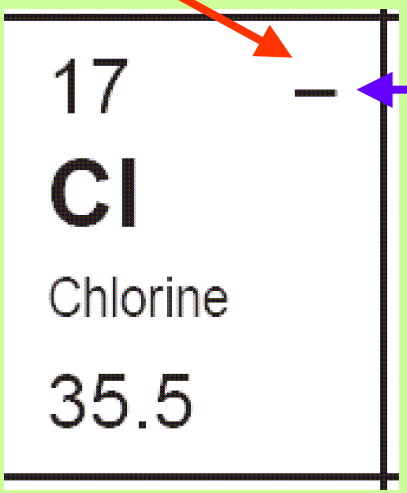


This means that there is ONE MORE electron than protons

So a chloride ION (Cl^-) has

17 protons and ____ electrons

The NET CHARGE on a Chloride ION is - (*means* -1)

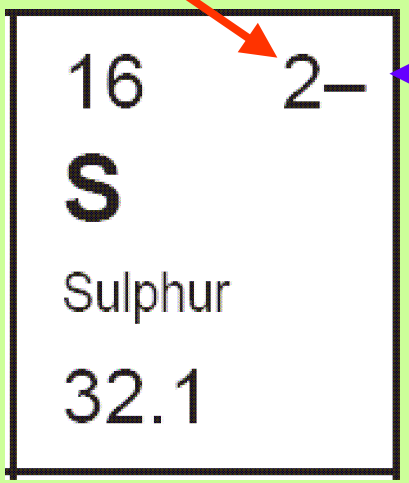


This means that there is ONE MORE electron than protons

So a chloride ION (Cl^-) has

17 protons and 18 electrons

The NET CHARGE on a Sulphide ION is 2- (*means* -2)

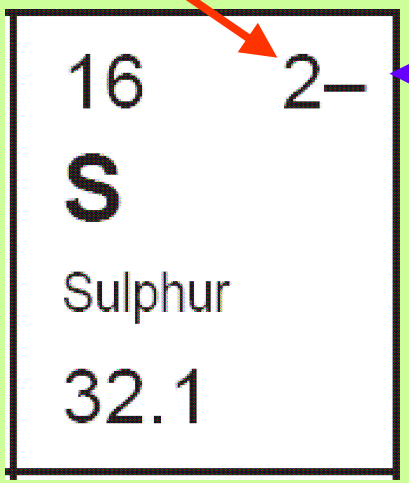


This means that there is TWO MORE electrons than protons

So a Sulphide ION (S^{2-}) has

___ protons and ___ electrons

The NET CHARGE on a Sulphide ION is 2- (*means* -2)

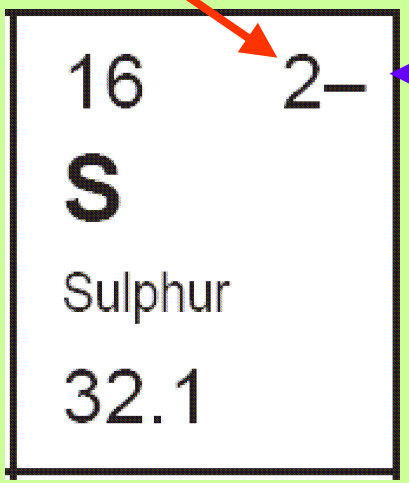


This means that there is TWO MORE electrons than protons

So a Sulphide ION (S^{2-}) has

16 protons and ___ electrons

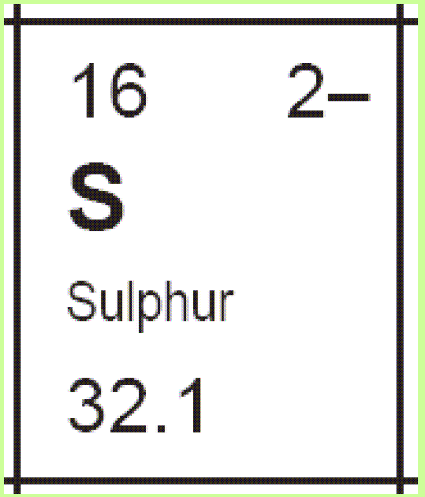
The NET CHARGE on a Sulphide ION is 2- (*means* -2)



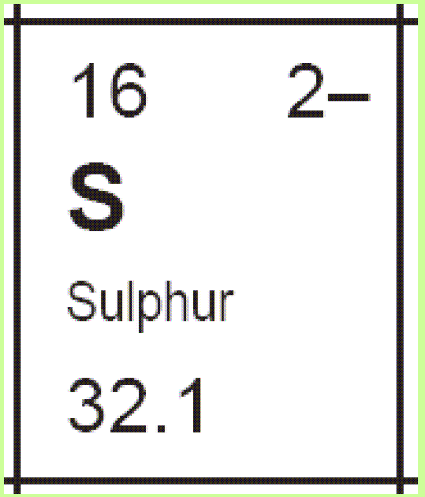
This means that there is TWO MORE electrons than protons

So a Sulphide ION (S^{2-}) has

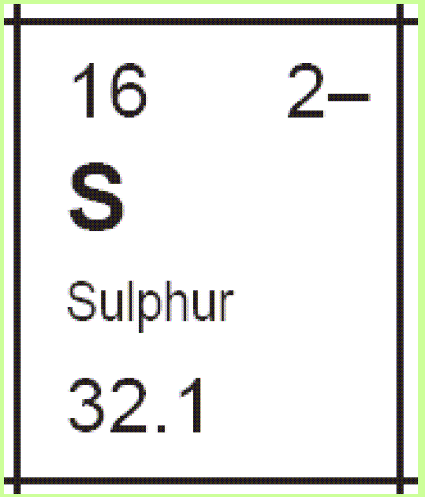
16 protons and 18 electrons



A Sulphur atom has __ Protons and __ Electrons.



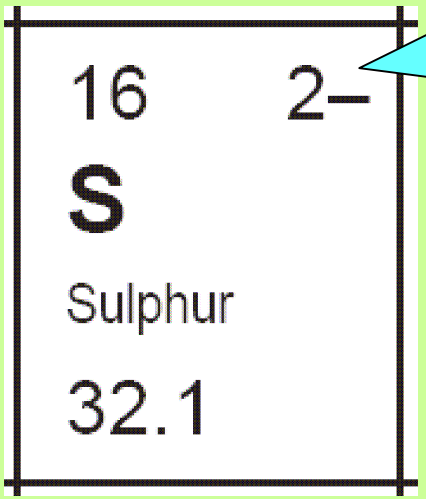
A Sulphur atom has 16 Protons and ___ Electrons.



A Sulphur atom has 16 Protons and 16 Electrons.

Remember: An "atom" means a NEUTRAL ATOM and in a neutral atom,

the # of P's = the # of e^-'s



Remember, this means the **NET CHARGE** on an **ION**, **not** on an **ATOM**

Use your Periodic Table to find the # of Protons and # of Electrons in each of the following:

	Symbol	# of Protons	# of Electrons
A Barium ion			
A Phosphide ion			
A Nitrogen atom			
A Nitrogen ion			
A Gallium atom			
A Gallium ion			

Use your Periodic Table to find the # of Protons and # of Electrons in each of the following:

	Symbol	# of Protons	# of Electrons
A Barium ion	Ba^{2+}		
A Phosphide ion			
A Nitrogen atom			
A Nitrogen ion			
A Gallium atom			
A Gallium ion			

Use your Periodic Table to find the # of Protons and # of Electrons in each of the following:

	Symbol	# of Protons	# of Electrons
A Barium ion	Ba^{2+}	56	
A Phosphide ion			
A Nitrogen atom			
A Nitrogen ion			
A Gallium atom			
A Gallium ion			

Use your Periodic Table to find the # of Protons and # of Electrons in each of the following:

	Symbol	# of Protons	# of Electrons
A Barium ion	Ba^{2+}	56	54
A Phosphide ion			
A Nitrogen atom			
A Nitrogen ion			
A Gallium atom			
A Gallium ion			

Use your Periodic Table to find the # of Protons and # of Electrons in each of the following:

	Symbol	# of Protons	# of Electrons
A Barium ion	Ba^{2+}	56	54
A Phosphide ion	P^{3-}		
A Nitrogen atom			
A Nitrogen ion			
A Gallium atom			
A Gallium ion			

Use your Periodic Table to find the # of Protons and # of Electrons in each of the following:

	Symbol	# of Protons	# of Electrons
A Barium ion	Ba^{2+}	56	54
A Phosphide ion	P^{3-}	15	
A Nitrogen atom			
A Nitrogen ion			
A Gallium atom			
A Gallium ion			

Use your Periodic Table to find the # of Protons and # of Electrons in each of the following:

	Symbol	# of Protons	# of Electrons
A Barium ion	Ba^{2+}	56	54
A Phosphide ion	P^{3-}	15	18
A Nitrogen atom			
A Nitrogen ion			
A Gallium atom			
A Gallium ion			

Use your Periodic Table to find the # of Protons and # of Electrons in each of the following:

	Symbol	# of Protons	# of Electrons
A Barium ion	Ba^{2+}	56	54
A Phosphide ion	P^{3-}	15	18
A Nitrogen atom	N		
A Nitrogen ion			
A Gallium atom			
A Gallium ion			

Use your Periodic Table to find the # of Protons and # of Electrons in each of the following:

	Symbol	# of Protons	# of Electrons
A Barium ion	Ba^{2+}	56	54
A Phosphide ion	P^{3-}	15	18
A Nitrogen atom	N	7	
A Nitrogen ion			
A Gallium atom			
A Gallium ion			

Use your Periodic Table to find the # of Protons and # of Electrons in each of the following:

	Symbol	# of Protons	# of Electrons
A Barium ion	Ba^{2+}	56	54
A Phosphide ion	P^{3-}	15	18
A Nitrogen atom	N	7	7
A Nitrogen ion			
A Gallium atom			
A Gallium ion			

Use your Periodic Table to find the # of Protons and # of Electrons in each of the following:

	Symbol	# of Protons	# of Electrons
A Barium ion	Ba^{2+}	56	54
A Phosphide ion	P^{3-}	15	18
A Nitrogen atom	N	7	7
A Nitrogen ion	N^{3-}		
A Gallium atom			
A Gallium ion			

Use your Periodic Table to find the # of Protons and # of Electrons in each of the following:

	Symbol	# of Protons	# of Electrons
A Barium ion	Ba^{2+}	56	54
A Phosphide ion	P^{3-}	15	18
A Nitrogen atom	N	7	7
A Nitrogen ion	N^{3-}	7	
A Gallium atom			
A Gallium ion			

Use your Periodic Table to find the # of Protons and # of Electrons in each of the following:

	Symbol	# of Protons	# of Electrons
A Barium ion	Ba^{2+}	56	54
A Phosphide ion	P^{3-}	15	18
A Nitrogen atom	N	7	7
A Nitrogen ion	N^{3-}	7	10
A Gallium atom			
A Gallium ion			

Use your Periodic Table to find the # of Protons and # of Electrons in each of the following:

	Symbol	# of Protons	# of Electrons
A Barium ion	Ba^{2+}	56	54
A Phosphide ion	P^{3-}	15	18
A Nitrogen atom	N	7	7
A Nitrogen ion	N^{3-}	7	10
A Gallium atom	Ga	31	31
A Gallium ion			

Use your Periodic Table to find the # of Protons and # of Electrons in each of the following:

	Symbol	# of Protons	# of Electrons
A Barium ion	Ba^{2+}	56	54
A Phosphide ion	P^{3-}	15	18
A Nitrogen atom	N	7	7
A Nitrogen ion	N^{3-}	7	10
A Gallium atom	Ga	31	31
A Gallium ion	Ga^{3+}	31	28

Remember that given Nuclear Notation, we can find the number of Protons and Neutrons:

To find P's and N's from Nuclear Notation

^{41}Ca

To find P's and N's from Nuclear Notation

$$^{41}Ca$$

Calcium's atomic Number = 20

To find P's and N's from Nuclear Notation

^{41}Ca

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So it has 20 Protons

To find P's and N's from Nuclear Notation

To find # of Neutrons, put Atomic Number Here:

^{41}Ca

Calcium's atomic Number = 20

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To find P's and N's from Nuclear Notation

To find # of Neutrons, put Atomic Number Here: →

$$^{41}_{20}\mathrm{Ca}$$

Calcium's atomic Number = 20

So it has 20 Protons

To find P's and N's from Nuclear Notation

Mass # = P + N

To find # of Neutrons, put Atomic Number Here:

$$^{41}_{20}Ca$$

Calcium's atomic Number = 20

So it has 20 Protons

To find P's and N's from Nuclear Notation

Mass # = P + N

To find # of Neutrons, put Atomic Number Here:

$$^{41}_{20}Ca$$

Subtract to get # of Neutrons

Calcium's atomic Number = 20

So it has 20 Protons

To find P's and N's from Nuclear Notation

Mass # = P + N

To find # of Neutrons, put Atomic Number Here:

$$\begin{array}{l} {}^{41}\mathrm{Ca} \\ \underline{20} \\ 21 \end{array}$$

Subtract to get # of Neutrons

Calcium's atomic Number = 20

So it has 20 Protons

To find P's and N's from Nuclear Notation

Mass # = P + N

To find # of Neutrons, put Atomic Number Here:

$$^{41}_{20}\mathrm{Ca}$$

Subtract to get # of Neutrons

21

Calcium's atomic Number = 20

So it has 20 Protons

So it has 21 Neutrons

We can also find the Number of Electrons!

If we are given this:

^{41}Ca

There is NO number on the top right, so this must be a NEUTRAL ATOM and the NET CHARGE = 0

If we are given this:

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In a neutral atom #of P's = # of e^-'s

If we are given this:

^{41}Ca

There is NO number on the top right, so this must be a NEUTRAL ATOM and the NET CHARGE = 0

In a neutral atom #of P's = # of e^-'s

So this atom has:
20 protons and 20 electrons

To Summarize:

^{41}Ca

Has: 20 Protons (Atomic Number)
21 Neutrons (41-20 = 21)
and 20 Electrons (e^-'s = P's)

Now try this one:

$$^{41}Ca^{2+}$$

Has ___ Protons
___ Neutrons
___ Electrons

Now try this one:

$$^{41}Ca^{2+}$$

Has 20 Protons (Atomic Number)
__ Neutrons
__ Electrons

Now try this one:

$$^{41}Ca^{2+}$$

Has 20 Protons (Atomic Number)
21 Neutrons (41-20 = 21)
__ Electrons

Now try this one:

Has 2 LESS Electrons than Protons

$$^{41}Ca^{2+}$$

Has 20 Protons (Atomic Number)
21 Neutrons (41-20 = 21)
18 Electrons (20-2 = 18)

Now try this one:

$^{37}Br^-$

Has ___ Protons
___ Neutrons
___ Electrons

Now try this one:

$$^{81}Br^{-}$$

Has 35 Protons (Atomic Number)
__ Neutrons
__ Electrons

Now try this one:

$$^{81}Br^{-}$$

Has 35 Protons (Atomic Number)
46 Neutrons (81-35 = 46)
__ Electrons

Now try this one:

$^{81}Br^-$

Has 1 MORE Electron than Protons

Has 35 Protons (Atomic Number)
46 Neutrons (81-35 = 46)
36 Electrons (35+1 = 36)

Now try this one:

$$^{238}U^{4+}$$

Has ___ Protons
___ Neutrons
___ Electrons

Now try this one:

$$^{238}U^{4+}$$

Has 92 Protons (atomic number)
__ Neutrons
__ Electrons

Now try this one:

$^{238}U^{4+}$

Has 92 Protons (atomic number)
146 Neutrons (238-92 = 146)
__ Electrons

Now try this one:

$$^{238}U^{4+}$$

Has 92 Protons (atomic number)
146 Neutrons (238-92 = 146)
88 Electrons (92-4 = 88)

Now try this one:

$^{33}P^{3-}$

Has ___ Protons
___ Neutrons
___ Electrons

Now try this one:

$^{33}P^{3-}$

Has 15 Protons (atomic number)
__ Neutrons
__ Electrons

Now try this one:

$^{33}P^{3-}$

Has 15 Protons (atomic number)
18 Neutrons (33-15 = 18)
__ Electrons

Now try this one:

Has 3 MORE Electrons than Protons

$^{33}P^{3-}$

Has 15 Protons (atomic number)
18 Neutrons (33-15 = 18)
18 Electrons (15+3 = 18)

The isotope:

$^{76}As^{3-}$

has __ protons

__ neutrons

__ electrons

The isotope:

$^{76}As^{3-}$

has 33 protons (atomic #)
43 neutrons (76-33)
36 electrons (33 +3)

The isotope:

$^{201}Au^{+}$

has __ protons

___ neutrons

__ electrons

The isotope:

$^{201}Au^{+}$

has 79 protons(atomic #)
122 neutrons (201-79)
78 electrons (79 - 1)

An isotope has 46 protons, 58 neutrons and 42 electrons. Write the nuclear notation:

An isotope has 46 protons, 58 neutrons and 42 electrons. Write the nuclear notation:

Answer: $^{104}Pd^{4+}$

An isotope has 52 protons,
79 neutrons and 54 electrons.
Write the nuclear notation:

An isotope has 52 protons, 79 neutrons and 54 electrons. Write the nuclear notation:

Answer: $^{131}Te^{2-}$