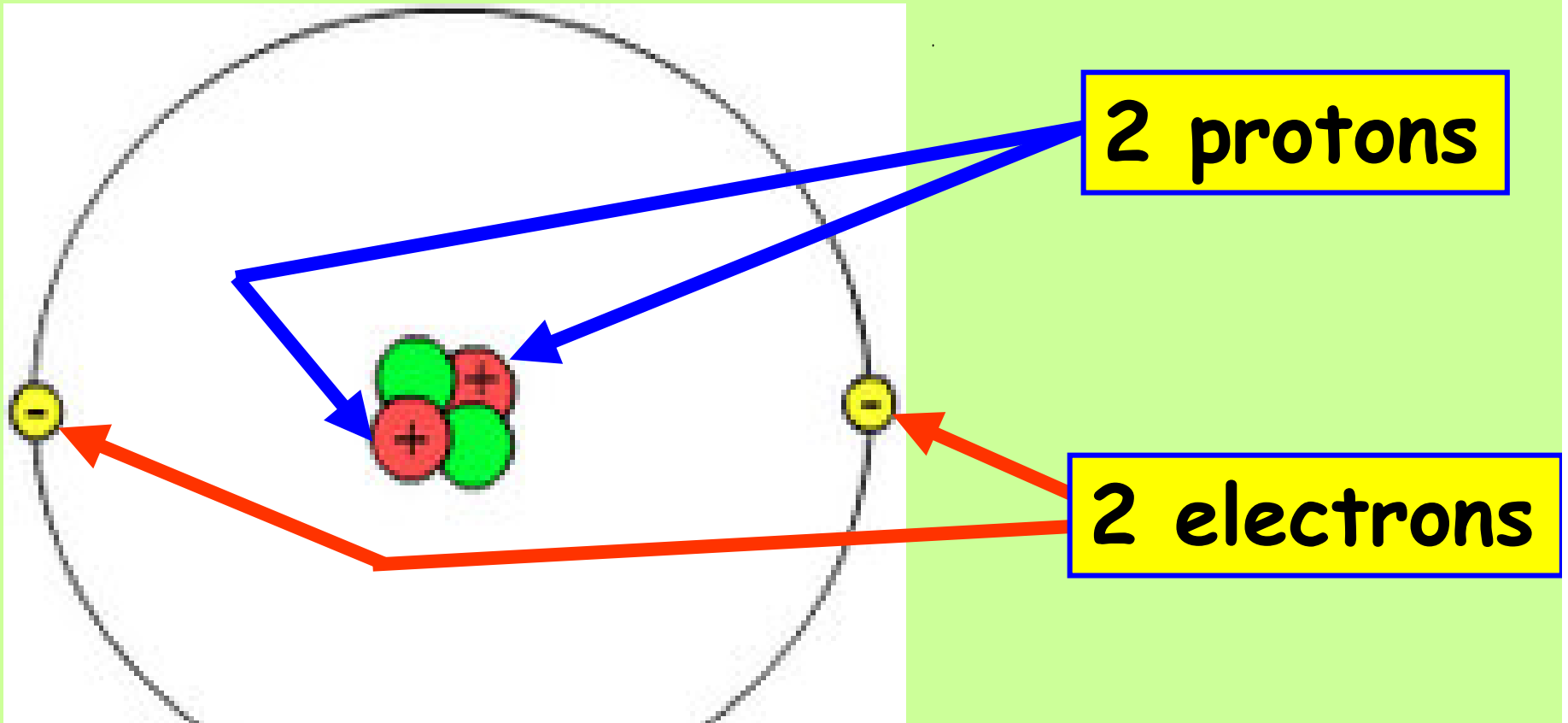
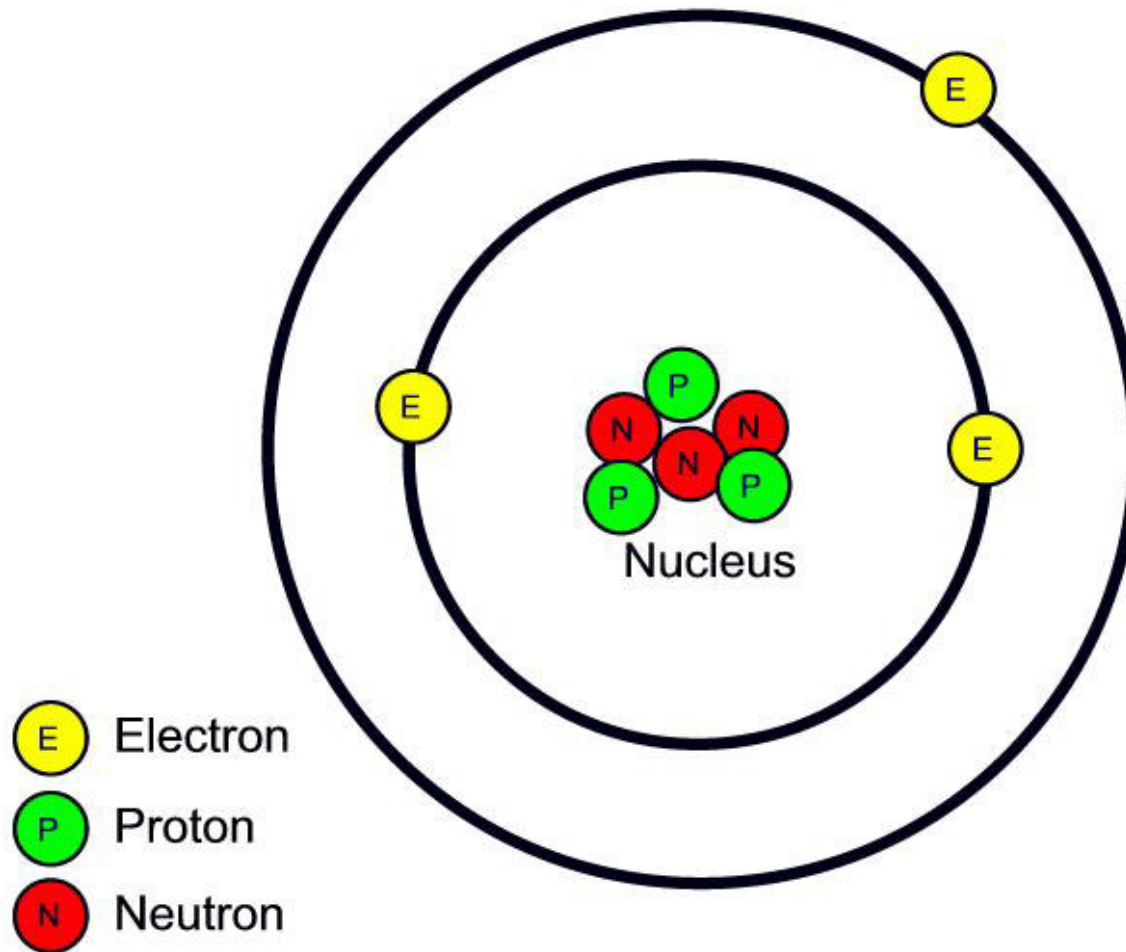


Atoms and Ions

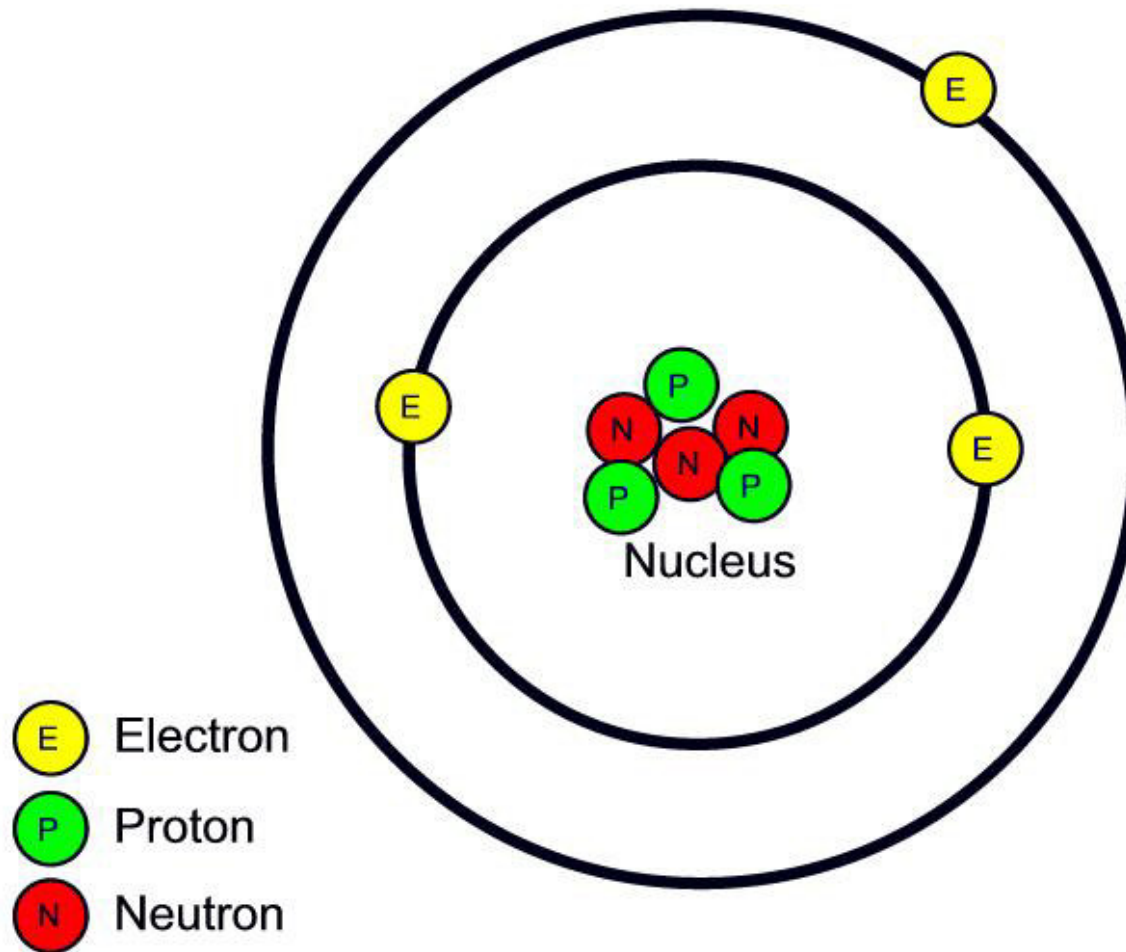


In a **Neutral Atom** of an Element:

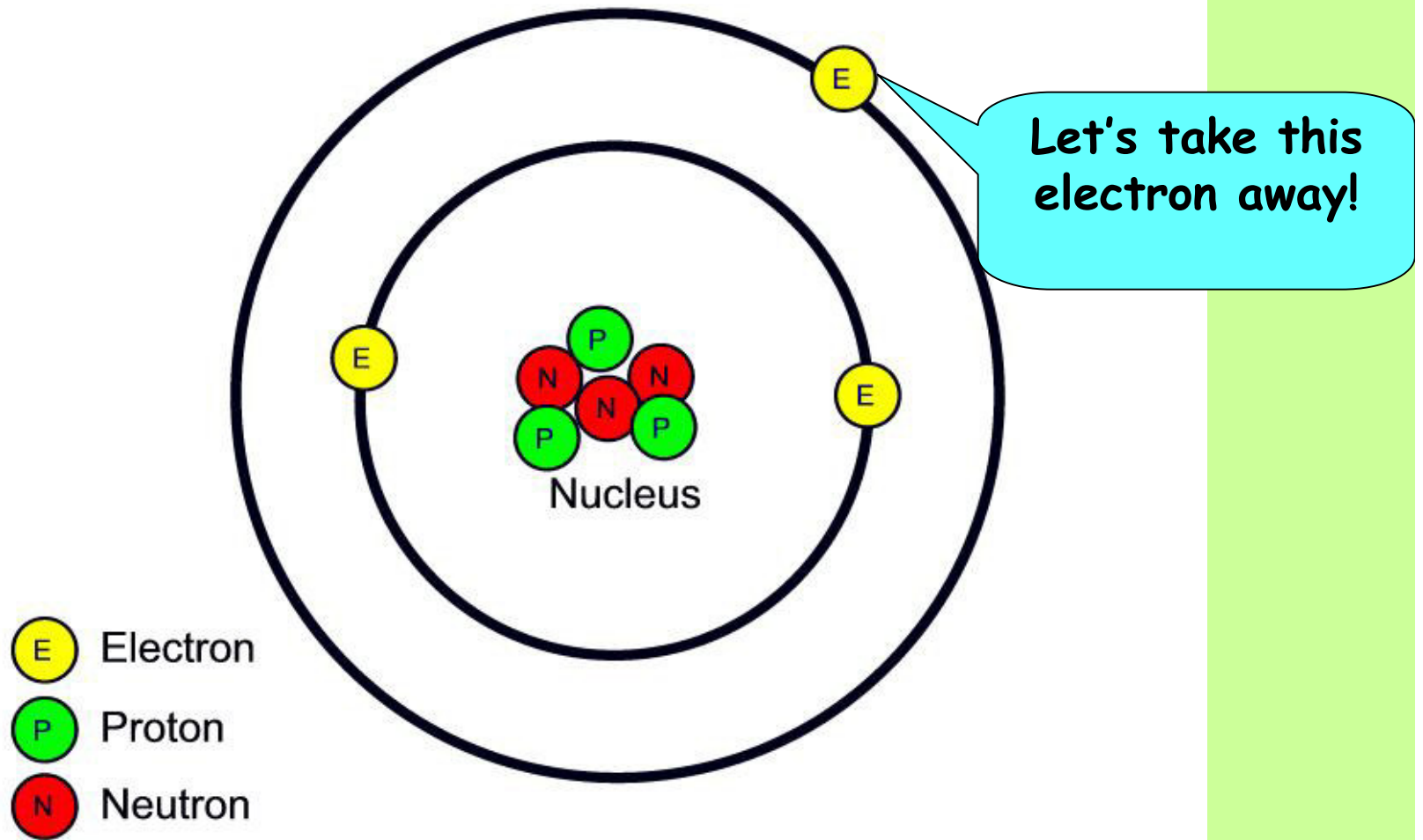
The # of Electrons(-) = The # of Protons(+)



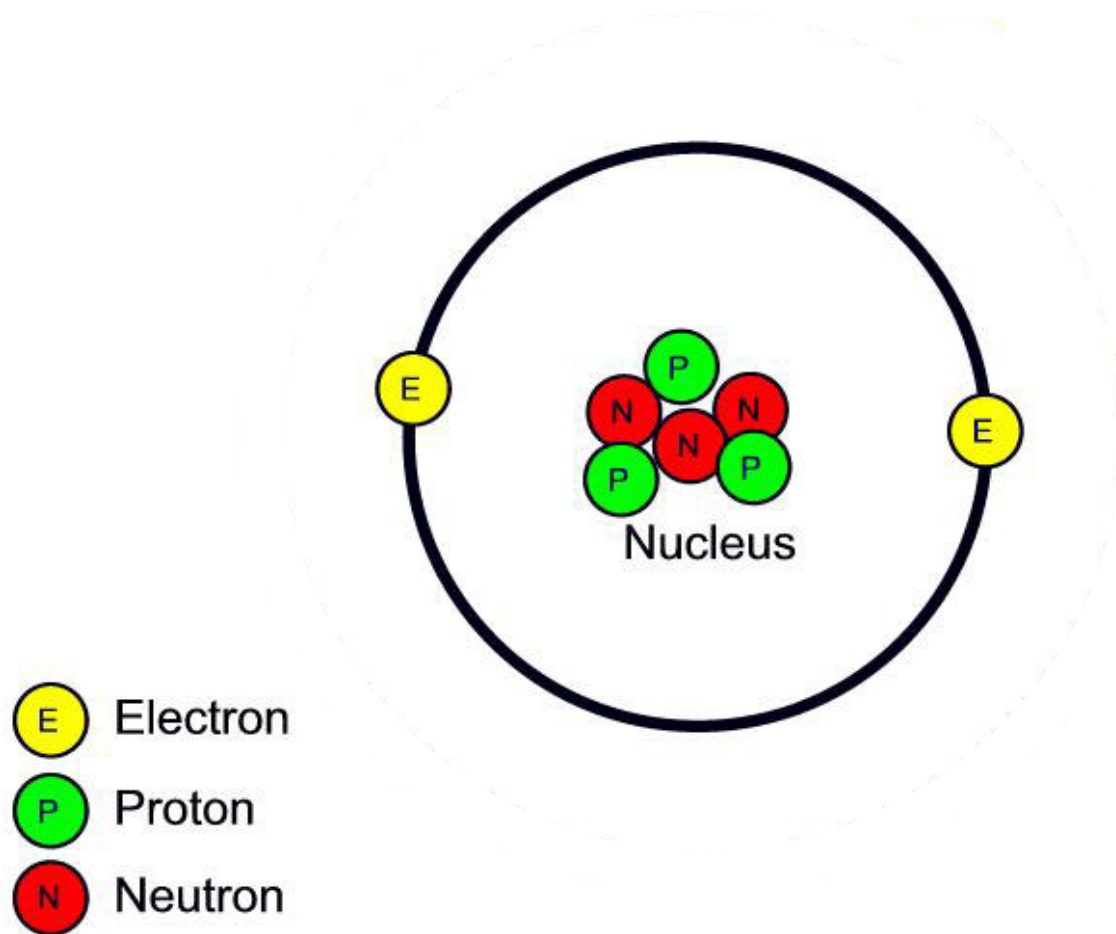
This represents an _____ of the
element _____ (___ P's & ___ e⁻'s)



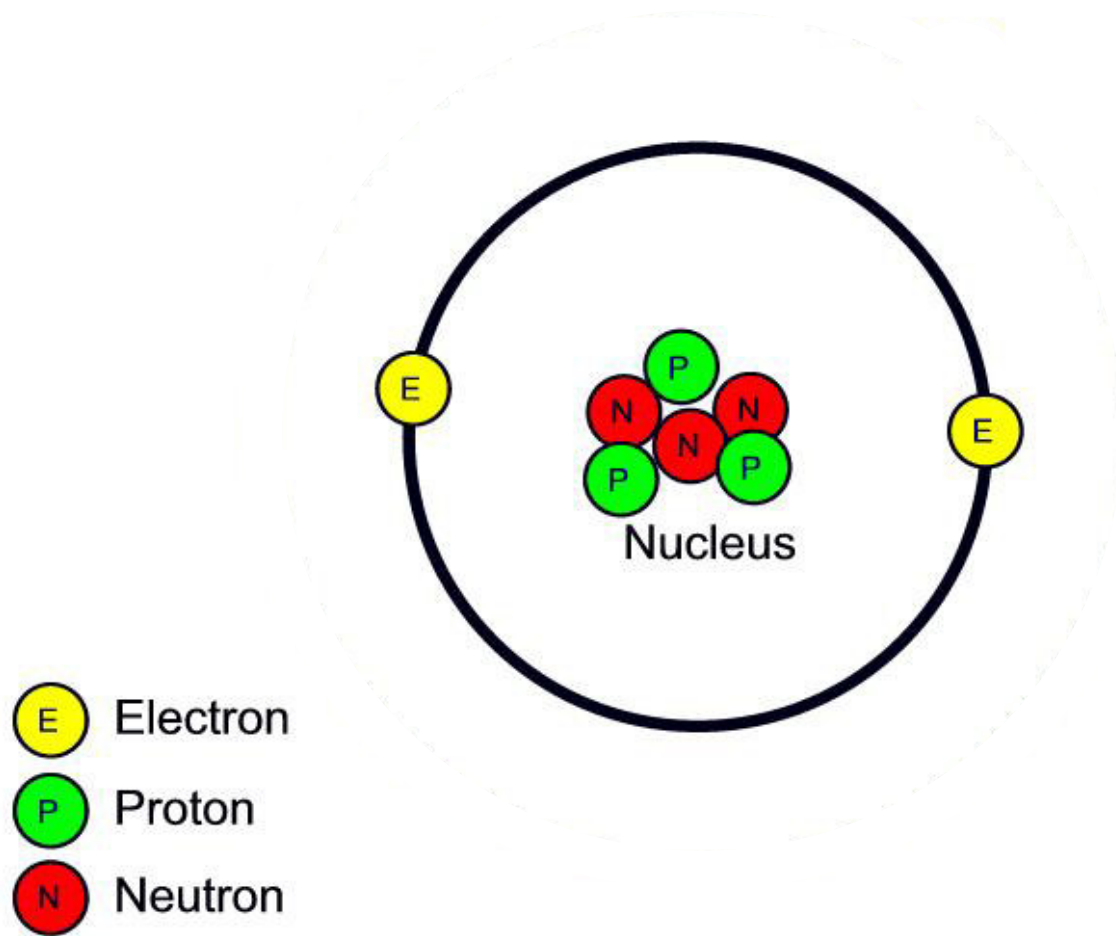
This represents an **atom** of the element **Lithium** (**3 P's** & **3 e⁻'s**)



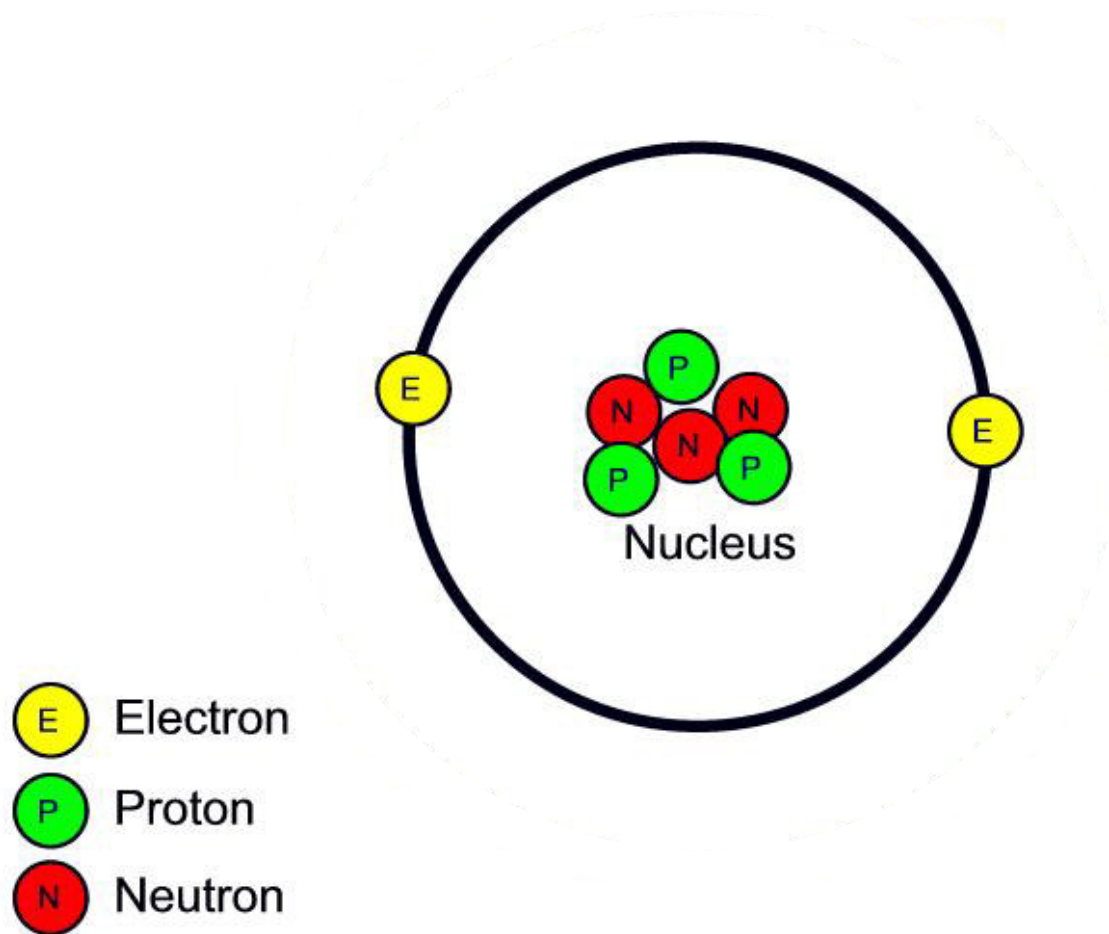
This represents an **atom** of the element **Lithium** (**3 P's** & **3 e⁻'s**)



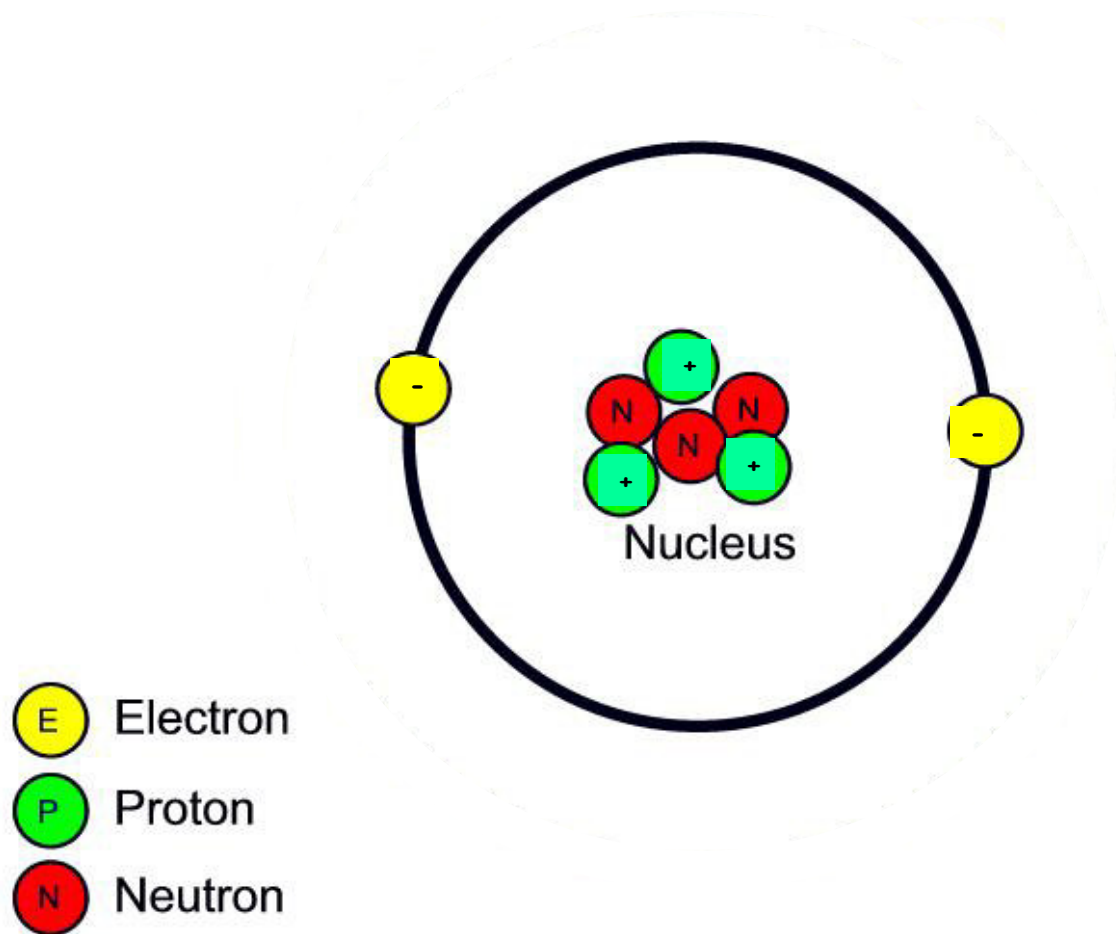
We have now taken one electron away from Lithium!



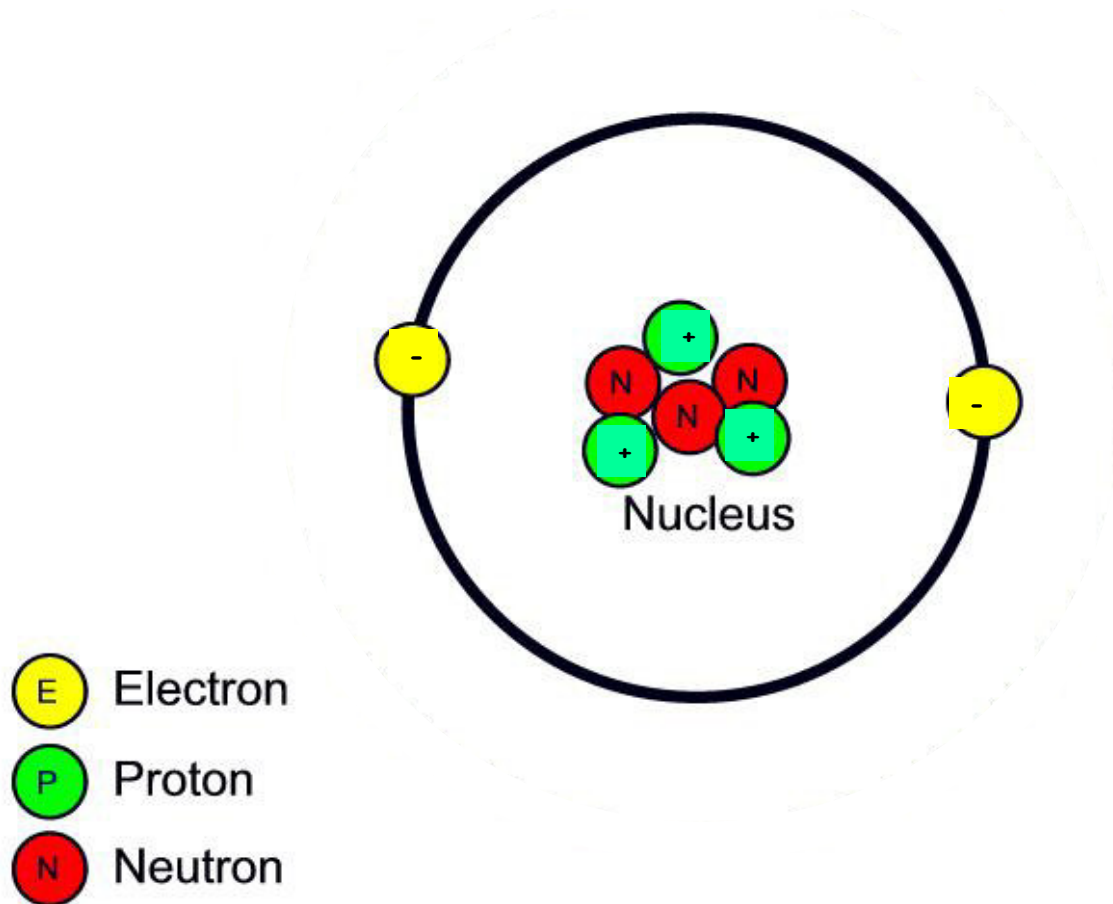
It still has 3 Protons, but now only 2 electrons! (Neutrons haven't changed)



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)

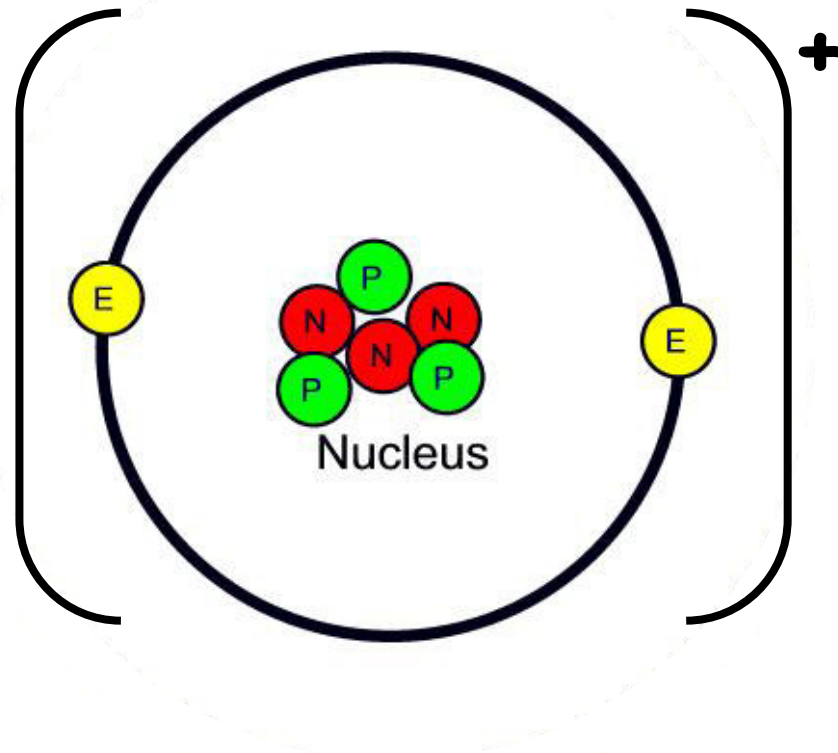
An **Ion** is an atom in which

of Electrons \neq **# of Protons**

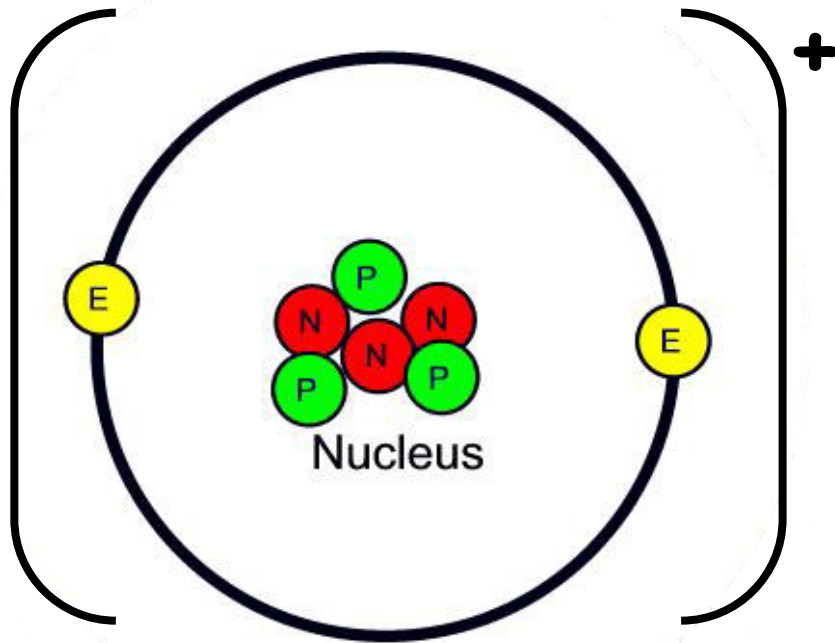
(Neutrons don't matter here)

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.



The symbol for a Lithium Ion is Li^+ .

(Take out your Periodic Table!)

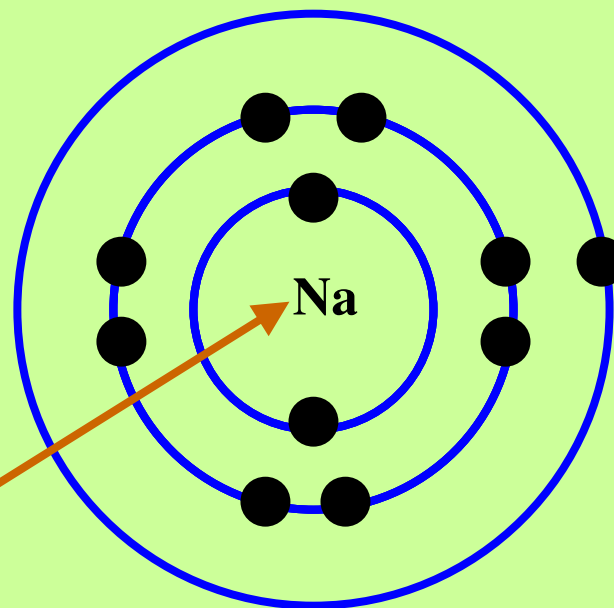
A Neutral Sodium (Na) Atom has

_____ Protons(+) and _____ Electrons(-)

(Take out your Periodic Table!)

A Neutral Sodium (Na) Atom has

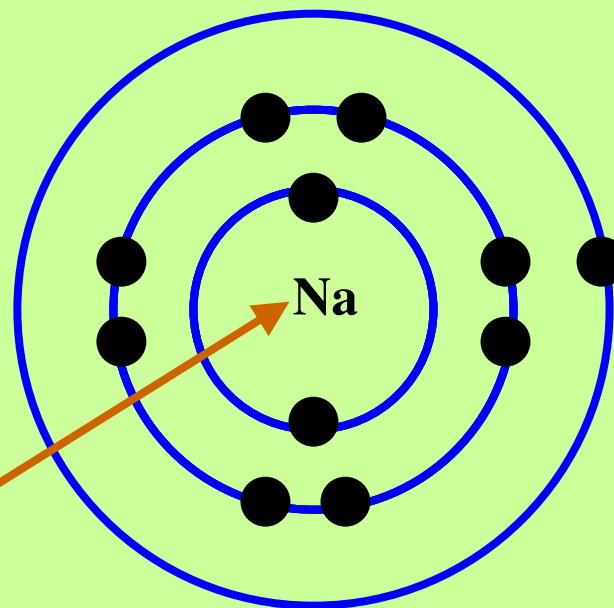
11 Protons(+) and **11** Electrons(-)



Has 11
Protons(+)
in the
Nucleus

Has 11
Electrons(-)
around the
outside.

A Neutral Sodium atom has a net charge of _____

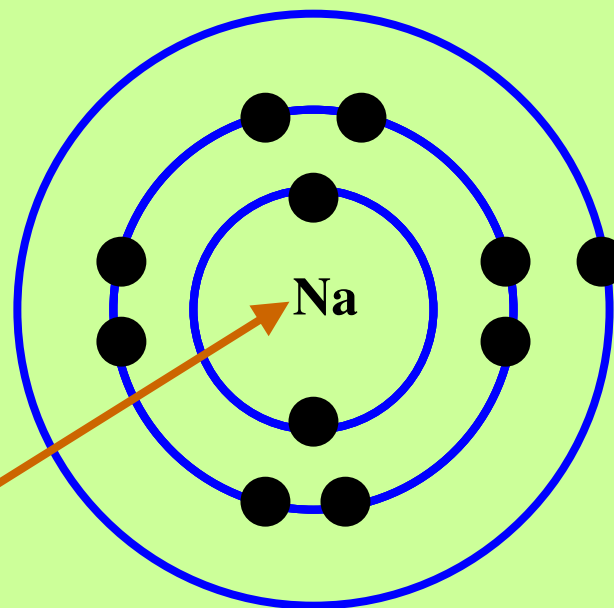


Has 11
Protons(+)
in the
Nucleus

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!)



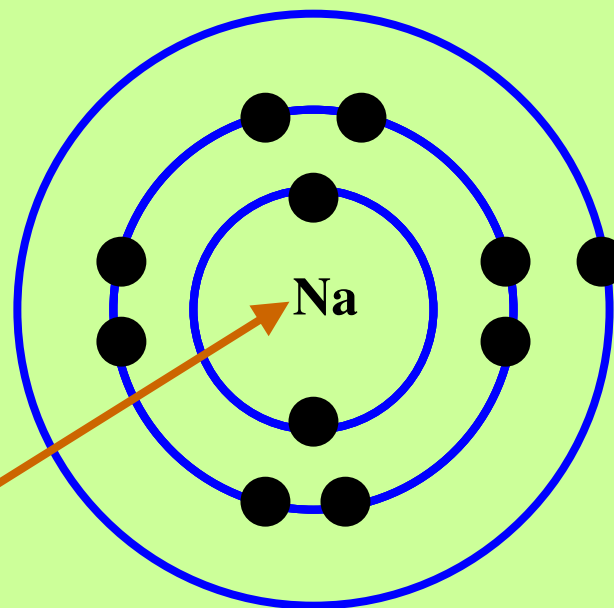
Has 11
Protons(+)
in the
Nucleus

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!)

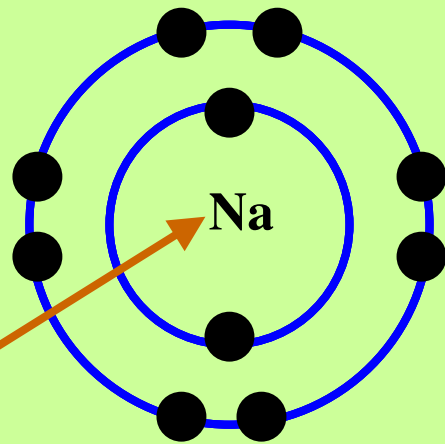


Has 11
Protons(+)
in the
Nucleus

Has 11
Electrons(-)
around the
outside.

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

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



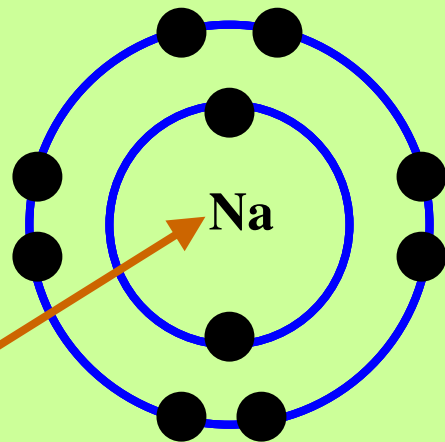
Has 11
Protons(+)
in the
Nucleus

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

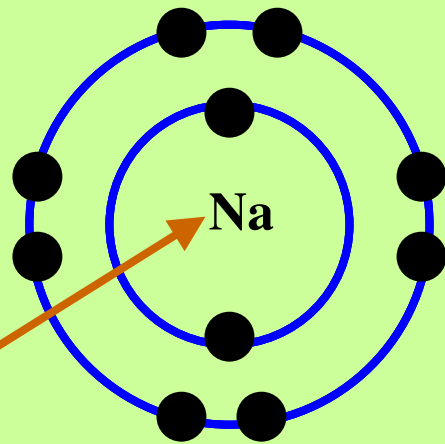


Has 11
Protons(+)
in the
Nucleus

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

A Sodium Ion has the symbol Na^+



Has 11
Protons(+)
in the
Nucleus

Has 10
Electrons(-)
around the
outside.

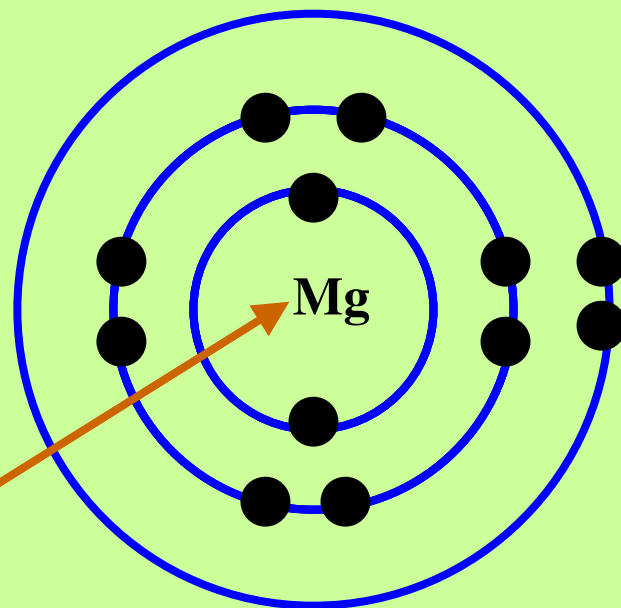
(Take out your Periodic Table!)

**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

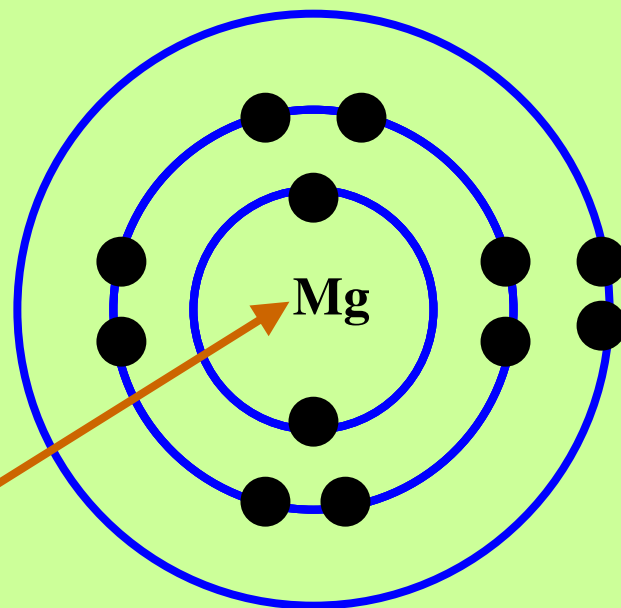
Has 12
Electrons(-)
around the
outside.

**Magnesium tends
to easily lose 2
electrons!**

(Take out your Periodic Table!)

A Neutral Magnesium (Mg) Atom has

12 Protons(+) and **12** Electrons(-)

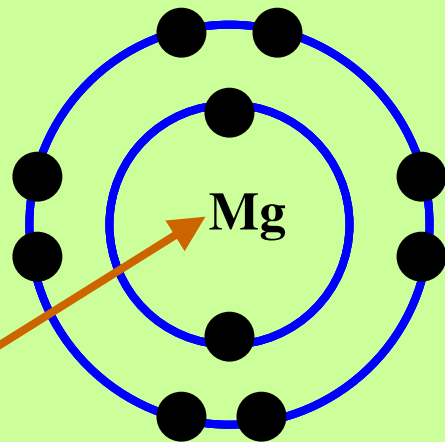


Has 12
Protons(+)
in the
Nucleus

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:



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) _____

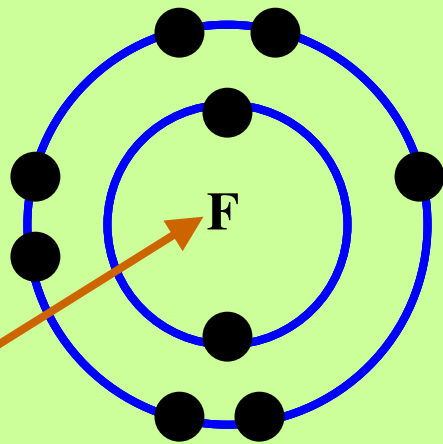
Electrons can be ADDED to Neutral Atoms to make IONS. If an Ion has MORE Electrons(-) than Protons(+), the NET CHARGE on that ion is (positive/negative) Negative

(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



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.

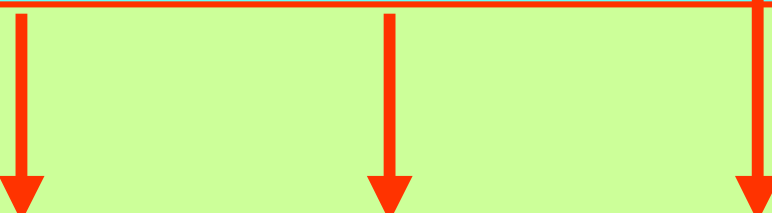
The ion As^{3-} has

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.




19	+	20	2+	21	3+
K		Ca		Sc	
Potassium		Calcium		Scandium	
39.1		40.1		45.0	

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

19	+	20	2+	21	3+
K		Ca		Sc	
Potassium		Calcium		Scandium	
39.1		40.1		45.0	


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



19	+
K	
Potassium	
39.1	

So a (neutral) potassium atom has
____ protons and ____ electrons

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



19	+
K	
Potassium	
39.1	

So a (neutral) potassium atom has
19 protons and **19** electrons

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

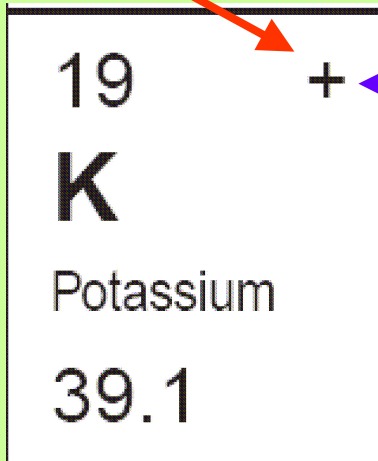
19	+
K	
Potassium	
39.1	

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*)

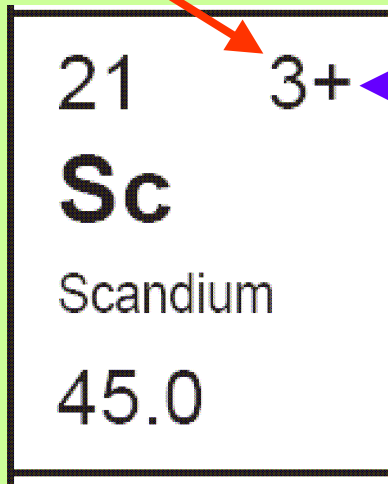


This means that there is ONE LESS electron than protons

So a potassium ION has

19 protons and **18** electrons

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

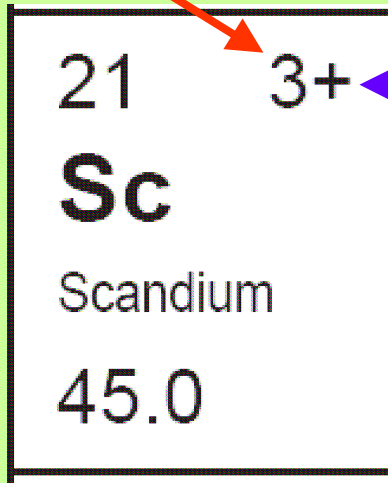


This means that there are THREE LESS electrons than protons

So a Scandium ION has

 protons and electrons

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

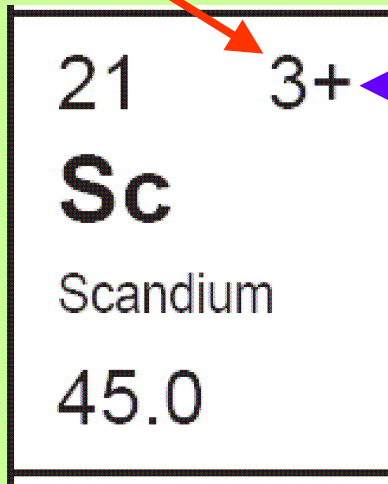


This means that there are THREE LESS electrons than protons

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+

26	3+
Fe	2+
Iron	
55.8	

Iron (Fe) can form TWO DIFFERENT ions:

One with a net charge of 3+

This ion Fe^{3+} would have
___ Protons and ___ Electrons

26	3+
Fe	2+
Iron	
55.8	

Iron (Fe) can form TWO DIFFERENT ions:

26	3+
Fe	2+
Iron	
55.8	

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:

26 3+

Fe 2+

Iron

55.8

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

Iron (Fe) can form TWO DIFFERENT ions:

26	3+
Fe	2+
Iron	
55.8	

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:

26	3+
Fe	2+
Iron	
55.8	

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:

26	3+
Fe	2+
Iron	
55.8	

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

This ion Fe^{2+} would have 26 Protons and 24 Electrons

17	—
Cl	
Chlorine	
35.5	

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*)

17	-
Cl	
Chlorine	
35.5	

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*)

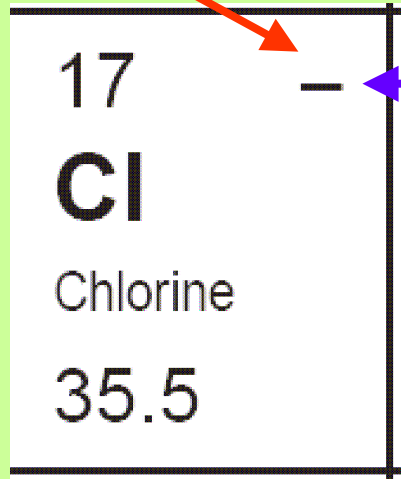
17	-
Cl	
Chlorine	
35.5	

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*)



17	-
Cl	
Chlorine	
35.5	

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*)

16	2-
S	
Sulphur	
32.1	

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*)

16	2-
S	
Sulphur	
32.1	

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*)

16	2-
S	
Sulphur	
32.1	

This means that there is TWO MORE electrons than protons

So a Sulphide ION (S^{2-}) has
16 protons and **18** electrons

16	2-
S	
Sulphur	
32.1	

A Sulphur atom has ___ Protons and ___ Electrons.

16	2-
S	
Sulphur	
32.1	

A Sulphur atom has **16** Protons and
___ Electrons.

16	2-
S	
Sulphur	
32.1	

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

16	2-
S	
Sulphur	
32.1	

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	Ba²⁺		
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	Ba²⁺	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

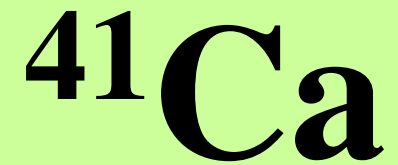


To find P's and N's from Nuclear Notation



Calcium's atomic
Number = 20


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



Calcium's atomic
Number = 20

So it has **20 Protons**

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

To find # of
Neutrons, put
Atomic Number
Here: 

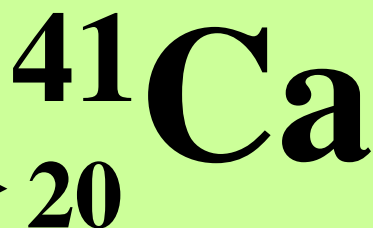


Calcium's atomic
Number = 20

So it has **20 Protons**

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

To find # of
Neutrons, put
Atomic Number
Here: \longrightarrow



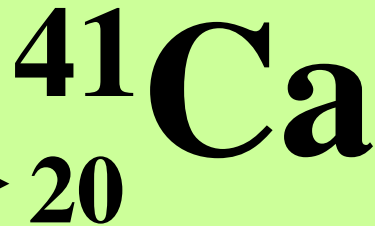
Calcium's atomic
Number = 20

So it has **20 Protons**

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

$$\text{Mass \#} = P + N$$

To find # of
Neutrons, put
Atomic Number
Here: \longrightarrow



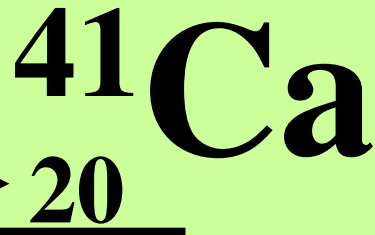
Calcium's atomic
Number = 20

So it has **20 Protons**

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

$$\text{Mass \#} = P + N$$

To find # of
Neutrons, put
Atomic Number
Here: \longrightarrow



Subtract to get #
of Neutrons

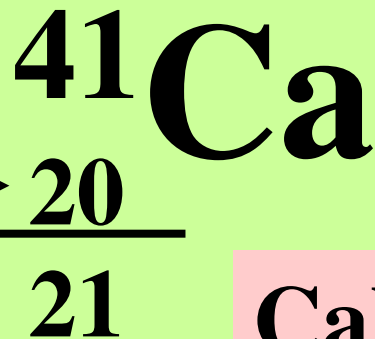
Calcium's atomic
Number = 20

So it has **20 Protons**

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

$$\text{Mass \#} = P + N$$

To find # of
Neutrons, put
Atomic Number
Here: \longrightarrow



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

$$\text{Mass \#} = \text{P} + \text{N}$$

To find # of
Neutrons, put
Atomic Number
Here: \longrightarrow



20

21

Subtract to get #
of Neutrons

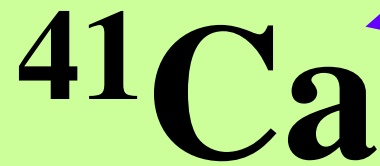
Calcium's atomic
Number = 20

So it has **20 Protons**

So it has **21 Neutrons**

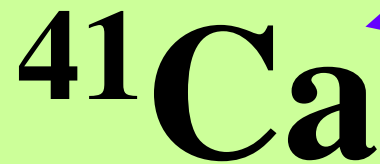
**We can also find
the Number of
Electrons!**

If we are given this:



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

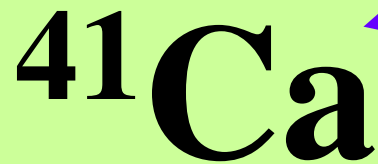
If we are given this:



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

If we are given this:



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:



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

Now try this one:



Has ___ Protons
___ Neutrons
___ Electrons

Now try this one:



Has **20** Protons (**Atomic Number**)

___ Neutrons

___ Electrons

Now try this one:



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

Now try this one:

Has 2 LESS Electrons
than Protons



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

Now try this one:



Has ___ Protons
___ Neutrons
___ Electrons

Now try this one:



Has **35** Protons (**Atomic Number**)

___ Neutrons

___ Electrons

Now try this one:



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

Now try this one:



Has 1 MORE Electron
than Protons

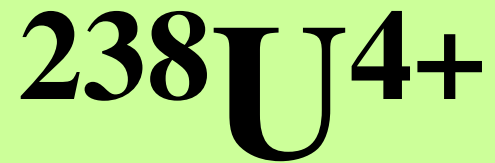
Has **35** Protons (**Atomic Number**)
46 Neutrons (**$81 - 35 = 46$**)
36 Electrons (**$35 + 1 = 36$**)

Now try this one:



Has ___ Protons
___ Neutrons
___ Electrons

Now try this one:



Has **92** Protons (atomic number)

___ Neutrons

___ Electrons

Now try this one:



Has **92** Protons (atomic number)
146 Neutrons ($238 - 92 = 146$)
___ Electrons

Now try this one:



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

Now try this one:



Has ___ Protons
___ Neutrons
___ Electrons

Now try this one:



Has **15** Protons (atomic number)

___ Neutrons

___ Electrons

Now try this one:



Has **15** Protons (atomic number)
18 Neutrons ($33 - 15 = 18$)
___ Electrons

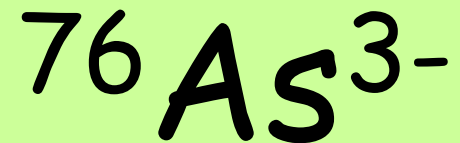
Now try this one:



Has 3 MORE Electrons
than Protons

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

The isotope:

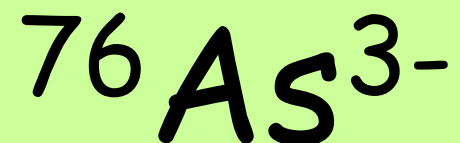


has ___ protons

___ neutrons

___ electrons

The isotope:

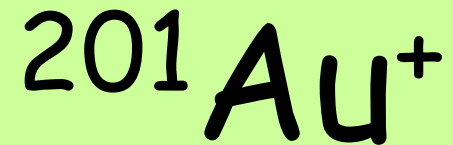


has 33 protons (atomic #)

43 neutrons ($76-33$)

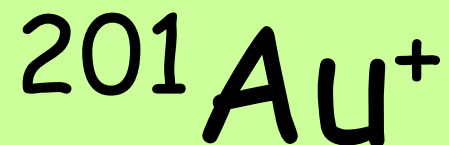
36 electrons ($33+3$)

The isotope:



has ___ protons
___ neutrons
___ electrons

The isotope:



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: $^{104}\text{Pd}^{4+}$

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: $^{131}\text{Te}^{2-}$