Atomic Structure

The Atom

- Everything in the world is made of atoms
- The atom is the smallest structure found on earth
- It is so small it has never been seen but scientists have different ideas about what an atom looks like
- We will look at Bohr's theory

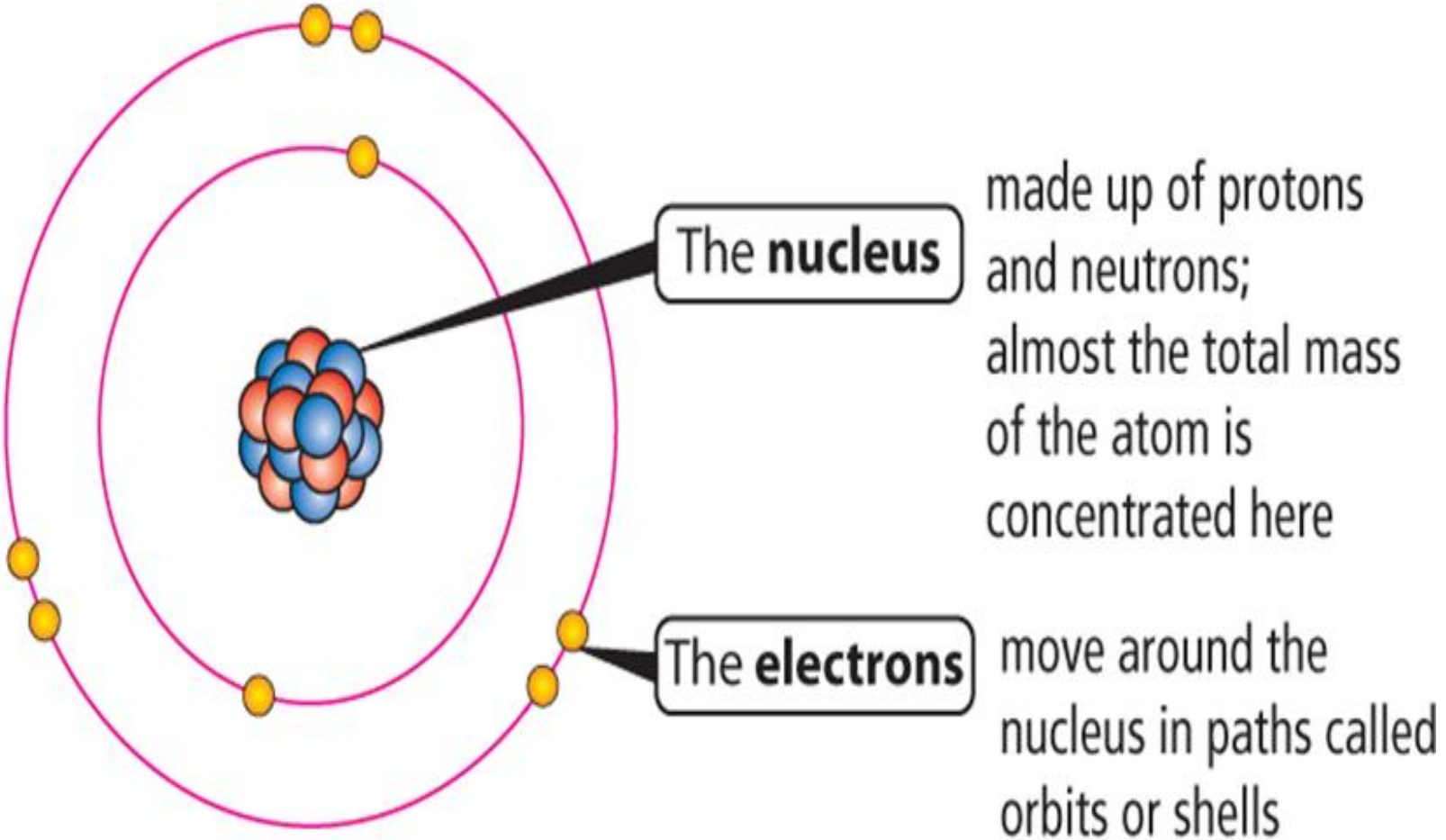


Fig 21.2 Sub-atomic particles

The Atom

- The atom is made up of 3 things:

1. Protons
2. Electrons
3. Neutrons

The Atom

- Protons and Neutrons are found in the nucleus

- Electrons are found whizzing around the outside in the orbitals or rings

Charges on Protons, Electrons and Neutrons

Particle in atom	Mass	Charge	Location
Proton	1 unit	Positive charge (+1)	Nucleus
Neutron	1 unit	None	Nucleus
Electron	Negligible	Negative charge (-1)	Orbiting the nucleus

Fig 21.3 Properties of sub-atomic particles

Mass and Atomic Number

- Every element in the periodic table has two numbers – their mass number and their atomic number

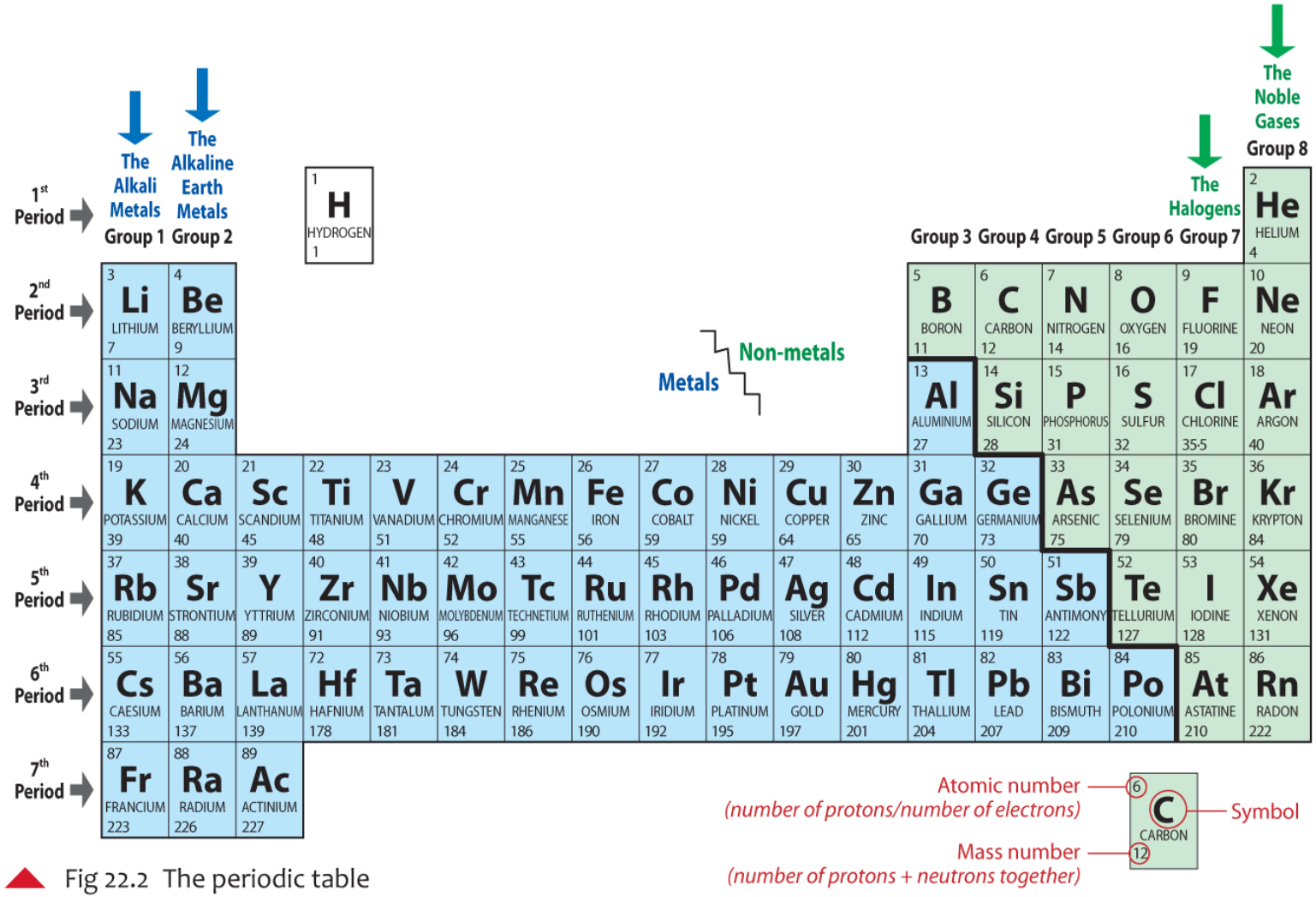


Fig 22.2 The periodic table

- The mass number is the number of protons and neutrons in an atom
- The atomic number is the number of protons in the atom (its always equal to the number of electrons!)

Drawing the Electronic Configuration of Elements

- We can draw the electronic configuration of elements by looking at the element in the peroidic table

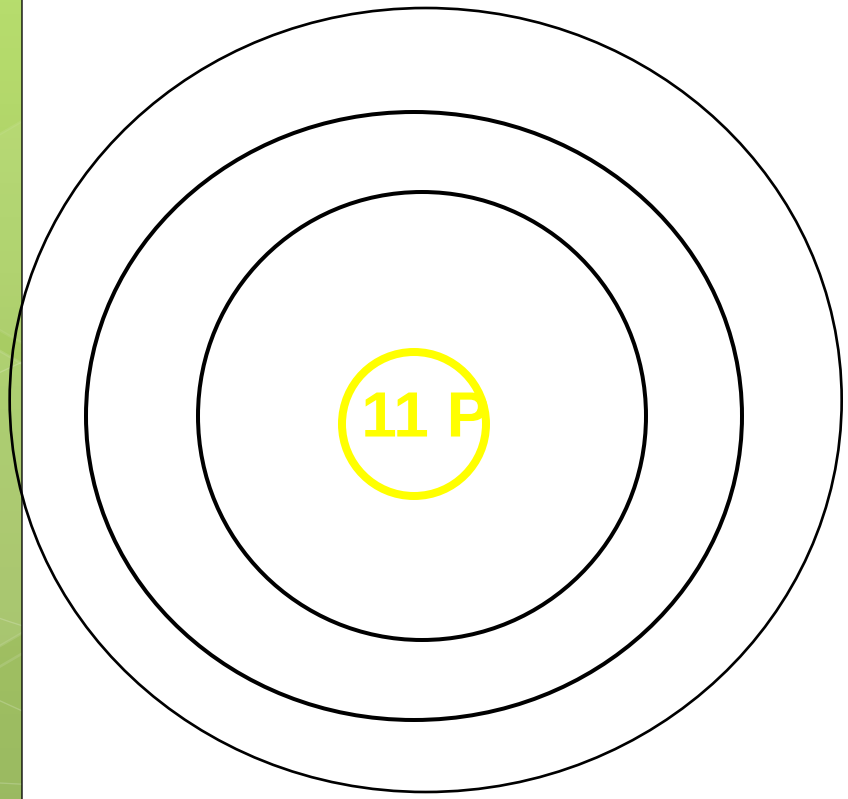
23
Na
11

- Atomic number = 11

- 11 = protons
- 11 = electrons
- 23 – 11 = 12 = neutrons

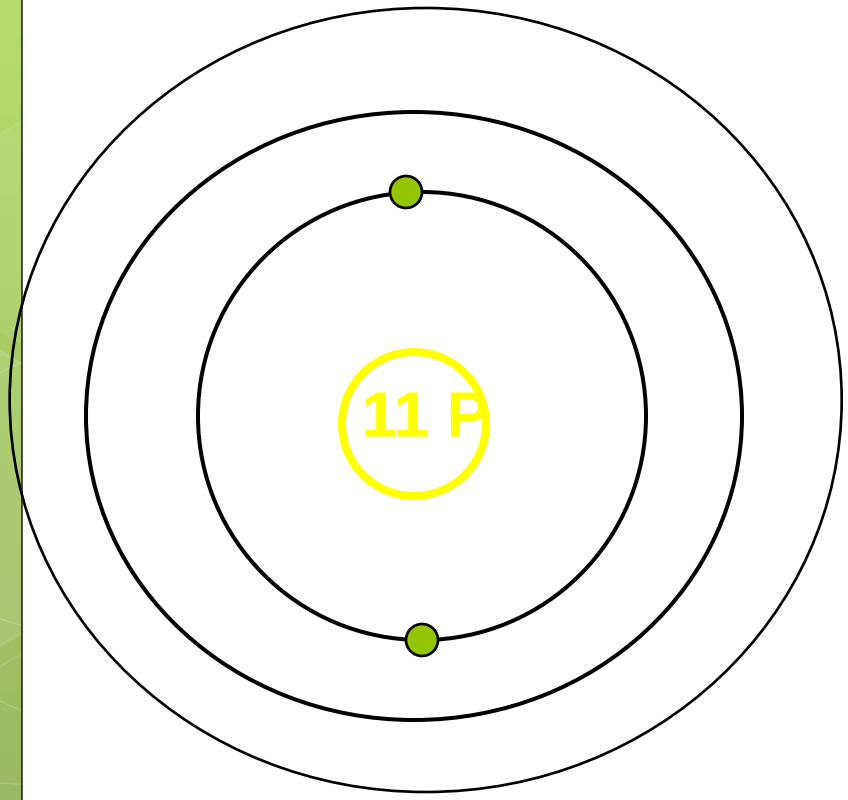
- Protons go in the centre of the atom

23
Na
11



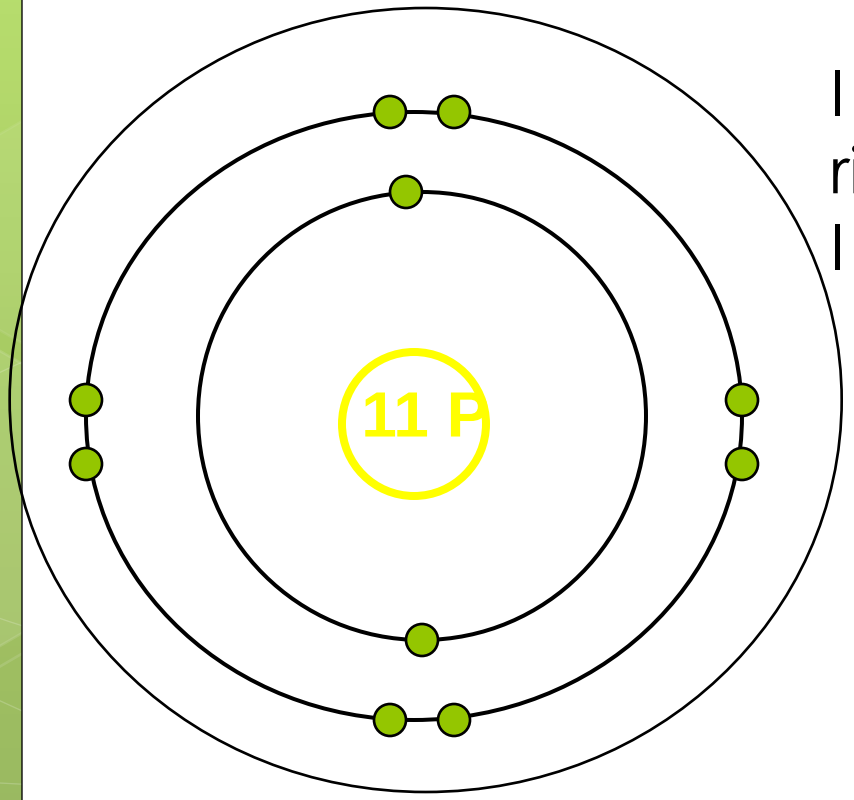
- Electrons go on the orbitals outside the atom
- The first orbital will take 2 electrons
- All the rest will take 8 electrons
- Na has 11 electrons so we need to fill up the orbitals

23
Na
11



We are now left with
9 electrons

23
Na
11

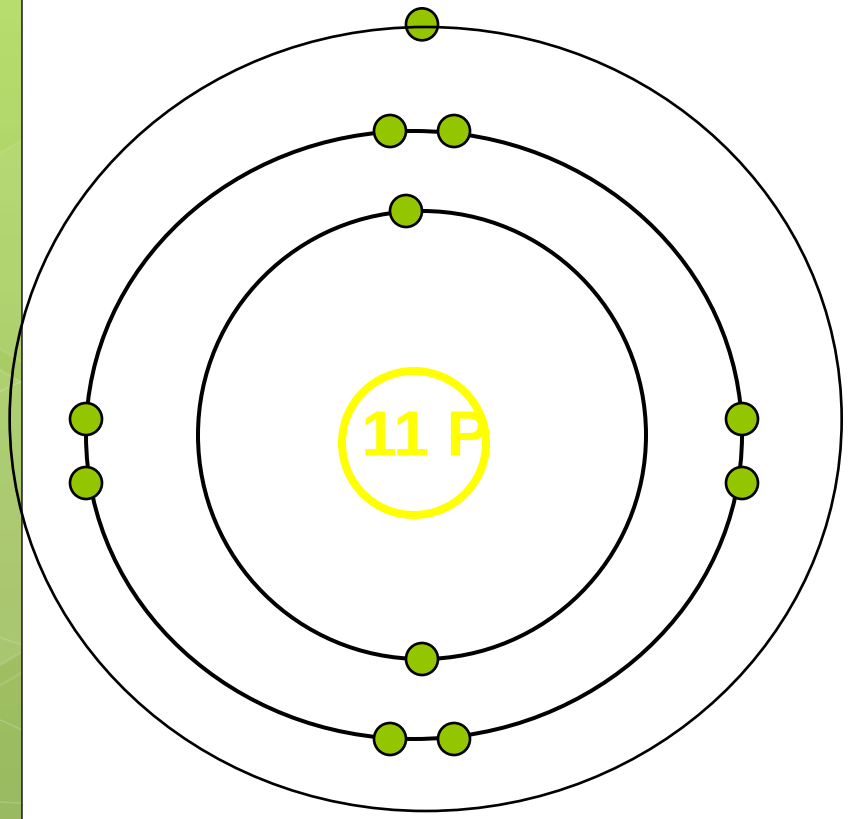


I have used 8 to fill the next ring.
I have 1 electron left

23

Na

11



Another way of saying this is that Na has an electron pattern of 2,8,1

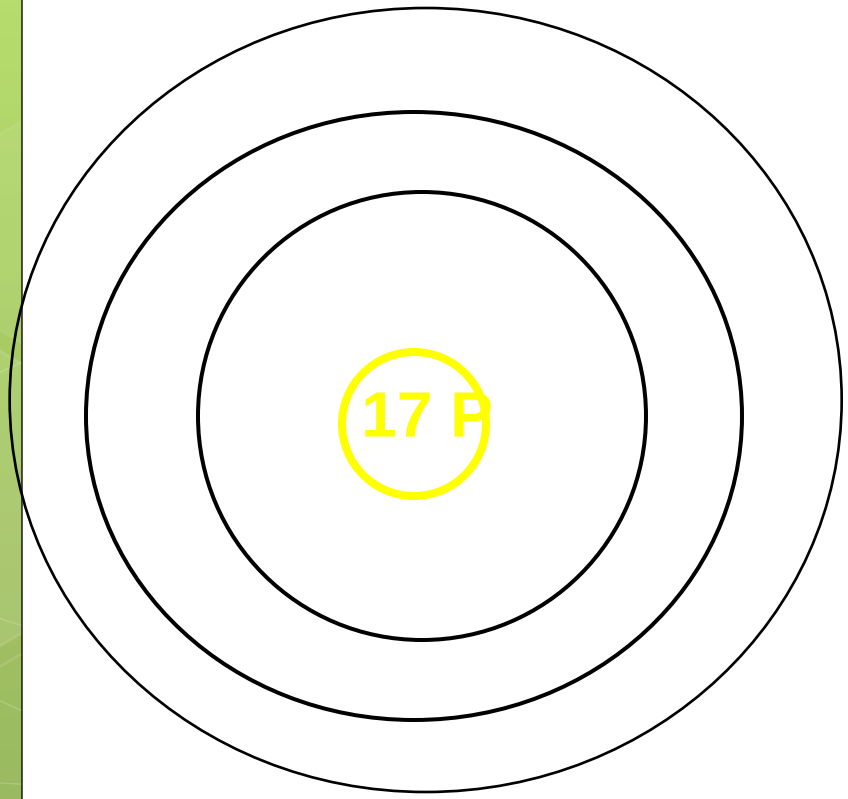
17
Cl
35

- Atomic number = 17

- 17 = protons
- 17 = electrons
- 35 – 17 = 18 = neutrons

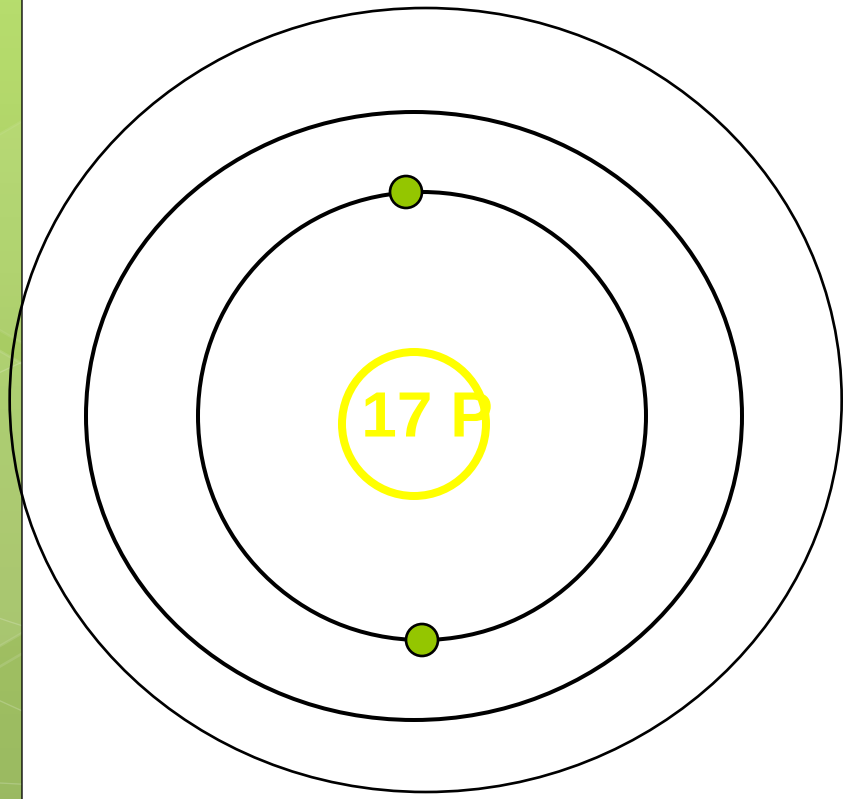
- Protons go in the centre of the atom

17
Cl
35



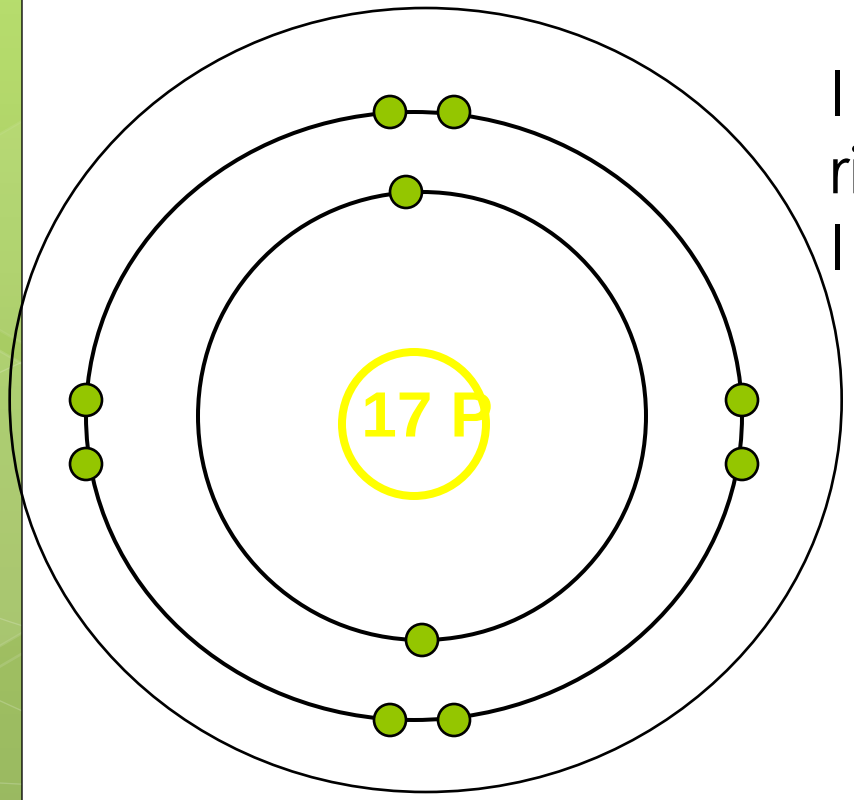
- Cl has 17 electrons so we need to fill up the orbitals

17
Cl
35



We are now left with
15 electrons

17
Cl
35

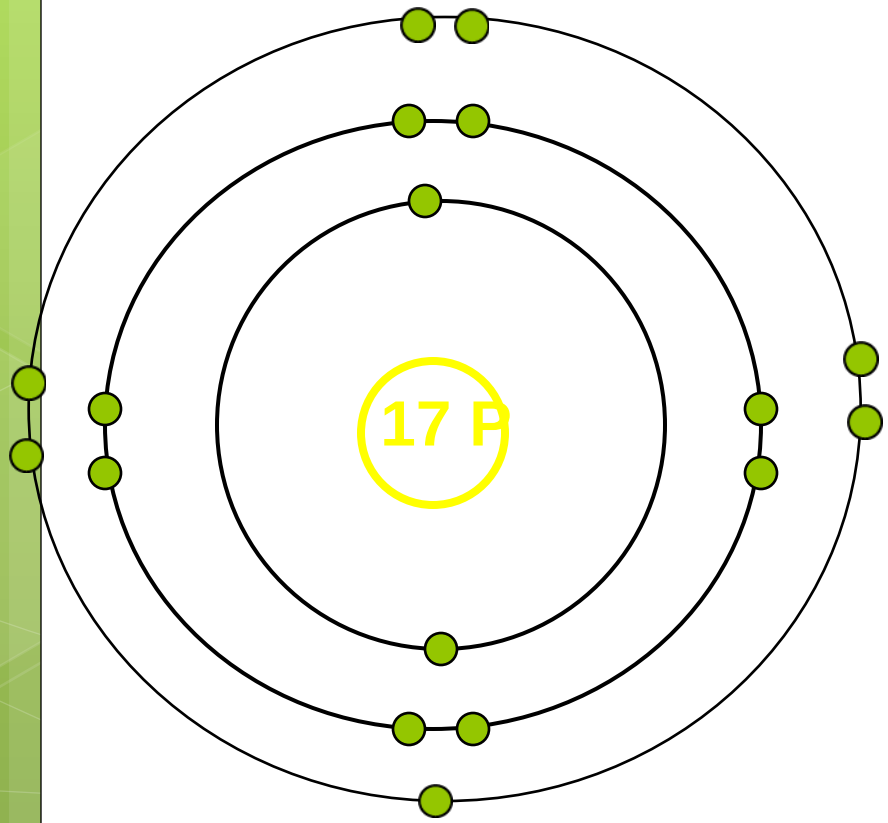


I have used 8 to fill the next ring.
I have 7 electrons left

17

Cl

35



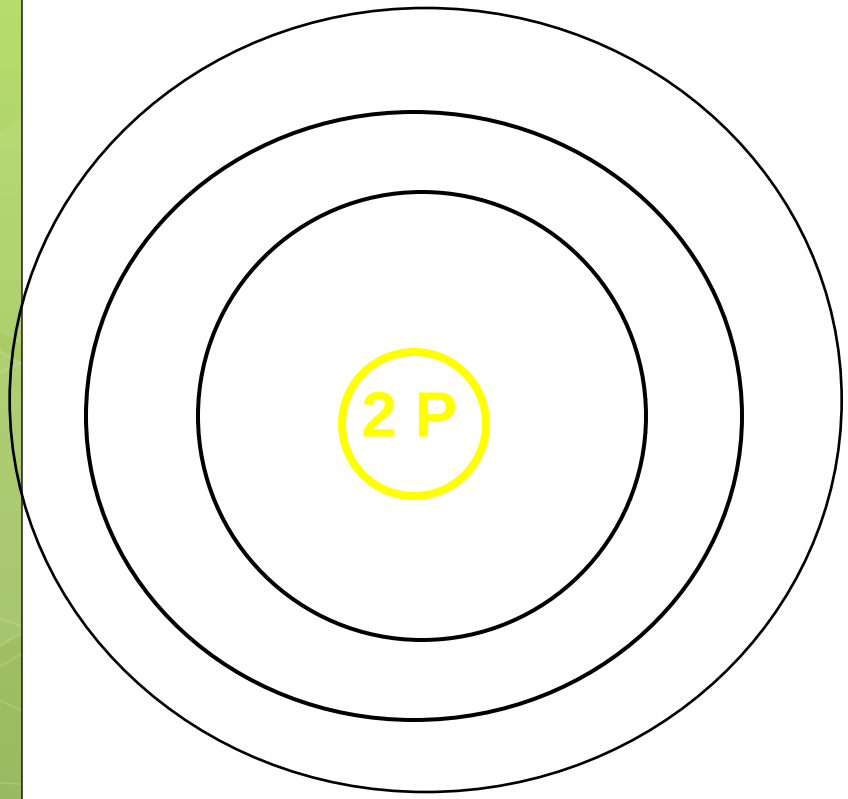
Another way of saying this is that Na has an electron pattern of 2,8,7

2
He
4

- Atomic number = 2

- 2 = protons
- 2 = electrons
- 4 – 2 = 2 = neutrons

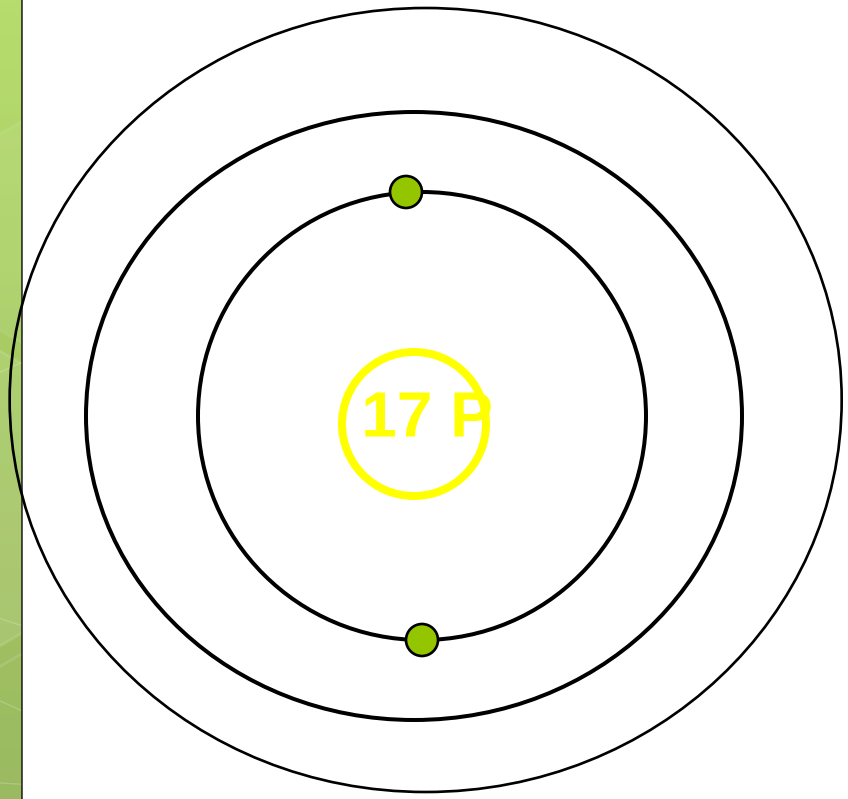
- Protons go in the centre of the atom



2
He
4

- He has 2 electrons so we need to fill up the orbitals

2
He
4

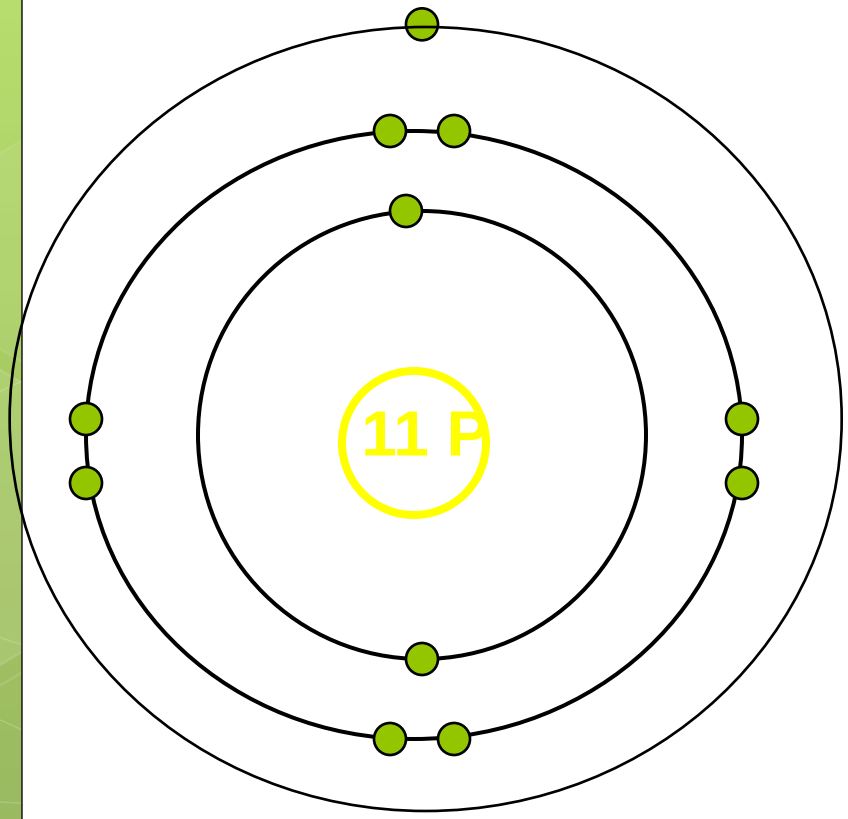


Another way of saying this is that Na has an electron pattern of 2

Reactivity

- An element with a full outer shell is stable or un-reactive
- An element without a full outer shell is unstable and thus more reactive

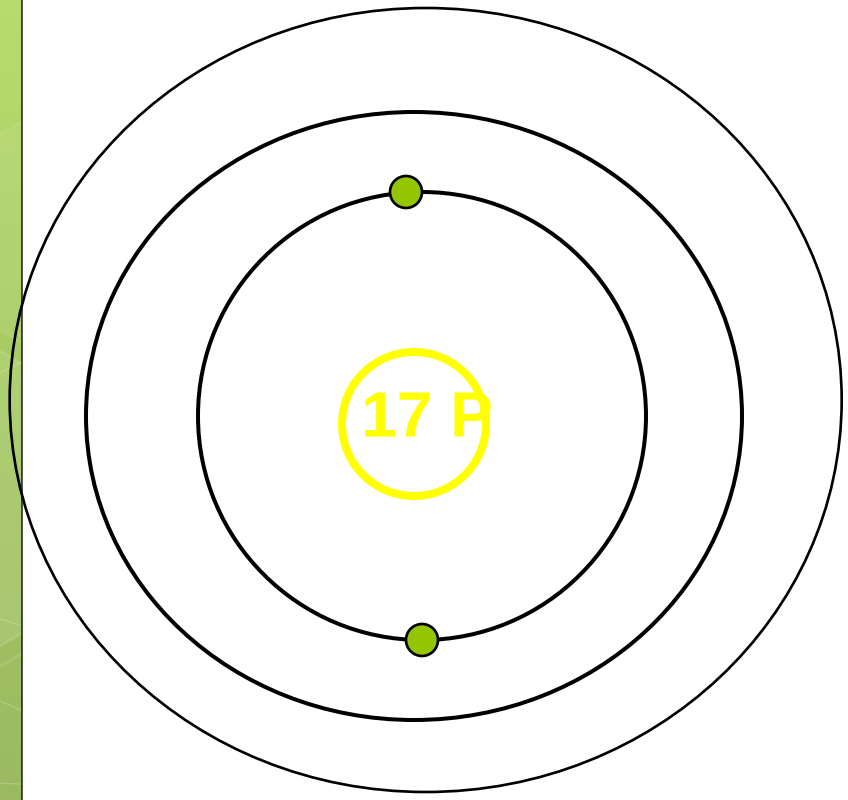
Is this atom stable (unreactive)?



23
Na
11

- No it is unstable (reactive) because it does not have a full outer shell

Is this atom stable (unreactive)?



2
He
4

- It is stable (unreactive) because it has a full outer shell

Isotopes

- Isotopes are atoms that have the same atomic number but different mass number

- **Example:**

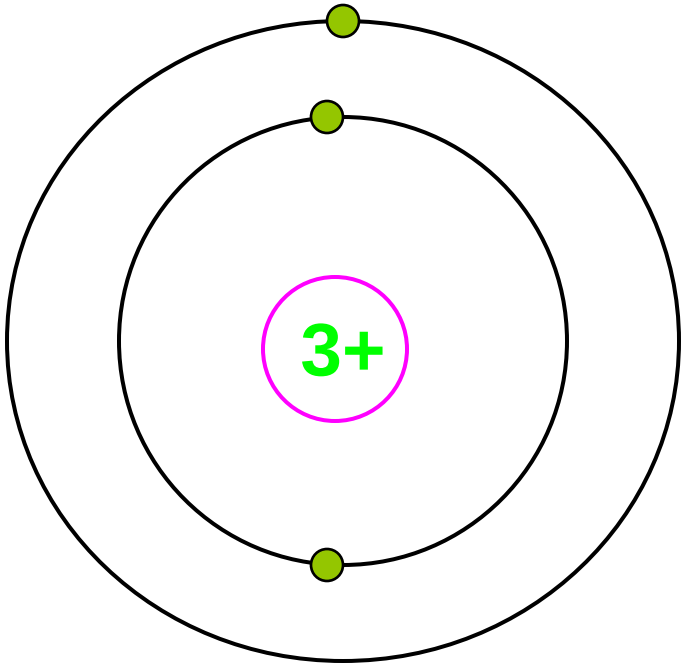
$$^{12}_{6}C \qquad\qquad ^{13}_{6}C$$

7

Li

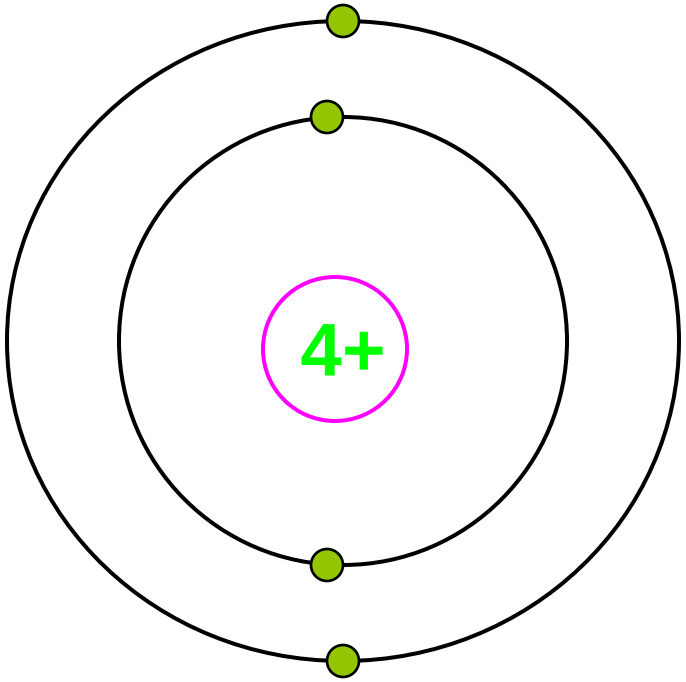
3

Lithium



9
Be
4

Beryllium



Electron Pattern

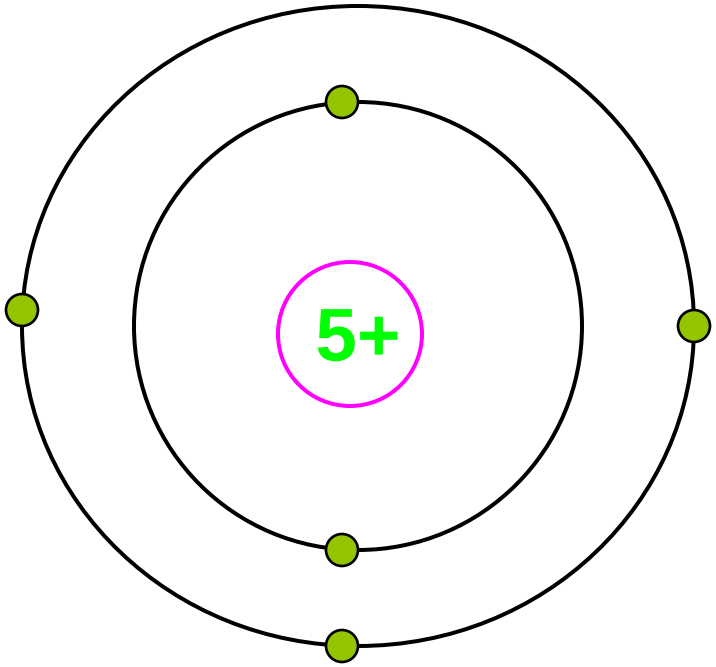
2, 2,

11

B

5

Boron

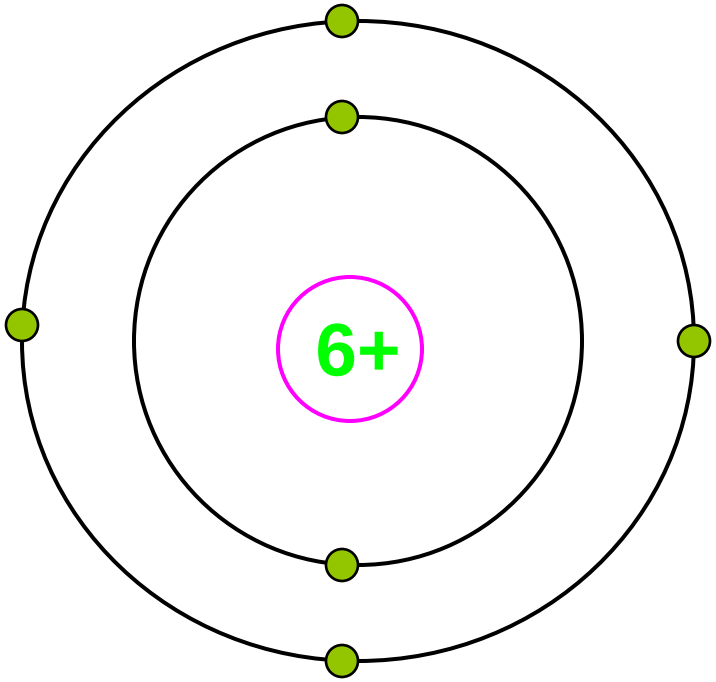


Electron Pattern

2, 3,

12
C
6

Carbon

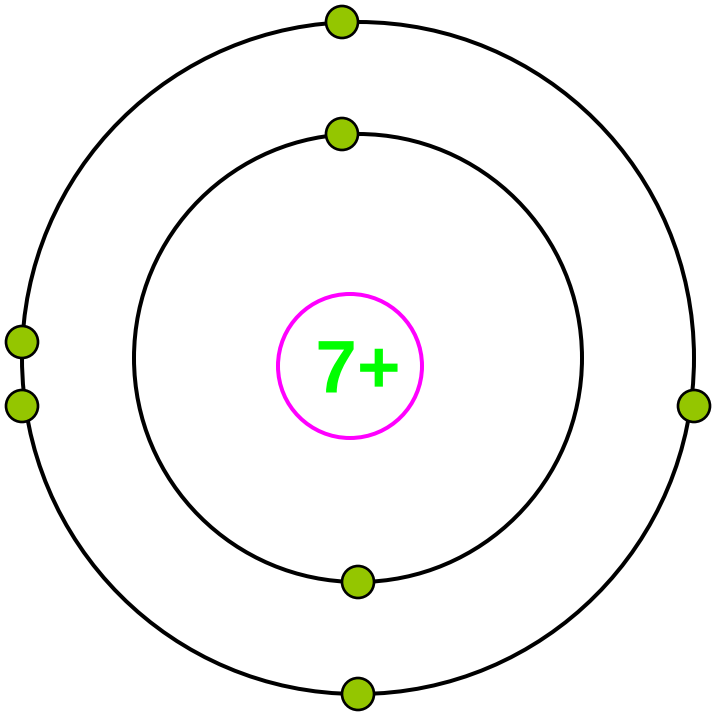


Electron Pattern

2, 4,

14
N
7

Nitrogen



Electron Pattern

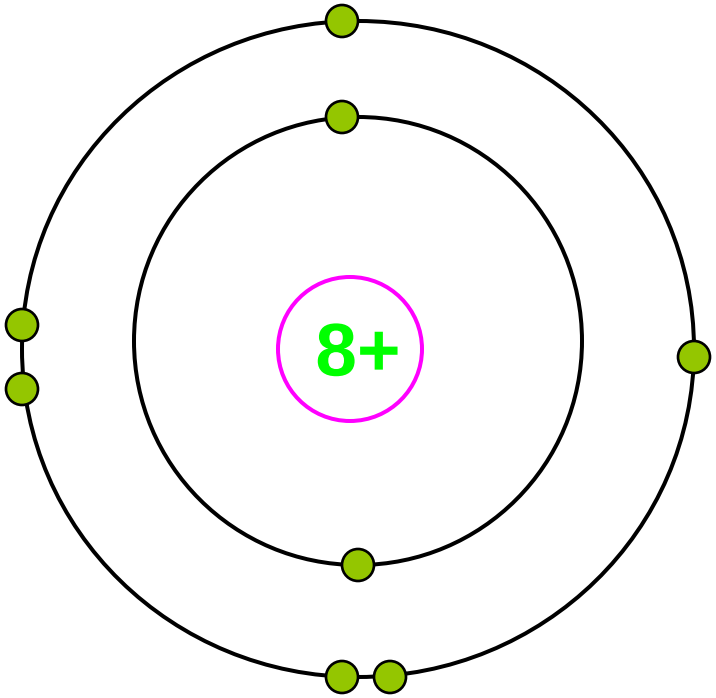
2, 5,

16

O

8

Oxygen



Electron Pattern

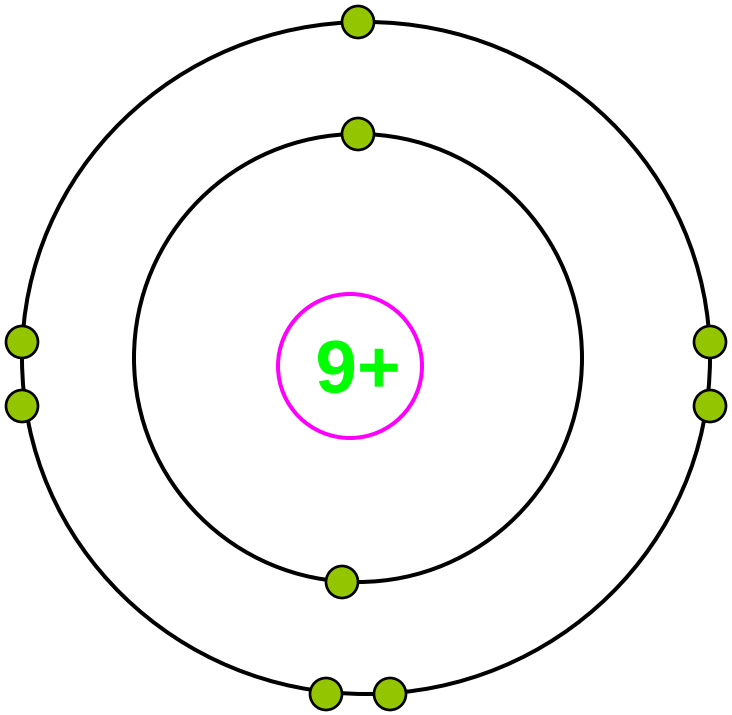
2, 6,

19

F

9

Fluorine

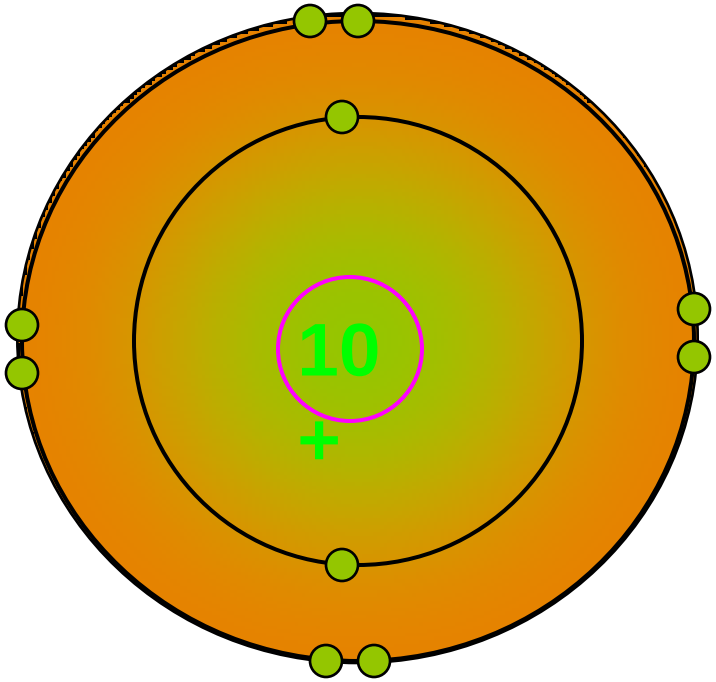


Electron Pattern

2, 7,

20
Ne
10

Neon

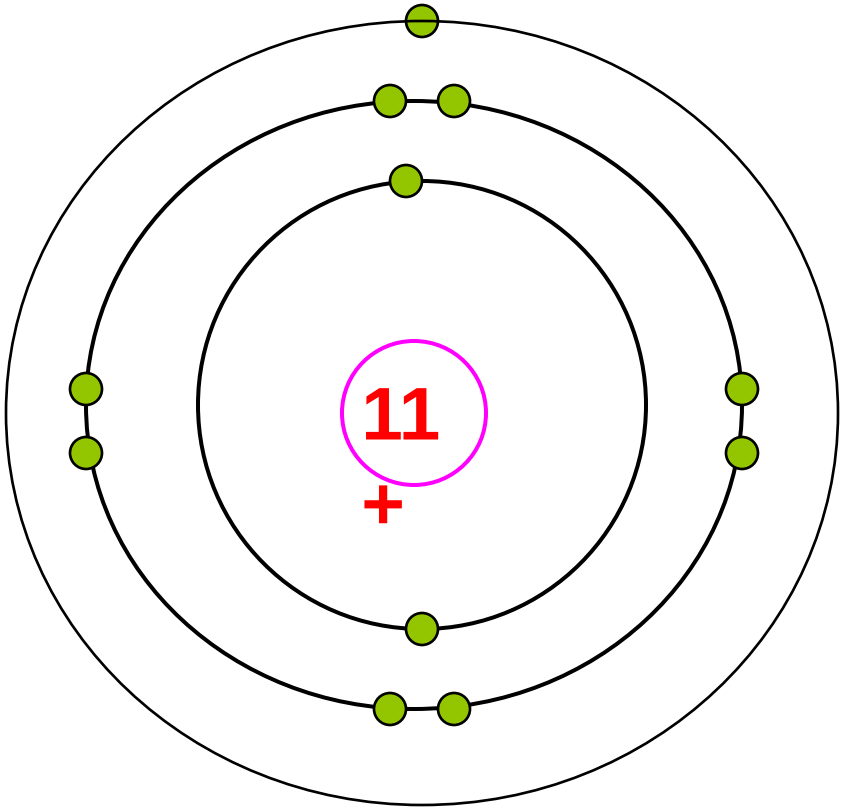


Electron Pattern

2, 8,

23
Na
11

Sodium

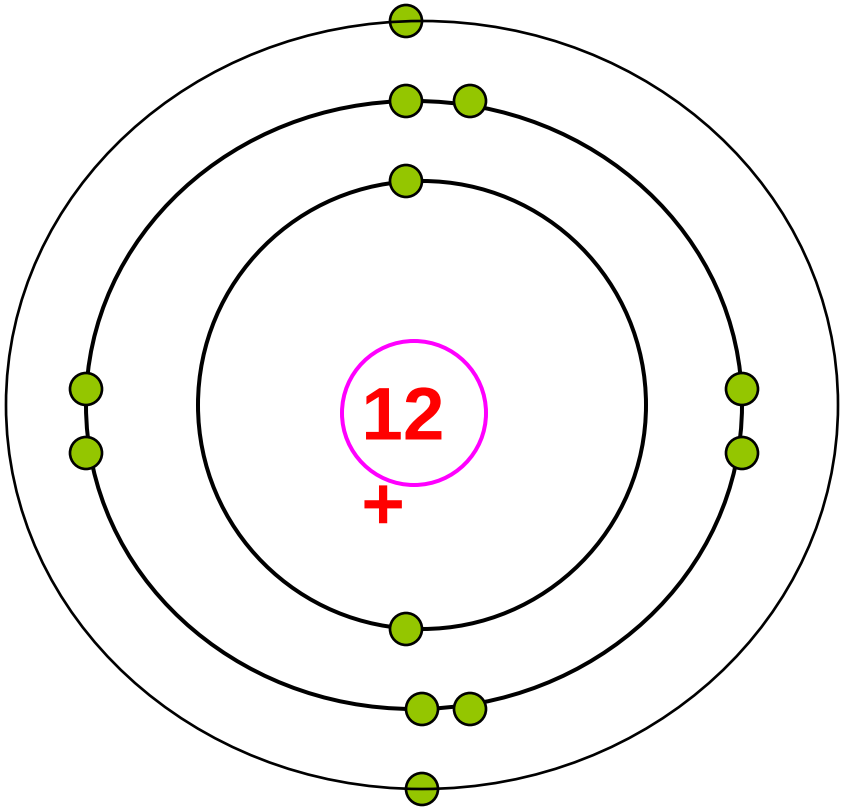


Electron Pattern

2, 8, 1

24
Mg
12

Magnesium



Electron Pattern

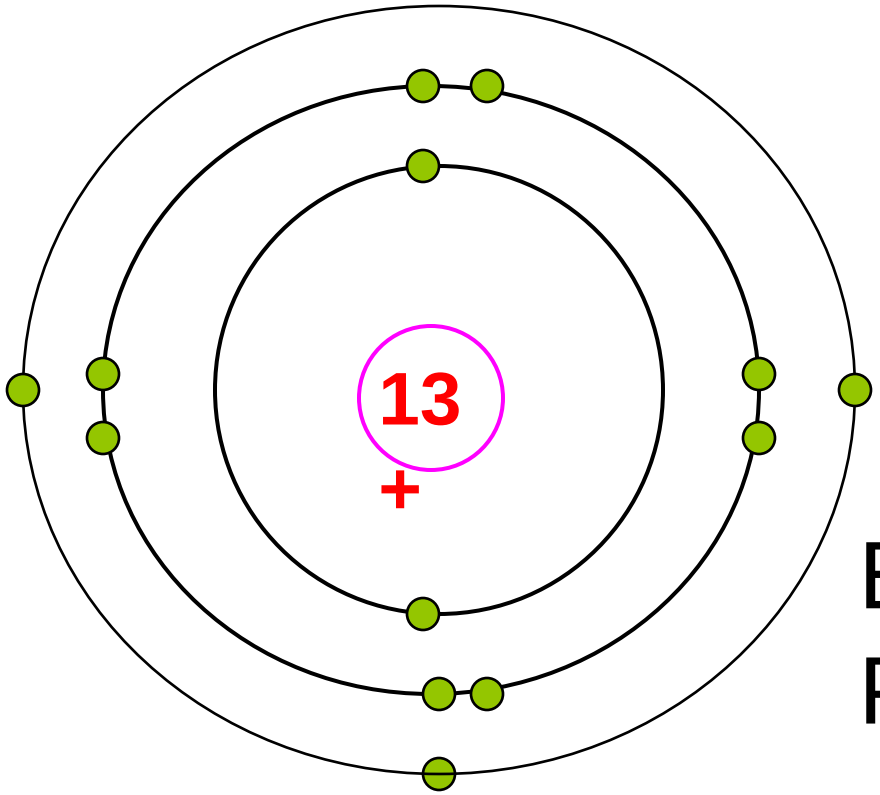
2, 8, 2

27

Al

13

Aluminium

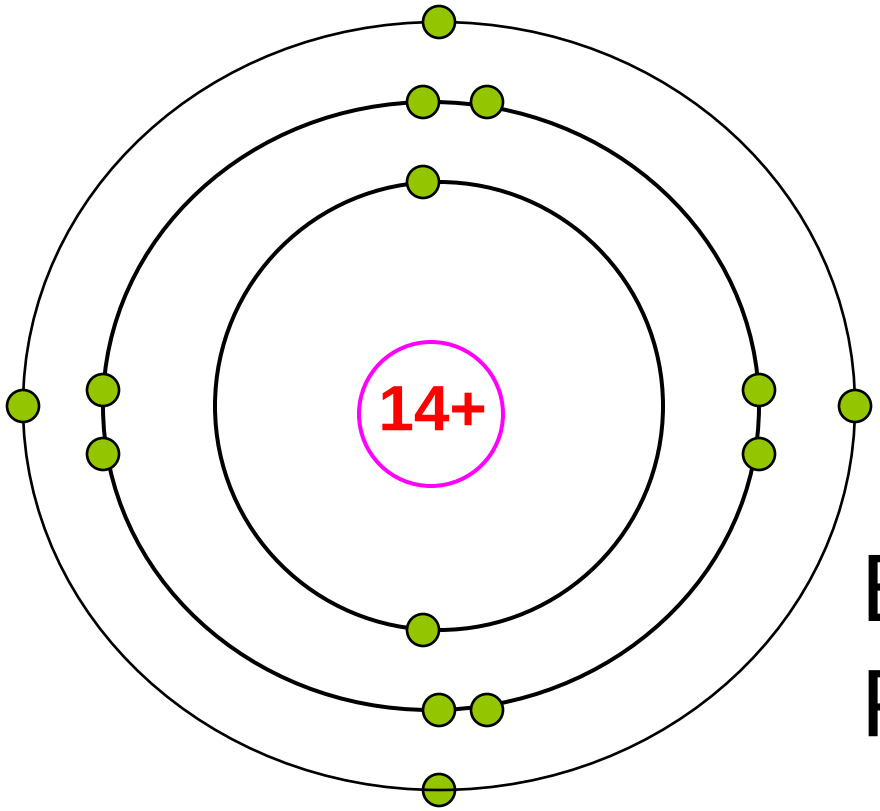


Electron Pattern

2, 8, 3

28
Si
14

Silicon



Electron Pattern

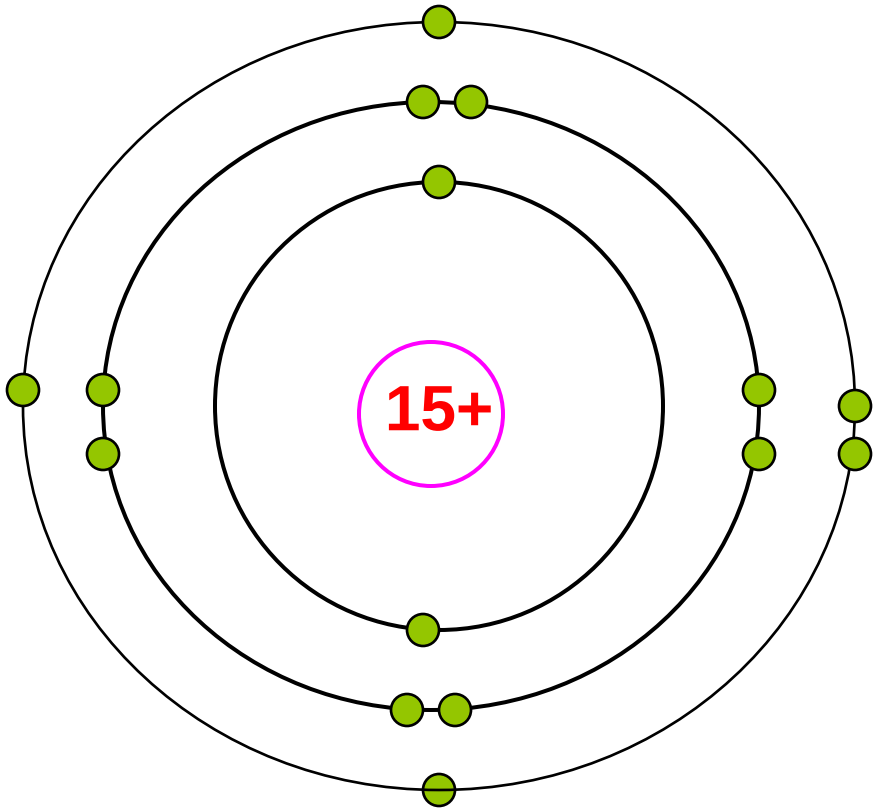
2, 8, 4

31

P

15

Phosphorous



Electron Pattern

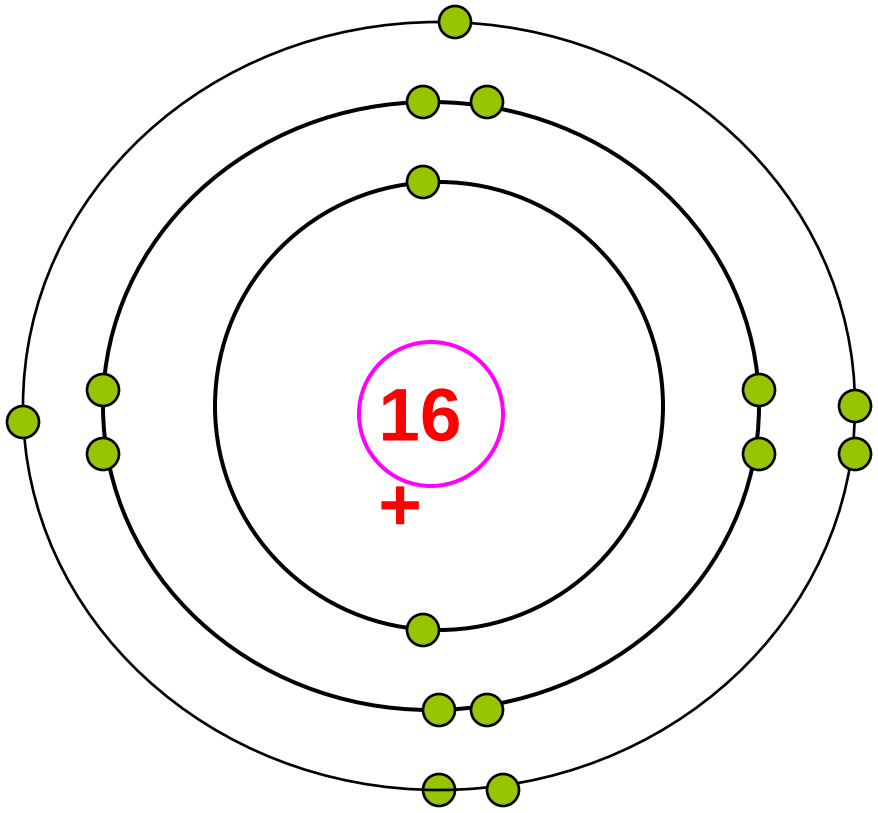
2, 8, 5

32

S

16

Sulphur

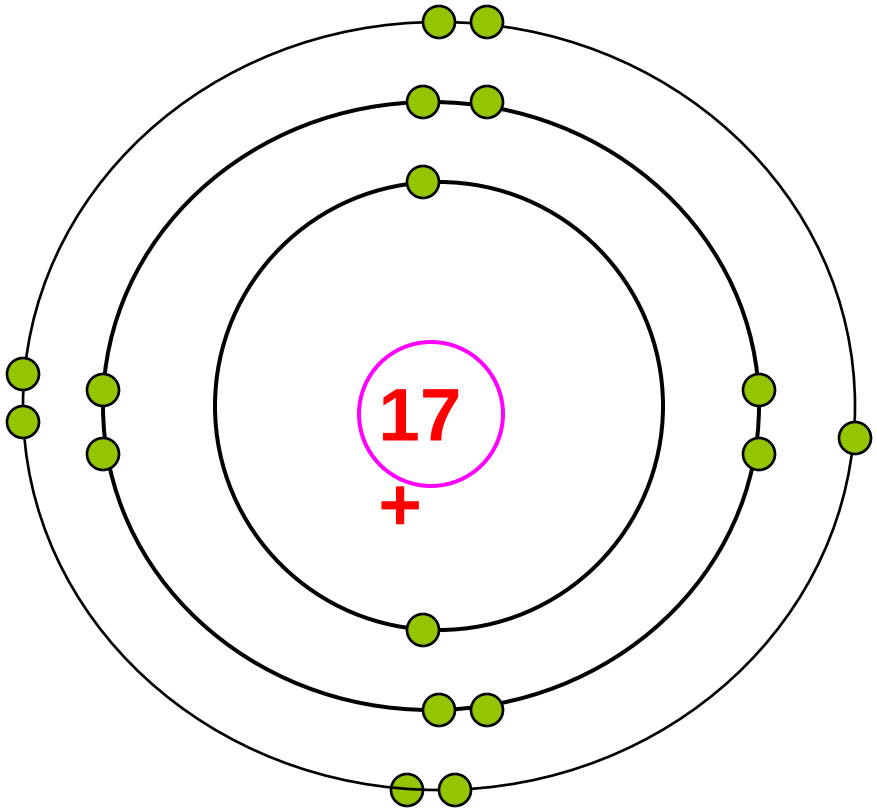


Electron Pattern

2, 8, 6

35
Cl
17

Chlorine

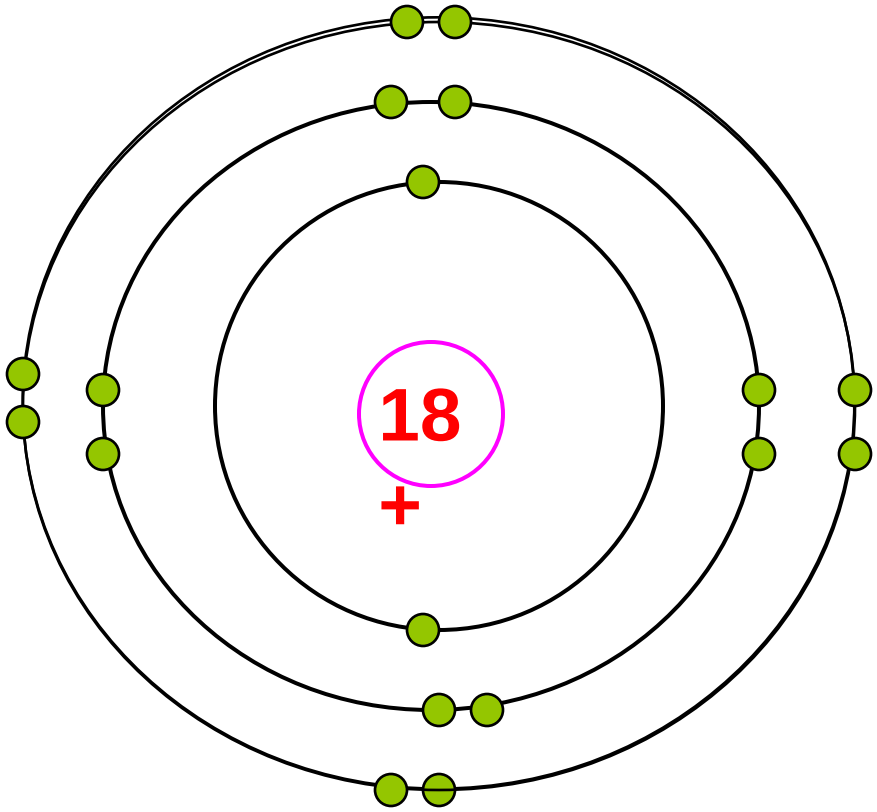


Electron Pattern

2, 8, 7

40
Ar
18

Argon



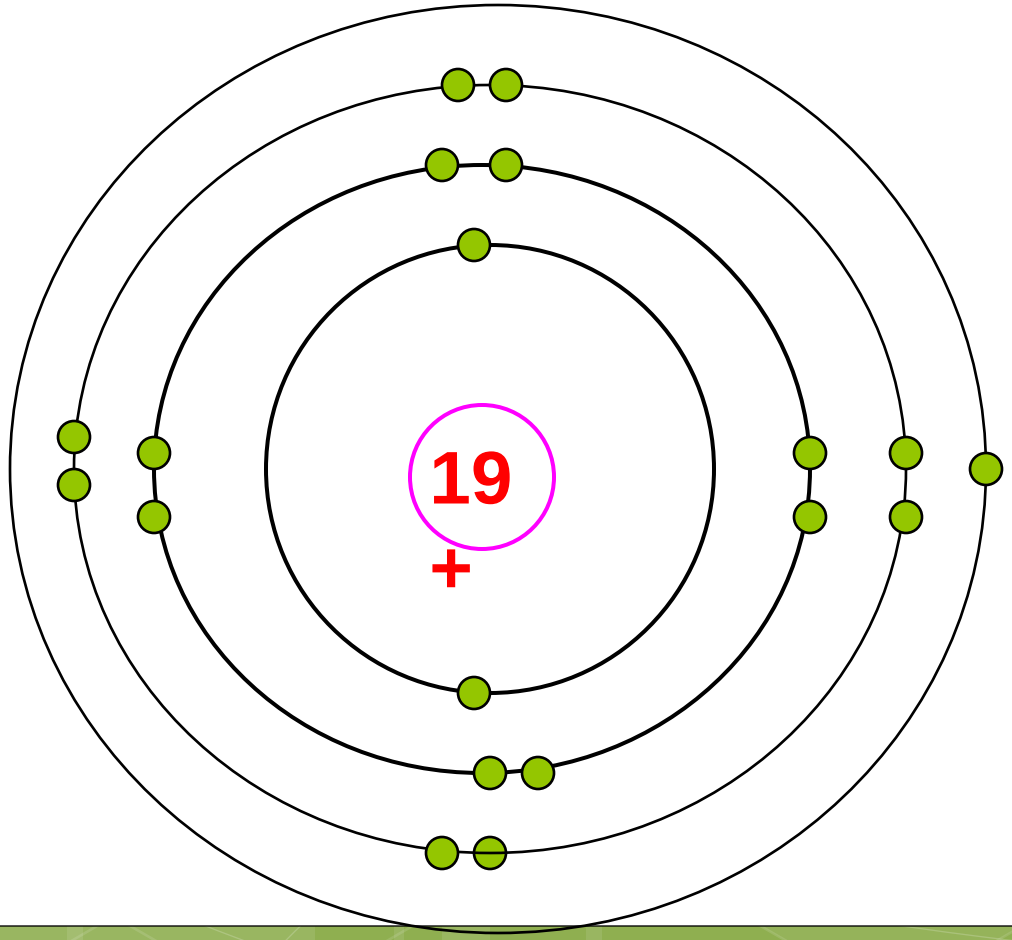
Electron Pattern
2, 8, 8

39

K

19

Potassium

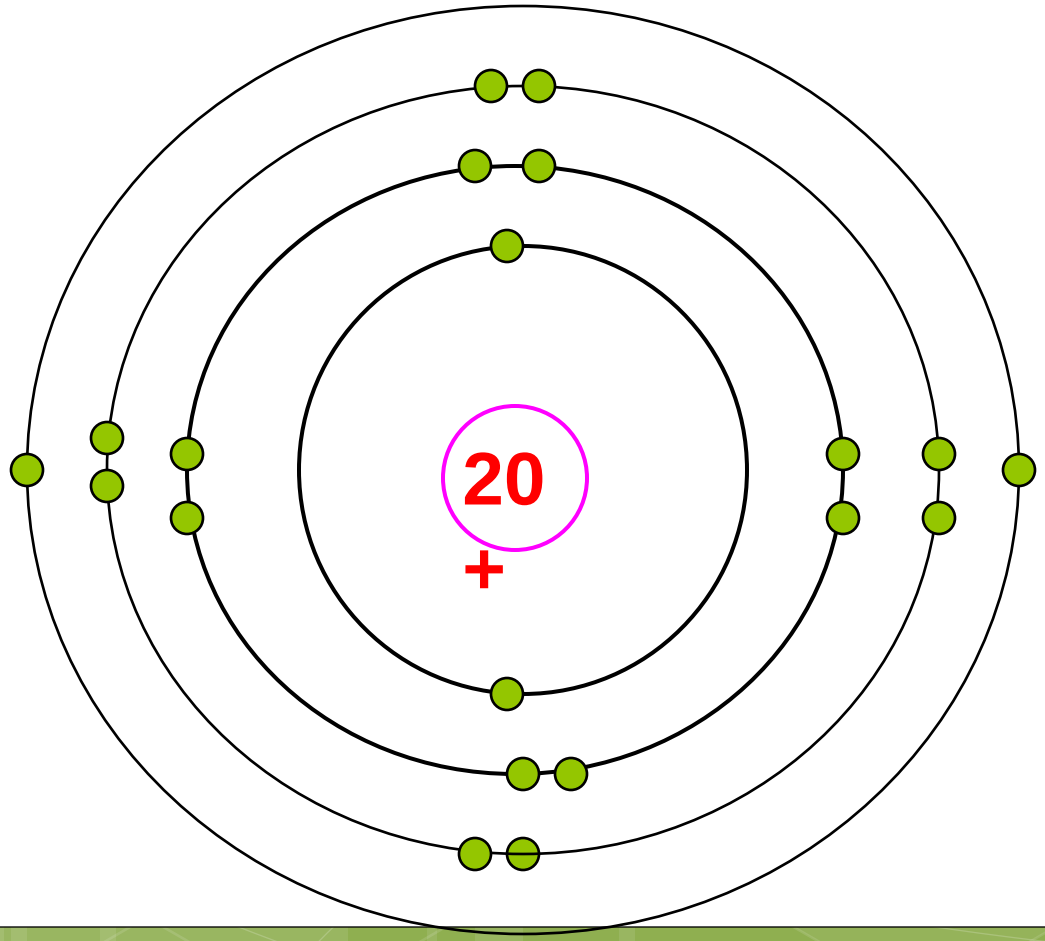


Electron Pattern

2, 8, 8,1

40
Ca
20

Calcium



Electron Pattern

2, 8, 8, 2