وزارة التربية والتعليم
MINISTRY OF EDUCATION

دائرة التعليم والمعرفة
DEPARTMENT OF EDUCATION AND KNOWLEDGE

CHAPTER 1

The Periodic Table and Periodic Law



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The Periodic Table and Periodic Law

Section 6.1 Development of the Modern Periodic Table (SELF LEARNING)

Section 6.2 Classification of the Elements (SOLVE PRACTICE)

Section 6.3 Periodic Trends



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CHAPTER- 1



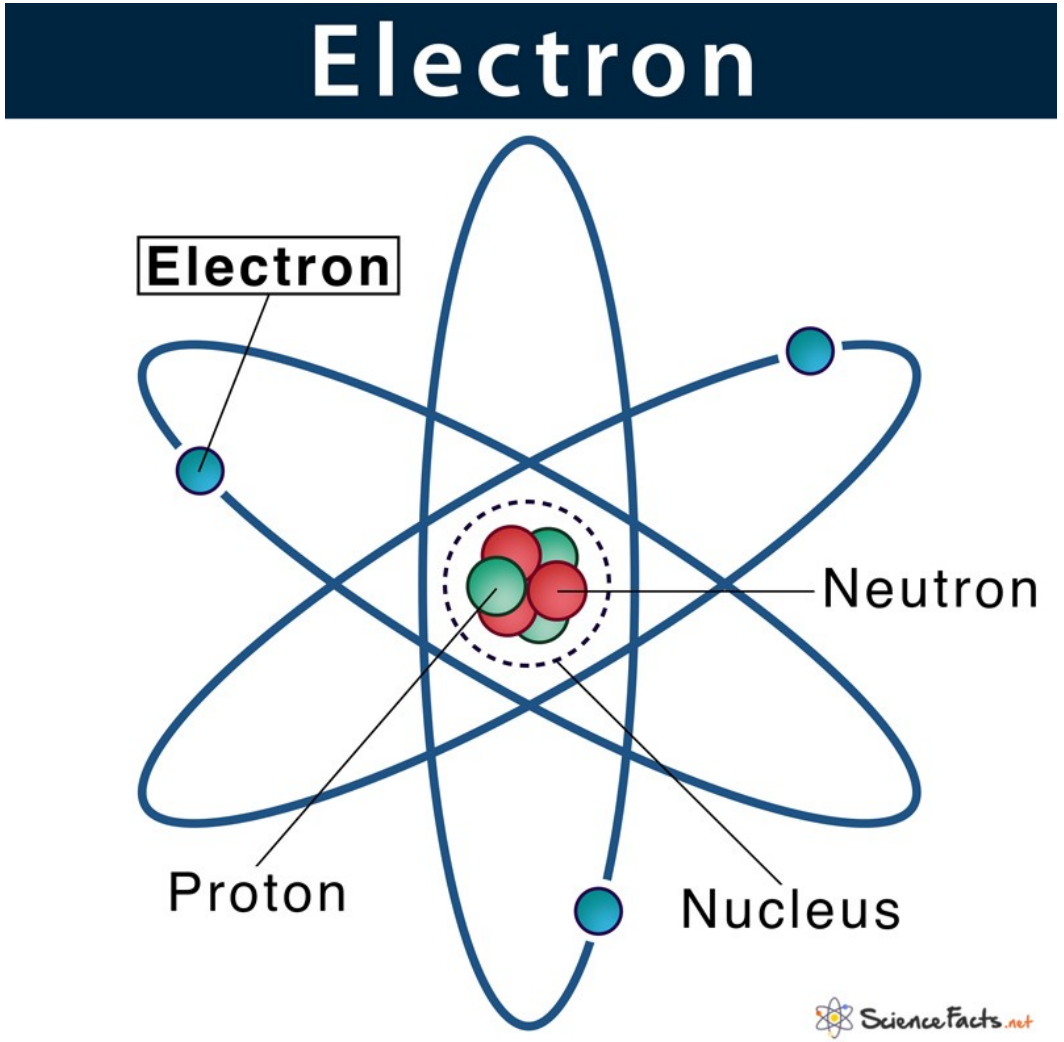
The classification of elements

Period 1

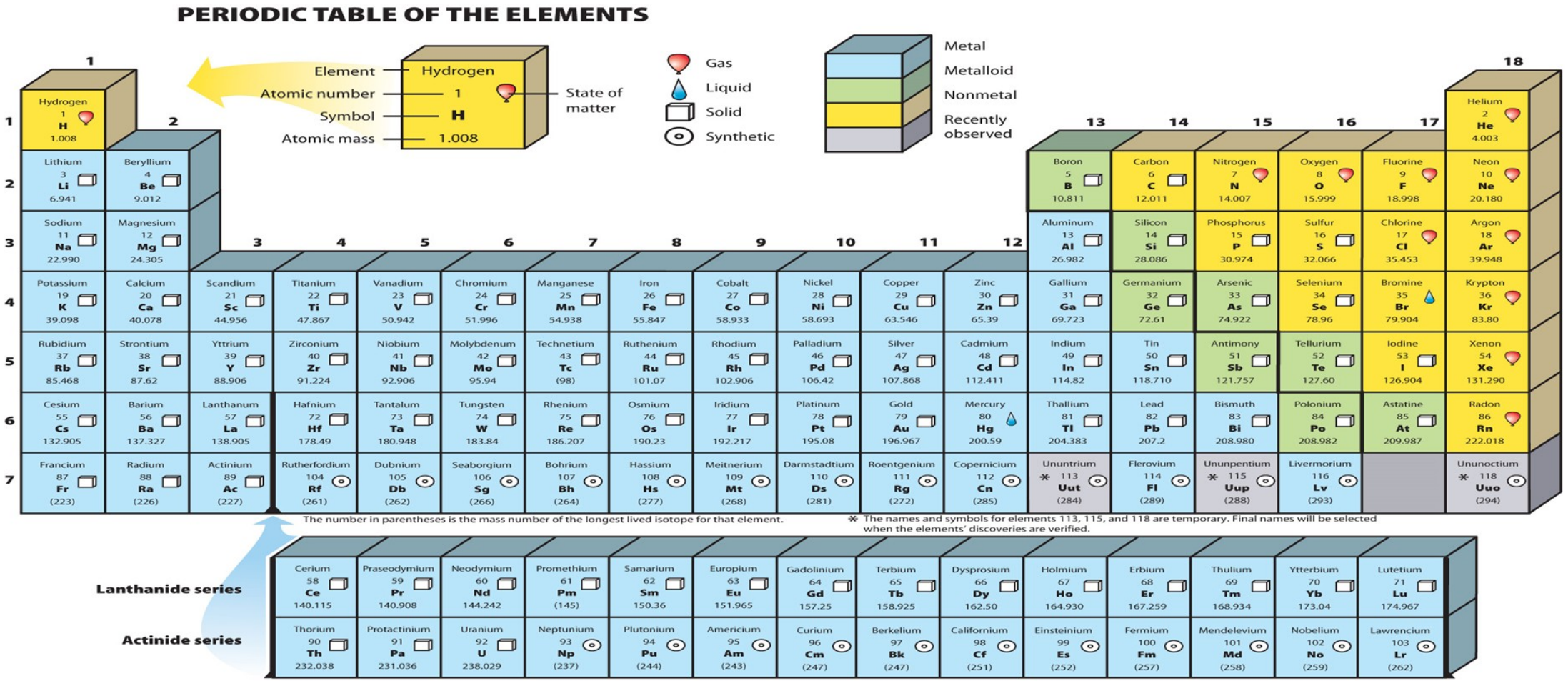
SEC-3 | Electron Configuration

Electron
الالكترون

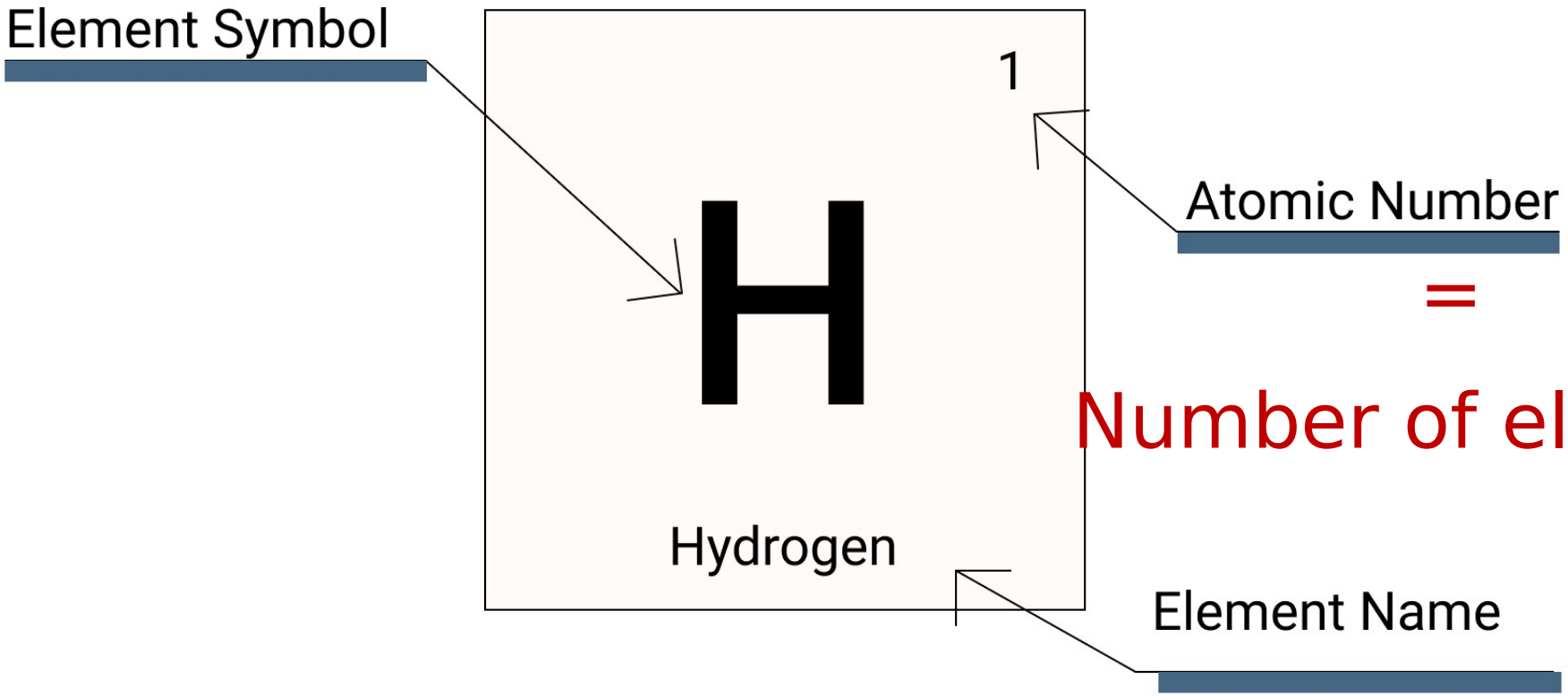
a negatively charged, fast-moving particle with an extremely small mass that is found in all forms of matter and moves through the empty space surrounding an



How can I get the number of electrons of an elements ???



Element Names & Symbols

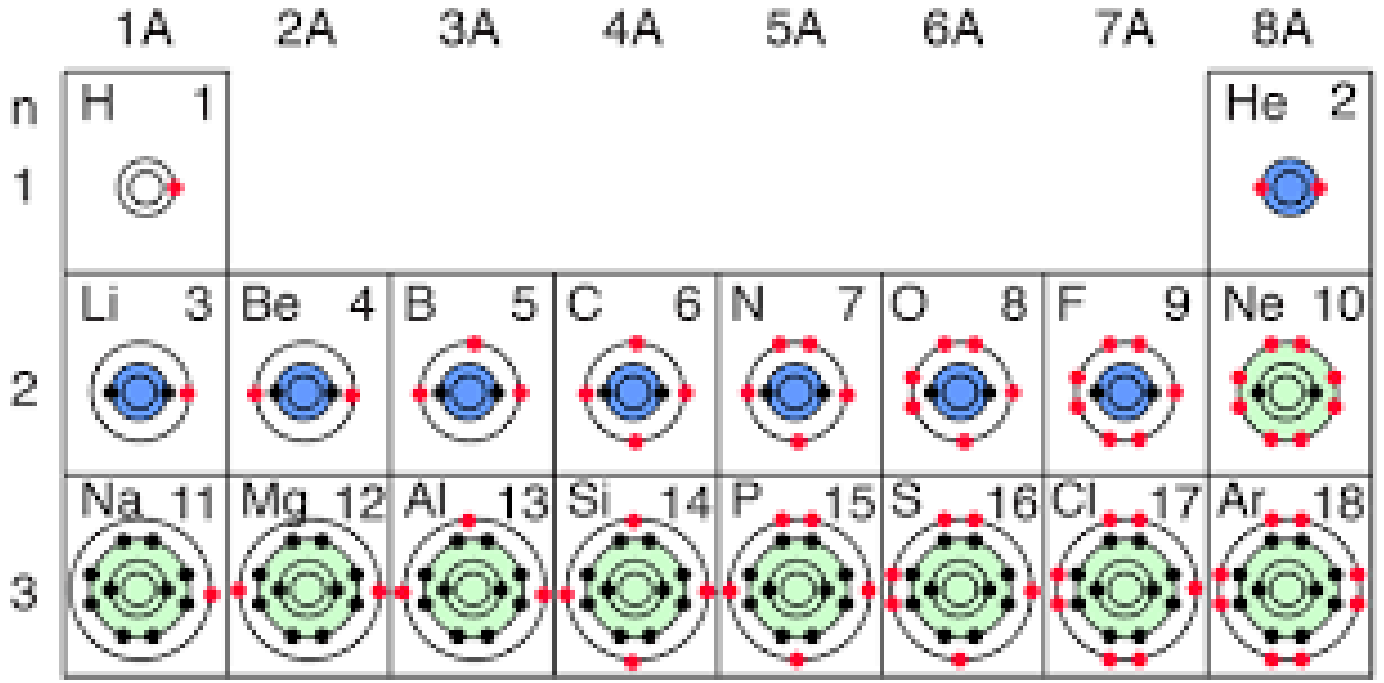


The electrons of He :

Atomic number = 2

Electrons = 2 e

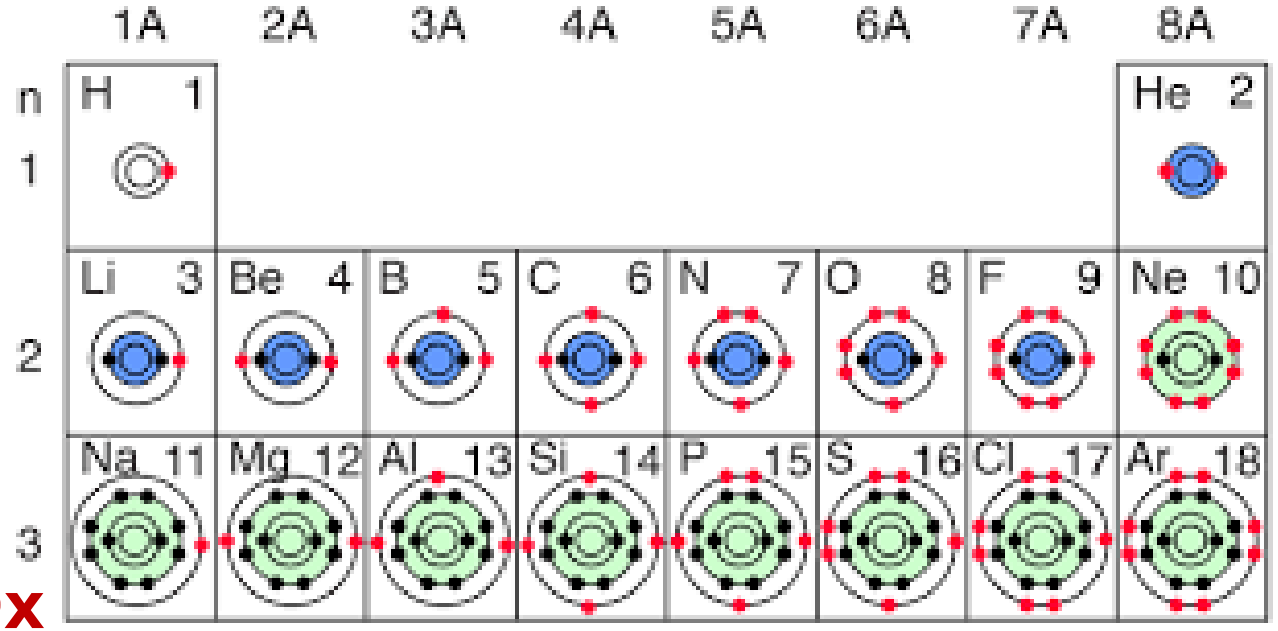
The number of electrons of Li :



The electrons of Ne (Neon) :

Atomic number =

Electrons =



The number of electrons of O (Oxygen) :

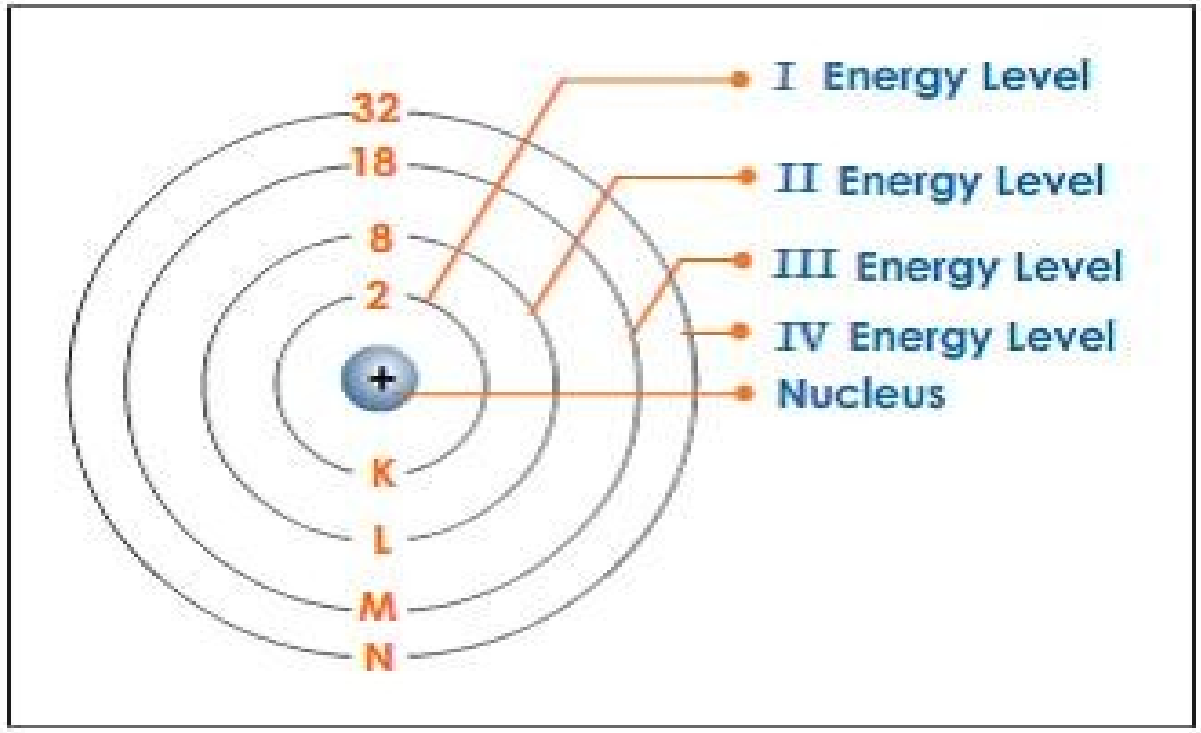
Atomic number =

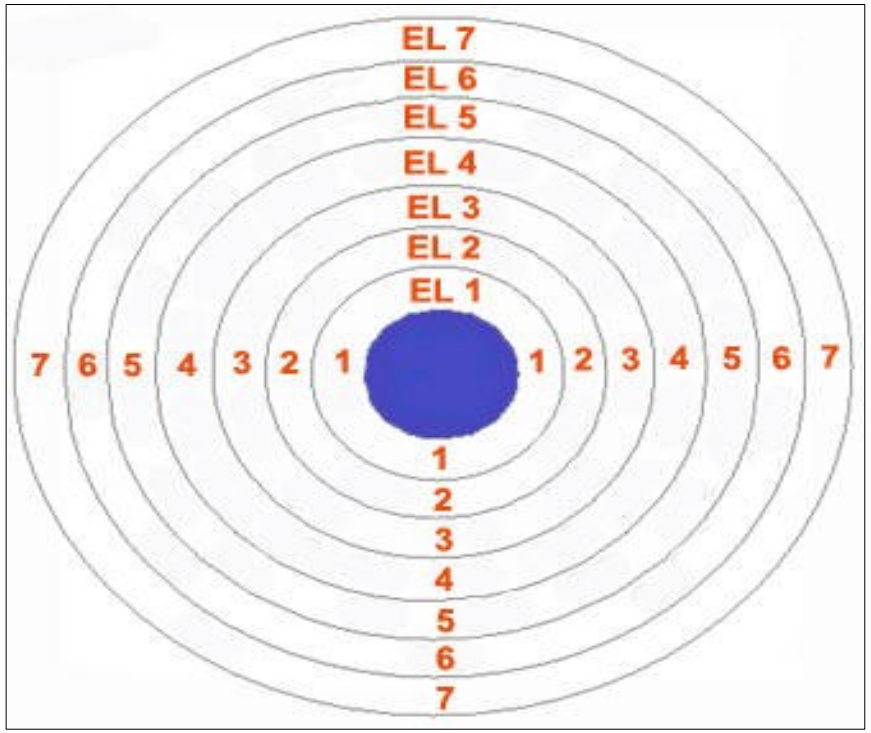
Electrons =

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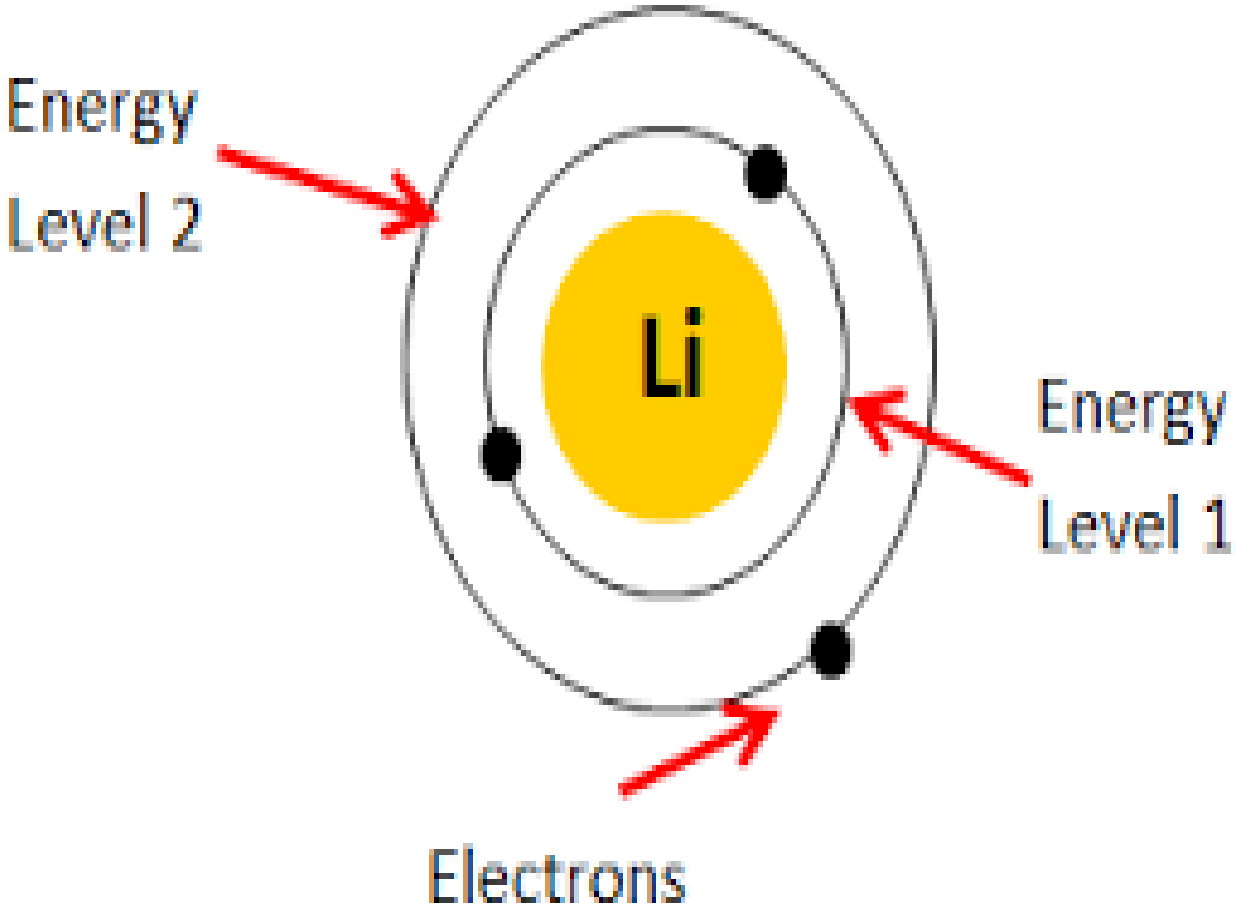
ENERGY LEVELS (n)

Electronic Configuration in an A tom

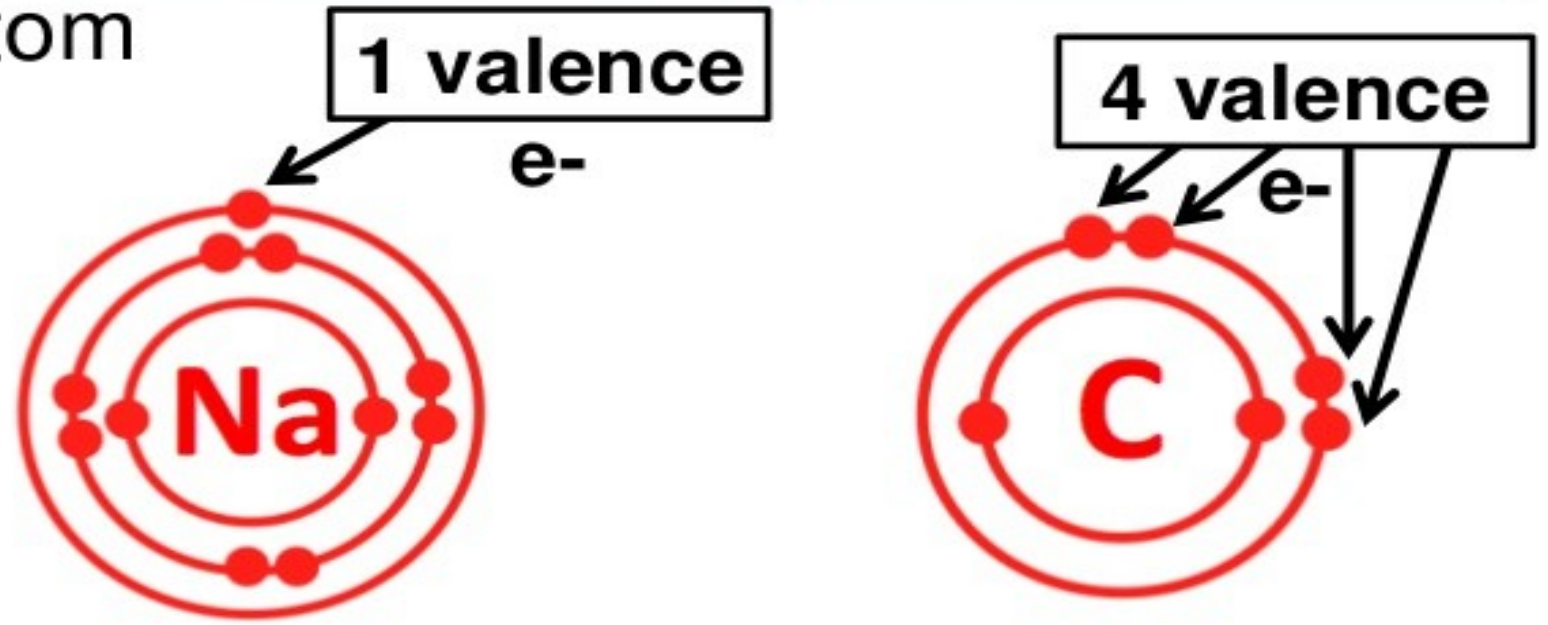




ENERGY LEVEL (n)

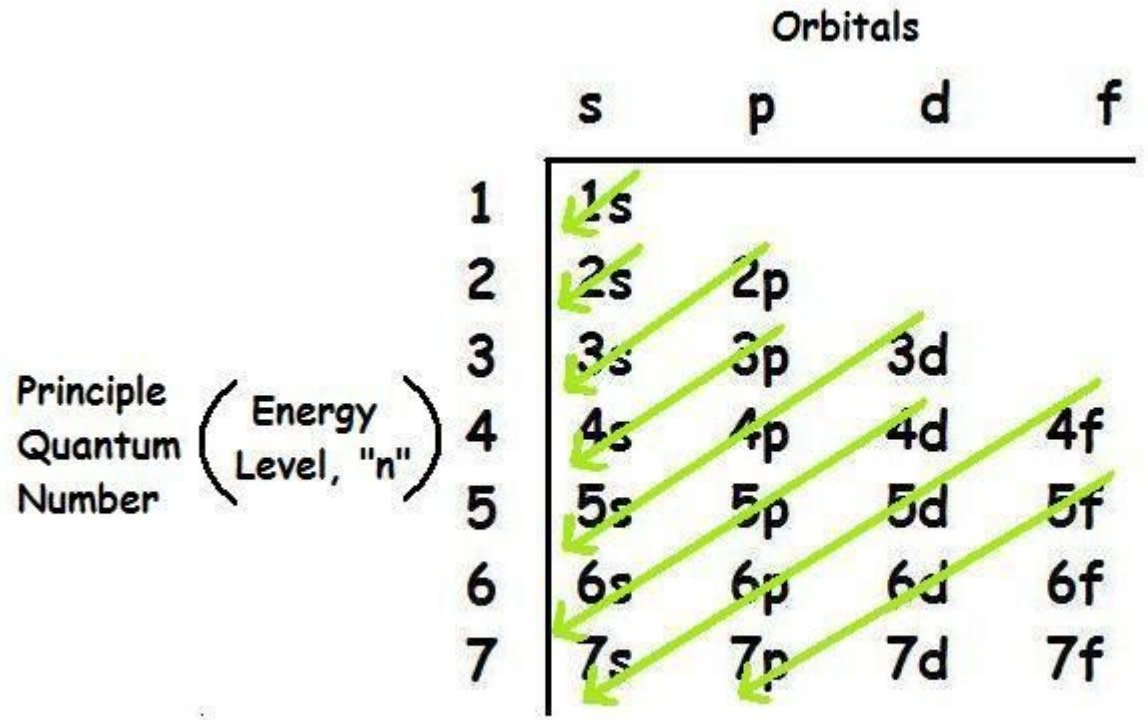


Valence electron: An electron on the outermost energy level in an atom



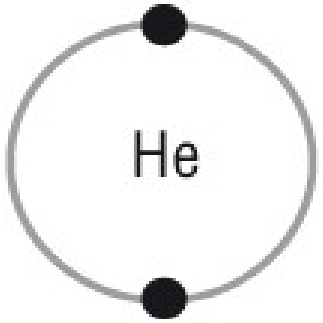
التركيب أو التوزيع الالكتروني
Electron Configuration

Electronic Configuration Chart

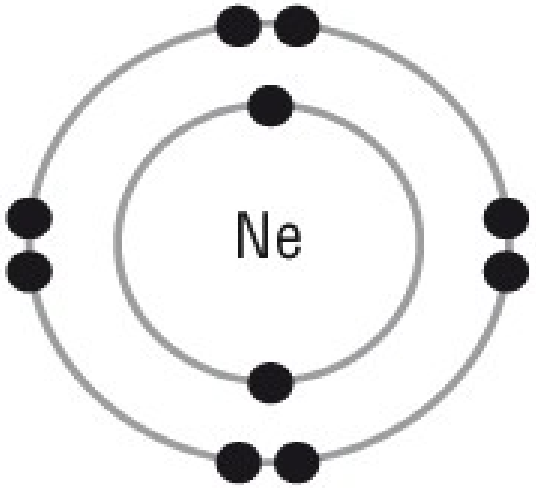


Order: 1s 2s 2p 3s 3p 4s 3d 4p 5s 4d 5p 6s 4f 5d 6p 7s 5f 6d 7p

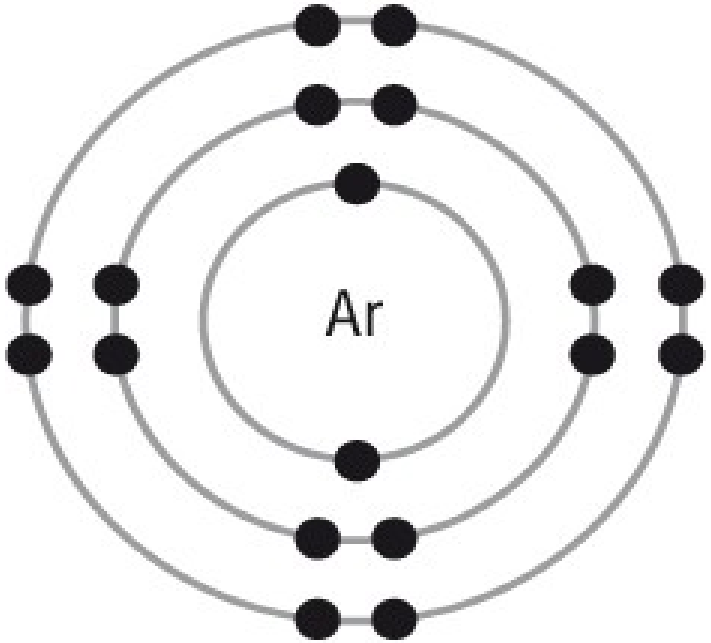
Electronic Configuration in an Atom



He atom
$1s^2$

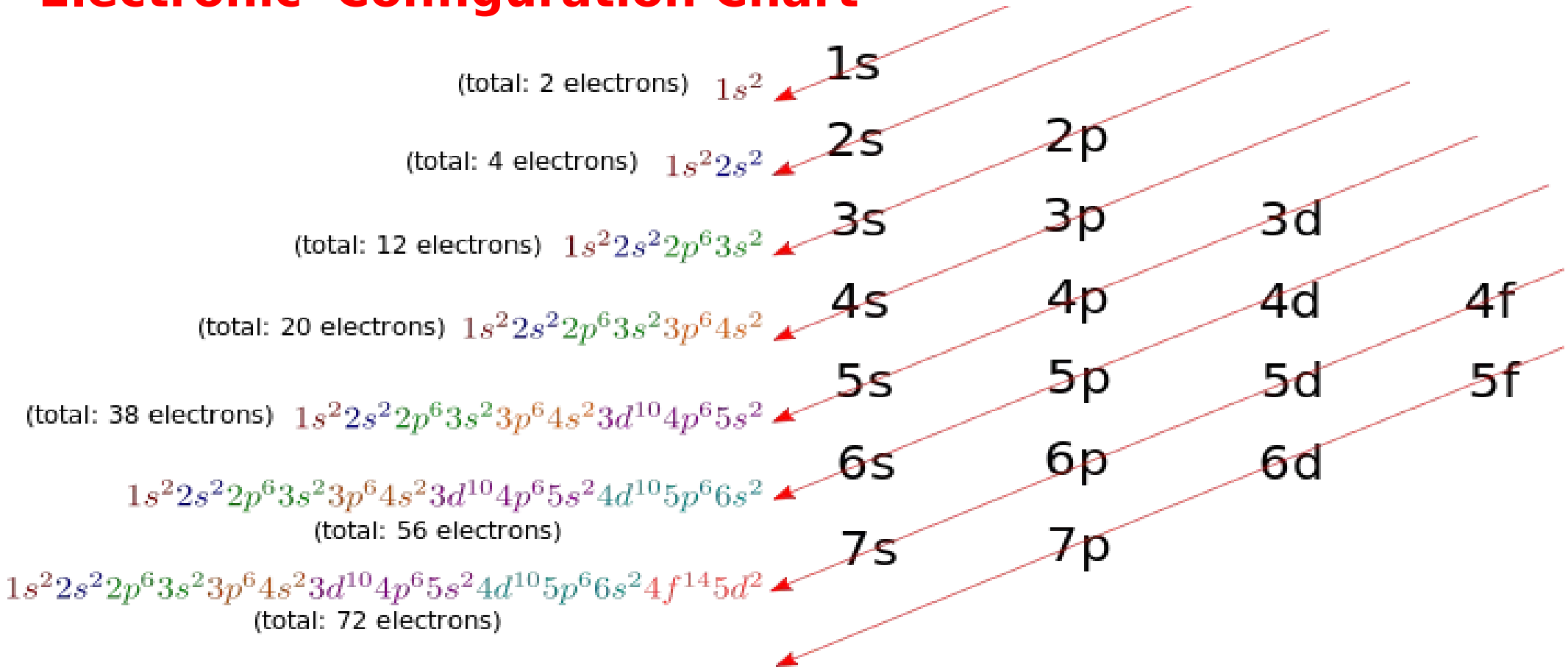


Ne atom
$1s^2 2s^2 2p^6$



Ar atom
$1s^2 2s^2 2p^6 3s^2 3p^6$

Electronic Configuration Chart

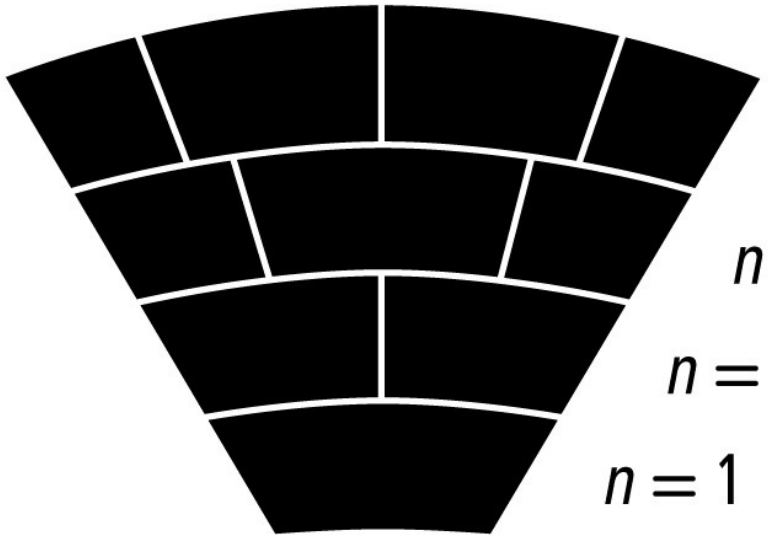


Energy sublevels

are contained within the principal energy levels. (n)

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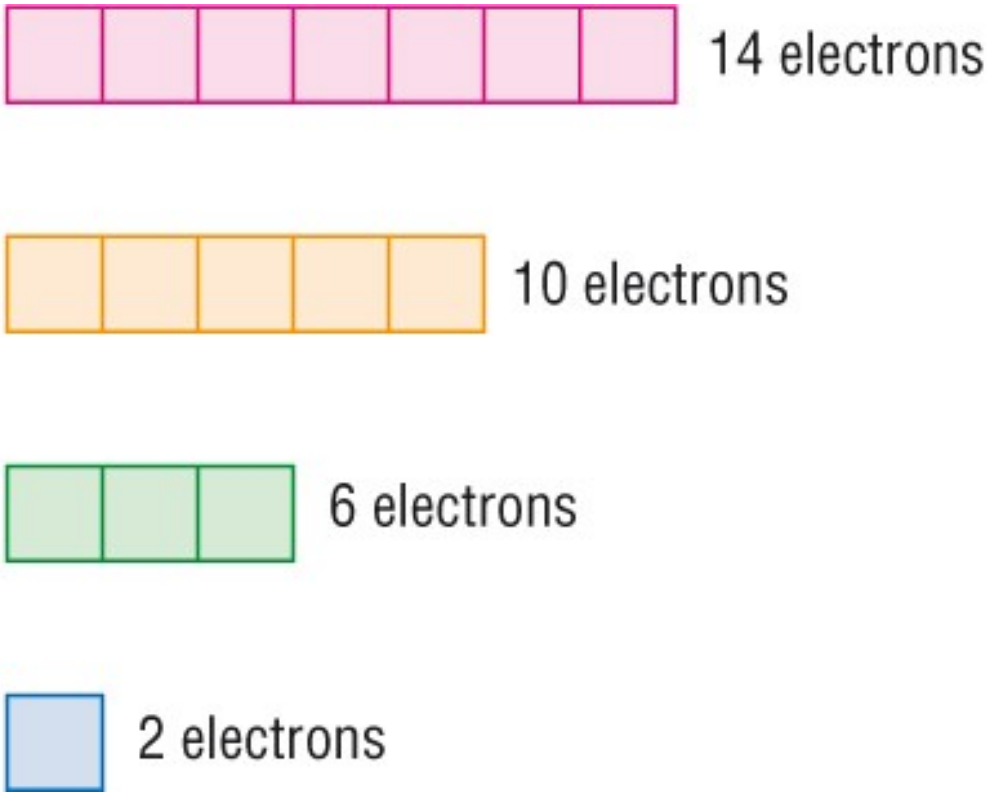
sublevels are (s , p , d, f)



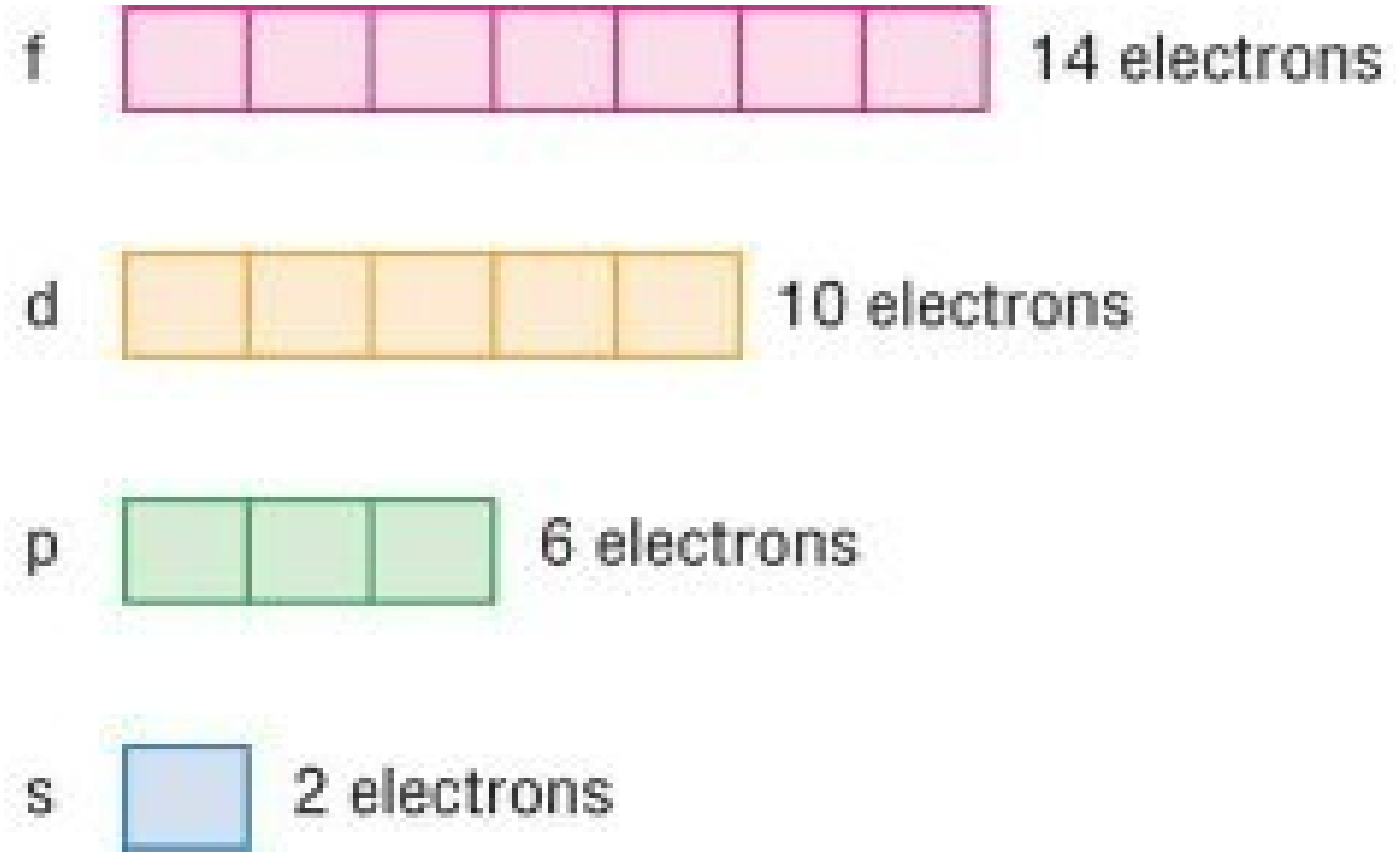
Electronic Configuration Chart

Orbitals

- Orbitals hold electrons, and show the area in which the electrons can be found.
- "s" orbitals can hold 2 electrons
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- "f" orbitals can hold 14 electrons

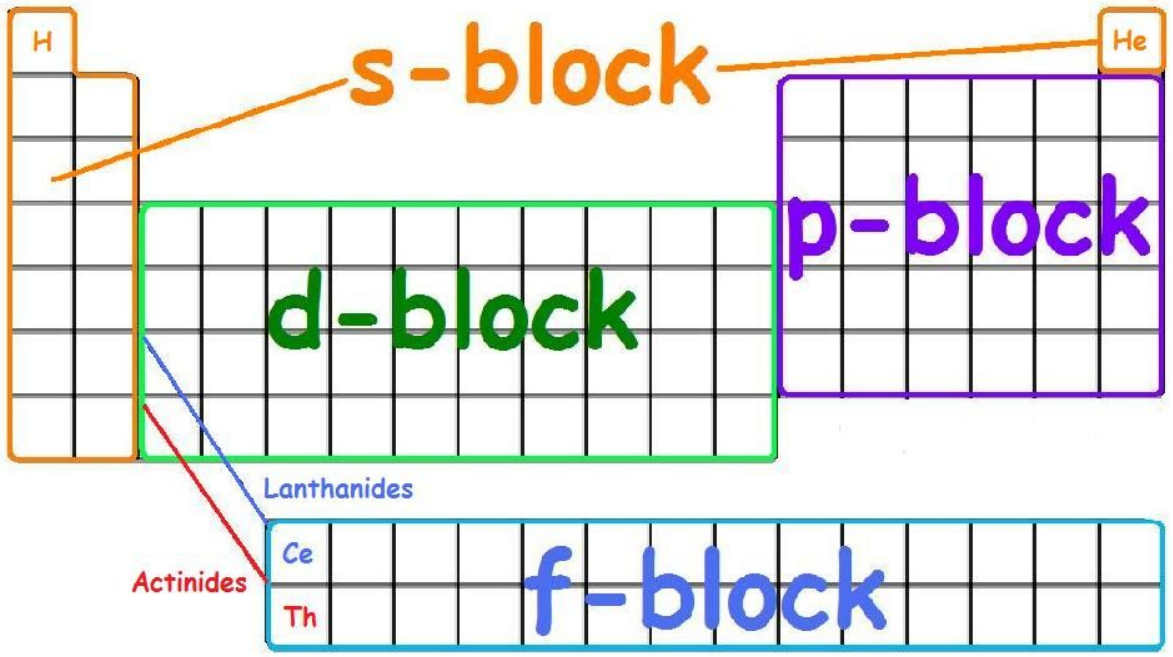


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Electron Configuration



The s-, p-, d-, and f-Block Elements

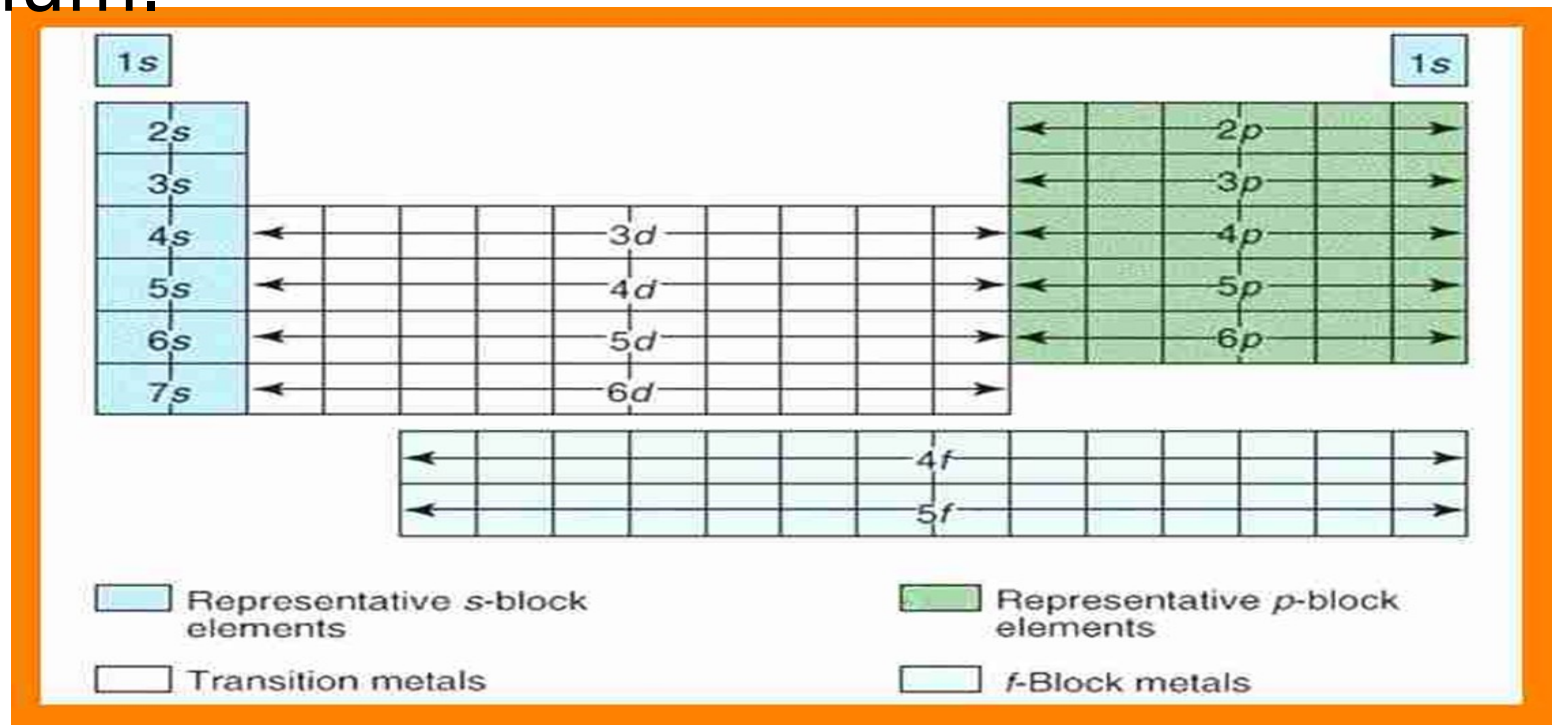
- The shape of the periodic table becomes clear if it is divided into blocks representing the atom's energy sublevel being filled with valence electrons.



The s-, p-, d-, and f-Block Elements (cont.)

- s-block elements consist of group 1 and 2, and the element helium.

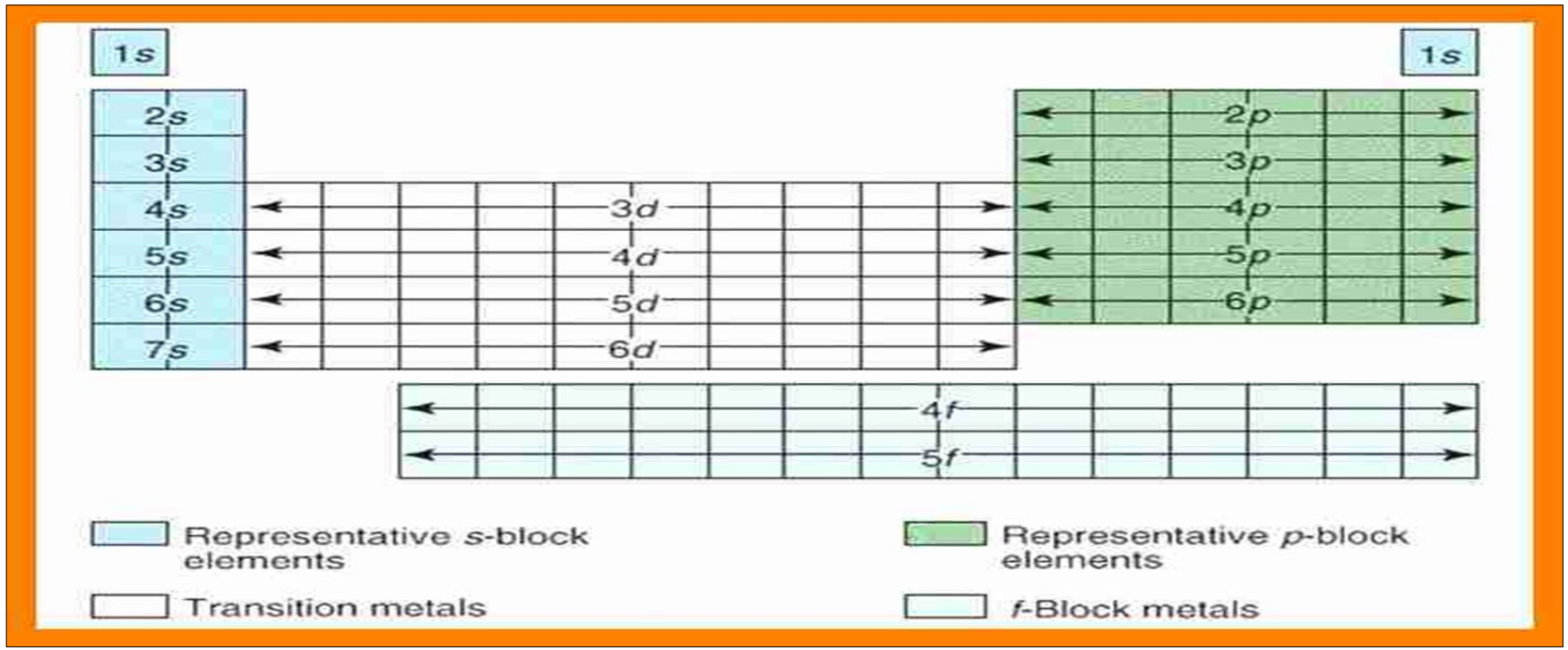
- Group 1 elements have a partially filled s orbital with one electron.
- Group 2 elements have a completely filled s orbital with two electrons.



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The s-, p-, d-, and f-Block Elements (cont.)

- s-block elements consist of group 1 and 2, and the element helium.

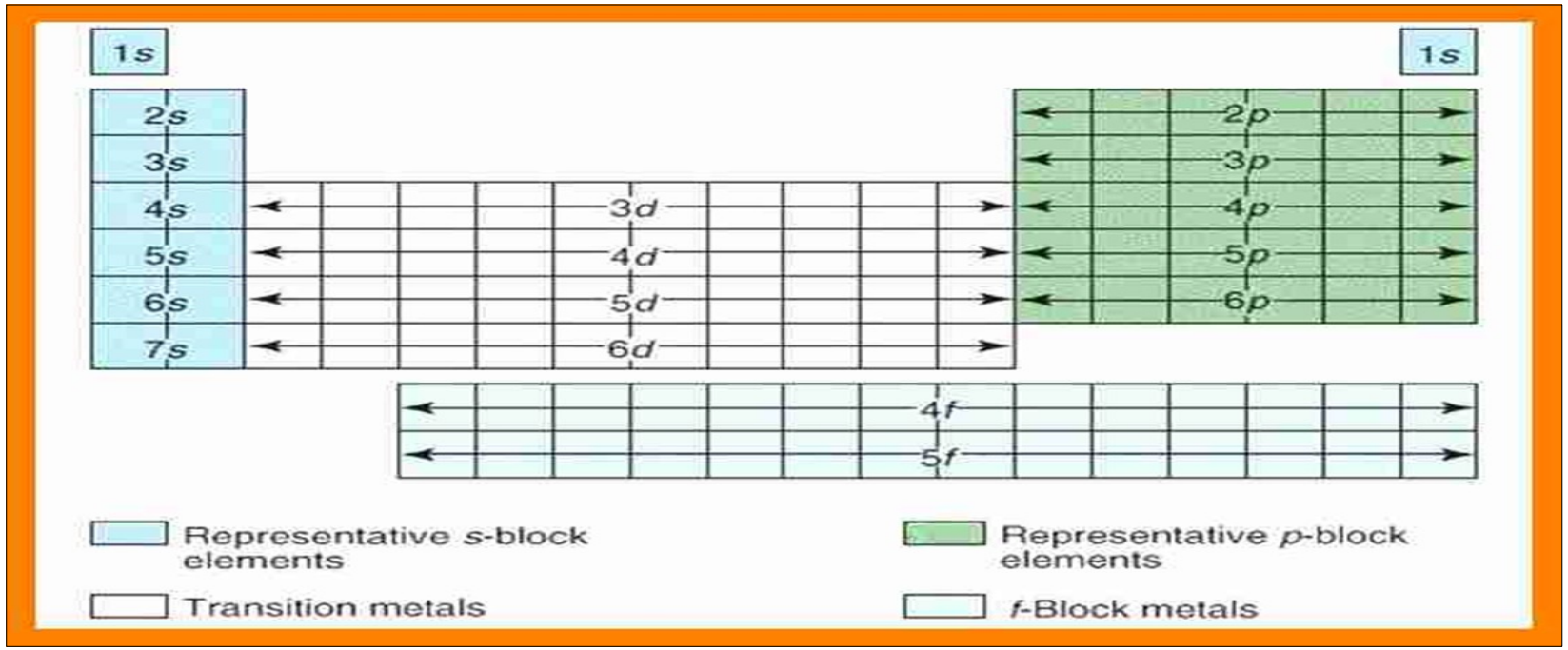


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The s-, p-, d-, and f-Block Elements (cont.)

- After the s-orbital is filled, valence electrons occupy the p-orbital.

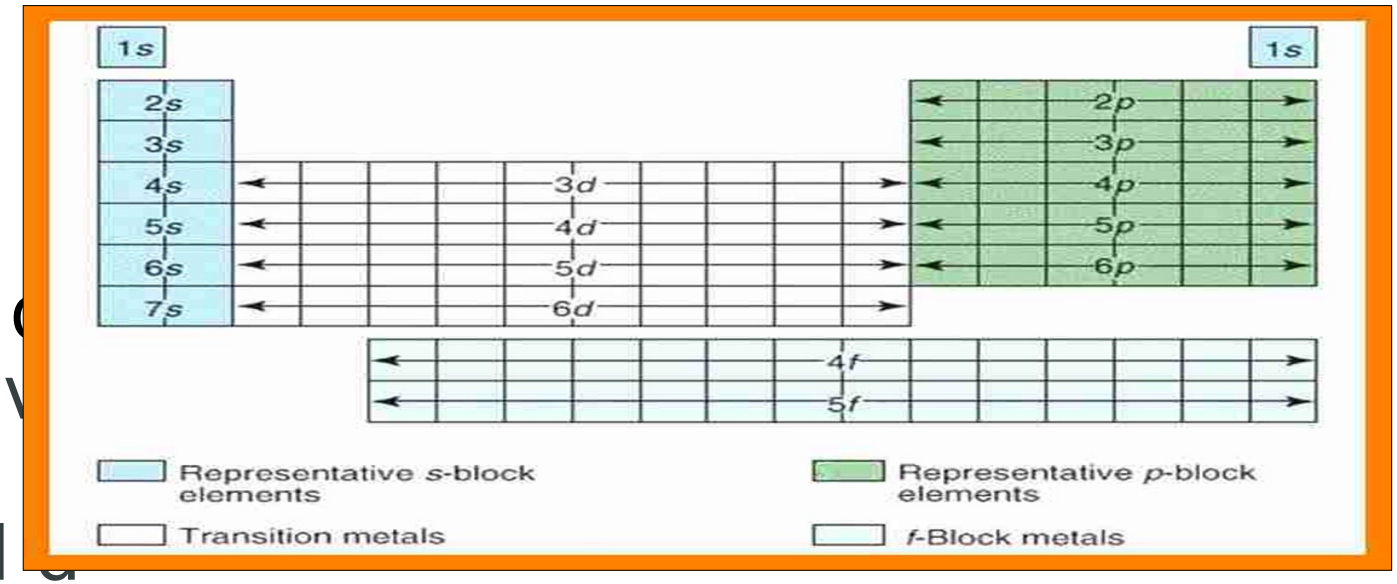
- Groups 13-18 contain elements with completely or partially filled p orbitals.



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The s-, p-, d-, and f-Block Elements (cont.)

- The d-block contains the transition metals and is the largest block.

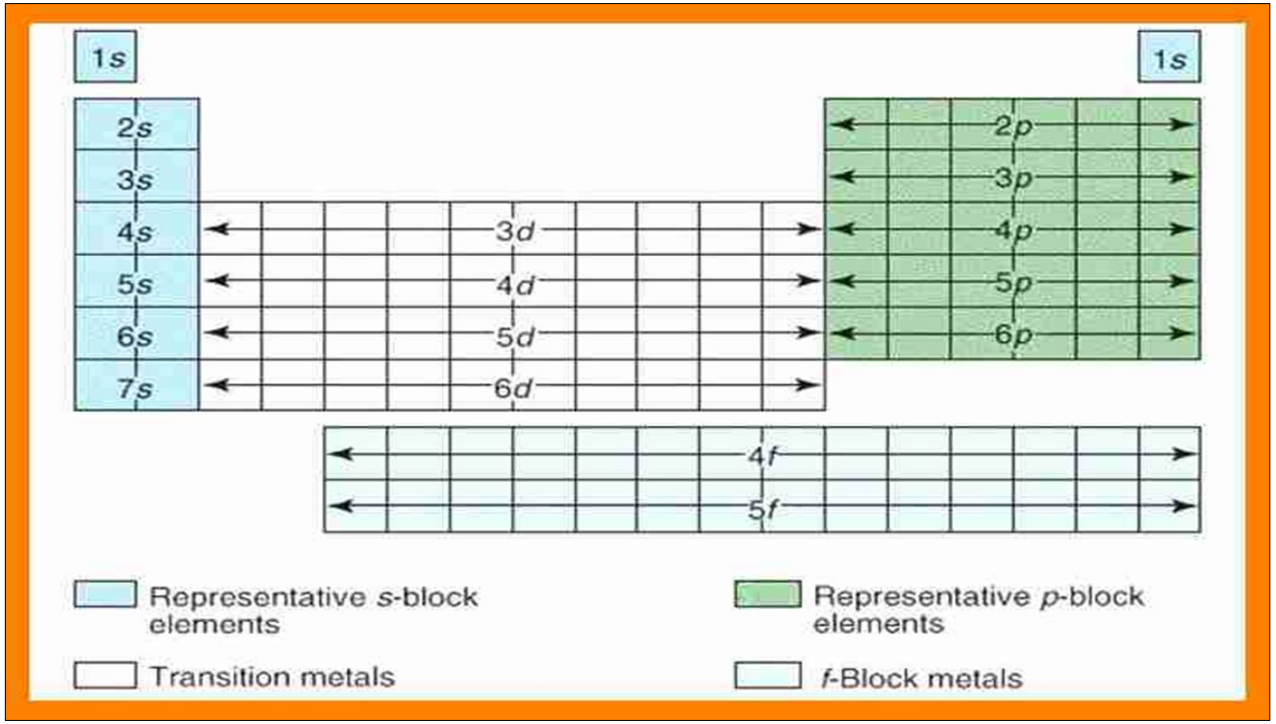


- There are exceptions, but e
block elements usually hav
filled outermost s orbital,
and filled or partially filled d
orbital.

- The five d orbitals can hold 10 electrons, so the d-block spans 10 groups on the periodic table.

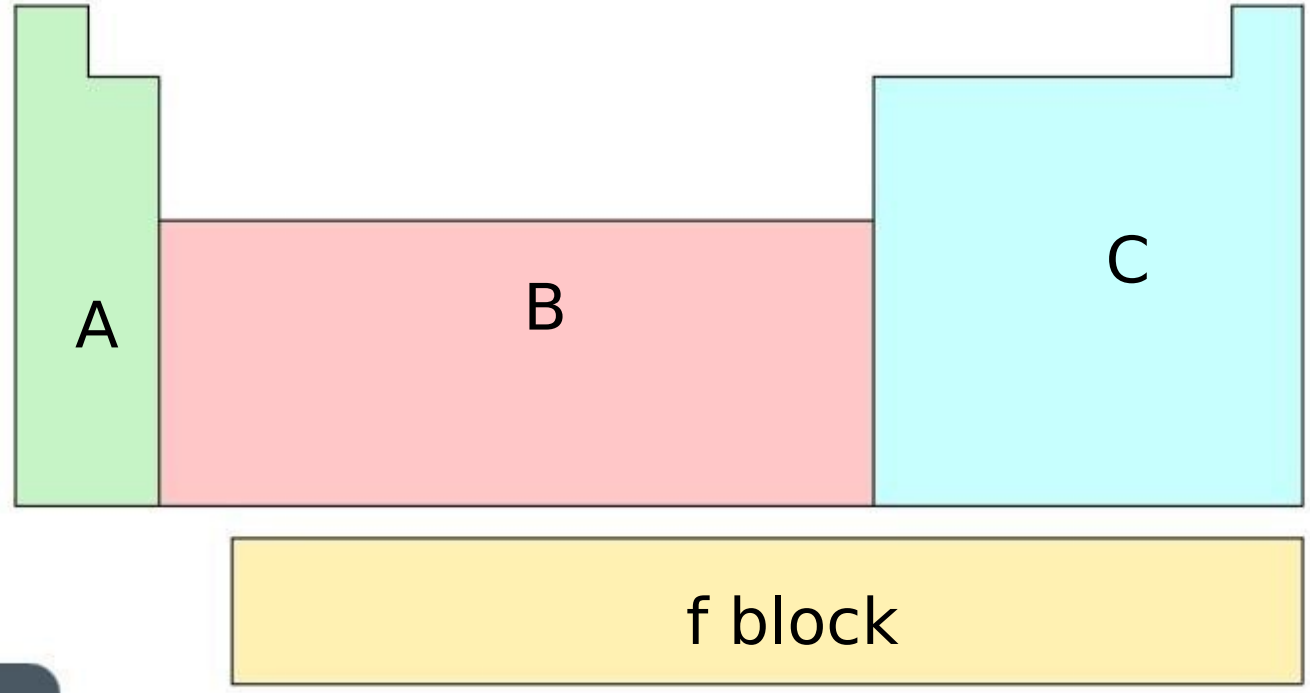
The s-, p-, d-, and f-Block Elements (cont.)

- **The f-block** contains the inner transition metals.
- f-block elements have filled or partially filled outermost s orbitals and filled or partially filled **4f and 5f orbitals**.
- The 7 f orbitals hold 14 electrons, and the **inner transition metals span 14** groups.



Select the correct location.

Which part of the periodic table would contain an element with a partially filled *f* sublevel?



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CHAPTER- 1



The classification of elements

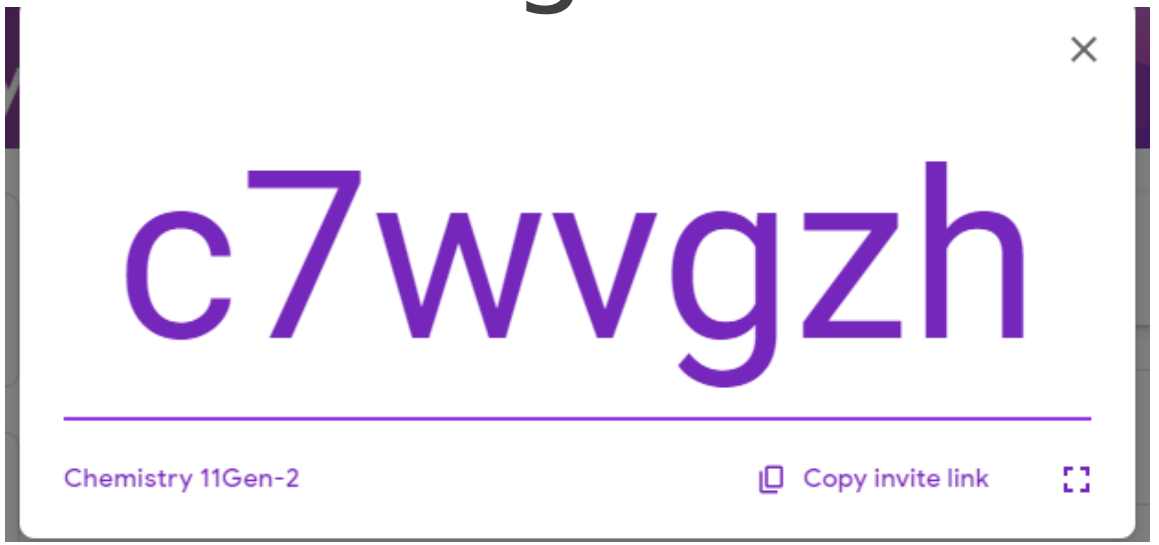
Period 2

Join classroom

11 gen 1



11 gen 2



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The Periodic Table and Periodic Law

Section 6.1 Development of the Modern Periodic Table (SELF LEARNING)

Section 6.2 Classification of the Elements (SOLVE PRACTICE)

Section 6.3 Periodic Trends



Objectives

- **Write** Electron configuration by orbital diagram and electron configuration notation
- **Identify** the four blocks of the periodic table based on their electron configuration.

New Vocabulary

- **Electrons**
- **Energy Level**
- **Electron Configuration**
- **Valance electrons**
- **Four blocks (s,p,d,f)**

Essential Questions

1. Based on their electron configurations, what are the four blocks of the periodic table?

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MAINIDEA

Element are organized into different blocks in the periodic table according to their electron configurations

K *What I Know*	**W** *What I Want to Find Out*	**L** *What I Learned*

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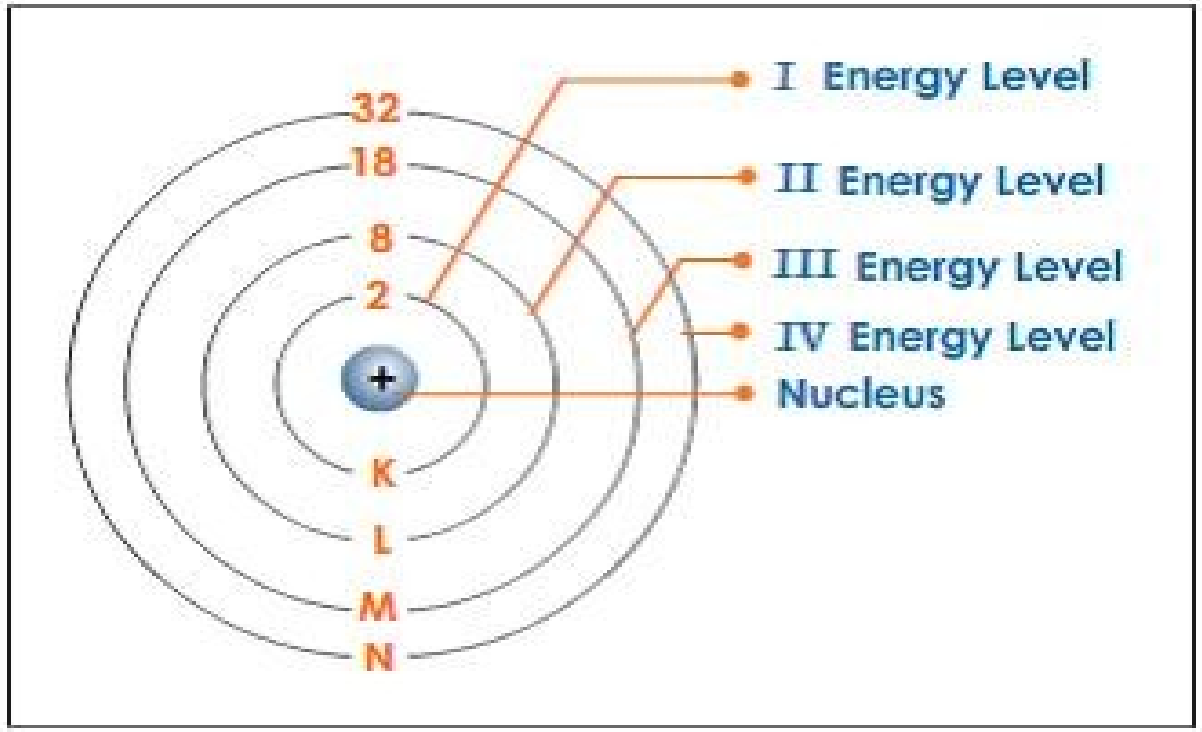
Review Vocabulary

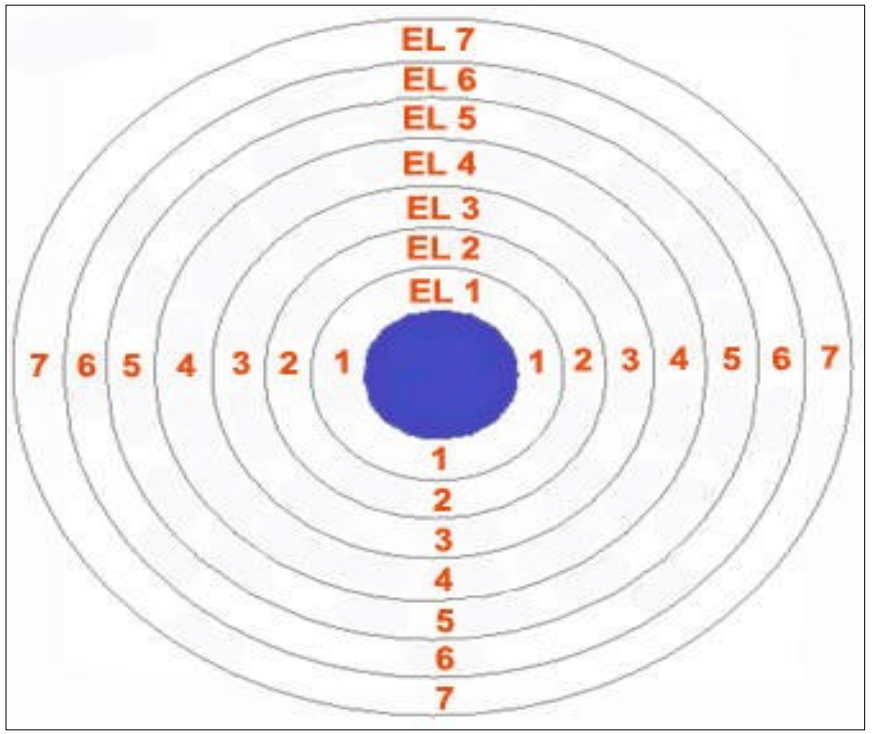
valence electron: electron in an atom's outermost orbitals; determines the chemical properties of an atom



Elements are organized into different blocks in the periodic table according to their electron configurations.

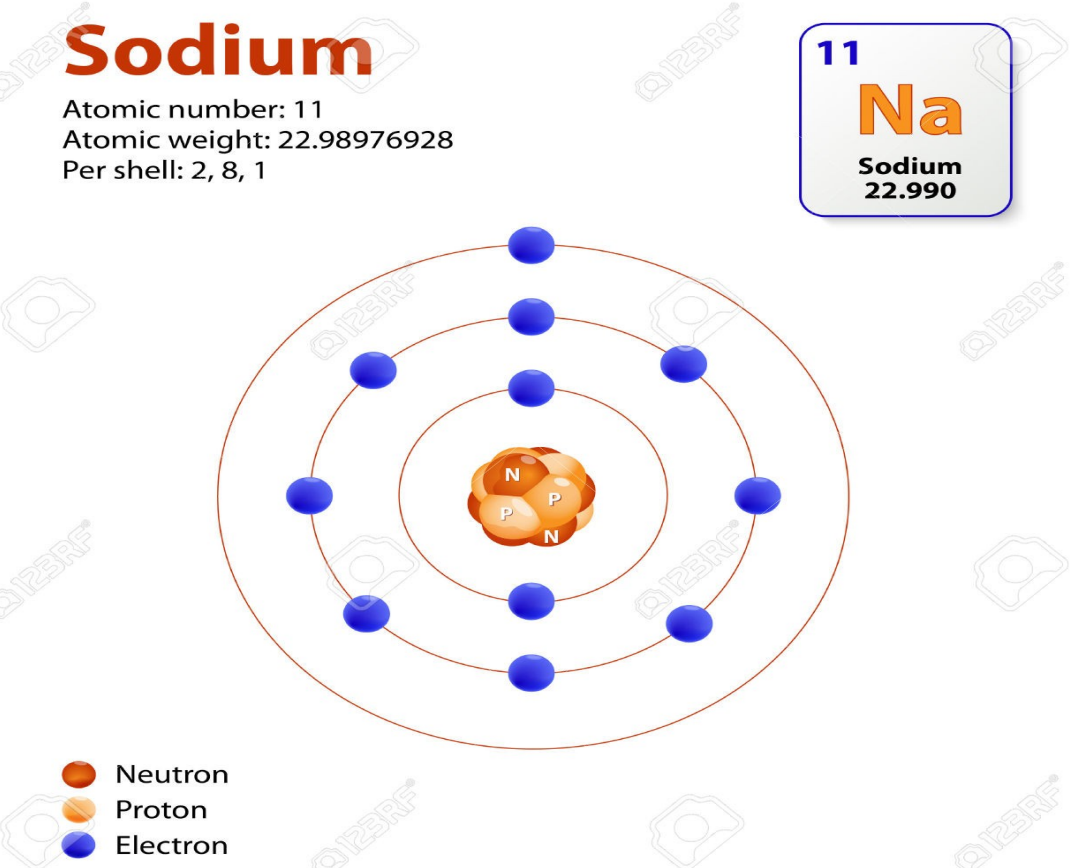
Electronic Configuration in an A tom

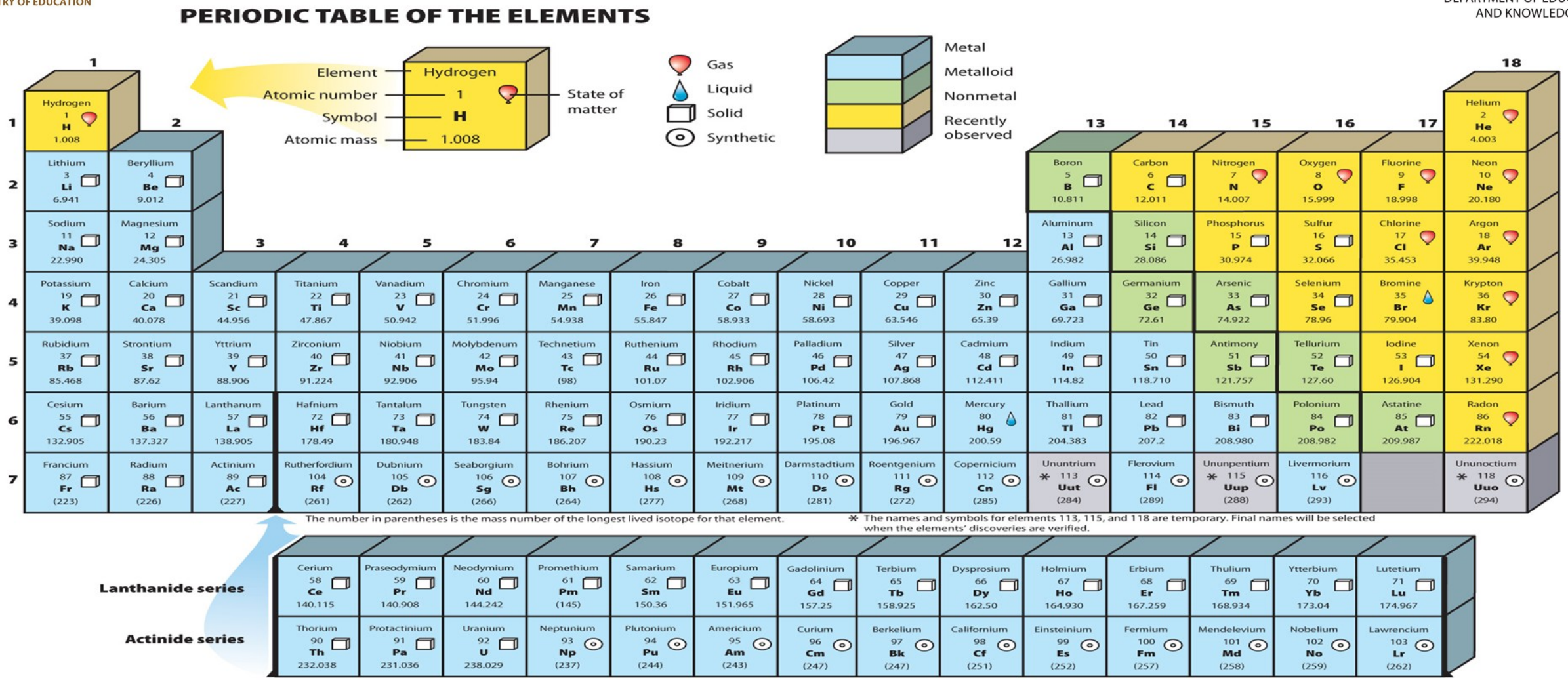




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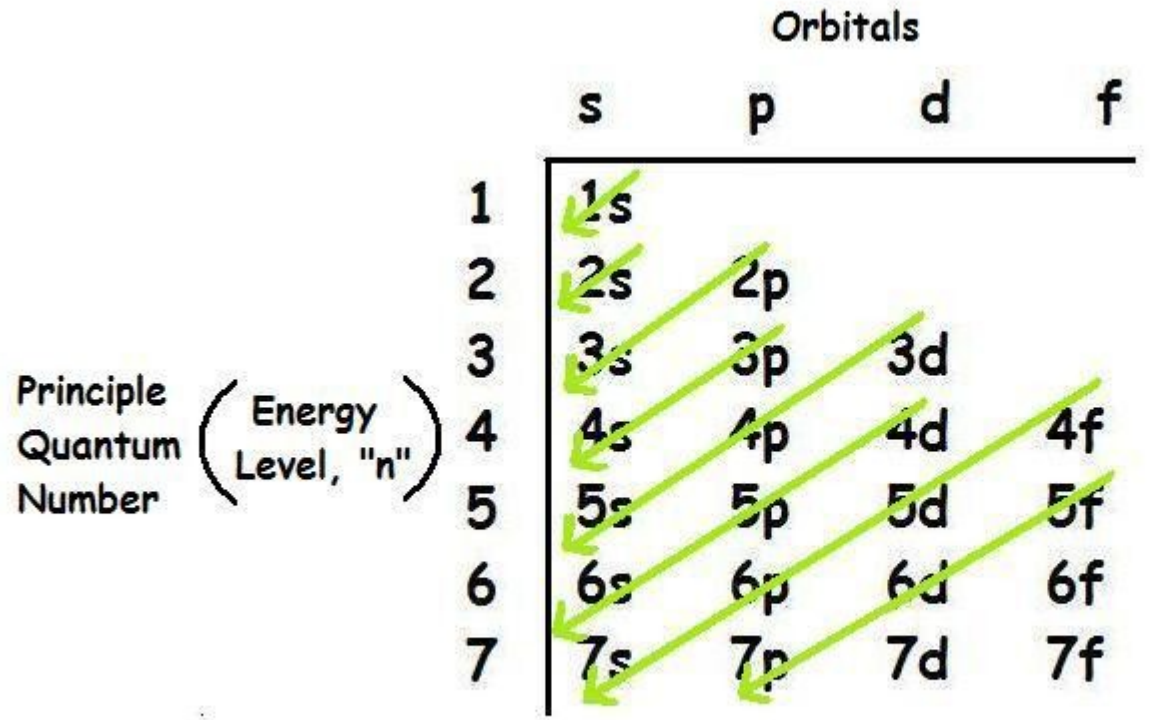
Electronic Configuration in an A tom




PERIODIC TABLE OF THE ELEMENTS
Element
Atomic number
Symbol
Atomic mass
Hydrogen
1
H
1.008
State of matter
Gas
Liquid
Solid
Synthetic
Metal
Metalloid
Nonmetal
Recently observed
The number in parentheses is the mass number of the longest lived isotope for that element.
* The names and symbols for elements 113, 115, and 118 are temporary. Final names will be selected when the elements' discoveries are verified.
Lanthanide series
Actinide series

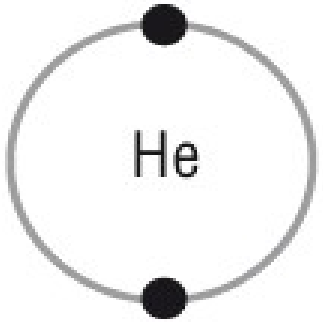
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Electronic Configuration Chart

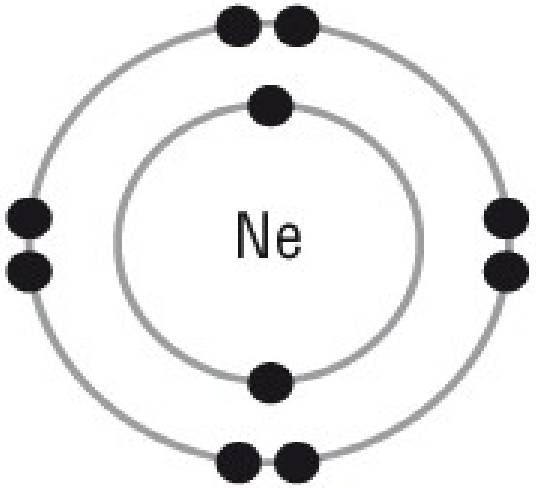


Order: 1s 2s 2p 3s 3p 4s 3d 4p 5s 4d 5p 6s 4f 5d 6p 7s 5f 6d 7p

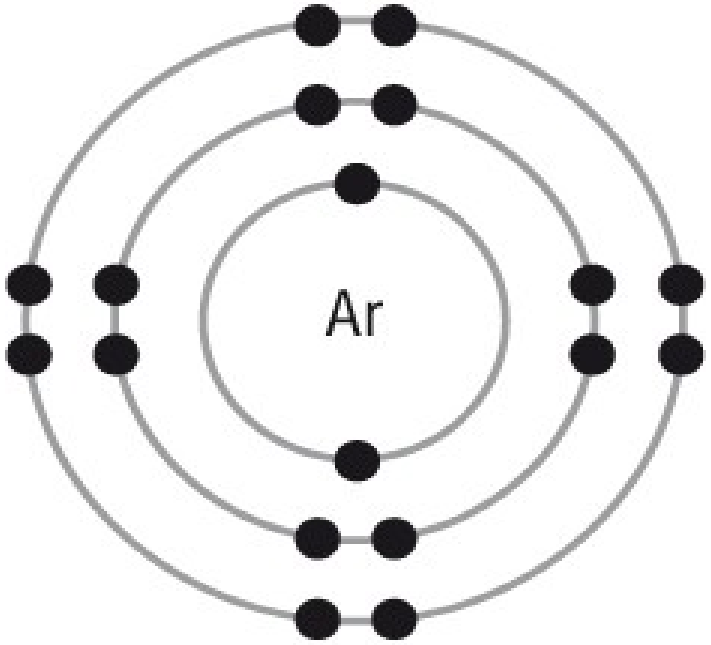
Electronic Configuration in an Atom



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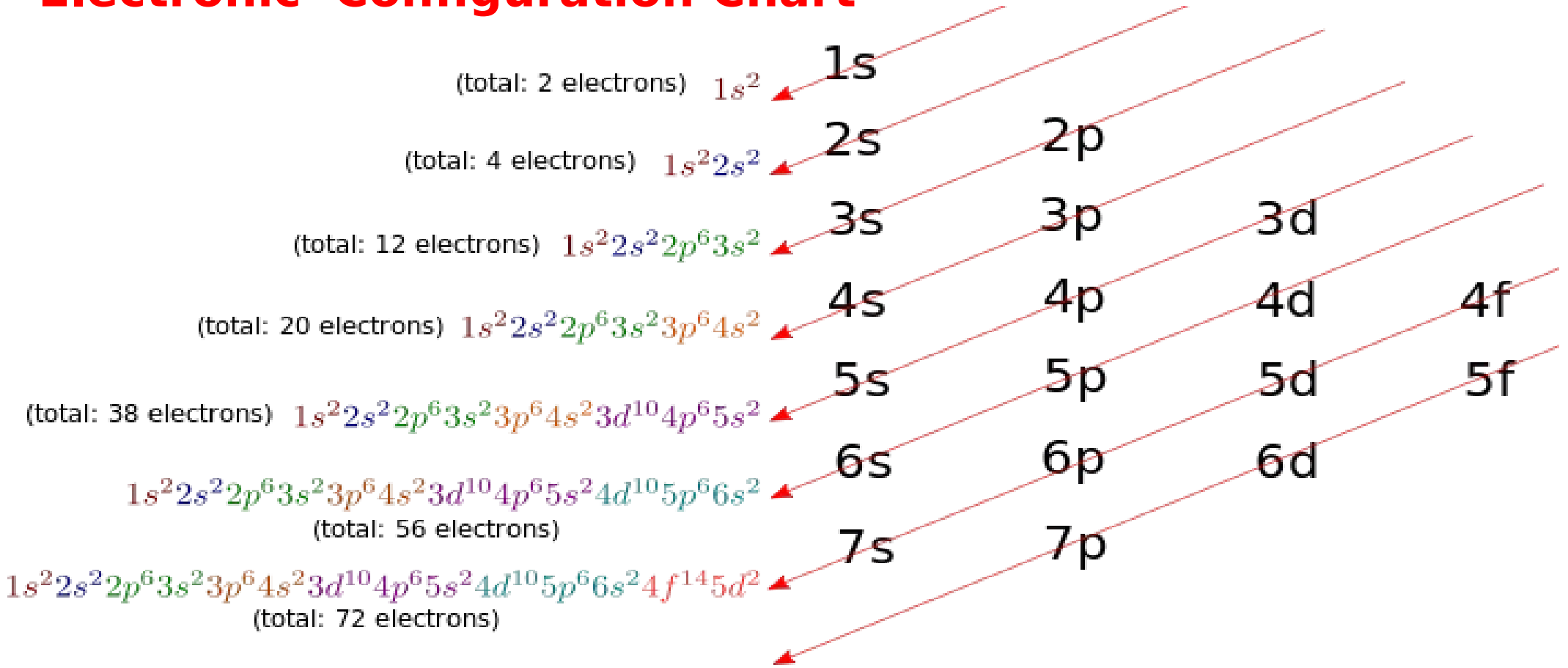


Ne atom
$1s^2 2s^2 2p^6$



Ar atom
$1s^2 2s^2 2p^6 3s^2 3p^6$

Electronic Configuration Chart

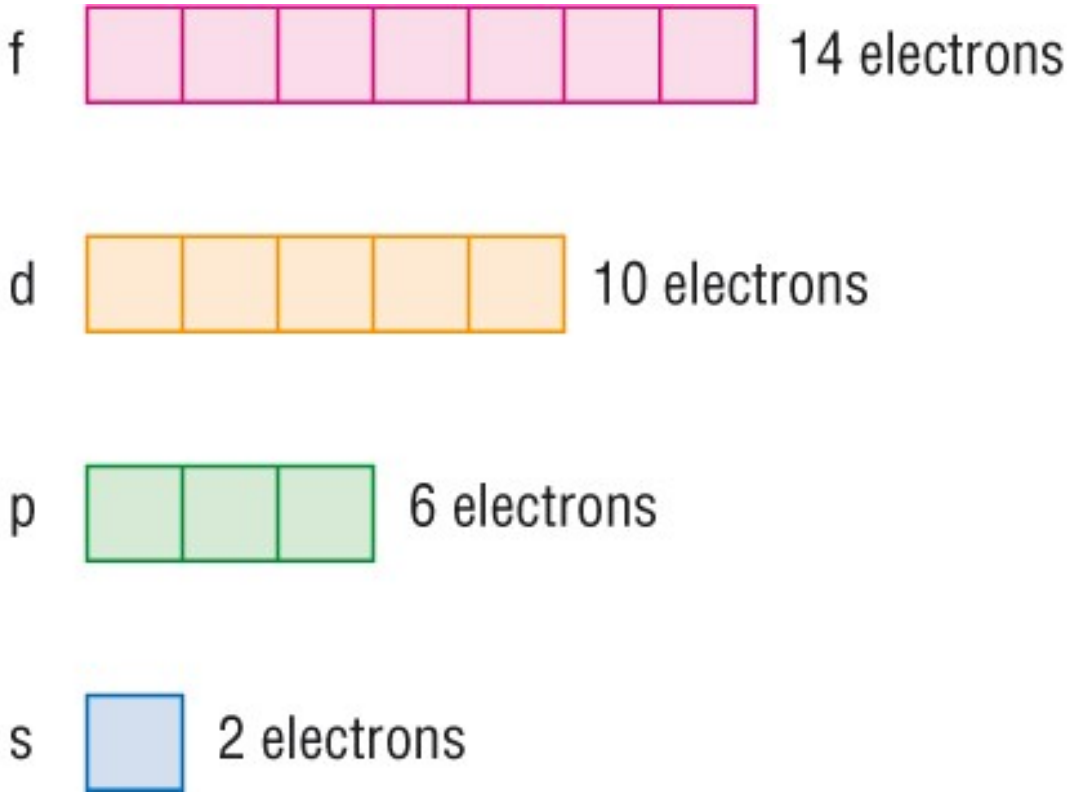


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Electronic Configuration Chart

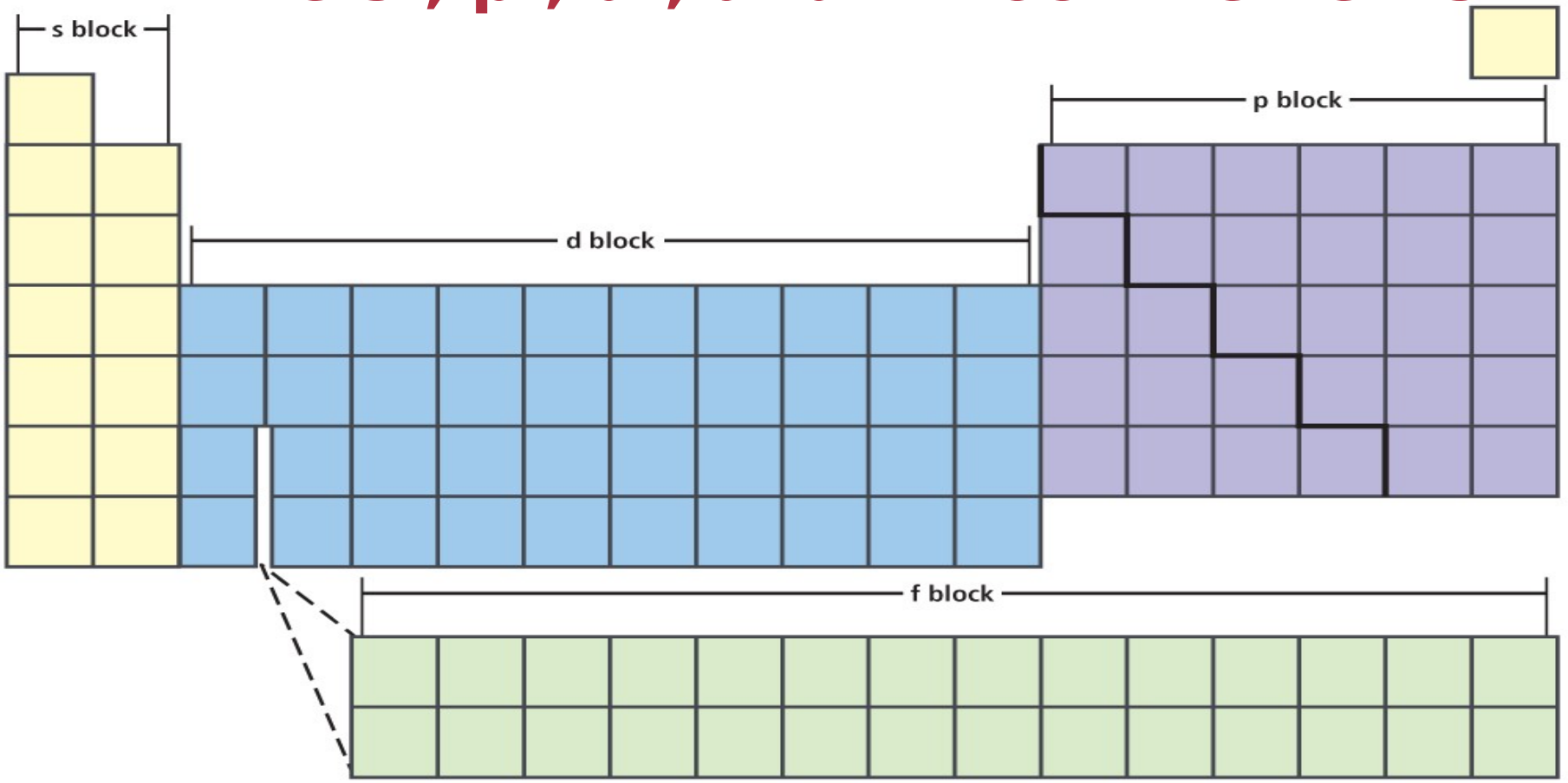
Orbitals

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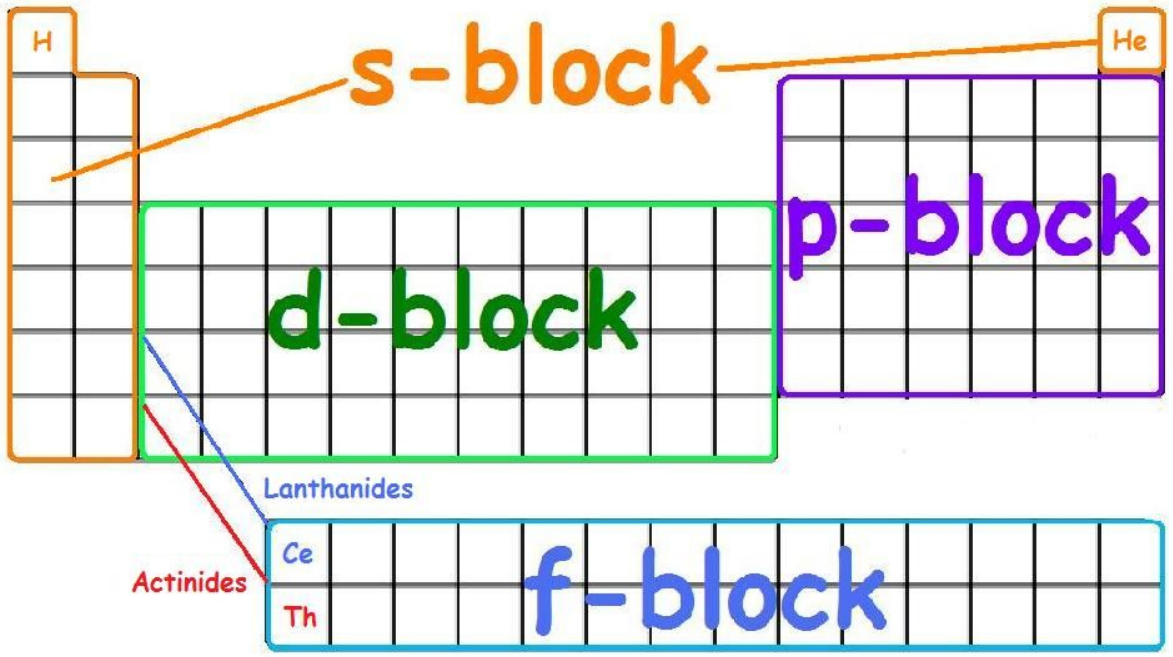
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The s-, p-, d-, and f-Block Elements

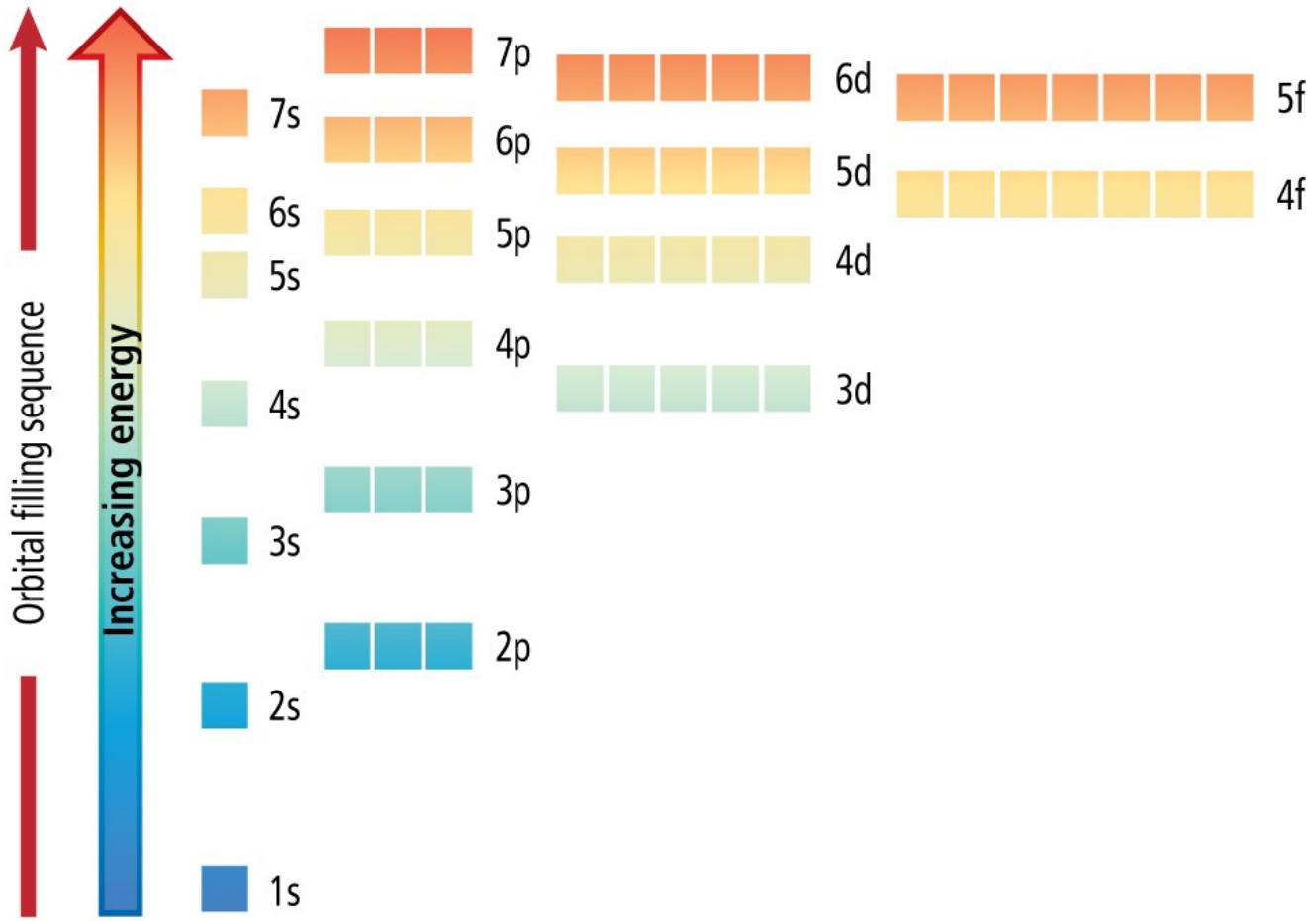


The s-, p-, d-, and f-Block Elements

- The shape of the periodic table becomes clear if it is divided into blocks representing the atom's energy sublevel being filled with valence electrons.



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Electron Configuration



$1s^2$
$2s^2$ $2p^6$
$3s^2$ $3p^6$ $3d^{10}$
$4s^2$ $4p^6$ $4d^{10}$ $4f^{14}$
$5s^2$ $5p^6$ $5d^{10}$ $5f^{14}$
$6s^2$ $6p^6$ $6d^{10}$
$7s^2$ $7p^6$

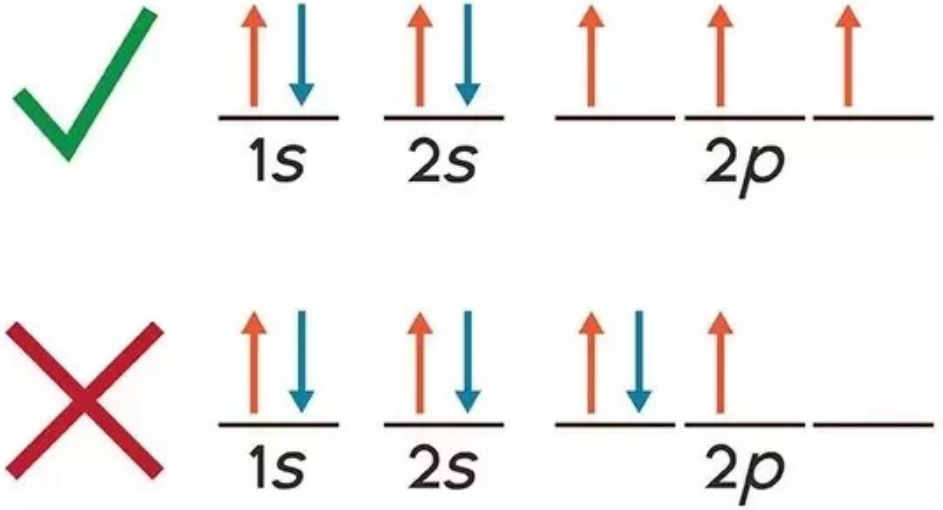
$1s^2 2s^2 2p^6\ 3s^2 3p^6 4s^2 3d^{10}\ 4p^6 5s^2 4d^{10}\ 5p^6 6s^2 4f^{14} 5d^{10}\ 6p^6 7s^2 5f^{14} 6d^{10}\ 7p^6$

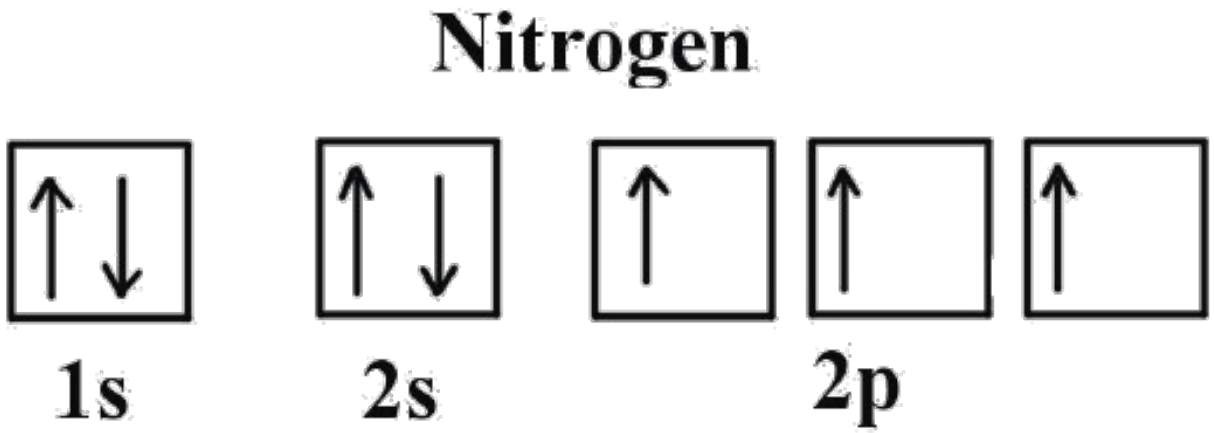
التركيب أو التوزيع الالكتروني
Electron Configuration

Orbital diagrams توزيع بالمربعات	Electron configuration notation التوزيع الالكتروني	Noble-gas notation التوزيع بالغاز النبيل (الطريقة المختصرة)

التركيب أو التوزيع الالكتروني
Electron Configuration

Orbital diagrams
توزيع بالمربعات

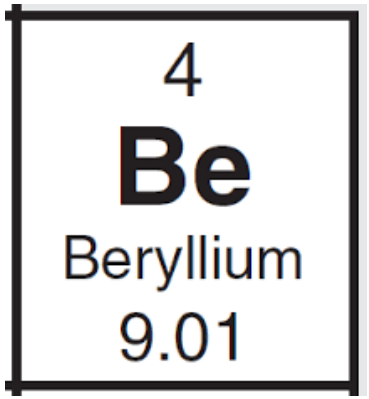


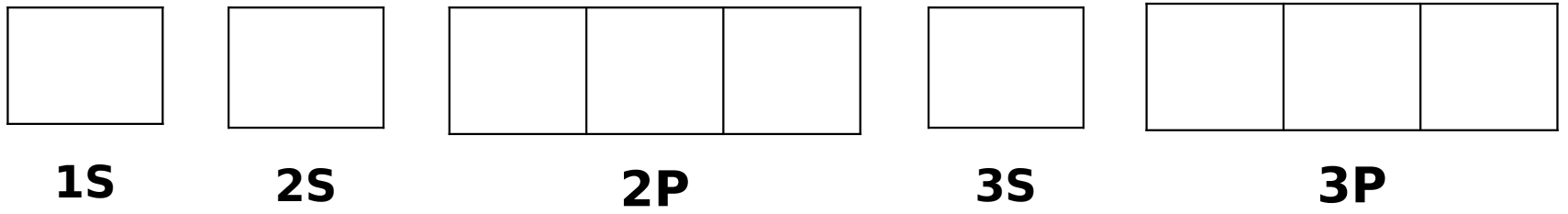


Orbital diagrams توزيع بالمربعات

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EX1	Write the orbital diagrams for each elements? اكتب التوزيع باستخدام المربعات (الافلاك)

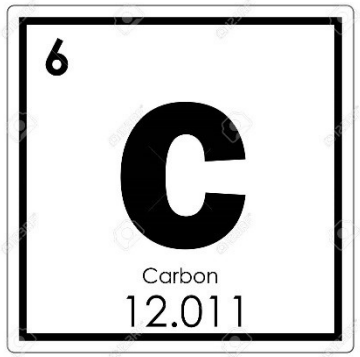


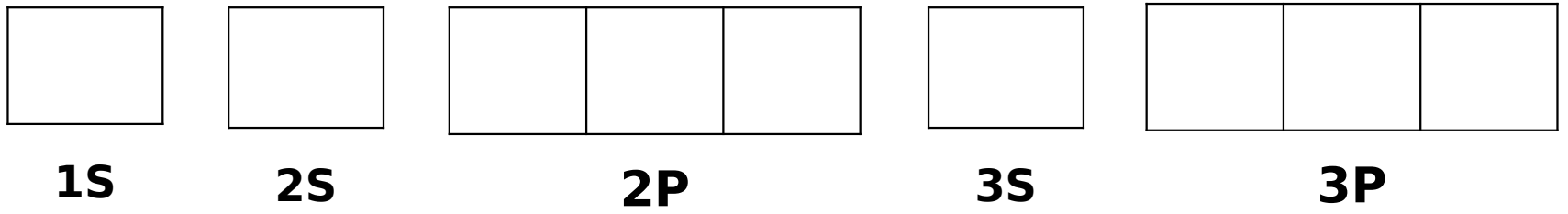


Orbital diagrams توزيع بالمربعات

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EX1	Write the orbital diagrams for each elements? اكتب التوزيع باستخدام المربعات (الافلاك)





التركيب أو التوزيع الالكتروني
Electron Configuration

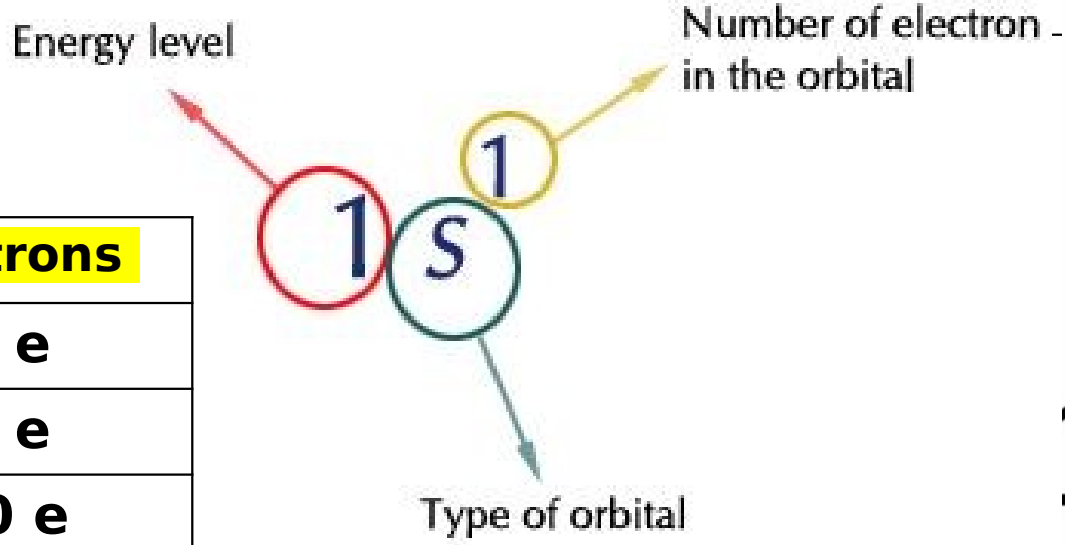
Orbital diagrams توزيع بالمربعات	Electron configuration notation التوزيع الالكتروني	Noble-gas notation التوزيع بالغاز النبيل (الطريقة المختصرة)

التوزيع الالكتروني Electron configuration notation

Electron configuration notation
التوزيع الالكتروني

distribute the electron on energy level (n) and sublevels

Sublevel	Electrons
s	2 e
p	6 e
d	10 e
f	14 e



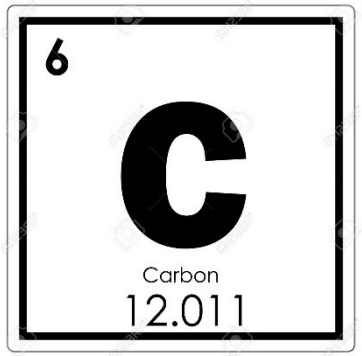
11
Na
Sodium
22.99

$1s^2\,2s^2\,2p^6\,3s^1$

التوزيع الالكتروني Electron configuration notation

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EX1	Write the Electron configuration notation for each elements?اكتب التزويع الابكتروني للعناصر التالية

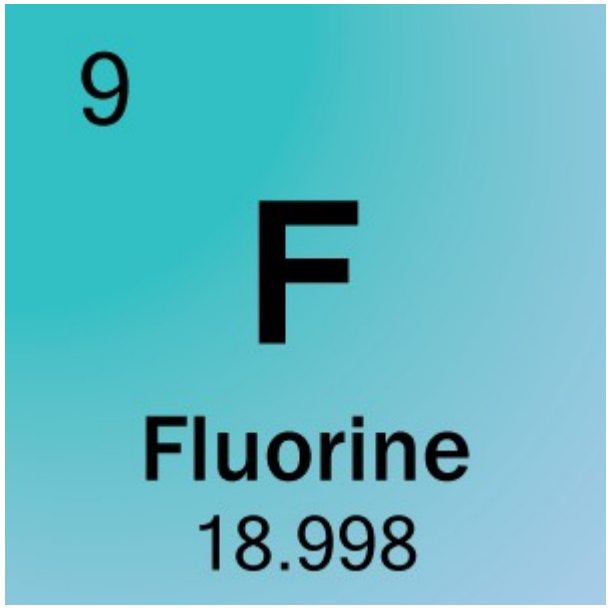


1s 2s 2p 3s 3p

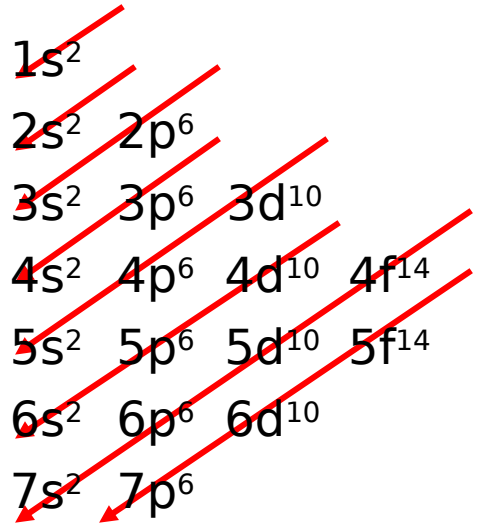
$1s^2$
$2s^2$ $2p^6$
$3s^2$ $3p^6$ $3d^{10}$
$4s^2$ $4p^6$ $4d^{10}$ $4f^{14}$
$5s^2$ $5p^6$ $5d^{10}$ $5f^{14}$
$6s^2$ $6p^6$ $6d^{10}$
$7s^2$ $7p^6$

التوزيع الالكتروني Electron configuration notation

EX1	Write the Electron configuration notation for each elements? اكتب التزويع الابكتروني للعناصر التالية



1s 2s 2p 3s 3p



Electron Arrangement الترتيب الالكتروني

الجدول 4-1 الترميز الإلكتروني ورسم مربعات المستويات للعناصر من 1 إلى 10

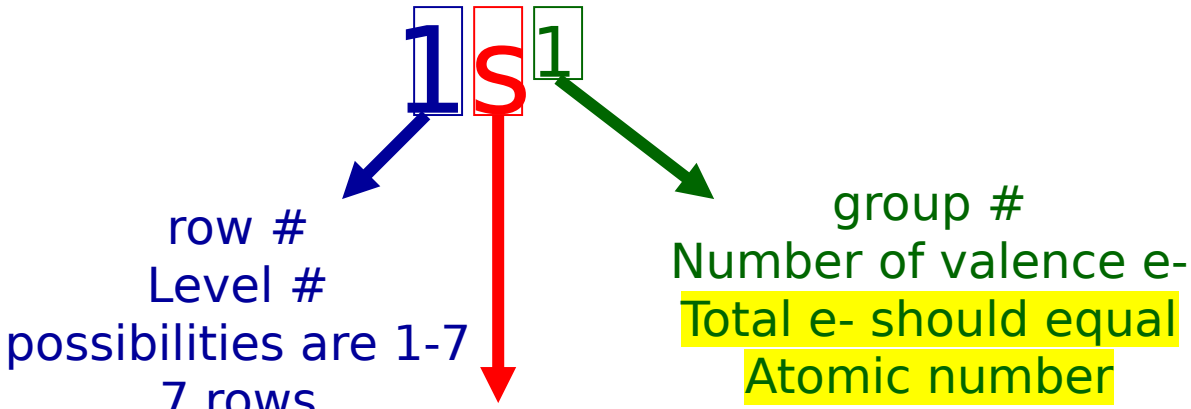
العنصر / رمزه	العدد الذري	رسم مربعات المستويات	الترميز الإلكتروني
الهيدروجين H	1	↑	$1s^1$
الهيليوم He	2	↑↓	$1s^2$
الليثيوم Li	3	↑↓ ↑	$1s^2\ 2s^1$
البيريليوم Be	4	↑↓ ↑↓	$1s^2\ 2s^2$
البورون B	5	↑↓ ↑↓ ↑ ☐ ☐	$1s^2\ 2s^2\ 2p^1$
الكربون C	6	↑↓ ↑↓ ↑ ↑ ☐	$1s^2\ 2s^2\ 2p^2$
النيتروجين N	7	↑↓ ↑↓ ↑ ↑ ↑	$1s^2\ 2s^2\ 2p^3$
الأكسجين O	8	↑↓ ↑↓ ↑↓ ↑ ↑	$1s^2\ 2s^2\ 2p^4$
الفلور F	9	↑↓ ↑↓ ↑↓ ↑↓ ↑	$1s^2\ 2s^2\ 2p^5$
النيون Ne	10	↑↓ ↑↓ ↑↓ ↑↓ ↑↓	$1s^2\ 2s^2\ 2p^6$

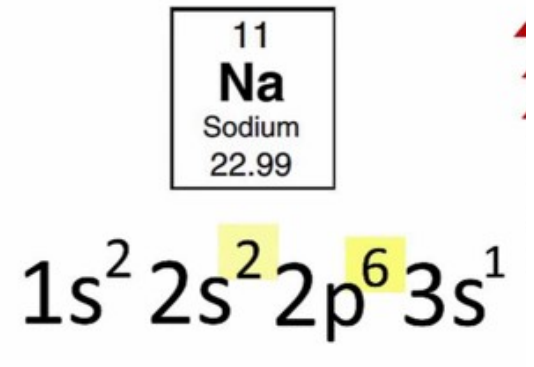
Using Electron configuration to get Group & periods of element

Lets have fun

One student blind

التركيب أو التوزيع الالكتروني
Electron Configuration





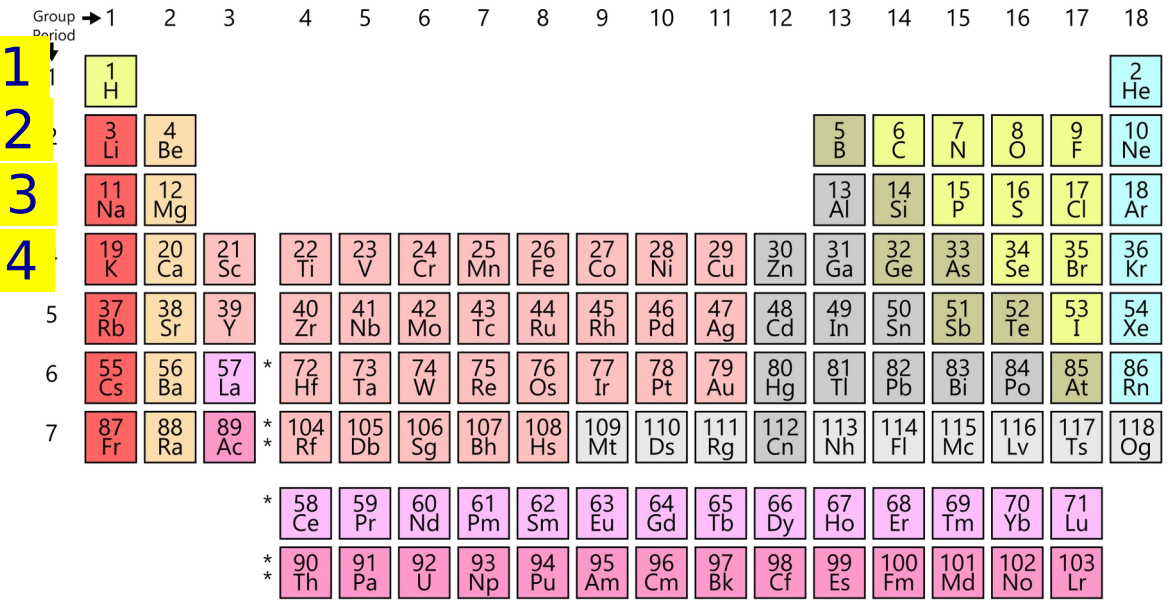
What element has an electron configuration of $1s^1$?

Energy Levels Can tell me about PERIODS

- **Principal quantum number** (*n*) indicates the relative size and energy of atomic orbitals.
- **principal energy levels**. *n* the atom's major energy levels
- **principal energy levels (n)** is the periods in the periodic table

n= 1
n= 2
n= 3
n= 4

Row / periods = # level (n)

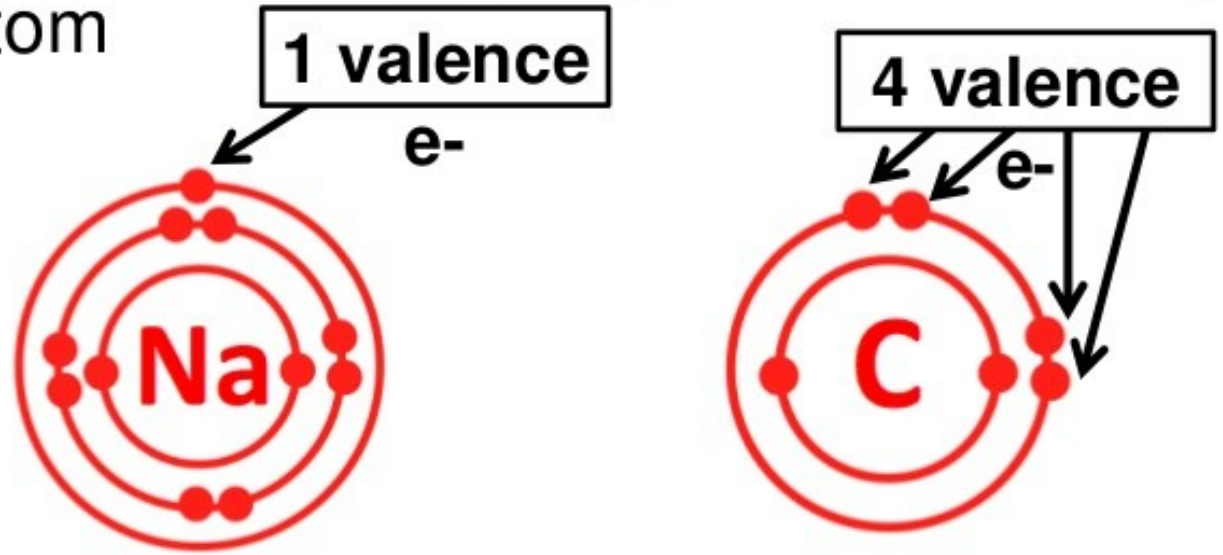


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Valance Electrons can tell me GROUPS

Vocabulary

Valence electron: An electron on the outermost energy level in an atom



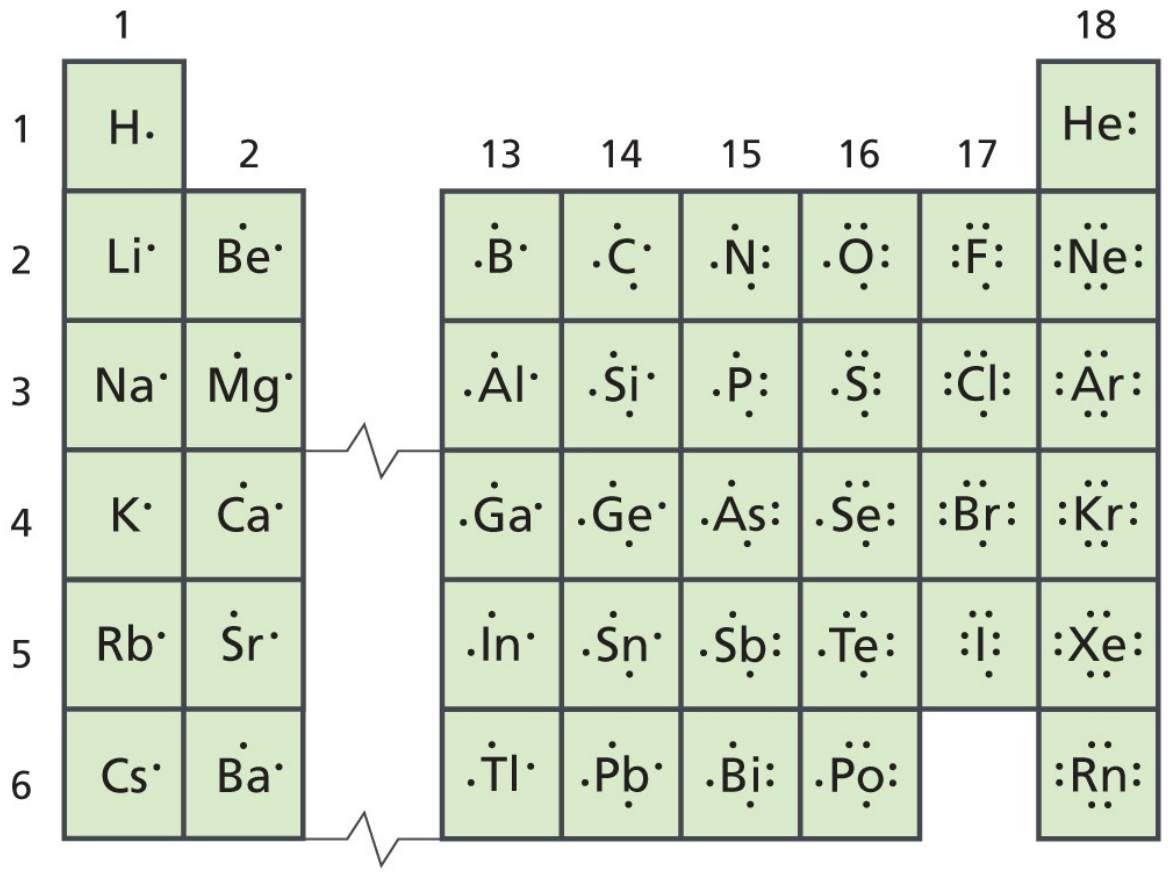
Valance Electrons can tell me GROUPS

All group 1 elements have one valence electron

Group 2 elements have two valence electrons

The number of valence electrons for elements in groups 13–18 is ten less than their group number

The energy level of an element's valence electrons indicates the period on the periodic table in which it is found.



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SUMMARY : How to get Group & periods

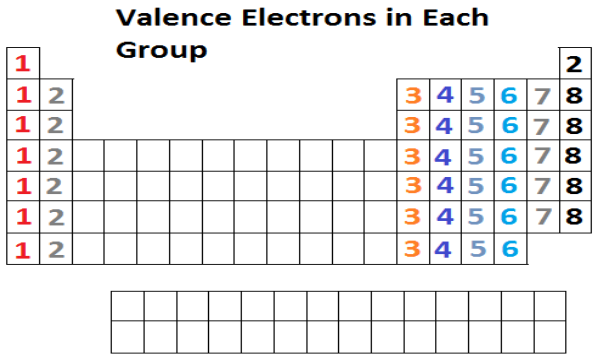
Period Number

The Highest energy level (n)

Group Number

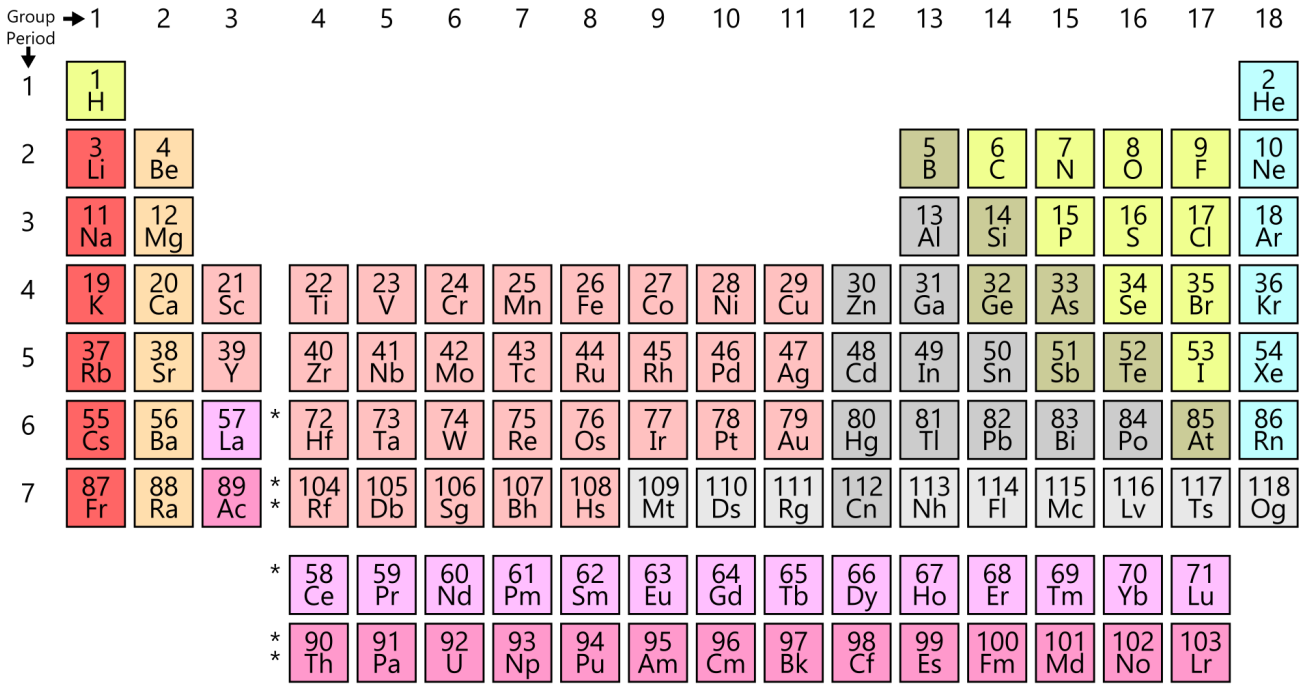
Valance Electron .

THE RULE



Valance Electron		Group number
1	SAME	1
2		2
3	Valance to group + 10	13
4		14
5	Group to valance without 10	15
6		16
7		17

Assessment



Valance electron of Mg? 1- Group ? ……. 2- valance electron ? ……

Valance electron of N? 1- Group ? ……. 2- valance electron ? ……

Valance electron of F? 1- Group ? ……. 2- valance electron ?

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Valence electrons

Remember: Energy levels are 1→7

Electrons in the outermost energy level

- Ar $1s^2 2s^2 2p^6 \boxed{3s^2\ 3p^6}$ 8 valence e^-
- Ge $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ \boxed{4s^2}\ 3d^{10}\ \boxed{4p^2}$ 4 valence e^-
- Mg $1s^2 2s^2 2p^6 \boxed{3s^2}$ 2 valence e^-
- K $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ \boxed{4s^1}$ 1 valence e^-
- As $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ \boxed{4s^2}\ 3d^{10}\ \boxed{4p^3}$ 5 valence e^-

.

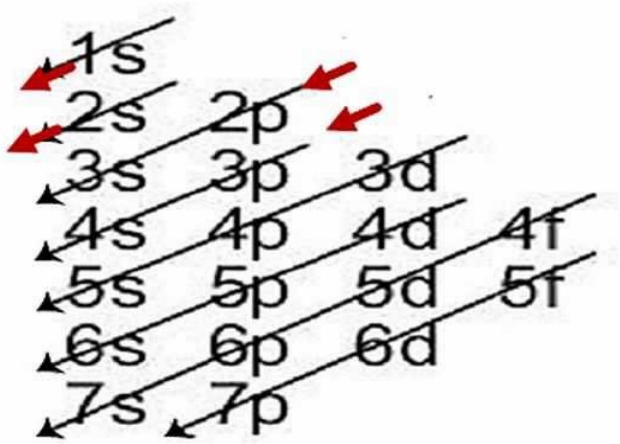
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Electron Configuration Chart

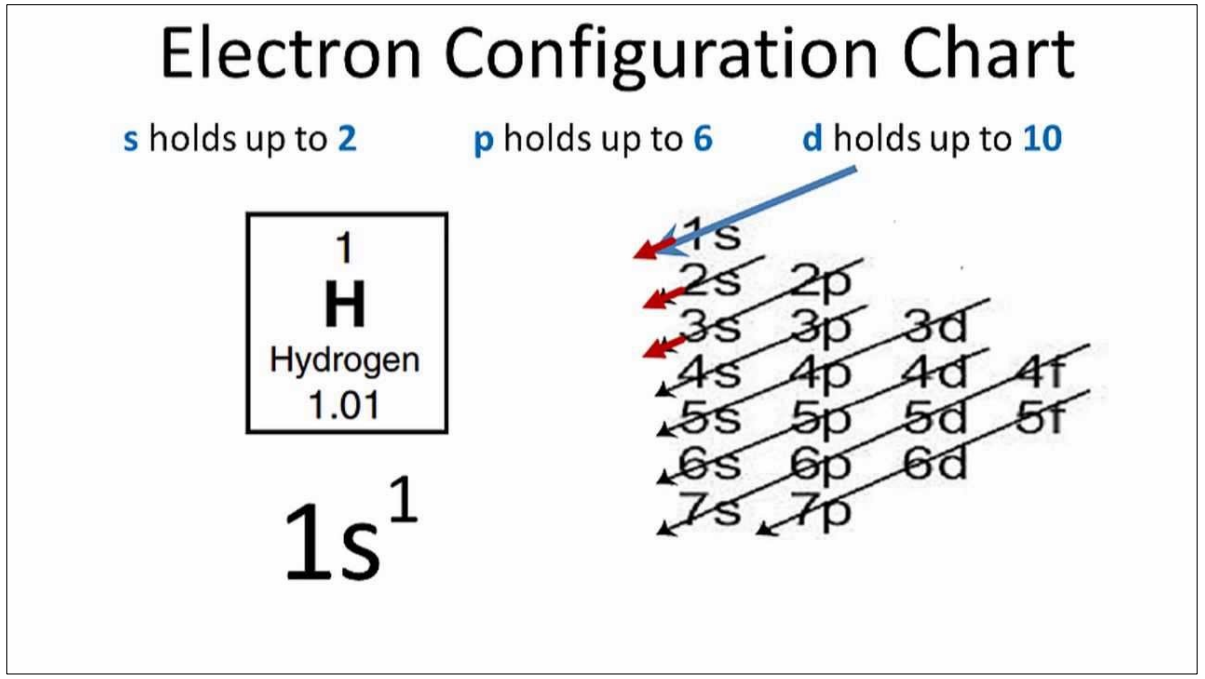
s holds up to **2** **p** holds up to **6** **d** holds up to **10**

3
Li
Lithium
6.94

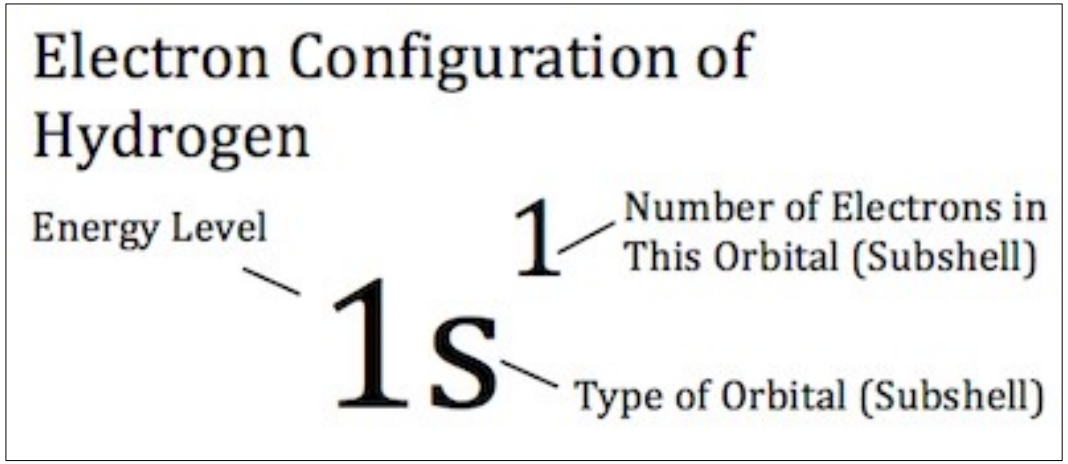


$1s^2\ 2s^1$

رقم المجموعة Group = valance electron	Valance electron in the highest level	رقم الدورة Period (n) =	Highest Energy level (n)	التوزيع الالكتروني Electron configuration	رمز Element العنصر
1	**1**	**2**	**2**	**$1s^2 2s^1$**	**^3Li**



Last period	Last group	Last sublevel (block)
1		



.

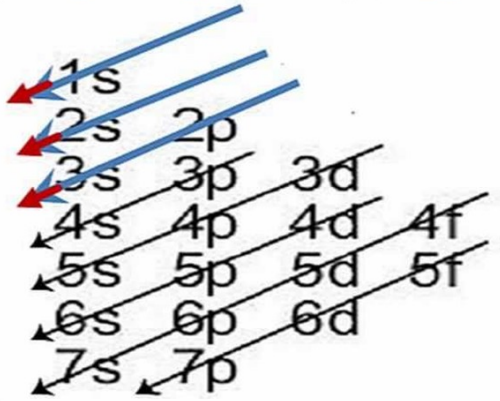
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Electron Configuration Chart

s holds up to 2 p holds up to 6 d holds up to 10

11
Na
Sodium
22.99



$1s^2\,2s^2\,2p^6\,3s^1$

Last Period (n)	Last group (Valance e)	Last sublevel (block)
3	**1**	S

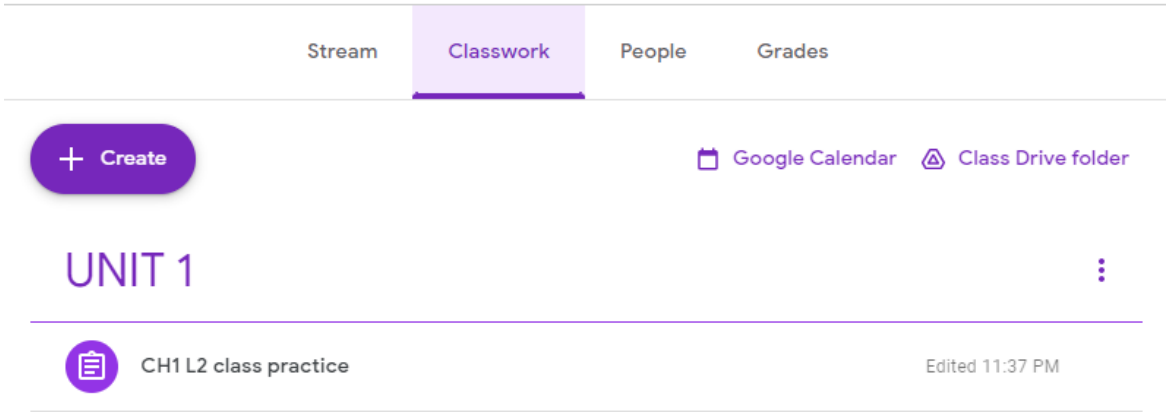
رقم المجموعة Group = valance electron	Valance electron in the highest level	رقم الدورة Period (n) =	Highest Energy level (n)	التوزيع الالكتروني Electron configuration	رمز Element العنصر
1	$1s^2\,2s^2\,2p^6\,3s^1$		**3**	**$1s^2 2s^1$**	**^3Li**

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ASSESMENT
Your turn
Open classroom





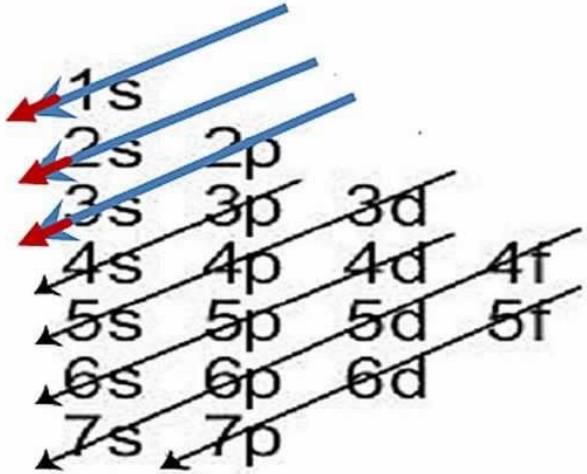
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Electron Configuration Chart

s holds up to **2** **p** holds up to **6** **d** holds up to **10**

8
O
Oxygen
16.00



$1s^2\ 2s^2\ 2p^4$

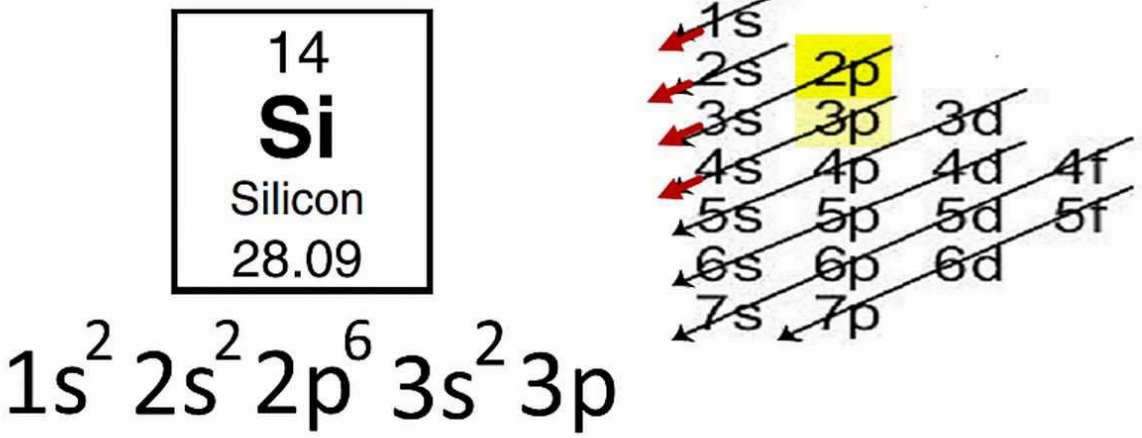
Last Period (n)	Last group (Valance e)	Last sublevel (block)

Last Period (n)	Last group (Valance e)	Last sublevel (block)
2	**v.e = 6 Group 16**	P

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Electron Configuration Chart

s holds up to **2** **p** holds up to **6** **d** holds up to **10**



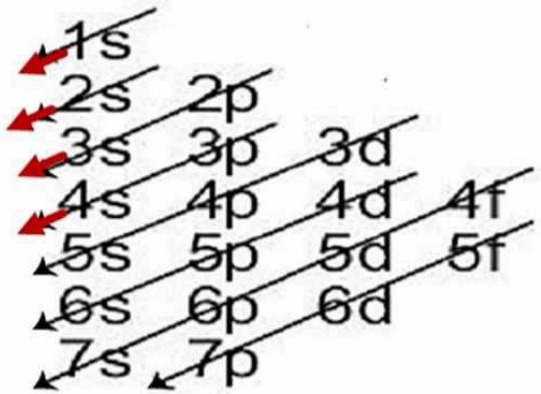
Last Period (n)	Last group (Valance e)	Last sublevel (block)
3	**v.e = 4 Group 14**	P

.

Electron Configuration Chart

s holds up to 2 p holds up to 6 d holds up to 10

15
P
Phosphorus
30.97



$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3$

Last Period (n)	Last group (Valance e)	Last sublevel (block)
3	**v.e = 5 Group 15**	P

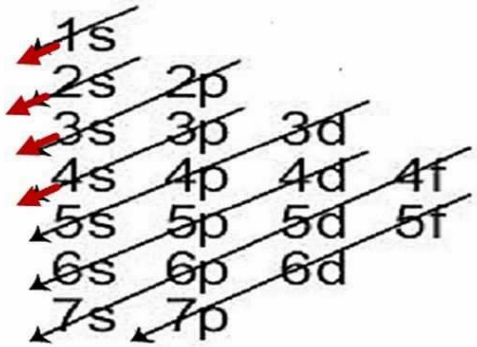
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Electron Configuration Chart

s holds up to 2 p holds up to 6 d holds up to 10

18
Ar
Argon
39.95

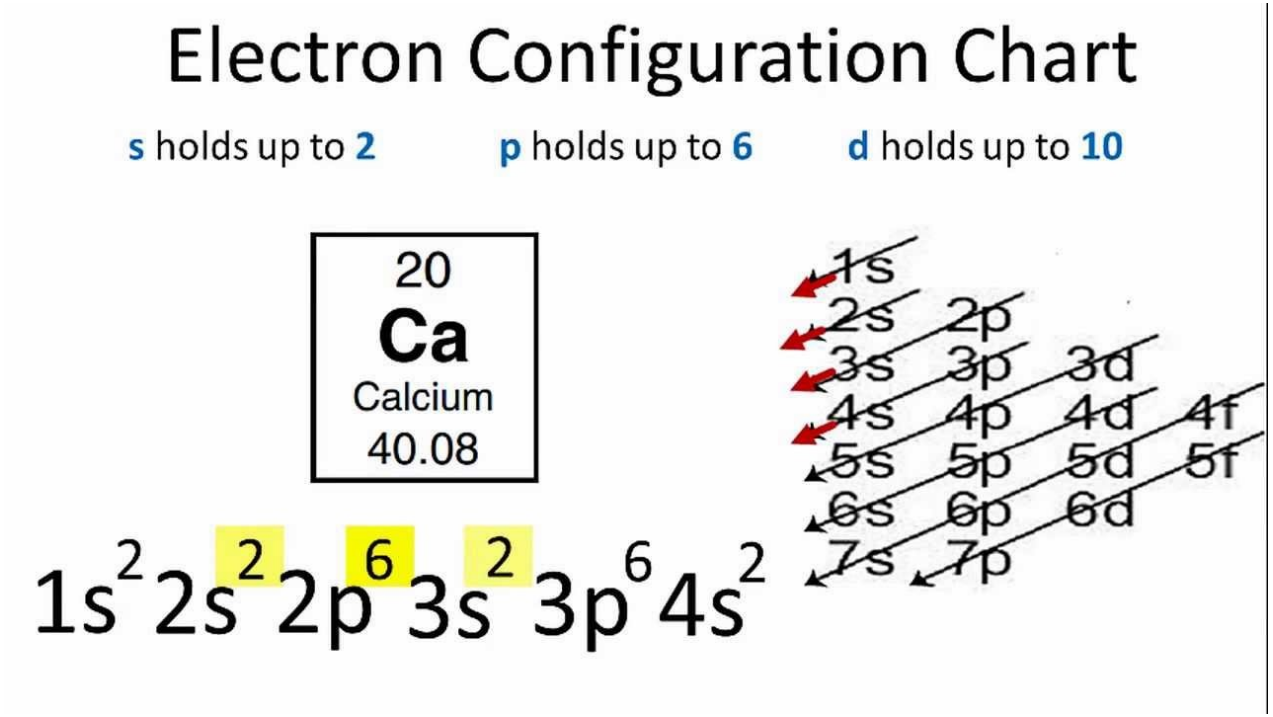


$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$

Last Period (n)	Last group (Valance e)	Last sublevel (block)
3	**v.e = 8 Group 18**	P

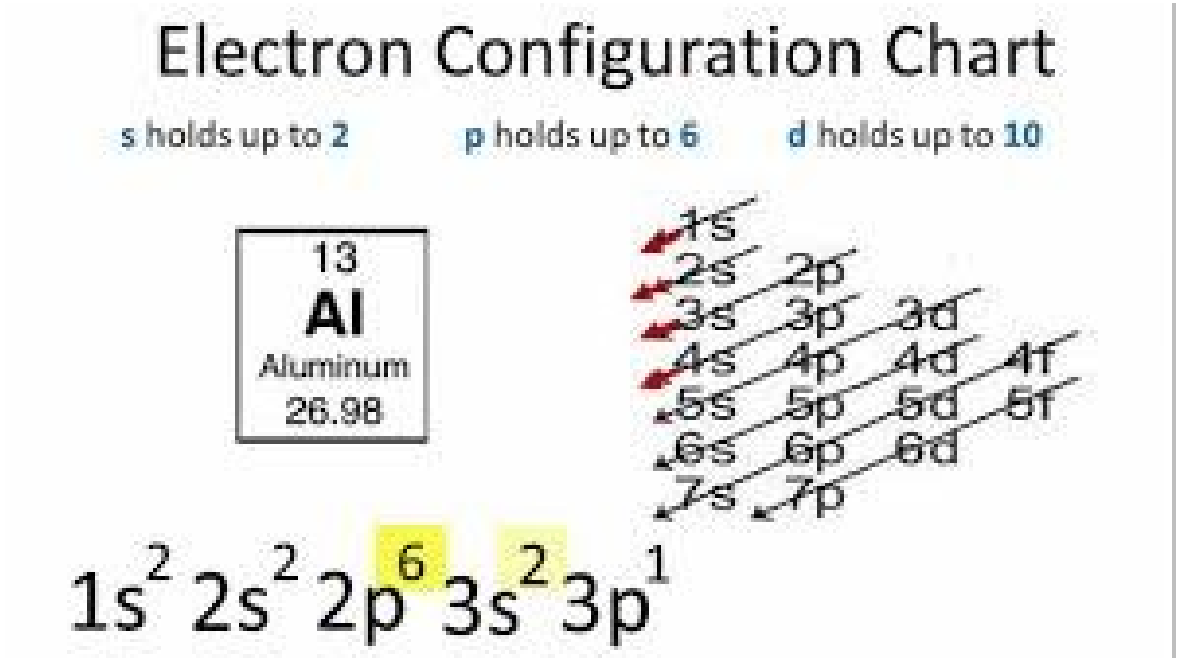
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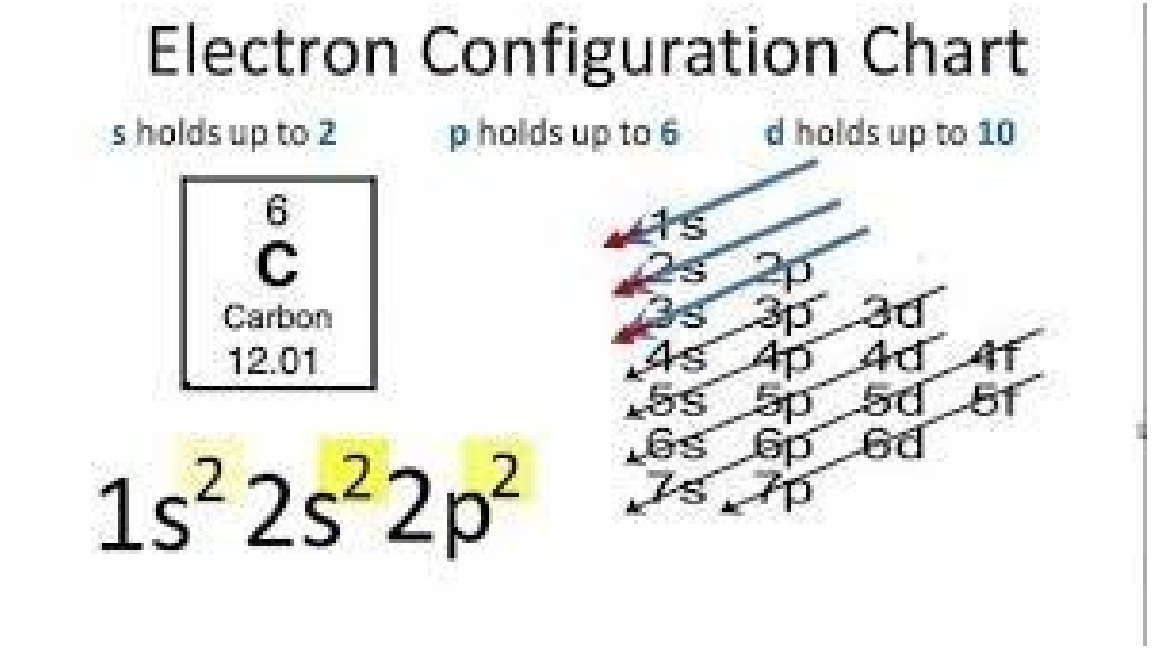
Last Period (n)	Last group (Valance e)	Last sublevel (block)
4	**v.e = 2 Group 2**	S

.



Last Period (n)	Last group (Valance e)	Last sublevel (block)
3	**v.e = 3 Group 13**	P

.



Last Period (n)	Last group (Valance e)	Last sublevel (block)

.

HOMEWORK
Open classroom
Due next class





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HOMEWORK : Writing Electron Configurations

Element	Atomic Number	Electron Configuration	Last period	Last group	Last sublevel	valence electron
H						
Li						
N						
Na						
Cl						

$1s^2$
$2s^2$ $2p^6$
$3s^2$ $3p^6$ $3d^{10}$
$4s^2$ $4p^6$ $4d^{10}$ $4f^{14}$
$5s^2$ $5p^6$ $5d^{10}$ $5f^{14}$
$6s^2$ $6p^6$ $6d^{10}$
$7s^2$ $7p^6$

Electron Configuration Chart

s holds up to 2 p holds up to 6 d holds up to 10

.

5 MARKS

HOMEWORK

5 MARKS

PRACTICE Problems

Extra Practice Page 979 and glencoe.com

9. What are the symbols for the elements with the following valence electron configurations?

a. s^2d^1 **b.** s^2p^3 **c.** s^2p^6

10. Challenge Write the electron configuration of the following elements.

BONUS 2 MARKS

a. the group 2 element in the fourth period

b. the group 12 element in the fourth period

c. the noble gas in the fifth period

d. the group 16 element in the second period

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The Noble Gas Electron Configuration

- The noble gases have 8 valence electrons
  - except for He, which has only 2 electrons
- Noble gases are especially unreactive
  - He and Ne are practically inert
- Reason noble gases are unreactive is that the electron configuration of the noble gases is especially stable

Noble gases
18
8A

2 **He**	$1s^2$
10 **Ne**	$2s^2 2p^6$
18 **Ar**	$3s^2 3p^6$
36 **Kr**	$4s^2 4p^6$
54 **Xe**	$5s^2 5p^6$
86 **Rn**	$6s^2 6p^6$

6

Electron Configuration and the Periodic Table

Problem 1

Strontium, which is used to produce red fireworks, has an electron configuration of [Kr]5s 2. Without using the periodic table, determine the group, period, and block of strontium

ANALYZE THE PROBLEM

You are given the electron configuration of strontium.

KNOWNUN

Electron configuration = [Kr]5s ²

Group = ?

Period = ?

Block = ?

.

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PRACTICE Problems

Extra Practice Page 979 and glencoe.com

8. Without using the periodic table, determine the group, period, and block of an atom with the following electron configurations.

a. $[Ne]3s^2$ **b.** $[He]2s^2$ **c.** $[Kr]5s^24d^{10}5p^5$

Summary

Energy Level	Types of sublevels/ orbitals	Designations	Electrons that they can hold
1	s	1s	2
2	s P	2s 2p	2 6
3	s P d	3s 3p 3d	2 6 10
4	s p d f	4s 4p 4d 4f	2 6 10 14

Section.2 Assessment

Which of the following is NOT one of the elemental blocks of the periodic table?

A. s-block

B. d-block

C. g-block

D. f-block

.

Section 2 Assessment

Which block spans 14 elemental groups?

A. s-block

B. p-block

C. f-block

D. g-block

.

Practice Problems

page 186

8. Without using the periodic table, determine the group, period, and block of an atom with the following electron configurations.

a. $[Ne]3s^2$ **b.** $[He]2s^2$

c. $[Kr]5s^24d^{10}5p^5$

Electron Configuration	Group	Period	Block
a. $[Ne]3s^2$	2	3	s
b. $[He]2s^2$	2	2	s
c. $[Kr]5s^24d^{10}5p^5$	17	5	p

9. What are the symbols for the elements with the following valence electron configurations?

a. s^2d^1

Sc, Y, La, Ac

b. s^2p^3

N, P, As, Sb, Bi

c. s^2p^6

Ne, Ar, Kr, Xe, Rn

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10. Challenge Write the electron configuration of

the following elements.

a. the group 2 element in the fourth period

$1s^22s^22p^63s^23p^64s^2$

b. the group 12 element in the fourth period

1s²2s22p63s23p64s23d10

c. the noble gas in the fifth period

$1s^22s^22p^63s^23p^64s^23d^{10}4p^65s^24d^{10}5p^6$

d. the group 16 element in the second period

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Section 6.2 Assessment

Section Summary

- The periodic table has four blocks (s, p, d, f).
- Elements within a group have similar chemical properties.
- The group number for elements in groups 1 and 2 equals the element's number of valence electrons.
- The energy level of an atom's valence electrons equals its period number.

11. MAIN Idea **Explain** what determines the blocks in the periodic table.

12. Determine in which block of the periodic table are the elements having the following valence electron configurations.

a. s^2p^4 **b.** s^1 **c.** s^2d^1 **d.** s^2p^1

13. Infer Xenon, a nonreactive gas used in strobe lights, is a poor conductor of heat and electricity. Would you expect xenon to be a metal, a nonmetal, or a metalloid? Where would you expect it to be on the periodic table? Explain.

14. Explain why elements within a group have similar chemical properties.

15. Model Make a simplified sketch of the periodic table, and label the s-, p-, d-, and f-blocks.

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Section 6.2 Assessment

11. The energy sublevel being filled defines the blocks in the periodic table.
12. **a.** p-block
    b. s-block
    c. d-block
    d. p-block
13. nonmetal; the nonreactive gases are noble gases in group 18 on the right of the periodic table
14. because they have the same valence electron configuration
15. Sketches should look similar to Figure 6.8. Refer to the Solutions Manual for a sample sketch.

HOME WORK

TESK BOOK	
Page No	Question .No
16	8-15
28-29	41-57

Activity lab BOOK	
Page No	Question .No
3-4	all
5	all

.

The Classification of Elements

Practice & Exercise

1. identify the element & element symbol by electron configuration



9. What are the symbols for the elements with the following valence electron configurations?

a. s^2d^1 **b.** s^2p^3 **c.** s^2p^6

2- Identify the period , block , group of an element



HOMEWORK

8. Without using the periodic table, determine the group, period, and block of an atom with the following electron configurations.

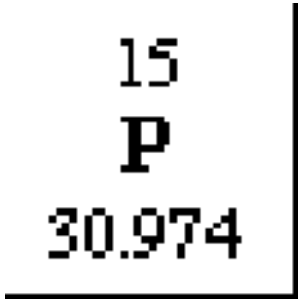
a. $[Ne]3s^2$

b. $[He]2s^2$

c. $[Kr]5s^24d^{10}5p^5$

Self check

Electron configuration: ----------



Name	Phosphorus
Symbol	P
Number of valence electrons	----------
Location	Period: ------- Group: -------- Block: --------
Type of element	----------

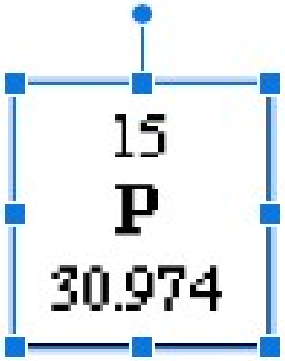
1.1.23 Conclude the electron configuration of elements based on their position in the
periodic table (period and group).

Correct answer

Example: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3$

= 15 electrons find from the periodic table which element has an atomic number 15

Name	Phosphorus
Symbol	P
Number of valence electrons	5
Location	Period:3 Group: 15 Block: P
Type of element	Non metal
Lewis structure	



1- Write electron configuration , orbital notation & noble gas notation

LET’S GO TO LIVE WORKSHEET
LINK ON THE CHAT

https://www.liveworksheets.com/qm2170199hh

https://www.liveworksheets.com/jn1660950kb

1																	18
1 **H** 1.0079	2											13	14	15	16	17	2 **He** 4.0026
3 **Li** 6.941	4 **Be** 9.0122											5 **B** 10.811	6 **C** 12.011	7 **N** 14.007	8 **O** 15.999	9 **F** 18.998	10 **Ne** 20.180
11 **Na** 22.990	12 **Mg** 24.305	3	4	5	6	7	8	9	10	11	12	13 **Al** 26.982	14 **Si** 28.086	15 **P** 30.974	16 **S** 32.065	17 **Cl** 35.453	18 **Ar** 39.948
19 **K** 39.098	20 **Ca** 40.078	21 **Sc** 44.956	22 **Ti** 47.867	23 **V** 50.942	24 **Cr** 51.996	25 **Mn** 54.938	26 **Fe** 55.845	27 **Co** 58.933	28 **Ni** 58.693	29 **Cu** 63.546	30 **Zn** 65.409	31 **Ga** 69.723	32 **Ge** 72.64	33 **As** 74.922	34 **Se** 78.96	35 **Br** 79.904	36 **Kr** 83.798
37 **Rb** 85.468	38 **Sr** 87.62	39 **Y** 88.906	40 **Zr** 91.224	41 **Nb** 92.906	42 **Mo** 95.94	43 **Tc** (98)	44 **Ru** 101.07	45 **Rh** 102.91	46 **Pd** 106.42	47 **Ag** 107.87	48 **Cd** 112.41	49 **In** 114.82	50 **Sn** 118.71	51 **Sb** 121.76	52 **Te** 127.60	53 **I** 126.90	54 **Xe** 131.29
55 **Cs** 132.91	56 **Ba** 137.33	57-71 *	72 **Hf** 178.49	73 **Ta** 180.95	74 **W** 183.84	75 **Re** 186.21	76 **Os** 190.23	77 **Ir** 192.22	78 **Pt** 195.08	79 **Au** 196.97	80 **Hg** 200.59	81 **Tl** 204.38	82 **Pb** 207.2	83 **Bi** 208.98	84 **Po** (209)	85 **At** (210)	86 **Rn** (222)
87 **Fr** (223)	88 **Ra** (226)	89-103 #	104 **Rf** (261)	105 **Db** (262)	106 **Sg** (266)	107 **Bh** (264)	108 **Hs** (277)	109 **Mt** (268)	110 **Ds** (281)	111 **Uuu** (272)	112 **Uub** (285)		114 **Uuq** (289)				

* Lanthanide series	57 **La** 138.91	58 **Ce** 140.12	59 **Pr** 140.91	60 **Nd** 144.24	61 **Pm** (145)	62 **Sm** 150.36	63 **Eu** 151.96	64 **Gd** 157.25	65 **Tb** 158.93	66 **Dy** 162.50	67 **Ho** 164.93	68 **Er** 167.26	69 **Tm** 168.93	70 **Yb** 173.04	71 **Lu** 174.97
# Actinide series	89 **Ac** (227)	90 **Th** 232.04	91 **Pa** 231.04	92 **U** 238.03	93 **Np** (237)	94 **Pu** (244)	95 **Am** (243)	96 **Cm** (247)	97 **Bk** (247)	98 **Cf** (251)	99 **Es** (252)	100 **Fm** (257)	101 **Md** (258)	102 **No** (259)	103 **Lr** (262)