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Task 1. Glossary

- **atomic number –** The number of protons in an atom. Sometimes called the proton number.
- **electron arrangement –** A shorthand way of writing the number of electrons in an atom's electron shells.
- **element –** A substance made up of only one type of atom.
- **group –** A column in the periodic table
- **period –** A row in the periodic table containing elements with the same number of full electron shells.
- **periodic table –** A table that lists all the elements in order of increasing atomic number
- **property –** Any characteristic of an element.

Make your own glossary

- **periodicity**
- **pattern**
- **outermost**
- **shell, subshell**
- **valence electron**
- **arrange, arrangement**
- **consider**
- **increase**
- **distribute**
- **belong**

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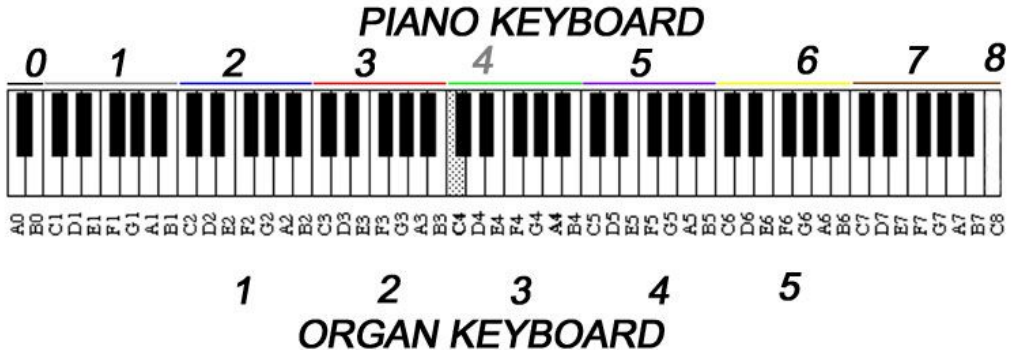
What is the periodicity?

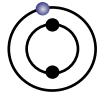
A **repeating pattern** of chemical properties in elements is called ***periodicity***.

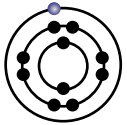


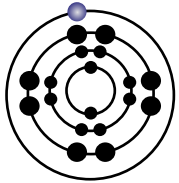
The periodicity in properties of elements can be explained by the the repetition of **outermost shell electrons** after certain regular intervals.

For example:
All the elements of group IA (alkali metals) end with the similar number of **valence electrons** which is ONE.
Because of similarity in the electronic configuration of all the elements **in a same group** have similar properties.

1A GROUP
ALKALI METALS

Li  **2, 1**

Na  **2, 8, 1**

K  **2, 8, 8, 1**

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Atomic number and electrons

The properties of elements are influenced by the number and arrangement of electrons in the atom.

atomic number = number of protons
number of protons = number of electrons
atomic number = number of electrons

As atomic number increases by one, the number of electrons also increases by one.
This means that the elements in the periodic table are also arranged in order of the number of electrons.

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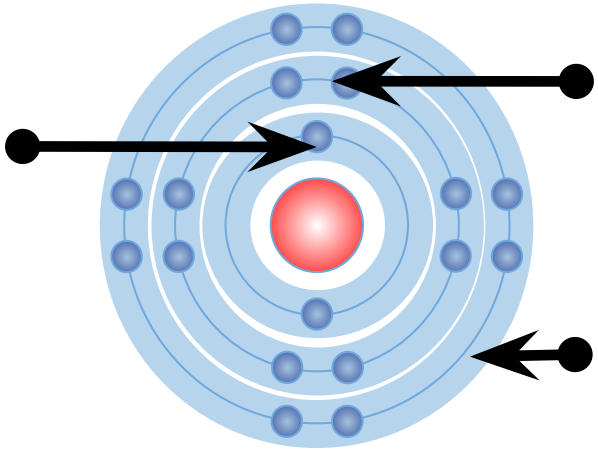
Electron shells

Electrons are arranged in **shells** around an atom's nucleus.

Each shell has a maximum number of electrons that it can hold.
Electrons will fill the shells nearest the nucleus first.

1st shell holds a maximum of 2 electrons



2nd shell holds a maximum of 8 electrons

3rd shell holds a maximum of 8 electrons

This **electron arrangement** is written as **2,8,8**

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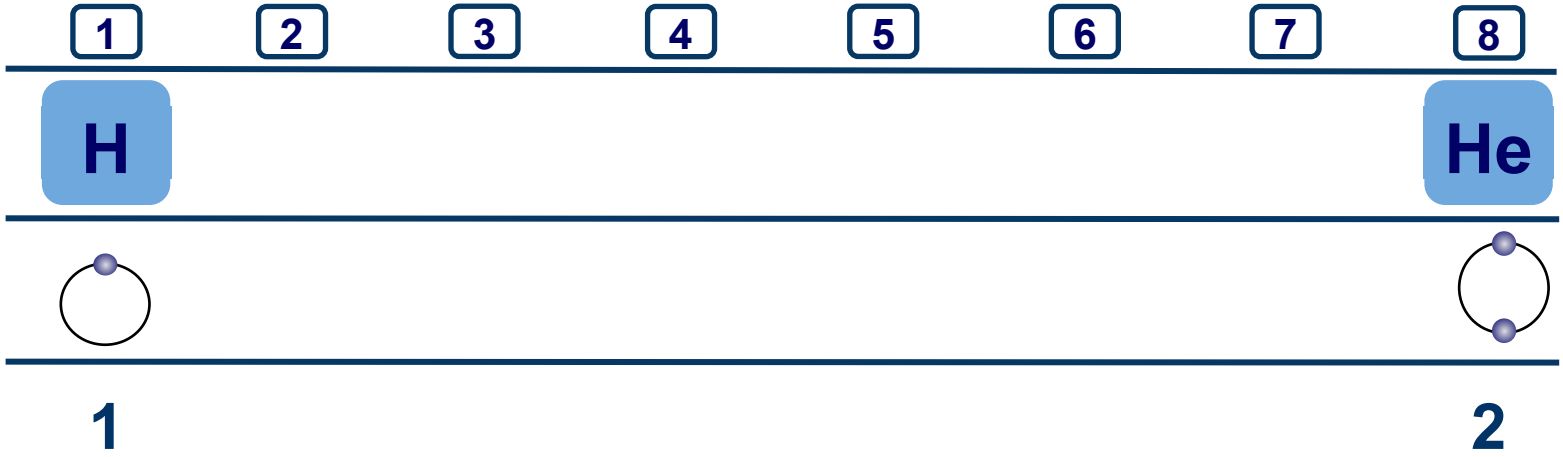
Electrons in period 1

Elements in **period 1** only have electrons in the first shell.

Why are there only two elements in period 1?



The first shell **can only** hold a maximum of two electrons,
so period 1 only includes the elements hydrogen and helium.

What is special about the outer shell of helium?

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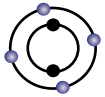
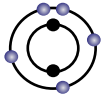
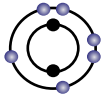
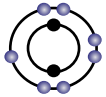
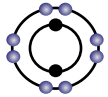
Electrons in period 2

Elements in period 2 all have a **complete first shell**.

What happens to electrons in the **second shell** in period 2?

1	2	3	4	5	6	7	8
Li	Be	B	C	N	O	F	Ne
							
2,1	2,2	2,3	2,4	2,5	2,6	2,7	2,8

At second shell the number of electron increases by one electron across the period from left to right.

What is special about the outer shell of neon?

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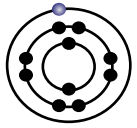
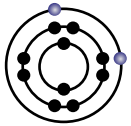
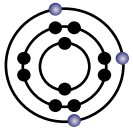
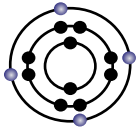
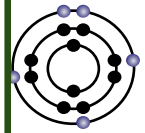
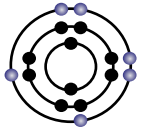
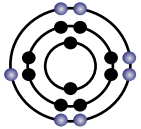
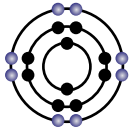
Electrons in period 3

Elements in period 3 have **complete** first and second shells.
What happens to electrons in the **third shell** in period 3?

1	2	3	4	5	6	7	8
Na	Mg	Al	Si	P	S	Cl	Ar
							
2,8,1	2,8,2	2,8,3	2,8,4	2,8,5	2,8,6	2,8,7	2,8,8

At second shell the number of electron increases by one electron across the period from left to right.

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Patterns of electron arrangements

Consider the electron arrangements of the first 20 elements in the periodic table.

	1	2	3	4	5	6	7	8
1	1							
2	2,1	2,2	2,3	2,4	2,5	2,6	2,7	2,8
3	2,8,1	2,8,2	2,8,3	2,8,4	2,8,5	2,8,6	2,8,7	2,8,8
4	2,8,8,1	2,8,8,2						

What is the pattern of outer shell electrons in a group?
What is the pattern of outer shell electrons across a period?
What is the pattern of full electron shells in a group?

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Electron trends in the periodic table

Trends down a group:

- the number of **complete electron shells** *increases by one*;
- the number of **outer shell electrons** *is the same*.

The **number of a group** is the same as the **number of electrons** in the outer shell of elements in that group.

Trends across a period:

- the number of **outer shell electrons** *increases by one*;
- the number of **complete electron shells** *stays the same*.

By the start of new period electrons begin to fill a new shell.

Electron trends in the periodic table

The **number of a group** is the same as the **number of electrons** in the outer shell of elements in that group.

The number of period is the same as the number of electron shells

	1	2	3	4	5	6	7	8
1	1							
2	2,1	2,2	2,3	2,4	2,5	2,6	2,7	2,8
3	2,8,1	2,8,2	2,8,3	2,8,4	2,8,5	2,8,6	2,8,7	2,8,8
4	2,8,8,1	2,8,8,2						

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What is the electronic configuration?

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As you know, all electrons are distributed among the shells and subshells. The arrangement of electrons can be shown by electronic configuration.

The physical and chemical properties of elements can be explained by their unique electron configuration.

The electron configuration simply the order of shells and subshell. In other word it is called orbitals. There are s, p , d and f orbitals.

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THE WAY OF THE FILLING THE ELECTRONIC CONFIGURATION

s s p s p s d p s d p s f d p s f d p s

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THE WAY OF THE FILLING THE ELECTRONIC CONFIGURATION

s s p s p s d p s d p s f d p s f d p s

s-orbital starts from **1st shell** and it can only contain **maximum 2 electrons**.

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THE WAY OF THE FILLING THE ELECTRONIC CONFIGURATION

1s 2s p 3s p 4s d p 5s d p 6s f d p 7s f d p 8s

s-orbital starts from **1st shell** and it can only contain **maximum 2 electrons**.

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THE WAY OF THE FILLING THE ELECTRONIC CONFIGURATION

$1s^2$ $2s^2$ p $3s^2$ p $4s^2$ d p $5s^2$ d p $6s^2$ f d p $7s^2$ f d p $8s^2$

s-orbital starts from **1st shell** and it can only contain **maximum 2 electrons**.

p-orbital starts from **2st shell** and it can only contain **maximum 6 electrons**.

THE WAY OF THE FILLING THE ELECTRONIC CONFIGURATION

$1s^2\ 2s^2\ 2p\ 3s^2\ 3p\ 4s^2\ d\ 4p\ 5s^2\ d\ 5p\ 6s^2\ f\ d\ 6p\ 7s^2\ f\ d\ 7p\ 8s^2$

s-orbital starts from **1st shell** and it can only contain **maximum 2 electrons**.

p-orbital starts from **2st shell** and it can only contain **maximum 6 electrons**.

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THE WAY OF THE FILLING THE ELECTRONIC CONFIGURATION

$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ d\ 4p^6\ 5s^2\ d\ 5p^6\ 6s^2\ f\ d\ 6p^6\ 7s^2\ f\ d\ 7p^6\ 8s^2$

s-orbital starts from **1st shell** and it can only contain **maximum 2 electrons**.

p-orbital starts from **2nd shell** and it can only contain **maximum 6 electrons**.

d-orbital starts from **3rd shell** and it can only contain **maximum 10 electrons**.

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THE WAY OF THE FILLING THE ELECTRONIC CONFIGURATION

$1s^2\ 2s^2\ \ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d\ \ 4p^6\ 5s^2\ 4d\ \ 5p^6\ 6s^2\ \ f\ \ 5d\ \ 6p^6\ 7s^2\ \ f\ \ 6d\ \ 7p^6\ 8s^2$

s-orbital starts from **1st shell** and it can only contain **maximum 2 electrons**.

p-orbital starts from **2nd shell** and it can only contain **maximum 6 electrons**.

d-orbital starts from **3rd shell** and it can only contain **maximum 10 electrons**.

THE WAY OF THE FILLING THE ELECTRONIC CONFIGURATION

$1s^2\ 2s^2\ \ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^{10}\ \ 5p^6\ 6s^2\ \ f\ \ 5d^{10}\ \ 6p^6\ 7s^2\ \ f\ \ 6d^{10}\ \ 7p^6\ 8s^2$

s-orbital starts from **1st shell** and it can only contain **maximum 2 electrons**.

p-orbital starts from **2nd shell** and it can only contain **maximum 6 electrons**.

d-orbital starts from **3rd shell** and it can only contain **maximum 10 electrons**.

f-orbital starts from **4th shell** and it can only contain **maximum 14 electrons**.

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THE WAY OF THE FILLING THE ELECTRONIC CONFIGURATION

$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^{10}\ 5p^6\ 6s^2\ 4f\ \ 5d^{10}\ \ 6p^6\ 7s^2\ 5f\ \ 6d^{10}\ 7p^6\ 8s^2$

s-orbital starts from **1st shell** and it can only contain **maximum 2 electrons**.

p-orbital starts from **2nd shell** and it can only contain **maximum 6 electrons**.

d-orbital starts from **3rd shell** and it can only contain **maximum 10 electrons**.

f-orbital starts from **4th shell** and it can only contain **maximum 14 electrons**.

THE WAY OF THE FILLING THE ELECTRONIC CONFIGURATION

$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^{10}\ 5p^6\ 6s^2\ 4f^{14}\ 5d^{10}\ 6p^6\ 7s^2\ 5f^{14}\ 6d^{10}\ 7p^6\ 8s^2$

s-orbital starts from **1st shell** and it can only contain **maximum 2 electrons**.

p-orbital starts from **2nd shell** and it can only contain **maximum 6 electrons**.

d-orbital starts from **3rd shell** and it can only contain **maximum 10 electrons**.

f-orbital starts from **4th shell** and it can only contain **maximum 14 electrons**.

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THE WAY OF THE FILLING THE ELECTRONIC CONFIGURATION

$$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^{10}\ 5p^6\ 6s^2\ 4f^{14}\ 5d^{10}\ 6p^6\ 7s^2\ 5f^{14}\ 6d^{10}\ 7p^6\ 8s^2$$

s-orbital starts from **1st shell** and it can only contain **maximum 2 electrons**.

p-orbital starts from **2nd shell** and it can only contain **maximum 6 electrons**.

d-orbital starts from **3rd shell** and it can only contain **maximum 10 electrons**.

f-orbital starts from **4th shell** and it can only contain **maximum 14 electrons**.

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THE WAY OF THE FILLING THE ELECTRONIC CONFIGURATION

$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^{10}\ 5p^6\ 6s^2\ 4f^{14}\ 5d^{10}\ 6p^6\ 7s^2\ 5f^{14}\ 6d^{10}\ 7p^6\ 8s^2$

Example: Write the electronic configurations of the following elements

Li_3, B_5, Mg_{12}, S_{16}

Li_3	$1s^2\ 2s^1$
B_5	$1s^2\ 2s^2\ 2p^1$
Al_{13}	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$
Ar_{18}	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$

THE WAY OF THE FILLING THE ELECTRONIC CONFIGURATION

$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^{10}\ 5p^6\ 6s^2\ 4f^{14}\ 5d^{10}\ 6p^6\ 7s^2\ 5f^{14}\ 6d^{10}\ 7p^6\ 8s^2$

Example: Write the electronic configurations of the following elements

Li_3, B_5, Mg_{12}, S_{16}

Li_3	$1s^2\ 2s^1$	number of shells is 2, so it is in 2nd period, valence electron is 1, so 1A group
B_5	$1s^2\ 2s^2\ 2p^1$	shells are 2 >>> 2nd period, valence electrons are 3, so 3A group
Al_{13}	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$	shells are 3 >>> 3nd period, valence electrons are 3, so 3A group
Ar_{18}	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$	shells are 3 >>> 3nd period, valence electrons are 8, so 8A group

THE WAY OF THE FILLING THE ELECTRONIC CONFIGURATION

$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^{10}\ 5p^6\ 6s^2\ 4f^{14}\ 5d^{10}\ 6p^6\ 7s^2\ 5f^{14}\ 6d^{10}\ 7p^6\ 8s^2$

Al_{13} $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$

Elements with ending **s and p orbitals** in their electronic configurations **belong to A group**

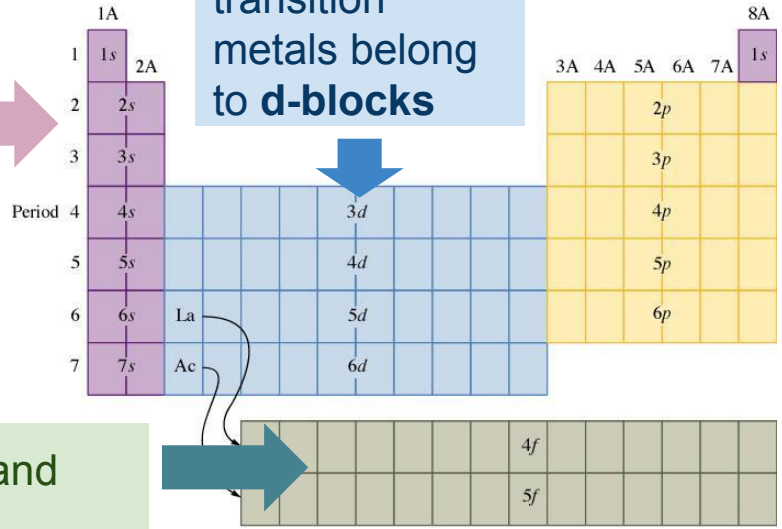
Fe_{26} $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}$

Elements with ending **d and f orbitals** in their electronic configurations **belong to B group**

According to their **electronic configuration ending**, elements can also be classified as **s-block, p-block, d-block and f-block.**
OR
s-elements, p-elements, d-elements and f-elements

1A and 2A group elements belong to **s-blocks**

transition metals belong to **d-blocks**



3A-8A group elements belong to **p-blocks**

Elements of Actinides and Lanthanides belong to **f-blocks**

Task 2. Work in pairs. Create the sentences from mixed-up words and share your answer with the class.

1. of chemical properties *periodicity* A repeating pattern is called in elements
2. end with which is ONE of group IA valence electrons number of (alkali metals) All the elements the similar
3. of electrons neutral atoms and the number are same of protons the number For the
4. in the of electrons. periodic table the number are also The elements arranged in order of

Answer:

Task 2

1. A repeating pattern of chemical properties in elements is called *periodicity*.
2. All the elements of group IA (alkali metals) end with the similar number of valence electrons which is ONE.
3. For the neutral atoms the number of protons and the number of electrons are same.
4. The elements in the periodic table are also arranged in order of the number of electrons.

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Task 3. Find the mistake. Here 4 sentences. In each sentences 2 words are changed their places. Find the words and replace them in a best way.

1. Electrons are arranged in the nucleus around an atom's shell.

_____

1. The number of electron is the same as the number of period shells.

_____

1. The physical and chemical configuration of elements can be explained by their unique electron properties.

_____

1. Second electron number can only hold maximum eight shell of electrons.

_____

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Task 3. Find the mistake. Here 4 sentences. In each sentences 2 words are changed their places. Find the words and replace them in a best way.

1. Electrons are arranged in the **shell** around an atom's **nucleus**.
2. The number of **period** is the same as the number of **electron** shells.
3. The physical and chemical **properties** of elements can be explained by their unique electron **configuration**.
4. Second electron **shell** can only hold maximum eight **number** of electrons.

In a group, In a period,	from top to bottom from top to bottom from left to right from right to left	the number of complete electron shells the number of valence electrons	increases by one decreases by one stays the same

Task 4. Electron trends in the periodic table. Write 4 sentences and make best matching of words from 4 columns.

1. _____
2. _____
3. _____
4. _____

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Task 4. Electron trends in the periodic table. Write 4 sentences and make best matching of words from 4 columns.

In a group, from top to bottom the number of complete electron shells increases by one

In a group, from top to bottom the number of valence electrons stays the same

In a period, from left to right the number of complete electron shells stays the same

In a period, from left to right the number of valence electrons increases by one

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Task 5. Electronic configuration.

Write the electronic configurations of the following elements and indicate the location of the element by group and period.

Be_4, N_7, Si_{14}, Zn_{30}

Be_4

$1s^2$ $2s^2$ number of shells is 2, so it is in 2nd period, valence electron is 2, so 2A group

N_7 _____

Si_{14} _____

Zn_{30} _____