

PERIODIC CLASSIFICATION

What is Periodic classification? (1)

(1)

- Periodic classification is the process of grouping elements in the periodic table in the order of increasing atomic number.

What is Periodic Table? (1)

- Periodic Table is the table which shows the arrangement of elements in the order of increasing atomic number in such away that elements with similar properties falls in the same vertical column.

MODERN PERIODIC TABLE

- Below is a diagram of modern periodic table

I	II	III	IV	V	VI	VII	VIII
H						He	
1	2	3	4	5	6	7	8
₃ Li	₄ Be	₅ B	₆ C	₇ N	₈ O	₉ F	₁₀ Ne
2:1	2:2	2:3	2:4	2:5	2:6	2:7	2:8
₁₁ Na	₁₂ Mg	₁₃ Al	₁₄ Si	₁₅ P	₁₆ S	₁₇ Cl	₁₈ 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
₁₉ K	₂₀ Ca						
2:8:8:1	2:8:8:2						

PERIODIC LAWS

- There are two periodic laws

(a) Mendeleev's periodic law

(b) Modern periodic law:

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HIGHLIGHTS OF CLASS 10 SCIENCE

(A) MENDELEEV'S PERIODIC LAW

- Mendeleev's periodic law states that "the properties of elements are periodic functions of their relative atomic masses"

(B) MODERN PERIODIC LAW

- The Modern periodic law states that "The properties of elements change systematically according to their atomic numbers"

PERIODICITY

What is periodicity?

- Periodicity is regular periodic changes of properties of elements due to changes in atomic numbers.

ARRANGEMENT OF ELEMENTS IN THE PERIODIC TABLE

- In periodic table, elements are arranged in
 - (a) Groups
 - (b) Periods

(A) GROUPS

- Groups are the vertical column of elements in the periodic table

NUMBER OF GROUPS IN THE PERIODIC TABLE

- There are eight (8) groups in the periodic table

- These groups are named by roman numbers as follows:

1. Group I

(3)

2. Group II

3. Group III

4. Group IV

5. Group V

6. Group VI

7. Group VII

8. Group VIII

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1. GROUP (I) {ALKALI METALS}

- The group I in the periodic table is called Alkali metals

- Group I consists of five metals, namely

i) Lithium (Li)

ii) Sodium (Na)

iii) Potassium (K)

iv) Rubidium (Rb)

v) Cesium (Cs)

PHYSICAL

PROPERTIES OF GROUP I ELEMENTS

- Group I elements have got the following properties

i) They are soft metals.

ii) They have low density.

iii) They are good conductor of heat and electricity.

iv) They have shiny surface when freshly cut.

v) They have one electron in their outermost shell.

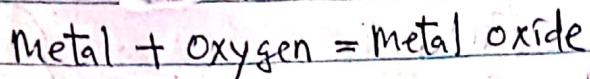
CHEMICAL

PROPERTIES OF GROUP I ELEMENTS

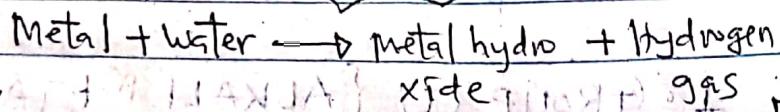
- Group I elements have got the following chemical properties

i) They react with water to form alkali

ii) They react with air (O_2) to form metal oxide (4)



iii) They react with water to form alkaline solution and hydrogen gas



SAMPLE QUESTIONS

(01) Briefly explain why group I is called alkali metal

(02) Define the following terms

(a) Periodic Table

(b) Periodicity

(03) State modern periodic law

(04) Draw Modern Periodic Table

(05) Mention chemical properties of group I elements

Answers

(01) Because they react with water to form alkali.

(02) a) Periodic Table - Is the table which shows arrangement of elements in the order of increasing atomic number.

b) Periodicity - Is the regular periodic changes of elements due to their atomic number.

(03) Modern periodic law states that "The properties of elements are a periodic function of their atomic numbers". (5)

(04) MODERN PERIODIC TABLE

I							VIII
1 H							2 He
1 Li	4 Be	5 B	6 C	7 N	8 O	9 F	10 Ne
2:1	2:2	2:3	2:4	2:5	2:6	2:7	2:8
11 Na	12 Mg	13 Al	14 Si	15 P	16 S	17 Cl	18 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
19 K	20 Ca						
2:8:8:1	2:8:8:2						

(05) Chemical properties of alkali metals. (Group I)

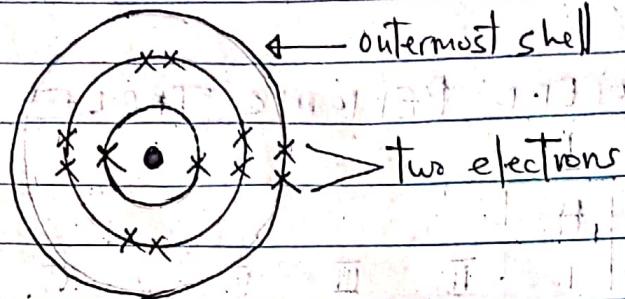
- i) They react with water to form alkali
- ii) They react with air (O_2) to form metal oxide
- iii) They react with water to form alkaline solution and hydrogen gas.

2. GROUP II (ALKALINE EARTH METALS)

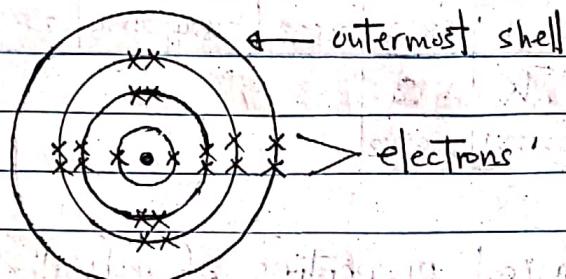
- Group II elements in the periodic table are called alkaline earth metals. Why?
- They are called alkaline earth metals because their oxides are alkaline in nature and exist in earth.
- Group II consists the following elements:
 - i) Beryllium (Be)
 - ii) Magnesium (Mg)
 - iii) Calcium (Ca)

→ This is a group which consists of elements which have two electrons in their outermost shell. (6)

$$\text{Mg} = 2:8:2$$



$$\text{Ca} = 2:8:8:2$$



PHYSICAL

PROPERTIES OF GROUP II ELEMENTS

→ The following are the physical properties of group II elements:

- i) They have two electrons in their outermost shell.
- ii) They are harder metals than those in group I.
- iii) They are good conductors of heat and electricity.
- iv) They are silvery grey in colour when pure and clean.

Example-06

(7)

- Give the reason why Group II elements are called alkaline earth metal.

Answer

- Because their oxides are alkaline in nature and exist in earth.

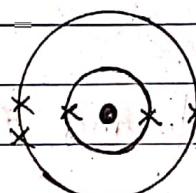
3. GROUP III

- Group III consists of the following elements.

(i) Boron (B):

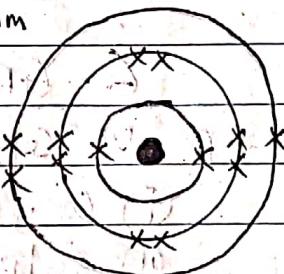
(ii) Aluminium (Al):

i) Boron



$$B = 2:3$$

ii) Aluminium



$$Al = 2:8:3$$

They have three (3) electrons in their outermost shell.

4. GROUP IV

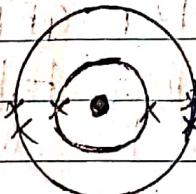
- Group IV consists the following elements:

(i) Carbon (C)

(ii) Silicon (Si)

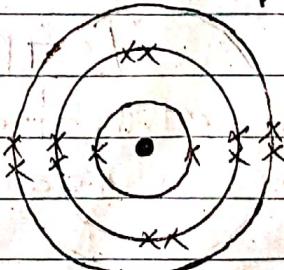
They have 4 electrons in their outer most shell.

i) Carbon



$$C = 2:4$$

ii) Silicon



$$Si = 2:8:4$$

5. GROUP VI

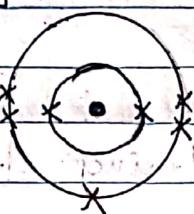
(8)

→ Group VI is a group which contains the following elements:

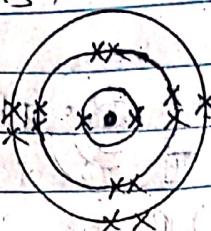
(i) Nitrogen (N)

(ii) Phosphorus (P)

i) Nitrogen



ii) Phosphorus



$$N = 2:5$$

$$P = 2:8:5$$

They have five electrons in their outermost shell.

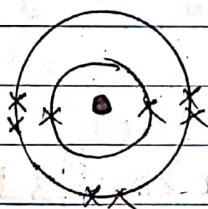
6. GROUP VII

→ Group VII consists the following elements:

(i) Oxygen (O)

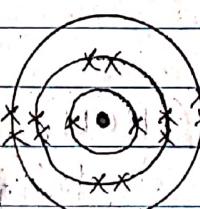
(ii) Sulphur (S)

i) Oxygen



$$O = 2:6$$

ii) Sulphur



$$S = 2:8:6$$

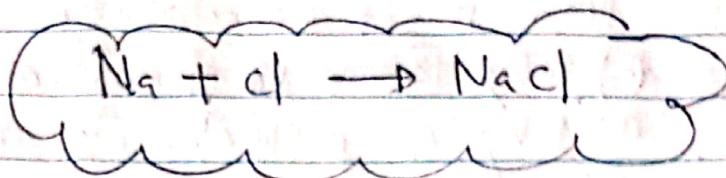
They have six electrons in their outermost shell.

7. GROUP VII {HALOGENS}

→ Group VII elements are called Halogens because they react with metal to form salt.

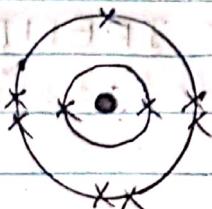
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Example : Sodium + chlorine \rightarrow sodium chloride (9)



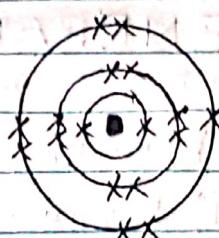
They have seven electrons in their outermost shell
Example i) Fluorine (F).
ii) Chlorine (Cl).

i) Fluorine (F)



$$F = 2:7$$

ii) chlorine



$$Cl = 2:8:7$$

8. GROUP VIII {NOBLE GASES}

- The group VIII elements are called Noble gases or rare gases.
- They were formerly called INERT GASES, because they do not readily react to form Compounds.
- They have eight electrons in their outermost shell.

Example - 07.

- Briefly explain why hydrogen is not a alkali metal

Answer

- Because it carries some properties similar to those of group I elements and some which are similar to those of group VII elements.

Example-08

(10)

— Give reason of the following

- Why group VII elements are called halogens?
- Why group VIII elements are called inert gas?

Answer

- Because they react with metal to form salt
- Because they do not readily react to form Compounds.

GENERAL PERIODIC TRENDS

- The trend observed includes variation in
 - (i) Melting point.
 - (ii) Boiling point.
 - (iii) Density.
 - (iv) Electronegativity.
 - (v) Atomic radius.

I. MELTING POINT

What is melting point?

- Is the temperature at which a solid melt to form liquid.

II. BOILING POINT

What is boiling point?

- Boiling point is the temperature at which a liquid boils to form gas.

III. DENSITY

What is density?

- # Density is the mass of an object per unit volume.

IV • ELECTRONEGATIVITY

(11)

What is electronegativity?

- Electronegativity is the ability of an atom to attract electrons.

V • IONIZATION ENERGY

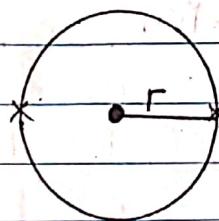
What is electronegativity?

- Ionization energy is the energy required to remove electron from an atom or ion.

VI • ATOMIC RADIUS

What is atomic radius?

- Atomic radius is the distance between the nucleus of an atom and outermost shell.



r = Atomic radius.

GENERAL GROUPS TRENDS

- The following are the general groups Trends
- (i) Atomic radius increase down the group
 - (ii) Densities increase down the group.
 - (iii) Melting point decrease down the group.
 - (iv) Electronegativity decrease down the group.
 - (v) Ionization energy decrease down the group.

MEMORY

G	A	I	D	I
Group ↓	Atomic radius	Increase	Density	Increase

TRANSITION ELEMENTS

12

- Are the elements in the block between group II and group III?

I	II	III	IV	V	VI	VII	VIII
	TRANSITION ELEMENTS						

EXAMPLES OF TRANSITION ELEMENTS

- The following are the examples of transition elements.

- (i) Manganese - Mn
 - (ii) Iron - Fe
 - (iii) Zinc - Zn
 - (iv) Silver - Ag
 - (v) Platinum - Pt
 - (vi) Gold - Au
 - (vii) Mercury - Hg

PROPERTIES OF TRANSITION ELEMENTS

- Includes
 - (i) They have high density
 - (ii) They have high melting point
 - (iii) They form Coloured Compound.
 - (iv) They form alloy and Interstitial Compounds
 - (v) They can show number of Valency (oxidation state).

(B) PERIODS

(13)

These are horizontal rows in the periodic table.

PERIODS AND NUMBER OF SHELLS OF THE FIRST 20 ELEMENTS

PERIOD	ELEMENTS	NUMBER OF SHELLS
PERIOD 1	Hydrogen, Helium	1
PERIOD 2	Lithium, Beryllium, Boron, Carbon, Oxygen, Fluorine, Neon	2
PERIOD 3	Sodium, Magnesium, Alum, Silicon, Phosphorus, Sulphur, Chlorine, Argon	3
PERIOD 4	Potassium, Calcium	4

→ Consider the periodic table below:

Period 1	H						He	
Period 2	Li	Be	B	C	N	O	F	Ne
Period 3	Na	Mg	Al	Si	P	S	Cl	Ar
Period 4	K	Ca						

• The horizontal rows ($\rightarrow 1, 2, 3, 4$) are called periods

GENERAL PERIODIC TRENDS

• The following are the trends across periods

- The atomic radius of elements in periodic table decrease from left to right.
- Electronegativity increases from left to right

- (iii) Elements to the left of periodic table shows metallic properties while elements to the right shows non-metallic properties (14)
- (iv) The number of electrons and protons increase from left to right.
- (v) The physical states of elements at room temperature (25°C) vary from solid to gss.

CLASSIFICATION OF PERIODIC TABLE

- Periodic table is classified into 5 groups
- 1. Metals
- 2. Non-metals

1. METALS

What is metals?

- Metals are the elements that ionize by losing electrons.
- Metals are found in group I and group II in the periodic table.

I	II	III	IV	V	VI	VII	He
H	Be	B	C	N	O	F	Ne
Li	Mg	Al	Si	P	S	Cl	Ar
K	Ga						

metals

Thus

- Group I = Alkali metals
- Group II = Alkaline earth metals

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EXAMPLE OF METALS

(15)

Includes

- (i) Lithium - Li
- (ii) Sodium - Na
- (iii) Potassium - K
- (iv) Beryllium - Be
- (v) Magnesium - Mg
- (vi) Calcium - Ca

PROPERTIES OF METALS

→ The following are the properties of metals

- (i) They are sonorous.
- (ii) They are good conductor of heat and electricity.
- (iii) They are malleable.
- (iv) They are ductile.
- (v) They are bright and shiny.
- (vi) They ionize by losing electrons.
- (vii) They form ionic bond.

2. NON-METALS

- Non-metals are the elements that ionize by gaining electrons.
- Non-metals are found from group III to group VII in periodic table.

Non-metals							VIII/0
H							He
	Li	Be	B	C	N	O	F
			IV	V	V	VI	
	Mg	Al	Si	P	S	Cl	Ar
	K	Ca					

Where

Group VII = Halogen's

Group VIII/0 = Noble gases

EXAMPLES OF NON-METALS

(16)

Includes

- (i) Aluminium
- (ii) Carbon
- (iii) Nitrogen
- (iv) Phosphorus
- (v) Oxygen
- (vi) Sulphur
- (vii) Chlorine
- (viii) Fluorine

PROPERTIES OF NON-METALS

- The following are the properties of non-metals:
- i) They are not sonorous.
- ii) They are poor conductor of heat and electricity.
- iii) They are not malleable.
- iv) They are not bright and shiny.
- v) They are not ductile.
- vi) They ionize by gaining electrons.
- vii) They form Covalent bond.

DIFFERENCES BETWEEN METALS AND NON-METALS

METALS

- They are ductile.
- They are sonorous.
- They are malleable.
- They form ionic bond.
- They ionize by losing electrons.
- They are bright / shiny.
- Good conductor of heat and electricity.

NON-METALS

- They are not ductile.
- They are not sonorous.
- They are not malleable.
- They form covalent bond.
- They ionize by gaining electrons.
- They are not bright / shiny.
- Poor conductor of heat and electrivity.

METALLOIDS

(17)

What is metalloids?

- Metalloids are the elements that display both metallic and non-metallic characteristics.

EXAMPLE OF METALLOIDS

→ The following are the examples of metalloids:

(i) Boron - B

(ii) Silicon - Si

(iii) Germanium - Ge

(iv) Arsenic - As

(v) Antimony - Sb

(vi) Tellurium - Te

→ Consider the table below:

I	II	III	IV	V	VI	VII	VIII
Alkali metals	Alkaline metals						
Al	Al	Transition metals					
						Halogens	Noble gases

Key



= metalloids

NoB

- The idea of arranging elements in periodic table was given by British known as JOHN NEWLANDS.

A. NEWLANDS FIRST ARRANGEMENT OF ELEMENTS

H | Li | Be | B | C | N | O | F | Na | Mg | Al | Si | P | S | Cl | K | Ga

B. NEWLAND'S OCTAVE OF ELEMENTS

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	H	Li	Be	B	C	N	O	
	F	Mg	Al	Si	P	S		
	Cl	K	Ga	Cr	Ti	Mn	Fe	

Example - Ques

- The following diagram represents the periodic table with four areas denoted 1, 2, 3, 4

1	2	3	4					

- Which area is most likely to contain non-metals?
- Which area is most likely to contain elements whose oxides dissolve in water?
- Which area contains transition elements?
- Which area is mostly likely to contain element with both metallic and non-metallic characteristics?

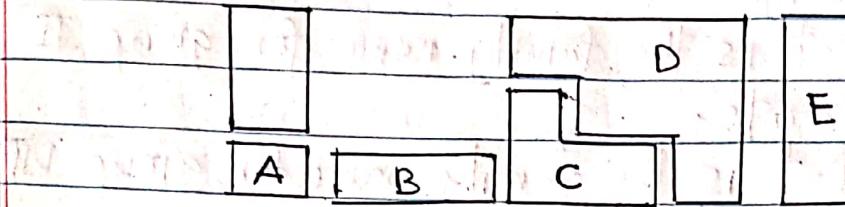
Answers

- Area 4
- Area 1
- Area 2
- Area 3

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Example-10

(19)



→ The diagram above shows part of periodic table divided into five blocks A, B, C, D, E In which block you will find -

- A metal which react violently with water forming hydrogen.
- An element which forms no Compound
- Metals which form a wide range of Coloured Compounds
- The element with the following arrangement of electrons. 2:8:2
- An element which is found in the ground as a yellow solid and whose oxide reacts with water to form an acid.

Answer

- BLOCK A.
- BLOCK E
- BLOCK B
- BLOCK A
- BLOCK D

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Example-11

- State modern periodic law
- Draw the part of periodic table representing the first twenty elements

- (c) i) What is the family name for group I elements. (20)
ii) What is the family name for group II elements.
iii) What is the family name for group VII elements.
iv) What is the family name for group VIII elements.
v) What is the family name (position) of the following in a periodic table
1. Metals
2. Non-metals
3. Metalloids.

Answer

- (a) refer to your notes (Page - 02)
(b) refer to your notes (Page - 01)
(c) i) Alkali metals
ii) Alkaline earth metals
iii) Halogens
iv) Noble gases
(v) 1. Metals are found in group I and II
2. Non-metals are found from group III to group VII.
3. Metalloids are found in group IV.

Example - 12

- (a) How does atomic radius change in periodic table.
(b) How does ionization energy change in the periodic table.

(c) How does electronegativity change in the periodic table.

(21)

Answer

(a) Atomic radius

- Increase down the group
- Decrease left to right

(b) Ionization energy

- Decrease down the group
- Increase left to right

(c) ELECTRONEGATIVITY

- Decrease down the group
- Increase left to right

Example - 13

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When referring to the modern periodic table, the transition elements are found between

- (a) Group I and II
- (b) Group I and III
- (c) Group II and III
- (d) Group III and IV

C

Example - 14

- (a) Why are certain elements in the periodic table referred to as metalloids?
- (b) Give three examples of metalloids.

Answer

- (a) Because they have both metallic and non-metallic characteristics
- (b) Boron, Silicon, Germanium

END OF TOPIC