Periodic Table – Periodic Properties & Variations Of Properties

For Objective and ICSE Board Type Questions
Questions (Solved)

2005

1. State the correct answer for changes in properties of elements on moving left to right across a period.
For each property, choose the letter corresponding to the correct answer from A, B, C and D.

1. Non-metallic character of elements
A: decreases.
B: increases
C: remains same
D: depends on period.

2. The electronegativity:
A: depends on the number of valence electrons.
B: remains the same.
C: decreases.
D: increase.

3. The ionization potential:
A: goes up and down
B: decreases
C: increases
D: remains the same.

4. Atomic size:
A: decreases.
B : increases.
C: remains the same.
D: sometimes increases or decreases.

5. The electron affinity of the elements in group 1 to 7:
A: goes up and then down.
B: decreases and then increases.
C: increases
D: decreases

2006

1. The elements of one short period of the Periodic Table are given below in order from left to right :- Li. Be, B, C, O, F, Ne

Question 1.
To which period do these elements belong. Which is the missing element and where should it be placed ?
Answer:
These elements belong to Second Period. The missing element is N (Nitrogen) and it should be placed between C and O.

Question 2.
Which element exhibits concatenation. Place the elements F, Be and N in order of increasing electro-negativity ?
Answer:
Carbon exhibits concatenation.
Elements in order of increasing electro negativity are Be, N, Fe.

Question 3.
Which one of the above elements belongs to the halogen series ?
Answer:
Fluorine (F)

2007

1. Boron, Aluminium, Gallium, Indium, Thallium are elements in the Periodic Table.
[Boron is the first member of the group and Thallium is the last.]
Answer the following questions in relation to the above group of elements:

1. Which element has the most metallic character ?
   Ans. Thallium
2. Which element would be expected to have the highest electro-negativity ?
   Ans. Boron
3. If Aluminium is 2, 8, 3 [elec. conf.], how many electrons are there in the outer shell of Thallium?
   Ans. 3
4. The atomic number of Boron is 5. Write the chemical formula of the compound formed when boron reacts with chlorine.
   Ans. BCl_3
5. Will the elements in the group to the right of this Boron group be more metallic or less metallic in character ? Justify your answer.
   Ans. The elements in the group to the right of this boron group will be non-metallic. This is because of decrease in the size of atom.

2008

Question 1.
Which of the following is generally true ?
A . Atomic size increases from left to right across a period.
B. Ionization potential increases from left to right across a period.

C. Electron affinity increases going down a group.
D. Electronegativity increases going down a group.

Question 2.

1. Name the first and last element in period 2.
   Ans.
   First element is lithium (Li) and the last element is Neon (Ne).
2. What happens to the atomic size of elements on moving from top to bottom of a group ?
   Ans.
   Atomic size increases as we move from top to bottom.
3. Which of the elements has the greatest electron affinity among the halogens.
   Ans.
   Chlorine (Cl)
4. What is the common feature of the electronic configurations of the elements in group 17[VII A],
   Ans.
   All of them have seven valence electrons.

Question 3.

1. If an element has a low ionisation energy then it is likely to be **Metallic**

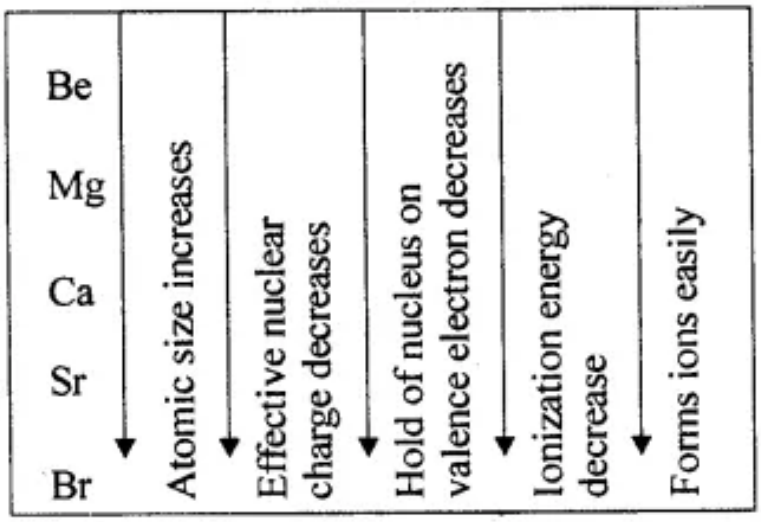
Question 4.

1. If an element has seven electrons in its outermost shell then it is likely to have the **smallest** atomic size among all the elements in the same period.

Question 5.

1. Be, Mg, Ca, Sr, Ba are group 2 metals. Which of these metals will form ions most readily and why ?
   Answer:
   Barium will form ions most readily. As we move down the group atomic size increases due to addition of new shell in every period. As a result effective nuclear charge decreases. The hold of nucleus on the valence electron also decrease which leads to decrease in ionisation energy and ions are formed

easily.



2. What property of an element is measured by electro negativity?
   Answer:
   Electronegativity of an element is its relative tendency to attract the shared pair of electrons towards itself in a covalent bond.

2009

Question 1.
Among Period-2 elements –
State the one which has high electron affinity.
(a) Lithium
(b) Carbon
(c) Fluorine
(d) Neon

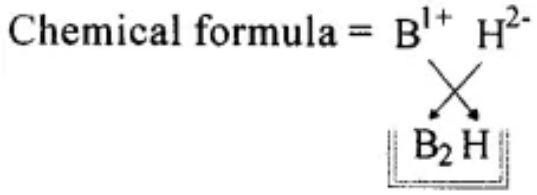
Question 2.
Group numbers

IA	IIA	IIIA	IVA	VA	VIA	VIIA	0
1	2	13	14	15	16	17	18
Li		D			O	J	Ne
A	Mg	E	Si		H	K	
B	C		F	G			L

Some elements are given above in their own symbol and position in the periodic table, while others are shown with a letter. With reference to the table:

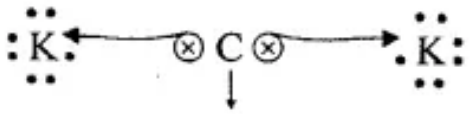
1. Which is the most electronegative ?
   Ans. J (which is fluorine) is the most electronegative element.

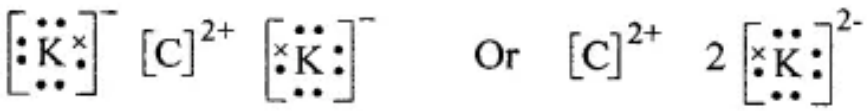
2. How many valence electrons are present in G ?
   Ans. G has group no. 15 or VA that means it will have 5 electrons in its outermost shell.
3. Write the formula of the compound between B and H.
   Ans. B has 1 valence electron so its valency will be + l. It will be represented as B^{1+}
   H has 6 valence electrons so its valency will be – 2. It will be represented as H^{2-}



4. In the compound between F and J, what type of bond will be formed ?
   Ans. Since F belongs to 14th group or IVA group. It has four valence electrons which means it will share electrons and the bond will be covalent.
5. Draw the electron dot structure for the compound formed between C and K.
   Ans. C has two valence electrons and K has seven valence electrons K needs 1 electron to complete its octet and C needs to lose 2 electrons.

Question 3.
Define the following term : Ionization potential
Answer:
Ionization potential: Ionisation action potential is the amount of energy absorbed to remove one or more electrons from the valence shell of an isolated gaseous atom.





2010

1. Select the correct answer from A, B, C and D.

Question 1(1).
The number of electrons in the valence [outermost] shell of a halogen is –
A : 1
B: 3
C:5
D : 7

Question 1(2).
Select the right answer –

Electronegativity across the period –**Increases**

Question 1(3).
Non-metallic character down the group – **Decreases**

Question 2.
Atomic number of an element is 16
State
(1) To which period it belongs.
(2) The number of valence electrons in the element
(3) is the element a metal or non-metal
Answer:

$$\text{Atomic no. (16)} \rightarrow \underset{K}{2}, \underset{L}{8}, \underset{M}{6}$$

1. 3 period (Because it has three shells)
2. 6 valence electrons (Valence electrons are present in outermost orbit)
3. Non metal (elements having 5, 6, or 7 valence electrons are non metals)

Question 3.
Define the terms:
(1) Ionisation Potential
(2) Electron affinity.
Answer:

1. **Ionization potential:** Ionisation action potential is the amount of energy absorbed to remove one or more electrons from the valence shell of an isolated gaseous atom.
   The unit of ionisation potential is **electron = eV.**
2. **Electron – Affinity:** The amount of energy released when an atom in the gaseous state accepts an electron to form an anion.
   Factors which affect in the electron – affinity:
   - Atomic size increases – Electro-affinity decreases.
   - Nuclear charge increases – Electron affinity increases.

2011

Question 1.
Give reasons – The oxidising power of elements increases from left to right along a period.
Answer:
Oxidising power means to accept electrons. As we move from left to right along a periodic table, the size of element decrease, hold of nucleus increases, incoming electron is accepted easily thus oxidising power of element increases.

Question 2.

1. Across a period, the ionization potential **increases**
2. Down the group, electron affinity **decreases**

Question 3.
Choose the correct answer from the choices given:

1. **In the periodic table alkali metals are placed in the group**
   A: 1
   B: 11
   C: 17
   D: 18
2. **Which of the following properties do not match with elements of the halogen family?**
   (a) They have seven electrons in their valence shell.
   (b) They are highly reactive chemically.
   (c) They are metallic in nature.
   (d) They are diatomic in their molecular form.

Question 4.
State the group and the period of the element having three shells with three electrons in valence shell.
Answer:
If three shells → element belongs to third period.
If three valence electrons → element belongs to 13 group.

2012

Question 1.
Select the element in period 3 whose electron affinity is zero –
(a) Neon
(B) Sulphur
(C) Sodium
(D) Argon

Question 2.
Give reasons:
(1) Ionisation potential of the element increases across a period.
(2) Alkali metals are good reducing agents.
Answer:

1. Atomic size decreases and nuclear charge increases, this makes removal of electron difficult. Hence, more energy is required to remove electron, thereby increasing electron potential.
2. They have greater tendency to loose electron which makes them good reducing agents.

Question 3.
There are three elements E, F and G with atomic numbers 19, 8 and 17 respectively.Classify the elements as metals and non-metals.
Answer:
E (Atomic number – 19): 2,8, 8, 1
F (Atomic number – 8) : 2,6

G (Atomic number – 17) : 2,8, 7
E is a metal while F and G are non-metals.

Question 4.
Name: A metal present in period 3, group 1 of the periodic table.
Answer:
As the metal belongs to 3rd period, it will have three energy levels. As it is present in Group 1, it will have one electron in the valence shell. Therefore, electronic configuration of the metal is 2, 8, 1 and atomic number = 2 + 8+1 = 11.
Hence, the metal is Sodium(Na).

2013

Question 1.
Among Period-2 elements – Lithium Carbon; Chlorine; Flourine –
State the one which has high electron affinity.
Answer:
Fluorine has highest electron affinity

Question 2.

Group	IA	IIA	IIIA	IVA	VA	VIA	VIIA	O
number	1	2	13	14	15	16	17	18
2nd period	Li		D			O	J	Ne
3rd period	A	Mg	E	Si		H	K	
4th period	R	T	I		Q	U		Y

In the above table – H does not represent hydrogen. Some elements are in their own symbol & position in the periodic table while others are shown with a letter. Identify:

1. The most electronegative element.
   Ans: J
2. The most reactive element of group 1.
   Ans: R
3. The element from period 3 with least atomic size.
   Ans: M
4. The noble gas of the fourth period.
   Ans: Y
5. How many valence electrons are present in Q ?
   Ans: 5
6. Which element from group 2 would have the least ionization energy ?
   Ans: T

7. In the compound between A and H what type of bond is formed and give its molecular formula.
   Ans: Ionic bond. Formula is A_2H.

Question 3.
Identify:The element which has the highest ionization potential.
Answer:
Helium.

2014

Question 1.

1. **Choose the correct answer from the choices given: Ionisation Potential increases over a period from left to right because the:**
   (a) Atomic radius increases and nuclear charge increases
   (b) Atomic radius and nuclear charge decreases
   (c) Atomic radius increases and nuclear charge decreases
   (d) Atomic radius decreases and nuclear charge increases.
2. **An element A belonging to Period 3 and Group II will have,**
   (a) 3 shells and 2 valence electrons
   (b) 2 shells and 3 valence electrons
   (c) 3 shells and 3 valence electrons
   (d) 2 shells and 2 valence electrons

Question 2.
Atomic number of an element Z is 16. Answer the following:
(1) State the period and group to which Z belongs.
(2) Is Z a metal or a non-metal?
(3) State the formula of the compound between Z and Hydrogen. What kind of a compound is this?
Answer:
An element Z has atomic number 16

1. Period – 3 group – 16 or VIA (as E.C. 2, 8, 6)
2. Z is a non-metal.
3. Formula between Z and hydrogen is H_2Z. The kind of compound is covalent.

Question 3.
In the activity series of metals-M is a metal above hydrogen in the in the activity series and its oxide has the formula M_z M_20 when dissolved in water forms the corresponding hydroxide which is a good conductor of electricity. In the above context answer the following:
(1) What kind of combination exists between M and O?
(2) State the number of electrons in the outermost shell of M?
(3) Name the group to which M belongs.
Answer:

1. M and O combine with electrovalent bond.
2. One
3. Group I

Question 4.
Give one words or phrase for: The amount of energy released when an atom in the gaseous state accepts an electron to form an anion.
Answer:
The amount of energy released when an atom in the gaseous state accepts an electron to form an anion → Electron Affinity.

Question 5.
Match the options A to B with the statements (1) to (2):
A metal (1) The metal that forms two types of ions
B iron (2) An element with electronic configuration 2, 8, 8,3
Answer:
A metal (2) An element with electronic configuration 2, 8, 8,3
B iron (1) The metal that forms two types of ions

2015

Question 1.
Among the elements given below, the element with the least electronegativity is:
(A) Lithium
(B) Carbon
(C) Boron
(D) Fluorine
Lithium: Lithium is an element with the least electronegativity.

Question 2.
(1) Arrange the following as per the instructions given in the brackets:
(1) Cs, Na, Li, K, Rb (increasing order of metallic character).
(2) Mg, Cl, Na, S, Si (decreasing order of atomic size).
(3) Na, K, Cl, S, Si (increasing order ionization energy)
(4) Cl, F, Br, I (increasing order of electron affinity)
Answer:

1. Li < Na < K < Rb < Cs
2. Na > Mg > Si > S > Cl
3. K < Na < Si < S < Cl .
4. I < Br < F < Cl

Question 3.
Select a covalent oxide of a metalloid from the following: SO_2, SiO_2, Al_{2O3}, MgO, CO, Na_2
Answer:
SiO_2

Question 4.
The metal of Group 2 in the periodic table from top to bottom are Be, Mg, Ca, Sr, and Ba.

1. Which one of these elements will form ions most readily. Give reasons.
2. State the common feature in the electronic configuration of all these elements given.

Answer:

1. In group 2, the atomic size increases down the group. As the atomic size increases, the nuclear charge decreases. Due to this, electrons of the outermost shell lie further away from the nucleus making the removal of electrons easy. So, Ba will form ions readily.
2. All the elements have 2 electrons in their valence shell.

2016

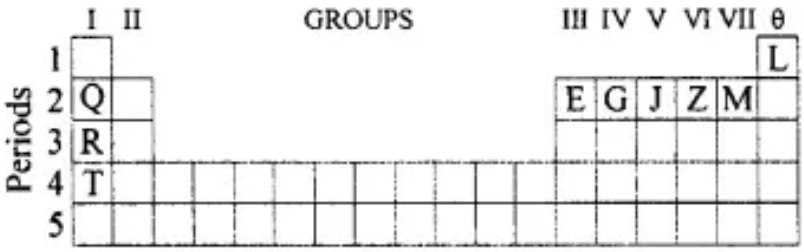
Question 1.
Select the correct answer from A, B, C and D: An element with the atomic number 19 will most likely combine chemically with the element whose atomic number is:
(A) 17
(B) 11
(C) 18
(D) 20

Question 2.
Identify the term in each of the following:
(1) The tendency of an atom to attract electrons to itself when combined in a compound.
(2) The electrons present in the outermost shell of an atom.
Answer:
(1) Electro negativity
(2) Valence electrons

Question 3.
Write the correct symbol > (greater than) or < (less than) in the statements:

1. The ionization potential of Potassium is **< (less than)** that of Sodium.
2. The electronegativity of Iodine is **< (less than)** that of Chlorine.

Question 4.
Use the letters only written in the Periodic Table given below to answer the questions that follow:



(1) State the number of valence electrons in atom J.
(2) Which element shown forms ions with a single negative charge?
(3) Which metallic element is more reactive than R?
(4) Which element has its electrons arranged in four shells?
Answer:

1. J → (5 valence electrons)
2. M→ (7 valence electrons) so it forms a uninegative ion
3. T
4. T

Question 5.
Fill in the blanks by selecting the correct word:

1. If an element has a low ionization energy then it is likely to be **metallic**
2. If an element has seven electrons in its outermost shell then it is likely to have the **smallest** atomic size among all the elements in the same period.

2017

Question 1.
Select the correct answer –

1. The energy required to remove an electron from a neutral isolated gaseous atom & convert it into a positively charged gaseous in ion is called **ionisation potential**

Question 2.
Match the atomic number 2, 4, 8, 15 & 19 with each of the following –

1. A solid non-metal belonging to the third period.
   Ans: Atomic number 15 (solid non-metal belonging to the third period)
2. A metal of valency 1.
   Ans: Atomic number 19 (metal of valency 1)
3. A gaseous element with valency 2.
   Ans: Atomic number 8 (gaseous element with valency 2)
4. An element belonging to Group 2.
   Ans: Atomic number 4 (element belonging to group 2)

Question 3.
Arrange the following as per the instruction in-the brackets –
(1) He, Ar, Ne [Increasing order of the number of electron shells].

(2) Na, Li, K [Increasing ionisation energy].
(3) F, Cl, Br [Increasing electronegativity].
(4) Na, K, Li [Increasing atomic size].

Answer:

1. He, ne, Ar (increasing number of electron shells)
2. K, Na, Li (increasing ionisation energy)
3. Br, Cl, F (increasing electronegativity)
4. Li, Na, K (increasing atomic size)

Additional Questions (Solved)

Question 1.
State the fundamental property on which the modern periodic table or long form of periodic table is based.
Answer:
Properties of the elements are periodic function of their atomic number.

Question 2.
State the important salient features of the modern periodic table. State how separation of elements and periodicity of elements forms an important feature of the modern periodic table.
Answer:
Physical and chemical properties of elements are periodic functions of their atomic number.
Salient Features of Modern Periodic Table –

1. This table has a eighteen veritcal columns **called groups or families.**
2. The groups are IA to VILA, IB to VIIB, VIII (three columns) and zero group. According to the latest recommendations of the International Union of Pure and Applied Chemistry (I.U.P.A.C.), the groups are numbered 1-18.
3. The group number is assigned to an element depending upon the number of the valence electrons.
4. Elements included in the same group of the periodic table have similar outer electronic configuration and constitute a family of chemically similar elements.

Question 3.
What are 'periods'. State the correlation of a period number with the elements of that period.
Answer:
Modem periodic table has seven horizontal rows called periods. There is a gradual change in properties with increase in atomic number in the periodic table.

Question 4.
Name the elements in correct order of their increasing atomic number present in the first, second and third short periods of the periodic table. State each

elements electronic configuration.

Answer:

(1) Elements of first period

Name of the Element	Atomic number (Z)	Electronic configuration		
		K	L	M
Hydrogen	1	1	–	–
Helium	2	2	–	–

(2) Elements of the second period

Name of the Element	Atomic number (Z)	Electronic configuration		
		K	L	M
Lithium	3	2	1	–
Beryllium	4	2	2	–
Boron	5	2	3	–
Carbon	6	2	4	–
Nitrogen	7	2	5	–
Oxygen	8	2	6	–
Fluorine	9	2	7	–
Neon	10	2	8	–

(3) Elements of the third period

Name of the Element	Atomic number (Z)	Electronic configuration		
		K	L	M
Sodium	11	2	8	1
Magnesium	12	2	8	2
Aluminium	13	2	8	3
Silicon	14	2	8	4
Phosphorus	15	2	8	5
Sulphur	16	2	8	6
Chlorine	17	2	8	7
Neon	18	2	8	8

Question 5.
Give a reason why
(a) completion of each period is logical
(b) period-2 elements are 'called bridge elements'.
Answer:
(a)
Completion of each period is logical since each period begins with Group 1 element having one electron in outermost shell and ends with Group 18 element having filled outermost shell with 8 electrons.
(b)
Li, Be, B, C are called Bridge elements because they show similarties in properties diagonally with the period of the next group.

Question 6.
State the property trends in general on moving from left to right in a period of the periodic table.
Answer:
The property trends in general on moving from left to right in a period of the periodic table are:

1. Number of valence electrons increases by one
2. Metallic character decreases while non-metallic character increases (with the exception of Noble gases).
3. Atomic radius – decreases.
4. Electron affinity – increases.
5. Electronegativity – increases (with the exception of Noble gases).
6. Ionisation potential – increases.

Question 7.
State
[1] the bonding and state of chlorides of period-3 – group 1 [IA], 15[VA], 16 [VIA] and
[2] the bonding and character of oxides of period-3 – group 1 [IA], 13[IIIA] and 16[VLA].
Answer:
(1)

Group	1	15	16
Element of Period 3	Na	P	S
Formula of Chloride	NaCl	PCl_3, PCl_5	SCl_2, S_2Cl_2
Nature of Bonding	Electrovalent	Covalent	Covalent
Physical State	Solid	Gas/Liquid	Liquid

(2)

Group	1	13	16
Element of Period 3	Na	Al	S
Formula of Chloride	Na_2O	Al_2O_3	SO_2, SO_3
Nature of Bonding	Electrovalent	Electrovalent	Covalent
Physical State	Solid	Solid	Gases

Question 8.
What are 'groups' of the Modern Periodic Table ? What does the 'group number' signify.
Answer:
There are 18 vertical columns in the Modem periodic table. These vertical columns are called Groups.It signifies the same electronic configuration and similar properties. .

Question 9.
State the type of elements present in
(a) group 1[IA]
(b) group 2 [IIA]
(c) group 3 to 12 [IB to VIIB and VIII]
(d) group 13 to 16 [HIA to VIA]
(e) group 17 [VIIA]

(f) group 18 [0].
Answer:

(a) Group-1 [IA] Alkali metals
(b) Group-2 [IIA] Alkaline Earth metals
(c) Group-3 to 12 IB to VII B to VIII – Transition elements- metals.
(d) Group 13-16 [III B to VI A] – Post Transition elements.
(e) Group 17 (VII A) Halogens.
(f) Group 18 (0) Noble gases.

Question 10.
What are transition elements and inner transition elements. State the position of the inner transition elements. State why noble gases are considered unreactive elements.
Answer:
Transition elements – Elements belonging to Group 3 to 12 are called transition elements. Transition elements consists of metals lying between strongly elctropositive metals on a left and least electropositive elements on the right. They all have similar properties.
Inner transition elements: Inner transition elements are the elements belonging to Group 3 in 6th and 7th period.
They form two series i.e. Lanthanide series and Actinide series.
They consists of two Horizontal rows of metals at the bottom of the table.
The gases of zero group (Noble gases) are unreactive because they have a stable electronic configuration.

Question 11.
State the characteristics which remain similar and those which show a transition on moving down a sub-group.
Answer:
Characteristics which remain similar on moving down a group/ sub-group are:

1. Valency of electrons.
2. Chemical properties.

Characteristics which show a transition or moving down a group are:

1. Metallic character increases down the group.
2. Number of electron shells increases down the group.
3. Atomic size increases down the group.
4. Ionisation potential decreases down the group.
5. Electron affinity decreases down the group.

Question 12.
Compare the properties of the elements of group 1[IA] i.e. alkali metals and group 17 [VTIA] , halogens.

Answer:

Properties	Group IA	Group 17 (VII A)
Elements	Lithium, sodium, potassium, rubedium, caesium.	Fluorine, chlorine, bromine, iodine, astatine.
Valency	Univalent *i.e.* 1 valence electrons.	Univalent *i.e.* 7 valence electrons.
Conductivity	Good conductors of heat & electricity.	Bad or non-conductors of heat & electricity.
Reducing/ *Oxidising Nature*	Strong Reducing agents. They are electron donors.	Strong Oxidising agents. They are electron acceptors.
Electronegativity	Low electronegativity They have Electro-positive character, which increases from Li to Cs.	High electronegativity. They have Electro-negative character, which decreases from F to I.

Question 13.
Explain the term **(a)** periodicity in properties of elements **(b)** periodic properties **(c)** periodicity of elements.
Answer:
(a) Periodicity in properties of elements means occurrence of characteristic properties at definite intervals in the modem periodic table, when elements are arranged in increasing order of their atomic number.

(b) Periodic properties: The properties which appear at regular intervals in the periodic table are called periodic properties.
Periodic Properties are:

- Atomic radii Ionisation potential
- Electron affinity Electro negativity
- Non Metallic and Metallic character.
- Density Melting and boiling points.

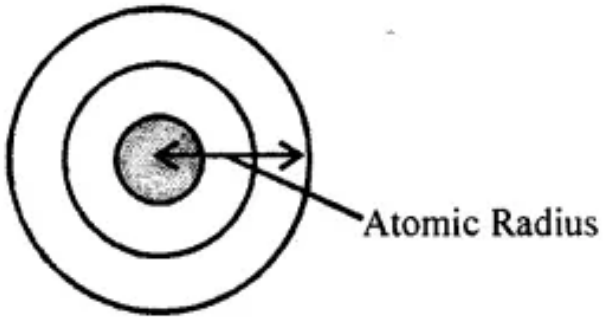
(c) Periodicity of elements: Occurrence of elements with similar chemical properties at definite intervals when elements are arranged in increasing order of

their atomic numbers is called periodicity of elements.

Question 14.
State the reasons for periodicity of elements in periods and groups.
Answer:
Reasons for Periodicity in properties in periods and groups.

1. After definite intervals of atomic number, similar valence shell electronic configuration occurs.
2. Properties of elements depend upon the number and arrangement of electrons in various shells including valence shells.
3. In the same period, sub-group, increases or decreases, in a particular property is due to gradual change in electronic configuration in the arranged elements.

Question 15.
Explain the meaning of the following periodic properties:-
[a] Atomic radius
[b] Ionisation potential
[c] Electron affinity
[d] Electronegativity
[e] Non-metallic and metallic character.
Answer:
(a) Atomic radii: It is distance between the center of the nucleus and outer-most shell of the atom.



(b) Ionisation potential (LP): It is the amount of energy required to remove an electron from the outer most shells of an isolated gaseous atom.

(c) Electron affinity: It is an amount of energy released when an atom in the gaseous state-accepts an electron to form an anion.

(d) Electro-negativity: It is the tendency of an atom to attract electrons to itself when combined in a compound.

(e) Non-metallic and Metallic character: In terms of electron loss or gain, an element is a Non-metal if it gains one or more electrons if it gains one or more electrons, and a Metal if it loses one or more electrons.

Question 16.
State the factors which affect the atomic size of elements in a periodic table. In

period 2 from left to right, state which element has the largest atomic size and which element has the smallest, giving reasons.

Answer:

Factors affecting the atomic size are:

1. **Number of shells:** As number of shells increases, atomic size i.e. the distance of the outermost shell from the nucleus also increases.
2. **Nuclear charge:** As nuclear charge increases, atomic size decreases. This is because a greater nuclear charge means a greater attraction between the nucleus and the electrons in the outermost shell.
   Lithium(Li) has the largest Atomic size and **Fluorine (F)** has the smallest Atomic size in period
   This is because on moving across a period, number of shells remains the same but the nuclear charge increases by one at each step.

Question 17.

Explain the trend in atomic radii on moving down a group, with reference to the alkali metals in Group 1 [IA].

Answer:

Atomic radii increases

<table>
<tr><th>Element</th><th>I.P. [eV]</th><th>Trends in ionis - ation potential</th><th>Down a group</th></tr>
<tr><td>Li
2, 1</td><td>5.4</td><td>Atomic Radii
-increases</td><td>-Ionisation Potential
-Decreases</td></tr>
<tr><td>Na
2, 8, 1</td><td>5.1</td><td>(no. of shells increases)</td><td></td></tr>
<tr><td>K
2, 8, 8, 1</td><td>4.3</td><td>Nuclear charge
-increases</td><td>-Ionisation Potential
-should increase</td></tr>
<tr><td>Rb
2, 8, 18, 8, 1</td><td>4.2</td><td colspan="2" rowspan="3">-increase in atomic radii-Dominates over
∴ Overall ionisation potential - Decreases</td></tr>
<tr><td>Cs
2,8,18,18,8,1</td><td>3.9</td></tr>
</table>

Question 18.

State the factors which influence or affect the ionisation potential of elements in a periodic table.

Answer:

The factors which influence the ionisation potential of an element are:

1. As Atomic size increases ionisation potential decreases.
2. As Nuclear charge increases ionisation potential increases.

Question 19.
Explain the trend in general of ionisation potential of elements
(1) on moving from left to right across a period
(2) on moving down a group.
Give reasons for the change in the periodic trend in each case.
Answer:
(a) Ionisation potential increases across a period left to rig**ht.**
Reason:
The nuclear charge increases –
The nuclear attraction on the outer electrons increases.
Hence the outer electrons are more firmly held.
∴ Ionisation potential increases.

(b) Ionisation potential decreased down group.
Reason: Atomic size increases
The nuclear attraction on the outer electrons decreases.
Hence the outer electrons are loosely held.
∴Ionisation potential decreases.

Question 20.
State the factors which affect **(a)** electron affinity **(b)** electronegativity of elements in a periodic table.
Answer:
(a) Electron affinity is the tendency of an atom to accept electrons.
The Factors affecting the electron affinity are:

- **Atomic size:** As the atomic size increases electron affinity decreases.
  Reason: A small atom takes up electrons more easily than a large atom since nucleus has greater attraction on the nucleus.

- **Nuclear charge:** As the nuclear charge increases electron affinity increases.
  Reason: More the nuclear charge, more is the tendency of an atom to accept electrons.

(b) Electronegativity is the tendency of an atom to pull the shared pair of electrons towards itself in a covalent compound.
The factors affecting electronegativity an element are:

- **Atomic size:** More the atomic size less is the electronegativity.
  Reason: A small atom will pull the shared pair of electrons more than a large atom.
- **Nuclear charge:** More the nuclear charge, more is the electronegativity.
  Reason: A greater nuclear charge means more attraction on the shared pair of electrons.

Question 21.
Explain the trend in general of

(1) electronaffinity
(2) electronegativity of elements

- on moving from left to right across a period;
- on moving down a group. Give reasons for the change in each periodic trend.

Answer:
(1) General variations of electron affinity in the Periodic table:
Electron affinity, in general, increases with increase in nuclear charge and decreases with increase in atomic size.

- **Variations in a Period:** On moving across a period from left to right, atomic size decreases while nuclear charge increases. Both of these factors increase the electron affinity. Thus electron affinity, in general, increases from left to right on moving across a period in the period table.
- **Variation in a Group:** On moving down a group from top to bottom, both atomic size and nuclear charge increase. However, the effect of increase in atomic size dominates over the effects of increase in nuclear charge. Thus, electron affinity, in general, decreases from top to bottom on moving down a group in the periodic table.

(2) General variations of electronegativity in the periodic table:
Electronegativity increases with increase in nuclear charge and decreases with increase in atomic size.

- **Variations in a Period :** On moving across a period from left to right atomic size decreases while nuclear charge increases. Both of these factors increase the electronegativity. Thus electronegativity, in general, increases from left to right on moving across a period in the periodic table.
- **Variations in a Group:** On moving down a group from top to bottom both atomic size and nuclear charge increase. However, the effect of increase in atomic size dominates over the effect of increase in nuclear charge. Thus electronegativity, in general, decreases from top to bottom on moving down a group in the periodic table.

Question 22.
With reference to the alkali metals in Group 1 [IA] and the halogens in 17 [VIIA] explain the trend in ionisation potential, electron affinity and electronegativity on moving down the groups in the periodic table.
Answer:
(1) Trends in periodic properties (Group 1)

Group 1 elements are Li (At. no. = 3), Na (At. no. = 11), K(At. no. = 19), Rb(At. no. = 37),
Cs (At. no. = 55).

(a) Trend in ionisation potential: On moving down the group, ionisation potential decreases, i. e., ionisation potential decreases in the order: Li > Na > K

> Rb > Cs.
Reason: On moving down the group, atomic size, as well as, nuclear charge increases.
However, the effect of increase in atomic size dominates over the effect of increase in nuclear charge. As such ionisation potential decreases down the group.

(b) Trend in electron affinity: On moving down the group, electron affinity decreases, e., electron affinity decreases in the order:
Li > Na > K > Rb > Cs.
Reason: Same as that in ionisation potential.

(c) Trend in electronegativity: On moving down the group, electronegativity decreases, e., electronegativity decreases in the order : Li > Na > K > Rb > Cs.
Reason: Same as that in ionisation potential.

(2) Trends in periodic properties (Group 17): Group 17 elements are F (At. no. = 9), Cl (At. no. = 17), Br (At. no. = 35) and I (At. no. = 53).

(a) Trend in Ionisation potential: On moving down the group ionisation potential decreases, e. ionisation potential decreases in the order : F > Cl > Br > I.
Reason: On moving down the group, atomic size number of shells as well as nuclear charge increase. However, the effect of increase in atomic size dominates over the effect of increase in nuclear charge. As such ionisation potential decreases down the group.

(b) Trend in electron affinity: On moving down the group, electron affinity, in general, decreases. However, the actual order of change in electron affinity is : F < Cl > Br > I. Reason : Same as in case of ionisation potential.

(c) Trend in electronegativity: On moving down the group, electronegativity decreases, e., electronegativity decreases in the order: F > Cl > Br > I.
Reason: Same as in case of ionisation potential

Question 23.
State the factors which affect the metallic and the non- metallic character of elements in a periodic table.
Answer:
Factors affecting metallic/non-metallic character in a periodic table:
(1) When atomic size increases, metallic character increases
(2) When ionisation potential increases, non-metallic character increases.

Question 24.
Explain the trends from metallic to non-metallic character of the different elements the first three periods.
Answer:
The ease with which an element loses one or more of its electrons is called its metallic or electropositive character. On the other hand, the ease with which an

element gains one or more electrons is called its non-metallic or electronegative character. It mainly depends upon atomic size and ionisation potential.

Trends in metallic/non-metallic character in the first three periods.

- Atomic radii – decreases
  Metallic character – Decreases
  Non metallic character – Increases

- Ionisation potential – Increases
  Metallic character – decreases
  Non-metallic character – increases

Question 25.
Explain with reasons the trends in metallic and non- metallic character down a group.
Answer:
The ease with which an element loses one or more of its electrons is called its metallic character. On the other hand, the ease with which an element gains one or more electrons is called its non-metallic character. It mainly depends upon atomic size and ionisation potential. More the atomic size and lesser the ionisation potential, more is the metallic character. However, the reverse is true for non-metallic character of an element. In a group atomic size increases while ionisation potential decreases as we move down a group. Thus, down a group metallic character increases while non-metallic character decreases. For example, the first five elements of Group 14 are C (At. No. = 6), Si (At. No. = 14), Ge (At. No. = 32), Sn (At. No. = 50) and Pb (At. No. = 68).
Out of these C (At. No. = 6) is a non-metal, Si (At. No. = 14) and Ge (At. No. = 32) are metalloids while Sn (At. No. = 50) —and Pb (At. No. = 68) are metals.

Question 26.
State how density and melting points of elements varies across a period and down a group.
Answer:
Density, in general, increases with increase in atomic number. As such density increases as we move down a group from top to bottom.
Trend in melting point is different for metals and non-metals as is clear from the change in melting point in Group I or Group 2 (groups which contain only metals), and Group 17 or Group 18 (groups which contain only non-metals). In groups which contain . only metals, m.p. decreases down the group while in groups which contain only non-metals, m.p. increases down the group. Thus in group I, m.p. is in the order ; Li > Na > K > Rb > Cs while in Group 17, m.p. is in the order: $F_2 > Cl_2 < Br_2 < I_2$

Question 27.
State the general trend in periodicity in properties of oxides, hydroxides, oxy-acids and hydrides of compounds of elements across a period and down a group.
Answer:

Oxides, hydroxides and oxy-acids:
Metals form basic oxides. If these oxides are soluble in water, they form metal hydroxides (alkalies). Metalloids form amphoteric oxides, which show both acidic and basic character : Non-metals generally form acidic oxides. These oxides, when dissolved in water, form oxy-acids.

Variations in a Period:
On moving from left to right in a Period, metallic character decreases while non-metallic character increases. Thus elements of Group 1, 2 and 13 form basic oxides and their basic character decreases along the period. Elements of Group 14, 15, 16 and 17 generally form acidic oxides. The acidic character of these oxides increases along the Period. For example, acidic/basic character of oxides **elements of period 3 is as follows:**

Group 1	Group 2	Group 13
Na_2O, NaOH	MgO, $Mg(OH)_2$	Al_2O_3, $Al(OH)_3$

Most basic $\xrightarrow{\text{Basic character decreases}}$ Least basic/Amphoteric

Group 14	Group 15	Group 16	Group 17
SiH_4	PH_3	H_2S	HCl

Neutral — Weakly acidic $\xrightarrow[\text{increases}]{\text{Acidic character}}$ Strongly acidic

Elements of group 18 do not form oxides.

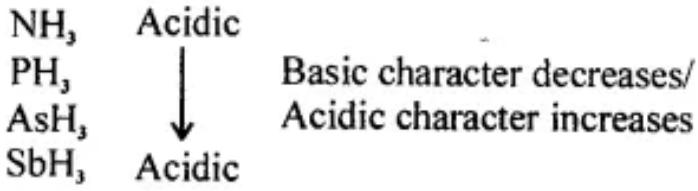
Variation in a Group:
On moving down a Group, metallic character increases while non-metallic character decreases. Thus, on moving down the group basic nature of oxides and hydroxides increases (for Group 1,2 and 13), while acidic nature of oxides and oxy-acids generally decreases (for Group 14,15,16 and 17).
For example, in Group 2, $Ba(OH)_2$ is a much stronger base than $Mg(OH)_2$, while in Group 15, H, PO_4 is a much weaker acid than HNO_3.

Hydrides:
Metals of Group 1, 2 and 13 form ionic hydrides which are strong reducing agents. Non-metals of Group 14 to 17 form covalent hydrides which can be acidic, basic or neutral.
Along a period, the acidic character of these hydrides increases.
For example, in 3rd period.

Group 14	Group 15	Group 16	Group 17
SiH_4	PH_3	H_2S	HCl

Neutral — Weakly acidic $\xrightarrow[\text{increases}]{\text{Acidic character}}$ Strongly acidic

Down the group, the basic nature of these hydrides decreases while acidic nature increases.
For example in Group 15,



Question 28.
State the relation between atomic number and atomic mass for light State which elements are considered radioactive giving reasons.
Answer:
For light elements,
Atomic mass = 2 x Atomic number
In other words, for light elements
Number of neutrons (n) = Number of protons (p)
Thus for light elements, nip 1
For example, in $_{10}Ne^{20}$, /? = 10 ; « = 20 -10=10. Thus nip = 10/10=1
For heavier elements, nip > 1. For example, in $_{17}CI^{37}$, p ~ 17 and n = 37- 17 = 20
Thus, nip = 20/17 = 1.176
If nip > 1.5, the nucleus of the elements becomes unstable and the element becomes radioactive. For example, in radioactive $_{92}U^{235}$, p = 92 and n = 235 – 92 = 143.
Thus, ntp= 143/92= 1.554.

Question 29.
Answer the following :-
(a) Name or state the following with reference to the elements of the modern periodic table.

1. The alkali metal in period 2 and the halogen in period 3.
Ans. Lithium, chlorine.

2. The noble gas having duplet arrangement of electrons.
Ans. He

3. The noble gas having an electronic configuration 2, 8, 8.
Ans. Ar

4. The number of electron shells in elements of period 3.
Ans. 3

5. The valency of elements in group 1[IA].
Ans. one

6. The metals present in period 3 and the non-metals present in period 2.
Ans.
Metals present in period 3 are Na, Mg and Al.
Non-metals present in period 2 are C, N, O and F.

7. The group whose elements have zero valency.
Ans. Inert gases i.e. Group 18

8. The non-metal in period 3 having a valency 1.
Ans. Cl

9. The formula of the hydroxide of the element having electronic configuration 2, 8, 2.
Ans. $Mg(OH)_2$

10. The formula of the hydride of the halogen in period 3.
Ans. HCl

11. The formula of the sulphite of the element in period-3, group 1 [IA].
Ans. Na_2S0_3

12. The element in period-3 which does not form an oxide.
Ans. Argon

13. The bonding [i.e. electrovalent or covalent] of the oxide of the element in period-3 group 16 [VIA].
Ans. Covalent

14. The character of the hydroxide of the element in period- 3 group 13 [IIIA].
Ans. Amphoteric

15. A light element in period-3 with a neutron/proton ratio around 1.
Ans.
Magnesium (Mg), Since the atomic mass of Mg is 24.305.
And it has 12 protons and 12.305 neutrons.
N/p ratio = 1.02 (which is nearest to 1)

16. The element with the least atomic size from carbon, nitrogen, boron and beryllium.
Ans. Nitrogen

17. The element, from the elements Li, Na, K, having the least number of electron shells.
Ans. Li

18. The element from the elements C, O, N, F, having the maximum nuclear charge.
Ans. F.

19. The element from the elements Be and Mg having a lower nuclear charge.
Ans. Be

20. The element from the elements fluorine and neon having a higher electron affinity.
Ans. F

21. The period and group to which the element 'X' with electronic configuration 2, 8, 8, 2 belongs.
Ans. Group 2, period 4

22. The more electronegative element from the elements Ar, S, Cl of period-3.
Ans. Cl

23. The element with the largest atomic size from the elements of period-1, 2 and 3.
Ans. Sodium (Na)

24. The element with the highest ionisation potential from the elements of period 1, 2 and 3.
Ans. Helium (He)

25. The element from the elements Li, Na, K which has maximum metallic character.
Ans. Potassium

26. The element with maximum non-metallic character from the elements of period-2.
Ans. Sulphur

27. The more non-metallic element from the elements S, P, Cl and Ar.
Ans. Cl (Chlorine)

28. The more non-metallic element from the elements 'X' and 'Y' having elec, config. 2,8,5 and 2, 8,6 respectively.
Ans. 'Y' 2, 8,6

29. The periodic property which relates to the amount of energy required to remove an electron from the outermost shell of an isolated gaseous atom.
Ans. Ionisation potential

30. The periodic property which refers to the character of element, which loses electron/s when supplied with energy.
Ans. Metallic property.

(b) Fill in the blanks with the appropriate word/s in each case.

1. Periods are **long** [5, 6, 7] horizontal rows of elements in the periodic table and an element with three electron shells and two electrons in its valence shell belongs to period **3** [6, 3, 1] and group **2** [3, 6, 2].

2. Across a period the valence electrons **increase by 1** while down a subgroup they **remain same**
3. Across a period, the electropositive character **decreases** and down a group the electronegative character **decreases.**
4. Elements at the extreme left of the modem periodic table are **most** reactive, while elements on the extreme right [group 18 (0)] are **un** reactive.
5. Elements of group 1 [IA] are strong **reducing** [oxidising / reducing] agents since they are electron **donors** [acceptors/ donors].
6. The element in group 17 [VILA] which is a liquid at room temperature is **Br** [F, Cl, Br, I],
7. Periodicity in properties is observed in elements after definite intervals due to similar **Number ofValence electrons** [electronic configuration, number of valence electrons, atomic numbers] of elements.
8. Across a period the nature of oxides and hydrides varies from **basic** to **acidic** while the strength of oxy-acids **increases** from left to right.
9. Nuclear charge of an atom is the **positive** charge on the nucleus of an atom, equivalent to the atomic **number** of an atom.
10. Atomic size of neon is **more** than the atomic size of fluorine.
11. Atomic size across a period **decreases** with increase in nuclear charge of the element. .
12. Ans. With increase in nuclear charge the nuclear attraction for outer electrons **increases,** hence ionisation potential **increases.**
13. Increase in nuclear charge of an atom **decreases** the tendency of the atom to lose electrons.
14. Elements with stable electronic configuration e.g. neon have an electron affinity value of **0.**
15. An atom with a small atomic radii takes up electrons **more** readily than an atom with a large radii.
16. If combining atoms of a compound have nearly similar electronegativities the bond between them is **covalent.**
17. Elements with low electronegativity are usually **metallic.**
18. An atom is said to be a non-metal, if it **gains** one or more electrons.
19. Atoms with **small** atomic radii and **high** ionisation potential tend to gain electrons.
20. Element 'X' in period 3 has high electron affinity and electronegativity. It is likely to be a **non-metal.**
21. Element 'B' is likely to be **more** non-metallic in character than element'A'.
22. Element 'Z' in sub-group 2[IIA] is below element 'Y' in the same sub-group. The element 'Z' will be expected to have higher atomic size and **more** metallic character than 'Y'
23. Argon in period 3 is likely to have a **larger** atomic size than chlorine and its electron affinity value would be **zero** compared to chlorine.
24. Across a period- Atomic size and metallic character **decreases** while I.P., E.A., E.N. and non-metallic character **increases** and nuclear charge **increases**. Down a group-Atomic size and metallic

character **increases** while I.P., E.A., E.N. and non- metallic character **decreases** and nuclear charge increases.

(c) Give reasons for the following:

Question 1.
In the same period or subgroup a gradual change in a particular property may be seen.
Answer:
In the same period or sub group a gradual change in particular property is due to the gradual change in electronic configuration in the arranged elements.

Question 2.
Atomic size of group 18 [0 group] elements is more than the atomic size of group 17 [VTIA] elements.
Answer:
In group 18 [0 group] inert gases, the outermost shell is completely filled resulting in force of repulsion increasing in atomic radii.

Question 3.
Ionisation potential increases with increase in nuclear charge of the elements.
Answer:
With increase in nuclear charge the nuclear attraction on the outer electrons increases. Hence the outer electrons are tightly held resulting in an increase in ionisation potential.

Question 4.
Electron affinity of noble gas elements is zero.
Answer:
Noble gas elements have completely filled outer-shell. Such electronic configurations are highly stable and as such noble gases find it difficult to accept electrons. Thus electron affinity of noble gas elements is zero.

Question 5.
Phosphorus, sulphur and chlorine are electronegative elements of the periodic table.
Answer:
The three non-metallic elements P, S and Cl are present at the end of period 3 in the modern periodic table. Along a period nuclear charge increases while atomic size decreases. Both of these factors increase the electronegativity. Thus these elements have highest electronegativity.

Question 6.
Sulphur is placed in group 16 [VIA], chlorine in group 17[VIIA] but argon in group 18 [0 group] of the pericdic table.
Answer:

Electronic configurations of S, Cl and Ar are:

	K,	L,	M
S (At, No. = 16) :	2,	8,	6
Cl (At. No. = 17) :	2,	8,	7
Ar (At. No. = 18) :	2,	8,	8

With 6 electrons in the outermost or valence shell, S is placed in Group 16. In the same way Cl with 7 electrons in the valence shell is placed in Group 17 and Ar with 8 electrons in the valence shell is placed in Group 18.

Question 7.
Fluorine is the most electronegative element of the periodic table.
Answer:
Except for noble gases, electronegativity increases along a period from left to right and decreases down a group from top to bottom. Therefore, fluorine present at the upper right hand comer of the modem long form of the periodic table has highest electronegativity.

Question 8.
Atoms with large atomic radii and low ionisation potential are more metallic in nature.
Answer:
Metals are electropositive in nature i.e., they can lose one or more electrons easily. Atoms with large atomic radii and low ionisation potential can easily lose one or more electrons as the nuclear pull on the outer electrons is less. As such, these atoms are more metallic in nature.

Question 9.
A decrease in ionisation potential of an element leads to a decrease in non-metallic character of the element.
Answer:
Due to decrease in ionisation potential tendency to lose electrons increases. This results in an increase in metallic character and a corresponding decrease in non-metallic character. Thus elements with lower ionisation potential are less non-metallic in nature.

Question 10.
Atomic size decreases across a period but increases down a group of the periodic table.
Answer:
As we move along a period from left to right in the periodic table, number of shells remains the same while nuclear charge increases by one at each step. Due to increase in nuclear charge electrons in the outermost shell are attracted with increasing force resulting in a gradual decrease in atomic size along a period.
As we move down a group from top to broom, number of shells as well as nuclear charge increases. However, this effect of increase in the number of shells

dominates over increase in nuclear charge. As such, atomic size increases down a group in the periodic table.

Unit Test Paper I-Periodic Table

1. In period 2, element 'A' is to the right of element 'B'

1. The element 'A' would probably have a **smaller** atomic size than 'B'
2. The element 'B' would probably have lower ionisation potential than 'A'.
3. The element 'A' would have **higher** electron affinity than 'B'.
4. Nuclear charge of element 'B' would be **less** than element 'A'.
5. If an element 'C' had a low electronegativity and ionisation potential it would have more tendency to**lose** electrons.

2. With reference to period 3 of the periodic table – State:

1. The type of bonding of the element with electronic configuration 2, 8, 7.
   Ans. With metals, it will form ionic bond and with non-metal, it will form covalent bond.
2. The formula of the chloride of the element with electronic configuration 2, 8, 4.
   Ans. Si Cl,
3. The nature of the oxide of the alkaline earth metal in the period.
   Ans. Strongly basic
4. The number of electrons in the penultimate shell of the element with valency – 1.
   Ans. Number of electrons in the penultimate with configuration 2,8,
5. The electronic configuration of the element whose hydroxide is a weak base.
   Ans. Magnesium hydroxide [Mg (OH),] 2, 8, 2

3. With reference to group 1[IA] of the periodic table – fill in the blanks with the correct word:

1. The elements are **light metals** since their atomic size is **large.** The energy binding the atoms is **low**and hence the elements have **low** melting points. The melting points of the elements **increases [**increases/decreases] down the subgroup. The electropositive character **increases** down the subgroup and the elements are strong **reducing** agents. The elements with electronic configuration 2,8,1 will have **lower** electron affinity and **larger** atomic size than the element with electronic configuration 2,1.

4. Match the elements in column 'X' with the correct group they belong from column 'Y'

'X'	'Y'
1. Element with atomic number 19	A : Group 18 [0 group]
2. Element with electronic	B : Group 16 [VIA]

configuration 2	
3. Element with a valency of -2	**C : Group 1 [IA]**
4. Element 'P' which loses 3 electrons to form cation	**D : Group 17 [VIIA]**
5. Element 'Q' in period - 3 which has the highest electron affinity.	**E : Group 13 [III A]**

Answer:

1. Element with At No. 19	(C) Group 1(IA)
2. Element with electronic Configuration 2	(A) Group 18 (0 group)
3. Element with valency of-2	(B) Group 16 (VI A)
4. Element 'P' which loses 3 electrons to form a cation.	(E) Group 13 (III A)
5. Element Q in period - 3 which has the highest electron affinity.	(D) 17 (VII A)

5. Give reasons for the following:

Question 1.
Occurrence of characteristic properties of elements takes place at definite intervals in the modern periodic table.
Answer:
This is due to recurrence of similar valence shell electronic configuration after a difference of 2, 8, 18 or 32 in atomic numbers.

Question 2.
Properties of elements are periodic functions of their atomic numbers and not atomic weights.
Answer:
Atomic number of an element is equal to the number of protons (or electrons in case of a neutral atom). Physical and chemical properties of elements depend on the number of electrons and their arrangement. Thus, properties of elements are periodic function of their atomic numbers and not atomic weights.,

Question 3.
Atomic size of an elements depends on the nuclear charge of that element.

Answer:
If there is no change in the number of shells (i.e., in a period), atomic size depends upon nuclear charge. More the nuclear charge, smaller is the atom.

Question 4.
Down a group ejectronegativity should increase with increase in nuclear charge but it is seen that the electronegativity decreases.
Answer:
Down a group, nuclear charge as well as number of shells increase. Due to increase in nuclear charge electronegativity should increase. On the other hand, due to increase in number of shells, electronegativity should decrease. However, the effect of increase in number of shells dominates over increase in nuclear charge. As such, on moving down a group, electronegativity decreases.

Question 5.
If combining atoms have nearly similar electronegativities the bond between them is covalent.
Answer:
If two combining atoms differ in their electronegativities then the atom with lower electronegativity gives electron (or electrons) while the atom with higher electronegativity accepts these electrons resulting in the formation of ionic bond. On the other hand, if two combining atoms have almost similar electronegativities then such transference of electrons cannot take place. In such a case covalent bond is formed by mutual contribution and mutual sharing of electrons.

Question 6.
Arrange the following elements as per the guidelines in brackets.
(1) Na,Cl; Mg, P [in decreasing order of atomic size]
(2) C,Li,F,N [in increasing order of electronegativity] [in increasing order of ionisation potential]
(3) Cl,Al.Na,S [in increasing order of electron affinity]
(4) Ar,He,Ne [in increasing order of number of electron shells]
Answer:

1. Na, Mg, P, Cl
2. Li, C, N, F
3. Na, Al, S, Cl
4. F, O, C, Li
5. He, Ne, Ar