Chapter 3

Classification of Elements and Periodicity in Properties

Solutions

SECTION - A

Objective Type Questions (One option is correct)

1. Which of the following has the largest size in aqueous medium?

   (1) Li^+ (2) Na^+ (3) Cs^+ (4) K^+

Sol. Answer (1)

Li^+ due to high hydration energy.

2. Which of the following has the largest ionisation energy?

   (1) Zn (2) Sc (3) Cd (4) Hg

Sol. Answer (4)

Hg ; 1007 kJ/mole

3. *s* orbital is more penetrating because

   (1) Probability of finding electron is maximum on the surface of nucleus

   (2) *s* orbital is non-directional

   (3) *s* orbital is spherical in shape

   (4) All of these

Sol. Answer (1)

Fact

4. Cs metal imparts colour to the flame because

   (1) Cs has low ionisation energy

   (2) Cs is a soft metal

   (3) Cs has low density

   (4) Cs has large size

Sol. Answer (1)

Due to low ionization energy.

5. In which compound Mn has highest electronegativity?

(1) MnO (2) Mn_3O_4 (3) MnO_2 (4) Mn_2O_5

Sol. Answer (4)

Higher will be oxidation state higher will be electronegative.

6. The correct pair regarding property given in bracket is

(1) $F_2 > Cl_2$ (Oxidising character)

(2) F > Cl (Electron affinity)

(3) F < Cl (Electronegativity)

(4) O > N (Ionisation energy)

Sol. Answer (1)

F_2 is stronger oxidizing agent.

7. The oxide which has highest acidic character is

(1) MnO (2) MnO_2

(3) Mn_2O_3 (4) Equal in all of these

Sol. Answer (2)

MnO_2

8. Choose the correct statement.

(1) Isotopes have nearly same chemical properties

(2) Isoelectronic species may be neutral

(3) Na and K have nearly same $Z_{effective}$

(4) All of these

Sol. Answer (4)

Fact

9. Maximum number of electrons in n^{th} shell is

(1) n^2 (2) $2(l + 1)$ (3) $2n^2$ (4) $(l + 1)^2$

Sol. Answer (3)

10. Choose the correct regarding electronegativity.

(1) B > Al > Ga > In (2) B > Al = Ga = In

(3) B > In > Ga = Al (4) B > In > Ga > Al

Sol. Answer (4)

B > Tl > In > Ga > Al

B = 2.0

Al = 1.5

Ga = 1.6

In = 1.7

Tl = 1.8

11. Long form of periodic table is the most acceptable arrangement of elements. Some statements are given below, select the statement which are not accurate w.r.t. modern periodic table.

(1) Period of an element is decided by the maximum principal quantum number.

(2) Azimuthal quantum number of subshell for last filling electron indicates the block of element.

(3) Group number of all elements can be calculated by sum of electrons in subshells having maximum principal quantum number

(4) Total groups in d-block are 10 because maximum ten electrons can be occupied by d-subshell.

Sol. Answer (3)

12. An atom gain electron in gaseous state to form anion. Which of the following gaseous anion is smallest in size?

(1) F^- (2) H^- (3) Cl^- (4) N^{3-}

Sol. Answer (1)

13. Select the statement which is not correct about an element having atomic number 43.

(1) The element belongs to the 5^{th} period and 7^{th} group

(2) The element belongs to *d*-block

(3) The element is non-radioactive in nature

(4) Mendeleev called this element as eka–manganese

Sol. Answer (3)

Element is Tc (Technetium) which is radioactive in nature.

14. Select the correct order of radius.

(1) Sc > Ti > V > Zn (2) Ra < Uus

(3) Ga < Al < In < Tl (4) $Fe^{2+} < Fe^{3+}$

Sol. Answer (3)

Al > Ga < In < Tl

15. Which of the following is an exothermic step?

(1) $O^-(g) + e^- \rightarrow O^{2-}(g)$ (2) $N(g) + e^- \rightarrow N^-(g)$

(3) $Na(g) + e^- \rightarrow Na^-(g)$ (4) $Na(g) \rightarrow Na^+(g) + e^-$

Sol. Answer (3)

Exothermic Step : $Na(g) + e^- \rightarrow Na^-(g)$

16. Which of the following element has second ionisation energy less than that of second ionisation energy of aluminium?

(1) Chlorine (2) Silicon (3) Sulphur (4) Phosphorus

Sol. Answer (2)

After losing one electron

Al^+ – [Ne] $3s^2$

Si^+ – [Ne] $3s^2\ 3p^1$

17. The atomic number of some elements are given. Mark an element that belongs to d-block and have maximum 24 electrons with same spin.

(1) 38 (2) 41

(3) 47 (4) 51

Sol. Answer (3)

$_{47}Ag = 1s^2 2s^2\ 2p^6\ 3s^2 3p^6\ 4s^2 3d^{10} 4p^6\ 5s^1 4d^{10}$

SECTION - B

Objective Type Questions (More than one options are correct)

1. Which of the following sequence contains atomic number of only representative elements?

(1) 55, 12, 48, 53 (2) 13, 33, 54, 83 (3) 3, 33, 53, 87 (4) 22, 33, 55, 66

Sol. Answer (2, 3)

The *p* block elements comprise those belonging to group 13 to 18 and these together with *s* block elements are called the representative or main group elements

Set 1

55	Cs	*s* block
12	Mg	*s* block
48	Cd	*d* block
53	I	*p* block

Set 2

13	Al	*p* block
33	As	*p* block
54	Xe	noble gas – *p* block
83	Bi	*p* block

Set 3

3	B	*p* block
33	As	*p* block
53	I	*p* block
87	Fr	*s* block

Set 4

22	Ti	*d* block
33	As	*p* block
55	Cs	*s* block
66	Dy	*f* block

All elements of Set 2, 3 only belongs to either *s* or *p* block, hence these sets belong to representative elements.

2. The elements which belong to *p*-block is/are

(1) Fe (2) Ga (3) Na (4) I

Sol. Answer (2, 4)

Ga and iodine belong to *p* block.

3. Choose the correct statement/statements regarding Modern periodic table.

(1) Actinoids are placed in main body of periodic table

(2) Chemical properties are periodic function of atomic number

(3) In periodic table, 18 groups are present

(4) 7th period is incomplete

Sol. Answer (2, 3, 4)

Actinoids are placed separately.

4. Which of the following pairs contain metalloids?

(1) Si, Ge (2) As, Te (3) I, Sb (4) In, Tl

Sol. Answer (1, 2)

Si, Ge, As, Sb, Te are metalloids.

5. Which of the following elements belongs to 16th group?

(1) Se (2) Te (3) Ra (4) Cr

Sol. Answer (1, 2)

O, S, Se, Te and Po are the elements of 16th group.

6. The correct statement about *d* block element is/are

(1) They are all metals (2) They show variable valency

(3) All these elements have full (n – 1) d subshell (4) They have strong tendency to gain electron

Sol. Answer (1, 2)

For d-block element

* All are metals.
* *d* block elements show variable valency.

7. Choose the correct statement(s)

(1) Cu, Ag, Au are known as coinage metals (2) Ce, Gd, U are Lanthanoids

(3) H is placed in 1st group (4) N has lower first ionization energy, than F

Sol. Answer (1, 3, 4)

Cu, Ag, Au are coinage metals. U is not a lanthanoid. IP_1 of N is greater than O but less than F.

8. Choose the correct statement(s).

(1) [Ar] $3d^{10}\ 4s^2\ 4p^6$ element is a noble gas (2) [Ar] $3d^5\ 4s^1$ element belongs to *s* block

(3) $1s^2$ element belongs to *f* block (4) [Xe] $4f^1\ 5d^1\ 6s^2$ element belongs to *f* block

Sol. Answer (1, 4)

[Ar] $3d^{10}\ 4s^2\ 4p^6$ is Kr (36) which is a noble gas element [Ar] $3d^5\ 4s^1$ is Cr(24) which is a *d* block element.

[Xe] $4f^1\ 5d^1\ 6s^2$ has atomic number 58 which is Ce (58) a lanthanoid belonging to *f* block.

9. Which of the following is/are correct order in accordance of electropositive nature of metal?

(1) Fe < Mg < Cu (2) Na > Mg > Al (3) Mg < Ca < Sr (4) Fe > Cu > Zn

Sol. Answer (2, 3, 4)

IA IIA IIIA

Na Mg Al

In a period electropositive (metallic) character decreases.

IIA

Mg

Ca

Sr

Going top to bottom in a group, size increases, hence electropositive (metallic) character also increases.

Fe forms more +ve ions like Fe^{+2} and Fe^{+3} while Cu can form only Cu^{+} and Cu^{+2} and Zn can form only Zn^{+2}.

10. Which of the following elements have same $Z_{effective}$?

(1) Na (2) Li (3) K (4) Rb

Sol. Answer (1, 3, 4)

11. Which of the following is/are correct pair regarding size?

(1) Zn > Cu (2) N > O (3) Al > Ca (4) B > C

Sol. Answer (1, 2, 4)

Zn has larger size than Cu.

Covalent radii of N = 0.74 Å while that of 'O' = 0.66 Å

Radii of Al < Ca

Radius of B > C

12. Which of the following is / are correct order regarding radius?

(1) $Be^{+2} < B^{+3} < Li^{+}$ (2) $B^{+3} < Be^{+2} < Li^{+}$

(3) $F^{-} < O^{-2} < N^{-3}$ (4) $B^{+3} < Ga^{+3} < Al^{+3}$

Sol. Answer (2, 3, 4)

B^{+3} = 0.02 Å

Be^{+2} = 0.31 Å

Li^{+} = 0.76 Å

$B^{+3} < Be^{+2} < Li^{+}$

F^{-}, O^{-2}, N^{-3} are isoelectroelectronic, hence higher the charge on nucleus lesser will be radius.

$F^{-} < O^{-2} < N^{-3}$

$B^{+3} < Ga^{+3} < Al^{+3}$

Size increases due to poor shielding of *d* electrons.

13. Which of the following pairs have nearly same size?

(1) Fe, Co (2) Zr, Hf (3) Ru, Rh (4) Nb, Ta

Sol. Answer (1, 2, 3, 4)

Element	**Radius in Å**
Fe	1.17
Co	1.16
Zr	1.45
Hf	1.44
Ru	1.24
Rh	1.25
Nb	1.34
Ta	1.34

(1), (2), (3), (4) all have nearly same size.

14. Choose the correct pair regarding ionisation energy (IE_1).

(1) B > Be (2) Tl > Ga (3) N > O (4) Li > Na

Sol. Answer (2, 3, 4)

Tl have has lower IE_1 than Ga.

15. Choose the correct order.

(1) Cl < S < P < Si

(2^{nd} Ionisation energy)

(2) Si < P < Cl < S

(2^{nd} Ionisation energy)

(3) $Be^{+2} < Li^{+} < Na^{+} < K^{+}$

(Inverse of charge density)

(4) Na & Mg are electropositive elements

Sol. Answer (2, 3, 4)

Si $3s^2\ 3p^2$ $Si^{+}\ 3s^2\ 3p^1$

P $3s^2\ 3p^3$ $P^{+}\ 3s^2\ 3p^2$

Cl $3s^2\ 3p^5$ $Cl^{+}\ 3s^2\ 3p^4$

S $3s^2\ 3p^4$ $S^{+}\ 3s^2\ 3p^3$

IV V VI VII

Si^{+} P^{+} S^{+} Cl^{+}

S^{+} has stable configuration so second ionization energy of S will be more than Cl^{+}.

Si < P < Cl < S

Size $Li^{+} < Na^{+} < K^{+}$

Size of $Be^{+2} < Li^{+} < Na^{+} < K^{+}$

Lesser cation is more hydrated, hence has lower ionic mobility.

So ionic mobility $\propto$ size

So correct order of ionic mobility is $Be^{+2} < Li^{+} < Na^{+} < K^{+}$

Na and Mg are electropositive elements.

16. Choose the pair in which IE_1 of first element is greater than IE_1 of second element but in case of IE_2 order is/are reversed.

(1) N, O (2) P, S (3) Be, B (4) F, O

Sol. Answer (1, 2, 3, 4)

In I, II and III stable electronic configuration of the first element is the reason while for the 4^{th} choice. IE of 1^{st} member is greater due to Z_{eff}.

17. Choose the correct option(s).

(1) Oxygen has highest first electron affinity among chalcogens

(2) $Be^{+2} < Li^{+} < Na^{+} < K^{+}$ (radii)

(3) F is 2^{nd} most electronegative element

(4) Cl has highest negative electron gain enthalpy

Sol. Answer (2, 4)

Element	Electron gain enthalpy
O	– 144
S	– 200
Se	– 195
T	– 190
Po	– 174

IA	IIA
Li	Be
Na	
K	

As we move from left to right across a period, size decreases.

As we move from top to bottom in a group, size increases.

$\therefore$ $Be^{+2} < Li^{+} < Na^{+} < K^{+}$

F is most electronegative element known.

Cl has highest negative electron gain enthalpy.

18. Choose the process which is/are endothermic.

(1) $O^{-1} + e^{-} \longrightarrow O^{-2}$ (2) $Ar \longrightarrow A_r^{+} + e^{-}$

(3) $Ar + e^{-} \longrightarrow Ar^{-}$ (4) $H + e^{-} \longrightarrow H^{-}$

Sol. Answer (1, 2, 3)

O^{-} will repel electron, hence, addition of electron in O^{-} is endothermic.

$Ar \longrightarrow Ar^{+} + e^{-}$, process is ionization, hence, endothermic.

$Ar + e^{-} \longrightarrow Ar^{-}$, Ar has noble gas configuration, hence, addition of e^{-} is not favored hence we have to give some energy, therefore, process is endothermic.

$\underset{1s^1}{H} + e^{-} \longrightarrow \underset{1s^2}{H^{-}}$, H^{-} is getting noble gas configuration hence it will favors addition of e^{-}. When H is converted to H^{-}, it gains stability hence loses energy.

19. Choose the correct order

(1) Mo(II) > Mo(III) > Mo(IV)
(Electronegativity order)

(2) Fe(I) < Fe(II) < Fe(III)
(Electronegativity order)

(3) Fe(III) < Fe(II) < Fe(I)
(Ionic radius)

(4) Mo (IV) > Mo (III) > Mo(II)
(Electronegativity order)

Sol. Answer (2, 3, 4)

As oxidation number (i.e., charge) of metal ion increases, electronegativity also increases.

So Mo(II) < Mo(III) < Mo(IV) and Fe(I) < Fe(II) < Fe(III) are correct increasing order of electronegativity.

20. Which of the following pair of oxides are acidic?

(1) CO_2 and NO_2 (2) SO_3 and SO_2

(3) MgO and Na_2O (4) Li_2O and K_2O

Sol. Answer (1, 2)

Oxides of non-metals are usually acidic.

$CO_2 + H_2O \rightarrow H_2CO_3$, $2NO_2 + H_2O \rightarrow HNO_2 + HNO_3$, $SO_3 + H_2O \rightarrow H_2SO_4$, $SO_2 + H_2O \rightarrow H_2SO_3$

SECTION - C

Linked Comprehension Type Questions

Comprehension I

Ionisation energy is the amount of energy required to remove the outermost e^- from a gaseous atom. It's unit is kJ/mole or kcal/mole.

Successive ionisation energy – It is the amount of energy required to remove electron successively from a gaseous ion. These are termed as IE_2, IE_3, IE_4 etc. The difference in the values of IE_1, IE_2 and IE_3 helps to determine electronic configuration of the element.

Element	IE_1	IE_2	IE_3	EA
A	150	350	1920	–50
B	52	729	1181	–60
C	418	1091	1652	–349
D	550	1025	1500	–495

All data is reported in kcal/mol

1. Which element forms stable unipositive ion?

(1) A (2) B (3) C (4) D

Sol. Answer (2)

It is an alkali metal because it shows greatest jump between 1st and 2nd IE.

2. Which of the following is a non-metal?

(1) A (2) B (3) C (4) D

Sol. Answer (3, 4)

Both (3) & (4) are possible.

3. Which element (most probably) belong to group-2?

(1) A (2) B (3) C (4) D

Sol. Answer (1)

Noble gas have very high ionization energy.

Comprehension II

Mulliken defined the electronegativity of an atom as the arithmetic mean of its ionisation energy and electron affinity.

$$\chi_A = \frac{1}{2}(\text{I.P.} + \text{E.A.})$$

One more relationship given by him, if the values are given in eV is

$$\chi_A = \frac{\text{Ionisation potential} + \text{Electron affinity}}{5.6}$$

When there is pure covalent bond between A – B

$$\frac{(IP)_A + (EA)_A}{5.6} = \frac{(IP)_B + (EA)_B}{5.6}$$

$$\chi_A = \chi_B$$

1. According to Mulliken, electronegativity depends on

(1) Ionisation potential (2) Electron gain enthalpy

(3) Electron affinity (4) Both (1) & (3)

Sol. Answer (4)

According Mulliken,

$$EN = \frac{IE + EA}{2}$$

Hence EN depends on both ionization energy as well as electron affinity.

2. When there is formation of $\overset{\delta-}{A}\text{———}\overset{\delta+}{B}$ bond then condition will be

(1) $\frac{(IP)_A + (EA)_A}{5.6} > \frac{(IP)_B + (EA)_B}{5.6}$ (2) $\frac{(IP)_B + (EA)_B}{5.6} > \frac{(IP)_A + (EA)_B}{5.6}$

(3) $\frac{(IP)_A + (EA)_B}{2.8} = \frac{(IP)_A + (EA)_B}{2.8}$ (4) $\frac{(IP)_A + (EA)_B}{5.6} > \frac{(IP)_A + (EA)_A}{5.6}$

Sol. Answer (1)

$A^- B^+ \equiv A \xrightarrow{\text{X}} B$

which implies that $(EN)_A > (EN)_B$

$$\frac{(IP)_A + (EA)_A}{5.6} > \frac{(IP)_B + (EA)_B}{5.6}$$

3. Pauling's Electronegativity scale is based on

(1) Thermochemical data (2) I.E. data

(3) E.A. data (4) Both (2) & (3)

Sol. Answer (1)

Pauling's electronegativity is based on bond energy data *i.e.*, thermo chemical data.

SECTION - D

Matrix-Match Type Questions

1. Match the following

Column I (Element)		Column II (Electronegativity on Pauling scale)
(A) Carbon	(p)	0.8
(B) Nitrogen	(q)	1.6
(C) Aluminium	(r)	2.5
(D) Cesium	(s)	3.0

Sol. Answer A(r), B(s), C(q), D(p)

Element	Electronegativity
C	2.5
N	3.0
Al	1.6
Cs	0.8

Increasing order of EN

$Cs < Al < C < N_3$

Cs is strongly electropositive hence least electronegative.

2. Match the following

Column I (Element)		Column II (Size (r) in Å)
(A) K^+	(p)	0.74
(B) Cu^+	(q)	0.99
(C) Ca^+	(r)	0.96
(D) Zn^{+2}	(s)	1.33

Sol. Answer A(s), B(r), C(q), D(p)

$Zn^{++} < Cu^+ < Ca^+ < K^+$

K^+	1.33 Å
Cu^+	0.96 Å
Ca^+	0.99 Å
Zn^{+2}	0.74 Å

3. Match the following

Column I		Column II
(A) Zirconium (Atomic no. 40)	(p)	Group no. 15; Period no. 4
(B) Thallium (Atomic no. 81)	(q)	Group no. 4; Period no. 5
(C) Arsenic (Atomic no. 33)	(r)	Group no. 14; Period no. 5
(D) Tin (Atomic no. 50)	(s)	Group no. 13; Period no. 6

Sol. Answer A(q), B(s), C(p), D(r)

4. Match the following

Column I (Element)		Column II (Effective nuclear charge for the outermost electron)
(A) Magnesium	(p)	2.20
(B) Potassium	(q)	2.60
(C) Aluminium	(r)	2.85
(D) Boron	(s)	3.50

Sol. Answer A(r), B(p), C(s), D(q)

SECTION - E

Assertion-Reason Type Questions

1. STATEMENT-1 : Nitrogen and oxygen have nearly same size.

   and

   STATEMENT-2 : Electron-electron repulsions tend to increase the size.

Sol. Answer (2)

Due to electron-electron repulsion attraction of nucleus decreases.

2. STATEMENT-1 : Nitrogen can form maximum four bonds with hydrogen.

   and

   STATEMENT-2 : Valency is the combining capacity of element and it is always constant.

Sol. Answer (3)

Valency is available quantity.

3. STATEMENT-1 : Noble gases have high ionisation energy

   and

   STATEMENT-2 : Noble gases belong to 18^{th} group.

Sol. Answer (2)

Due to inert configuration, I.E. is very high.

4. STATEMENT-1 : Actinoides belongs to *f* block.

   and

   STATEMENT-2 : Lanthanoid belongs to 3^{rd} group.

Sol. Answer (2)

5. STATEMENT-1 : Fluorine has less electron affinity than chlorine.

   and

   STATEMENT-2 : Due to small size, more electron-electron repulsions are observed in F.

Sol. Answer (1)

It is due to very high shielding effect in F.

6. STATEMENT-1 : Long form of periodic table exactly explain the position of hydrogen.

and

STATEMENT-2 : Hydrogen is most abundent element of the universe.

Sol. Answer (4)

Properties of hydrogen match with I^{st} & 17^{th} group both.

7. STATEMENT-1 : He and H^- have same size

and

STATEMENT-2 : He and H^- have same number of electrons in valence shell.

Sol. Answer (4)

In H^- and He, effective nucleus charges are different.

8. STATEMENT-1 : B_2O_3 is more acidic than BeO.

and

STATEMENT-2 : Ionisation energy of B is more than Be.

Sol. Answer (3)

Ionisation energy of Be is greater than B.

9. STATEMENT-1 : Bond dissociation energy of F_2 is more than that of Cl_2.

and

STATEMENT-2 : Due to smaller size of fluorine there are greater electron repulsions between the F atoms than Cl atoms.

Sol. Answer (4)

Bond dissociation energy of F_2 is less than that of Cl_2 due to smaller size of fluorine there is greater electronic repulsion between F atoms than Cl atoms.

10. STATEMENT-1 : Ions Na^+, Mg^{2+}, Al^{3+} are isoelectronic.

and

STATEMENT-2 : In each ion, the total number of electrons are 10.

Sol. Answer (1)

$Na^+ = 11 - 1 = 10$

$Mg^{+2} = 12 - 2 = 10$

$Al^{+3} = 13 - 3 = 10$

Na^+, Mg^{+2}, Al^{+3} all have $10e^-$, hence, isoelectronic.

11. STATEMENT-1 : First Ionisation energy of beryllium is more than that of boron.

and

STATEMENT-2 : In boron, 2p orbital is fully filled, whereas, in beryllium, it is not fully filled.

Sol. Answer (3)

Be has stable outermost electronic configuration, hence has high ionisation energy.

Be(4) = $1s^2\ 2s^2$

B(5) = $1s^2\ 2s^2\ 2p^1$

In boron 2*p* orbital is not full-filled.

In Be 2*p* orbital is empty.

12. STATEMENT-1 : Fluorine is smaller in size than chlorine.

and

STATEMENT-2 : Fluorine is more electronegative than chlorine.

Sol. Answer (2)

F is highest electronegative element known.

F is smaller in size than chlorine.

Both size and Z_{eff} explains the equation.

13. STATEMENT-1 : Ionization energy of *s*-electrons are more than the *p*-electrons for the same shell.

and

STATEMENT-2 : *s* electrons are closer to the nucleus than *p*-electrons, hence, more tightly attached.

Sol. Answer (1)

s electrons are closer to nucleus than *p* electrons, hence ionisation energy of *s* electrons is higher than *p* electrons.

14. STATEMENT-1 : Li and Mg show diagonal relationship.

and

STATEMENT-2 : Li and Mg have nearly same atomic radius.

Sol. Answer (3)

Li, Mg and Be, Al and B, Si show diagonal relationship

Li	1.23 Å
Mg	1.36 Å
Be	0.89 Å
Al	1.25 Å
B	0.80 Å
Si	1.17 Å

Li and Mg do not have same atomic size.

15. STATEMENT-1 : He and Be both have the same outer electronic configuration like ns^2 type.

and

STATEMENT-2 : Both are chemically inert as they have fully filled orbital.

Sol. Answer (3)

He $1s^2$

Be $1s^2\ 2s^2$

He and Be both have similar electronic configuration like ns^2.

Be forms compounds, hence it is not inert.

SECTION - F

Integer Answer Type Questions

1. What is the group number of element Une?

Sol. Answer (9)

Atomic number is 109.

2. What is screening constant for outer electron of H?

Sol. Answer (0)

In H only one electron is present so, no other electron which can screen it.

3. Which group will show lowest second ionization energy? (Non radioactive element)

Sol. Answer (2)

Fact

4. The element which has highest electron affinity will belong with group number x. Then x – 10 will be.

Sol. Answer (7)

Cl(17^{th} group) have maximum affinity.

17 – 10 = 7

5. To which group Ce belongs?

Sol. Answer (3)

All f-block elements belongs to IIIrd group.

6. The largest group in Modern periodic table is _____.

Sol. Answer (3)

All f-block elements & other five elements belongs to IIIrd group.

7. Element 'A' (with minimum atomic number) in which last electron has n + m > 3 but divisible by 3.

How many given statements are correct about A? (n → Principal quantum number, m → magnetic quantum number)

(i) Sum of group number and period number (in Modern Periodic Table) is even number.

(ii) Element belongs to *s*-block

(iii) Element belongs to IIIA group number

(iv) Element is a metal

(v) Atomic number of element is divisible by 3

(vi) Another element B has an atomic number = atomic number of A + 10, then element B belongs to III B group.

(vii) Element A has largest radius in their period.

(viii) The group in which element A is present, has maximum elements in Modern Periodic Table.

Sol. Answer (4)

n + m > 3 but divisible by 3 means n + m = 6 for minimum atomic number

So possible case

6*s*, 5*p*, 4*d*

So for minimum atomic number last electron goes to 4*d* and configuration is $5s^2\ 4d^1$ element is yttrium.

8. If there were 8 periods in the periodic table and each orbital could have maximum 5 electrons, then maximum number of elements would be present in period 8 is *x* then $\frac{x}{5}$ is

Sol. Answer (25)

Possible subshells are present in the 8th period : 8*s* 7*d* 6*f* 5*g* 8*p*

Total electrons : 5 + 25 + 35 + 45 + 15 = 125 = x

$$\frac{x}{5} = 25$$

9. The first four ionization energy values of an element are 120, 240, 520 and 8420 kcal. The number of valence electrons in the element is _____.

Sol. Answer (3)

As there is very high difference between $I.E._3$ and $I.E._4$, thus it has three electrons in its valence shell.

10. Calculate the difference in the number of protons of the largest element of the fourth period and the smallest element of the third period.

Sol. Answer (19)

Smallest in 3rd period $_{17}Cl$

Largest in 4th period $_{36}Kr$

36 – 17 = 19

11. An unielectronic ion of element A (atomic number of element 'A' is 'n') has velocity of electron in x^{th} orbit equal to velocity of electron in H-atom in nth orbit. Group number of element A in modern periodic is [if kinetic energy of electron in H-atom in x^{th} orbit is more than 0.2125 eV/atom and $x \neq n$]

Sol. Answer (18)

$$2.18\times10^6\times\left(\frac{n}{x}\right) = 2.18\times10^6\times\left(\frac{1}{n}\right)$$

$n^2 = x$

Both n and x must be integer and $x < 8$

If x = 4

n = 2

Element is Helium.

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