

## Classification of Elements and Periodicity in Properties

1. Amongst the following elements (whose electronic configuration are given below), the one having the highest ionization energy is

(a)  $[\text{Ne}]3s^23p^1$  (b)  $[\text{Ne}]3s^23p^2$  (c)  $[\text{Ne}]3s^23p^3$  (d)  $[\text{Ne}]3s^23p^4$

Ionization energy increases as the valence shell orbital of an atom is half filled or completely filled which is more stable, it has higher IE.

2. The correct decreasing order of electropositive character among the following elements is

(a)  $\text{Fe} > \text{Sc} > \text{Rb} > \text{Br} > \text{Te} > \text{F} > \text{Ca}$

(b)  $\text{Ca} > \text{Rb} > \text{Sc} > \text{Fe} > \text{Te} > \text{F} > \text{Br}$

(c)  $\text{Rb} > \text{Ca} > \text{Sc} > \text{Fe} > \text{Br} > \text{Te} > \text{F}$

(d)  $\text{Rb} > \text{Ca} > \text{Sc} > \text{Fe} > \text{Te} > \text{Br} > \text{F}$

Answer: (d)

Alkali and alkaline earth metals are most electropositive. Alkali metals are more electropositive than alkaline earth metals. In d-block elements, the elements near the alkaline earth metals are more electropositive than rest of the members. Metalloids are less electropositive than metals.

Halogens (nonmetals) are least electropositive. In halogen group electropositive character increases down the group.

3. (A), (B) and (C) are elements in the third short period. Oxide of (A) is ionic, that of (B) is amphoteric and of (C) a giant molecule. (A), (B) and (C) have atomic numbers in the order of

(a)  $(A) < (B) < (C)$  (b)  $(A) < (C) < (B)$  (c)  $(A) < (C) < (B)$  (d)  $(A) < (B) < (C)$   
 Answer: (a)

A, B and C are magnesium (A), aluminium (B) and silicon (C). Magnesium forms ionic oxide,  $MgO$ , aluminium forms amphoteric oxide,  $Al_2O_3$  and silicon forms a giant molecule

$SiO_2$ .

4.  $K^+$ ,  $Cl^-$ ,  $Ca^{2+}$  and  $S^{2-}$  are isoelectronic. The decreasing order of their size is

(a)  $S^{2-} > Cl^- > Ca^{2+} > K^+$

(b)  $Ca^{2+} > K^+ > Cl^- > S^{2-}$

(c)  $Cl^- > S^{2-} > Ca^{2+} > K^+$

(d)  $K^+ > Cl^- > Ca^{2+} > S^{2-}$

Answer: (a)

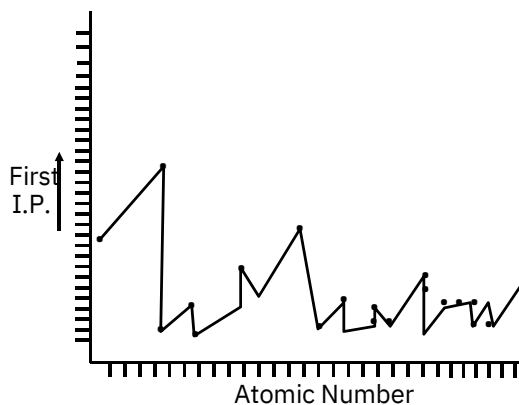
Size of isoelectronic decreases with increase in atomic number.

5. Which of the following is incorrect?
- (a) An element which has high electronegativity always has high electron gain enthalpy.
  - (b) Electron gain enthalpy is the property of an isolated atom.
  - (c) Electronegativity is the property of bonded atoms.
  - (d) Both electronegativity and electron gain enthalpy are usually directly related to nuclear charge and inversely related to atomic size.

Answer: (a)

Elements with high electronegativity usually but not always have high electron gain enthalpies. For example both N and Cl have an electronegativity of 3 but electron gain enthalpy of N is zero while that of chlorine is the highest in the periodic table.

6. The graph of first ionization enthalpy versus atomic number as follows:



Which of the following statement is correct?

- (a) Alkali metals are at the maxima and noble gases at the minima.
- (b) Noble gases are at the maxima and alkali metals at the minima.
- (c) Transition element are at the maxima.
- (d) Minima and maxima do not show any regular behaviour.

Answer: (b)

In a period, alkali metals have the lowest and noble gases have the maximum I.E.

Hence, (b) is correct.

7. Eka-aluminium and Eka-silicon are known as  
 (a) Gallium and Germanium (b) Aluminium and Silicon  
 (c) Iron and Sulphur (d) Proton and Silicon

Answer: (a)

Eka-aluminium  $\Rightarrow$  Ga

Eka-silicon  $\Rightarrow$  Ge

8. Choose incorrect statement  
 (a) reducing power in aqueous solution is maximum for lithium metal  
 (b) electron affinity order  $O > O^- > O^{2-}$   
 (c) order of oxidation number of oxygen  $O_3 > KO_2 > BaO_2 > K_2O$   
 (d) pH of aqueous solution  $LiCl > BeCl_2 > MgCl_2 > AlCl_3$

Answer: (d)

pH of aqueous solution  $LiCl < BeCl_2 < MgCl_2 < AlCl_3$

9. According to modern periodic law, variations in the properties of elements is related to their  
 (a) atomic weight (b) nuclear weight  
 (c) atomic numbers (d) neutron-proton ratios

Answer: (c)

Atomic Number

The Modern periodic law states “The chemical and physical properties of elements are a periodic function of their atomic numbers”.

10. An element having electronic configuration  $[\text{Ar}]3d^44s^2$  belongs to

- (a) d-block (b) f-block  
(c) s-block (d) p-block

Answer: (a)

Cr d-block element.

11. Which one of the following is not the representative element?

- (a) Fe (b) K (c) Ba (d) N

Answer: (a)

Group 1, 2, 13, 14, 15, 16, 17 are representative elements.

12. The order of which the following oxides are arranged according to decreasing basic nature

- (a)  $\text{Na}_2\text{O}$ ,  $\text{MgO}$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{CuO}$   
(b)  $\text{CuO}$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{MgO}$ ,  $\text{Na}_2\text{O}$   
(c)  $\text{Al}_2\text{O}_3$ ,  $\text{CuO}$ ,  $\text{MgO}$ ,  $\text{Na}_2\text{O}$   
(d)  $\text{CuO}$ ,  $\text{MgO}$ ,  $\text{Na}_2\text{O}$ ,  $\text{Al}_2\text{O}_3$

Answer: (a)

As we move from left to right in a period, the basic character of the oxides of s- and p- block elements decreases while their acidic character increase. The basic character of oxides of transition elements is however lower

than alkali and alkaline earth metal. Thus  $\text{Na}_2\text{O}$  is most basic followed by  $\text{MgO}$  and  $\text{Al}_2\text{O}_3$  while  $\text{CuO}$  is least basic.

13. Which of the following represents the electronic configuration of the most electropositive element?

(a)  $[\text{He}]2s^1$

(b)  $[\text{Xe}] 6s^1$

(c)  $[\text{He}]2s^2$

(d)  $[\text{Xe}]6s^2$

Answer: (b)

Element (A) and (B) are alkali metals whereas (c) and (d) are alkaline earth metals. Amongst alkali and alkaline earth metals, alkali metals with the biggest size is the most electropositive element.

14. In the isoelectronic species, the ionic radii of  $\text{N}^{3-}$ ,  $\text{O}^{2-}$  and  $\text{F}^-$  are respectively given by

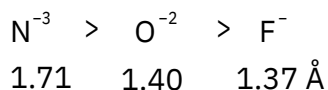
(a) 1.36, 1.40, 1.71

(b) 1.36, 1.71, 1.40

(c) 1.71, 1.40, 1.36

(d) 1.71, 1.36, 1.40

Answer: (c)



15. Without looking at the periodic table, select the elements of IIIA group of the periodic table (Atomic numbers are given) (a) 3, 11, 19, 37 (c) 7, 15, 31, 49

Answer: (d) (b) 5, 13, 21, 39

III A group  $\Rightarrow$  5B, 13Al, 31Ga, 49In, 81Tl (d) 5, 13, 31, 49

16. Atomic radii of fluorine and neon in angstroms units are respectively

(a) 1.60 and 1.60 (b) 0.72 and 1.60

(c) 0.72 and 0.72 (d) none of these

Answer: (b)

F < Ne  $\rightarrow$  vanderwaal's Radius

0.72 1.60

17. The elements with atomic numbers 58 to 71 are called

(a) normal elements (b) transition elements

(c) lanthanides (d) actinides

Answer: (c)

Z=58  $\rightarrow$  71  $\Rightarrow$  Lanthanides series elements

18. The atomic masses of Li and K are 7 and 39, respectively.

According to law of triads the atomic mass of Na will be

(a) 23 (b) 32 (c) 46 (d) 64

Answer: (a)



|    |    |     |                           |
|----|----|-----|---------------------------|
| I  | II | III | Atomic Mass of II element |
| Li |    | K   |                           |
| 7  | 23 | 39  | $\frac{7+39}{2} = 23$     |

19. Which of the following processes requires maximum energy

- (a)  $\text{Mg(g)} \rightarrow \text{Mg}^+(\text{g}) + e^-$                       (b)  $\text{Mg}^+(\text{g)} \rightarrow \text{Mg}^{2+}(\text{g}) + e^-$
- (c)  $\text{Na(g)} \rightarrow \text{Na}^+(\text{g}) + e^-$                       (d)  $\text{Na}^+(\text{g)} \rightarrow \text{Na}^{2+}(\text{g}) + e^-$
- Answer: (d)                      (d)  $\text{Na}^+(\text{g)} \rightarrow \text{Na}^{2+}(\text{g}) + e^-$
- $\text{Na}^+$  has stable electronic configuration.

20. Which is correct order of ionization energy

- (a)  $\text{Be} > \text{Mg} > \text{Ca}$     (b)  $\text{Na} > \text{K} > \text{Rb}$
- (c)  $\text{Rb} > \text{K} > \text{Na}$     (d) Both (a) and (b)

Answer: (d)

Down the group, ionization energy decreases.

21. Which is correct order of ionic radii in increasing order

- (a)  $\text{Cr}^{6+} < \text{Cr}^{3+} < \text{Cr}^{2+}$                       (b)  $\text{Mn}^{2+} < \text{Mn}^{6+} < \text{Mn}^{7+}$
- (c)  $\text{Pb}^{4+} < \text{Pb}^{2+}$                       (d) Both (a) and (c)

Answer: (d)

As nuclear charge decreases, ionic radii increases.

22. The set representing the correct order of first ionization energy is (a)  $K > Na > Li$  (c)  $N > P > As$

Answer: (d) (b)  $Be > Mg > Ca$

down the group ionization energy decreases.

23. Which is correct order of reducing character in case of alkali metals?

(a)  $Li < Na < K < Rb < Cs$

(b)  $Cs < K < Rb < Na < Li$

(c)  $Na < K < Rb < Cs < Li$

(d)  $K < Na < Rb < Cs < Li$

Answer: (c)

As we move from sodium to caesium with decrease in ionization energy reducing character increases. For lithium, it is hydration energy which makes it as best reducing agent. Thus order of reducing character is  $Na < K < Rb < Cs < Li$ .

24. Which is correct order of atomic radii?

(a)  $Mg < Al < Na < K$

(b)  $Al < Mg < Na < K$

(c)  $K < Na < Mg < Al$

(d) None of these

Answer: (b)

In a period as we move from left to right atomic size decreases.

25. Which of the following statement is correct?

- (a) Generally reducing character of elements increases in period.
- (b) Generally oxidising character of elements increases in period.
- (c) Generally, basic character of oxides decreases in a group.
- (d) All are correct

Answer: (b)

oxidising character of elements increases in a period.

26. An element of atomic mass 40 has 2, 8, 8, 2 as the electronic configuration. Which one of the following statement regarding this element is not correct?

- (a) It forms an basic oxide
- (b) It belongs to II A group
- (c) It belongs to IV period
- (d) It forms an acidic oxide

Answer: (d)

The element is calcium and hence its oxide (CaO) is basic in nature.

27. Which of the following sequence regarding the first ionization potential of coinage metal is correct?

- (a)  $\text{Cu} > \text{Ag} > \text{Au}$
- (b)  $\text{Cu} < \text{Ag} < \text{Au}$
- (c)  $\text{Cu} > \text{Ag} < \text{Au}$
- (d)  $\text{Ag} > \text{Cu} < \text{Au}$

Answer: (c)

Atomic sizes of Ag and Au are closer to each other but nuclear charge is more on Au.

(Au:889,CU;745,Ag:731kJmol<sup>-1</sup>)

28. Which of the following is incorrect?

- (a) IE<sub>1</sub> of Li > IE<sub>1</sub> of Be      (b) IE<sub>1</sub> of Be > IE<sub>1</sub> of B  
(c) IE<sub>1</sub> of Li > IE<sub>1</sub> of Na      (d) IE<sub>1</sub> of He > IE<sub>1</sub> of Ne

Answer: (b)

IE<sub>1</sub> of Be > IE<sub>1</sub> of B; In Be removal occurs from 2s; In B it occurs from 2p. More closer are subshell to nucleus more is IE.

29. Four successive members of first row transition elements are listed below with their atomic numbers. Which one of them is expected to have the highest third ionization enthalpy

- (a) Iron (Z = 26)      (b) Chromium (Z = 24)  
(c) Manganese (Z = 25)      (d) Vanadium (Z = 23)

Answer: (c)

Mn has 3d<sup>5</sup>,4s<sup>2</sup> configuration. Removal of third electron will be from half-filled 3d. Note that energy shell also changes.

30. The radii of F<sup>-</sup>, O<sup>2-</sup> and O<sup>-</sup> are in the order of

- (a) O<sup>2-</sup> > F<sup>-</sup> > O<sup>-</sup> > O      (b) F<sup>-</sup> > O<sup>2-</sup> > F > O  
(c) O<sup>2-</sup> > O > F<sup>-</sup> > F      (d) O<sup>2-</sup> > F<sup>-</sup> > O > F

Answer: (d)

Anions are larger than their parent atoms. Also size of isoelectronics decreases with increase in at. no.

31. Which is not arranged in the correct sequence
- (a)  $d^5, d^3, d^1, d^4$ —increasing magnetic moment
  - (b)  $MO, M_2O_3, MO_2, M_2O_5$ —decreasing basic strength
  - (c) Sc, V, Cr, Mn—increasing number of oxidation states
  - (d)  $Co^{2+}, Fe^{3+}, Cr^{3+}, Sc^{3+}$ —increasing stability

Answer: (a)

$d^1, d^3, d^4, d^5$ —increasing magnetic moment.

32. In which of the following have higher difference in the value of  $I_{Ind}$  and  $I_{Ird}$  I.P.

- (a)  $1s^2 2s^2 2p^6 3s^2 3p^1$
- (b)  $1s^2 2s^2 2p^6 3s^2$
- (c)  $1s^2 2s^2 2p^6 3s^1$
- (d)  $1s^2 2s^2 2p^6 3s^2 3p^2$

Answer: (c)

Sodium has electronic configuration as  $1s^2 2s^2 2p^6 3s^1$ . The last electron or the valence electron is in S orbital. If sodium loses (ionizes) its valence electron then it will achieve a stable configuration. Hence it has tendency to lose its valence electrons. This results in low first ionization energy for sodium and it has higher difference in the value of  $I_{Ind}$  and  $I_{Ird}$  I.P.

33. The order of basic character of given oxides is

- (a)  $\text{Na}_2\text{O} > \text{MgO} > \text{Al}_2\text{O}_3 > \text{CuO} > \text{Na}_2\text{O}$  (c)  
(b)  $\text{Al}_2\text{O}_3 > \text{MgO} > \text{CuO} > \text{Na}_2\text{O}$   
(d)  $\text{CuO} > \text{Na}_2\text{O} > \text{MgO} > \text{Al}_2\text{O}_3$

Answer: (a)

According to their metallic character which decreases from Na to Cu.

34. Which is not correct order for the stated property?

- (a)  $\text{Ba} > \text{Sr} > \text{Mg}$ : Atomic Radius  
(b)  $\text{F} > \text{O} > \text{N}$ : First ionization energy  
(c)  $\text{Cl} > \text{F} > \text{I}$ : Electron affinity  
(d)  $\text{O} > \text{Se} > \text{Te}$ : Electro negativity

Answer: (b)

$\text{F} > \text{N} > \text{O}$  is correct order of first ionization energy.

35. Which of the following statements is incorrect in relation to ionization enthalpy?

- (a) Ionization enthalpy increases for each successive electron.  
(b) The greatest increase in ionization enthalpy is experienced on removal of electron from core of noble gas configuration.  
(c) End of valence electrons is marked by a big jump in ionization enthalpy.  
(d) Removal of electron from orbitals bearing lower n value is easier than from orbital having higher n value.

Answer: (d)

Removal of Electron from orbital bearing lower n value is difficult than from orbitals having higher n values.

36. Which is incorrect order of size?

- (a)  $\text{Ni} < \text{Pd} \approx \text{Pt}$  (b)  $\text{Ti} < \text{Zr} \approx \text{Hf}$   
(c)  $\text{Ti} < \text{Zr} < \text{Hf}$  (d) All are correct

Answer: (c)

Due to lanthanide contraction size of  $\text{Pd} \approx \text{Pt}$  and size of  $\text{Zr} \approx \text{Hf}$  (size of 5d series elements is  $\approx$  size of 4d series elements).

37. Which of the following order is incorrect

- (a)  $\text{I}^+ < \text{I} < \text{I}^- \Rightarrow$  order of size  
(b)  $\text{Se} < \text{S} < \text{Cl} \Rightarrow$  order of IE  
(c)  $\text{F} < \text{O} < \text{N} \Rightarrow$  order of oxidizing property  
(d)  $\text{Na} < \text{Mg} < \text{Al} \Rightarrow$  order of EN

Answer: (c)

$\text{N} < \text{O} < \text{F}$  is correct order of oxidizing property, as oxidizing property increases in a period.

38. Without looking at the periodic table select the elements of III A group of the periodic table. (Atomic no. are given)

- (a) 3, 11, 19, 37 (b) 5, 13, 21, 39  
(c) 7, 15, 31, 49 (d) 5, 13, 37, 49

Answer: (d)

5-Boron,13-Aluminum, 31-gallium, 49-indium.

39. Which of the following is correct about the radius of species?

- (a)  $Al > Ga$  (b)  $Zr > Hf$   
(c)  $Fe^{3+} < Fe^{2+} < Fe^+$  (d) above all

Answer: (d)

Size of  $Al > Ga$  due to poor shielding effect of d-orbitals

$Zr > Hf$  Due to Lanthanide contraction

$Fe^{3+} < Fe^{2+} < Fe^+$  → +ve O.N ↓ size ↑

40. In Mendeleev's periodic table some pairs of elements do not follow increasing order of atomic weight known as anomalous pair. The correct example of anomalous pair is

- (a) Cl, Ar (b) Th, Pa (c) Te, In (d) Co, Nb

Answer: (b)

Atomic weight of Th = 232

Atomic weight of Pa = 231

41. Which of the following groups in modern periodic table have largest number of elements

- (a) I A (b) III A  
(c) III B (d) zero group

Answer: (c)

Group III B includes lanthanides and actinides and the total number of elements in this group = 32.

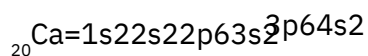


42. An element with atomic number 20 is placed in which period of the periodic table?

- (a) 4                      (b) 3                      (c) 2                      (d) 1

Answer: (a)

$$Z = 20$$



Period = 4th

43. In the long form of periodic table, elements are arranged according to

- (a) increasing atomic number  
(b) decreasing atomic number  
(c) increasing atomic mass  
(d) decreasing atomic mass

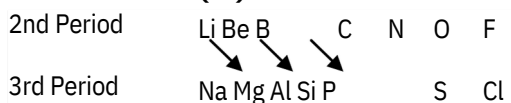
Answer: (a)

Long form of the Periodic table based on atomic no.

44. Chemical properties of Li and Mg are similar because:

- (a) these belong to same group  
(b) shows diagonal relationship  
(c) both has same ionization potential  
(d) both has same electron affinity

Answer: (b)



45. The statement that is not correct for the periodic classification of elements is
- (a) The properties of elements are the periodic functions of their atomic numbers.
  - (b) Non-metallic elements are lesser in number than metallic elements.
  - (c) The first ionization energies of elements along a period do not vary in a regular manner with increase in atomic number.
  - (d) For transition elements the d-sub shells are filled with electrons monotonically with increase in atomic number.

Answer: (d)

For transition elements the d-sub shells are filled with electrons monotonically with Increase in atomic number.