

# Classification of Elements and Periodicity in Properties

1. The set representing the correct order of ionic radius is  
 (1)  $\text{Na}^+ > \text{Li}^+ > \text{Mg}^{2+} > \text{Be}^{2+}$   
 (2)  $\text{Li}^+ > \text{Na}^+ > \text{Mg}^{2+} > \text{Be}^{2+}$   
 (3)  $\text{Mg}^{2+} > \text{Be}^{2+} > \text{Li}^+ > \text{Na}^+$   
 (4)  $\text{Li}^+ > \text{Be}^{2+} > \text{Na}^+ > \text{Mg}^{2+}$   
[AIIEEE-2009]
2. The correct sequence which shows decreasing order of the ionic radii of the elements is  
[AIIEEE-2010]
  - (1)  $\text{O}^{2-} > \text{F}^- > \text{Na}^+ > \text{Mg}^{2+} > \text{Al}^{3+}$
  - (2)  $\text{Al}^{3+} > \text{Mg}^{2+} > \text{Na}^+ > \text{F}^- > \text{O}^{2-}$
  - (3)  $\text{Na}^+ > \text{Mg}^{2+} > \text{Al}^{3+} > \text{O}^{2-} > \text{F}^-$
  - (4)  $\text{Na}^+ > \text{F}^- > \text{Mg}^{2+} > \text{O}^{2-} > \text{Al}^{3+}$
3. The correct order of electron gain enthalpy with negative sign of F, Cl, Br and I, having atomic number 9, 17, 35 and 53 respectively, is  
[AIIEEE-2011]
  - (1)  $\text{Br} > \text{Cl} > \text{I} > \text{F}$
  - (2)  $\text{I} > \text{Br} > \text{Cl} > \text{F}$
  - (3)  $\text{F} > \text{Cl} > \text{Br} > \text{I}$
  - (4)  $\text{Cl} > \text{F} > \text{Br} > \text{I}$
4. The increasing order of the ionic radii of the given isoelectronic species is  
[AIIEEE-2012]
  - (1)  $\text{S}^{2-}, \text{Cl}^-, \text{Ca}^{2+}, \text{K}^+$
  - (2)  $\text{Ca}^{2+}, \text{K}^+, \text{Cl}^-, \text{S}^{2-}$
  - (3)  $\text{K}^+, \text{S}^{2-}, \text{Ca}^{2+}, \text{Cl}^-$
  - (4)  $\text{Cl}^-, \text{Ca}^{2+}, \text{K}^+, \text{S}^{2-}$
5. The coagulating power of electrolytes having ions  $\text{Na}^+$ ,  $\text{Al}^{3+}$  and  $\text{Ba}^{2+}$  for arsenic sulphide sol increases in the order  
[JEE (Main)-2013]
  - (1)  $\text{Al}^{3+} < \text{Ba}^{2+} < \text{Na}^+$
  - (2)  $\text{Na}^+ < \text{Ba}^{2+} < \text{Al}^{3+}$
  - (3)  $\text{Ba}^{2+} < \text{Na}^+ < \text{Al}^{3+}$
  - (4)  $\text{Al}^{3+} < \text{Na}^+ < \text{Ba}^{2+}$
6. Which of the following represents the correct order of increasing first ionization enthalpy for Ca, Ba, S, Se and Ar?  
[JEE (Main)-2013]
  - (1)  $\text{Ca} < \text{S} < \text{Ba} < \text{Se} < \text{Ar}$
  - (2)  $\text{S} < \text{Se} < \text{Ca} < \text{Ba} < \text{Ar}$
  - (3)  $\text{Ba} < \text{Ca} < \text{Se} < \text{S} < \text{Ar}$
  - (4)  $\text{Ca} < \text{Ba} < \text{S} < \text{Se} < \text{Ar}$
7. The ionic radii (in Å) of  $\text{N}^{3-}$ ,  $\text{O}^{2-}$  and  $\text{F}^-$  are respectively  
[JEE (Main)-2015]
  - (1) 1.36, 1.40 and 1.71
  - (2) 1.36, 1.71 and 1.40
  - (3) 1.71, 1.40 and 1.36
  - (4) 1.71, 1.36 and 1.40
8. Which of the following atoms has the highest first ionization energy?  
[JEE (Main)-2016]
  - (1) Na
  - (2) K
  - (3) Sc
  - (4) Rb
9. The group having isoelectronic species is  
[JEE (Main)-2017]
  - (1)  $\text{O}^{2-}, \text{F}^-, \text{Na}, \text{Mg}^{2+}$
  - (2)  $\text{O}^-, \text{F}^-, \text{Na}^+, \text{Mg}^{2+}$
  - (3)  $\text{O}^{2-}, \text{F}^-, \text{Na}^+, \text{Mg}^{2+}$
  - (4)  $\text{O}^-, \text{F}^-, \text{Na}, \text{Mg}^+$
10. In general, the properties that decrease and increase down a group in the periodic table, respectively, are  
[JEE (Main)-2019]
  - (1) Electronegativity and electron gain enthalpy
  - (2) Atomic radius and electronegativity
  - (3) Electron gain enthalpy and electronegativity
  - (4) Electronegativity and atomic radius
11. Aluminium is usually found in +3 oxidation state. In contrast, thallium exists in +1 and +3 oxidation states. This is due to  
[JEE (Main)-2019]
  - (1) Lattice effect
  - (2) Lanthanoid contraction
  - (3) Diagonal relationship
  - (4) Inert pair effect
12. The transition element that has lowest enthalpy of atomisation, is  
[JEE (Main)-2019]
  - (1) V
  - (2) Cu
  - (3) Fe
  - (4) Zn
13. When the first electron gain enthalpy ( $\Delta_{eg}H$ ) of oxygen is  $-141 \text{ kJ/mol}$ , its second electron gain enthalpy is  
[JEE (Main)-2019]
  - (1) Almost the same as that of the first
  - (2) A more negative value than the first
  - (3) Negative, but less negative than the first
  - (4) A positive value

14. The electronegativity of aluminium is similar to [JEE (Main)-2019]
- (1) Beryllium (2) Carbon  
 (3) Lithium (4) Boron
15. The 71<sup>st</sup> electron of an element X with an atomic number of 71 enters into the orbital [JEE (Main)-2019]
- (1) 5 d (2) 6 p  
 (3) 4 f (4) 6 s
16. The correct order of the atomic radii of C, Cs, Al, and S is [JEE (Main)-2019]
- (1) S < C < Al < Cs  
 (2) C < S < Cs < Al  
 (3) S < C < Cs < Al  
 (4) C < S < Al < Cs
17. The correct option with respect to the Pauling electronegativity values of the elements is [JEE (Main)-2019]
- (1) Si < Al (2) P > S  
 (3) Te > Se (4) Ga < Ge
18. The relative stability of +1 oxidation state of group 13 elements follows the order [JEE (Main)-2019]
- (1) Ti < In < Ga < Al  
 (2) Al < Ga < Ti < In  
 (3) Al < Ga < In < Ti  
 (4) Ga < Al < In < Ti
19. The element with Z = 120 (not yet discovered) will be an/a [JEE (Main)-2019]
- (1) Inner-transition metal  
 (2) Transition metal  
 (3) Alkaline earth metal  
 (4) Alkali metal
20. The correct order of atomic radii is [JEE (Main)-2019]
- (1) Ce > Eu > Ho > N (2) N > Ce > Eu > Ho  
 (3) Eu > Ce > Ho > N (4) Ho > N > Eu > Ce
21. The element that shows greater ability of form  $\pi\pi - \pi\pi$  multiple bonds, is [JEE (Main)-2019]
- (1) Sn (2) Si  
 (3) Ge (4) C
22. The size of the iso-electronic species Cl<sup>-</sup>, Ar and Ca<sup>2+</sup> is affected by [JEE (Main)-2019]
- (1) Nuclear charge  
 (2) Principal quantum number of valence shell  
 (3) Azimuthal quantum number of valence shell  
 (4) Electron-electron interaction in the outer orbitals
23. The IUPAC symbol for the element with atomic number 119 would be [JEE (Main)-2019]
- (1) Une (2) Uun  
 (3) Uue (4) Unh
24. The element having greatest difference between its first and second ionization energies, is [JEE (Main)-2019]
- (1) K (2) Sc  
 (3) Ca (4) Ba
25. The isoelectronic set of ions is [JEE (Main)-2019]
- (1) N<sup>3-</sup>, Li<sup>+</sup>, Mg<sup>2+</sup> and O<sup>2-</sup>  
 (2) Li<sup>+</sup>, Na<sup>+</sup>, O<sup>2-</sup> and F<sup>-</sup>  
 (3) N<sup>3-</sup>, O<sup>2-</sup>, F<sup>-</sup> and Na<sup>+</sup>  
 (4) F<sup>-</sup>, Li<sup>+</sup>, Na<sup>+</sup> and Mg<sup>2+</sup>
26. The correct order of the first ionization enthalpies is [JEE (Main)-2019]
- (1) Mn < Ti < Zn < Ni  
 (2) Ti < Mn < Zn < Ni  
 (3) Ti < Mn < Ni < Zn  
 (4) Zn < Ni < Mn < Ti
27. The group number, number of valence electrons, and valency of an element with atomic number 15, respectively, are [JEE (Main)-2019]
- (1) 15, 5 and 3 (2) 15, 6 and 2  
 (3) 16, 5 and 2 (4) 16, 6 and 3
28. In comparison to boron, beryllium has [JEE (Main)-2019]
- (1) Greater nuclear charge and lesser first ionisation enthalpy.  
 (2) Greater nuclear charge and greater first ionisation enthalpy.  
 (3) Lesser nuclear charge and greater first ionisation enthalpy.  
 (4) Lesser nuclear charge and lesser first ionisation enthalpy.

29. The atomic radius of Ag is closest to

[JEE (Main)-2020]

- |        |        |
|--------|--------|
| (1) Cu | (2) Au |
| (3) Hg | (4) Ni |

30. The electron gain enthalpy (in kJ/mol) of fluorine, chlorine, bromine and iodine, respectively, are

[JEE (Main)-2020]

- |                               |
|-------------------------------|
| (1) -296, -325, -333 and -349 |
| (2) -333, -325, -349 and -296 |
| (3) -349, -333, -325 and -296 |
| (4) -333, -349, -325 and -296 |

31. Within each pair of elements F & Cl, S & Se, and Li & Na, respectively, the elements that release more energy upon an electron gain are

[JEE (Main)-2020]

- |                  |                   |
|------------------|-------------------|
| (1) F, S and Li  | (2) F, Se and Na  |
| (3) Cl, S and Li | (4) Cl, Se and Na |

32. The first ionization energy (in kJ/mol) of Na, Mg, Al and Si respectively, are

[JEE (Main)-2020]

- |                        |                        |
|------------------------|------------------------|
| (1) 786, 737, 577, 496 | (2) 496, 577, 786, 737 |
| (3) 496, 737, 577, 786 | (4) 496, 577, 737, 786 |

33. The third ionization enthalphy is minimum for

[JEE (Main)-2020]

- |        |        |
|--------|--------|
| (1) Mn | (2) Fe |
| (3) Co | (4) Ni |

34. The increasing order of the atomic radii of the following elements is

[JEE (Main)-2020]

- |        |        |
|--------|--------|
| (a) C  | (b) O  |
| (c) F  | (d) Cl |
| (e) Br |        |

- |                                 |
|---------------------------------|
| (1) (d) < (c) < (b) < (a) < (e) |
| (2) (b) < (c) < (d) < (a) < (e) |
| (3) (c) < (b) < (a) < (d) < (e) |
| (4) (a) < (b) < (c) < (d) < (e) |

35. The electronic configurations of bivalent europium and trivalent cerium are

[JEE (Main)-2020]

(atomic number : Xe = 54, Ce = 58, Eu = 63)

- |   |
|---|
| (1) [Xe] 4f <sup>7</sup> and [Xe] 4f <sup>1</sup>                                 |
| (2) [Xe] 4f <sup>7</sup> 6s <sup>2</sup> and [Xe] 4f <sup>2</sup> 6s <sup>2</sup> |
| (3) [Xe] 4f <sup>2</sup> and [Xe] 4f <sup>7</sup>                                 |
| (4) [Xe] 4f <sup>4</sup> and [Xe] 4f <sup>9</sup>                                 |

36. The acidic, basic and amphoteric oxides, respectively, are

[JEE (Main)-2020]

- |   |   |
|---|---|
| (1) Na <sub>2</sub> O, SO <sub>3</sub> , Al <sub>2</sub> O <sub>3</sub> | (2) Cl <sub>2</sub> O, CaO, P <sub>4</sub> O <sub>10</sub>                            |
| (3) MgO, Cl <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub>              | (4) N <sub>2</sub> O <sub>3</sub> , Li <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub> |

37. B has a smaller first ionization enthalpy than Be. Consider the following statements.

- (I) It is easier to remove 2p electron than 2s electron
- (II) 2p electron of B is more shielded from the nucleus by the inner core of electrons than the 2s electrons of Be
- (III) 2s electron has more penetration power than 2p electron
- (IV) Atomic radius of B is more than Be  
(atomic number B = 5, Be = 4)

The correct statements are

[JEE (Main)-2020]

- |                         |                          |
|-------------------------|--------------------------|
| (1) (I), (II) and (IV)  | (2) (I), (III) and (IV)  |
| (3) (I), (II) and (III) | (4) (II), (III) and (IV) |

38. In general the property (magnitudes only) that show an opposite trend in comparison to other properties across a period is

[JEE (Main)-2020]

- (1) Electron gain enthalpy
- (2) Electronegativity
- (3) Ionization enthalpy
- (4) Atomic radius

39. Three elements X, Y and Z are in the 3<sup>rd</sup> period of the periodic table. The oxides of X, Y and Z, respectively, are basic, amphoteric and acidic. The correct order of the atomic numbers of X, Y and Z is

[JEE (Main)-2020]

- |               |               |
|---------------|---------------|
| (1) X < Z < Y | (2) Y < X < Z |
| (3) Z < Y < X | (4) X < Y < Z |

40. The atomic number of the element unnilennium is

[JEE (Main)-2020]

- |         |         |
|---------|---------|
| (1) 109 | (2) 119 |
| (3) 102 | (4) 108 |

41. Consider the hypothetical situation where the azimuthal quantum number, l, takes value 0, 1, 2, ... n + 1, where n is the principal quantum number. Then, the element with atomic number

[JEE (Main)-2020]

- (1) 9 is the first alkali metal
- (2) 6 has a 2p-valence subshell
- (3) 8 is the first noble gas
- (4) 13 has a half-filled valence subshell

42. Among the statements (I – IV), the correct ones are  
 (I) Be has smaller atomic radius compared to Mg.  
 (II) Be has higher ionization enthalpy than Al.  
 (III) Charge/radius ratio of Be is greater than that of Al.  
 (IV) Both Be and Al form mainly covalent compounds.
- [JEE (Main)-2020]**
- (1) (I), (III) and (IV)  
 (2) (I), (II) and (IV)  
 (3) (I), (II) and (III)  
 (4) (II), (III) and (IV)
43. The five successive ionization enthalpies of an element are 800, 2427, 3658, 25024 and 32824 kJ mol<sup>-1</sup>. The number of valence electrons in the element is
- [JEE (Main)-2020]**
- (1) 3                                  (2) 4  
 (3) 2                                  (4) 5
44. The elements with atomic numbers 101 and 104 belong to, respectively,
- [JEE (Main)-2020]**
- (1) Group 6 and Actinoids  
 (2) Actinoids and Group 4  
 (3) Group 11 and Group 4  
 (4) Actinoids and Group 6
45. The ionic radii of O<sup>2-</sup>, F<sup>-</sup>, Na<sup>+</sup> and Mg<sup>2+</sup> are in the order
- [JEE (Main)-2020]**
- (1) F<sup>-</sup> > O<sup>2-</sup> > Na<sup>+</sup> > Mg<sup>2+</sup>  
 (2) Mg<sup>2+</sup> > Na<sup>+</sup> > F<sup>-</sup> > O<sup>2-</sup>  
 (3) O<sup>2-</sup> > F<sup>-</sup> > Mg<sup>2+</sup> > Na<sup>+</sup>  
 (4) O<sup>2-</sup> > F<sup>-</sup> > Na<sup>+</sup> > Mg<sup>2+</sup>
46. The process that is NOT endothermic in nature is
- [JEE (Main)-2020]**
- (1) Ar<sub>(g)</sub> + e<sup>-</sup> → Ar<sub>(g)</sub><sup>-</sup>  
 (2) H<sub>(g)</sub> + e<sup>-</sup> → H<sub>(g)</sub><sup>-</sup>  
 (3) Na<sub>(g)</sub> → Na<sub>(g)</sub><sup>+</sup> + e<sup>-</sup>  
 (4) O<sub>(g)</sub><sup>-</sup> + e<sup>-</sup> → O<sub>(g)</sub><sup>2-</sup>
47. In the sixth period, the orbitals that are filled are
- [JEE (Main)-2020]**
- (1) 6s, 4f, 5d, 6p                          (2) 6s, 5d, 5f, 6p  
 (3) 6s, 6p, 6d, 6f                          (4) 6s, 5f, 6d, 6p
48. The correct order of the ionic radii of O<sup>2-</sup>, N<sup>3-</sup>, F<sup>-</sup>, Mg<sup>2+</sup>, Na<sup>+</sup> and Al<sup>3+</sup> is
- [JEE (Main)-2020]**
- (1) Al<sup>3+</sup> < Mg<sup>2+</sup> < Na<sup>+</sup> < F<sup>-</sup> < O<sup>2-</sup> < N<sup>3-</sup>  
 (2) Al<sup>3+</sup> < Na<sup>+</sup> < Mg<sup>2+</sup> < O<sup>2-</sup> < F<sup>-</sup> < N<sup>3-</sup>  
 (3) N<sup>3-</sup> < F<sup>-</sup> < O<sup>2-</sup> < Mg<sup>2+</sup> < Na<sup>+</sup> < Al<sup>3+</sup>  
 (4) N<sup>3-</sup> < O<sup>2-</sup> < F<sup>-</sup> < Na<sup>+</sup> < Mg<sup>2+</sup> < Al<sup>3+</sup>
49. Lattice enthalpy and enthalpy of solution of NaCl are 788 kJ mol<sup>-1</sup> and 4 kJ mol<sup>-1</sup>, respectively. The hydration enthalpy of NaCl is
- [JEE (Main)-2020]**
- (1) 784 kJ mol<sup>-1</sup>                          (2) -780 kJ mol<sup>-1</sup>  
 (3) 780 kJ mol<sup>-1</sup>                          (4) -784 kJ mol<sup>-1</sup>
50. The set that contains atomic numbers of only transition elements, is
- [JEE (Main)-2020]**
- (1) 21, 32, 53, 64                          (2) 9, 17, 34, 38  
 (3) 37, 42, 50, 64                          (4) 21, 25, 42, 72
51. The atomic number of Unnilinium is \_\_\_\_\_.
- [JEE (Main)-2020]**

