# Chapter 01 Periodic Table and Periodic Properties

## JEE-FLASHBACK

### JEE MAINS QUESTION

**Q.1** According to the Periodic Law of elements, the Variation in properties of elements is related to their ? **[AIEEE-2003]**
(1) Nuclear masses
(2) Atomic numbers
(3) Nuclear neutron-proton number ratio
(4) Atomic masses

**Q.2** Which one of the following groups represent a collection of isoelectronic species ?
(At. no. Cs = 55, Br = 35) **[AIEEE-2003]**
(1) $N^{3-}$, $F^-$, $Na^+$ (2) Be, $Al^{3+}$, $Cl^-$
(3) $Ca^{2+}$, $Cs^+$, Br (4) $Na^+$, $Ca^{2+}$, $Mg^{2+}$

**Q.3** Which one of the following sets of ions represents the collection of isoelectronic species ? **[AIEEE-2004]**
(1) $K^+$, $Cl^-$, $Mg^{2+}$, $Sc^{3+}$ (2) $Na^+$, $Ca^{2+}$, $Sc^{3+}$, $F^-$
(3) $K^+$, $Ca^{2+}$, $Sc^{3+}$, $Cl^-$ (4) $Na^+$, $Mg^{2+}$, $Al^{3+}$, $Cl^-$

**Q.4** In which of the following arrangements the order is NOT according to the property indicated against it ? **[AIEEE-2005]**
(1) $Al^{3+} < Mg^{2+} < Na < F^-$ – increasing ionic size
(2) B < C < N < O – increasing first ionisation enthalpy
(3) I < Br < F < Cl – increasing electron gain enthalpy (with negative sign)
(4) Li < Na < K < Rb – increasing metallic radius

**Q.5** Which of the following oxides is amphoteric in character ? **[AIEEE-2005]**
(1) $SnO_2$ (2) $SiO_2$ (3) $CO_2$ (4) CaO

**Q.6** Pick out the isoelectronic structure from the following : **[AIEEE-2005]**
I. $^+CH_3$ II. $H_3O^+$ III. $NH_3$ IV. $CH_3^-$
(1) I and II (2) III and IV
(3) I and III (4) II, III and IV

**Q.7** The increasing order of the first ionization enthalpies of the elements B, P, S and F (lowest first) is – **[AIEEE-2006]**
(1) F < S < P < B (2) P < S < B < F
(3) B < P < S < F (4) B < S < P < F

**Q.8** Which one of the following sets of ions represents a collection of isoelectronic species? **[AIEEE-2006]**
(1) $N^{3-}$, $O^{2-}$, $F^-$, $S^{2-}$ (2) $Li^+$, $Na^+$, $Mg^{2+}$, $Ca^{2+}$
(3) $K^+$, $Cl^-$, $Ca^{2+}$, $Sc^{3+}$ (4) $Ba^{2+}$, $Sr^{2+}$, $K^+$, $Ca^{2+}$

**Q.9** Which one of the following orders presents the correct sequence of the increasing basic nature of the given oxides ? **[AIEEE-2011]**
(1) $Al_2O_3 < MgO < Na_2O < K_2O$
(2) $MgO < K_2O < Al_2O_3 < Na_2O$
(3) $Na_2O < K_2O < MgO < Al_2O_3$
(4) $K_2O < Na_2O < Al_2O_3 < MgO$

**Q.10** Which of the following atoms has the highest first ionization energy ? **[JEE Main-2016]**
(1) Rb (2) Na (3) K (4) Sc

**Q.11** The group having isoelectronic species is : **[JEE Main-2017]**
(1) $O^{2-}$, F–, $Na^+$, $Mg^{2+}$ (2) $O^-$,$F^-$, Na, $Mg^+$
(3) $O^{2-}$, $F^-$, Na, $Mg^{2+}$ (4) $O^-$,F–

**Q.12** The element with Z = 120(not yet discoverer) will be an/a **[JEE Main - 2019(January)]**
(1) Inner transition metal
(2) Alkaline earth metal
(3) Alkali metal
(4) Transition metal

**Q.13** The effect of lanthanoid contraction in the lanthanoid series of elements by the large means **[JEE Main- 2019 (January)]**
(1) Increase in both atomic and ionic radii
(2) Decrease in atomic radii and increase in ionic radii
(3) Decrease in both atomic and ionic radii

(4) Increase in atomic radii an decrease in ionic radii

**Q.14** The electronegativity of aluminum is similar to **[JEE Main-2019(January)]**

(1) Carbon (2) Beryllium
(3) Boron (4) Lithium

**Q.15** The corrector order of atomic radii is: **[JEE Main-2019(January)]**

(1) N > Ce > Eu > Ho
(2) Ho > N > Eu > Ce
(3) Ce > Eu > Ho > N
(4) Eu > Ce > Ho > N

**Q.16** The correct options with respect to the Pauling electronegativity values of the elements is: **[JEE Main-2019(January)]**

(1) Te > Se (2) Ga < Ge
(3) Si < Al (4) P > S

**Q.17** The relative stability of + 1 oxidation state of group 13 elements follows the order: **[JEE Main-2019(January)]**

(1) Al < Ga < TI < In (2) TI < In < Ga < Al
(3) Ga < Al < In < TI (4) Al < Ga < In < TI

**Q.18** In general, the properties that decreases and increase down a groups in the periodic table respectively are **[JEE Main-2019(January)]**

(1) atomic radius and electorngegativity electronegativity
(2) electron gain enthalpy and electronegativity
(3) electronegativity and atomic radius enthalpy
(4) electronegativity and electron gain enthalpy

**Q.19** Aluminum is usually found in +3 oxidation state. In contrast, thallium exists in +1 and +3 oxidation states. This is due to **[JEE Main-2019(January)]**

(1) inert pair effect
(2) diagonal relationship
(3) lattice effect
(4) lanthanoid contraction

**Q.20** When the first electron gain enthalpy ($\Delta_{eg}$ H) of oxygen is –141 kJ/mol, its second electron gain enthalpy is **[JEE Main-2019(January)]**

(1) a more negative value than the first
(2) almost the same as that of the first
(3) negative, but less negative than the first
(4) a positive value

**Q.21** The correct order of the atomic radii of C, Cs, Al and S is: **[JEE Main-2019(January)]**

(1) C < S < Al < Cs (2) S < C < Cs < Al
(3) S < C < Al < Cs (4) C < S < Cs < Al

**Q.22** The IUPAC symbol for the element with atomic number 119 would be: **[JEE Main 2019 (April)]**

(1) unh (2) uun (3) une (4) uue

**Q.23** The statements that is INCORRECT about the interstitial compounds is: **[JEE Main 2019 (April)]**

(1) They have high melting points
(2) They are chemically reactive
(3) They ae metallic conductivity
(4) They are very hard

**Q.24** In comparison to boron, beryllium has: **[JEE Main 2019 (April)]**

(1) lesser nuclear charge and greater first ionisation enthalpy
(2) lesser nuclear charge and lesser first ionisation enthalpy
(3) greater nuclear charge and greater first inoisation enthalpy
(4) greater nuclear charge and lesser first ionisation enthalpy

**Q.25** The maximum number of possible oxidation states of actinoides are shown by **[JEE Main 2019 (April)]**

(1) berkelium (BK) and californium (CF)
(2) nobelium (No) and lawrencium(Lr)
(3) actinium (Ac) and thorium (Th)
(4) neptunium (Np) and plutonium (Pu)

**Q.26** The correct sequence of thermal stability of the following carbonates is **[JEE Main 2019 (April)]**

(1) $BaCO_3 < CaCO_3 < SrCO_3 < MgCO_3$
(2) $MgCO_3 < CaCO_3 < SrCO_3 < BaCO_3$
(3) $BaCO_3 < SrCO_3 < CaCO_3 < MgCO_3$
(4) $MgCO_3 < SrCO_3 < CaCO_3 < MgCO_3$

**Q.27** The groups number, numbers of valance electrons, and valency of an element with atomic number 15, respectively, are **[JEE Main 2019 (April)]**

(1) 16, 5 and 2 (2) 16, 6 and 3
(3) 15, 5 and 3 (4) 15, 6 and 2

**Q.28** The correct order of catenation is; **[JEE Main 2019 (April)]**

(1) C > Si > Ge ≈ Sn (2) C < Sn > Si ≈ Ge

(3) Ge > Sn > Si > C (4) Si > Sn > C > Ge

**Q.29** The correct order of the first ionization enthalpies is: **[JEE Main 2019 (April)]**

(1) Mn < Ti < Zn < Ni (2) Ti < Mn < Ni < Zn
(3) Zn < Ni < Mn < Ti (4) Ti < Mn < Zn < Ni

**Q.30** The highest possible oxidation states of uranium and plutonium, respectively, are **[JEE Main 2019 (April)]**

(1) 6 and 4 (2) 7 and 6
(3) 4 and 6 (4) 6 and 7

**Q.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 (January)]**

(1) Ci, S and LI (2) F, S and Li
(3) F, Se and Na (4) Cl, Se and Na

**Q.32** The first ionization energy (in kJ/mol) of Na, Mg, Al and Si respectively, are **[JEE Main-2020 (January)]**

(1) 469, 576, 737, 786
(2) 786, 737, 577, 946
(3) 496, 577, 786, 737
(4) 496, 737, 577, 786

**Q.33** The third ionization enthalpy is minimum for: **[JEE Main-2020 (January)]**

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

**Q.34** The increasing order of he atomic radii of following elements is: **[JEE Main-2020 (January)]**

(a) C (b) O (c) F
(1) (a) < (b) < (c) (2) (c) < (b) < (a)
(3) (b) < (a) < (c) (4) (a) < (c) < (b)

**Q.35** B has a smaller first ionization enthalpy than Be. Consider the following statements: **[JEE Main-2020 (January)]**

(i) It is easier to remove 2p electron than 2s electron
(ii) 2p electron of B is more shielded form 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 statement are:

(1) (i), (iii) and (iv) (2) (ii), (iii) and (iv)
(3) (i), (ii) and (iv) (4) (i), (ii) and (iii)

**Q.36** The first and second ionisation enthalpies of a metal are 496 and 4560 kJ $mol^{-1}$, respectively. How many moles of HCl and $H_2SO_4$, respectively, will be needed to react completely with 1 mole of the metal hydroxide? **[JEE Main-2020 (January)]**

(1) 1 and 0.5 (2) 2 and 0.5
(3) 1 and 2 (4) 1 and 1

**Q.37** Three elements X, Y and Z are in the 3rd 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 (September)]**

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

**Q.38** In general the property (magnitudes only) that show an opposite trend in comparison to other properties across a period is **[JEE Main-2020 (September)]**

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

**Q.39** The atomic number of the element ununennium is **[JEE Main-2020 (September)]**

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

**Q.40** The process that is NOT endothermic in nature is **[JEE Main-2020 (September)]**

(1) $Ar(g) + e^- \rightarrow Ar^-(g)$
(2) $H(g) + e^- \rightarrow H^-(g)$
(3) $Na(g) \rightarrow Na^+(g) + e^-$
(4) $O–(g) + e^- \rightarrow O^{2-}(g)$

**Q.41** The ionic radii of $O^{2-}$, $F^-$, $Na^+$ and $Mg^{2+}$ are in the order **[JEE Main-2020 (September)]**

(1) $F^- > O^{2-} > Na^+ > Mg^{2+}$
(2) $Mg^{2+} > Na^+ > F^- > O^{2-}$
(3) $O^{2-} > F > Mg^{2+} > Na^+$
(4) $O^{2-} > F^- > Na^+ > Mg^{2+}$

**Q.42** The elements with atomic numbers 101 and 104 belong to, respectively, **[JEE Main-2020 (September)]**

(1) Group 6 and Actinoids
(2) Actinoids and Group 4

(3) Group 11 and Group 4
(4) Actinoids and Groups 6

**Q.43** Considering that $\Delta_0$ P, the magnetic moment (in BM) of $[Ru(H_2O)]^{2+}$ would be _____.
**[JEE Main-2020 (September)]**

**Q.44** The correct order of the ionic radii of $O^{2-}$, $N^{3-}$, $F^-$, $Mg^{2+}$, $Na^+$ and $Al^{3+}$ is
**[JEE Main-2020 (September)]**
(1) $Al^{3+} < Mg^{2+} < Na^+ < F^- < O^{2-} < N^{3-}$
(2) $Al^{3+} < Na^+ < Mg^{2+} < O^{2-} < F^- < N^{3-}$
(3) $N^{3-} < F^- < O^{2-} < Mg^{2+} < Na^+ < Al^{3+}$
(4) $N^{3-} < O^{2-} < F^- < Na^+ < Mg^{2+} < Al^{3+}$

**Q.45** The atomic number of ununnilium is _____.
**[JEE Main-2020 (September)]**
(1) 199 (2) 119 (3) 109 (4) 110

**Q.46** The set that contains atomic numbers of only transition elements, is
**[JEE Main-2020 (September)]**
(1) 21, 32, 53, 64 (2) 9, 17, 34, 38
(3) 37, 42, 50, 64 (4) 21, 25, 42, 72

**Q.47** Given below are two statements: one is labelled as Assertion (A) and the others is labelled as Reason (R).
**Assertion (A):** Metallic character decreases and non-metallic character increases on moving from left to right in a period.
**Reason (R):** It is due to increase in ionization enthalpy and decrease in electron gain enthalpy, when one moves from left to right in a period.
In the light of the above statements, choose the most appropriate answer from the options given below: **[JEE Main-2021]**
(1) (A) is false but (R) is true.
(2) (A) is true but (R) is false.
(3) Both (A) and (R) are correct and (R) is the correct explanation of (A).
(4) Both (A) and (R) are correct but (R) is not the correct explanation of (A).

**Q.48** The correct order of ionic radii for the ions, $P^{3-}$, $S^{2-}$, $Ca^{2+}$, $K^+$, $Cl^-$ is :
**[JEE Main-2021]**
(1) $P^{3-} > S^{2-} > Cl^- > K^+ > Ca^{2+}$
(2) $Cl^- > S^{2-} > P^{3-} > Ca^{2+} > K^+$
(3) $P^{3-} > S^{2-} > Cl^- > Ca^{2+} > K^+$
(4) $K^+ > Ca^{2+} > P^{3-} > S^{2-} > Cl^-$

**Q.49** Chalcogen group elements are:
**[JEE Main-2021]**
(1) Se, Tb and Pu (2) Se, Te and Po
(3) S, Te and Pm (4) O, Ti and Po

**Q.50** Metals generally melt at very high temperature. Amongst the following, the metal with the highest melting point will be
**[JEE Main-2022]**
(1) Hg (2) Ag (3) Ga (4) Cs

**Q.51** The correct order of electron gain enthalpies of Cl, F, Te and Po is **[JEE Main-2022]**
(1) F < Cl < Te < Po (2) Po < Te < F < Cl
(3) Te < Po < Cl < F (4) Cl < F < Te < Po

**Q.52** Which of the following elements in considered as a metalloid? **[JEE Main-2022]**
(1) Sc (2) Pb (3) Bi (4) Te

**Q.53** Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
**Assertion (A):** The ionic radii of $O^{2-}$ and $Mg^{2+}$ are same.
**Reason (R):** Both $O^{2-}$ and $Mg^{2+}$ are isoelectronic species.
In the light of the above statements, choose the correct answer from the options given below
**[JEE Main-2022]**
(1) Both (A) and (R) are true and (R) is the correct explanation of (A).
(2) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(3) (A) is true but (R) is false.
(4) (A) is false but (R) is true.

**Q.54** The correct order of increasing ionic radii is
**[JEE Main-2022]**
(1) $Mg^{2+} < Na^+ < F^- < O^{2-} < N^{3-}$
(2) $N^{3-} < O^{2-} < F^- < Na^+ < Mg^{2+}$
(3) $F^- < Na^+ < O^{2-} < Mg^{2+} < N^{3-}$
(4) $Na^+ < F^- < Mg^{2+} < O^{2-} < N^{3-}$

**Q.55** Inert gases have positive electron gain enthalpy. Its correct order is:
**[JEE MAINS (Jan.) 2023]**

(1) Xe < Kr < Ne < He
(2) He < Ne < Kr < Xe
(3) He < Xe < Kr < Ne
(4) He < Kr < Xe < Ne

**Q.56** Match List-I with List-II.

| List-I (Atomic number) | | List-II (Block of periodic table) | |
|---|---|---|---|
| A. | 37 | I. | p-block |
| B. | 78 | II. | d-block |
| C. | 52 | III. | f-block |
| D. | 65 | IV. | s-block |

Choose the correct answer from the options given below: **[JEE MAINS (Jan.) 2023]**
(1) A-II, B-IV, C-I, D-III (2) A-I, B-III, C-IV, D-II
(3) A-IV, B-III, C-II, D-I (4) A-IV, B-II, C-I, D-III

**Q.57** Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R.
**Assertion A:** The first ionization enthalpy of 3d series elements is more than that of group 2 metals.
**Reason R:** In 3d series of elements successive filling of d-orbitals takes places.
In the light of the above statements, choose the correct answer from the options given below:
**[JEE MAINS (Jan.) 2023]**
(1) Both A and R are true and R is the correct explanation of A.
(2) Both A and R are true but R is not the correct explanation of A.
(3) A is false but R is true
(4) A is true but R is false

**Q.58** Which of the following elements have half-filled f-orbitals in their ground state?
(Given: Atomic number Sm = 62; Eu = 63; Tb = 65; Gd = 64; Pm = 61)
A. Sm
B. Eu
C. Tb
D. Gd
E. Pm
Choose the correct answer from the options given below: **[JEE MAINS (Jan.) 2023]**
(1) B and D only (2) A and E only
(3) A and B only (4) C and D only

## JEE ADVANCED QUESTION

**Q.1** Among the following, the number of elements showing only one non-zero oxidation state is:
O, Cl, F, N, P, Sn, TI, Na, Ti **[JEE-2010]**

**Q.2** The increasing order of atomic radii of the following groups 13 elements is
**[JEE ADVANCED-2016]**
(1) Al < Ga < In < TI (2) Ga < Al < In < TI
(3) Al < Al < In < TI (4) Al < Ga < TI < In

**Q.3** The option(s) with only amphoteric oxides is (are) **[JEE ADVANCED-2017]**
(1) NO, $B_2O_3$, PbO, $SnO_2$
(2) $Cr_2O_3$, CrO, SnO, PbO
(3) $Cr_2O_3$, BeO, SnO, $SnO_2$
(4) ZnO, $Al_2O_3$, PbO, $PbO_2$

**Q.4** The 1st, 2nd and the 3rd ionization enthalpies $I_1$, $I_2$ and $I_3$, of four atoms with atomic numbers n, n+1, n+2 and n+3, where n < 10, are tabulated below, what is the value of n?
**[JEE ADVANCED-2020]**

| Atomic number | Ionization Enthalpy (kJ/mol) | | |
|---|---|---|---|
| | $I_1$ | $I_2$ | $I_3$ |
| n | 1681 | 3374 | 6050 |
| n+1 | 2081 | 3952 | 6122 |
| n+2 | 496 | 4562 | 6910 |
| n+3 | 738 | 1451 | 7733 |

# ANSWER KEY

## JEE-FLASHBACK

| Que. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ans. | 2 | 1 | 3 | 2 | 1 | 4 | 4 | 3 | 1 | 4 | 1 | 2 | 3 | 2 | 4 |
| Que. | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| Ans. | 2 | 4 | 4 | 1 | 4 | 1 | 4 | 2 | 1 | 4 | 2 | 3 | 1 | 2 | 4 |
| Que. | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 |
| Ans. | 1 | 4 | 4 | 2 | 4 | 1 | 4 | 4 | 1 | 2 | 4 | 2 | 0 | 1 | 4 |
| Que. | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | | |
| Ans. | 4 | 2 | 1 | 2 | 2 | 2 | 4 | 4 | 1 | 3 | 4 | 1 | 1 | | |

## JEE-ADVANCED

| Que. | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Ans. | 2 | 2 | 3,4 | 9 |