

## Periodic Table

### JEE (Main) Exercises

#### Single Correct Answer Type

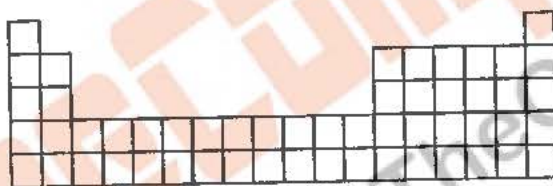
- Which electronic configuration of neutral atom will have the highest first ionization potential?  
 (a)  $1s^2, 2s^2 2p^1$  (b)  $1s^2, 2s^2 2p^3$   
 (c)  $1s^2, 2s^2 2p^2$  (d)  $1s^2, 2s^2 2p^4$
- $K^+$ ,  $Cl^-$ ,  $Ca^{2+}$ , and  $S^{2-}$  ions are isoelectronics. The decreasing order of their size is:  
 (a)  $S^{2-} > Cl^- > K^+ > Ca^{2+}$   
 (b)  $Ca^{2+} > K^+ > Cl^- > S^{2-}$   
 (c)  $K^+ > Cl^- > Ca^{2+} > S^{2-}$   
 (d)  $Cl^- > S^{2-} > Ca^{2+} > K^+$
- The ionization energy will be maximum for the process:  
 (a)  $Ba \longrightarrow Ba^{2+}$  (b)  $Be \longrightarrow Be^{2+}$   
 (c)  $Cs \longrightarrow Cs^+$  (d)  $Li \longrightarrow Li^+$
- Which of the following ion has the largest radius?  
 (a)  $Cl^-$  (b)  $S^{2-}$   
 (c)  $Na^+$  (d)  $F^-$
- Which of the following is isoelectronic with carbon atom?  
 (a)  $Na^+$  (b)  $Al^{3+}$   
 (c)  $O^{2-}$  (d)  $N^+$
- Which of the following species has four lone pairs of electrons in its outer shell?  
 (a) I (b)  $O^-$   
 (c)  $Cl^-$  (d) He
- Which among the following element has the lowest value of ionization energy?  
 (a) Mg (b) Ca  
 (c) Ba (d) Sr
- Which ion is not isoelectronic with  $O^{2-}$ ?  
 (a)  $N^{3-}$  (b)  $Na^+$   
 (c)  $F^-$  (d)  $Ti^+$
- Which of the following does not reflect the periodicity of elements?  
 (a) Bonding behavior (b) Electronegativity  
 (c) Ionization potential (d) Neutron/proton ratio
- The element with strong electropositive nature is:  
 (a) Cu (b) Cs  
 (c) Cr (d) Ba
- Which among the following has the highest ionic radius?  
 (a)  $F^-$  (b)  $B^{3+}$   
 (c)  $O^{2-}$  (d)  $Li^+$
- Ionic radii of:  
 (a)  $Ti^{4+} < Mn^{7+}$  (b)  $Cr^{6+} > Cr^{3+}$   
 (c)  $K^+ > Cl^-$  (d)  $P^{3+} > P^{5+}$
- The most electronegative element is:  
 (a) Nitrogen (b) Fluorine  
 (c) Oxygen (d) Chlorine
- The set representing the correct order of first ionization enthalpy is:  
 (a)  $K > Na > Li$  (b)  $Be > Mg > Ca$

- (c)  $B > C > N$  (d)  $Ge > Si > C$
15. The correct order of atomic radii is:  
 (a)  $Na < Be < B$  (b)  $F^- < O^{2-} < N^{3-}$   
 (c)  $Na < Li < K$  (d)  $Fe^{3+} < Fe^{2+} < Fe^{4+}$
16. The outermost electronic configuration of the most electronegative element is:  
 (a)  $ns^2 np^3$  (b)  $ns^2 np^4$   
 (c)  $ns^2 np^5$  (d)  $ns^2 np^6$
17. Amongst the following elements (whose electronic configurations are given below) the one having the highest ionization is:  
 (a)  $[Ne] 3s^2 3p^1$  (b)  $[Ne] 3s^2 3p^3$   
 (c)  $[Ne] 3s^2 3p^2$  (d)  $[Ar] 3d^{10}, 4s^2 4p^3$
18. Which of the following set of ions represents a collection of isoelectronic species?  
 (a)  $Ba^{2+}, Sr^{2+}, K^+, Ca^{2+}$  (b)  $K^+, Cl^-, Ca^{2+}, Sc^{3+}$   
 (c)  $N^{3-}, O^{2-}, F^-, S^{2-}$  (d)  $Li^+, Na^+, Mg^{2+}, Ca^{2+}$
19. Aluminium is diagonally related to:  
 (a) Li (b) Si  
 (c) Be (d) B
20. Which of the following pair of atomic numbers represents  $s$ -block elements?  
 (a) 7, 15 (b) 6, 12  
 (c) 9, 17 (d) 3, 12
21. An element of atomic number 29 belongs to:  
 (a)  $s$ -block (b)  $d$ -block  
 (c)  $p$ -block (d)  $f$ -block
22. Which of the following has the largest radius?  
 (a)  $O^{2-}$  (b)  $Mg^{2+}$   
 (c)  $Na^+$  (d)  $F^-$
23. The electronic configuration of an element is  $1s^2, 2s^2 2p^6, 3s^2, 3p^3$ . What is the atomic number of the element which is just below the above element in the periodic table?  
 (a) 34 (b) 49  
 (c) 33 (d) 31
24. Which of the following has the largest atomic size?  
 (a) Al (b)  $Al^{2+}$   
 (c)  $Al^{3+}$  (d)  $Al^+$
25. Alkaline earth metals form ions of the formula:  
 (a)  $M^+$  (b)  $M^-$   
 (c)  $M^{2+}$  (d)  $M^{2-}$
26. Atomic number 56 belongs to which block?  
 (a)  $s$  (b)  $p$   
 (c)  $d$  (d)  $f$
27. Eka-aluminium and eka-silicon are known as:  
 (a) Gallium and germanium  
 (b) Aluminium and silicon  
 (c) Iron and sulphur  
 (d) Proton and silicon
28. Increasing order of electron gain enthalpy is:  
 (a)  $N < O < Cl < Al$  (b)  $O < N < Al < Cl$   
 (c)  $N < Al < O < Cl$  (d)  $Cl < N < O < Al$
29. According to modern periodic law, variations in the properties of elements are related to their:  
 (a) Atomic weights (b) Nuclear weights  
 (c) Atomic numbers (d) Neutron-proton ratios
30. Which of the following has maximum ionization enthalpy?  
 (a) K (b) Na  
 (c) Mg (d) Be
31. The electronic configuration of transition elements is exhibited by:  
 (a)  $ns^1$  (b)  $ns^2 np^5$   
 (c)  $ns^2 (n-1)d^{10}$  (d)  $(n-1)d^{1-10} ns^{0-2}$
32. Which of the following has the lowest ionization energy?  
 (a) Oxygen (b) Nitrogen  
 (c) Fluorine (d) Sulphur
33. If  $A$ ,  $B$ , and  $C$  are the three elements of Dobereiner's triad, and atomic weights of  $A$  and  $B$  are 7 and 15, respectively, then the atomic weight of  $C$  is:  
 (a) 1 (b) 11  
 (c) 23 (d) 25
34. The incorrect hydrated radius order is:  
 (a)  $Li^+_{(aq)} < Be^{2+}_{(aq)}$  (b)  $Na^+_{(aq)} < Al^{3+}_{(aq)}$   
 (c)  $I^-_{(aq)} > Cl^-_{(aq)}$  (d)  $Ba^{2+}_{(aq)} < Ca^{2+}_{(aq)}$
35. The correct hydration energy order is:  
 (a)  $Fe^{2+} > Fe^{3+}$  (b)  $Cu^{2+} < Cu^+$   
 (c)  $K^+ > Cs^+$  (d)  $F^- < Br^-$
36. Atomic radii of fluorine and neon in Angstrom units are, respectively, given by:  
 (a) 0.72, 1.60 (b) 1.60, 1.60  
 (c) 0.72, 0.72 (d) 1.60, 0.72
37. Select the correct ionic radius order:  
 (a)  $P^{3-} < P^{2-}$  (b)  $P^{3-} < S^{3-}$   
 (c)  $Na^+ < Mg^{2+}$  (d)  $S^{2-} < Ca^{2+}$
38. Which of the following element is not a " $p$ -" block element?



- [illegible]

41. The overall layout of the empty periodic table is shown below (up to element 54).



(a) 0 (b) 2  
(c) 4 (d) 6



54. Which of the following pair of symbols represents nuclei that have the same number of neutrons?
- (a)  $^{56}_{26}\text{Fe}$  and  $^{58}_{28}\text{Ni}$  (b)  $^{58}_{26}\text{Fe}$  and  $^{56}_{26}\text{Fe}^{2+}$   
 (c)  $^{57}_{27}\text{Co}$  and  $^{58}_{26}\text{Fe}^{58}$  (d)  $^{57}_{28}\text{Ni}$  and  $^{58}_{28}\text{Ni}$
55. What is the electronic configuration for an  $\text{Fe(III)}$  ion in its ground state?
- (a)  $[\text{Ar}]3d^5$  (b)  $[\text{Ar}]3d^6$   
 (c)  $[\text{Ar}]4s^2 3d^6$  (d)  $[\text{Ar}]4s^2 3d^6$
56. Select the correct order of ionic radii:
- (a)  $\text{O}^{2-} > \text{S}^{2-} > \text{Se}^{2-} > \text{Te}^{2-}$   
 (b)  $\text{Te}^{2-} > \text{S}^{2-} > \text{O}^{2-} > \text{Se}^{2-}$   
 (c)  $\text{O}^{2-} > \text{Te}^{2-} > \text{S}^{2-} > \text{Se}^{2-}$   
 (d)  $\text{Te}^{2-} > \text{Se}^{2-} > \text{S}^{2-} > \text{O}^{2-}$
57. Select the correct order of ionic radii:
- (a)  $\text{O}^{2-} > \text{F}^- > \text{Mg}^{2+} > \text{Na}^+$   
 (b)  $\text{Na}^+ > \text{Mg}^{2+} > \text{O}^{2-} > \text{F}^-$   
 (c)  $\text{O}^{2-} > \text{F}^- > \text{Na}^+ > \text{Mg}^{2+}$   
 (d)  $\text{Mg}^{2+} > \text{Na}^+ > \text{F}^- > \text{O}^{2-}$
58. Select the correct order of I.E.:
- (a)  $\text{Cl}^- > \text{Cl} > \text{Cl}^+$  (b)  $\text{Cl}^+ > \text{Cl} > \text{Cl}^-$   
 (c)  $\text{Cl} > \text{Cl}^+ > \text{Cl}^-$  (d)  $\text{Cl}^- > \text{Cl}^+ > \text{Cl}$
59. Which configuration represents atom having the highest second ionization energy?
- (a)  $1s^2, 2s^2 2p^4$  (b)  $1s^2, 2s^2 2p^6$   
 (c)  $1s^2, 2s^2 2p^6, 3s^1$  (d)  $1s^2, 2s^2 2p^6, 3s^2$
60. From the electronic configuration of the given element K, L, M, and N, which one has the highest ionization potential:
- (a)  $\text{K} = [\text{Ne}]3s^3, 3p^2$  (b)  $\text{L} = [\text{Ne}]3s^2, 3p^3$   
 (c)  $\text{M} = [\text{Ne}]3s^2, 3p^1$  (d)  $\text{N} = [\text{Ar}]3d^{10}, 4s^2, 4p^3$
61. The increasing order of the first ionization enthalpies of the elements B, P, S, and F (lowest first) is:
- (a)  $\text{F} < \text{S} < \text{P} < \text{B}$  (b)  $\text{P} < \text{S} < \text{B} < \text{F}$   
 (c)  $\text{B} < \text{P} < \text{S} < \text{F}$  (d)  $\text{B} < \text{S} < \text{P} < \text{F}$
62. The process requiring the absorption of energy is:
- (a)  $\text{F} \longrightarrow \text{F}^-$  (b)  $\text{H} \longrightarrow \text{H}^-$   
 (c)  $\text{Cl} \longrightarrow \text{Cl}^-$  (d)  $\text{O} \longrightarrow \text{O}^{2-}$
63. Which of the following has the largest size?
- (a)  $\text{Al}$  (b)  $\text{Al}^+$   
 (c)  $\text{Al}^{2+}$  (d)  $\text{Al}^{3+}$
64. Which of the following is isoelectronic with carbon atom?
- (a)  $\text{Na}^+$  (b)  $\text{Al}^{3+}$   
 (c)  $\text{O}^{2-}$  (d)  $\text{N}^+$
65. The correct ionic radii order is:
- (a)  $\text{N}^{3-} > \text{O}^{2-} > \text{F}^- > \text{Na}^+$   
 (b)  $\text{N}^{3-} > \text{Na}^+ > \text{O}^{2-} > \text{F}^-$   
 (c)  $\text{Na}^+ > \text{O}^{2-} > \text{N}^{3-} > \text{F}^-$   
 (d)  $\text{O}^{2-} > \text{F}^- > \text{Na}^+ > \text{N}^{3-}$
66. The radii of F,  $\text{F}^-$ , O, and  $\text{O}^{2-}$  are in the order of:
- (a)  $\text{O}^{2-} > \text{F}^- > \text{F} > \text{O}$  (b)  $\text{F}^- > \text{O}^{2-} > \text{F} > \text{O}$   
 (c)  $\text{O}^{2-} > \text{O} > \text{F}^- > \text{F}$  (d)  $\text{O}^{2-} > \text{F}^- > \text{O} > \text{F}$
67. Which of the following sets represents the collection of isoelectronic species?
- (a)  $\text{Na}^+, \text{Mg}^{2+}, \text{Al}^{3+}, \text{Cl}^-$  (b)  $\text{Na}^+, \text{Ca}^{2+}, \text{Sc}^{3+}, \text{F}^-$   
 (c)  $\text{K}^+, \text{Cl}^-, \text{Mg}^{2+}, \text{Sc}^{3+}$  (d)  $\text{K}^+, \text{Ca}^{2+}, \text{Sc}^{3+}, \text{Cl}^-$
68. The calculated value of magnetic moment of  $^{23}\text{V}^{3+}$  is:
- (a)  $1.73 \mu_B$  (b)  $2.83 \mu_B$   
 (c)  $3.87 \mu_B$  (d)  $4.90 \mu_B$
69. The ionic radii of  $\text{Fe}^{2+}$  and  $\text{Fe}^{3+}$  are  $x$  and  $y$ , respectively. The correct relationship between  $x$  and  $y$  is:
- (a)  $x > y$  (b)  $x < y$   
 (c)  $x = y$  (d) Cannot be predicted
70. Ce (58) is a member of:
- (a) s-block (b) p-block  
 (c) d-block (d) f-block
71. The element with the highest ionization potential from the following is:
- (a) Oxygen (b) Nitrogen  
 (c) Carbon (d) Boron
72. The ions  $\text{O}^{2-}$ ,  $\text{F}^-$ ,  $\text{Na}^+$ ,  $\text{Mg}^{2+}$ , and  $\text{Al}^{3+}$  are isoelectronic. Their ionic radii show:
- (a) An increase from  $\text{O}^{2-}$  to  $\text{F}^-$  and then a decrease from  $\text{Na}^+$  to  $\text{Al}^{3+}$   
 (b) A decrease from  $\text{O}^{2-}$  to  $\text{F}^-$  and then an increase from  $\text{Na}^+$  to  $\text{Al}^{3+}$   
 (c) A significant increase from  $\text{O}^{2-}$  to  $\text{Al}^{3+}$   
 (d) A significant decrease from  $\text{O}^{2-}$  to  $\text{Al}^{3+}$
73. Which one of the following grouping represents a collection of isoelectronic species? (At. no., Cs = 55 and Br = 35)
- (a)  $\text{N}^{3-}, \text{F}^-, \text{Na}^+$  (b)  $\text{Ca}^{2+}, \text{Cs}^+, \text{Br}$   
 (c)  $\text{Be}, \text{Al}^{3+}, \text{Cl}^-$  (d)  $\text{Na}^+, \text{Ca}^{2+}, \text{Mg}^{2+}$
74. The first ionization enthalpies of four consecutive elements present in the second period of the periodic table are 8.3, 11.3, 14.5, and 13.6 eV, respectively. Which



one of the following is the first ionization enthalpy of nitrogen?

- (a) 13.6 (b) 14.5  
(c) 11.3 (d) 8.3

75. The electronic configuration of the element which is just above the element with atomic number 43 in the same periodic group is:

- (a)  $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^5, 4s^2$   
(b)  $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^{10}, 4s^2, 4p^5$   
(c)  $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^6, 4s^1$   
(d)  $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^{10}, 4s^1, 4p^6$

76. If the atomic number of an element is 33, it will be placed in the periodic table in the:

- (a) First group (b) Third group  
(c) Fifth group (d) Seventh group

### JEE (Advanced) Exercises

#### Single Correct Answer Type

- Which one of the following ions has the smallest radius?  
(a)  $C^{4-}$  (b)  $S^{2-}$   
(c)  $K^+$  (d)  $Ca^{2+}$
- The most electropositive element is:  
(a) Cs (b) Ga  
(c) Li (d) Pb
- Which of the following has the lowest ionization enthalpy?  
(a)  $4s^1$  (b)  $3d^2$   
(c)  $3p^6$  (d)  $2p^6$
- Of the following elements, which one has the highest electronegativity?  
(a) I (b) Br  
(c) Cl (d) F
- Which one of the following is the smallest cation?  
(a)  $Na^+$  (b)  $Mg^{2+}$   
(c)  $Ca^{2+}$  (d)  $Al^{3+}$
- Which one of the following ions has the lowest magnetic moment?  
(a)  $Cu^{2+}$  (b)  $Ni^{2+}$   
(c)  $Co^{3+}$  (d)  $Fe^{2+}$
- The lanthanide contraction is responsible for the fact that:  
(a) Zr and Y have about the same radius

- (b) Zr and Nb have similar oxidation state  
(c) Zr and Hf have about the same radius  
(d) Zr and Zn have the same oxidation state

8. Select the correct order of electronegativity (E.N.):

- (a)  $F > Cl > Br > I$  (b)  $N > P > As$   
(c) Both (a) and (b) (d)  $S > O > Se$

9. Identify the least stable ion amongst the following:

- (a)  $Li^-$  (b)  $Be^-$   
(c)  $B^-$  (d)  $C^-$

10. General electronic configuration of outermost and penultimate shell is  $(n-1)s^2(n-1)p^6(n-1)d^xns^2$ . If  $n=4$  and  $x=5$ , then the number of protons in the nucleus will be:

- (a)  $> 25$  (b)  $< 24$   
(c) 25 (d) 30

11. Select the correct order of hydrated size of ion:

- (a)  $Li^+_{(aq)} > Na^+_{(aq)} > K^+_{(aq)}$   
(b)  $Be^{2+}_{(aq)} < Mg^{2+}_{(aq)} < Ca^{2+}_{(aq)}$   
(c)  $Al^{3+}_{(aq)} < Mg^{2+}_{(aq)} < Si^{4+}_{(aq)}$   
(d)  $Cs^+_{(aq)} > Rb^+_{(aq)} > K^+_{(aq)}$

12. Outer electronic configurations of K, Cu, and Cr are, respectively,

- (a)  $4s^1, 3d^{10}, 3d^6$  (b)  $4s^2, 3d^{10}, 3d^4$   
(c)  $4s^1, 3d^9, 3d^4$  (d)  $4s^1, 3d^9, 3d^4$

13. In which one of the following pairs the radius of the second species is greater than that of the first?

- (a) Na, Mg (b)  $O^{2-}, N^{3-}$   
(c)  $Li^+, Be^{2+}$  (d)  $Ba^{2+}, Sr^{2+}$

14. The electronic configurations of four elements are given below. Arrange these elements in the correct order of magnitude (without sign) of their electron affinity:

- (i)  $2s^2 2p^5$  (ii)  $3s^2 3p^5$   
(iii)  $2s^2 2p^4$  (iv)  $3s^2 3p^4$

Select the correct answer using the codes given below:

- (a) (i)  $<$  (ii)  $<$  (iii)  $<$  (iv) (b) (ii)  $>$  (i)  $>$  (iv)  $>$  (iii)  
(c) (i)  $<$  (iii)  $<$  (iv)  $<$  (ii) (d) (iii)  $<$  (iv)  $<$  (ii)  $<$  (i)

15. The electronic configuration of the atom having maximum difference between first and second ionization energies is:

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

16. The electronic configuration of the element with maximum electron affinity is:

- (a)  $1s^2, 2s^2, 2p^3$  (b)  $1s^2, 2s^2, 2p^5$   
(c)  $1s^2, 2s^2, 2p^6, 3s^2, 3p^5$  (d)  $1s^2, 2s^2, 2p^6, 3s^2, 3p^3$



17. Which of the following magnetic moment values will correspond to the highest ionization energy for Mn species?  
 (a)  $2\sqrt{2}$  (b)  $\sqrt{15}$   
 (c)  $\sqrt{35}$  (d)  $\sqrt{24}$
18. Select the correct statement:  
 (a) Ionic mobility of  $\text{Al}^{3+}$  is greater than that of  $\text{Mg}^{2+}$  in water  
 (b)  $\text{K}^+(\text{aq})$  has lesser ionic mobility than  $\text{Ca}^{2+}(\text{aq})$   
 (c)  $\text{Cl}^-(\text{aq})$  has the highest ionic mobility among halide (aq) ions  
 (d) Ionic mobility of  $\text{Cs}^+(\text{aq})$  is the highest among the alkali metal ions
19. Nishit Bhandari went to meet his friend Rohit, where he saw that his friend was doing the study of a particular chemistry book. But he could not find the theoretical value of bond length in H—F but he found that  $r_{\text{H}}$  and  $r_{\text{F}}$  are 0.37 Å and 0.72 Å, respectively, and electronegativities of F and H are 4.0 and 2.1, respectively. What is the bond length of H—F bond?  
 (a) 1.09 (b) 1.784  
 (c) 0.92 (d) 0.46
20. Which element exhibits both +1 and +3 oxidation numbers in its compounds?  
 (a) B (b) Be  
 (c) Sn (d) Tl
21. What is the number of unpaired electrons in a manganese atom ( $Z = 25$ ) in its lowest energy states?  
 (a) 1 (b) 3  
 (c) 5 (d) 7
22. In which pair do both species have the same electron configurations?  
 (a)  $\text{Se}^{2-}$ , Kr (b)  $\text{Mn}^{2+}$ ,  $\text{Cr}^{3+}$   
 (c)  $\text{Na}^+$ ,  $\text{Cl}^-$  (d) Ni,  $\text{Zn}^{2+}$
23. Which of the following species is paramagnetic?  
 1.  $\text{Ti}^{4+}$ , 2.  $\text{Fe}^{2+}$ , 3.  $\text{Zn}^0$   
 (a) 2 only (b) 3 only  
 (c) 1 and only (d) 2 and 3 only
24. When the elements C, N, and Si are arranged in order of increasing first ionization energy, what is the correct order?  
 (a)  $\text{C} < \text{N} < \text{Si}$  (b)  $\text{N} < \text{C} < \text{Si}$   
 (c)  $\text{Si} < \text{C} < \text{N}$  (d)  $\text{Si} < \text{N} < \text{C}$
25. Which gaseous ion in its ground state has the greatest number of unpaired electrons?  
 (a)  $\text{Mn}^{3+}$  (b)  $\text{Fe}^{3+}$   
 (c)  $\text{Co}^{3+}$  (d)  $\text{Ni}^{3+}$
26. Which element can exhibit more than one oxidation state in compounds?  
 1. Cr, 2. Pb, 3. Sr  
 (a) 1 only (b) 1 and 2 only  
 (c) 2 and 3 only (d) 1, 2, and 3
27. Which set of orbitals is listed in the sequential order of filling in a many-electron atom?  
 (a)  $3s, 3p, 3d$  (b)  $3d, 4s, 4p$   
 (c)  $3d, 4p, 5s$  (d)  $4p, 4d, 5s$
28. When the atoms Li, Be, B, and Na are arranged in order of increasing atomic radius, what is the correct order?  
 (a) B, Be, Li, Na (b) Li, Be, B, Na  
 (c) Be, Li, B, Na (d) Be, B, Li, Na
29. What is the total number of valence electrons in the peroxydisulphate,  $\text{S}_2\text{O}_8^{2-}$ , ion?  
 (a) 58 (b) 60  
 (c) 62 (d) 64
30. What is the total number of  $p$  electrons in a single phosphorus atom in its ground state?  
 (a) 3 (b) 5  
 (c) 9 (d) 15
31. Which pair of symbols identifies two elements that are metalloids?  
 (a) B and Ge (b) Mg and Si  
 (c) P and As (d) Ti and V
32. Select the correct order of ionic radii:  
 (a)  $\text{Ti}^{2+} > \text{Ti}^{3+} > \text{Ti}^{4+}$  (b)  $\text{Ti}^{4+} > \text{Ti}^{2+} > \text{Ti}^{3+}$   
 (c)  $\text{Ti}^{3+} > \text{Ti}^{2+} > \text{Ti}^{4+}$  (d)  $\text{Ti}^{4+} > \text{Ti}^{3+} > \text{Ti}^{2+}$
33. The metalloid among the following group of elements is:  
 (a) P (b) As  
 (c) Al (d) N
34. The correct order of radii is:  
 (a)  $\text{N} < \text{Be} < \text{B}$  (b)  $\text{F}^- < \text{O}^{2-} < \text{N}^{3-}$   
 (c)  $\text{Na} < \text{Li} < \text{K}$  (d)  $\text{Fe}^{3+} < \text{Fe}^{2+} < \text{Fe}^{4+}$
35. Which shows the highest lattice energy?  
 (a) RbF (b) CsF  
 (c) NaF (d) KF

36.

37.

38.

39.

40.

41.

42.

43.

4.

4

4

36. Which of the following configurations is associated with biggest jump between 2nd and 3rd I.E.?

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

37. Alkali metals in each period have:

- (a) Largest size (b) Lowest I.E.  
(c) Highest I.E. (d) Highest electronegativity

38. The set representing the correct order of first ionization potential is:

- (a)  $K > Na > Li$  (b)  $Be > Mg > Ca$   
(c)  $B > C > N$  (d)  $Ge > Si > C$

39. Lattice energy of an ionic compound depends upon:

- (a) Charge on the ions only  
(b) Size of the ions only  
(c) Packing of the ions only  
(d) Charge and size of the ions

40. Which of the following is the correct order for electron gain enthalpy?

- (a)  $S < O < Cl < F$  (b)  $O < S < F < Cl$   
(c)  $Cl < F < S < O$  (d)  $F < Cl < O < S$

41. The oxidation states of Cr in  $K_2Cr_2O_7$  and  $K_2CrO_4$ , respectively, are:

- (a) 6+, 7+ (b) 7+, 6+  
(c) 6+, 6+ (d) 7+, 7+

42. Which of the following electronic configuration would be associated with the highest magnetic moment?

- (a)  $d^2$  (b)  $d^4$   
(c)  $d^5$  (d)  $d^7$

43. Select equations having exothermic step.

- (I)  $S_{(g)}^- \longrightarrow S_{(g)}^{2-}$   
(II)  $Na_{(g)}^+ + Cl_{(g)}^- \longrightarrow NaCl_{(s)}$   
(III)  $N_{(g)} \longrightarrow N_{(g)}^-$   
(IV)  $Al_{(g)}^{2+} \longrightarrow Al_{(g)}^{3+}$

Choose the correct code:

- (a) II (b) I, II  
(c) III and IV (d) II and III

44. Which of the following is not an actinide?

- (a) Curium (b) Californium  
(c) Uranium (d) Terbium

45. Europium belongs to:

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

46. Which of the following pairs has both members from the same group of the periodic table?

- (a) Na, Ca (b) Na, Cl  
(c) Ca, Cl (d) Cl, Br

47. Which one of the following belongs to representative group of elements in the periodic table?

- (a) Lanthanum (b) Argon  
(c) Chromium (d) Aluminium

48. Of cobalt and zinc salts, which are attracted in magnetic field?

- (a) Cobalt salts (b) Zinc salts  
(c) Both (a) and (b) (d) None of these

49. Which is the largest stable atom?

- (a) V (b) Na  
(c) Al (d) Pb

50. Which of the following is the strongest base?

- (a)  $Be(OH)_2$  (b)  $Mg(OH)_2$   
(c)  $Al(OH)_3$  (d)  $Si(OH)_4$

51. Which one of these is amphoteric oxide?

- (a)  $CO_2$  (b)  $SnO_2$   
(c)  $NO_2$  (d)  $SO_2$

52. Calculate the lattice energy of a salt  $MX_{(s)}$  from the data given below:

Heat of formation of  $MX(\Delta H) = -550$  kJ/mol

Heat of sublimation of  $M(S) = 80$  kJ/mol

Heat of dissociation of  $X_2(D) = 155$  kJ/mol

Ionization energy of  $M(I) = 347$  kJ/mol

Electron affinity of  $X(E) = -343$  kJ/mol

- (a)  $-838.5$  kJ/mol (b)  $-938.5$  kJ/mol  
(c)  $-711.5$  kJ/mol (d)  $-638.5$  kJ/mol

53. Which of the following species has the highest electron gain enthalpy?

- (a)  $F^-$  (b) S  
(c)  $O^-$  (d) O

54. Two elements have electronegativities 1.2 and 3.0, respectively; the bond formed between them would be:

- (a) Ionic (b) Covalent  
(c) Coordinate (d) Metallic

55. Which of the following sets is of coinage metals?

- (a) Cu, Ag, Au (b) Zn, Cd, Hg  
(c) Au, Ag, Zn (d) Li, Na, K

56. The correct order of increasing electron affinity of halogens is:

- (a)  $F < Cl < Br < I$  (b)  $I < Br < F < Cl$   
(c)  $I < Br < Cl < F$  (d)  $Br < I < F < Cl$



57. If atomic number of inert gas is  $Z$ , then ionic bond is formed between:  
 (a)  $(Z - 1)$  and  $(Z + 1)$  (b)  $(Z - 2)$  and  $(Z + 2)$   
 (c) Both (a) and (b) (d) None of these
58. Comment on the E.N. of Sb in  $\text{SbF}_3$  and  $\text{SbF}_5$ :  
 (a) E.N. of Sb ( $\text{SbF}_3$ ) > E.N. of Sb ( $\text{SbF}_5$ )  
 (b) E.N. of Sb ( $\text{SbF}_3$ ) < E.N. of Sb ( $\text{SbF}_5$ )  
 (c) E.N. of Sb is identical in both cases  
 (d) No comment can be predicted
59. In which of the following compounds is the size of cation to anion ratio minimum?  
 (a) CsF (b) LiI  
 (c) LiF (d) CsI
60. Which of the following has 2nd I.P. < 1st I.P.?  
 (a) Mg (b) Ne  
 (c) C (d) None of these
61. In which of the following processes is the maximum amount of energy involved?  
 (a)  $\text{Cl} \rightarrow \text{Cl}^-$  (b)  $\text{Br}^{2-} \rightarrow \text{Br}$   
 (c)  $\text{F}^- \rightarrow \text{F}$  (d)  $\text{I}^- \rightarrow \text{I}$
62. Which of the following has the highest electron affinity?  
 (a) F (b) Br  
 (c) Cl (d) I
63. Which one of the following series is arranged in order of increasing ionic radius?  
 (a)  $\text{Mg}^{2+} < \text{S}^{2-} < \text{Cl}^- < \text{K}^+ < \text{Ca}^{2+}$   
 (b)  $\text{Mg}^{2+} < \text{Ca}^{2+} < \text{K}^+ < \text{Cl}^- < \text{S}^{2-}$   
 (c)  $\text{S}^{2-} < \text{Cl}^- < \text{K}^+ < \text{Mg}^{2+} < \text{Ca}^{2+}$   
 (d)  $\text{S}^{2-} < \text{Mg}^{2+} < \text{Ca}^{2+} < \text{Cl}^- < \text{K}^+$
64. What is the formula for the basic anhydride of  $\text{Ba}(\text{OH})_2$ ?  
 (a)  $\text{Ba}_2\text{O}$  (b) BaO  
 (c)  $\text{BaO}_2$  (d) Ba
65. An element with the electron configuration  $[\text{Xe}]4f^{14}5d^7 6s^2$  is:  
 (a) An alkaline earth element  
 (b) A transition element  
 (c) An inert gas (d) A rare earth
66. The formula of sodium tungstate is  $\text{Na}_2\text{WO}_4$  and that of lead phosphate is  $\text{Pb}_3(\text{PO}_4)_2$ . What is the formula of lead tungstate?  
 (a)  $\text{PbWO}_4$  (b)  $\text{Pb}_2(\text{WO}_4)_3$   
 (c)  $\text{Pb}_3(\text{WO}_4)_2$  (d)  $\text{Pb}_3(\text{WO}_4)_4$
67. Which metal requires the least energy to exhibit the photoelectric effect?  
 (a) Cs (b) Ca  
 (c) Cu (d) Hg
68. Which set is expected to show the smallest difference in first ionization energy?  
 (a) He, Ne, Ar (b) B, N, O  
 (c) Mg,  $\text{Mg}^+$ ,  $\text{Mg}^{2+}$  (d) Fe, Co, Ni
69. In which list are the elements arranged in order of increasing first ionization energy?  
 (a) Li, Na, K (b) S, O, F  
 (c) Na, Mg, Al (d) F, Ne, Na
70. All of the following possess complete  $d$ -shells except:  
 (a)  $\text{Ag}^+$  (b)  $\text{Cu}^{2+}$   
 (c)  $\text{Ga}^{3+}$  (d)  $\text{Zn}^{2+}$
71. Which element exhibits the greatest number of oxidation states in its compounds?  
 (a) Ca (b) V  
 (c) Cu (d) Na
72. Which terms are exothermic for the formation of  $\text{NaF(s)}$ ?  
 I.  $\text{Na}_{(g)} \rightarrow \text{Na}_{(g)}^+ + e^-$   
 II.  $\text{F}_{(g)} + e^- \rightarrow \text{F}_{(g)}^-$   
 III.  $\text{Na}_{(g)}^+ + \text{F}_{(g)}^- \rightarrow \text{NaF}_{(s)}$   
 (a) I only (b) II only  
 (c) I and III only (d) II and III only
73. The set(s) representing the correct order of ionic radius is/are:  
 (a)  $\text{Li}^+ > \text{Be}^{2+} > \text{Na}^+ > \text{Mg}^{2+}$   
 (b)  $\text{Na}^+ > \text{Li}^+ > \text{Mg}^{2+} > \text{Be}^{2+}$   
 (c)  $\text{Li}^+ > \text{Na}^+ > \text{Mg}^{2+} > \text{Be}^{2+}$   
 (d)  $\text{Mg}^{2+} > \text{Be}^{2+} > \text{Li}^+ > \text{Na}^+$
74. The formation of the oxide ion  $\text{O}^{2-}(\text{g})$  requires first an exothermic and then an endothermic step as shown below:  
 $\text{O}_{(g)} + e \longrightarrow \text{O}_{(g)}^-; \quad \Delta H = -142 \text{ kJ/mol}$   
 $\text{O}_{(g)}^- + e \longrightarrow \text{O}_{(g)}^{2-}; \quad \Delta H = 844 \text{ kJ/mol}$   
 This is because:  
 (a)  $\text{O}^-$  ion has comparatively larger size than oxygen atom  
 (b) Oxygen has high electron affinity



(c)  $O^-$  ion will lead to resisting of the addition of another electron

(d) Oxygen is more electronegative

75. Select the correct order of 2nd ionization energy of C, N, O, and F:

(a)  $C > N > O > F$

(b)  $N > C > O > F$

(c)  $C < N < O < F$

(d)  $O > F > N > C$

### Multiple Correct Answers Type

1. Select the correct statement(s):

(a) Size of  $H^-$  is larger than  $F^-$

(b) Rb is more electropositive compared to Ca

(c)  $Na^+$  is more electronegative than Na

(d)  $Cl^-$  is more electronegative than F

2. Select the incorrect ionization energy order:

(a)  $Li < B < Be < C < N < O < F$

(b)  $Na < Mg < Al < Si < S < P < Cl$

(c)  $K < Ga < Ca < Ge < As < Se < Br$

(d)  $Rb < Sr < In < Sn < Sb < Te < I$

3. The statement(s) that is/are correct for the periodic classification of elements is/are:

(a) The properties of elements are periodic function of their atomic numbers

(b) Non-metallic elements are lesser in number than metallic elements

(c) The first ionization energies of the elements along the periods do not vary in a regular manner with the increase in atomic number

(d) For transition elements, the  $d$ -subshells are filled with electrons monotonically with increase in atomic number

4. Which of the following order(s) is/are correct?

(a)  $NH_3 < PH_3 < AsH_3$  (Acidic)

(b)  $Li < Be < B < C$  (I.E.<sub>1</sub>)

(c)  $Al_2O_3 < MgO < Na_2O < K_2O$  (Basic)

(d)  $Li^+ < Na^+ < K^+ < Cs^+$  (Ionic radius)

5. Which is/are false about electronegativity order of the following elements?

(a)  $P > Si$

(b)  $C > N$

(c)  $C > Br$

(d)  $Sr > Ca$

6. Which of the following species has same number of unpaired electrons?

(a)  $Cr^{3+}$

(b)  $Mn^{2+}$

(c)  $Fe^{3+}$

(d)  $Cu^{2+}$

7. Select the correct statement(s):

(a) In general, more the ionization energy, more will be the electronegativity

(b) Electronegativity increases means metallic character increases

(c) In general, lower the ionization energy, higher will be the reducing property

(d) Cl has higher electron affinity than F

8. Which of the following statement is/are false?

(a) Lanthanum is the first element of lanthanides

(b) Actinium violates the Aufbau's principle

(c) Chromium violates the Pauli's exclusion principle

(d) Total 10 exchanges are possible for  $d$ -electrons in Zn

9. Which prediction(s) is/are incorrect according to the Lothar Meyer's curve?

(a) Each peak of the curve is occupied by the alkali metals

(b) Alkaline earth metals occupy ascending positions of curve

(c) Atomic volume increases first and then decreases in a period (which is defined later) in Lothar Meyer's curve

(d) Identically placed elements in the atomic volume vs atomic mass curve occur in the same period in the periodic table

10. Find the correct 2nd ionization energy order from the following option(s):

(a)  $Al > Mg$

(b)  $Te > Sb$

(c)  $Fe > Fe^+$

(d)  $In > Sr$

11. Ionization energies of element A are given below in kJ/mol:

I.E.<sub>1</sub>

I.E.<sub>2</sub>

I.E.<sub>3</sub>

120

430

13000

If A reacts with different elements, which compounds are not possible:

(a)  $AF$

(b)  $A_2O$

(c)  $A_3N$

(d)  $A_3N_2$

12. The first ionization energy of oxygen is less than that of nitrogen. Which of the following is/are the incorrect reason(s) for this observation?

(a) Lesser effective nuclear charge of oxygen than nitrogen



- 3



(d) The third ionization potential of Mg is greater than the third ionization potential of Al

26. Stability of ions of Ge, Sn, and Pb will be in the order:

- (a)  $\text{Ge}^{2+} < \text{Sn}^{2+} < \text{Pb}^{2+}$
- (b)  $\text{Ge}^{4+} > \text{Sn}^{4+} > \text{Pb}^{4+}$
- (c)  $\text{Sn}^{4+} > \text{Sn}^{2+}$
- (d)  $\text{Pb}^{2+} > \text{Pb}^{4+}$

27. On moving down the group from F to I, which of the properties decrease?

- (a) Ionic radius
- (b) Ionization energy
- (c) Oxidizing agent
- (d) Electronegativity

28. Ionic radius of:

- (a)  $\text{Fe}^{2+} < \text{Fe}^{3+}$
- (b)  $\text{Ne} > \text{Na}^+$
- (c)  $\text{Rb}^+ < \text{K}^+$
- (d)  $\text{As}^{3+} > \text{As}^{5+}$

29. An element X belongs to fourth period and fifteenth group of the periodic table. Which one of the following is/are false regarding the outer electronic configuration of X? It has:

- (a) Partially filled *d*-orbital and completely filled *s*-orbital
- (b) Completely filled *s*-orbital and completely filled *p*-orbital
- (c) Completely filled *s*-orbital and half filled *p*-orbital
- (d) Half filled *d*-orbital and completely filled *s*-orbital

30. If  $X^{2-}$  is isoelectronic with " $\text{O}_2^+$ " and has  $Z + 1$  neutrons ( $Z$  is atomic number of  $X^{2-}$ ), then:

- (a) The mass number of  $X^{2-}$  is 27
- (b) The mass number of  $X^{2-}$  is 57
- (c) The atomic number of  $X^{2-}$  is 28
- (d) The number of protons in  $X^{2-}$  is 13

31. Which of the following properties are the properties of metals?

- (a) They are sonorous
- (b) They are in general poor conductor of heat and electricity
- (c) They are malleable and ductile
- (d) They are hard

32. Ionization energy depends upon:

- (a) Principal quantum number
- (b) Azimuthal quantum number
- (c) Magnetic quantum number
- (d) Spin quantum number

## Comprehension Type

### Comprehension-1: (Q. 1 to Q. 3)

If one electron has been removed from an atom, it becomes increasingly difficult to remove the second and subsequent electrons from the resulting positively charged ions on account of electrostatic attraction.

1. Suppose a gas mixture of F, Cl, Br, and I is irradiated with photons of frequency appropriate to ionize Cl. What ion(s) will be present in the mixture?

- (a)  $\text{F}^+$  only
- (b)  $\text{Cl}^+$  only
- (c)  $\text{F}^+$ ,  $\text{Cl}^+$ ,  $\text{Br}^+$  only
- (d)  $\text{Cl}^+$ ,  $\text{Br}^+$ ,  $\text{I}^+$  only

2. If the ionization values of elements are plotted against atomic number, then peaks are occupied by:

- (a) Alkali metals
- (b) Alkaline earth metals
- (c) Noble gas elements
- (d) Halogens

3. The numerical value of energy involved in the given process  $\text{K} \longrightarrow \text{K}^+$  is less than that of which of the following processes?

- (a)  $\text{K}^- \longrightarrow \text{K}$
- (b)  $\text{K} \longrightarrow \text{K}^+$
- (c) Both (a) and (b)
- (d) None of these

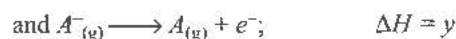
### Comprehension-2: (Q. 4 to Q. 6)

On moving across a period, the atomic size decreases and nuclear charge increases and therefore the force of attraction exerted by the nucleus on the electron in the outermost shell increases.

4. The first ionization potentials (in eV) of As and Se atoms, respectively, are:

- (a) 14.6, 13.6
- (b) 13.6, 14.6
- (c) 13.6, 13.6
- (d) 14.6, 14.6

5. For the process



select correct alternate:

- (a) Ionization energy of  $A_{(g)}^-$  is  $y$
- (b) Electron affinity of  $A_{(g)}$  is  $x$
- (c) Electron affinity of  $A_{(g)}$  is  $-y$
- (d) All are correct statements

6. Potassium forms  $\text{K}^+$  ion but it does not form  $\text{K}^{2+}$  because of:

- (a) Very low value of  $(\text{I.E.})_1$  and  $(\text{I.E.})_2$
- (b) Very high value of  $(\text{I.E.})_1$  and  $(\text{I.E.})_2$
- (c) Low value of  $(\text{I.E.})_1$  and low value of  $(\text{I.E.})_2$
- (d) Low value of  $(\text{I.E.})_1$  and high value of  $(\text{I.E.})_2$

## Assertion-Reasoning Type

- Statement-I:**  $\text{Cl}^-$  and  $\text{Ca}^{2+}$  are isoelectronic species.  
**Statement-II:** Isoelectronic species should have same charges.

(a) Statement-I is true; Statement-II is true; Statement-II is correct explanation for statement-I.  
 (b) Statement-I is true; Statement-II is true; Statement-II is NOT the correct explanation for statement-I.  
 (c) Statement-I is true; Statement-II is false.  
 (d) Statement-I is false; Statement-II is true.
- Statement-I:** Cd is a transition element.  
**Statement-II:** Cd and  $\text{Cd}^{2+}$  both have completely filled  $d$ -orbitals in their ground state.

(a) Statement-I is true; Statement-II is true; statement-II is correct explanation for Statement-I.  
 (b) Statement-I is true; Statement-II is true; Statement-II is NOT the correct explanation for Statement-I.  
 (c) Statement-I is true; Statement-II is false.  
 (d) Statement-I is false; Statement-II is true.
- Statement-I:** 1st ionization energy of "P" is greater than "S".  
**Statement-II:**  $Z_{\text{eff}}$  value of "S" is greater than "P".

(a) Statement-I is true; Statement-II is true; Statement-II is correct explanation for Statement-I.  
 (b) Statement-I is true; Statement-II is true; Statement-II is NOT the correct explanation for statement-I.  
 (c) Statement-I is true; Statement-II is false.  
 (d) Statement-I is false; statement-II is true.
- Statement-I:**  $\text{Mg}^{2+}$  and  $\text{Al}^{3+}$  are isoelectronic but ionic radius of  $\text{Al}^{3+}$  is less than that of  $\text{Mg}^{2+}$ .  
**Statement-II:** The effective nuclear charge on the outershell electrons in  $\text{Al}^{3+}$  is more than that in  $\text{Mg}^{2+}$ .

(a) Statement-I is true; Statement-II is true; Statement-II is correct explanation for Statement-I.  
 (b) Statement-I is true; Statement-II is true; Statement-II is NOT the correct explanation for Statement-I.  
 (c) Statement-I is true; Statement-II is false.  
 (d) Statement-I is false; Statement-II is true.

## Matching Column Type

- Match the column:
 

Column-I	Column-II
(a) He	(p) High electron gain enthalpy
(b) Cl	(q) Most electropositive element
(c) Cs	(r) Strongest reducing agent
(d) Li	(s) Highest ionization energy
- Match the column:
 

Column-I	Column-II
(a) Noble gas	(p) Sodium
(b) Transition element	(q) Argon
(c) Lanthanide	(r) Cerium
	(s) Chromium
- Match the column:
 

Column-I	Column-II
(a) Zinc	(p) Solid at room temperature
(b) Hg	(q) Transition element
(c) Cr	(r) $d$ -block element
	(s) Liquid at room temperature
- Match the column:
 

Column-I	Column-II
(a) Electron affinity	(p) Depends upon effective nuclear charge
(b) Ionization potential	(q) Depends upon shielding constant
(c) Electronegativity	(r) Depends upon half filled and fully filled electronic configuration
	(s) Can be estimated from bond-energy data
- Match the column:
 

Column-I	Column-II
(a) 89	(p) $d$ -block or $p$ -block
(b) 35	(q) 5th period element
(c) 37	(r) Violates Aufbau's principle
(d) 24	(s) Not lanthanides