

3. CLASSIFICATION OF ELEMENTS AND PERIODICITY IN PROPERTIES

Single Correct Answer Type

- Which of the following has the electronic configuration $[Ar]3d^5$?
a) Cr b) Fe^{3+} c) Mn d) V
- Electron affinity is positive when

| | | | |
|------------------|----------------------|------------------|-------------------------------|
| O^- is | O^{2-} is | O^+ is | Electron affinity |
| a) formed from 0 | b) formed from O^- | c) formed from 0 | d) is always a negative value |
- (A), (B), (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) will have atomic number in the order

| | | | |
|------------|------------|------------|------------|
| (A) | (C) | (A) | (B) |
| a) $< (B)$ | b) $< (B)$ | c) $< (C)$ | d) $< (A)$ |
| $< (C)$ | $< (A)$ | $< (B)$ | $< (C)$ |
- First long period contains elements
a) 8 b) 18 c) 32 d) 2
- Li resemble Mg. This is called diagonal relationship which is attributed to
a) Same value of electron negativity b) Same value of electron affinity c) Penetration of sub-shells d) Identical effective nuclear charge
- Which of the following does not represent the correct order of the properties indicated?

| | | | | |
|--|---------------------|--------------------------|--|--|
| $Ni^{2+} > Cr^{2+} > Fe^{2+} > Mn^{2+}$ (size) | a) $Cr > Mn$ (size) | b) $Ti > Cr > Mn$ (size) | c) $Mn^{2+} > Fe^{2+} > Ni^{2+} > Co^{2+}$ (unpaired electron) | d) $Cu^{2+} > Ni^{2+} > Fe^{2+} > Co^{2+}$ (unpaired electron) |
|--|---------------------|--------------------------|--|--|
- If Aufbau and Hund's rule are not used, then incorrect statement is

| | | | |
|-------------------------------|--------------------------------------|-----------------------------|------------------------------|
| K^+ would be a coloured ion | Na will be in same s-block (if these | Cu would be s-block element | Magnetic moment of Cr(24) |
| a) be | b) same s-block (if these | c) be s-block element | d) Magnetic moment of Cr(24) |
- Representative elements belong to
a) s- and p-block b) d-block c) d- and f-block d) f-block
- Which of the following oxides is highly basic?
a) Al_2O_3 b) Cr_2O_3 c) Na_2O d) BaO
- If Aufbau rule is not followed, K-19 will be placed in block
a) s b) p c) d d) f
- Which of the following metals forms an amphoteric oxide?
a) Ca b) Ni c) Zn d) Fe
- Catenation properties of C, Si, Ge, Sn, Pb are in order

| | | | |
|--------------|-----------|-----------|------------------------------|
| C \gg Si | C $<$ Si | C $>$ Si | None of the above is correct |
| a) $> Ge$ | b) $< Ge$ | c) $> Sn$ | d) the above is correct |
| $\approx Sn$ | $< Sn$ | $> Ge$ | |
| $\gg Pb$ | $< Pb$ | $> Pb$ | |
- Select the correct statement

| | | | |
|--|--|--|---|
| a) More active metals are on the left side of the Periodic Table | b) Less active metals are on the left side of the Periodic Table | c) Reducing power decreases as moving down the group | d) All the above statements are correct |
|--|--|--|---|
- The electronegativities of elements A and B are 1.2 and 3.4 units respectively. The type of bond connecting A and B in compound AB is
a) Covalent b) Ionic c) Coordinate covalent d) Polar covalent
- Which of the following will have maximum electron affinity?
a) $1s^2 2s^2 2p^1$ b) $1s^2 2s^2 2p^2$ c) $1s^2 2s^2 2p^3$ d) $1s^2 2s^2 2p^4$
- Select the correct alternate

| | | | |
|-------------------------------------|---------------------------------------|---------------------------------------|---------------------------------|
| Due to lanthanide contraction on Zr | Due to completion of 3d-subshell, the | Both (a) & (b) are correct statements | Both of the above are incorrect |
| a) decrease in atomic radius | b) increase in atomic radius | c) correct | d) above are incorrect |



- and Hf have almost equal size and Hf have almost equal size electronic charge density in this subshell becomes very high which increase the inter-electronic repulsion hence, size increases
17. Point out the oxide which is amphoteric in nature
a) CO b) Bi₂O₃ c) PbO d) CO₂
18. Covalent radius of nitrogen is 70 pm. Hence, covalent radius of boron is about
a) 60 pm b) 110 pm c) 50 pm d) 40 pm
19. Melting points of NaCl, NaBr, NaI and NaF will be in order
NaI NaF NaBr NaCl
a) < NaBr b) < NaCl c) < NaF d) < NaI
< NaCl b) < NaBr c) < NaCl d) < NaF
< NaF < NaI < NaI < NaBr
20. Which pair is different from the others?
a) Li – Mg b) Na – K c) Ca – Mg d) B – Al
21. For the process
 $X(g) + e^- \rightarrow X^-(g), \Delta H = x$
and $X^-(g) \rightarrow X(g) + e^-, \Delta H = y$
Select the correct alternate
Ionization energy of X⁻(g) is y
Electron affinity of X(g) is x
Electron affinity of X(g) is -y
All the above are correct statements
22. The atoms of the elements belonging to the same group of the Periodic Table will have

- a) The same number of protons
b) The same number of electrons in the valence-shell
c) The same number of neutrons
d) The same number of electrons
23. EC of Gd (64) is written as
a) [Xe]₅₄4f⁷ b) [Xe]₅₄4f⁸ c) [Xe]₅₄4f⁹ d) [Xe]₅₄4f¹⁰
24. Numbering of groups as 1, 2, ..., 18 was adopted by IUPAC in
a) 1986 b) 1906 c) 1908 d) 1988
25. Which of the following forms a stable +4 oxidation state?
a) Lanthanum b) Cerium c) Europium d) Gadolinium
26. A molecule H – X will be 50% ionic if electronegativity difference of H and X is
a) 1.2 eV b) 1.4 eV c) 1.5 eV d) 1.7 eV
27. Most stable cation of element 113 will be
a) M³⁺ b) M²⁺ c) M⁺ d) M₂²⁺
28. Which is incorrect statement?
In solid state O²⁻ is stabilized by neighbouring cations
Formation of O²⁻ from O⁻ is unfavourable in the gas phase
Electron affinity of O > S
All of the above are incorrect
29. With respect to oxygen maximum valency is shown by
a) Halogen family b) Oxygen family c) Nitrogen family d) Boron family
30. The dominant factor in determining the IE of the elements on moving down the groups is its
a) Atomic radius b) Effective nuclear charge c) Both (a) and (b) d) None of the above
31. Select the correct statement(s)
a) Across a transition series, there is
b) The rate of decrease in the
c) Both (a) & (b) are correct
d) None of the above statements



- only a small decrease in atomic radius from one element to another due to very small increase in effective nuclear charge
- size across the lanthanide series is less than the first transition series
- statement is correct
32. Which of the following statement is false?
 a) Elements of IB and IIB groups are transition elements
 b) Elements of VB group do not contain metalloids
 c) Elements of IA and IIA groups are normal elements
 d) Elements of IVB group are neither strongly electron egative nor strongly electropositive
33. Which has maximum ionization potential?
 a) N b) O c) O⁺ d) Na
34. Which has maximum IE?
 a) Mg b) Mg⁺ c) Mg²⁺ d) Equal
35. $M(g) \rightarrow M^+(g) + e^-, \Delta H = 100 \text{ eV}$
 $M(g) \rightarrow M^{2+}(g) + 2e^-, \Delta H = 250 \text{ eV}$
 Which is the incorrect statement?
 a) I_1 of $M(g)$ is 100 eV b) I_1 of $M^+(g)$ is 150 eV c) I_2 of $M(g)$ is 250 eV d) I_2 of $M(g)$ is 150 eV
36. Which is best oxidizing agent?
 a) Ge⁴⁺ b) Pb⁴⁺ c) Sn⁴⁺ d) Sn²⁺
37. Element with valence shell-electronic configuration as d^5s^1 is placed in

- a) IA, s-block b) VIA, s-block c) VIB, s-block d) VIB, d-block
38. Which group of elements is analogous to the lanthanides?
 a) Halides b) Actinides c) Chalcogens d) Borides
39. Which will have graded property similar to EC $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$?
 a) [Ar]3d¹⁰ b) [Kr]4d¹⁰ c) [Kr]5s¹ d) All of these
40. The separation of lanthanides in ion-exchange method is based on
 a) Basicity of the hydroxides b) Size of the hydrate ions c) Size of the unhydrated ions d) The solubility of their nitrates
41. Which of the following will have the most negative electron affinity and which the least negative?
 a) F, Cl b) Cl, F c) Cl, S d) Cl, P
42. Select the correct statement about radius of an atom
 a) Values of van der Waals' radii are larger than those of covalent radii because the van der Waals' forces are much weaker than the forces operating between
 b) The metallic radii are smaller than the van der Waals' radii, since the bonding forces in the metallic crystal lattice are much stronger than the van der Waals' forces
 c) Both (a) & (b) are correct
 d) None of the above is correct



- atoms in
a
covalent
ly
bonded
molecul
e
43. Sodium forms Na^+ ion but it does not form Na^{2+} because
- | | | | |
|--|--|---|--|
| Very low value of a) $(\text{IE})_1$ and $(\text{IE})_2$ | Very high value of b) $(\text{IE})_1$ and $(\text{IE})_2$ | Low value of c) $(\text{IE})_1$ and low value of $(\text{IE})_2$ | Low value of d) $(\text{IE})_1$ and high value of $(\text{IE})_2$ |
|--|--|---|--|
44. The electronic configuration $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^{10}, 4s^2, 4p^6, 4d^{10}, 5s^2$ is for
- | | | | |
|-------------------------------|-------------------------------|-------------------------------|-------------------------------|
| a) <i>f</i> -block element | b) <i>d</i> -block element | c) <i>p</i> -block element | d) <i>s</i> -block element |
|-------------------------------|-------------------------------|-------------------------------|-------------------------------|
45. Which one of the following has the smallest atomic radius?
- | | | | |
|------|-------|-------|-------|
| a) F | b) Cl | c) Cs | d) Mg |
|------|-------|-------|-------|
46. Mixture containing aqueous $\text{Li}^+, \text{Na}^+, \text{K}^+$ ions are electrolysed. Cations are discharged at cathode in the order: (easiest at the end)
- $$M^+(aq) + e^- \rightarrow M$$
- | | | | |
|---------------------------------|--------------------------------|---|--|
| a) Li^+, Na^+ , | b) K^+, Na^+ , | c) $\text{Li}^+, \text{K}^+, \text{Nd}$ | d) $\text{Na}^+, \text{K}^+, \text{I}$ |
|---------------------------------|--------------------------------|---|--|
47. Screening effect is not observed in
- | | | | |
|------------------|---------------------|---------------------|-----------------------|
| a) He^+ | b) Li^{2+} | c) Be^{3+} | d) All of these cases |
|------------------|---------------------|---------------------|-----------------------|
48. Which has maximum stability?
- | | | | |
|--------------------|--------------------|--------------------|----------|
| a) AsCl_3 | b) SbCl_3 | c) BiCl_3 | d) Equal |
|--------------------|--------------------|--------------------|----------|
49. In periodic Table, metallic elements appear
- | | | | |
|-----------------------------|--------------------|------------------------------|-----------------------|
| a) In the left-hand columns | b) In the top rows | c) In the right-hand columns | d) In the bottom rows |
|-----------------------------|--------------------|------------------------------|-----------------------|
50. For the element (X), student (A) measured its radius as 102 nm, student (B) as 103 nm and (C) as 100 nm using same apparatus. Their teacher explained that measurements were correct by saying that recorded values by (A), (B) and (C) are
- | | | | |
|--|-------------------------------------|----------------------------------|--------------------|
| a) Crystal, van der Waals and covalent radii | b) Covalent and van der Waals radii | c) Van der Waals and ionic radii | d) None is correct |
|--|-------------------------------------|----------------------------------|--------------------|
51. The hydration energy of lithium ion is -544 kJ mol^{-1} which is higher than that of other alkali metal ions. This is explained in terms of
- | | | | |
|--------------------------|--------------|------------------------------------|---|
| a) Small size of lithium | b) Higher IP | c) Element of lowest atomic weight | d) More reactive than other alkali metals |
|--------------------------|--------------|------------------------------------|---|
52. The ionic radii of $\text{O}^{2-}, \text{F}^-, \text{Na}^+$ and Mg^{2+} are 1.35, 1.34, 0.95 and 0.66 Å respectively. The radius of the Ne atom is
- | | | | |
|-----------|-----------|-----------|-----------|
| a) 1.39 Å | b) 1.12 Å | c) 0.85 Å | d) 0.50 Å |
|-----------|-----------|-----------|-----------|
53. Metallic nature increases moving down the group because
- | | | | |
|-----------------------------|------------------------|---------------------|----------------------|
| a) Nuclear charge increases | b) Shielding increases | c) Both (a) and (b) | d) None of the above |
|-----------------------------|------------------------|---------------------|----------------------|
54. Which reaction has most negative ΔG° value?
- | | | | |
|---|---|---|---------------------|
| $\text{Ga}^{3+} + 2e^- \rightarrow \text{Ga}^+$ | $\text{In}^{3+} + 2e^- \rightarrow \text{In}^+$ | $\text{Tl}^{3+} + 2e^- \rightarrow \text{Tl}^+$ | Cannot be predicted |
|---|---|---|---------------------|
55. Fluorine has the highest electronegativity among the ns^2np^5 group on the Pauling scale, but the electron affinity of fluorine is less than that of chlorine because
- | | | | |
|---|--|--|---|
| The atomic number of fluorine is less than that of chlorine | Fluorine being the first member of the family behaves in an unusual manner | Chlorine can accommodate an electron better than fluorine by utilizing its | Small size, high electron density and an increased electron repulsion makes |
|---|--|--|---|



vacant addition
3d- of an
orbital electron
to
fluorine
less
favourab
le than
that in
the case
of
chlorine

56. Fluorine does not form any polyhalide as other halogens because

- It has maximum character
a) m ionic character
- It has low F – F bond energy (38.5 kcal mol⁻¹)
b) energy (38.5 kcal mol⁻¹)
- Of the absence of d-orbitals in the valence shell of fluorine
c) orbitals in the valence shell of fluorine
- It brings about maximum coordination number in other elements
d) coordina tion number in other elements

57. Among the following, the number of elements showing only one non-zero oxidation state is O, Cl, F, N, P, Sn, Tl, Na, Ti

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

58. Select the correct statement

- Ionic hydrides are better reducing agents
a) better reducing agents
- Covalent nature of hydrides increases across a period and decreases down the group
b) a period and decrease s down the group
- LiAlH₄ can reduce carbonyl compounds to alcohols
c) carbonyl d) compounds to alcohols
- All the above are correct statements
d) correct statements

59. The following acids have been arranged in the order of decreasing acid strength. Identify the correct order

- ClOH (I) BrOH (II) IOH (III)
- a) I > II > III b) II > I > III c) III > II > I d) I > III > II

60. Gd (64) has unpaired electrons with sum of spin.....

- a) 7, 3.5 b) 8, 3 c) 6, 3 d) 8, 4

61. For Cu⁺, effective nuclear charge felt by a 3d-electron is

- a) 14.25 b) 13.95 c) 14.65 d) 29.0

62. The relative thermal stabilities of alkali metal halides are such that

- | | | | |
|----------|----------|----------|----------|
| CsCl | LiCl | CsCl | CsCl |
| > RbCl | > NaCl | > RbCl | < RbCl |
| a) > KCl | b) > KCl | c) < KCl | d) > KCl |
| > NaCl | > RbCl | > NaCl | < NaCl |
| > LiCl | > CsCl | < LiCl | > LiCl |

63. Which of the following order is wrong?

- | | | | |
|---|-------------------------------------|--|--|
| NH ₃ < PH ₃ < AsH ₃ acidic | Li < Be < B < C – (IE) ₁ | Al ₂ O ₃ < MgO < Na ₂ O – basic | Li ²⁺ < Na ⁺ < K ⁺ < Cs ⁺ – ionic radius |
|---|-------------------------------------|--|--|

64. The statement is not true for the long form of the Periodic Table

- It reflects the sequence of filling the shells s, p, d and f
- It helps to predict trends in the physical relative of the chemical properties of the elements
- It helps to predict trends in the physical relative of the chemical properties of the elements
- a) electron shells s, p, d and f b) stable states of the elements c) and chemical properties of the elements d) ionicity of the bond between any two elements

65. Element with atomic number 115 has configuration as and with most stable cation as

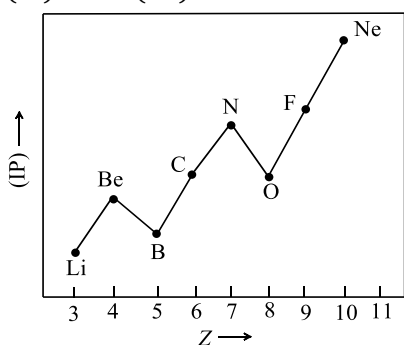
- a) [Rn]7s²5f⁵M³⁺ b) [Rn]7s²5f⁵M⁵⁺ c) [Rn]7s²5f⁵M⁺ d) [Rn]5d¹⁰M⁵⁺

66. In which case effective nuclear charge is minimum?

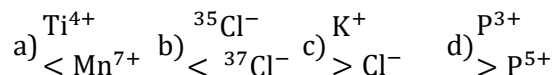
- a) Be b) Be²⁺ c) Be³⁺ d) Equal



67. Following graph shows variation of ionization potential (IP) with atomic number in second period (Li – Ne). Value of ionization potential (IP) of Na (11) will be



- a) Above Ne b) Below Ne but above O c) Below Li d) Between N and O
68. Recently (in Aug 2003) two new elements have been discovered with atomic numbers
a) 113, 114 b) 114, 115 c) 115, 116 d) 113, 115
69. AB is predominantly ionic as A^+B^- if (IP stands for ionization potential, EA for electron affinity and EN for electronegativity)
a) $(IP)_A < (IP)_B$ b) $(EA)_A < (EA)_B$ c) $(EN)_A < (EN)_B$ d) $(IP)_B < (IP)_A$
70. M^{3+} has electronic configuration as $[Ar]3d^{10}4s^2$, hence it lies in
a) s -block b) p -block c) d -block d) f -block
71. Transition elements have vacant
a) s -orbital b) p -orbital c) d -orbital d) f -orbital
72. When the following five anions are arranged in order of decreasing ionic radius, the correct sequence is
a) $Se^{2-}, I^-, Br^-, S^{2-}, Cl^-$ b) $I^-, Se^{2-}, Cl^-, S^{2-}, Br^-$ c) $Se^{2-}, I^-, Br^-, S^{2-}, Cl^-$ d) $I^-, Se^{2-}, Br^-, S^{2-}, Cl^-$
73. Match Column I (atomic number of elements) with Column II (position of elements in Periodic Table) and select the correct answer using the codes given below the Columns
- | | Column I | | Column II |
|---|----------|----|------------|
| A | 19 | 1. | p -block |
| B | 22 | 2. | f -block |
| C | 32 | 3. | d -block |
| D | 64 | 4. | s -block |
- Codes
A B C D
a) 1 2 3 4 b) 4 3 1 2 c) 4 1 3 2 d) 2 1 3 4
74. Ionic radii of:



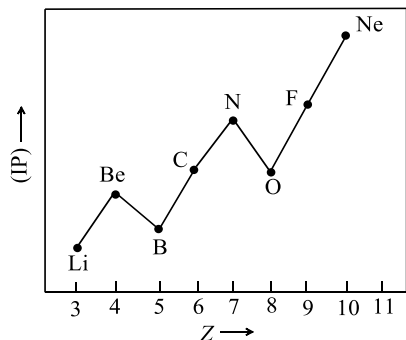
75. Covalency is favoured in the following cases
a) A smaller cation b) A larger anion c) Large charges on cation or anion d) In all the above cases
76. Main group elements constitute
a) s - and p -block b) p - and d -block c) s - and d -block d) d - and f -block
77. Oxidation energy of $Li(s)$ to $Li^+(aq)$ is least in group IA elements. This is because of
a) Maximum heat of sublimation of $Li(s)$ b) Maximum heat of hydration of Li^+ c) Less negative heat of hydration of Li^+ d) Maximum ionization energy of Li
78. Select the correct statement
a) Electron affinity of nitrogen is much lower than that of its neighboring element carbon and oxygen b) Electron affinity of F is higher than that of chlorine c) Both (a) & (b) are correct d) None of the above is correct
79. Chalcogens are elements of
a) Group 16 b) p -block c) ns^2np^4 configuration d) All are correct
80. The electron affinities of N, O, S and Cl are such that
a) $N < O < S < Cl$ b) $O < N < Cl < S$ c) $O \approx Cl < N \approx S$ d) $O < S < Cl < N$
81. Ionic radii are



- a) Inversely proportional to effective nuclear charge
b) Inversely proportional to square of effective nuclear charge
c) Directly proportional to effective nuclear charge
d) Directly proportional to square of effective nuclear charge
82. Out of BeH_2 , CuH_2 , CrH_2 and NaH , covalent hydrides are
a) BeH_2 , NaH b) CuH_2 , CrH_2 c) BeH_2 , CuH_2 d) All of these
83. Which of the following is a transition element?
a) Al b) As c) Ni d) Rb
84. Elements X and Y have valence shell electron configuration as
 $X: ns^2 np^1$; $Y: ns^2 np^3$
Which compound is likely formed from X and Y ?
a) X_3Y_5 b) Y_3X_5 c) XY d) YX
85. Higher values of ionization energies of the $5d$ -transition elements are consistent with the
a) Relatively smaller effective nuclear charge
b) Relatively smaller size of their atoms
c) Relatively smaller penetration of ion
d) All of the above are correct
86. Tendency of I^- , Br^- , Cl^- and F^- to be oxidized is in order
a) $\text{I}^- > \text{Br}^- > \text{Cl}^- > \text{F}^-$
b) $\text{I}^- < \text{Br}^- < \text{Cl}^- < \text{F}^-$
c) $\text{I}^- < \text{Cl}^- < \text{F}^- < \text{Br}^-$
d) $\text{I}^- = \text{Br}^- < \text{Cl}^- = \text{F}^-$
87. For which of the following crystals would you expect the assumption of anion-anion contact to be valid?
a) CsBr b) NaI c) KCl d) NaI
88. Which of the following represents the correct order of increasing first ionization enthalpy for Ca , Ba , S , Se and Ar ?
a) $\text{Ca} < \text{Ba} < \text{S} < \text{Se} < \text{Ar}$
b) $\text{S} < \text{Ca} < \text{Ba} < \text{Ar} < \text{Se}$
c) $\text{Ba} < \text{Ca} < \text{S} < \text{Ar} < \text{Se}$
d) $\text{Ca} < \text{Ba} < \text{S} < \text{Se} < \text{Ar}$
89. Valence electrons in the element A are 3 and that in element B are 6. Most probable compound formed from A and B is
a) A_2B b) AB_2 c) A_6B_3 d) A_2B_3
90. Which of the following ions has the smallest radius?
a) Ti^{2+} b) Pt^{2+} c) Ni^{2+} d) Zr^{2+}
91. As we proceed from top to bottom in the Periodic Table
a) Hydroxides are more basic
b) Oxyacids are less acidic
c) Neither of the above
d) Both of the above
92. Element 113 is produced via
a) α -decay of element 115
b) β -decay of element 114
c) α -decay of element 111
d) β -decay of element 112
93. Two new elements (discovered in Aug 2003) with atomic number 113 and 115 are to be placed in
a) s -block b) p -block c) d -block d) f -block
94. Nitrogen is found to have higher value of ionization potential because
a) It has half-filled p -orbitals
b) It is chemically inert
c) It has shielding effect
d) All of the above are correct
95. Extent of hydration of Na^+ , Mg^{2+} , Al^{3+} is in order
a) $\text{Na}^+ < \text{Mg}^{2+} < \text{Al}^{3+}$
b) $\text{Na}^+ < \text{Al}^{3+} < \text{Mg}^{2+}$
c) $\text{Mg}^{2+} < \text{Al}^{3+} < \text{Na}^+$
d) Equal
96. Which pair represents incorrect first IE?
a) $\text{Be} > \text{B}$ b) $\text{N} > \text{O}$ c) $\text{Li} > \text{Na}$ d) $\text{He} > \text{He}^+$
97. Of the following pairs, the one containing examples of metalloid elements in the Periodic Table is
a) Na and K b) F and Cl c) Cu and Ag d) B and Si
98. Which of the following reactions should be most favoured thermodynamically?



99. Na_2O Na_2O Na_2O Na_2O
 a) + $\text{Cl}_2\text{O}_7 \rightarrow 2\text{NaCl}$ b) + $\text{SO}_3 \rightarrow \text{Na}_2\text{SO}$ c) + $\text{P}_2\text{O}_5 \rightarrow 2\text{Na}_3\text{P}$ d) + $\text{SiO}_2 \rightarrow \text{Na}_2\text{SiC}$



- which is the incorrect statements?
- a) I_1 of Be > I_1 of B but I_2 of Be < I_2 of B
 b) I_1 of Be < I_1 of B but I_2 of Be < I_2 of B
 c) I_2 of $\text{Be}^+ < I_1$ of B^+
 d) I_1 of Be^{2+} is abnormally high
100. State, which one of the following has the largest atomic radius?
 a) Cs b) Mg c) Ba d) Cr
101. The lanthanides have electron configuration with $6s^2$ in common but with variable occupation of the
 a) $6p$ -level b) $5p$ -level c) $5d$ -level d) $4f$ -level
102. Which is largest in size in aqueous solution?
 a) Li^+ b) Na^+ c) Cs^+ d) Rb^+
103. First, second and third IP values are 100 eV, 150 eV and 1500 eV. Element can be
 a) Be b) B c) F d) Na
104. The high oxidizing power of fluorine is due to
 a) High electron affinity b) High ionization energy c) Both (a) and (b) d) None of these
105. The relative extent to which the various orbitals penetrate the electron clouds of other orbitals is
 a) $s > p > d > f$ b) $s < p < d < f$ c) $s < d < p < f$ d) $d < s < p < f$
106. The compound of vanadium has magnetic moment of 1.73 BM. The vanadium chloride has the formula
 a) VCl_2 b) VCl_3 c) VCl_4 d) VCl_5
107. Recently discovered element with atomic number 115 is

- a) Uun b) Uub c) Uup d) Uus
108. Consider the following statements,
 1. Cs^+ is more highly hydrated than the other alkali metal ions
 2. Among the alkali metals Li, Na, K and Rb, lithium has the highest melting point
 3. Among the alkali metals only lithium forms a stable nitride by direct combination
- Of these statements
 a) I, II and III are correct
 b) I and II are correct
 c) I and III are correct
 d) II and III are correct
109. Which represents alkali metals based on $(IE)_1$ and $(IE)_2$ values?

| | $(IE)_1$ | $(IE)_2$ |
|---|----------|----------|
| X | 100 | 95 |
| Y | 110 | 120 |
| Z | 195 | 500 |
| M | 200 | 250 |

 a) X b) Y c) Z d) M
110. Which has maximum polarizing power in cation?
 a) Li^+ b) Mg^{2+} c) Al^{3+} d) O^{2-}
111. The correct order of increasing ionic character is

| Compound | Relative Ionic Character |
|--|--------------------------|
| a) $\text{BeCl}_2 < \text{MgCl}_2 < \text{CaCl}_2 < \text{BaCl}_2$ | Low to High |
| b) $\text{BeCl}_2 < \text{CaCl}_2 < \text{MgCl}_2 < \text{BaCl}_2$ | Low to High |
| c) $\text{BaCl}_2 < \text{CaCl}_2 < \text{MgCl}_2 < \text{BeCl}_2$ | High to Low |
| d) $\text{MgCl}_2 < \text{CaCl}_2 < \text{BeCl}_2 < \text{BaCl}_2$ | Low to High |
112. Recently discovered elements (August 2003) with atomic number 113 and 115 have valence electrons in
 a) s -orbital b) p -orbital c) d -orbital d) f -orbital
113. Element with atomic number 113 has been reported in August 2003. Its electronic configuration is similar to that of
 a) Si b) Ga c) Bi d) At
114. Which of the following properties shows a clear periodic variation?
 a) First ionization energy b) Molar mass of the element c) Number of isotopes of the atom d) All of the above
115. Select the correct alternate about (IE)



- (IE)₁ of Be > (IE)₁ of O > (IE)₁ of B > (IE)₁ of N
116. IP of an element does not depend on
a) Its nuclear charge b) The shielding effect c) Electron neutrality d) Penetration effect
117. Reducing action of hydrides is due to
a) Oxidation of H⁻ to H b) Oxidation of H to H⁺ c) Reduction of H to H⁻ d) Reduction of H⁺ to H
118. Which element has the highest electron affinity?
a) F b) Cl c) Br d) I
119. Ionic radii of
a) Ti⁴⁺ < Mn⁷⁺ b) ³⁵Cl⁻ < ³⁷Cl⁻ c) K⁺ > Cl⁻ d) P³⁺ > P⁵⁺
120. Fluorine is more electronegative than nitrogen. The best explanation is that
a) The valence electron is on the average, a little closer to the nucleus than in N b) The charge on a F nucleus is +9, while that on N is +7 c) The valence electron is in F and N shells and thus their energy are greatly different d) Electron negativity increases from left to right in each of the periods
121. Select the incorrect order of size of ions/atoms
a) I⁺ < I⁻ b) Fe = Co = Ni c) Ni < Cu < Zn d) None is incorrect
122. The heat of hydration of Ca²⁺, Sr²⁺ and Ba²⁺ in the decreasing order is
a) Ca²⁺ > Sr²⁺ > Ba²⁺ b) Ca²⁺ > Ba²⁺ > Sr²⁺ c) Sr²⁺ > Ba²⁺ > Ca²⁺ d) Ba²⁺ > Sr²⁺ > Ca²⁺
123. Following are the values of the electron affinities (in kJ mol⁻¹) of the formation of O⁻ and O²⁻ from O
a) -142, -7 b) -142, 70 c) 142, 702 d) -142, -1

124. The second ionisation energy is always higher than the first ionization energy because the
a) Ion becomes more stable attaining an octet or duplet configurations b) Electron is more tightly bound to the nucleus in an ion c) Electron is attracted more by the core electron s d) None of the above is correct
125. SI unit of IE is
a) kJ mol⁻¹ b) eV atom⁻¹ c) J mol⁻¹ d) kcal mol⁻¹
126. Out of C, Si, Ge, Sn, Pb metallic nature is in
a) Ge, Sn, Pb b) Sn, Pb c) Ge, Pb d) Ge, Sn
127. Which element has the highest first IP?
a) N b) Ne c) He d) H
128. An oxide behaves as an acid or a base depending on its
a) Size and charge b) Size only c) Charge only d) None of these
129. The electronegativities of N, C, Si and P are such that
a) P < Si < C < N b) Si < P < N < C c) Si < P < C < N d) P < Si < N < C
130. Recently (in 2003) element with atomic number 110 has been named by IUPAC as
a) HS b) Mt c) Ds d) Sg
131. The size of the second and third row transition elements being almost the same. This is due to
a) d- and f-orbitals do not shield the nuclear charge very effectively b) Lanthanide contraction c) Both (a) & (b) are true d) None of the above is true
132. Out of F₂, Cl₂, Br₂ and I₂, most oxidizing agent is
a) F₂ b) Cl₂ c) Br₂ d) I₂
133. Select the correct order of (IE)₁



- a) $\text{Cu} < \text{Zn}$ b) $\text{Ag} < \text{Cd}$ c) $\text{Hg} > \text{Au}$ d) None of these
 $< \text{Ga}$ $< \text{In}$ $> \text{Tl}$

134. Of the four ΔH values needed to calculate the lattice energy using the Born-Haber cycle, the one that is most difficult to measure is

- a) The heat of sublimation of the metal
 b) The heat of formation of gaseous atoms of the non-metal
 c) The ionization energy of the metal
 d) The electron affinity of the non-metal

135. The lanthanides contraction refers to

- a) Ionic radius of the series
 b) Valence electrons of the series
 c) The density of the series
 d) Electron negativity

136. 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 vary in a regular manner with increase in atomic number
 d) For transition elements the d -subshells are filled with electron monotonically with increase in atomic number

137. $N_0/2$ atoms of $X(g)$ are converted into $X^+(g)$ by energy E_1 . $N_0/2$ atoms of $X(g)$ are converted into $X^-(g)$ by energy E_2 . Hence, ionization potential and electron affinity of $X(g)$ are

- a) $\frac{2E_1}{N_0}, \frac{2(E_1 - E_2)}{N_0}$ b) $\frac{2E_1}{N_0}, \frac{2E_2}{N_0}$ c) $\frac{(E_1 - E_2)}{N_0}$ d) None of correct

138. Following the transition elements, $(IE)_1$ drops abruptly in Ga, In and Tl. This is due to

- Removal of an electron from the singly occupied np -orbitals of higher energy than the ns -orbitals of Zn, Cd and Hg
 Decrease in effective nuclear charge
 Increase in atomic radius
 None of the above is correct

139. Electronegativity and electron affinity of an element A are X and Y respectively. Hence, ionization potential of A is

- a) $\frac{X + Y}{2}$ b) $2X - Y$ c) $2Y - X$ d) $2X + Y$

140. Following triads have approximately equal size

- a) $\text{Na}^+, \text{Mg}^{2+}, \text{F}^-, \text{Ne}, \text{O}^{2-}$
 b) $\text{Fe}^+, \text{Co}, \text{Ni}$
 c) $\text{Mn}^+, \text{Fe}^{2+}$
 d) $\text{Fe}, \text{Co}, \text{Ni}$

141. The first ionization potential of Al is smaller than that of Mg because

- a) The atomic size of Al > Mg
 b) The atomic size of Al < Mg
 c) Al has one unpaired electron in p -orbital
 d) The atomic number of Al > Mg

142. The ionization potential of nitrogen is

- a) Same as that of oxygen
 b) Less than that of oxygen
 c) Greater than that of oxygen
 d) None of the above

143. Which of the following sets of elements is arranged in order of increasing electronegativity based on Pauling scale?

- a) S, Si, P b) P, S, Si c) S, P, Si d) P, Si, S

144. For Be, $Z_{\text{eff}} = 1.95$ and for Be^{x+} , $Z_{\text{eff}} = 2.30$. Hence, ion is

- a) Be^+ b) Be^{2+} c) Be^{3+} d) Be^0

145. Ionic hydrides react with water to give



- a) A basic solution b) An acidic solution c) A hydride ion d) Protons
146. Going down in a group from F to I, which of the following properties increases
a) Ionic radius b) Ionization energy c) Oxidizing power d) Electron negativity
147. In which case bond length is shortened?
a) When multiplicity occurs between atoms b) When electron egativity are different c) In both cases the above cases d) None of the above cases
148. Ionization energy of the element $X(g)$ is I and the electron affinity of $X^+(g)$ is E then
a) $I = E$ b) $I = -E$ c) $I = \frac{E}{2}$ d) $I = -\frac{E}{2}$
149. The ionization energy of hydrogen is 13.6 eV and the first ionization energy of helium is 24.6 eV. Energy evolved in the following electron-gain process is
 $He^{2+} + 2e^- \rightarrow He$
a) -49.2 eV b) -54.4 eV c) -27.2 eV d) -79.0 eV
150. Which pair is different from the others?
a) Li - Mg b) B - Si c) Be - Al d) Li - Na
151. Pick out the property which is not shown by transition elements
a) Show variable oxidation state b) Impart colour to flame c) Are paramagnetic in nature d) Act as catalytic agents
152. The ions O^{2-} , F^- , Na^+ , Mg^{2+} and Al^{3+} are isoelectronic. Their ionic radii show
An increase from O^{2-} to F^- and then decrease from Na^+ to Al^{3+} A decrease from O^{2-} to F^- and then increase from Na^+ to Al^{3+} A significant increase from O^{2-} to Al^{3+} A significant decrease from O^{2-} to Al^{3+}
153. Select the correct statement.

- (IE)₁ of the corresponding elements of 3d and 4d series are almost similar
(IE)₁ of 5d-series elements are smaller than that of 3d and 4d-series elements Both of the above are correct Both (a) and (b) are correct (a) and (b) are incorrect
154. Which set does not show correct matching?
 $Sc^{3+}[Ne]$ $Fe^{2+}[Ar]$ $Cr[Ar]3d$
a) zero group b) VIII group c) VIB group d) All of the above
155. The basic character of hydrides of group 15 (VA) is in which of the following order?
 $NH_3 < PH_3$ $NH_3 > PH_3$ $NH_3 < PH_3$ None of the above
a) $< BiH_3 > AsH_3 < SbH_3 < AsH_3 < SbH_3 < BiH_3$ b) $> AsH_3 > SbH_3 > BiH_3$ c) $< AsH_3 < SbH_3 < BiH_3$ d) the above

Multiple Correct Answers Type

156. The first element of a group in many ways differs from the other heavier members of the group. This is due to
The high electron negativity The unavailability of d-orbitals The higher shielding effect
a) smaller size b) and high ionization potential c) availability of d-orbitals d) higher shielding effect
157. Pick out the isoelectronic structures from the following:
(I) CH_3^+ (II) H_3O^+ (III) NH_3 (IV) CH_3^-
a) I and II b) III and IV c) I and III d) II, III and IV
158. Which of the following compounds possesses zero dipole moment?
a) Water b) Benzene c) tetrachloro-ride d) Carbon tetrachloride Boron trifluoride
159. Which of the following statements is/are true?



Metallic and covalent radii of potassium are 2.3 Å and 2.03 Å respectively

Atomic and ionic radii of niobium and tantalum are almost same

Ionisation energy is inversely proportional to the screening effect

The first ionisation energies of Be and Mg are more than ionisation energies of B and Al respectively

160. An increase in both atomic and ionic radii with atomic number occurs in any group of the Periodic Table and in accordance with this the ionic radii of Ti(IV) and Zr(IV) ions are 0.68 Å and 0.74 Å respectively; but for Hf(IV) ion the ionic radius is 0.75 Å which is almost the same as that for Zr(IV) ion. This is due to

- a) Greater degree of covalency in compound of Hf⁴⁺
- b) Lanthanide contraction
- c) Difference in the coordination number of Zr⁴⁺ and Hf⁴⁺ in their compounds
- d) Actinide contraction

161. Which of the following pairs of species have nearly same size?

- a) Rb⁺, O²⁻ b) Cl⁻, Na⁺ c) Mg²⁺, Na⁺ d) Li⁺, Mg²⁺

162. Which form two or more chlorides?

- a) Na b) Hg c) Cu d) Fe

163. Which of the following statements is/are correct?

- a) The peroxide ion has a bond order of 1 while
- b) The peroxide ions has a longer and weaker
- c) The peroxide ion as well as the oxygen
- d) The bond length of peroxide ion is greater

the oxygen molecule has a bond order of 2

bond than oxygen molecule has

molecule are paramagnetic

than that of the oxygen molecule

164. Which statement(s) is/are correct?

- a) A pi-bond is weaker than sigma-bond
- b) A sigma-bond is weaker than pi-bond
- c) A(=) bond is stronger than single bond
- d) A covalent bond is stronger than H-bond

165. Intermolecular H-bonding in HF makes it:

- a) High b.p. liquid
- b) Capable of forming two series of salt
- c) Dibasic
- d) Capable of forming acid salt

166. IE_2 for an element are invariably higher than IE_1 because:

- a) The size of cation is smaller than its atom
- b) It is difficult to remove 'e' from cation
- c) IE is endothermic
- d) All of the above

167. Which statement(s) is/are correct?

- a) PF₃ has higher bond angle than PCl₃
- b) Dipole moment of NH₃ is more than NF₃
- c) I⁺ is smaller than I⁻ ion
- d) I⁻ is smaller than I⁺ ion

168. The melting point of RbBr is 682°C while that of NaF is 988°C. The principal reason that the melting point of NaF is much higher than that of RbBr is that

- a) The molar mass of NaF is smaller
- b) The bond in RbBr has more covalent character
- c) The difference in electronegativity between
- d) The internuclear distance, $r_c + r_a$ is greater



than that of RbBr
r than the bond in NaF
Rb and Br is smaller than the difference between Na and F
for RbBr than for NaF

169. Which among the following is/are linear?

- a) BeF_2 b) $\text{Ag}(\text{CN})_2^-$ c) CO_2 d) XeF_2

170. The isotone(s) of $^{76}_{32}\text{Ge}$ is/are:

- a) $^{77}_{32}\text{Ge}$ b) $^{77}_{33}\text{As}$ c) $^{77}_{34}\text{Se}$ d) $^{78}_{34}\text{Se}$

171. Electrovalency is favoured by:

- a) Low IE values b) High EA values c) High lattice energy d) None of these

172. Resonance occurs due to the:

- a) Delocalization of a lone pair of electrons
b) Delocalization of sigma-electrons
c) Delocalization of pi-electrons
d) Migration of protons

173. Which molecule(s) has/have V-shape?

- a) H_2O b) SnCl_2 c) H_2S d) None of these

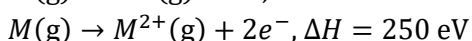
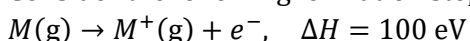
174. Which is/are correct order of ionic mobility?

- a) $\text{Li}^+ < \text{Na}^+ < \text{K}^+$
b) $\text{Na}^+ < \text{Mg}^{2+} < \text{Al}^{3+}$
c) $\text{Al}^{3+} < \text{Mg}^{2+} < \text{Na}^+$
d) $\text{Na}^+ < \text{Li}^+ < \text{K}^+$

175. Resonance structures of a molecule should have:

- a) Identical arrangement of atoms
b) Nearly the same energy content
c) The same number of paired electrons
d) Identical bonding

176. Consider the following ionization steps



Select the correct statement(s)

- (IE)₁ of $M(g)$ is 100 eV
 (IE)₁ of $M^+(g)$ is 150 eV
 (IE)₂ of $M(g)$ is 250 eV
 (IE)₂ of $M(g)$ is 150 eV

177. Select the correct statements

- a) are f -block elements
b) are d -block elements
c) have been placed in s -block
d) are metalloids
- Ce, Pr and Nd
Cu, Pd and Ni
Cu($[\text{Ar}]3d^10 4s^1$)
and Si, Ge and As
K($[\text{Ar}]4s^1$)

178. The molecule(s) which show H-bonding is/are:

- a) nitrophenol
b) Water
c) HCl
d) acetate
- o -Ethyl

179. The compound which contains both ionic and covalent bond is/are:

- a) CH_4 b) NH_4OH c) KCN d) $\text{K}_4[\text{Fe}(\text{CN})_6]$

180. When an isotope undergoes K-capture, its mass number

- a) Remains the same while the atomic number increases by one
b) Remains the same while the atomic number increases by two
c) Remains the same while the atomic number decreases by one
d) As well as the atomic number decreases by one

181. The octet rule is not obeyed in:

- a) CO_2 b) BCl_3 c) PCl_5 d) SiF_4

182. The species that does not contain peroxide bond is/are:

- a) PbO_2 b) H_2O_2 c) MnO_2 d) BaO_2

183. Which combination(s) given below is/are correct?

- a) HgCl_2 -linear
b) ClF_3 -T-shaped
c) ICl_4^- -square planar
d) XeF_6^- -pentagonal bipyramidal

184. A, B, C are three substances. A does not conduct electricity in the solid or liquid state. B conducts electricity both in the fused and solution states, while C conducts electricity only in the solution state. Which of the following statement(s) is/are true regarding A, B and C ?



A has polar covalent linkage
A has non-polar covalent linkage
B is ionic in nature
C has polar covalent linkage

185. Which of the following statements is/are correct?

CH_3^+ shows sp^2 -hybridization whereas CH_3^- shows sp^3 -hybridization
 NH_4^+ has a regular tetrahedral geometry
 sp^2 -hybridized orbitals have equal s - and p -character
Hybridized orbitals always form σ -bonds

186. The type of bond(s) present in ammonium chloride is/are

a) Ionic b) Covalent c) Coordinate d) None of these

187. Which of the following is/are coloured and paramagnetic?

a) Cu^+ b) NO_2 c) $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ d) $[\text{Al}(\text{OH})_4]^-$

188. Which of the following compounds contain both ionic and covalent bonds?

a) NH_4Cl b) KCN c) $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ d) NaOH

189. Select the correct statement(s)

Cs^+ is more highly hydrated than other alkali metal ions
Among the alkali metals Li, Na, K and Rb, lithium has the highest melting point
Ionic mobility of Li^+ is maximum among Li^+ , Na^+ and K^+ ions
Ionization potential of Li is smaller than that of Na

190. The linear structure is assumed by:

a) SnCl_2 b) NCO^- c) CS_2 d) NO_2^+

191. Which possess fractional bond order?

a) O_2^+ b) O_2^- c) H_2^+ d) N_2

192. Which of the following elements have the similar value of electronegativity?

a) Te b) S c) P d) H


193. Chlorine atom does not differ from chlorine ion in the number of which of the following?

a) Neutrons b) Electrons c) Size d) Protons

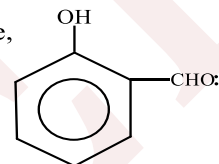
194. Ionization energy is influenced by:

a) Size of atom b) Charge on the nucleus c) Electrons present in inner shells d) None of the above

195. Which has/have zero value of dipole moment?

a) $[\text{Ni}(\text{CN})_4]^{2-}$ b) CHCl_3 c) CO_2 d) 

196. The molecule,



Has intermolecular H-bonding
Has intermolecular H-bonding
Reduces Tollen's reagent
Is steam-volatile

197. Which of the following conditions apply to resonating structures?

a) The contributing structures should have similar energies
b) The contributing structures should be represented such that unlike charges reside on atoms that far apart
c) The electropositive element should always has positive charge and the electronegative element should have negative charge
d) The contributing structures must have the same number of unpaired electrons

198. Which has/have magnetic moment?

a) $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ b) $[\text{Ni}(\text{CN})_4]^{2-}$ c) $[\text{Fe}(\text{CN})_6]^{3-}$ d) O_2



199. The factors that influence the ionization energies are

- a) The size of the atom
b) The charge on the nucleus
c) How effective ly the inner electron s screen the nuclear charge
d) The atomic mass

200. In which, central atom(s) has/have one lone pair of electron?

- a) Cl_2 b) NH_3 c) PCl_3 d) XeF_6

201. Which of the following force(s) is/are weak?

- a) Covalent forces
b) Van der Waals' forces
c) Coulomb forces
d) London forces

202. Stability of ions of Ge, Sn and Pb will be in order

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

203. Which one of the following arrangements does not give the correct picture of the trends indicated against it?

- a) $\text{F}_2 > \text{Cl}_2 > \text{Br}_2 > \text{I}_2$: Electron gain enthalpy
b) $\text{F}_2 > \text{Cl}_2 > \text{Br}_2 > \text{I}_2$: bond dissociation energy
c) $\text{F}_2 > \text{Cl}_2 > \text{Br}_2 > \text{I}_2$: Electron negativity
d) $\text{F}_2 > \text{Cl}_2 > \text{Br}_2 > \text{I}_2$: Oxidising power

204. The properties that show similar trends down the group among the elements of group 1 to 17, is/are

- a) Metallic character
b) Reactivity
c) Electron negativity
d) Melting or boiling points

205. Which of the following have a dipole moment?

- a) 2,2,3,3-tetramethylpentane
b) *Trans*-2-pentene
c) *Cis*-1,2-dichloroethene
d) *Trans*-1,2-dichloroethene

206. Which of the following statements is/are correct regarding ionic compounds?

- a) They are good conductors at room temperature
b) They are generally soluble in polar solvents
c) They consist of ions
d) They generally have high melting and boiling points

Assertion - Reasoning Type

This section contain(s) 0 question(s) numbered 207 to 206. Each question contains STATEMENT 1(Assertion) and STATEMENT 2(Reason). Each question has the 4 choices (a), (b), (c) and (d) out of which **ONLY ONE** is correct.

- a) Statement 1 is True, Statement 2 is True; Statement 2 is correct explanation for Statement 1
b) Statement 1 is True, Statement 2 is True; Statement 2 is not correct explanation for Statement 1
c) Statement 1 is True, Statement 2 is False
d) Statement 1 is False, Statement 2 is True

Statement 1: If difference of electronegativity between two atoms is zero the resultant molecule will be non-polar covalent

Statement 2: The shared pair of electron lies just in the middle of two atoms

208

Statement 1: PCl_5 conducts current in solid state

Statement 2: PCl_5 exists as $[\text{PCl}_4]^+$ and $[\text{PCl}_6]^-$ ions

209

Statement 1: Solubility of NaOH in water increases with rise in temperature, although it is exothermic dissolution



210 **Statement 2:** Changes showing exothermic nature occurs in backward direction if temperature is raised

Statement 1: The electron attachment enthalpy of fluorine is more negative than that of chlorine

Statement 2: All alkaline earth and noble gas elements have positive value of electron attachment enthalpies

211

Statement 1: N and P show a maximum covalency of five

Statement 2: P can expand the outer shell of electrons beyond an octet by involving *d*-orbitals present in its valence shell

212

Statement 1: Shielding effect increases as we go down the group

Statement 2: More is the electrons in the penultimate shell, more is shielding

213

Statement 1: The lattice energy of silver halides is
 $\text{AgF} > \text{AgCl} > \text{AgBr} > \text{AgI}$

Statement 2: AgF is water soluble

214

Statement 1: The bond angle in H_2O is greater than H_2S

Statement 2: H-bonding does not occur in H_2S due to low electronegativity of S

215

Statement 1: Manganese has a less favourable electron affinity than its neighbours in either side

Statement 2: The magnitude of an element's electron affinity depends on the element's valence shell electrons configuration

216

Statement 1: Plutonium among the transuranic elements is the longest lived element.

Statement 2: Plutonium is not radioactive.

217

Statement 1: NH_3 and CH_3^- both have pyramidal shape

Statement 2: N in NH_3 and C in CH_3^- both have sp^3 -hybridization with one lone pair of electron on each

218

Statement 1: The bond angle in BF_3 is smaller than that in BF_4^-

Statement 2: BF_3 has sp^2 -hybridization, whereas BF_4^- has sp^3 -hybridization

219

Statement 1: The ionisation energy of ${}_1\text{H}^2$ is more than ionisation energy of ${}_1\text{H}^1$

Statement 2: This is due to isotopic effect

220

Statement 1: Atomic size of silver is almost equal to that of gold.

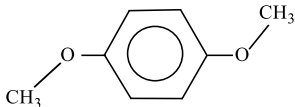
Statement 2: *d*-subshell has low penetration power and produce poor shielding.

221

Statement 1: F atom has less electron affinity than Cl atom

Statement 2: Additional electrons are repelled more effectively by 3*p*-electrons in Cl atom than by 2*p*-electrons in F atom



- 222
- Statement 1:** *p*-dimethoxy benzene is polar molecule
- Statement 2:** The two methoxy groups at para positions are located as
- 
- 223
- Statement 1:** The molecule *cis*-1-chloropropene is more polar than *trans*-1-chloropropene
- Statement 2:** The magnitude of resultant vector in *trans*-1-chloropropene is non-zero
- 224
- Statement 1:** The first ionization energy of Be is greater than B.
- Statement 2:** $2p$ - orbitals have lower energy than $2s$ - orbitals .
- 225
- Statement 1:** The dipole moment of NF_3 is more than NH_3
- Statement 2:** The presence of lone pair of electron on N shows an additive contribution in dipole moment of NH_3 whereas it shows a negative contribution towards dipole moment of NF_3
- 226
- Statement 1:** E_{A_2} for halogens is endothermic
- Statement 2:** Halogens have ns^2np^5 configuration and can accommodate only one electron
- 227
- Statement 1:** In any period, the radius of the noble gas is lowest
- Statement 2:** He has the highest IE in the Periodic Table
- 228
- Statement 1:** Nobel gases have large positive electron gain enthalpy.
- Statement 2:** Electron has the enter the next higher principal quantum level.
- 229
- Statement 1:** P – Cl bond in PCl_3 and PCl_5 had different bond energy
- Statement 2:** P in PCl_3 and PCl_5 is sp^3 - hybridized
- 230
- Statement 1:** The first ionisation energy of N is greater than O
- Statement 2:** N atom has half filled p - orbitals
- 231
- Statement 1:** Sulphur atom has higher electron affinity than oxygen.
- Statement 2:** Oxygen is more electronegative than sulphur, that's why can hold electron better.
- 232
- Statement 1:** IF_7 is super octet molecule
- Statement 2:** Central atom of I in IF_7 has 14 electrons
- 233
- Statement 1:** FeCl_2 is more covalent than FeCl_3 because electro negativity of $\text{Fe}^{3+} > \text{Fe}^{2+}$
- Statement 2:** Higher is the charge on cation, more is deformation of anion, more is covalent character
- 234
- Statement 1:** Solubility of NaCl in D_2O is less than, H_2O



235 **Statement 2:** Higher viscosity of D_2O is responsible for low solubility of NaCl

Statement 1: The bond energy of P – Cl bond in PCl_3 and PCl_5 are different

Statement 2: In PCl_3 , $sp^3 - p$ overlapping whereas in PCl_5 , $sp^3d - p$ overlapping is noticed

236

Statement 1: BF_3 molecule is planar with an angle of $120^\circ C$

Statement 2: BF_3 has bond pair-lone pair electron ratio 1 : 3

237

Statement 1: First ionization energy for nitrogen is lower than oxygen.

Statement 2: Across a period effective nuclear charge decreases.

238

Statement 1: SF_4 has lone pair of electron at equatorial position in preference to apical position in the overall trigonal bipyramidal geometry

Statement 2: If lone pair is at equatorial position then only repulsion is minimum

239

Statement 1: All molecules with polar bond have dipole moment

Statement 2: Dipole moment is a vector quantity

240

Statement 1: Isoelectronic species are having same number of electrons but different radii.

Statement 2: Higher the charge, smaller the ion.

241

Statement 1: The dipole moment of NH_3 is less than NF_3

Statement 2: The lone pair present on N shows additive nature to N – H vector whereas it is subtractive to N – F vector

242

Statement 1: MO configuration of CO is $\sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma 2p_x^2, \pi 2p_y^2, \pi$

Statement 2: The bond energy level $\sigma^* 2s^2$ possesses higher energy because then only bond length order for CO (more) and CO^+ (less) can be explained

243

Statement 1: IE_1 for He is maximum and EA_1 for Cl is more than EA_1 of F

Statement 2: He possesses electrons in 1s sub-shell, closest to nucleus, whereas electron density in F is maximum which exerts more electron-electron repulsion

244

Statement 1: Known elements may contain as many as 32 electrons in an energy level but only s and p sublevel electrons are considered for the octet rule.

Statement 2: For any atom, electrons present in s- and p- subshells assume greater stability.

245

Statement 1: Ionisation energy of nitrogen (7) is more than that of oxygen (8)

Statement 2: Half-filled p-orbitals in nitrogen ($2p^3$) are more stable



246

Statement 1: The first ionisation energy of Be is greater than that of B

Statement 2: $2p$ -orbital is lower in energy than $2s$ -orbital

Matrix-Match Type

This section contain(s) 0 questions. Each question contains Statements given in 2 columns which have to be matched. Statements in **columns I** have to be matched with Statements in **columns II**.

247 Match the element (in Column I) with its unique properties (in Column II)

| Column-I | Column- II |
|----------|-------------------------------|
| (A) F | (1) Maximum ionization energy |
| (B) Cl | (2) Maximum electronegativity |
| (C) Fe | (3) Maximum electronaffinity |
| (D) He | (4) Recently named by IUPAC |
| (E) Ds | (5) Variable valency |

Codes :

| | A | B | C | D | E |
|-----|---|---|---|---|---|
| (a) | 3 | 4 | 2 | 5 | 1 |
| (b) | 1 | 2 | 3 | 4 | 5 |
| (c) | 2 | 3 | 5 | 1 | 4 |
| (d) | 5 | 1 | 4 | 3 | 2 |

248 Match the type of elements (in Column I) with the corresponding electronic configuration (in Column II)

| Column-I | Column- II |
|-------------------------|--------------------------|
| (A) Inert gas elements | (1) ns^1 to ns^2np^5 |
| (B) Main group elements | (2) $1s^2$ to ns^2np^6 |

- | | |
|-------------------------------|--|
| (C) Transition elements | (3) $(n - 2)f^{1-14}(n - 1)s^2p^6d^{10}ns^2$ |
| (D) Inner transition elements | (4) $(n - 1)d^{1-9}ns^2$ |
| | (5) $(n - 1)d^{10}ns^2$ |

Codes :

| | A | B | C | D |
|-----|---|---|---|---|
| (a) | 1 | 2 | 3 | 4 |
| (b) | 2 | 1 | 4 | 3 |
| (c) | 4 | 3 | 2 | 1 |
| (d) | 3 | 4 | 1 | 2 |

249 The correct match of contents in Column I with those in column II is

| Column-I | Column- II |
|----------|----------------------------------|
| (A) He | (1) High electron affinity |
| (B) Cl | (2) Most electropositive element |
| (C) Ca | (3) Strongest reducing agent |
| (D) Li | (4) Highest ionisation energy |

Codes :

| | A | B | C | D |
|-----|---|---|---|---|
| (a) | 3 | 1 | 2 | 4 |
| (b) | 4 | 3 | 2 | 1 |
| (c) | 2 | 4 | 1 | 3 |
| (d) | 1 | 2 | 3 | 4 |
| (e) | 4 | 1 | 2 | 3 |

250 Match the atomic number (in Column I) with its IUPAC nomenclature (in Column II)

| Column-I | Column- II |
|----------|------------|
| (A) 105 | (1) Uuh |



- (B) 107 (2) Uun
(C) 109 (3) Uns
(D) 110 (4) Unp
(E) 116 (5) Une

Codes :

| | A | B | C | D | E |
|-----|---|---|---|---|---|
| (a) | 4 | 3 | 5 | 2 | 1 |
| (b) | 1 | 2 | 3 | 4 | 5 |
| (c) | 2 | 5 | 4 | 3 | 2 |
| (d) | 5 | 1 | 2 | 5 | 4 |

251 Match atomic number of elements (in Column I) with position of elements in the Periodic Table (in Column II)

Column-I

Column- II

- (A) 19 (1) *p*-block
(B) 22 (2) *f*-block
(C) 32 (3) *d*-block
(D) 64 (4) *s*-block

Codes :

| | A | B | C | D |
|-----|---|---|---|---|
| (a) | 4 | 3 | 1 | 2 |
| (b) | 3 | 4 | 2 | 1 |
| (c) | 2 | 1 | 3 | 4 |
| (d) | 1 | 2 | 4 | 3 |

252

Column-I

Column- II

- (A) Melting point (1) $O^{2-} < O^- < O < O^+$
(B) Thermal stability (2) $F^- < Cl^- < Br^- < I^-$

- (C) Polarisability (3) $HI < HBr < HCl < HF$
(D) Electron affinity (4) $XeF_6 < XeF_4 < XeF_2$

Codes :

| | A | B | C | D |
|-----|---|---|---|---|
| (a) | 4 | 3 | 2 | 1 |
| (b) | 2 | 1 | 4 | 3 |
| (c) | 3 | 2 | 1 | 4 |
| (d) | 1 | 4 | 3 | 2 |

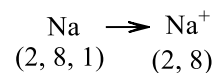
Linked Comprehension Type

This section contain(s) 0 paragraphs. Based upon each paragraph, multiple choice questions have to be answered. Each question has at least 4 choices (a), (b), (c) and (d) out of which **ONLY ONE** is correct.

Paragraph for Question Nos. 253 - 252

Ionic radius is the effective distance from the nucleus of an ion up to which it has its influence on its electron cloud. A cation is always much smaller than the corresponding atom. Further more the number of electrons removed, smaller will be the size of the resulting positive ion. For example $r_{Fe} > r_{Fe^{2+}} > r_{Fe^{3+}}$

A cation formed by the loss of electrons may result in the complete disappearance of the outer shell and since, the remaining inner shells do not extend so far in space, the cation is much smaller than the metal atom. For example



In case of isoelectronic ions, the greater the nuclear charge, the greater is the attraction for electrons and smaller is ionic radius

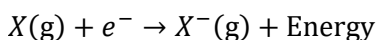
253. The size of the species Pb, Pb^{2+} and Pb^{4+} decreases as



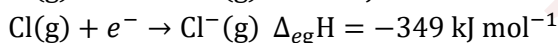
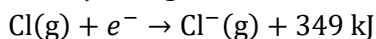
- Pb⁴⁺ Pb Pb⁴⁺ Pb²⁺
a) > Pb²⁺ b) > Pb²⁺ c) > Pb d) > Pb⁴⁺
> Pb > Pb⁴⁺ > Pb²⁺ > Pb

Paragraph for Question Nos. 254 - 254

Just as energy is required to remove an electron from an atom, energy is generally released when an electron is added to a neutral atom. When an electron is added to a neutral gaseous atom to convert it into a negative ion, the enthalpy change accompanying the process is called the electron gain enthalpy ($\Delta_{eg}H$). It provides a quantitative measure of the ease with which an atom adds an electron to form anion



Electron gain enthalpy, like ionisation potential, is expressed in electron volt/atom or kcal/mol or kJ/mol. Electron gain enthalpy of chlorine is -349 kJ/mol. This means that 349 kJ of energy is released when one mole of chlorine atoms (6.02×10^{23} atoms) change into Cl⁻ ions



254. Second electron gain enthalpy

- a) Can be positive or negative
b) Is always zero
c) Is always negative (energy is released)
d) Is always positive (energy is absorbed)

Paragraph for Question Nos. 255 - 255

Following questions are based on Sc ($Z = 21$)

255. Out of Sc³⁺, Sc²⁺ and Sc⁺ paramagnetic as well coloured ions are

All being

- a) Sc⁺, Sc²⁺ b) Sc⁺, Sc³⁺ c) Sc²⁺, Sc³⁺ d) d -block element

Paragraph for Question Nos. 256 - 256

Following rule in general, classifies p -block elements into metals, non-metals and metalloids (where P is the period and N the valence electrons)
($P + 1$) > N , the element would be metal
($P + 1$) < N , the element would be non-metal
($P + 1$) = N , the element would be metalloid

Answer the following question

256. Metalloid will be out of elements with atomic number 13, 14, 15, 16

- a) 13 b) 14 c) 15 d) 16

Paragraph for Question Nos. 257 - 257

In the following table I_1, I_2 and I_3 of the main group elements in 2nd period have been given

| | Li | Be | B | C | N | O | F | Ne |
|-------|-----|-----|-----|-----|-----|-----|-----|------|
| I_1 | 513 | 899 | 801 | 108 | 140 | 131 | 168 | 2081 |
| I_2 | 729 | 175 | 242 | 235 | 285 | 338 | 337 | 3981 |
| I_3 | 8 | 7 | 7 | 2 | 6 | 8 | 4 | 2 |
| | 118 | 148 | 366 | 462 | 457 | 530 | 605 | 611 |
| | 15 | 48 | 0 | 0 | 8 | 0 | 0 | 2 |

Answer the following questions based on the above table

257. There is increase in ionization energy along a period going Li to Ne, but I_1 of B is less than that of Be. This is due to

- Valence electron in B is in $2p$ -orbital of higher energy than that of Be in $2s$ -orbital of lower energy
Removal of paired electron in Be requires higher energy than that of removal of unpaired electron in B
Both (a) and (b) above
None of the above

Paragraph for Question Nos. 258 - 258

The sums of first and second ionization energies and those of third and fourth ionization energies (MJ mol^{-1}) of nickel and platinum are

| | $(IE)_1 + (IE)_2$ | $(IE)_3 + (IE)_4$ |
|----|-------------------|-------------------|
| Ni | 2.49 | 8.80 |
| Pt | 2.66 | 6.70 |

Based on this information, answer the following questions



258. Most common oxidation states of Ni and Pt are respectively

- a) +2, +2 b) +4, +2 c) +2, +4 d) +4, +4

Paragraph for Question Nos. 259 - 259

The $(IE)_1$ and the $(IE)_2$ on kJ mol^{-1} of a few elements designated by Roman numerals are shown below

| Element | $(IE)_1$ | $(IE)_2$ |
|---------|----------|----------|
| A | 2372 | 5251 |
| B | 520 | 7300 |
| C | 900 | 1760 |
| D | 1680 | 3380 |

Based on the above information, answer the following questions

259. Which of the above elements is likely to be a reactive metal?

- a) A b) B c) C d) D

Paragraph for Question Nos. 260 - 260

Consider the following table comparing ionic radius

| Ion \rightarrow | N^{3-} | O^{2-} | F^- | Na^+ | Mg^{2+} |
|---------------------------|-----------------|-----------------|--------------|---------------|------------------|
| Number of electron | 10 | 10 | 10 | 10 | 10 |
| Number of nuclear protons | 7 | 8 | 9 | 11 | 12 |
| Ionic radius (pm) | 146 | 140 | 133 | 98 | 79 |

Answer the following questions.

260. Select the correct alternate(s) in term of size

- a) $\text{Na} > \text{Na}^+$ b) $\text{Mg} > \text{Mg}^+$ c) $\text{F}^- > \text{F}$ d) $\text{O}^{2-} > \text{O}$
 e) $\text{Mg} > \text{Mg}^{2+}$ f) $\text{O}^{2-} > \text{O}^-$

Paragraph for Question Nos. 261 - 261

The heats of formation (ΔH_f°) of the oxides of the third period, sodium to chlorine, are in kJ mol^{-1}

| | | | | | |
|-------------------------|--------------|-------------------------|----------------|---------------------------|---------------|
| Na_2O | MgO | Al_2O_3 | SiO_2 | P_4O_{10} | SO_3 |
| Cl_2O_7 | | | | | |
| -416 | -602 | -1676 | -911 | -2984 | -395 |
| +250 | | | | | |

Based on these data, answer the following questions

261. Which oxide has maximum negative heat of formation per oxygen atom?

- a) P_4O_{10} b) Al_2O_3 c) Na_2O d) MgO

Paragraph for Question Nos. 262 - 262

The singly-bonded metallic radius of Na is 157 pm.

Assume that the increment between radii of different magnitudes is 60 pm

Answer the following questions

262. The covalent radius of Na is

- a) 157 pm b) 97 pm c) 217 pm d) 267 pm

Paragraph for Question Nos. 263 - 263

Following species have been given. Assign the species (by its number) showing the indicated property

- (1) LiCl (2) AlCl_3 (3) Al_2O_3 (4) BaO
 (5) LiH (6) Cl_2
 (7) F_2 (8) Br_2 (9) MgCl_2

263. Which is maximum hydrated?

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

Paragraph for Question Nos. 264 - 264

Dipole moment of a bond is a vector and physical quantity to calculate the percentage ionic character in a covalent bond. It is expressed as:

$$\text{Dipole moment } (\mu) = \delta \times d$$

Where, δ is dipole moment and d is the bond length

It is usually expressed in terms of CGS unit known as Debye (D) $1D = 10^{-18}$ esu cm. In SI unit it is

expressed in coulomb meter. Resultant dipole moment (μ_R) of two bond moments (μ_1 and μ_2) acting at an angle θ , is given by:

$$\mu_R = \sqrt{\mu_1^2 + \mu_2^2 + 2\mu_1\mu_2 \cos \theta}$$

If $\mu_1 = \mu_2$, also if $\cos \theta = -1$, i. e., $\theta = 180^\circ$ then $\mu = 0$ (molecule is nonpolar)

If $\mu \neq 0$ molecule is polar.

Dipole moment plays an important role in deciding the stability order of alkanes, i. e., a more stable alkane has less dipole moment. The dipole moment of a molecule can predict the geometrical and position isomers as well as orientations in benzene nucleus and polarity of molecule

264. Dipole moment of HCl molecule is found to be 0.816 D. Assuming HCl bond length to be equal to 1 Å, the % ionic character of HCl molecule is:

- a) 10% b) 17% c) 27% d) 37%



Integer Answer Type



SENJEE



CLASSIFICATION OF ELEMENTS AND PERIODICITY IN PROPERTIES

: ANSWER KEY :

| | | | | | | | | | | | | | | | |
|------|-------|------|-------|------|---------|------|---|------|---------|------|---------|------|-------|------|---|
| 1) | b | 2) | b | 3) | a | 4) | b | 161) | a,d | 162) | b,c,d | 163) | a,b | 164) | |
| 5) | a | 6) | a | 7) | a | 8) | a | | a,c,d | | | | | | |
| 9) | d | 10) | c | 11) | c | 12) | a | 165) | a,b,c,d | 166) | a,b | 167) | a,b,c | 168) | d |
| 13) | a | 14) | b | 15) | c | 16) | c | 169) | a,b,c,d | 170) | b,d | 171) | a,b,c | 172) | |
| 17) | c | 18) | b | 19) | a | 20) | a | | a,c | | | | | | |
| 21) | d | 22) | b | 23) | a | 24) | d | 173) | a,b,c | 174) | a,c | 175) | a,b | 176) | |
| 25) | b | 26) | d | 27) | c | 28) | c | | a,b,d | | | | | | |
| 29) | a | 30) | a | 31) | c | 32) | d | 177) | a,b,d | 178) | a,b,d | 179) | b,c,d | 180) | c |
| 33) | c | 34) | c | 35) | c | 36) | b | 181) | b,c | 182) | a,c | 183) | a,b,c | 184) | |
| 37) | d | 38) | b | 39) | c | 40) | b | | b,c,d | | | | | | |
| 41) | d | 42) | c | 43) | d | 44) | b | 185) | a,b,d | 186) | a,b,c | 187) | b,c | 188) | |
| 45) | a | 46) | a | 47) | d | 48) | c | | a,b,c,d | | | | | | |
| 49) | a | 50) | a | 51) | a | 52) | a | 189) | b | 190) | b,c,d | 191) | a,b,c | 192) | |
| 53) | c | 54) | c | 55) | c | 56) | c | | a,c,d | | | | | | |
| 57) | b | 58) | d | 59) | a | 60) | d | 193) | a,d | 194) | a,b,c | 195) | a,c,d | 196) | |
| 61) | a | 62) | b | 63) | b | 64) | d | | b,d | | | | | | |
| 65) | a | 66) | a | 67) | c | 68) | d | 197) | a,b,c,d | 198) | a,c,d | 199) | a,b,c | 200) | |
| 69) | c | 70) | b | 71) | c | 72) | d | | b,c,d | | | | | | |
| 73) | b | 74) | d | 75) | d | 76) | a | 201) | b,d | 202) | a,b,c,d | 203) | a,b | 204) | |
| 77) | c | 78) | a | 79) | d | 80) | a | | a,c | | | | | | |
| 81) | a | 82) | c | 83) | c | 84) | c | 205) | b,c | 206) | b,c,d | 207) | c | 208) | b |
| 85) | b | 86) | a | 87) | d | 88) | c | 209) | d | 210) | d | 211) | b | 212) | a |
| 89) | d | 90) | c | 91) | d | 92) | a | 213) | d | 214) | d | 215) | b | 216) | c |
| 93) | b | 94) | a | 95) | b | 96) | d | 217) | c | 218) | b | 219) | c | 220) | b |
| 97) | d | 98) | a | 99) | b | 100) | a | 221) | a | 222) | a | 223) | b | 224) | c |
| 101) | d | 102) | a | 103) | a | 104) | a | 225) | b | 226) | b | 227) | d | 228) | a |
| 105) | a | 106) | c | 107) | c | 108) | d | 229) | a | 230) | c | 231) | b | 232) | c |
| 109) | c | 110) | c | 111) | a | 112) | b | 233) | b | 234) | c | 235) | c | 236) | d |
| 113) | b | 114) | a | 115) | a | 116) | c | 237) | d | 238) | c | 239) | b | 240) | c |
| 117) | a | 118) | b | 119) | d | 120) | a | 241) | b | 242) | c | 243) | c | 244) | b |
| 121) | d | 122) | a | 123) | b | 124) | b | 245) | a | 246) | a | 247) | c | 248) | b |
| 125) | c | 126) | b | 127) | c | 128) | a | 249) | c | 250) | a | 251) | a | 252) | a |
| 129) | c | 130) | c | 131) | c | 132) | a | 253) | b | 254) | d | 255) | a | 256) | b |
| 133) | c | 134) | d | 135) | a | 136) | d | 257) | c | 258) | c | 259) | b | 260) | |
| 137) | b | 138) | c | 139) | b | 140) | c | | a,b,c,d | | | | | | |
| 141) | c | 142) | c | 143) | b | 144) | d | 261) | d | 262) | a | 263) | c | 264) | b |
| 145) | a | 146) | a | 147) | c | 148) | b | 265) | 8 | 266) | 5 | 267) | 1 | 268) | 7 |
| 149) | d | 150) | d | 151) | b | 152) | d | 269) | 6 | 270) | 2 | 271) | 2 | 272) | 1 |
| 153) | a | 154) | a | 155) | b | 156) | | 273) | 6 | 274) | 5 | 275) | 2 | 276) | 3 |
| | a,b,c | | | | | | | 277) | 1 | 278) | 7 | 279) | 3 | 280) | 5 |
| 157) | b,d | 158) | b,c,d | 159) | a,b,c,d | 160) | b | 281) | 6 | 282) | 7 | 283) | 2 | 284) | 4 |



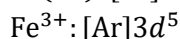
| | | | | | | | |
|------|---|------|---|------|---|------|---|
| 285) | 4 | 286) | 7 | 287) | 5 | 288) | 3 |
| 289) | 6 | 290) | 4 | 291) | 4 | | |



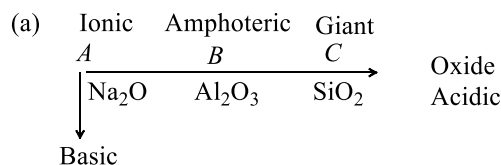
: HINTS AND SOLUTIONS :

Single Correct Answer Type

1 (b)



3 (a)



Thus, atomic number increases in the order $A < B < C$

4 (b)

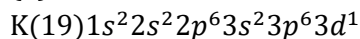
First long period starts with 3rd period [K(19)–Kr(36)]

Thus, total = 18 elements

6 (a)

Ni²⁺ is smallest in size

7 (a)

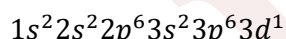


K⁺(19)1s²2s²2p⁶3s²3p⁶ Colourless ion due to lack of electron in *d*-orbitals

Thus, (a) is incorrect

10 (c)

E.C. of K = 19 in the absence of Aufbau rule is

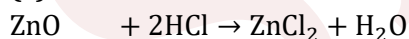


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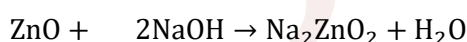
Last-filling electron goes into *d*-orbital

Thus, *d*-block element

11 (c)



Basic oxide



Acidic oxide

14 (b)

A (1.2) is electropositive element

B (3.4) is electronegative element

Thus, ionic bond is formed

15 (c)

(b) and (d) with s²p⁶ configuration has zero values of EA

Cl(c) with empty *d*-orbital has greater EA than F(a)

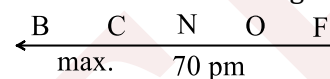
17 (c)

PbO is soluble in NaOH – an acidic oxide

PbO is soluble in HCl – a basic acid

18 (b)

Radius decreases along a period left to right



Thus, covalent radius of B would be higher than that of N

19 (a)

Smaller the size of anion, smaller the polarizing power and thus larger the ionic character of NaX.

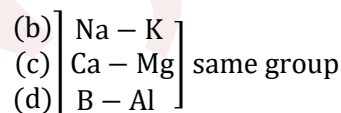
Thus, ionic character



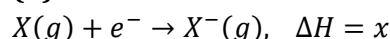
and mp : NaI < NaBr < NaCl < NaF

20 (a)

(a) Li – Mg diagonal relationship



21 (d)



(EA of X(g))



Thus, (a), (b), (c) true

22 (b)

Elements in a group have same (EC) in valence shell

25 (b)



Thus, Ce⁴⁺ has [Xe] configuration

27 (c)

Atomic number 113 belong to *p*-block (Group IIIA)

Probable oxidation states are +1, +3, but due to inert-pair effect



- stability of $+1 > +3$
Thus, M^+
- 29 (a)
 Cl_2O_7 Cl = +7
- 30 (a)
Going down the group effective nuclear charge remains almost constant, hence (IE) is dependent on radius of two element
- 32 (d)
(IV) B contain C, Si, Ge, Sn, Pb
Ge, Sn, Pb are strongly electropositive
- 33 (c)
Isoelectronic N(7) and $\text{O}^+(8)$ have same EC

$$\left. \begin{array}{l} \text{N}(7) \\ \text{O}^+(8) \end{array} \right\} 1s^2 2s^2 2p^3$$

| | | |
|---|---|---|
| 1 | 1 | 1 |
|---|---|---|

$$2p_x^1 2p_y^1 2p_z^1$$
 Most stable due to all unpaired electrons
 $\text{O}_8] 1s^2 2s^2 2p^4$

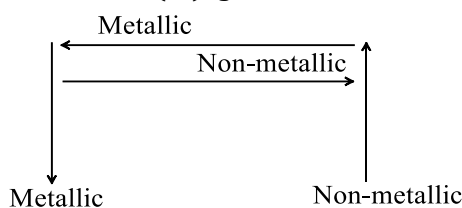
| | | |
|---|---|---|
| 1 | 1 | 1 |
|---|---|---|

 Less stable than O^+ and N
 Since Z of $\text{O}^+ > Z$ of N
 Hence IP of $\text{O}^+ > N$
 Na with only one unpaired electron in $3s^1$ has lowest IP
- 34 (c)
 $\text{Mg} \rightarrow \text{Mg}^+ + e^-$ (IE)₁
 $\text{Mg}^+ \rightarrow \text{Mg}^{2+} + e^-$ (IE)₂
 $\text{Mg}^{2+} \rightarrow \text{Mg}^{3+} + e^-$ (IE)₃
 (IE)₁ < (IE)₂ < (IE)₃
- 35 (c)
 $M(g) \rightarrow M^+(g) + e^-$, $I_1(M) = \Delta H_1 = 100 \text{ eV}$
 (a) is correct
 $M^+(g) \rightarrow M^{2+}(g) + e^-$, $I_2(M) = 250 - 100 = 150 \text{ eV}$
 or $I_2(M^+) = 150 \text{ eV}$ (b) is correct
 I_2 of $M(g)$ is 150 eV thus (c) is incorrect
- 36 (b)
 $\text{Pb}^{4+} + 2e^- \rightarrow \text{Pb}^{2+}$
 Stability of $\text{Pb}^{2+} > \text{Pb}^{4+}$
 Hence, Pb^{4+} is reduced most easily and is thus best oxidizing agent
- 37 (d)
 Valence shell electronic configuration is d^5s^1

- Differentiating electron goes into d -orbitals. Thus, d -block element. Group VIB
- 38 (b)
 $5f$ -block elements
- 39 (c)
 EC: $1s^2 2s^2 2p^6 3s^3 3p^6 4s^1$
 (Total 19 electrons i.e. $Z = 19$)
 It is K (alkali metals of Group 1)
 Graded property will be that of same group
- $[\text{Ar}]3d^{10}4s^1$ – Cu group 11
 - $[\text{Kr}]4d^{10}5s^1$ – Ag group 11
 - $[\text{Kr}]5s^1$ – Rb group 1
- 43 (d)
 $\text{Na} \xrightarrow{(\text{IE})_1} \text{Na}^+$
 $[\text{Ne}]3s^1$ [Ne]
 $\text{Na}^+ \xrightarrow{(\text{IE})_2} \text{Na}^{2+}$
 Ne
 Na^+ has stable inert gas configuration
 Thus, (IE)₂ is very high
- 46 (a)
 Size of $\text{Li}^+ < \text{Na}^+ < \text{Rb}^+ < \text{Cs}^+$
 Hydration $\text{Li}^+ > \text{Na}^+ > \text{Rb}^+ > \text{Cs}^+$
 Size of hydrated ion $\text{Li}^+ > \text{Na}^+ > \text{Rb}^+ > \text{Cs}^+$
 Smaller the size, $\text{Li}^+ < \text{Na}^+ < \text{Rb}^+ < \text{Cs}^+$
 Larger the hydration, hence larger the size of the hydrated ion (in aqueous solution)
 Heavier the ion, smaller the ionic mobility
 Size $\text{Li}^+ < \text{Na}^+ < \text{K}^+$
 Hydration $\text{Li}^+ > \text{Na}^+ > \text{K}^+$
 Ionic mobility $\text{Li}^+ < \text{Na}^+ < \text{K}^+$
 Discharged at cathode $\text{Li}^+ < \text{Na}^+ < \text{K}^+$ (Most easiest)
- 47 (d)
 $\text{He}^+, \text{Li}^{2+}$ and Be^{3+} are isoelectronic of H atom (with one electron). Hence, single electron is not screened
- 48 (c)
 As, Sb, Bi are group 15 having oxidation +3 and +5. Stability is in order
 $\text{As}^{5+} > \text{Sb}^{5+} > \text{Bi}^{5+}$
 $\text{As}^{3+} < \text{Sb}^{3+} < \text{Bi}^{3+}$ due to inert-pair effect
 Thus, BiCl_3 is most stable
- 49 (a)



Smaller the (IE), greater the metallic nature

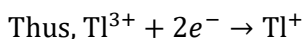
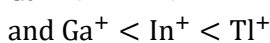
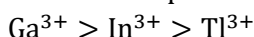


52 (a)

In case of Ne van der Waals' radius is taken. Hence, it should have maximum size out of the given option

54 (c)

Due to inert-pair effect, stability of

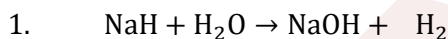


Is most spontaneous. Thus $\Delta G^\circ < 0$ and is most negative

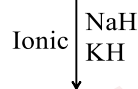
57 (b)

F is the most electronegative element which cannot lose electron to other so it exhibits only -1 state. Na is alkali metal which can lose only one electron so exhibits only +1 state.

58 (d)



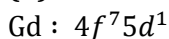
Reducing nature



59 (a)

Greater the electronegativity of X (Cl > Br > I) greater the acid strength
Thus, I > II > III

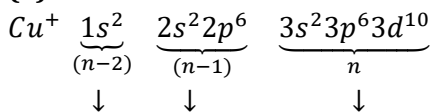
60 (d)



Unpaired electrons = 8

$$\text{Sum of spin} = 8 \times \frac{1}{2} = 4$$

61 (a)

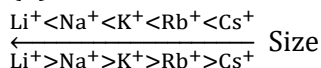


$$S = 2 \times 1 + 8 \times 0.85 + 17 \times 0.35 = 14.75$$

(One d-electron is screened by 17 electrons in nth, 8 electrons in (n - 1) and 2 electrons in (n - 2)

$$Z_{\text{eff}} = 29 - 14.75 = 14.25$$

62 (b)

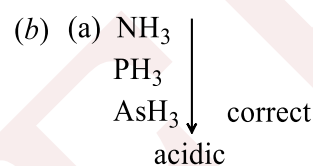


Maximum \leftarrow Covalent nature MCl

Maximum \leftarrow Lattice energy of MCl

Maximum \leftarrow Thermal stability

63 (b)



(b) Li < B < Be < C (IE)

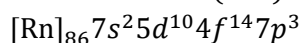
Be has paired electron hence its (IE) is larger than that of B

Thus, (b) is incorrect

(c) Correct (d) correct

65 (a)

Atomic number (115) has E.C. has



Probable oxidation states are +3, +5

But due to inert pair effect M^{3+} is the most stable cation

66 (a)

Effective nuclear charge $Z_{\text{eff}} = Z - S$

Where, Z = atomic number

and S = screening constant

= 0.35 per electron for electron in nth orbit

= 0.85 per electron for electron in (n - 1)th orbit

= 1.00 per electron for electrons in (n - 2)th,

(n - 3)th, (n - 4)th orbit

= 0.30 per electron in 1s-orbital (when alone)

Be $1s^2 2s^2$ one valence-electron in 2s is screened

by one electron in 2s-orbital (nth orbit) and two electrons in 1s-orbital ((n - 1)th orbit)

$$\therefore S = 0.35 + 2 \times 0.85 = 2.05$$

$$\therefore Z_{\text{eff}} = 4 - 2.05 = 1.95 \text{ (given)}$$



- Be⁺ 1s²2s¹ 2s electron is screened by two electrons in 1s-orbital ((n - 1)th orbital)
 $S = 2 \times 0.85 = 1.70$
 $\therefore Z_{\text{eff}} = 4 - 1.70 = 2.30$
 Be³⁺ 1s¹ one electron in 1s-orbital (alone exists) is screened by another electron in same orbit.
 Thus,
 $S = 0.30$
 $\therefore Z_{\text{eff}} = 4 - 0.30 = 3.70$
 Be³⁺ 1s¹ no-screening (single electron)
 Thus, $Z_{\text{eff}} = 4$
 Thus, $Z_{\text{effective}}$: Be < Be⁺ < Be²⁺ < Be³⁺
- 67 (c)
 (IP) of Na (11) < (IP) of Li (3)
- 69 (c)
 $A \rightarrow A^+ + e^-$ (IP)_A < (IP)_B
 $B + e^- \rightarrow B^-$ (EA)_B > (EA)_A
 (EN)_B > (EN)_A
- 70 (b)
 M^{3+} : [Ar]3d¹⁰4s²
 M : [Ar]3d¹⁰4s²4p³
 Three electrons have been removed from 4p-suborbital
 Thus, p-block element
- 72 (d)

| | | | |
|----|----|-------|---|
| O | F | Thus, | F < O |
| S | Cl | | F ⁻ < O ²⁻ |
| Se | Br | | I > Br > F |
| I | I | | Se > O |
| | | | I ⁻ > Br ⁻ > F ⁻ |
| | | | Se ²⁻ > O ²⁻ |

 I > Se
 $\therefore I^- > Se^{2-}$
 Thus, $I^- > Se^{2-} > Br^- > O^{2-} > F^-$
- 73 (b)
 A-19 s-block
 B-22 d-block
 C-32 p-block
 D-64 f-block
- 79 (d)
 Chalcogens are the elements of oxygen family:
 Valence shell configuration : ns²np⁴
 Group: 16
 Block: p
- 81 (a)
 $r_n = \frac{n^2 a_0}{Z_{\text{effective}}}$
 Thus, $r_n \propto \frac{1}{Z_{\text{effective}}}$

- 82 (c)
 NaH is an ionic hydride, others are covalent hydrides
- 83 (c)
 Ni: [Ar]3d⁸4s²
 Last electron enters into 3d-suborbital
 Thus, d-block element
- 84 (c)
 $X: ns^2 np^1$
 Valency = +3 (as in Al)
 It can lose three electrons to attain stable configuration
 $Y: ns^2 np^3$
 Valency = -3 (as in N)
 It can gain five electrons to attain stable configuration
 Thus, X³⁺ Y³⁻ or XY
- 86 (a)
 I⁻ is oxidized by Br₂, Cl₂, F₂
 Br⁻ is oxidized by Cl₂, F₂
 Cl⁻ is oxidized by F₂
- 89 (d)

| Element | Valence electrons | Possible ion |
|---------|-------------------|-----------------|
| A | 3 | A ³⁺ |
| B | 6 | B ²⁻ |

 $B + 2e^- \rightarrow B^{2-}$
 8 electrons in valence shell (stable)
 $A \rightarrow A^{3+} + 3e^-$
 Stable
 Thus, A³⁺B²⁻A₂B₃
- 90 (c)
 $r_n \propto \frac{1}{Z}$
 $Ti^{2+} (22) > Ni^{2+} (28)$
 smaller
 Pt²⁺ (5d-series)
 Zr²⁺ (4d-series)
 Have higher number of orbitals
 Hence, larger size
- 92 (a)
 ${}_{115}^m A \rightarrow {}_{113}^{m-4} B + \alpha({}_2^4 He)$
- 93 (b)
 $113 - 32 - 32 - 18 = 31$
 Thus, 113 and 115 are placed as shown

| | |
|-------|-------|
| IIIA | VA |
| Ga 31 | 33 As |



In 49 51 Sb

Tl 81 81 Bi

$\frac{113}{ns^2np^1}$ $\frac{115}{ns^2np^3}$

Thus, these belong to p -block

95 (b)

Na^+ , Mg^{2+} and Al^{3+} are isoelectronic

Size $\text{Na}^+ > \text{Mg}^{2+} > \text{Al}^{3+}$

Charge +1 +2 +3

Smaller the size of cation,

Larger the charge,

Greater the hydration

Thus, $\text{Na}^+ < \text{Mg}^{2+} < \text{Al}^{3+}$

96 (d)

(d) Be $\begin{array}{|c|c|} \hline \uparrow\downarrow & \uparrow\downarrow \\ \hline 1s^2 & 2s^2 \\ \hline \end{array}$ ← paired electron requires more energy than unpaired electron in B

B $\begin{array}{|c|c|c|} \hline \uparrow\downarrow & \uparrow\downarrow & \uparrow \\ \hline \end{array}$

Thus, IE of Be > B

N $\begin{array}{|c|c|c|c|} \hline \uparrow\downarrow & \uparrow\downarrow & \uparrow & \uparrow & \uparrow \\ \hline 1s^2 & 2s^2 & \underbrace{\hspace{2cm}}_{2p^3} \\ \hline \end{array}$

stable higher (IE) than O due to paired electrons in $2p$

O $\begin{array}{|c|c|c|c|} \hline \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow & \uparrow \\ \hline 1s^2 & 2s^2 & \underbrace{\hspace{2cm}}_{2p^4} \\ \hline \end{array}$

Thus, IE of N > O

(IE) $_{\text{Li}} > \text{Na}$ due to smaller size of Li

$\text{He} \rightarrow \text{He}^+ + e^-$ (IE) $_1$

$\text{He}^+ \rightarrow \text{He}^{2+} + e^-$ (IE) $_2$

(IE) $_2 > \text{(IE)}_1$

Thus, (IE) of $\text{He}^+ > \text{He}$

Thus, (d) is incorrect

97 (d)

2. Na, K - Metals

3. F, Cl - Non-metals

4. Cu, Ag - Metals

5. B, Si - Metalloids

98 (a)

Na_2O is basic in nature and other oxides are acidic/basic/amphoteric

SiO_2 P_2O_5 SO_3 Cl_2O_7

O. N. of element +4 +5 +6 +7

Acidic nature $\xrightarrow{\hspace{2cm}}$ increases

Thus, greater the acidic nature, greater the tendency of the reaction to occur

Thus, Cl_2O_7

100 (a)

$$r_n = \frac{n^2 a_0}{Z_{\text{eff}}}$$

Cs (alkali metal) has largest atomic radius

101 (d)

Lanthanides form $4f$ -series

102 (a)

Size of $\text{Li}^+ < \text{Na}^+ < \text{Rb}^+ < \text{Cs}^+$

Hydration $\text{Li}^+ > \text{Na}^+ > \text{Rb}^+ > \text{Cs}^+$

Size of hydrated ion $\text{Li}^+ > \text{Na}^+ > \text{Rb}^+ > \text{Cs}^+$

Smaller the size, $\text{Li}^+ < \text{Na}^+ < \text{Rb}^+ < \text{Cs}^+$

Larger the hydration, hence larger the size of the hydrated ion (in aqueous solution)

103 (a)

$M \rightarrow M^+ + e^-$ (IE) $_1 = 100$ eV

$M \rightarrow M^{2+} + e^-$ (IE) $_2 = 150$ eV

$M^{2+} \rightarrow M^{3+} + e^-$ (IE) $_3 = 1500$ eV

(IE) $_3$ is very high indicating that M^{3+} is not formed easily. Thus, M^{3+} has attained inert gas configuration

$\text{Be} \rightarrow \text{Be}^+ + e^-$

$1s^2 2s^2$ $1s^2 2s^1$

$\text{Be}^+ \rightarrow \text{Be}^{2+} + e^-$

$1s^2 2s^1$ $1s^2$

104 (a)

$\text{F} + e^- \rightarrow \text{F}^-$

Can be reduced easily

106 (c)

$V(Z = 23) = [\text{Ar}]4s^2 3d^3$

$V^{x+} = ?$

$\begin{array}{|c|} \hline \uparrow\downarrow \\ \hline 4s^2 \\ \hline \end{array}$

$\begin{array}{|c|c|c|} \hline 1 & 1 & 1 \\ \hline \end{array}$

$3d^3$

If there are N unpaired electrons then

Magnetic moment = $\sqrt{N(N+2)}BM = 1.73$

$\therefore N(N+2) = 3$

$\therefore N = 1$

Thus, vanadium exists as V^{4+}

$V^{4+} = [\text{Ar}]3d^1$

Thus, vanadium chloride is VCl_4

107 (c)

1 1 5



↑ ↑ ↑

U u p

Thus, Uup

109 (c)

M^+ (alkali metal ion) has inert gas configuration.
Thus, after M^+ is formed from M (by $(IE)_1$),
further ionization to M^{2+} from M^+ (by $(IE)_2$)
requires very high energy

110 (c)

Maximum charge

Least size

Maximum polarizing power

Thus, (c) [Note O^{2-} is anion]

111 (a)

Based on Fajan's rule

112 (b)

$$113 - 32 - 32 - 18 = 31$$

Thus, 113 and 115 are placed as shown

| IIIA | VA |
|-------|-------|
| Ga 31 | 33 As |
| In 49 | 51 Sb |
| Tl 81 | 81 Bi |

| | |
|------------|------------|
| <u>113</u> | <u>115</u> |
| ns^2np^1 | ns^2np^3 |

Thus, these belong to p -orbital

113 (b)

Element with atomic number 113 is placed in
group 13 (IIIA) and has EC of valence shell as
 ns^2np^1

Si – Group 14

Ga – Group 13

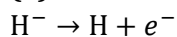
Bi – Group 15

At – Group 17

114 (a)

$(IE)_1$ decreases regularly

117 (a)



119 (d)

Greater the charge on cation smaller the size

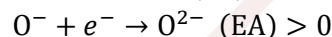
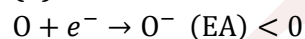
- Ti^{4+} ($Z = 22$, electron = 18) > Mn^{7+} ($Z = 25$ electrons = 18)
- $^{37}Cl^- = ^{35}Cl^-$ ($Z = 17$)
- $K^+ < Cl^-$
- $p^{3+} > p^{5+}$

Thus, correct

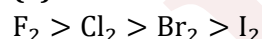
121 (d)

- True
- True
- True

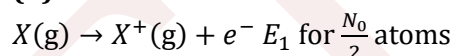
123 (b)



132 (a)

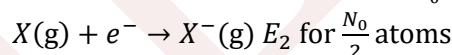


137 (b)



$\frac{N_0}{2}$ atoms of $X(g)$ have been ionized, by energy = E_1

Thus, ionization energy $X(g) = \frac{2E_1}{N_0}$ per atom



Thus, electron affinity of $X(g)$ is $\frac{2E_0}{N_0}$ per atom

139 (b)

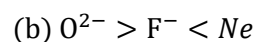
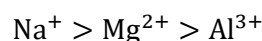
$$(EN)_A = \frac{(EN)_A + (IE)_A}{2}$$

$$X = \frac{Y + (IE)_A}{2}$$

$$(IE)_A = 2X - Y$$

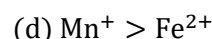
140 (c)

$$(a) r_n \propto \frac{1}{Z}$$



(c) Repulsive forces are balanced by attractive force

Thus, true



143 (b)



| | | |
|---|---|--|
| 1 | 1 | |
|---|---|--|

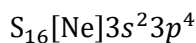
2.8



| | | |
|---|---|---|
| 1 | 1 | 1 |
|---|---|---|



2.1



| | | |
|---|---|---|
| 1 | 1 | 1 |
|---|---|---|

2.5

Thus, $P < S < Si$

144 (d)

Effective nuclear charge $Z_{\text{eff}} = Z - S$

Where, Z = atomic number

and S = screening constant

= 0.35 per electron for electron in n th orbit

= 0.85 per electron for electron in $(n - 1)$ th orbit

= 1.00 per electron for electrons in $(n - 2)$ th,

$(n - 3)$ th, $(n - 4)$ th orbit

= 0.30 per electron in 1s-orbital (when alone)

Be $1s^22s^2$ one valence-electron in 2s is screened

by one electron in 2s-orbital (n th orbit) and two electrons in 1s-orbital ($(n - 1)$ th orbit)

$$\therefore S = 0.35 + 2 \times 0.85 = 2.05$$

$$\therefore Z_{\text{eff}} = 4 - 2.05 = 1.95 \text{ (given)}$$

Be⁺ $1s^22s^1$ s electron is screened by two electrons in 1s-orbital ($(n - 1)$ th orbital)

$$S = 2 \times 0.85 = 1.70$$

$$\therefore Z_{\text{eff}} = 4 - 1.70 = 2.30$$

Be³⁺ $1s^1$ one electron in 1s-orbital (alone exists) is screened by another electron in same orbit.

Thus,

$$S = 0.30$$

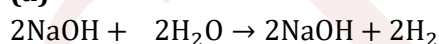
$$\therefore Z_{\text{eff}} = 4 - 0.30 = 3.70$$

Be³⁺ $1s^1$ no-screening (single electron)

Thus, $Z_{\text{eff}} = 4$

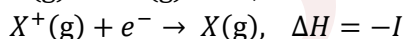
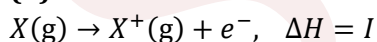
Thus, $Z_{\text{effective}}$: Be < Be⁺ < Be²⁺ < Be³⁺

145 (a)



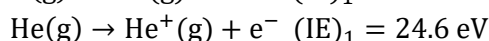
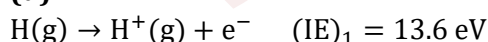
Ionic hydride basic

148 (b)



Thus, $I = -E$

149 (d)



He⁺(g) is now isoelectronic of H(g)

$$\text{Thus, } (\text{IE})_1(\text{He}^+) = (\text{IE})_1(\text{H})(Z)^2 = 13.6 \times 2^2 = 54.4 \text{ eV}$$

Thus, $(\text{IE})_1$ of He = 24.6 given

$$(\text{IE})_2 \text{ of He} = (\text{IE})_1 \text{ of He}^+ = 54.4 \text{ eV}$$

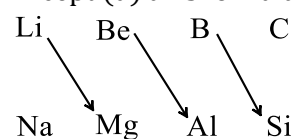
Thus, $\text{He}(g) \rightarrow \text{He}^{2+}(g) + 2e^-$

$$(\text{IE})_1 + (\text{IE})_2 = 24.6 + 54.4 = 79.0 \text{ eV}$$

$$\text{Hence, } \text{He}^{2+} + 2e^- \rightarrow \text{He} \quad \Delta H = -79.0 \text{ eV}$$

150 (d)

Except (d) all show diagonal relationship



151 (b)

Transition metals have very high (IE). They do not emit colour in flame

152 (d)

| | | | | | |
|---------------------------|-----------------|----------------|-----------------|------------------|------------------|
| | O ²⁻ | F ⁻ | Na ⁺ | Mg ²⁺ | Al ³⁺ |
| Z | 8 | 9 | 10 | 11 | 12 |
| Electron | 10 | 10 | 10 | 10 | 10 |
| $r_n \propto \frac{1}{Z}$ | | | | | |

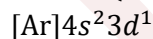
Thus, correct order is

$$\text{O}^{2-} > \text{F}^- > \text{Na}^+ > \text{Mg}^+ > \text{Al}^{3+}$$

154 (a)

Sc³⁺ 18 electrons

Thus, Z (atomic number = 21)



Thus, IIIB group, thus given matching is incorrect

155 (b)

Smaller the size of element, greater the tendency to donate electron-pair. Thus, greater the basic nature

Multiple Correct Answers Type

159 (a,b,c,d)

(a) $r_{\text{metallic}} > r_{\text{covalent}}$ because covalent bond formation involves the overlapping of orbitals

(b) Due to lanthanide contraction

(c) If screening effect increases, the valence shell electron get loosely bound. Hence, ionisation energy decreases

(c) Be and Mg has ns^2 configuration, i.e., stable configuration, thus have higher IE

161 (a,d)

Li and Mg show diagonal relationship, thus have same size. Rb⁺ and O²⁻ also have similar size

192 (a,c,d)

Electronegativity of H (1.2), Te (2.1) and P (2.1) on Pauling's scale are similar but the



electronegativity of S (2.5) is different from the other three elements

193 (a,d)

Number of protons (17) and neutrons (18) in Cl and Cl^- ion are equal. The ionic size of Cl^- ion is larger than that of Cl atom and also it has one electron more (18) than Cl (17)

204 (a,c)

Metallic character and electronegativity always follow the similar trends down the group among the elements of group 1 to 17

Assertion - Reasoning Type

207 (c)

Explanation is correct reason for statement

208 (b)

Solid ionic compounds conduct current only in fused state. PCl_5 in solid state exists as $[\text{PCl}_6]^- [\text{PCl}_4]^+$

209 (d)

Assertion is an experimental fact observed against Le Chatelier principle

210 (d)

All alkaline earth metals and noble gases have positive values of electron attachment enthalpies as they have ns^2 and ns^2np^6 (fully-filled) electronic configuration

Cl has more electron affinity than F because the more compact electronic configuration in F imparts greater electron repulsion to the incoming electron

211 (b)

N shows maximum covalence of +3 along with one coordinate bond whereas P shows maximum covalence of +5 due to given explanation

212 (a)

The phenomenon in which the penultimate shell, i.e., $(n - 1)$ electrons act as shield in between nucleus and valence shell electrons thereby reducing the effective nuclear charge is known as shielding effect

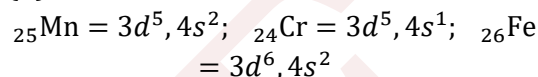
213 (d)

In spite of higher lattice energy AgF is soluble because F^- is extensively hydrated and heat of hydration predominates over lattice energy

214 (d)

The bond angle in H_2S is smaller because S atom has bigger size than O. Also H_2S does not show H-bonding

215 (b)



Electron affinity of an element depends upon electronic configuration

216 (c)

${}_{94}^{38}\text{Pu}$ has longest half-life period. It is used in breeder reactor as a fissionable nucleides and break up by slow neutrons and from fission product. It is a radioactive element.

217 (c)

Explanation is correct reason for statement

218 (b)

In sp^2 -hybridization bond angle is 120° . In sp^3 it is $109^\circ 28'$

219 (c)

Explanation is correct reason for statement

220 (b)

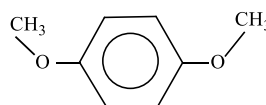
Atomic size of silver is almost equal to that of gold due to lanthanide contraction.

221 (a)

Electron affinity of F < Electron affinity of Cl. Due to more $2p$ -test electron repulsion in F atom

222 (a)

p-dimethoxy benzene is polar due to orientation of CH_3 group as, The resultant vector is not zero



223 (b)



- Both *cis*- and *trans*-forms are polar. *Trans* is more polar due to higher value of dipole moment due to additive nature of CH_3 and Cl vectors
- 224 (c)
The lower IE_1 of B than that of Be is because in boron ($1s^2 2s^2 2p^1$) electron is to be removed from 2 *P* which is easy, while in Be ($1s^2 2s^2$) electron is to be removed from 2*s*-which is difficult.
- 225 (b)
The dipole moment of NH_3 is more than NF_3 because of the given explanation
- 226 (b)
Halogens can have only EA_1 value because they can accommodate only one electron ($ns^2 np^5$ to $ns^2 np^6$): No scope for further addition, thus EA_2 for halogens is zero
- 227 (d)
Statement I is incorrect as in any period, the radius of the noble gas is largest and not the lowest
- 228 (a)
Noble gases have large positive electron gain enthalpy because the electron has to enter the next high principle quantum level leading to a very unstable electronic configuration.
- 229 (a)
P in PCl_3 is sp^3 -hybridized; P – Cl bond is $sp^3 - p$ bond
P in PCl_5 is $sp^3 d$ -hybridized; P – Cl bond is $sp^3 d - p$ bond
- 230 (c)
Removal of electron from N atom requires more energy due to half filled *p*-orbital in N atom
- 231 (b)
Sulphur valence shell is less dense than oxygen.
- 232 (c)
Explanation is correct reason for statement
- 233 (b)
This is Fajans' rule. FeCl_3 is more covalent
- 234 (c)
Explanation is correct reason for statement
- 235 (c)
Explanation is correct reason for statement
- 236 (d)
 BF_3 is planar due to sp^2 -hybridization. Also in BF_3 , three bond pair on boron atom and 9 lone pairs of electrons on F atoms
- 237 (d)
The ionization energy of N (*VA*) is more than O (*VI A*) because half filled and completely filled orbitals are more stable. Across a period effective nuclear charge increases with increase in atomic number and atomic size in atomic number and atomic size decreases.
- 238 (c)
Explanation is correct reason for statement
- 239 (b)
Molecules having polar bonds may (*e.g.*, ClF_3 polar) or may not (*e.g.*, BF_3) have dip[ole moment. The resultant vector of bond moment decides the net dipole moment in molecule
- 240 (c)
Charge is not defined as positive or negative [Isoelectronic species having higher the negative charge, larger the size, higher the positive charge smaller the size].
- 241 (b)
That is why $\mu_{\text{NH}_3} > \mu_{\text{NF}_3}$
- 242 (c)
Explanation is correct reason for statement
- 243 (c)
Explanation is correct reason for statement
- 244 (b)
Electrons in *d* and *f* sublevels can never be in the outer level of a neutral atom. The *s*- and *p*-electrons are in the highest energy level in the



atom and are the electrons involved in the chemical reactions.

245 (a)

Symmetrical configuration (half-filled) is stable. Oxygen also gains half-filled configuration by losing an electron

246 (a)

Energy level of 2s is lesser than 2p-orbital

Matrix Match Type

249 (c)

(i) For noble gases (*e.g.*, He), ionisation energy is highest due to their completely filled electronic configuration.

(ii) Generally electron affinity increases in a period (from IA to VII A group) and decreases in a group but electron affinity is highest for chlorine (Cl) (due to smaller size and high electron density of fluorine).

(iii) The ionization energy is lowest for Li, so it can lose electrons very easily, thus it behaves as a strongest reducing agent.

(iv) Electropositive character generally decreases in a period (from left to right) and increases in a group (on moving down), thus Ca is the most electropositive element among the given.

Hence, on the basis of above facts, the correct matches are (A)-iv (B)-i (C)-ii (D)-iii

Linked Comprehension Type

253 (b)

Higher is the positive charge, smaller is the size of the atom

254 (d)

During addition of second electron to a uninegative gaseous ion to form divalent gaseous ion, energy is absorbed to overcome the repulsions between the incoming second electron and the negative charge on the ion

264 (b)

$$\mu_m = \bar{\delta} \times d$$

$$0.816 \times 10^{-18} = \delta \times 10^{-8}$$

$$\therefore \delta = 0.816 \times 10^{-10} \text{ esu}$$

$$\therefore \% \text{ ionic character} = \frac{0.816 \times 10^{-10}}{4.803 \times 10^{-10}} \times 100$$
$$= 16.9\%$$

