Some Very Important Value of Increasing and Decreasing

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Remember / Questions

Question: Arrange than in increasing or decreasing order according to characteristics

1.	Decreasing ionic size	Mg^{2+}, O^{2-}, Na^{+}, F^{-}
2.	Increasing acidic property	ZnO, Na_2O_2, P_2O_5, MgO
3.	Increasing bond length	F_2, N_2, Cl_2, O_2
4.	Increasing size	Cl^{-}, S^{2-}, Ca^{2+}
5.	Increasing acid strength	$HClO_3$, $HClO_4$, $HClO_2$, $HClO$
6.	Increasing oxidation number of iodine	I_2, HI, HIO_4, ICl
7.	Increasing thermal stability	$HOCl$, $HOClO_2$, $HOClO_3$, $HOClO$
8.	Increasing bond enthalpy	N_2, O_2, F_2, Cl_2
9.	Increasing acidic character	CO_2, N_2O_5, SiO_2, SO_3
10.	Increasing ionic size	N^{3-}, Na^{+}, F^{-}, O^{2-}, Mg^{2+}
11.	Increasing strength of hydrogen bonding ($H \cdots H - X$)	O, S, F, Cl, N
12.	Increasing ionic radii in water	Li^{+}, Na^{+}, K^{+}, Rb^{+}, Cs^{+}
13.	Increasing molar conductivity in water	Li^{+}, Na^{+}, K^{+}, Rb^{+}, Cs^{+}
14.	Increasing reactivity with water	Li, Na, K, Rb, Cs
15.	Increasing basic nature of hydroxides	LiOH, NaOH, KOH, RbOH, CsOH
16.	Increasing covalent character	LiCl, LiBr, LiI
17.	Increasing ionic character	$CaCl_2$, $BeCl_2$, $MgCl_2$, $BaCl_2$, $SrCl_2$
18.	Increasing solubility	$BeCO_3$, $MgCO_3$, $CaCO_3$, $BaCO_3$
19.	Increasing solubility	$Be(OH)_2$, $Mg(OH)_2$, $Ca(OH)$, $Ba(OH)_2$
20.	Increasing basicity	$Be(OH)_2$, $Mg(OH)_2$, $Ca(OH)$, $Ba(OH)_2$
21.	Increasing hydration of ions	Be^{2+}, Mg^{2+}, Ca^{2+}, Sr^{2+}, Ba^{2+}
22.	Increasing reactivity with water	Be, Mg, Ca, Sr, Ba
23.	Increasing reactivity towards air	Be, Mg, Ca, Sr, Ba

24.	Increasing solubility	$BeSO_4$, $MgSO_4$, $CaSO_4$, $SrSO_4$, $BaSO_4$
25.	Increasing ionic character	BCl_3, $AlCl_3$, $GaCl_3$
26.	Increasing strength of Lewis acid	BF_3, BCl_3, BBr_3
27.	Increasing strength of Lewis acid	$AlCl_3$, $GaCl_3$, $InCl_3$
28.	Increasing reducing power	$GeCl_2$, $SnCl_2$, $PbCl_2$
29.	Increasing oxidizing power	$GeCl_4$, $SnCl_4$, $PbCl_4$
30.	Increasing basic character	NH_3, AsH_3, SbH_3, PH_3
31.	Increasing thermal stability	NH_3, AsH_3, SbH_3, PH_3
32.	Increasing acidic strength	HNO_3, H_3PO_4, H_3AsO_4, H_3SbO_4
33.	Increasing solubility in water	HNO_3, H_3PO_4, H_3AsO_4, H_3SbO_4
34.	Increasing order of +5 oxidsation state	N, P, As, Sb and Bi
35.	Increasing stability of hydrides	H_2O, H_2S, H_2Se, H_2Te
36.	Increasing poisonous nature	H_2S, H_2Se, H_2Te, H_2Po
37.	Increasing acidic strength	H_2O, H_2S, H_2Se, H_2Te
38.	Increasing strength of oxoacids	H_2SO_3, H_2SeO_3, H_2TeO_3
39.	Increasing stability of oxoacids	H_2SO_3, H_2SeO_3, H_2TeO_3
40.	Increasing stability of oxoacids	H_2SO_3, H_2SeO_3, H_2TeO_3
41.	Increasing stability of oxoacids	H_2SO_3, H_2SeO_3, H_2TeO_3
42.	Increasing electron affinity	F, Cl, Br, I
43.	Increasing reducing power	HF, HCl, HBr, HI
44.	Increasing affinity for hydrogen	F_2, Cl_2, Br_2, I_2
45.	Increasing acidity	HF, HCl, HBr, HI
46.	Increasing boiling point	HF, HCl, HBr, HI
47.	Increasing stability	HFO_3, $HClO_3$, $HBrO_3$, HIO_3
48.	Increasing covalent character	$TiCl_2$, $TiCl_3$, $TiCl_4$
49.	Increasing magnetic moment	Ti^{3+}, Ni^{2+}, Cr^{2+}, Co^{2+}, Zn^{2+}
50.	Increasing ionic character	VCl_2, VCl_3, VCl_4
51.	Increasing basic characteristics	Li_2O, BeO, B_2O_3, CO_2
52.	Increasing electronegativity	As, P, S, Cl
53.	Increasing acidity	HOCl, HOBr, HOI
54.	Increasing thermal stability	HF, HCl, HBr, HI
55.	Increasing bond enthalpy	N_2, O_2, F_2,Cl_2
56.	Increasing melting point	CaF_2, $CaCl_2$, $CaBr_2$, CaI_2
57.	Increasing oxidizing power	O, S, Se, Te
58.	Increasing oxidizing power	F, Cl, Br, I
59.	Increasing single bond strength	N—N, O—O, F—F

60.	Increasing stability of hydrides	LiH, NaH, KH, CsH
61.	Increasing pH of aqueous solution	LiCl, $BeCl_2$, $MgCl_2$, $AlCl_3$
62.	Increasing acidic oxide	Al_2O_3, MgO, SiO_2, P_4O_{10}
63.	Increasing basicity	F^-, Cl^-, Br^-, I^-
64.	Increasing basic strength	F^-, OH^-, NH_2^-, CH_3^-
65.	Increasing thermal stability	$BeCO_3$, $MgCO_3$, $CaCO_3$, $BaCO_3$
66.	Increasing paramagnetism	Ca, Al, N, O
67.	Increasing ionic character	LiBr, NaBr, KBr, RbBr, CsBr
68.	Increasing hydration energy	Be^{2+}, Mg^{2+}, Ca^{2+}, Ba^{2+}, Sr^{2+}
69.	Increasing bond angle	NH_3, PH_3, AsH_3
70.	Increasing bond angle	NF_3, PH_3, AsF_3
71.	Increasing bond angle	H_2O, H_2S, H_2Se
72.	Increasing bond angle	NF_3, NCl_3
73.	Increasing bond angle	NO_2^+, NO_2, NO_2^-
74.	Increasing bond angle	NH_3, NF_3

Answers

1. $O^{2-} > F^- > Na^+ > Mg^{2+}$

All the four species are isoelectronic ($1s^2\ 2s^2\ 2p^6$). The number of positive charge in the nucleus decreases in the $_{12}Mg > {}_{11}Na > {}_9F > {}_8O$. Hence O^{2-} involved minimum nucleus-electrons attraction and maximum electron-electron repulsion while Mg^{2+} involves maximum nucleus electrons attraction and minimum electron-electron repulsion. These factors make the size of anion greater than the corresponding neutral atom and that of cation lesser than the corresponding atom.

2. $Na_2O_2 < MgO < ZnO < P_2O_5$

Oxides of electropositive elements are alkaline while those of electronegative element are acidic. Alkaline property will increase with increase in electropositive character of metal and acidic characteristics increase with increase in electronegative characteristics of nonmetals. Since the electro-negativity increases in the order Na < Mg < Zn < P, the acidic character of oxide will also increase in the same order.

3. $N_2 < O_2 < F_2 < Cl_2$

Nitrogen contains triple bond, oxygen contains double bond and fluorine and chlorine contain a single bond each. Chlorine involves bonding of 3p orbitals while fluorine involves 2p orbitals.

4. $Ca^{2+} < Cl^- < S^{2-}$

The given species are isoelectronic. So more the number of proton more attraction on electrons so use radius.

5. $HClO < HClO_2 < HClO_3 < HClO_4$

These acids are better represented as

More the oxidation number of central metal more acidic.

6. $HI < I_2 < ICl < HIO_4$

The oxidation states of iodine in HI, I_2, ICl and HIO_4 are –1, 0 + 1 and +7, respectively

7. $HOCl < HOClO < HOClO_2 < HOClO_3$

The stability is explained by the increasing number of electrons involved in the formation of σ and π bonds in going from HOcl to $HOClO_3$. In ClO_4^- ion all the valence orbtials and electrons of chlorine are involved in the formation bonds.

8. $F_2 < Cl_2 < O_2 < N_2$

N_2 involves a triple bond, O_2 involves a double bond, F_2 and Cl_2 involve a single bond each F_2, has a lower bond enthalpy than Cl_2. This is due to more repulsion of nonbonding electrons in F_2. Besides this, there is a possibility of multiple bonding in Cl_2 involving d orbitals.

9. $SiO_2 < CO_2 < N_2O_5 < SO_3$

Increasing electronegativity of an element makes its oxide more acidic.

10. $Mg^{2+} < Na^+ < F^- < O^{2-}$

11. $S < Cl < N < O < F$

The negative charge on X in HX increases with increasing electronegative of X. Thismakes the hydrogen bonding more strong.

12. $Cs^+ < Rb^+ < K^+ < Na^+ < Li^+$

The ions in a solution are present as hydrated ions. The smaller the size of the on, the greater the extent of hydration. So the size of hydrated ions becomes larger for smaller sized ion and vice versa.

13. $Li^+ < Na^+ < K^+ < Rb^+ < Cs^+$

Li^+ ion being heavily hydrated has the lowest mobility and Cs^+ ion being less hydrated has the highest mobility.

14. $Li < Na < K < Rb < Cs$

The reactivity increases on descending the group 1.

15. $LiOH < NaOH < KOH < RbOH < CsOH$

The basic nature of hydroxides of elements of Group I increases on descending the group.

16. $LiCl < LiBr < LiI$

The smaller sized Li^+ ions polarizes the larger anion more predominantly giving larger covalent character.

17. $BeCl_2 < MgCl_2 < CaCl_2 < BaCl_2 < SrCl_2$

18. $BaCO_3 < CaCO_3 < MgCO_3 < BeCO_3$

On moving down the group, the lattice energies of carbonates do not decrease much while the degree of hydration of the metal ions increases significantly leading to decreased solubility.

19. $Be(OH)_2 < Mg(OH)_2 < Ca(OH)_2 < Ba(OH)_2$

20. $Be(OH)_2 < Mg(OH)_2 < Ca(OH)_2 < Ba(OH)_2$

21. $Ba^{2+} < Sr^{2+} < Ca^{2+} < Mg^{2+} < Be^{2+}$

The extent of hydration of ion decreases with increase in ionic size.

22. $Be < Mg < Ca < Sr < Ba$

The reaction of alkaline-earth metals become increasingly vigorous with increasing atomic number.

23. $Be < Mg < Ca < Sr < Ba$

24. $BaSO_4 < SrSO_4 < CaSO_4 < MgSO_4 < BeSO_4$

Hydration of ion plays a dominating role as compared to lattice energy.

25. $BCl_3 < AlCl_3 < GaCl_3$

Increase in the electropositive of element increases its ionic character.

26. $BF_3 < BCl_3 < BBr_3$

Besides σ bond between boron and halogen atoms, there exist additional pπ-pπ bond between the two atoms resulting from back-donation of electrons from fluorine to boron (back bonding).

The tendency to form pπ-pπ bond is maximum in BF_3(2pπ-2pπ back bonding) and falls rapidly on passing to BCl_3 (2pπ-3pπ back bonding) and BBr_3 (3pπ-4pπ back bonding). The tendency to accept electron pair, therefore, increases from BF_3 to BBr_3.

27. $InCl_3 < GaCl_3 < AlCl_3$

With increase in size of element of Group 13, the tendency to accept electron pair is decreased.

28. $PbCl_2 < SnCl_2 < GeCl_2$.

The stability of element in +H oxidation state increases on ascending the group 14. This is due to inert-pair effect.

29. $GeCl_4 < SnCl_4 < PbCl_4$.

The stability of element in +IV oxidation state decreases on ascending the Group 14. This is due to inert pair effect.

30. $SbH_3 < AsH_3 < PH_3$

The decrease in electronegativity and increase in size of element cause the decrease in tendency to accept proton.

31. $SbH_3 < AsH_3 < PH_3 < NH_3$

32. $H_3SbO_4 < H_3AsO_4 < H_3AsO_3 < HNO_3$

33. $H_3SbO_4 < H_3AsO_4 < H_3AsO_3 < HNO_3$

34. Bi < Sb < As < P < N

35. $H_2Te < H_2Se < H_2S < H_2O$

36. $H_2S < H_2Se < H_2Te < H_2Po$

37. $H_2O < H_2S < H_2Se < H_2Te$

Larger the size of X (=O, S, Se, Te) weaker its bonds with hydrogen and more easily H^+ gets lost in aqueous solution.

38. $H_2TeO_3 < H_2SeO_3 < H_2SO_3$

Decreasing size and increasing electronegativity from Te to S withdraws electrons from O—H bond towards itself, thus, facilitating the release of proton.

39. $H_2TeO_3 < H_2SeO_3 < H_2SO_3$

40. $H_2TeO_4 < H_2SeO_4 < H_2SO_4$

41. $H_2TeO_4 < H_2SeO_4 < H_2SO_4$

42. Cl > F > Br > I

43. HF < HCl < HBr < HI

44. $I_2 < Br_2 < Cl_2 < F_2$

45. HF < HCl < HBr < HI

46. HCl < HBr < HI < HF

Anomalous behaviour of HF is due to hydrogen bonding.

47. $HFO_3 < HClO_3 < HBrO_3 < HIO_3$

Ions of these acids are stabilized due to strong pπ-pπ bonding between full 2p orbital on oxygen and empty orbitals on the halogen atom. Fluorine has no d orbitals and cannot form pπ-dπ bonds. Thus oxoacids of fluorine are not known.

48. $TiCl_2 < TiCl_3 < TiCl_4$

Increasing oxidation state of Ti increases charge density on the metal leading to increase in the polarization of the anionic charge cloud and thus covalency increases.

49. $Zn^{2+} < Ti^{3+} < Ni^{2+} < Co^{2+} < Cr^{2+}$

Increasing number of unpaired electrons increases magnetic moment. The number of unpaired electrons in the given species are as follows.

Ti^{3+} one, Ni^{2+} two, Co^{2+} three, Cr^{2+} four and Zn^{2+} zero.

50. $VCl_4 < VCl_3 < VCl_2$

Decreasing oxidation state of element increases the ionic character.

51. $CO_2 < B_2O_3 < BeO < Li_2O$

52. As < P < S < Cl

53. HOI < HOBr < HOCl

54. HI < HBr < HCl < HF

55. $F_2 < Cl_2 < O_2 < N_2$

56. $CaI_2 < CaBr_2 < CaCl_2 < CaF_2$

57. Te < Se < S < O

58. I < Br < Cl < F

59. N—N < O—O < F—F

60. CsH < KH < NaH < LiH

61. $LiCl > MgCl_2 > BeCl_2 > AlCl_3$

Hydrolysis of cations depends on two factors; larger charge and smaller size favour more hydrolysis, hence more free H^+ (*i.e.* lesser pH).

62. $MgO < Al_2O_3 < SiO_2 < P_4O_{10}$

63. $I^- < Br^- < Cl^- < F^-$

Stronger the acid, weaker it's the conjugate base.

64. $F^- < OH^- < NH_2^- < CH_3^-$

More electronegative the atom, lesser its tendency to give a lone pair of electrons.

65. $BeCO_3 < MgCO_3 < CaCO_3 < BaCO_3$

Increasing size of cation decreases its polarizing ability towards carbonate making the compound more stable.

66. Ca < Al < O < N

Paramagnetism increases with increase of number of unpaired electrons.

67. LiBr < NaBr < KBr < RbBr < CsBr

The larger the difference between the electro-negativities, greater the ionic character.

68. $Ba^{2+} < Sr^{2+} < Ca^{2+} < Mg^{2+} < Be^{2+}$

The smaller the size, more the hydration energy.

69. $AsH_3 < PH_3 < NH_3$

The increasing size and lower electronegativity of the central atom permit the bonding electrons to be drawn out further, thus decreasing repulsion between bonding pairs.

70. $AsH_3 < PH_3 < NH_3$

71. $H_2Se < H_2S < H_2O$

72. $NF_3 < NCl_3$

The bonding pair repulsion in NF_3 is less than that in NCl_3

73. $NO_2^+ < NO_2 < NO_2^-$

There is maximum repulsion between free electron(s) on nitrogen and bonding pairs.

74. $NF_3 < NH_3$

There is lesser repulsion in bonding pairs in NF_3.