CHEMISTRY

BOOKS - CENGAGE CHEMISTRY (HINGLISH)

PERIODIC CLASSIFICATION OF ELEMENTS AND GENERAL INORGANIC CHEMISTRY

Illustration

1. What would be the $IUPAC$ name and symbol for the element with atomic number 120?

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2. There are $2, 8$ and 8 elements in the first, second and third periods of periodic table respectively. Explain.

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3. Which of the following is correct:

(a) The element Mendelebium (d) has been named is the honour of Mendeleev. What is the atomic number of that element?

(i) 100 , (ii) 101 , (iii) 102 , (iv) 103

(b) The element Seaborgium (Sg) has been nemed in

the honour of Glenn T. Seaborg. What is the atomic number of that elements?

(i) 104 , (ii) 105 , (iii) 106 , (iv) 107

(c) Glenn T. Seaborg was awarded Nobel Prize in 1951 for the discovery of which element / elements?

(i) Uranium (U)

(ii) Elelments from 90 to 93

(iii) Elements from 94 to 102

(iv) elements from 103 to 106

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4. Which of the atomic numers and the $IUPAC$ name and sysmbol for the elements Mendelevium

(Md) and Seaborgium (Sg)?

(b) What is the atomic number of the element for which both the American and Soviet scientists claimed credit for the discovery?

(c) Refer to the problem (b) above, what name is given to the element by the American and Soviet scientists?

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5. How would you justify the presence of 18 elements in the $5th$ period of the periodic table?

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6. Considering the atomic number position in the periodic table, arrange the following elements in the increasing order of metallic character: Si, Be, Mg, Na, P.

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7. Predict the period, group number and block of the following elements. A(at.no$1 = 8$), B (at.no. $= 11$), C (at.no. $= 28$), D (at.no. $= 54$).

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8. What is the atomic number of the element having maximum number of unpaired $2p$ electrons? To which group it belongs?

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9. The elements $Z = 117$ and 120 have not yet have been discovered, in which family / group would you place these elements and also give the electronic configuration in each case.

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10. Write the electronic configuration of the elements given below and also predict the block, group number and period to which they belong. ($Z =$ Atomic number)

I. $A(Z = 5), B(Z = 11), c(Z = 28),$

$D(Z = 54), E(Z = 59), F(Z = 90).$

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11. Write the names and the atomic numbers (Z) of the following elements:

a. The fourth alkaline earth metal

b. The fifth alkali metal

c. The sixth element of the first transition series

d. The second inner transition elements and

e. The third noble gas

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12. How do the electronic configuration of the elements with $Z = 106 - 108$ differ from one another?

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13. Predict the name and position of the element in the periodic table with the electronic configuration $(n-1)d^8ns^2$ for $n=5$.

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14. Elements A to E have the following electronic configuration:

$A: [He]2s^2 2p^2, B: [Ne]3s^2 3p^2, C: [Ne]3s^2 3p^3,$

$D: [Ne]3s^2 3p^4, E: [Ar]4s^2.$

Which of the above will belong to the same group in the periodic table?

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15. Which of the following species will have the largest and the smallest size Mg, Mg^{2+}, Al, Al^{3+}?

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16. a. Compare the size of Cl, $Cl^{\ominus}$ and Fe^{2+} ion.

b. the radii of Ar is greater than the radii of chlorine. Explain.

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17. a. Give and explain the decreasing order of atomic radius of fluorine (F), nitrogen (N) and oxygen (O).

b. Give the decreasing order of van der Waals radii: N, O, H, Cl, Br.

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18. a. In the sixth period, after filling of $6p$ orbitals, the next electron (i.e. $57th$) enters the $5d$-orbital against aufbau principal and there after the filling of seven $4f$-orbitals starts with cerium $(Z = 71)$. Explain this anomalous behaviour.

b. In the seventh period, after the filling of $7s$-orbital,

the next two electrons (i.e. $89th$ and $90th$) enter the $6d$-orbital against Aufbau principle and there after the filling of seven $5f$-orbitals begins with proactinium $(Pr, Z = 91)$ and ends up with lawrencium $(Lr, Z = 103)$. Explain this anomalous behaviour.

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19. which of the following species are isoelectronic ?

(i) Ne ,(ii) O^{2-} , (iii) Mg^{2+} , (iv) F

(v) Al^{3+} , (vi) $Cl^{\ominus}$, (vii) K , (viii) Na

Arrange them in decreasing order of their size.

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20. Which of the following species has the smallest size?

(a) $K^{\oplus}, Sr^{2+}, Ar$, (b) Si, P, Cl , (c) $O, O^{\ominus}, O^{2-}$

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21. Arrange the following in order of decreasing radii?

a. $F^{\ominus}, O^{2-}, N^{3-}, S^{2-}$, b. P, Si, N, C, c. $I^{\ominus}, I^{\oplus}, I$

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22. Calculate the effective nuclear charge experienced by the $4s$-electron in potassium atom $(Z = 19)$.

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23. Calculate the effective nuclear charge of the last electron in an atom. The electronic configuration is $1s^2, 2s^2 2p^6, 3s^2 3p^5$.

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24. Calculate the screening constant in Zn.

a. For a $4s$-electron b. For a $3d$-electron

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25. The first ionisation enthalpy $\left(\Delta_i H^{o-}\right)$ values of the third period elements, Na, Mg and Si are respectively $496, 737$ and $786 kJmol^{-1}$. Predict whether the first $\Delta_i H^{o-}$ value for Al will be more close to 575 or $760 kJmol^{-1}$? Justify your answer.

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26. Calculate the energy required to convert all atoms of Mg to Mg^{2+} ions present in $48mg$ of Mg vapours. IE_1 and IE_2 of Mg are 740 and $1450kJmol^{-1}$ respectively.

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27. The first (IE_1) and second (IE_2) ionisation energies $\left(kJmol^{-1}\right)$ of a new elements designated by roman numerals are shown below:

	IE_1	IE_2
I	2370	5250
II	520	7300
III	900	1800
IV	1700	3400

Which of the above elements is likely to be :

a. A reactive metal

b. A reactive non-metal

c. a noble gas

d. A metal that forms a stable binary halide of the formula AX_2 ($X =$ the halogen).

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28. The electronic configuration for some neutral atoms are given below.

A: $1s^2 2s^2$, B: $1s^2 2s^2 2p^3$

C: $1s^2 2s^2 2p^4$, D: $1s^2 2s^2 2p^6 3s^1$

In which of this electronic configuration would you expect to have highest (a) IE_1 and (b) IE_2.

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29. The ionisation potential of hydrogen is $13.60eV$. Calculate the energy required to produce one mole of $H^{\oplus}$ ion $\left(1eV = 96.3kJmol^{-1}\right)$.

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30. Which of the following electronic configurations has the lowest value of ionisation energy? Explain.

a. $1s^2 2s^2 2p^6$

b. $1s^2 2s^2 2p^5$

c. $1s^2 2s^2 2p^6 3s^1$

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31. For each of the following pairs which has greater IE and why?

a. $Li, Li^{\oplus}$, b. K, Br , c. Br, I , d. $Na^{\oplus}, Ne$

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32. Calculate the percentage of $Mg^{\oplus}_{(g)}$ and $Mg^{2+}_{(g)}$ if $2.4g$ of Mg absorbs $120kJ$ of energy. The IE_1 and IE_2 of $Mg_{(g)}$ are 740 and $1450kJmol^{-1}$.

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33. The electronic configuration for the following atoms are given below :

a. $1s^2 2s^2 2p^5$, b. $1s^2 2s^2 2p^4$, c. $1s^2 2s^2 2p^6 3s^2$

d. $1s^2 2s^2 2p^6$, e. $1s^2 2s^2 2p^6 3s^1$

i. From the above configuration, arrange them in decreasing IE.

ii. Which of the electronic configuration given above

wil have the lowest IE ?

iii. Which of the electronic configuration given above will be for noble gases ?

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34. The IE_1 and $IE_2\left(kJmol^{-1}\right)$ of three elements A, B and C are given below :

	A	B	C
IE_1	400	550	1150
IE_2	2650	1070	2090

Identify the elements which represent (a) an alkali metal, (b) an alkaline earth metal or (c) non-metal.

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35. The sum of IE_1 and IE_2 and those of IE_2 and those of IE_3 and IE_4 in $\left(kJmol^{-1}\right)$ of Ni and Pt are :

	$(IE_1 + IE_2)$	$(IE_2 + IE_4)$	Total
Ni	2.5×10^3	8.8×10^3	11.3×10^3
Pt	2.7×10^3	6.7×10^3	9.4×10^3

a. What is the most common oxidation state (O.S.) of Ni and Pt.

b. Name of the metal (Nior Pt) which can more easily form compounds in its $+4$ O.S.

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36. The IE_1 of C atom is greater than that of boron (B) atom, whereas the reverse is true for IE_2. Explain?

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37. The second IE for alkali metals shows a jump while the third IE for alkaline metals shows a jump. Explain.

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38. Which of the following will have the most negative electron gain enthalpy and which the least negative ? $F, P, S, CI.$

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39. The amount of energy released when 10^{12} atoms of Cl vapours are converted to $Cl^{\ominus}$ ions, according to the equation :

$C_{(g)} + e^{-} \rightarrow Cl^{\ominus}_{(g)}$ is $58 \times 10^{-10} J$

Calculate the $\Delta_{eg}H^{\ominus}$ of Cl atom in $kJmol^{-1}$ and $eV\text{atom}^{-1}$.

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40. The electron gain enthalpy of chlorine $3.7eV$. How much energy in kJ and $kcal$ is released when $1g$ of chlorine is converted completely to Cl^{o-} ion in the gaseous state. $\left(1eV = 96.3kJmol^{-1}\right)$

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41. Write the electronic configuration of the element with atomic number of $9, 11, 21$ and 36. Preedict the folloiwng from these configurations:

(a) Which of them has the lowest ionisation potential ?

(b) Which of them has the hihest electron gain enthalpy ?

(c) Which of them are non-metals?

(d) Which of them has zero electron gain enthalpy ?

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42. Which of the following has the hihest electron gain enthalpy. Give reasons.

(a) $[Ne]3s^2 3p^3$ (b) $[Ne]3s^2 3p^4$

(c) $[Ne]3s^2 3p^5$, (d) $[Ne]3s^2 3p^6$

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43. Arrange the elements with the following electronic configuration of valence electron in decreasing order of $\Delta_{eg}H^{\ominus}$.

(a) $3s^2 3p^4$, (b) $2s^2 2p^4$

(c) $2s^2 2p^3$, (d) $2s^2 2p^5$

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44. Which one of the following pairs has higher $\Delta_{eg}H^{\ominus}$?

(a) $S^{\ominus}, O$, (b) $N^{\ominus}, P$

(c) $S, O^{\ominus}$, (d) $O^{\ominus}, S^{\ominus}$

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45. Give the decreasing order of $\Delta_{eg}H^{\ominus}$ of the following elements: B, C, N, O.

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46. How many Cl atoms can you ionise in the process $Cl \rightarrow Cl^{+} + e$, by the energy liberated for the process $Cl + e \rightarrow \ \rightarrow Cl^{-}$ for one Avogadro's number of atoms ? (Given : $IP = 13.0eV$ and $EA = 3.60eV$) .

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47. Calculate the percentage of ionic character in $Cs - Cl$ bond in $CsCl$ molecule. The electronegativity values of CS and Cl are 0.7 and 0.3 respectively.

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48. The ionic resonance energy of $C - H$ bond is $\approx 6.0 kcal mol^{-1}$. The EN of H is 2.1. Calculate EN of carbon ? Given : $\Delta_{C-H} \approx 6.0 kcal mol^{-1}$

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49. The ionic resonance energy of $C-H$ bond is $\approx 6.0 kcal mol^{-1}$. The EN of H is 2.1. Calculate EN of carbon ? Given : $\Delta_{C-H} \approx 6.0 kcal mol^{-1}$

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50. Arrnge the following compounds in order of their decresaing stabilities:

HF, CCl_3, HBr, HI, HCl

(Given EN values of element as below)

$H = 2.1, F = 4, Cl = 3.0, Br = 2.8, I = 2.3, N = 3.0$

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51. Predict which of the following hydroxy compounds is acidic and which is basic in aqueous solution :

(i). $CsOH$, ii. IOH.

EN values are:

$Cs = 0.7, O = 3.5, H = 2.1, I = 2.5.$

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52. $NaOH$ behaves as a base while $Zn(OH)_2$ is amphoteric why ?

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53. Calculale the $d_{(N-C)}$ in $(CH_3)_3N$ molecule by using Eqs. (1.18) and (1.19) above and show from which equation $d_{(N-C)}$ closely resembles with the experimental value of $d_{(M|N-C)} = 1.47\text{Å}$.

(Given:

$r_N = 0.75\text{Å}, r_C = 0.77\text{Å}, \chi_A = 3.0, \chi_C = 2.5$

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54. In which of the following triatomic molecules, the observed bond angle is $116^\circ, 49'$?

a. H_2O b. OF_2 c. CO_2 d. O_3

II. In which of the following molecules, bond angle is

the maximum?

a. $BeBr_2$ b. H_2O c. H_2S d. CH_4

III. In which of the following molecules, bond angle between two adjacent covalent bonds is smallest?

a. BeH_2 b. BF_3 c. NH_3 d. CCl_4

IV. Bond angle $(H-S-H)$ in H_2S is close to

a. 109° b. 107° c. 105° d. 90°

V. The hybridisation of B in BF_3 is sp^2. The bond angle in $BF_4^{\ominus}$ will be

a. 107° b. 109° c. 120° c. 120° d. 180°

VI. Which of the following molecules contains a bond angle which is smaller than the bond angle in CH_4?

a. SF_6 b. SO_2 c. O_3 d. $\overset{\oplus}{N}H_4$

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55. Using the perodic table, perdict the formulas of compounds which might be formed by the following pairs of elements : (a) silicon and bromine (b) aluminium and sulphur.

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56. Are the oxidation state and covalency of in $\left[AlCl(H_2O)_5\right]^{2+}$ same ?

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57. Show by a chemical reaction with water that Na_2O is a basic oxide and ClO_7 is an acidic oxide.

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58. Predict the formulae of the stable binary compounds that would be formed by the following pairs of compounds :

(a) Al and Cl , (b) Mg and I

(c) Element 113 and F , (d) Si and S (e) Element 119 and oxygen.

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59. Give the decreasing order of magnetic moment of the following:

(a) Ca , (b) Al , (c) N, (d) O

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60. Which element in $3d, 4d$, and $5d$ transition series has the highest paramagnetism in

(a) elemental form , (b) $+1O.\ S.$

(c) $+2O.\ S.$, (d) $+3O.\ S.$

$[O.\ S.\ = \text{oxidation state}]$

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61. Give the decreasing order of the acidic properties of oxides.

a. ZnO , b. KO_2 , c. P_2O_5 , d. MgO

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62. Give the decreasing order of the basic properties of oxides.

a. Tl_2O , b. Al_2O_3 , c. Tl_2O_3 , d. Ga_2O_3

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63. Give the increasing order of melting points of the following compounds:

a. I. NaF , II. $NaCl$, III. $NaBr$, IV. NaI

b. I. CaI_2 , II. $CaBr_2$, III. $CaCl_2$, IV. CaF_2 , V. $BeCl_2$

d. I. $NaCl$, II. $MgCl_2$, III. $AlCl_3$

e. I. CCl_4 , II. BCl_3 , III. $BeCl_2$, IV. $LiCl$

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64. Give the decreasing order of covalent character of the following compounds.

a. I. $GeCl_2$ II. $GeCl_4$ III. $SnCl_2$ IV. $SnCl_4$

V. $PbCl_2$ VI. $PbCl_4$

b. I. CH_4 II. NH_3 III. H_2O IV. HF

c. I. HF II. HCl III. HBr IV. HI

d. I. AgI II. NaI III. CuI IV. NaCl

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65. Give the decreasing pH of aqueous solution of the following compounds :

a. $NaCl$, b. $MgCl_2$, c. $AlCl_3$, d. PCl_5

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66. Calculate the ratio of lattice energies of $CaCl_{2(s)}$ and $NaCl_{(s)}$, if the inter-ionic distance in $CaCl_2$ is twice that of $NaCl_{(s)}$.

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67. Give the decreasing order of melting points of the following compounds:

i. NaF ii. BeO iii. MgO iv. SrO

Given: The inter-ionic distance in $\mathring{A}$ as

$NaF = 2.31, BeO = 1.65, MgO = 2.106, SrO = 2.58$

b. Given the decreasing order of hardness of the following compounds:

i. CaO ii. BeO iii. TiC

Given : The inter-ionic distances in Å as

$CaO = 2.405, BaO = 2.762, TiC = 2.159$

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68. Identify the complexes which are expected to be coloured.

a. $\left[Ti(NO_3)_4\right]$, b. $\left[Cu(NCCH_3)_4\right]^{\oplus} BF_4^{\ominus}$

c. $\left[Cr(NH_3)_6\right]^{3+} 3Cl^{\ominus}$, d. $K_3[VF_6]$

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69. $(p\pi - p\pi)$ back bonding occurs in the halides of boron but not in those of aluminium. Explain.

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70. The Lewis acid character of boron trihalides decreases as: $BBr_3 > BCl_3 > BF_3$. Explain ?

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71. The correct order of relative basic character of $NaOH$, $Mg(OH)_2$ and $Al(OH)_3$ is

A. $Al(OH)_3 > Mg(OH)_2 > NaOH$

B. $Mg(OH)_2 > NaOH > Al(OH)_3$

C. $NaOH > Mg(OH)_2 > Al(OH)_3$

D. $Al(OH)_3 > NaOH > Mg(OH)_2$

Answer: C

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72. Which of the oxdies behave both as neutral oxide and suboxide ?

(a) N_2O , b. NO, c. C_3O_2 , d. CO

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73. Which of the following is not amphoteric oxide ?

A. ZnO

B. BeO

C. Al_2O_3

D. CrO_3

Answer: D

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74. Which of the following is superoxide ?

A. Na_2O_2

B. BaO_2

C. CsO_2

D. MnO_2

Answer: C

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75. Which of the oxides is coloured and contains $3e^-$ bond ?

A. MgO

B. Na_2O

C. KO_2

D. Mn_3O_4

Answer: C

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76. The least stable hydride is

A. Staanane

B. Silane

C. Plumbane

D. Germane

Answer: C

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77. The most stable hydride is

A. B_2H_6

B. AlH_3

C. GaH_3

D. InH_3

Answer: A

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78. The strongest reducing hydride is

A. NH_3

B. PH_3

C. AsH_3

D. SbH_3

Answer: A

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79. Give the decreasing order of acidic strength of the following :

(a) CH_4

(b) H_2O

(c) HF

(d) NH_3

(e) LiH

(f) BeH_2.

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80. Arrange the following acids in the decreasing order of their acid strength:

HF, HCl, HBr, HI

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81. Arrange the order of decreasing/increasing properties given below:

1. Decreasing order of atomic and ionic radii

a. $Mg^{2+}, O^{2-}, Na^{\oplus}, F^{\ominus}$

b. $Cl^{\ominus}, S^{2-}, Ca^{2+}, Ar$

c. $N^{3-}, Na^{\oplus}, F^{\ominus}, O^{2-}, Mg^{2+}$

d. S, O, Se, C

e. B, Be, Li, Na

f. $Li^{\oplus}, Na^{\oplus}, K^{\oplus}, Rb^{\oplus}, Cs^{\oplus}$ (in aqueous solution)

g. $Cl^{7+}, Si^{4+}, Mg^{2+}, Na^{\oplus}$

h. $H^{\oplus}, Li, H^{\ominus}$

i. $O^{2-}, B^{3+}, Li^{\oplus}, F^{\ominus}$

j. $Br^{\ominus}, I, I^{\ominus}, I^{\oplus}$

k. $I^{\ominus}, I, I^{\oplus}$

l. $K^{\oplus}, Ca^{2+}, Ti^{3+}, Ti^{4+}$

m. Ce, Sn, Yb, Lu

n. $F, F^{\ominus}, O, O^{2-}$

o. Ar, Br, Ca^{2+}, Mg^{2+}

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Solved Examples

1. Predict the group number and block to which the given elements belong.

$A(Z=9), B(Z=20), C(Z=29), D(Z=36)$ and $E(Z=58)$.

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2. The first (IE_1) and second (IE_2) ionisation energies $\left(kJmol^{-1}\right)$ of a new elements designated by roman numerals are shown below:

	IE_1	IE_2
I	2370	5250
II	520	7300
III	900	1800
IV	1700	3400

Which of the above elements is likely to be :

a. A reactive metal

b. A reactive non-metal

c. a noble gas

d. A metal that forms a stable binary halide of the formula AX_2 ($X =$ the halogen).

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3. Identify the three elements A, B and C from the data given below

a. The elements have successive atomic numbers

b. A forms a stable anion, $A^{\ominus}$

c. C forms a stable cation, $C^{\oplus}$

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4. Among the elements, Ar, Si, Na and Cl. Select an elements with

a. Highest IE b. Highest EA

c. Smallest size d. Highest electrical conductivity

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5. Arrange the following in decreasing order as directed.

(a) Decreasing order of EN: H, O, Al, F

b. Decreasing order of radii: Ar, Br, Ca^{2+}, Mg^{2+}

c. Decreasing order of EA: C, N, Be, F, O, CI

d. Decreasing order of IE and EA: F, Cl, Br, I

e Decreasing order of EN: F, N, O, Cl, S

f. Decreasing order of IE: Ne, O, Na, $Na^{\oplus}$

g. Decreasing electropositive character: Na, Cu, Zn

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6. Predict from each set, the atom/ion which has the greatest IE_1 with explanation:

a. Cl or F , b. S or Cl

c. Ar or K , d. Xe or Kr

e. O or N , f. $Na^{\oplus}$ or Na

g. $Be^{\oplus}$ or Mg^{2+} , h. $I^{\ominus}$ or I

i. B or C , j. Ne or F

k. N, O, F l. P, Ar, Mg

m. B, Al, Ga

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7. The $\Delta_{eg}H^{\ominus}$ of Br is $3.4eV$. How much energy in kcal is released when $0.8g$ of $Br(g)$ is completely converted to $Br^{\ominus}(g)$ ions. $\left(1eV = 23.06kcalmol^{1-}\right)$

b. The energy released when 10^7 atoms of $I(g)$ is converted to $I^{\ominus}(g)$ ions, is $5 \times 10^{-13}J$. Calculate $\Delta_{eg}H^{\ominus}$ of $I(g)$ in (i) $eV\text{atom}^{-1}$ and (ii) $kJmol^{-1}$.

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8. Predict from each set, the element which has the more negative electron gain enthalpy $\left(\Delta_{eg}H^{\ominus}\right)$. Give reasons:

a. C or Si , b. F or Cl , c. O or S

e. F, ClS, P

f. (i) $[Ne]3s^2 3p^5$, (ii) $[Ne]3s^2 3p^4$, (iii) $[Ne]3s^2 3p^3$

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9. (a) The EN of cesium (Cs) is 0.7 and that of chlorine (Cl) is 3.5. Predict tha bond formed between them.

(b) The $X - X$ bond length is $100 \pm$ and $C - C$ bond length is $154 \pm$. If EN of $'X'$ and $'C'$ are 3.0 and 2.0 respectively, calculate the $C - X$ bond length.

(i) $127 \pm$, (ii) $118 \pm$

(iii) $108 \pm$, (iv) $128 \pm$

(c) Which of the properties can be predicted by EN values?

(d) If a, b and c are EN, IE and EA respectively. What is the formula of $EA(c)$ in the terms of EN (a) and $IE(b)$?

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10. Among the elements with $Z = 9, 12$ and 36, identify by atomic number of an element which is

(a) Highly electropositive

(b) Highly EN

(c) An inert gas

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11. Explain the following question (based on ionisation energy):

(a) Why IE_1 of N is higher than that of O atom ?

(b) Why IE_1 of Mg is higher than that of Al atom?

(c) Why IE_1 of C is greater than that of B atom

whereas IE_2 is reverse ?

(d) In general, IE increases along the period $(\rightarrow)$. Explain why the IE_2 of Cr is higher than that of Mn (Manganese)?

(e) The IE_1 and IE_2 of K are 420 and $3050kJmol^{-1}$ respectively and those of Ca are 560 and $1140kJmol^{-1}$ respectively. Compare their values and comment on the differences.

(f) The IE of Li, Be and C are 5.5, 9.3 and $11.3eV$. What would be the case and explain.

i. K, Ca, Se , ii. N, O, F

iii. $K^{\oplus}$, Ar, $Cl^{\ominus}$, iv Fe, Fe^{2+}, Fe^{3+}

v. C, N, O , vi. Cu, Ag, Au

vii. K, Rb, Cs , viii Be, B, C

ix. Na, Mg, Al

(h) Explain why Fe^{2+} is more easily oxidised to Fe^{3+} than Mn^{2+} to Mn^{3+}.

(i) Explain whether IE_1 of two isotopes of same element would be same or different.

(j) What are the factors on which IE of main group elements tends to decrease douwn the group ($\downarrow$).

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12. Answer the following question (Based on EA, $\Delta_{eg}H^{\ominus}$ and IE).

(a) IE_1 of Li is $5.4eV\text{atom}^{-1}$ and the EA of Cl is $3.6eV\text{atom}^{-1}$. Calculate $\Delta_r H^{\ominus}$ in kcal mol^{-1} and

$kJmol^{-1}$ for the reaction

$$Li_{(g)} + Cl_{(g)} \rightarrow Li^{\oplus}_{(g)} + Cl^{\ominus}_{(g)}$$

formed at such a low pressure that resulting ions do not combine with each other.

(b) The IE of atoms X and Y are 400 and $300kcalmol^{-1}$ respectively. $EA's$ of these atoms are 80.0 and $85.0Kcalmol^{-1}$. Explain as which of the atoms has higher EN.

(c) Explain why EA of S is $-200kJmol^{-1}$ but the second EA is $+649kJmol^{-1}$?

(d) Which of the following pairs of elements would have more negative electron gain enthalpy $\left(\Delta_{eg}H^{\ominus}\right)$?

(i) F or Cl , (ii) O or F

(e) What would be the second electron gain enthalpy $\left(\Delta_{eg}H_2^{\ominus}\right)$ of oxygen as positive, more negative or less negative than first $\left(\Delta_{eg}H_1^{\ominus}\right)$? Explain.

(f) Which has less negative $\Delta_{eg}H^{\ominus}$ oxygen or sulphur?

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13. Explain the following question (based on size of atoms or ions and other periodic properties):

a. Arrange the following species in decreasing order of their sizes//ionic radii.

i. Ar, $K^{\oplus}$, $Cl^{\ominus}$, S^{2-} and Ca^{2+}

ii. Al^{3+}, Mg^{2+}, $Na^{\oplus}$, $Cl^{\ominus}$, N^{3-} and O^{2-}

b. What are isoelectronic species? Name the species which are isoelectronic with each of the following atom or ions.

i. $Rb^{\oplus}$ ii. $F^{\ominus}$, iii. Mg^{2+} iv. Ar

c. Arrange the following species/atoms in decreasing order of reducing character.

i. Na, Mg and Al ii. Mg, Ca and Sr

iii. Na, K and Rb iv. $F^{\ominus}$, $Cl^{\ominus}$, $Br^{\ominus}$ and $I^{\ominus}$

d. The decreasing order of reactivety of group 1 elements is $Cs > Rb > K > Na > Li$ whereas that of group 17 elements is $(Cl > F > Br > I)$. Explain.

e. Predict the formula of the stable binary compounds that would be formed by the

combination of the following pairs of elements:

i. Mg and N

ii. Si and O

iii. Elements with $Z = 71$ and F

iv. P and F

v. Al and I

vi. Li and O

f. Ansewer the following by the use of periodic table.

i. Identify the element that would tend to gain two electrons.

ii. Identify the group having metal, non-metal, liquid as well as gas at the room temperature,

iii. Identify the element with five electrons in the outer shell.

iv. Identify the element that would tend to lose two elctrons.

Watch Video Solution

14. For the gaseous reaction

$K + F \rightarrow K^{\oplus} + F^{\ominus}$

$\Delta H = 19 kcal mol^{-1}$ under the condition when cations and anions are prevented by electrostatic separation from combining with each other. The IE_1 of K is $4.3eV$. Calculate $\Delta_{eg} H^{\ominus}$ of F.

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15. For the reaction $K(g) + F(g) + K^{\oplus} + F^{\Theta}$ (separated ions $\Delta H = 19 kcal mol^{-1}$), if the ionisation potential of K and the electron affinity of F^{Θ} have a geometric means of $3.88eV$ and $IP > EA$, calculate the values fo ionisation potential and electron affinity.

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16. From N atoms of an element A, when half the atoms transfer one electron to the another atom. $405 kJ mol^{-1}$ of energy was found to be consumed. An additional energy of $745 kJ mol^{-1}$ was further required to convert all the $A^{\ominus}$ ions to $A^{\oplus}$. Calculate

the ionisation energy and the electron gain enthalpy of atom A in $eV(1eV = 96.48kJ)$.

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17. The conservation of gaseous atoms K and F to $K^{\oplus}$ and $F^{\ominus}$ absorbs $0.85eV$ of energy. If the IE and $\Delta_{eg}H^{\ominus}$ of K and F have magnitudes in the ratio of $7:6$, what is the electron gain enthalpy $\left(\Delta_{eg}H^{\ominus}\right)$ of fluorine ?

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18. Explain the following:

a. Which of the following Na, Mg, Si and P would have the greatest difference between the IE_1 and IE_2? Explain?

b. The $EN's$ of B, Al and Ga are $2.0, 1.5$ and 1.6 respectively. The trends is not regular.Explain?

c. Li_2CO_3 decomposes on heating but other alkali metal barbonate (e.g. Na_2CO_3) does not. Explain?

d. Expalin why $Cu^{\oplus}$ is found only is solid state and not solutions.

e. Be of N have extremely low value of EA (i.e. less negative value)against the trend. Explain?

f. Arrange the following in decreasing order of their

properties indicated:

$Na^{\oplus} Mg^{2+}$ and Al^{3+}

i. Ionic mobillity in H_2O

ii. Size of ions

iii. Standard reduction protential $\left(E^{\ominus}_{M^{x+}(aq.)} / M_s\right)$

iv. Extent of hydration

v. Hydration energy

vi. Size of hydrated ions

g. In iodomentry. why KI is not added dropwise to an acidified solution of $KMnO_4$ but reverse is done?

h. Why the decrease in size between Li and Be is much greater than that between Na and Mg or K and Ca?

i. K_2CO_3 is less soluble than Cs_2CO_3 or Rb_2CO_3

while among group 2 elements $MgCO_3$ is more soluble than $BaCO_3$.

j. Expalin the decreasing order of solubility of sulphate of group 2 elements.

k. $'EA'$ of Cl is the highest among the halogens, yet F is the strongest oxidising agent'. Why?

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19. Classify the following oxides as

a. Strongly acidic b. Weakly acidic

c. Neutral d. Amphoteric

e. Weakly basic and f. Strongly basic

i. SnO_2 ii. SnO iii. CO iv. PbO

v. MnO_2 vi. RaO vii. N_2O viii. FeO

ix. Ag_2O x. OsO_4 xi. Al_2O_3 xii. Fe_2O_3

xii. CeO_2 xiv. CO_2 xv. MgO xvi. K_2O

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20. Select the strongest and weakest acid in each of the following sets:

a. $HBr, HF, H_2, Te, H_2Se, PH_3, H_2O$

b. $HClO, HIO, H_3PO_3, H_2SO_3, H_2AsO_3$

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21. A $0.10M$ aqueous solution of which salt in each of the following pairs would have the higher pH?

a. $NanO_2$ or $NaAsO_2$

b. NaF or $NaCN$

c. Na_2SO_3 or Na_2TeO_3

d. $NaOHCl$ or $NaOBr$

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22. Identify:

a. The good oxidising agent (s)

b. The good reducing agent

c. The good dehydrating agent (s) among the

following substances:

$H_2SO_3, HNO_3, P_4O_{10}, H_2S, H_2SO_4.$

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23. Answer the following:

a. Which of the following has the greatest affinity for water: $P_4O_{10}. Cl_2O, I_2O_5.$

b. Which of the following is the most basic: $Al_2O_3, TI_2O_3, TI_2O.$

c. Which of the following has the lowest melting point: $LiBr, Be, BBr_3.$

d. Which of the following has higher $EN: Li, Be, Mg.$

e. Which of the following is most stable towards oxidation: $GeCl_2, SnCl_2, PbCl_2$.

f. Which of the following is the strongest oxidising agent:

$CrO_4^{2-}, MoO_4^{2-}, WO_4^{2-}$.

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24. Explain the following:

a. The formation of Cs_2O from its element is less exothermic than the formation of ZnO from its element.

b. On the basis of appropriate Born-Haber cycle, state what factor (s) is (are)responsible for the fact

that lithium nitride (Li_3N) is more stable while potassium nitride (K_3N) is unstable.

c. Why Al^{3+} is the only stable oxidation state of Al in its compounds while TI has $+1$ and $+3$ oxidation states?

d. Pb^{4+} is a powerful oxidising agent. What is the reducing ability of Pb^{2+}

e. Which is more soluble in water LiI or KI?

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25. Give the name and atomic number of the inert gas atom in which the total number of d-electrons is

equal to the difference in number to the p-and $-s$-electrons.

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26. Classify the elements having atomic numbers $(9, 12, 16, 34, 53, 56)$ into three separate pairs on the basis of similar chemical properties.

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27. Calculate the electronegativity of fluorine from the following data:

$E_{H-H} = 104.4 kcal mol^{-1}$, $E_{F-F} = 36.6 kcal mol^{-1}$

$E_{H-F} = 134.3 kcal mol^{-1}$, $\chi_H = 2.1$

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28. Calculate electronegativity of carbon at Pauling scale Given that :

$E_{H-H} = 104.2 kcal \text{mol}^{-1} E_{C-C} = 83.1 kcal \text{mol}^{-1}$,

$E_{C-H} = 98.8 kcal \text{mol}^{-1}$.

Electronegativity of hydrogen $= 2.1$.

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29. Ionisation potential and electron affinity of fluorine are 17.42 and $3.45eV$ respectively .Calculate the electronegativity of fluorine on Mulliken scale and Pauling scale .

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30. Calculate the electonegativity of silicon using Allred -Rochow method .(Covalent radius of silicoan $= 1.175\text{Å}\big)$.

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31. Calculate the electronegativity value of chlorine on Mulliken's scale, given that $IP = 13.0eV$ and $EA = 4.0eV$.

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32. Find the electronegativity of lead with the help of the given valus. Screening consitant (σ) of $Pb = 76.70$. Atomic number of lead $= 82$ and covalent radius of $Pb = 5.3\text{Å}$

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33. The ionisation potentials of atoms A and B are 400 and $300 kcal mol^{-1}$ respectively. The electron gain enthalpy of these atoms are 80.0 and $85.0 kcal mol^{-1}$ respectively. Which of the atoms has highrt electronegativity.

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34. Give the names of seven f-orbitals and how they are represented.

View Text Solution

Ex 1.1

1. $3d-$, $4d-$ and $5d-$ series consists of 10 elements each? Explain.

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2. Why the f-block elements are called inner transition elements?

Watch Video Solution

3. Transition elements show horizontal as well as vertical relationship. Explain.

Watch Video Solution

4. Be and Al are placed in different periods and groups but they show the similar properties. Explain.

Watch Video Solution

5. The outer electronic configuration of some elements are given below:

(a) $6d^1 7s^2$, (b) $4f^1 5d^1 6s^1$

(c) $2s^2 2p^6 3s^2$

(d) $3d^5 4s^1$

(e) $4s^1 4p^3$

State to which of the periodic table each of these elements belongs.

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6. Arrange the following elements in decreasing order of metallic character:

$K, Mg, B, Al.$

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7. Name the species that will be isoelectronic with the following atoms or ions.

(a) Ca^{2+} , (b) Ne , (c) $Cl^{\ominus}$,(d) $Rb^{\oplus}$

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8. Which of the following pairs would have a smaller size. Explain.

(a) $Na^{\oplus}$ or Mg^{2+} , (b) O^{2-} or $F^{\ominus}$

(c) P or As

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9. Arrange the following ions in order of their decreasing ionic radii.

$Li^{\oplus}, K^{\oplus}, Mg^{2+}, Al^{3+}$

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10. What property did Mendelev use to classify the elements in his perodic table.

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11. Elements with $Z = 107, 108$ and 109 have been made recently. Indicate the groups to which they

belong.

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12. Why Zn, Cd and Hg are not considered as typical transitions elements ?

Watch Video Solution

13. Why Cu, Ag and Au are transition elementsm although they have completely filled d-orbititals ?

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14. Stability Of Completely Filled And Half Filled Orbitals

Watch Video Solution

Ex 1.1 (Very Short)

1. What are supper heavy elements?

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2. How many anomalous pairs were present in original Mendeleev periodic table ?

Watch Video Solution

3. How many s-block elements are known ?

Watch Video Solution

4. Which block of elements consists of metals, non metals and metalloids ?

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5. Which is the hardest elements ?

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6. Which elements is heaviest melting point liquid metal ?

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7. Which element is heaviest melting and boiling point metal ?

Watch Video Solution

8. Name the liquid non-metal.

Watch Video Solution

9. Name the best and the poorest conductor of current among metals.

Watch Video Solution

10. Name the heaviest solid metal.

Watch Video Solution

11. Name the most poisonous element.

Watch Video Solution

Watch Video Solution

12. Name of the heaviest naturally occurring element.

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13. Among the radioactive elements, which is a liquid element?

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14. Name the element having the lowest electronegative, lightest and liquid metal.

Watch Video Solution

15. Name the lightest solid non-metal having the highest tensile strenght.

Watch Video Solution

16. Which elements has highest catenation property?

Watch Video Solution

17. Which non-metal sublime on heating and have metallic lusture.

Watch Video Solution

18. Which is the most stable element?

Watch Video Solution

19. Name the element which is the poorest conductor of current among non-metals.

Watch Video Solution

20. Name the elements with highest EN and with highest EA or $\Delta_{eg}H^{\ominus}$.

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21. Which is used in high temperature thermometry ?

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22. Which element is used in the making of infared (IR) windows, prism and lenses ?

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Ex 1.1 (Objective)

1. Which of the following statement is wrong?

A. Among the following elements :

$K, Mn, Ca, Cs, Fe, Cu, Pb, Os, Y$

The number of transition element is 4.

B. All the lanthanides and actionides belong to $IIIB$ or the $3rd$ group in the periodic table.

C. The inner transition elements belong to the f-block of the periodic table and are shown separately at the bottom of the periodic table.

D. The d-block elements have variable valency.

Answer: A

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2. Which of the following statement is wrong?

A. In the lanthanide series the electrons occupy $4f$-orbitals in preference to $5d$ the and $6p$-orbitals.

B. Zero group was not present in the periodic table when Mendeleev presented it.

C. Law of octave was presented by Newland.

D. Cuprous compounds are coloured while cupric compounds are colourless.

Answer: D

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3. Which of the following triads have approximately equal size ?

A. $Na^{\oplus}, Mg^{2+}, Al^{3-}$ (isoelectronic)

B. $F^{\ominus}, Ne, O^{2-}$ (isoelectronic)

C. Fe, Co, Ni

D. Mn^{1+}, Fe^{2+}, Cr (isoelectronic)

Answer: C

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4. Which is the correct order of size ?

$\left(O^{\ominus}, O^{2-}, F^{\ominus} \text{ and } F\right)$

A. $O^{2-} > O^{\ominus} > F^{\ominus} > F$

B. $O^{\ominus} > O^{2-} > F^{\ominus} > F$

C. $O^{2-} > F^{\ominus} > F > O^{\ominus}$

D. $O^{2-} > F^{\ominus} > O^{\ominus} > F$

Answer: A

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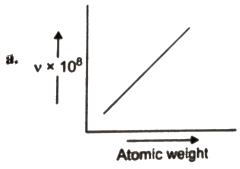
5. Select the correct statement :

Which of the following graph represents Mosely's experiement.

($v =$ frequency of X-rays)

A. 

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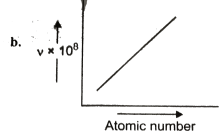

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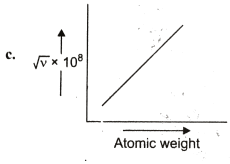
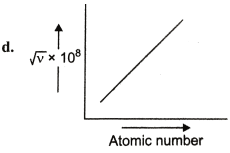


D.



Answer: D

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6. Calculate the screening constant of alkali metals for valenvy electrons.

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7. Calculate the screening constants of members of the $2nd$ period for valency electrons.

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8. Answer the following :

(a) Name of the element not known at time of Mendeleev.

(b) Name any two typical elements.

(c) Name any two bridge elements.

(d) Name two pairs showing diagonal relationship.

(e) Name two transition elements.

(f) Name two are rare earth elements.

(g) Name two transuranic elements.

(h) In which case compounds of Cr show maximum radius.

(i) K_2CrO_7, (ii) CrO_2Cl_2 , (iii) $Cr_2(SO_4)_3$

(iv) $CrCl_2$

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9. In s- and p-block elements the OS. changes in units, but in transition elements it changes it chnages in units of one. Explain ?

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10. Mn_2O_7 is an acidic oxide, why ?

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11. Why Ar (argon) (at, wt. $= 39.94$) has been placed before K (at. Wt. $= 39.10$) in the periodic table?

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12. Why Ag is a noble metal and K is a highly reactive metal ?

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Ex 1.2

1. Answer the following :

(a) Why inert gases are monoatomic ?

(b) Potassium (K) is strongly metallic, while Cl is strongly non-metallic. Explain.

(c) Why metals are good conductors of electricity ?

(d) Comment on 'Iodine possesses some metallic lusture'.

(e) Of all noble metals, gold (Au) has a relatively high EA. Explain.

(f) In alkali metal which element is the strongest reducing agent in aqueous solution and why?

(g) Cl and be converted to $Cl^{\ominus}$ ion easily than F to

$F^{\ominus}$ ion. Explain.

(h) Why $Al(OH)_3$ is amphoteric in nature ?

(i) Why Be and Mg do not impart flame colouration?

(j) The IE of K is same as EA of $K^{\oplus}$ ion. Explain.

(k) Explain the large atomic radii of noble gases.

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Ex 1.2(Objective)

1. Which has maximum polarising power in cation ?

A. O^{2-}

B. Al^{+3}

C. Li^{+}

D. Mg^{+2}

Answer: B

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2. Which has the maximum IE ?

A. $O^{\oplus}$

B. N

C. O

D. Na

Answer: A

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3. The correct order of hydration enthalpies of alkali metal ions is:

A. $Na^{\oplus}$

B. $Li^{\oplus}$

C. $Cs^{\oplus}$

D. $K^{\oplus}$

Answer: B

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4. Inert pair effect is shown by

A. s-block

B. p-block

C. d-block

D. f-block

Answer: B

Watch Video Solution

5. Which is / are ampoteric oxide ?

A. ZnO

B. BeO

C. SnO

D. All of these

Answer: D

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6. EA is positive when

A. $O^{\ominus}$ is formed from O

B. $O^{\oplus}$ is formed from O

C. O^{2-} is formed from O

D. EA is always a negative value

Answer: C

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7. Which has the maximum covalent character?

A. $MgCl_2$

B. NaCl

C. $SiCl_4$

D. $AlCl_3$

Answer: C

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8. In which sovalent KBr has maximum solubility?

A. C_2H_5OH

B. CH_3COCH_3

C. $C_2H_5OC_2H_5$

D. H_2O

Answer: D

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9. Lattice energy of $BeCO_3(I), MgCO_3(II)$ and $CaCO_3(III)$ is in order.

A. $I > II > III$

B. $III > II > I$

C. $II > III > I$

D. $III > I > II$

Answer: A

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10. NO_2 and N_2O_4 are two forms of nitrogen dioxide. One exists in gaseous state while other in liquid state. The nature of NO_2 and N_2O_4 forms are

A. Both are diamagnetic

B. Both are paramagnetic

C. NO_2 is dimagnetic while N_2O_4 is paramagnetic

D. NO_2 is paramagnetic while N_2O_4 is diamagnetic

Answer: D

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11. Magnetic moment of $V(Z=23), Cr(Z=24),$ and $Mn(Z=25)$ are x, y, zrepectively hence

A. $x = y = z$

B. $x < y < z$

C. $x < z < y$

D. $z < y < x$

Answer: C

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12. Solubility of groups 1 and 2 fluorides increases down the group'. Which of the following is correct explanation for the above given statement ?

A. Both the hydration and lattice energies decrease down the group $(\downarrow)$ but decrease in lattice energy is rapid.

B. Both the energies increase down the group but increase in hydration energy is rapid.

C. Both the energies decrease down the group but decrease in hydration energy is rapid.

D. Hydration energy increases and lattice energy decreases down the group.

Answer: A

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13. Which of the following molecule is theoretically not possible ?

A. OF_4

B. O_2F_2

C. OF_2

D. SF_4

Answer: A

Watch Video Solution

14. Which of the following triads have approximately equal size ?

A. $Na^{\oplus}$, Mg^{2+}, Al^{3+} (isoelectronic)

B. $Mn^{\oplus}$, Fe^{2+}, Cr (isoelectronic)

C. $F^{\ominus}, Ne, O^{2-}$ (isoelectronic)

D. Fe, Co, Ni

Answer: D

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15. Which pair is different from the others ?

A. $Na - K$

B. $Ca - Mg$

C. $Li - Mg$

D. $B - Al$

Answer: C

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16. Compound XY is predominantly ionic as $X^{\oplus}Y^{\ominus}$ if

A. $(IE)_X < (IE)_Y$

B. $(EA)_X < (EA)_Y$

C. $(EN)_X < (EN)_Y$

D. $(IE)_Y) < (IE)_X.$

Answer: C

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17. $(X), (Y), (Z)$ are elements in third short period. Oxide of (X) is ionic, (Y) is amphoteric and (Z) is a giant molecule. $(X), (Y)$ and (Z) will have atomic number in the order :

A. $(X) < (Y) < (Z)$

B. $(Z) < (Y) < (X)$

C. $(X) < (Z) < (Y)$

D. $(Y) < (X) < (Z)$

Answer: A

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18. Which of the correct order of size ?

$\left(O^{\ominus}, O^{2-}, F^{\ominus} \text{ and } F ?\right)$

A. $O^{2-} > O^{\ominus} > F^{\ominus} > F$

B. $O^{\ominus} > O^{2-} > F^{\ominus} > F$

C. $O^{2-} > F^{\ominus} > O^{\ominus} > F$

D. $O^{2-} > F^{\ominus} > F > O^{\ominus}$

Answer: A

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19. F has the highest electronegativity among the group 17 elements (i.e. $ns^2np^2np^5$ type), on the Pailing scale, but the EA of F is less than that of Cl because

A. F being the first member of the family behaves in an unusual manner.

B. The atomic number of F is less than that of Cl.

C. Cl can accommodate an electron better than F by utilsing its vacant $3d$ orbital.

D. Small size, high EN and an increased electron-electron replusion makes addition of an electron to F less favourable.

Answer: D

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20. The correct order of decreasing ionic character is

A. $BaCl_2 > CaCl_2 > MgCl_2 > BeCl_2$

B. $BaCl_2 > MgCl_2 > CaCl_2 > BeCl_2$

C. $BeCl_2 > MgCl_2 > CaCl_2 > BaCl_2$

D. $BaCl_2 > BeCl_2 > CaCl_2 > MgCl_2$

Answer: A

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21. The correct order of decreasing polarisability of ion is

A. $Cl^{\ominus} > Br^{\ominus} > I^{\ominus} > F^{\ominus}$

B. $F^{\ominus} > I^{\ominus} > Br^{\ominus} > Cl^{\ominus}$

C. $I^{\ominus} > Br^{\ominus} > Cl^{\ominus} > F^{\ominus}$

D. $F^{\ominus} > Cl^{\ominus} > Br^{\ominus} > I^{\ominus}$

Answer: C

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22. Which of the following has the smallest bond length ?

A. O_2

B. N_2

C. Cl_2

D. HCl

Answer: B

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Ex 1.3

1. Arrange the following in order of decreasing ionic character.

a. ClF_3, SO_2, N_2, K_2O and LiF

b. $C-H, F-H, Br-H, Na-I, K-F$ and $Li-Cl$

c. AlF_3, $AlCl_3$, $AlBr_3$

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2. Arrange the following in order of decreasing bond angle.

a. CO_2, H_2O, CH_4

b. SO_4^{2-}, SO_3^{2-}

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3. $CaCO_3$ dissolves in HCl but not in water. Why ?

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4. Why MgO exist as $Mg^{2+}O^{2-}$ not as $Mg^{\oplus}O^{\ominus}$ whereas the formation of Mg^{2+} from Mg requires more energy than formation of $Mg^{\oplus}$ and formation of $O^{\ominus}$ from O is exothermic whereas the formation of O^{2-} is endothermic .

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5. Anhydrous $AlCl_3$ is covalent. From the date given below, predict whether it would remain covalent or become ionic in aqueous solution. (Ionisation energy for Al is $1537 kJ mol^{-1}$)

$\Delta_{\text{hydration}} f$ or $Al^{3+} = -4665 kJ mol^{-1}$

$\Delta_{\text{hydration}} f$ or $Cl^{\ominus} = -381 kJ mol^{-1}$.

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6. Which compound for each of the following pairs is more ionic and why ?

a. $BeBr_2$ or $MgBr_2$, b. $PbCl_2$ or $PbCl_4$

c. $AgBr$ or AgI , d. CuO or CuS

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7. $NaBr$ gives pale yellow precipitate with $AgNO_3$ solution but CBr_4 does not. Why ?

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8. Copper is conducting as such while $CuSO_4$ is conducting only in molten state or in aqueous solution. Why ?

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9. Explain the observed bond angle order.

$Cl_2O(110.8^\circ) > H_2O(104.5^\circ) > F_2O(103.2^\circ)$

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10. $\overset{\oplus}{N}H_4$ has bond angle identical to CH_4 but NH_3 has different bond angle. Why?

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11. Electronegativities of F, O, N, Cl, H are $4.0, 3.5, 3.2$ and 2.1 respectively. In which atoms there is strongest bond.

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12. The IE_1 of Li is $5.4eV$ and IE_1 of H is $13.6eV$. Calculate the charge acting on the outermost electron of Li atom.

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13. a. The melting point of KBr is higher than that of $AgBr$ through the crystal radii of $Ag^{\oplus}$ and $K^{\oplus}$ ions are almost the same. Explain.

b. $SnCl_2$ is solid but $SnCl_4$ is liquid. Why ?

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Ex 1.3 (Objective)

1. The correct order of IE_2 of C, N, O and F is

A. $O > F > N > C$

B. $F > O > N > C$

C. $C > N > O > F$

D. $O > N > F > C$

Answer: A

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2. The least stable ion among the following is

A. $Li^{\oplus}$

B. $B^{\ominus}$

C. $C^{\ominus}$

D. $Be^{\ominus}$

Answer: D

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3. Which has the most stable $+2$ oxidation state ?

A. Sn

B. Fe

C. Pb

D. Ag

Answer: C

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4. Amongst the following elements (whose electronic configuration an given below) the one having highest ionization energy is

A. $[Ne]3s^2 3p^3$

B. $[Ne]3s^2 3p^1$

C. $[Ne]]3s^2 3p^2$

D. $[Ar]3d^{10} 4s^2 4p^3$

Answer: A

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5. The magnitude of lattice energy of a solid increases if

A. The ions are large

B. The ions are small

C. The ions are of equal sizes

D. Charges on the ions are small

Answer: B

6. Bond angle in PH_3 is

A. Much less than NH_3

B. Much less than PF_3

C. Slightly more than NH_3

D. Much more than PF_3

Answer: A

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7. The correct order of decreasing bond angles in H_2S, NH_3, BF_3 and SiH_4 is

A. $BF_3 > SiH_4 > H_2S > NH_3$

B. $BF_3 > SiH_4 > NH_3 > H_2S$

C. $BF_3 > NH_3 > SiH_4 > H_2S$

D. $SiH_4 > BF_3 > NH_3 > H_2S$

Answer: B

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8. The bond angle around central atom is maximum for

A. H_2O

B. H_2S

C. H_2Se

D. H_2Te

Answer: A

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Ex 1.3 (Multiple Correct)

1. Which of the following can conduct electricity in?

A. $MgBr_2$

B. $CaBr_2$

C. $BaBr_2$

D. $BeBr_2$

Answer: A::B::C

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2. Which of the following are expected to be covalent?

A. $BeCl_2$

B. $SnCl_4$

C. CuS

D. $CaCl_2$

Answer: A::B

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3. Which of the following does not exist?

A. HS_6

B. HPO_4

C. FeI_3

D. $HClO_4$

Answer: A::B::C

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4. Which of the following relation is/are correct?

A. Covalent character $\propto$ Pseudo inert configuration

B. Ionic character $\propto$ Inert configuration

C. Covalent character $\propto \frac{1}{\text{Dipole moment}}$

D. Ionic character $\propto \frac{1}{\text{Dipole moment}}$

Answer: A::B::C

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5. Which of the following are correct?

A. As^{5+} salts are better oxidising agents

B. Tl^{3+} salts are better oxidising agents

C. $Ga^{\oplus}$ salts are better oxidising agents

D. Pb^{4+} salts are better oxidising agents

Answer: B::C::D

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Ex 1.29 (Integer)

1. On the basis of quantum number, which period of the periodic table should have 32 elements.

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2. What is the atomic number of the element present in the second period anf group 15.

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3. $\Delta_f H^{\ominus}$ of hypothetical MX is $-150 kJ mol^{-1}$ and for MX_2 is $-600 kJ mol^{-1}$. The enthalpy of disproportionation of MX is $= -100x kJ mol^{-1}$. Find the value of x.

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Ex 1.32 (Assertion-Reasoning)

1. Assertion (A) : IE_1 of Mg is greater than that of Al.

Reason (R) : It is easier to remove an electron fro $3s$ orbital than from $3p$ orbital.

A. If both A and R are correct and R is the correct explanation for A.

B. If both A and R are correct and R is not the correct explanation for A.

C. If A is correct and R is incorrect

D. If A is incorrect and R is correct

Answer: C

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2. Assertion (A): s- block elements can form ionic hydrides. Which on electrolysis in fused state give H_2 gas at cathode.

Reason (R) : s-block elements have low IE and low EN as compared to p-block elements.

A. If both A and R are correct and R is the correct explanation for A.

B. If both A and R are correct and R is not the correct explanation for A.

C. If A is correct and R is incorrect

D. If A is incorrect and R is correct

Answer: D

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Exercises (Linked Comprehension)

1. Effective nuclear charge $\left(Z_{eff}\right)$ is the net attractive force on electrons under consideration

and is equal to:

$Z_{eff} = Z - \sigma$ (nuclear charge - screening constant).

Z_{eff} or σ is calculated by Slater's formula, as given.

If one electrons is present in the outermst orbit, there will be no screening in that orbital. Each electrons contribute, 0.35 (total electrons minus one electron) present in the outermost shell.

A contribution of 0.85 for each electrons is taken in the $(n-1)th$ shell.

The screening constant (σ) for $4s$ electron of $Mn(Z = 25)$ will be

A. 18.00

B. 4.25

C. 18.35

D. 22.6

Answer: D

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2. Effective nuclear charge $\left(Z_{eff}\right)$ is the net attractive force on electrons under consideration and is equal to:

$Z_{eff} = Z - \sigma$ (nuclear charge - screening constant).

Z_{eff} or σ is calculated by Slater's formula, as given.

If one electrons is present in the outermst orbit, there will be no screening in that orbital. Each

electrons contribute, 0.35 (total electrons minus one electron) present in the outermost shell.

A contribution of 0.85 for each electrons is taken in the $(n-1)th$ shell.

Which of the following statement is wrong?

A. IE_1 of $Ga > Al$, due ot imperfect shielding of $3d$-orbitals in Ga.

B. IE_1 of $Ga < Al$, due ot perfect shielding of $3d$ -orbitals in Ga.

C. The atomic size of Ga and Al are almost same because of poor shielding effect of electrons in

d-orbitals as the effective nuclear charge increases in Ga.

D. IE_1 of group 16 elements is less than that of group 15 elements.

Answer: B

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3. Effective nuclear charge $\left(Z_{eff}\right)$ is the net attractive force on electrons under consideration and is equal to:

$Z_{eff} = Z - \sigma$ (nuclear charge - screening constant).

Z_{eff} or σ is calculated by Slater's formula, as given.

If one electrons is present in the outermst orbit, there will be no screening in that orbital. Each electrons contribute, 0.35 (total electrons minus one electron) present in the outermost shell.

A contribution of 0.85 for each electrons is taken in the $(n-1)th$ shell.

Which of the following statement is wrong?

A. The number of lobes in f-orbitals are 8.

B. IE_1 of elements increases along the period.

C. IE_1 of the group 3 elements is more than that of the group 2 elements.

D. IE_1, IE_2 and IE_3 of an elemnt are $9.5, 18.5$ and $154.4eV$. Predict that the element has either two s-electrons or two p-electrons in the valence shell.

Answer: C

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4. In the long or modern form of the periodic table, the element in the periodic table have been divided into four blocks, $s-p-d$-and f-. Each period begins with the filling of new energy shell. Two series

of f-block elements are placed at the bottom of the periodic table.

The element with $Z = 39$ belongs to

A. s-block

B. p-block

C. d-block

D. f-block

Answer: C

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5. In the long or modern form of the periodic table, the element in the periodic table have been divided into four blocks, $s-p-d$-and f-. Each period begins with the filling of new energy shell. Two series of f-block elements are placed at the bottom of the periodic table.

The element with $Z=113$ has been discovered. Its block, group number, period and ourershell electronic configuration are

A. s-block, group 2, period 7, $7s^2$

B. p-block, group 13, period 7, $7s^2 7p^1$

C. p-block, group, 13, $period 6$, $6s^2 6p^1$

D. d-block, group 12,period 6, $5d^{10}$, $6s^2$

Answer: B

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6. In the long or modern form of the periodic table, the element in the periodic table have been divided into four blocks, $s-p-d$-and f-. Each period begins with the filling of new energy shell. Two series of f-block elements are placed at the bottom of the periodic table.

Which of the element whose atomic numbers are

given below cannot be accommodated in the present set-up of the modern periodic table?

A. 109

B. 118

C. 120

D. 125

Answer: D

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7. In the long or modern form of the periodic table, the element in the periodic table have been divided

into four blocks, $s-p-d$-and f-. Each period begins with the filling of new energy shell. Two series of f-block elements are placed at the bottom of the periodic table.

What is the maximum number of electrons that can be accommodated with $n=5$ ($n=$ principal quantum number)?

A. 10

B. 18

C. 36

D. 54

Answer: C

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8. In the long or modern form of the periodic table, the element in the periodic table have been divided into four blocks, $s-p-d$-and f-. Each period begins with the filling of new energy shell. Two series of f-block elements are placed at the bottom of the periodic table.

Which of the following ions is most stable?

A. $Li^{\ominus}$

B. $Be^{\ominus}$

C. $B^{\ominus}$

D. $C^{\ominus}$

Answer: A

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9. In the long or modern form of the periodic table, the element in the periodic table have been divided into four blocks, $s-p-d$-and f-. Each period begins with the filling of new energy shell. Two series of f-block elements are placed at the bottom of the periodic table.

The last element of the p-block in the present

periodic table is represented by the configuration, where $[X]$ represents inert gas is

A. $[X]7s^2p^6$

B. $[X]5f^{14}, 6d^{10}, 7s^27p^5$

C. $[X]4f^{14}, 5d^{10}, 6s^26p^6$

D. $[X]$ None of the above

Answer: C

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10. In the long or modern form of the periodic table, the element in the periodic table have been divided

into four blocks, $s-p-d$-and f-. Each period begins with the filling of new energy shell. Two series of f-block elements are placed at the bottom of the periodic table.

If the elements were discovered in future in which the electrons would be present in g-orbitals. Then g-orbital starts, and ends up with what atomic number?

A. $121, 139$

B. $121, 138$

C. $122, 140$

D. $122, 139$

Answer: B

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11. The energy required to remove an electron from the outermost shell of an isolate gaseous atom is known as IE_1 of that atom. Similarly, the enrgy required for the removal of the electron from the unipositive ion, diapositive ion and tripositive ion are known as IE_2, IE_3 and IE_4 respectively, and are called successive ionisation energies. The magnitude of the charge depends on the size of the orbital of electron. Electrons in smaller orbitals are on average close with each other and have more repulsion. Thus

for $Be(2s^2)$, the IE_1 and IE_2 are 9.3 and $18.2eV\text{atom}^1$, whereas for $Ca(4s^2)$, the values are 6.1 and $11.9eV$.

The correct order of arrangement of the first ionisation energies of C, N, O and F (in decreasing values) is

A. $C > N > O > F$

B. $O > N > F > C$

C. $O > F > N > C$

D. $F > N > O > C$

Answer: D

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12. The energy required to remove an electron from the outermost shell of an isolate gaseous atom is known as IE_1 of that atom. Similarly, the enrgy required for the removal of the electron from the unipositive ion, diapositive ion and tripositive ion are known as IE_2, IE_3 and IE_4 respectively, and are called successive ionisation energies. The magnitude of the charge depends on the size of the orbital of electron. Electrons in smaller orbitals are on average close with each other and have more repulsion. Thus for $Be\left(2s^2\right)$, the IE_1 and IE_2 are 9.3 and $18.2eV\text{atom}^1$, whereas for $Ca\left(4s^2\right)$, the values are

6.1 and $11.9eV$.

Four elemensts have the following first ionization energies in $KJmol^{-1}: 762, 709, 59$ and 558. The elements are $Ca, Ge. \ In$ and Sn (not in order). Which of these elements has the ionisation energy of $762KJmol^{-1}$?

A. In

B. Ga

C. Sn

D. Ge

Answer: D

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13. The energy required to remove an electron from the outermost shell of an isolate gaseous atom is known as IE_1 of that atom. Similarly, the enrgy required for the removal of the electron from the unipositive ion, diapositive ion and tripositive ion are known as IE_2, IE_3 and IE_4 respectively, and are called successive ionisation energies. The magnitude of the charge depends on the size of the orbital of electron. Electrons in smaller orbitals are on average close with each other and have more repulsion. Thus for $Be\left(2s^2\right)$, the IE_1 and IE_2 are 9.3 and $18.2eV\text{atom}^1$, whereas for $Ca\left(4s^2\right)$, the values are

6.1 and $11.9eV$.

Which of the following are isoelectronic species?

$1 \to CH_3^{\oplus}, II \to NH_2^{\ominus}, III \to NH_4^{\oplus}, IV \to NH_3$

A. I, II and III

B. II, $III$and IV

C. I, II and IV

D. II and$I$

Answer: B

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14. The energy required to remove an electron from the outermost shell of an isolate gaseous atom is known as IE_1 of that atom. Similarly, the enrgy required for the removal of the electron from the unipositive ion, diapositive ion and tripositive ion are known as IE_2, IE_3 and IE_4 respectively, and are called successive ionisation energies. The magnitude of the charge depends on the size of the orbital of electron. Electrons in smaller orbitals are on average close with each other and have more repulsion. Thus for $Be\left(2s^2\right)$, the IE_1 and IE_2 are 9.3 and $18.2eV\text{atom}^1$, whereas for $Ca\left(4s^2\right)$, the values are 6.1 and $11.9eV$.

Among the following ionisation reactions, which one will have the maximum value of ionisation energy?

A. $Be \rightarrow Be^{\oplus}$

B. $Be^{\oplus} \rightarrow Be^{2+}$

C. $Sr \rightarrow Sr^{\oplus}$

D. $Sr^{\oplus} \rightarrow Sr^{2}$

Answer: B

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15. The energy required to remove an electron from the outermost shell of an isolate gaseous atom is

known as IE_1 of that atom. Similarly, the enrgy required for the removal of the electron from the unipositive ion, diapositive ion and tripositive ion are known as IE_2, IE_3 and IE_4 respectively, and are called successive ionisation energies. The magnitude of the charge depends on the size of the orbital of electron. Electrons in smaller orbitals are on average close with each other and have more repulsion. Thus for $Be\left(2s^2\right)$, the IE_1 and IE_2 are 9.3 and $18.2eV\text{atom}^1$, whereas for $Ca\left(4s^2\right)$, the values are 6.1 and $11.9eV$.

Consider the IE_1 of the element whose electronic configuration correspond to the following:

A. $[He]2s^22p^3$

B. $[He]2s^2 2p^4$

C. $[Ne]3s^2 3p^1$

D. $[Ar]3d^{10}4s^2 4p^1$

Answer: C

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16. The energy required to remove an electron from the outermost shell of an isolate gaseous atom is known as IE_1 of that atom. Similarly, the enrgy required for the removal of the electron from the unipositive ion, diapositive ion and tripositive ion are

known as IE_2, IE_3 and IE_4 respectively, and are called successive ionisation energies. The magnitude of the charge depends on the size of the orbital of electron. Electrons in smaller orbitals are on average close with each other and have more repulsion. Thus for $Be\left(2s^2\right)$, the IE_1 and IE_2 are 9.3 and $18.2eV\text{atom}^1$, whereas for $Ca\left(4s^2\right)$, the values are 6.1 and $11.9eV$.

The relationship between IE_4 and IE_2 of an element is

A. $IE_4 > IE_2$

B.

C. $IE_4 = IE_2$

D. None of the above

Answer: A

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17. Energy is released when an electron is added to neutral isolated gaseous atom in its ground state to give monoanion and this is known as EA, or $\Delta_{eg}H_1^{\ominus}$. The greater the amount of energy released the greater is the EA. EA is expressed in $eVa\text{atom}^{-1}$ or $kcal$ or $KkJmol^{-1}$.

The EA values of element depends on the following:

i. Nuclear charge

ii. Electroniv configuration

iii. Atomic size

iv. chemical environment

A. I,iii, iv

B. I,ii,iii

C. ii,iii,iv

D. All

Answer: B

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18. Energy is released when an electron is added to neutral isolated gaseous atom in its ground state to give monoanion and this is known as EA, or $\Delta_{eg}H_1^{\ominus}$. The greater the amount of energy released the greater is the EA. EA is expressed in $eVa\text{atom}^{-1}$ or $kcal$ or $KkJmol^{-1}$.

EA values of N and P are exceptionally low, because

A. Both N and P have half-filled p-orbitals in the valence shell.

B. The atom is more stable than the corresponding anoin.

C. The electronic configuration of the anoin $N^{\ominus}$ and $P^{\ominus}$ is relatively more stable than the corresponding atom.

D. Both (b) and C.

Answer: A

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19. Energy is released when an electron is added to neutral isolated gaseous atom in its ground state to give monoanion and this is known as EA, or $\Delta_{eg}H_1^{\ominus}$. The greater the amount of energy released the

greater is the EA. EA is expressed in $eV a\text{atom}^{-1}$ or $kcal$ or $KkJmol^{-1}$.

Select the correct statements (more than one correct)

A. EA and $\Delta_{eg}H_1^{\ominus}$ of an atom of element have same magnitude

B. $\Delta_{eg}H_1^{\ominus}$ of $Al > B$

C. $\Delta_{eg}H_1^{\ominus}$ of $P > N$

D. $\Delta_{eg}H_1^{\ominus}$ of $S > O$

Answer: A::B::C::D

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20. Energy is released when an electron is added to neutral isolated gaseous atom in its ground state to give monoanion and this is known as EA, or $\Delta_{eg}H_1^{\ominus}$. The greater the amount of energy released the greater is the EA. EA is expressed in $eV a\text{atom}^{-1}$ or $kcal$ or $KkJmol^{-1}$.

Select the correct statement (more than one correct)

A. $\Delta_{eg}H^{\ominus}$ of noble gases have large positive values.

B. $\Delta_{eg}H^{\ominus}$ of noble gases have large negative values.

C. $\Delta_{eg}H^{\ominus}$ of helium (He) is the lowest of all the noble gases.

D. $\Delta_{eg}H^{\ominus}$ of Ar is lower than that of Ne.

Answer: A::C::D

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21. Along the period $(\rightarrow)$ atomic/ionic radii and metallic character decreases while IE, EN, non-metallic character and oxidising power increases. Down the group $(\downarrow)$, atomic/ionic radii, metallic character and reducing character increase while IE

and EN decrease. However, $\Delta_{eg}H^{\ominus}$ becomes less negative down a group but more negative along a period.

Which of the following isoelectronic species has lowest IE_1 ?

A. $K^{\oplus}$

B. Ca^{2+}

C. S^{2-}

D. $Cl^{\ominus}$

Answer: C

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22. Along the period ($\rightarrow$) atomic/ionic radii and metallic character decreases while IE, EN , non-metallic character and oxidising power increases. Down the group ($\downarrow$), atomic/ionic radii, metallic character and reducing character increase while IE and EN decrease. However, $\Delta_{eg}H^{\ominus}$ becomes less negative down a group but more negative along a period.

If the ionic radii of $M^{\oplus}$ and $X^{\ominus}$ are about $135pm$, then expected values of metallic radii of M and X should be respectively.

A. 65 and $230pm$

B. 230 and $60pm$

C. 230 and $135pm$

D. 135 and $135pm$

Answer: B

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23. Along the period ($\rightarrow$) atomic/ionic radii and metallic character decreases while IE, EN , non-metallic character and oxidising power increases. Down the group ($\downarrow$), atomic/ionic radii, metallic character and reducing character increase while IE and EN decrease. However, $\Delta_{eg}H^{\ominus}$ becomes less negative down a group but more negative along a

period.

In which of the following pairs, both species have nearly the same size ? (more than one correct)

A. Mg^{2+}, Al^{3+}

B. $K^{\oplus}, F^{\ominus}$

C. $Li^{\oplus}, Mg^{2+}$

D. $Rb^{\oplus}, O^{2-}$

Answer: B::C::D

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24. Along the period ($\rightarrow$) atomic/ionic radii and metallic character decreases while IE, EN , non-metallic character and oxidising power increases. Down the group ($\downarrow$), atomic/ionic radii, metallic character and reducing character increase while IE and EN decrease. However, $\Delta_{eg}H^{\ominus}$ becomes less negative down a group but more negative along a period.

Correct order of IE_2 of the following is

A. $F > O > N > C$

B. $O > N > F > C$

C. $O > F > N > C$

D. $C > N > O > F.$

Answer: C

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25. Along the period ($\rightarrow$) atomic/ionic radii and metallic character decreases while IE, EN , non-metallic character and oxidising power increases. Down the group ($\downarrow$), atomic/ionic radii, metallic character and reducing character increase while IE and EN decrease. However, $\Delta_{eg}H^{\ominus}$ becomes less negative down a group but more negative along a period.

Which of the following are statements ? (more than one correct)

A. IE and EA are defined at absolute zero temperature. At any other temperature, heat capacities for the reactants and product have to be taken into account.

B. The ionisation enthalpy $\left(\Delta_r H^{\ominus}\right)$ and IE related to each other by the equation.

$\Delta_i H^{\ominus}$ (ionisation enthalpy)

$$= \left[IE\left(\text{ionisation energy} + \frac{5}{2} RT \right] \right.$$

C. The electron gain enthalpy $\left(\Delta_{eg}H^{\ominus}\right)$ and EA are related to each other by the equation:

$\Delta_{eg}H^{\ominus}$ (ionisation enthalpy)

$$= \left[-IE\left(\text{electron affinity} - \frac{5}{2}RT\right]\right.$$

D. The valuye of C_p (heat capacity at constant pressure and C_v (heat capacity at constant volume) are $\frac{3}{2}R$ and $\frac{5}{2}R$ respectively)

Answer: A::B::C

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Exercises (Multiple Correct) General Electronic Configuration And Periodicity

1. Which of the following statement (s) is/are correct ?

A. Mendeleev's periodic law was based on atomic number of the element.

B. Zero group was not present in the periodic table when Mendeleev presented it.

C. The effective nuclear charge $\left(Z_{eff}\right)$ is the atomic number minus shielding effect.

D. There are four transition series in the periodic table each one consists of 10 elements.

Answer: B::C::D

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2. Which of the following statement (s) is/are correct ?

A. Similar electrons configuration is repeated after intervals of $2, 8, 8, 18$ and 32 in the extended form of periodic table.

B. In a period from right ot left $(\leftarrow)$, reducing nature increases.

C. Along the period $(\rightarrow)$ thye number of valency electrons increases from 1 to 8.

D. The first member of lanthanide series is lanthanum.

Answer: A::B::C::D

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3. Which of the following statement (s) is/are correct ?

A. All the memebers of the actinide series are man made.

B. Zero group elements are paramagnetic.

C. Third group of the periodic table accommodates maximum number of elements.

D. All elements of zero groups are non-metals.

Answer: C::D

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

A. In Mendeleev periodic table, all groups are divided into two subgroups.

B. There is no relationship between electronic configuration of the elements and their position in the extended form of periodic table.

C. s-block elements have one or two electrons in their outermost shell.

D. Osmium has the maximum density among metals.

Answer: C::D

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5. Which of the following statement (s) is/are correct ?

A. The last member of the $7th$ period of the periodic table will have atomic number 118 if observed.

B. All the transition elements are metals and paramagnetic .

C. The maximum number of elements are present in the $5th$ period of the periodic table.

D. Every period of the periodic table starts with a member of alkali group.

Answer: A::B

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Exercises (Multiple Correct) Atomic And Ionic Radii

1. Which of the following is correct in order of increasing size ?

A. $I^{\oplus} < I < I^{\ominus}$

B. $Fe < Fe^{2+} < Fe^{3+}$

C. $Fe^{3+} < Fe^{2+} < Fe$

D. All of these

Answer: A::C

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2. Reason for diagonal relationship is

A. Same size

B. Same electronegativity

C. Same electron affinity

D. Same polarisability

Answer: A::B::D

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3. Which of the following pairs of elements have alomost similar atomic radii ?

A. Zr, Hf

B. Mo, W

C. Co, Ni

D. Nb, Ta

Answer: A::B::C::D

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

A. An anion is larger than a cation if they are isoelectronic.

B. Out of $Na^{\oplus}$ and Al^{3+}, $Na^{\oplus}$ has the largest size.

C. The ionic radii of trivalent lanthanides $[La^{3+}, Ce^{3+}, Pr^{3+}, \ldots.]$ decreases with increasing atomic number.

D. Out of P^{3-}, S^{2-}, and $Cl^{\ominus}$, $Cl^{\ominus}$ ion has the largest size.

Answer: A::B::C

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Multiple Correct Answer type

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

A. Z_{eff} of elements increases along the period $(\rightarrow)$.

B. Z_{eff} of elements increases down the group ($\downarrow$).

C. Isoelectronic species have the same nuclear charge.

D. Screening constant (σ) increases down the group ($\downarrow$).

Answer: A::D

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Exercises (Multiple Correct) Ionisation Energy (Ie)

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

A. Successive $IE's$ are lower.

B. Less energy is required to remove and electron from a alf-filled shell or completely filled shell.

C. IE_1 or $Al < IE_1$ of Mg

D. IE_1 of $Be > IE_1$ of B

Answer: C::D

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2. The factors that influence the ionisation energies are

A. Size of the atom

B. Charge on the nucleus

C. The inner electrons which effectively screen the nuclear charge

D. Atomic number of the element

Answer: A::B::C

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3. Which is the correct increasing order of ionisation energy ?

A. $Li < B < Be$

B. $Be < B < Li$

C. $Li < Na < K$

D. $O < N < F$

Answer: A::D

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4. Which is correct about ionisation potential ?

A. IE_1 of IE_1 of O

B. IE_2 of $N > IE_2$ of O

C. IE_2 of $Li > IE_2$ of Ne

D. IE_1 of $Al > IE_1$ of Ca

Answer: A::C

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5. The first eight ionisation energies for a particular neutral atom is as given below. All values are expressed in $kJmol^{-1}$. Which oxidation states (s) is

/are not possible of the atom ?

$1st$	$2nd$	$3rd$	$4th$	$5th$	$6th$	$7th$	$8th$
1.31	3.39	5.30	7.47	10.99	13.33	71.33	84.01

A. -2

B. -3

C. -6

D. 6

Answer: B::C::D

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6. IE_2 for an element is inveriably higher than IE_1 because

A. The size of cations is smaller than its atom.

B. It is difficult to remove electron from cations.

C. Ionisation energy is endothermic.

D. All of the above

Answer: A::B

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7. Which sequence is correct regarding the first ionisation potential of coinage metals ?

A. $Cu > Ag > Au$

B. $Cu < Ag < Au$

C. $Cu > Ag < Au$

D. $Ag > Cu > Au$

Answer: C

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8. Mark the correct statements out of the following:

A. He has highest IE_1 in the periodic table.

B. CI has the highest EA out of all elements in the periodic table.

C. Hg and Br are liquid at room temperature.

D. In any period, the atomic radius of the noble gas is lowest.

Answer: A::B::C

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9. Ionization energy is influenced by :

A. Size of the atom

B. Charge on the nucleus

C. Electrons present in inner shells

D. None of the above

Answer: A::B::C

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10. Which of the following statement (s) is $/ are$ correct ?

A. The element which has higher EA acts as a strong oxidising agent.

B. The element with higher EA has higher IE.

C. Along a period halogen has maximum EA.

D. The decreasing order of EA is $F > Cl > Br$.

Answer: A::B::C

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11. Which of the following process do not involve absorption of energy?

A. $Cl(g) + e^- \rightarrow Cl^{\ominus}(g)$

B. $S(g) + e^- \rightarrow S^{\ominus}(g)$

C. $O(g) + e^- \rightarrow O^{\ominus}(g)$

D. $O^{\ominus} + e^- \rightarrow O^{2-}(g)$

Answer: A::B::C

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Exercises (Multiple Correct) Electronegativity (En)

1. Which of the following properties can be determined by using Born-Haber cycle ?

A. $\Delta_{\mathrm{hyd}} H^{\ominus}$

B. $\Delta_{eg} H^{\ominus}$

C. $\Delta_{u} H^{\ominus}$

D. EN

Answer: B::C

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2. Select the correct statement (s).

A. On Mulliken scale, the average of IP and EA (in $eV\text{atom}^{-1}$) is known as EN.

B. The maximum EN is shown by Cl.

C. H, P and Te have similar value of EN.

D. H, S and Te have similar value of EN.

Answer: A::C

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3. Select the correct statement (s).

A. Mulliken's values of EN are about 2.8 times more than the Pauling scale.

B. Mulliken's value of EN are about 2.8 times less than the Pauling scale.

C. On Mulliken's scale if IP and EA are in $kJmol^{-1}$, then $EN = \frac{IP + EN}{540}$

D. On Mulliken's scale if IP and EA are in kcal mol^{-1}, then $EN = \frac{IP + EA}{2 \times 62.5}$

Answer: A::C::D

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4. Select the correct statement (s)

A. On Pauling scale, the difference in EN of two atoms A and B in SI units is.

$(EN_A - EN_B) = 0.1017\sqrt{\Delta_{A-B}}$.

B. On Pauling scale, the difference in EN of two atoms A and B in $kcalmol^{-1}$ is.

$(EN_A - EN_B) = 0.208\sqrt{\Delta_{A-B}}$.

C. The Mulliken's EN values are scaled down to match the Pauling value by dividing $\left(\frac{IP+EA}{2}\right)$ in eV by 3.17.

D. The Maulliken's EN values are scaled down to match the Pauling value by multiplying $\left(\frac{IP+EA}{2}\right)$ in eV by 3.17

Answer: A::B::C

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5. Select the correct statement (s).

A. EN of Ga and $Ge > EN$ of Al and Si, due to d- block contraction.

B. EN of Ga and $Ge < EN$ of Al and Si, due to d-block contraction.

C. EN of $Pb > EN$ of TI and Bi, due to d-block contraction

D. EN of $Pb < EN$ of TI and Bi, due to d-block contraction

Answer: A::C

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Exercises (Multiple Correct) Miscellaneous

1. Transition metals are characterised by which of the following properties ?

A. Variable valency

B. Coloured compounds

C. High melting and boiling points

D. Tendency to form complexes

Answer: A::B::C::D

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2. Which is correct statement reagarding BOH (where χ is electronegate) ?

A. If $\chi_O - \chi_B > \chi_O - \chi_H$ will be basic.

B. If $\chi_O - \chi_B < \chi_O - \chi_H$ will be acidic

C. If $\chi_O - \chi_B > \chi_O - \chi_H$ will be acidic.

D. If $\chi_O - \chi_B < \chi_O - \chi_H$ will be basic

Answer: A::B

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3. The elements which are radioactive and have been named after the name of planet are

A. Hg (Mercury) (Hergentium)

B. Np (Neptunium)

C. Pu (Plutonium)

D. Ra(Radium)

Answer: B::C

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4. The properties which are common to the elements belonging to group 1 and 17 of periodic tables are\

A. Electropositive character increases downt the group.

B. Reactivity decreases from a top to bottom

C. Atomic radii increases as atomic number increases

D. Electronegatively decreases on moving down a group.

Answer: A::C::D

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5. The number of which subatomic particle is same in case of chlorine atom and chloride ion?

A. Electron

B. Proton

C. Neutrons

D. All of the above

Answer: B::C

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6. Which of the following show amphoteric behaviour?

A. $Zn(OH)_2$

B. BeO

C. Al_2O_3

D. $Pb(OH)_2$

Answer: A::B::C::D

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7. Which is correct in increasing order of ionic character ?

A. $AlCl_3 < MgCl_2 < NaCl$

B. $LiI < LiBr < LiCl < LiF$

C. $NaCl > MgCl_2 < AlCl_3$

D. None of the above

Answer: A::B

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8. Highly pure dilute solution of sodium in ammonia

A. Shows blue colouration due to solvated electrons

B. Shows electrical conductivity due to both solvated electrons and solvated sodium ions

C. Shows red colouration due to solvated electrons but a bad conductor or electricity

D. Produces hydrogen gas or carbonate

Answer: A::B

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9. Which of the following are ionic carbides ?

A. CaC_2

B. Al_4C_3

C. SiC

D. Be_2C

Answer: A::B::D

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10. Which of the following substance (s) is/are used in laboratory for drying purposes ?

A. Anhydrous P_2O_5

B. Graphite

C. Anhydrous $CaCI_2$

D. Na_3PO_4

Answer: A::C

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11. Which of the following properties can be determined by using Born-Haber cycle ?

A. Electronegativity

B. Hydration energy

C. Lattice energy of ionic crystals

D. Binding energy of electrons

Answer: A::B::D

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12. The compound (s) which have $-O-O-$ bonds (s) is / are

A. BaO_2

B. Na_2O_2

C. CrO_5

D. Fe_2O_3

Answer: A::B::C

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13. Which of the following compounds are paramagnetic in nature ?

A. KO_2

B. K_2O_2

C. Na_2O_2

D. RbO_2

Answer: A::D

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14. Select the correct statement (s).

A. Cr^{2+} compounds are ionic.

B. They are oxidised to Cr^{3+} by air.

C. They are reducing agent in aqueous solution.

D. None is correct.

Answer: A::B::C

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15. On moving down the group from F to I, which of the following properties decreases ?

A. Ionic radius

B. IE

C. Oxidising power

D. EN

Answer: B::C::D

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16. Select the correct statement (s)

A. Alkali metals have lowest IE in respective period.

B. Noble gas have highest IE is respective period.

C. EA_1 of $N < EA_1$ of O.

D. $F^{\ominus}$ is the strongest reducing agent among halide ions.

Answer: A::B::C

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17. The electronic configuration of given speices (X) is $1s^2$, $2s^2 2p^6$, $3s^2 3p^6 3d^5$, $4s^1$. This can be its

A. Cationic form $X^{\oplus}$

B. Anionic form $X^{\ominus}$

C. Excited state

D. Ground state

Answer: A::D

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18. Which of the following sets contain only isoelectronic species?

A. $K^{\oplus}, Ca^{2+}, Sc^{3+}, Cl^{\ominus}$

B. $Zn^{2+}, Ca^{2+}, Ga^{3+}, Al^{3+}$

C. $Ti^{4+}, Ar, Cr^{6+}, V^{5+}$

D. $P^{3-}, S^{2-}, Cl^{\ominus}, K^{\oplus}$

Answer: A::C::D

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19. In which of the following arrangements, the order is according to the property indicated against it?

A. $IE_1 : O > N > C > B$

B. $\Delta_{eg}H^{\oplus}(\text{with -ve sign}) : Cl > F > Br > I$

C. Metallic radius: $Rb > K > Na > Li$

D. Ionic size: $F^{\ominus} > Na^{\oplus} > Mg^{2+} > Al^{3+}$

Answer: B::C::D

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20. In which of the following arrangements, the order is according to the property indicated against it?

A. Basic strenght: $SbH_3 > AsH_3 > PH_3 > NH_3$

B. $IE_1 : N > O > C > B.$

C. Oxidising power :

$$PbO_2 > SnO_2 > SiO_2 > CO_2$$

D. Acid strength: $HI > HCl > HF$

Answer: B::C::D

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21. The bond dissociation energy of $B-F$ in BF_3 is $646kJmol^{-1}$ whereas that of $C-F$ in CF_4 is $515kJmol^{-1}$. The correct reason for higher $B-F$ bond dissociation energy as compared to that of $C-F$ in CF_4 is

A. Lower degreee of $p\pi-p\pi$ interaction between B and F BF_3 than that between C and F in CF_4

B. Significant $p\pi-p\pi$ interaction between B and F in BF_3 whereas there is no possibility of such interaction between C and F in CF_4

C. Smaller size of B-atoms as compared to that of C-atom and the stronger bond between B and F in BF_3 as compared to that between C and CF_4

D. Lewis acid character pf boron trihalides is as: $BBr_3 > BCl_3 > BF_3$

Answer: B:

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Exercises (Singlecorrect) General Electronic Configuration And Periodicity

1. According to periodic law of elements, the variation in properties of elements is related to their:

A. Atomic mass

B. Atomic number

C. Density

D. Mass number

Answer: B

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2. Newland's law of octave applies to which of the following set elements ?

A. Be, Mg, Ca

B. As, K, Ca

C. B, N, C

D. None of these

Answer: A

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3. The element whose electronic configuration is $1s^2, 2s^2 2p^6, 3s^2$ is a / an

A. Metal

B. Metalloid

C. Inert gas

D. Non-metal

Answer: A

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4. The member of periods and group in the long form of periodic table are

A. 7 and 9

B. 8 and 18

C. 7 and 18

D. 6 and 10

Answer: C

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5. The elements of group $1, 2, 13, 14, 15, 16, 17, 18$ are collectively called

A. Noble elements

B. Typical elements

C. Transition elements

D. Representative elements

Answer: D

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6. The statement that is false regarding the long form the periodic table is

A. It reflects the sequence of filling the electrons in the order of sub-energy levels s, p, d and f.

B. It helps to predict the stable valency states of the elements.

C. It reflects trends in physical and chemical properties of the elements.

D. It helps to predict the relative ionic character of the bond between any two elements

Answer: D

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7. In the periodic table, going down in fluorine group

A. Reactivity will increase

B. Electronegativity will increase

C. Ionic radius will increase

D. Ionisation potential will increase

Answer: C

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8. In the long form of periodic table all the non-metals are placed under

A. s-block

B. p-block

C. d-block

D. f-block

Answer: B

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9. Alkali metals in each period have

A. Smallest size

B. Highest EN

C. Lowest IE

D. Highest IE

Answer: C

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10. Which one pair of atoms or ions will have same configuration ?

A. $F^{\oplus}$ and Ne

B. $Li^{\oplus}$ and $He^{\ominus}$

C. Na and K

D. $Cl^{\ominus}$ and Ar

Answer: D

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11. In the modern periodic table, the period indicates the value of

A. Atomic number

B. Atomic mass

C. Principal quantum number

D. Azimuthal quantum number

Answer: C

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12. Which of the following does not reflect periodicity of elements ?

A. Bonding behaviour

B. EN

C. IE

D. Neutron / proton ratio

Answer: D

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13. The $3rd$ period of the periodic table contains

A. 8 elements

B. 32 elements

C. 3 elements

D. 18 elements

Answer: A

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14. Which of the following set

A. Hf, Zr

B. K, Rb

C. Be, Al

D. B, Al

Answer: C

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15. Which of the following belongs to the category of transition metal?

A. K

B. Ra

C. Fe

D. All of the above

Answer: C

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16. Without looking at the periodic table, select the elements belonging to same from the following list.

A. $Z = 12, 38, 4, 88$

B. $Z = 9, 16, 3, 35$

C. $Z = 5, 11, 27, 19$

D. $Z = 24, 47, 42, 55$

Answer: A

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17. The elements of same group of the periodic table have

A. Same number of protons

B. Same valence shell

C. Same valence electrons

D. Same electrons affinity

Answer: C

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18. The elements which are characterised by the outer shell configuration ns^1 to np^6 are colectively called

A. Transition elements

B. Representative elements

C. Lanthanides

D. Inner transition elements

Answer: B

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19. The outer most electronic configuration of transition elements is

A. ns^2nd^{1-10}

B. $(n-1)d^{1-10}ns^{1-2}$

C. $(n-1)d^2ns^{0-2}$

D. $(n-1)d^{1-10}ns^2$

Answer: B

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20. An element with atomic number 20 will be placed in which period of the periodic table

A. 4

B. 3

C. 2

D. 1

Answer: A

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21. The statement that is not correct for periodic classification of elements is

A. The properties of elements are the periodic functions of their atomic numbers.

B. Non-metallic elements are less in number than metallic elements.

C. The first ionisation energies of elements along a period do not vary in a regular manner with an increase in atomic number.

D. For transition elements the ionisation energies increase gradually with increase in atomic

number.

Answer: D

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22. In the modern periodic table, elements are arranged in

A. Increasing mass

B. Increasing volume

C. Increasing atomic number

D. Alphabetically

Answer: C

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23. Name of the heaviest naturally occurring element.

A. U

B. Ra

C. Pb

D. Hg

Answer: A

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24. The screening effect of d-electron is

A. Equal to p-electron

B. Much more than p-electron

C. Same as f-electrons

D. Less than p-electrons

Answer: D

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25. Which of the following represents the electronic configuration of the electropositive element ?

A. $[He]2s^1$

B. $[Xe]6s^1$

C. $[He]2s^2$

D. $[Xe]6s^2$

Answer: B

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Exercises (Singlecorrect) Atomic And Ionic Radii

1. Which of the following has the largest ionic radius ?

A. Be^{2+}

B. Mg^{2+}

C. Ca^{2+}

D. Sr^{2+}

Answer: D

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2. The size of species I, I^{+} and $I^{\ominus}$ decrease in the order.

A. $I^{\oplus} > I^{\ominus} > I$

B. $I^{\ominus} > I > I^{\oplus}$

C. $I^{\ominus} > I^{\oplus} > I$

D. $I > I^{\oplus} > I^{\ominus}$

Answer: B

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3. Which one of the following is the smallest in size?

A. $Na^{\oplus}$

B. N^{3-}

C. O^{2-}

D. $F^{\ominus}$

Answer: A

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4. Which of the following represent increasing order of size of $4th$ period element ?

A. K, Kr, Ca, Br

B. Kr, Br, Ca, K

C. K, Ca, Br, Kr

D. Br, Kr, Ca, K

Answer: D

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5. Which of the following van der Waals radii is the largest ?

A. Ne

B. Cl

C. O

D. F

Answer: B

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6. The correct order of the size of Be, C, N, P and S is

A. $N < C < P < S$

B. $C < N < P < S$

C. $N < C < S < P$

D. $C < N < S < P$

Answer: C

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7. The correct order of the size of Be, C, F and Ne is

A. $Be > C > F > Ne$

B. $Be < C < F < Ne$

C. $F < C < S < P$

D. $Be > C > F < Ne$

Answer: D

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8. The correct order of increasing radii are

A. $Be^{2+}, Mg^{2+}, Na^{\oplus}$

B. $K^{\oplus}, Ca^{2+}, S^{2-}$

C. $O^{2-}, F^{\ominus}, N^{3-}$

D. S^{2-}, O^{2-}, As^{3-}

Answer: A

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9. The correct arrangement of decreasing order of atomic radius among Na, K, Mg and Rb is

A. $Rb > Na > N > Mg$

B. $K > Rb > Na > Mg$

C. $Rb > K > Na > Mg$

D. $Mg > Rb > K > Na$

Answer: C

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10. Which of the following pairs of elements have almost similar atomic radii ?

A. Zr, Hf

B. Cu, Ag

C. Sc, Ti

D. Pd, Pt

Answer: A

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11. The radius of isoelectronic species

A. Increases with increase in nuclear charge

B. Decreases with increases in nuclear charge

C. Same for all

D. First increases and then decreases

Answer: B

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12. Atomic radil of fluorine and neon in Angstrom units are respectively given by

A. $0.72, 1.60$

B. $1.60, 1.60$

C. $0.72, 0.72$

D. $1.60, 0.72$

Answer: A

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13. Anything that influences the valence electrons will affect the chemistry of the element. Which one of the following factors does not affect the valence shell ?

A. Valence principal quantum number (n)

B. Nuclear charge (Z)

C. Nuclear mass

D. Number of core electrons

Answer: C

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14. The size of isoelectronic species $F^{\ominus}$, Ne, and $Na^{\oplus}$ is affected by

A. Nuclear charge (Z)

B. Valence principal quantum number (n)

C. Electron-electron interaction in the outer orbitals

D. None of the factors because their size the same

Answer: C

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15. Ionic radii of :

A. $.^{35}Cl^{\ominus} > Cl(\ominus)$

B. $Mn^{7+} > Ti^{4+}$

C. $K^{\oplus} > Cl$

D. $P^{3+} > P^{5+}$

Answer: D

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Exercises (Single Correct) Effective Nuclear Charge (Z_{Eff})

1. Which of the following statement is most correct ?

Effective nuclear charge of atom depends on

A. The charge on the ion

B. The atomic number of an atom

C. The screening effect

D. Both (a) and (c)

Answer: D

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2. The sheilding effect of d-electrons is

A. More than s-electrons

B. More than p-electrons

C. Less than s-electrons

D. Same as f-electrons

Answer: C

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3. The chemistry of lithium is very similar to that to that of magnesium even though they are placed in different groups. Its reason is

A. Both are found together in nature

B. Both have nearly the same size

C. Both have similar electronic configuration

D. The raito of their charge and size (i.e. charge density) is nearly the same

Answer: D

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4. In a given energy level, the order of penetration effect of different orbitals is

A. $f < d < p < s$

B. $s = p = d = f$

C. $s < p < d < f$

D. $p > s > d > f$

Answer: A

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5. Which one of the following group of atoms or ions is not isoelectronic ?

A. $He, H^{\ominus}, Li^{\oplus}$

B. $Na^{\oplus}, Mg^{2+}, Al^{3+}$

C. $F^{\ominus}, O^{2-}, N^{3-}$

D. $K^{\oplus}, Ca^{2+}, Ne$

Answer: D

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6. The correct order of relative stability of half filled and completely filled sub-shell is

A. $p^3 > d^5 < d^{10} < p^6$

B. $d^5 > p^3 < d^{10} < p^6$

C. $d^5 > p^3 > d^{10} > p^6$

D. $p^3 < d^{10} < d^5 < p^6$

Answer: C

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Exercises (Single Correct) Ionisation Energy (Ie)

1. From the ground state electronic configuration of the elements given below, pick up the one with the highest value of second ionisation energies

A. $1s^2, 2s^2 2p^6, 3s^2$

B. $1s^2, 2s^2 2p^6, 3s^1$

C. $1s^2, 2s^2 2p^6$

D. $1s^2, 2s^2 2p^5$

Answer: B

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2. Which of the following process refers to IE_2 ?

A. $X_{(g)} \rightarrow X_{(g)}^{2+}$

B. $X_{(g)}^{\oplus} \rightarrow X_{(g)}^{2-}$

C. $X_{(aq)}^{\oplus} \rightarrow X_{(g)}^{2+}$

D. $X_{(g)} \rightarrow X_{(g)}^{\oplus}$

Answer: B

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3. Which of the following statement concerning ionisation energy is not correct ?

A. The IE_2 is always more than the first.

B. Within a group, there is a gradual increase in ionisation energy because nuclear charge increases.

C. Ionisation energies of Be is more than B.

D. Ionisation energies of noble gases are high.

Answer: B

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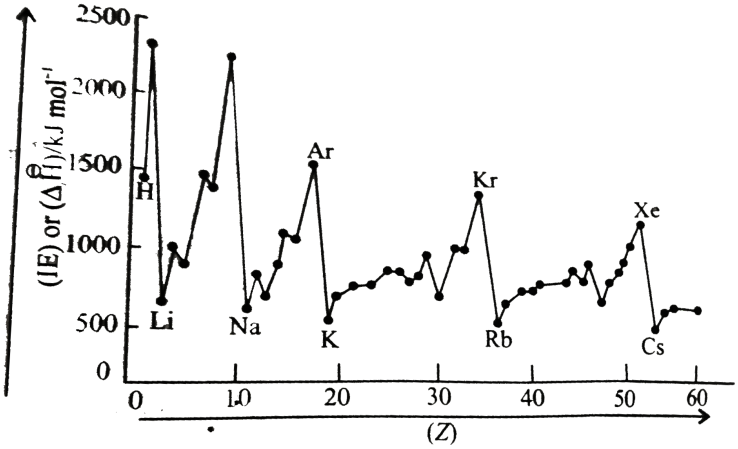
4. The graph of IE_1 or $\Delta_1 H_1^{\ominus}$ versus atomic number (Z) is given below:



Which of the following statement is correct ?

A. Alkali metals are at the maxima and noble gases at the minima.

B. Noble gases are at the maxima and alkali metals at the minima.

C. Transition elements are at the maxima.

D. Minima and maxima do not show any regular behaviour.

Answer: B

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5. Which of the following ioelectronic ions have the lowest ionisation enthalpy ?

A. $K^{\oplus}$

B. Ca^{2+}

C. $Cl^{\ominus}$

D. S^{2-}

Answer: D

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6. The second ionisation potential is

A. less than

B. higher than

C. same

D. depends on the elements

Answer: B

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7. Which of the following process requires the largest amount of energy ?

A. $Al_{(g)} \rightarrow Al^{\oplus} + e^{-}$

B. $Al^{2+}_{(g)} \rightarrow Al^{3+} + e^{-}$

C. $Al^{\oplus}_{(g)} \rightarrow Al^{2+} + e^{-}$

D. All require same amount of energy

Answer: B

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8. Which of the following in an energy consuming process ?

A. $O_{(g)} + e^- \rightarrow O^{\ominus}_{(g)}$

B. $Na^{\oplus}_{(g)} + e^- \rightarrow Na_{(g)}$

C. $O^{\ominus}_{(g)} + e^- \rightarrow O^{2-}_{(g)}$

D. $O^{2-}_{(g)} \rightarrow O^{\ominus} + e^-$

Answer: C

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9. Arrange S, P and As in order of increasing ionisation energy.

A. $S < P < As$

B. $P < S < As$

C. $As < S < P$

D. $As < P < S$

Answer: C

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10. The five successive energies of an element are $800, 2427, 3658, 25024$ and $32824 kJ mol^{-1}$ respectively. The number of valence electron is

A. 3

B. 5

C. 1

D. 2

Answer: A

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11. Which of the following transitions involves maximum amount of energy?

A. $M_{(g)}^{\ominus} \rightarrow M_{(g)}$

B. $M_{(g)}^{\ominus} \rightarrow M_{(g)}^{\oplus}$

C. $M_{(g)}^{\oplus} \rightarrow M_{(g)}^{2+}$

D. $M_{(g)}^{2+} \rightarrow M_{(g)}^{3+}$

Answer: D

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12. Which of the elements show least values of ionisation within their periods ?

A. Alkaline earth metals

B. Alkali metals

C. Noble gases

D. Chalcogens

Answer: B

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13. Which of the following has the largest ionisation energy.

A. $._{11}Na$

B. $._{19}K$

C. $._{12}Mg$

D. $._{37}Rb$

Answer: C

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14. Which one of the following elements has the highest ionisation energy?

A. $[Ne]3s^2 3p^1$

B. $[Ne]3s^2 3p^3$

C. $[Ne]3s^2 3p^2$

D. $[Ar]3d^{10} 4s^2 4p^2$

Answer: B

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15. The correct order of the second ionisation potential of carbon, nitrogen, oxygen and fluorine is

A. $C > N > O > F$

B. $O > N > F > C$

C. $O > F > N > C$

D. $F > O > N > C$

Answer: C

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16. Which has the largest first ionisation energy ?

A. Na

B. K

C. Rb

D. Li

Answer: D

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17. Which of the following element has the highest ionisation enregy ?

A. Carbon

B. Boron

C. Oxygen

D. Nitrogen

Answer: D

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18. The ionisation energy of nitrogen is more than that of oxygen because

A. Greater attraction of electrons by the nucleus

B. Extra stability of the half-filled p-orbitals

C. Smaller size of nitrogen

D. More penetrating effect

Answer: B

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19. The set representing the correct order of the first ionisation potential is

A. $K > Na > Li$

B. $Be > Mg > Ca$

C. $B > C > N$

D. $Ge > Si > C$

Answer: B

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20. The first ionisation potential of which of the element is highest

A. Na

B. Mg

C. Al

D. Si

Answer: D

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21. Highest ionisation potential in a period is shown by

A. Alkali metals

B. Transition elements

C. Halogens

D. Alkaline earth metals

Answer: C

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22. The first ionisation energy is maximum for

A. Na

B. Mg

C. K

D. Kr

Answer: D

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23. Which sequence is correct regarding the first ionisation potential of coinage metals ?

A. $Cu > Ag < Au$

B. $Cu > Ag > Au$

C. $Cu < Ag < Au$

D. $Au > Ag < Cu$

Answer: A

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24. The second ionisation potentials in electron volts of oxygen and fluorine atoms are respectively given by

A. $35.1, 38.3$

B. $38.3, 38.3$

C. $38.3, 35.1$

D. $35.1, 35.1$

Answer: C

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25. The value of IE_1, IE_2, IE_3 and IE_4 of an atom are respectively $7.5eV, 25.6eV, 48.6eV$ and $170.6eV$. The electronic configuration of the atom will be

A. $1s^2, 2s^2 2p^6, 3s^1$

B. $1s^2 2s^2 2p^6 3s^2 3p^1$

C. $1s^2, 2s^2 2p^6 3s^2 3p^3$

D. $1s^2, 2s^2 2p^6 3s^2$

Answer: B

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26. IE_1, IE_2 and IE_3 values are $100, 150$ and $1500eV$ respectively. The element can be

A. Na

B. B

C. Be

D. F

Answer: C

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27. $N_0/2$ atoms of $X_{(g)}$ are converted into $X^{\oplus}_{(g)}$ by energy E_1, $N_0/2$ atoms of $X_{(g)}$ are converted inot $X^{\ominus}_{(g)}$ by energy E_2. Hence ionisation potential and electron affinity of $X_{(g)}$ per atom are

A. $\frac{2E_1}{N_0}, \frac{2(E_2 - E_1)}{N_0}$

B. $\frac{2E_1}{N_0}, \frac{2E_2}{N_0}$

C. $\frac{(E_1 - E_2)}{N_0}, \frac{2E_2}{N_0}$

D. None is correct.

Answer: A

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28. Which of the following ionisation energy valuyes for calcium show a sudden increase?

A. Third

B. Second

C. First

D. Fourth

Answer: A

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29. Which one of the following statements is incorrect in relation to ionisation enthalpy?

A. Ionisation enthalpy increases for each successive electron.

B. The greatest increase in ionisation enthalpy is experienced on removal of electron from core noble gas configuration.

C. End of valence electrons is marked by a big jump in ionisation enthalpy.

D. Removal of electron from orbitals bearing lower n value is easier than from orbitals

having higher than n value.

Answer: D

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30. IE_2 for an element is inveriably higher than IE_1 because

A. It is difficult to remove electron from cation

B. The size of the cation is smaller than its atoms

C. Z_{eff} is more for cation

D. All the above

Answer: D

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31. Which of the following metal requires radiation of the lowest wavelength to cause emission of electrons?

A. Na

B. K

C. Mg

D. Ca

Answer: C

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Exercises (Single Correct) Isoelectronic Species

1. Which of the following are isoelectronic?

$NO_3^{\ominus}, CO_3^{2-}, ClO_3^{\ominus}, SO_2$

A. $NO_3^{\ominus}, CO_3^{2-}, ClO_3^{\ominus}$

B. $NO_3^{\ominus}, CO_3^{2-}, SO_2$

C. $CO_3^{2-}, ClO_3^{\ominus}, SO_2$

D. None of these

Answer: B

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2. Consider the ioselectronic series , $K^{\oplus}, S^{2-}, Cl^{\ominus}, Ca^{2+}$, the radii of the ions decrease as

A. $Ca^{2+} > K^{\oplus} > Cl^{\ominus} > S^{2-}$

B. $Cl^{\ominus} > S^{2-} > K^{\oplus} > Ca^{2+}$

C. $S^{2-} > Cl^{\ominus} > K^{\oplus} > Ca^{2+}$

D. $K^{\oplus} > Ca^{2+} > S^{2-} > Cl^{\ominus}$

Answer: C

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3. Which of the following are isoelectronic species ?

$\overset{\oplus}{C}H_3(I), \overset{\ominus}{N}H_2(II), \overset{\oplus}{N}H_4(III)$ and $NH_3(IV)$

A. II, III and IV

B. I, II and III

C. I, II and IV

D. II and I

Answer: A

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4. Two p-block elements x (outer configuration ns^2np^3) and z (outer configuration ns^2np^4) occupy neighbouring positions in a period. Using this information which of the following is correct with respect to their ionisation potential I_x and I_z.

A. $I_x > I_z$

B. $I_z > I_x$

C. $I_z = I_x$

D. Relation between I_x and I_x is uncertain

Answer: A

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Exercises (Single Correct) Matallic-Non Metallic Character

1. Considering the elements B, Al, Mg and K, the correct order of their metallic character is

A. $B > Al > Mg > K$

B. $Al > Mg > B > K$

C. $Mg > Al > K > B$

D. $K > Mg > Al > B$

Answer: D

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2. IE_1 and IE_2 of Mg are 178 and $348 kcal mol^{-1}$. The energy required for the reaction $Mg \rightarrow Mg^{2+} + 2e^-$ is

A. $+170 kcal$

B. $+526 kcal$

C. $-170 kcal$

D. $-526kcal$

Answer: B

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3. Considering the elements B, C, N and Si, the correct order of their non-metallic character is ?

A. $B > C > Si > N > F$

B. $Si > C > B > N > F$

C. $F > N > C > B > Si$

D. $F > N > C > Si > B$

Answer: C

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Exercises (Single Correct) Electron Affinity (Ea) And Electron Gain Enthalpy $\left(\Delta_{Eg}H^{\Theta}\right)$

1. Which of the following have least electron affinity?

A. Oxygen

B. Fluorine

C. Nitrogen

D. Carbon

Answer: C

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2. Second and successive electron affinity of an element

A. is always successive (energy is released)

B. is always positive (energy is absorbed)

C. can be positive or negative

D. is always zero

Answer: B

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3. Which one of the following statements is incorrect?

A. Greater is the nuclear, greater is the electron affinity.

B. Neon has zero electron affinity.

C. Electron affinity decreases from fluorine to iodine in the group

D. Electron affinity decreases in going down a group and increases across from the left to the

right ($\rightarrow$).

Answer: C

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4. The lower electron affinity of fluorine than that of chlorine is due to

A. Smaller size

B. Smaller nuclear charge

C. Difference in their electronic arrangement

D. Its highest reactivity

Answer: A

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5. The EA order for halogen is

A. $F > Cl > Br > I$

B. $F < Cl < Br < I$

C. $F < Cl > Br > I$

D. $F > Cl < Br > I$

Answer: C

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6. The EA for inert gases is likely to be

A. High

B. Small

C. Zero

D. Positive

Answer: C

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7. Ionisation of energy $F^{\ominus}$ is $320kJmol^{-1}$. The electronic gain enthalpy of fluorine would be

A. $-320kJmol^{-1}$

B. $-160kJmol^{-1}$

C. $+320kJmol^{-1}$

D. $+160kJmol^{-1}$

Answer: A

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8. Which of the following represents the correct order of electron affinities?

A. $F > Cl > Br > I$

B. $C < N < O < F$

C. $N < C < O < F$

D. $C < Si < P < N$

Answer: C

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9. Fluorine has the highest electronegativity among the group on the Pauling scale, but the electron affinity of fluorine is less than that of chlorine because

A. The atomic number of fluorine is less than that of chlorine

B. Fluorine being the first member of the family behaves in an unuseual manner

C. Chlorine can accommodate an electron better than fluorine by untilising its vacant $3d$ orbital

D. Small size, high electron density and an increases electron repulsion make addition of an electron to fluorine less favourable than that in the case of chlorine

Answer: D

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Exercises (Single Correct) Electronegativity (En)

1. Which is true about the electronegative order of the following elements ?

A. $P > Si$

B. $C > N$

C. $Br > Cl$

D. $Sr > Ga$

Answer: A

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2. The electronnegativity of the following elements increases in the order

A. C, N, Si, P

B. N, Si, C, P

C. Si, P, C, N

D. P, Si, N, C

Answer: C

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3. An atom with high EA generally has

A. Tendency to form $+ve$ ions

B. High ionisation energy

C. Large atomic size

D. Low electron affinity

Answer: B

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4. The electronegativity of the following elements increases in the order

A. $S < P < N < O$

B. $P < S < N < O$

C. $N < O < P < S$

D. $N < P < S < O$

Answer: B

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5. Downwards in a group, the electropositive character of elements

A. Increases

B. decreases

C. Remain same

D. None

Answer: A

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6. What is the correct order of electronegativity?

A. $M^{1-} < M^{2-} < M^{3-} < M^{4-}$

B. $M^{1-} > M^{2-} > M^{3-} > M^{4-}$

C. $M^{1-} > M^{2-} < M^{3-} > M^{4-}$

D. $M^{4-} < M^{2-} < M^{3-} < M^{1-}$

Answer: B

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7. Due to screening effect of electrons in an atom

A. IE decreases

B. IE increases

C. No change in IE

D. Attraction of nucleus on the valence electron increases

Answer: A

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8. Select the group where EN increases down the group

A. F, Cl, Br

B. Li, Na, K

C. Ca, Sr, Ba

D. Zn, Cd, Hg

Answer: D

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9. Which of the following element has the highest EN?

A. As

B. Sb

C. P

D. S

Answer: D

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10. In C, N, O and F the electronegativity

A. Increases from carbon to fluorine

B. Decreases from carbon to fluorine

C. Increases up to oxygen and is minimum at fluorine

D. Is minimum at nitrogen and then increases continuously

Answer: A

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Exercises (Single Correct) Acidic, Basicand Amphoteric Character

1. Among the following oxides, which is least acidic ?

A. Al_2O_3

B. B_2O_3

C. CO_2

D. NO_2

Answer: A

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2. Which of the following oxides is most basic ?

A. Na_2O

B. MgO

C. Al_2O_3

D. CuO

Answer: A

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3. The order in which the following oxides are arranged according to decreasing basic nature is

A. Na_2O, MgO, Al_2O_3, CuO

B. CuO, Al_2O_3, MgO, Na_2O

C. Al_2O_3, CuO, MgO, Na_2O

D. CuO, MgO, Na_2O, Al_2O_3

Answer: A

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4. Identify the correct order of acidic strength of CO_2, CuO, CaO and H_2O.

A. $CaO < CuO < H_2O < CO_2$

B. $CaO < H_2O < CuO < CO_2$

C. $H_2O < CuO < CaO < CO_2$

D. $H_2O < CO_2 < CaO < CuO$

Answer: B

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5. What is the nature of Al_2O_3 and B_2O_3 ?

A. Acidic, acidic

B. Acidic, amphoteric

C. Amphoteric, amphoteric

D. Amphoteric, acidic

Answer: D

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6. which one of the following oxides is neutral?

A. SiO_2

B. CO

C. ZnO

D. SnO_2

Answer: B

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7. Which of the following oxides is amphoteric is nature ?

A. CaO

B. CO_2

C. SnO_2

D. SiO_2

Answer: C

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8. The correct order of acidic strength of the following is

A. $SO_2 > P_2O_3 > SiO_2 > Al_2O_3$

B. $P_2O_3 > SO_2 > SiO_2 > Al_2O_3$

C. $P_2O_3 > Al_2O_3 > SO_2 > SiO_2$

D. $Al_2O_3 > SiO_2 > P_2O_3 > SO_2$

Answer: A

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9. Which of the oxdies behave both as neutral oxide and suboxide ?

(a) N_2O , b. NO, c. C_3O_2 , d. CO

A. CO

B. CO_2

C. C_3O_2

D. N_2O

Answer: D

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10. Which of the odies is not a mixed oxide ?

A. $Co(Al_2O_2)_2$

B. Mn_3O_4

C. Pb_3O_4

D. C_3O_2

Answer: D

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11. Which of the oxides is basic as well as normal oxide ?

A. N_2O

B. Na_2O

C. NO

D. H_2O

Answer: B

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Exercises (Single Correct) Bond Angle

1. Decreasing order of bond angle of (NH_3, PH_3, AsH_3) is

A. $NH_3 > PH_3 > AsH_3$

B. $NH_3 > AsH_3 > PH_3$

C. $PH_3 > NH_3 > AsH_3$

D. $AsH_3 > PH_3 > NH_3$

Answer: A

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2. The correct order of bond angle of NO_2^+, NO_2 and NO_2^- is

A. $NO_2^{\ominus} > NO_2 > NO_2^{\oplus}$

B. $NO_2^{\oplus} > NO_2 > NO_2^{\ominus}$

C. $NO_2^{\ominus} > NO_2^{\oplus} > NO_2$

D. $NO_2 > NO_2^{\ominus} > NO_2^{\oplus}$

Answer: B

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3. Decreasing order of bond angle of $\left(NH_3, \overset{\oplus}{N}H_4, PCl_5, SCl_2\right)$ is

A. $NH_3 > SCl_2 > PCl_5 > \overset{\oplus}{N}H_4$

B. $NH_3 > SCl_2 > \overset{\oplus}{N}H_4 > PCl_5$

C. $\overset{\oplus}{N}H_4 > NH_3 > SCl_2 > PCl_5$

D. $\overset{\oplus}{N}H_4 > NH_3 > PCl_5 > SCl_2$

Answer: C

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4. Increasing order of bond angle of $\left(Cl_2O, ClO_2, Cl_2O_7, I_3^{\ominus}\right)$ is

A. $Cl_2O < ClO_2 < Cl_2O_7 < I_3^{\ominus}$

B. $Cl_2O < ClO_2 < I_3^{\ominus} < Cl_2O_7$

C. $I_3^{\ominus} < Cl_2O_7 < ClO_2 < Cl_2O$

D. $Cl_2O < Cl_2O_7 < ClO_2 < I_3^{\ominus}$

Answer: D

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Exercises (Single Correct) Lattice And Hydration Energy

1. Decreasing order of hydration energy of the following is

A. $Li^{\oplus} > Na^{\oplus} > K^{\oplus} > Cs^{\oplus}$

B. $Cs^{\oplus} > K^{\oplus} > Na^{\oplus} > Li^{\oplus}$

C. $Li^{\oplus} > K^{\oplus} > Na^{\oplus} > Cs^{\oplus}$

D. $Cs^{\oplus} > Na^{\oplus} > K^{\oplus} > Li^{\oplus}$

Answer: A

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2. Extent of hydrolysis of the following is

A. $PCl_5 > SiCl_4 > MgCl_2 > AlCl_3$

B. $AlCl_3 > MgCl_2 > SiCl_4 > PCl_5$

C. $SiCl_4 > PCl_5 > MgCl_2 > AlCl_3$

D. $PCl_5 > SiCl_4 > AlCl_3 > MgCl_2$

Answer: D

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3. Give the decreasing order of thermal stability of the following .

A. $BeCO_3 > MgCO_3 > CaCO_3 > BaCO_3$

B. $BaCO_3 > CaCO_3 > MgCO_3 > BeCO_3$

C. $BaCO_3 > CaCO_3 > BaCO_3 > MgCO_3$

D. $MgCO_3 > CaCO_3 > BaCO_3 > BeCO_3$

Answer: B

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4. Lattice energy of an ionic compound depedns upon :

A. Change density of the ions only

B. Packing of ions only

C. Size of the ion only

D. Charge on the ions only

Answer: A

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5. Na_2SO_4 is soluble in water while $BaSO_4$ is insoluble. Which of the reason is correct about the above statement.

A. Lattice energy of $BaSO_4$ exceeds its hydration energy.

B. Hydration energy of $BaSO_4$ exceeds its lattice energy.

C. The solubility in H_2O of a compound depends ony on its hydration energy.

D. The solubility in H_2O of a compound depends only on its lattice enregy.

Answer: A

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6. Calculate the lattice energy from the following data (given $1eV = 23.0kcalmol^{-1}$)

i. $\Delta_f H^{\ominus}(KI) = -78.0kcalmol^{-1}$

ii. IE_1 of $K = 4.0eV$

iii. $\Delta_{diss} H^{\ominus}(I_2) = 28.0kcalmol^{-1}$

iv. $\Delta_{sub} H^{\ominus}(K) = 20.0kcalmol^{-1}$ ltbvrgt v. EA of $I = -70.0kcalmol^{-1}$

vi. $\Delta_{sub} H^{\ominus}$ of $I_2 = 14.0kcalmol^{-1}$

A. $+14.1kcalmol^{-1}$

B. $-14.1 kcal mol^{-1}$

C. $-141 kcal mol^{-1}$

D. $+141 kcal mol^{-1}$

Answer: C

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7. Calculate the EA of O atom to O^{2-} ion from the following data:

i. $\Delta_f H^{\ominus}[MgO(s)] = -600 kJ mol^{-1}$

ii. $\Delta_u H^{\ominus}[MgO(s)] = -3860 kJ mol^{-1}$

iii. $IE_1 + IE_2$ of $Mg(g) = 2170 kJ mol^{-1}$

iv. $\Delta_{\text{diss}} H^{\ominus}$ of $Mg(s) = +494 kJ mol^{-1}$

v. $\Delta_{\text{sub}} H^{\ominus}$ of $Mg(s) = +150 kJ mol^{-1}$

A. $+693 kJ mol^{-1}$

B. $-693 kJ mol^{-1}$

C. $+69.3 kJ mol^{-1}$

D. $-69.3 kJ mol^{-1}$

Answer: A

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Exercises (Single Correct)Miscellaneous

1. Which of the following is incorrect ?

A. With increase in atomic size, ionisation energy increases

B. With increase in atomic size, electron affinity increases

C. With increase in atomic size, metallic character increases

D. With increase in atomic size, electronegativity increases

Answer: C

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2. Which of the following is incorrect?

A. An element which has high electronegativity always has high electron gain enthalpy.

B. Electron gain enthalpy is the property of an isolated atom.

C. Electronegativity is the property of bonded atom.

D. Both electronegativity and electron gain enthalpy are usually directly related to nuclear

charge and inversely related to atomic size.

Answer: A

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3. The ionisation of hydrogen atom would give rise to

A. Hydride ion

B. Hydronium ion

C. Proton

D. Hydroxyl ion

Answer: C

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4. Chloride of an element A gives neutral solution in watt . In the periodic table, the elements A belong to

A. First group

B. Third group

C. Fifth group

D. First transition group

Answer: A

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5. In a period, density first ___then_____and in a group it_down the group

A. Decreases, increases, remains constant

B. Increases, decreases, decreases

C. Increases, remaina constant , increases

D. Increases, decreases, increases

Answer: D

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6. In the transformation of $Na(s) \rightarrow Na^{\oplus}(g)$, the energies involved are

A. Ionisation energy

B. Sublimation energy

C. Ionisation energy and sublimation energy

D. Bond dissociation energy

Answer: C

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7. Beryllium and aluminimum exhibit many properties which are similar . But, the two elements differ in

A. Forming covalent halides

B. Forming covalent hydrides

C. Exhibiting maximum covalency in compounds

D. Exhibiting amphoteric nature in their oxides

Answer: C

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8. Among $LiCI$, $BeCI_2$ and CCI_4 the covalent bond character varies as .

A. $LiCl > BeCl_3 > BCl_3 > CCl_4$

B. $LiCl < BECl_2BCl_3 < CCl_4$

C. $LiCl > BeCl_2 > CCl_4 > BCL_3$

D. $BECl_2 > LiCl > BCL_3 > CCl_4$

Answer: B

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9. The correct order of decreasing polarisability of ion is

A. $Cl^{\ominus} > Br^{\ominus} > I^{\ominus} > F^{\ominus}$

B. $F^{\ominus} > I^{\ominus} > Br^{\ominus} > Cl^{\ominus}$

C. $I^{\ominus} > Br^{\ominus} > Cl^{\ominus} > F^{\ominus}$

D. $F^{\ominus} > Cl^{\ominus} > Br^{\ominus} > I^{\ominus}$

Answer: C

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10. Diagonal relationship is down by

A. All elements with their diagonally opposite elements.

B. All elements of $3rd$ and $4th$ periods

C. Some of the elements of $2nd$ and $3rd$ periods

D. Elements of d-block

Answer: C

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Exercises (Assertion Reasoning)

1. Assertion: Helium and beryllium have similar outer electronic configuration of the type ns^2.

Reason: Both are chemically inert.

A. If both Assertion (A) and (R) are correct and Reason (R) is the correct explanation of Assertion (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A).

C. If (A) is correct but (R) is not correct.

D. If (A) and (R) are correct

Answer: C

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2. Assertion (A) : EA of O is less than that of F but greater than that of N.

Reason (R): IE is as follows: $N > O > F$.

A. If both Assertion (A) and (R) are correct and Reason (R) is the correct explanation of Assertion (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A).

C. If (A) is correct but (R) is not correct.

D. If (A) and (R) are correct

Answer: C

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3. Assertion (A): IE_1 of N is lower than O.

Reason (R) : Across a period Z_{eff} decrease.

A. If both Assertion (A) and (R) are correct and Reason (R) is the correct explanation of Assertion (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A).

C. If (A) is correct but (R) is not correct.

D. If both (A) and (R) are correct

Answer: C

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4. Assertion(A) : IE_2 of Li is the highest in the second period.

Reason (R): $Li^{\oplus}$ haqs nob,le gas i.e., NE gas configuration.

A. If both Assertion (A) and (R) are correct and Reason (R) is the correct explanation of Assertion (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A).

C. If (A) is correct but (R) is not correct.

D. If (A) and (R) are correct

Answer: C

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5. Assertion(A) : IE_2 of C is greater than that of B.

Reason (R): Due to penetration effect.

A. If both Assertion (A) and (R) are correct and Reason (R) is the correct explanation of Assertion (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A).

C. If (A) is correct but (R) is not correct.

D. If (A) is incorrect and (R) is correct

Answer: D

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6. Assertion (A) : In the mordern periodic table period indicates the value of azimuthal quantum number.

Reason (R): Each period begins with the filling of new shell.

A. If both Assertion (A) and (R) are correct and Reason (R) is the correct explanation of Assertion (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A).

C. If (A) is correct but (R) is not correct.

D. If (A) and (R) are correct

Answer: D

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7. Assertion (A) : Anything that influences of the valence electorns will affect the chemistry of the element. So, the nuclear molar mass does not affect the valence shell.

Reason (R) : Nucleus contains protons and neutrons, whereas protons i.e. nuclear charge affects the valence shell but neutrons doe not.

A. If both Assertion (A) and (R) are correct and Reason (R) is the correct explanation of Assertion (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A).

C. If (A) is correct but (R) is not correct.

D. If (A) and (R) are correct

Answer: A

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8. Assertion (A) : Metallic character order is $K > Mg > Al > B$.

Reason (R) : Along the period $(\rightarrow)$ metallic character increases and decreases down the group $(\downarrow)$.

A. If both Assertion (A) and (R) are correct and Reason (R) is the correct explanation of Assertion (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A).

C. If (A) is correct but (R) is not correct.

D. If (A) and (R) are correct

Answer: C

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9. Assertion (A) : When the transition element ionises, the $4s$-orbital electrons are removed before the $3d$-orbital electrons.

Reason (R) : The energy of $3d$-orbital electrons is lower than that of $4s$-orbital electrons.

A. If both Assertion (A) and (R) are correct and Reason (R) is the correct explanation of

Assertion (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A).

C. If (A) is correct but (R) is not correct.

D. If (A) and (R) are correct

Answer: A

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10. Assertion (A) : Mercurous ion is paramagnetic.

Reason (R): It contains one unpaired electron.

A. If both Assertion (A) and (R) are correct and Reason (R) is the correct explanation of Assertion (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A).

C. If (A) is correct but (R) is not correct.

D. If both (A) and (R) are incorrect

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11. Assertion (A): Lithium chloride is predominantly covalent compound.

Reason (R): electronegativity difference between Li and CI is small.

A. If both Assertion (A) and (R) are correct and Reason (R) is the correct explanation of Assertion (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A).

C. If (A) is correct but (R) is not correct.

D. If (A) and (R) are correct

Answer: C

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Exercises (Integer)

1. Among the following oxides how many of them are suboxides ?

(a) C_3O_2 , (b) N_2O , (c) NO_2 , (d) CO

(e) Fe_3O_4 , (f) KO_2

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2. The number of factors that influence the IE are

a. Size of the atom , b. Charge on the nucleus

c. Shielding effect , d. The atomic mass

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3. The number of process (es) rquiring the absorption of energy/are

a. $Cl \rightarrow Cl^{\oplus}$, b. $O^{\oplus} \rightarrow O^{2-}$

c. $Fe^{+3} \rightarrow Fe^{+2}$, d. $Ar \rightarrow Ar^{\oplus}$

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4. For an element (X) the successive ionisation energies, IE_1, IE_2, IE_3, IE_4 and IE_5 are $800, 2427, 3658, 25024$ and $32824 kJ mol^{-1}$ respectively, then that what is the number of valence electrons present in the element?

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5. The diagonal relationship is shown by the elements upto how many groups only ?

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6. The number of the followinjg pairs contains elements with similar atomic radii

a. Co, Ni , b. Zn, Mo , c. Rh, Ir , d. Hf, Ti

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7. How many of the following energies are involved in the transformation of $Na(s) \rightarrow Na^{\oplus}(aq)$?

(a) $1E$, (b) $\Delta_{\text{sub}}H^{\ominus}$, (c) $\Delta_{\text{diss}}H^{\ominus}$, (d) $\Delta_{\text{hyd}}H^{\ominus}$

(e) $\Delta_{u}H^{\ominus}$

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8. Among the following oxides how many of them are mixed oxides ?

(a) H_2O , (b) C_3O_2 , (c) Fe_3O_4 , (d) Fe_2O_3

(e) Pb_3O_4 , (f) PbO_2 , (g) $Co(AlO_2)_2$, (h) Mn_3O_4

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9. Number of species that are isoelectronic with Ar is.

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10. Among the following oxides, how many of them are amphoteric oxides ?

(a) B_2O_3 , (b) Al_2O_3 , (c) CaO , (d) ZnO

(e) Ga_2O_3 , (f) SnO_2 , (g) PbO_2 , (h) BeO

(i) CuO , (j) Fe_2O_3

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11. Among the following elements how many of them are inner transition elements ?

(a) Sg , (b) Bk, (c) Er , (d) Em

(e) Fe , (f) Pb , (g) Cr , (h) Ca

(i) Ar , (j) Zr , (k) Ce

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12. How many number of pairs of elements exhibit diagonal relationship.

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13. Among $BECO_3, CaCO_3, SrCO_3$ and $BaCO_3$, how many number than of these compounds are thermally more stable than $MgCO_3$?

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Exercises (Fill In The Blanks)

1. $IUPAC$ name for the element with $Z = 117$ is _____ and its symbol is _____.

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2. In the long form of the perodic table, physical and chemical properties of the elements are a periodic function of their _____ .

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3. The property used by Mendeleev to classify the elements in his periodic table is _____.

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4. The elements which constitute $5f$-block are called _____ with atomic numbers from _____ to _____ .

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5. Elements of s and p blocks are collectively called _____

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6. The group all members of which are in gaseous state under ordinary conditions is a _____ group.

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7. Lather Meyer drew a graph showing the relation between atomic _____ and atomic _____ .

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8. Ionic radii _____ with increases in atomic number in a period and _____ in a group.

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9. The electron gain enthalpy of oxygen is _____ that of sulphur.

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10. On Mulliken scale the average of IP and EA is known as _____ .

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11. On the Pauling's EN scale, the element next to F is _____

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12. The IE of Be is _____ than that of B.

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13. The bond angle in SO_4^{2-} ion is _____ .

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14. The angle between two covalent bonds is maximum for (CH_4, H_2O, CO_2) _____ .

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15. Second element of group 1 shows diagonal relationship with the first element of group _____ .

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16. The EN of the elements C, N, Si and P increases in the order of _____ .

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17. The decreasing ordr IE for elements Li, Be, CB is _____ .

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18. The type of magnetism exhibited by $\left[Mn(H_2O)_6\right]^{2+}$ ion is _____ .

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19. Among the ions $Cl^{\ominus}$, S^{2-} and $Na^{\oplus}$, the largest ion is _____ .

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20. The inner electrons are shielded to a _____ extent than the outer electrons.

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Exercises (True/False)

1. Number of species that are isoelectronic with $F^{\ominus}$ ion are five.

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2. Number of species that are isoelectronics with Sr^{2+} ion are four.

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3. Among the elements , Li, K, Ca, Cl and Kr, the element K has the lowest IE and Kr has the highest IE.

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4. Be and Mg atoms do not impart colour to the flame.

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5. Energy is released when electron is added to an isolated gases anion.

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6. van der Waals radius of chlorine is less than that of covalent radius.

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7. The oxides and hydroxides of alkali metals are strong bases.

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8. Lithium is the lightest metal.

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9. As the s character of the hybrid orbital decreases, the EN increases.

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10. Ionic bonds are non-directional while covalent bonds are directional.

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Exercises (Archives) Multiple Correct

1. Which of the following statements is/are true for the long form of the periodic table?

A. It refers the sequence of filling the electrons in the order of sub-energy level s, p, d and f

B. It helps to predict the stable valency states of the elements.

C. It refers trends in physical and chemical properties of the elements.

D. It helps to predict the relativity ionicity of the bond between any two elements.

Answer: A::C::D

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2. Sodium sulphate is soluble in water,whereas barium sulphate is sparingly soluble because

A. the hydration energy of sodium sulphate is more than its lattice energy

B. the lattice energy of barium sulphate is more than its hydriation energy

C. the lattice energy has no role to play in solubility

D. the hydration energy of sodium sulphate is less than its lattice energy.

Answer: A::B

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3. Ionic radii of :

A. $Ti^{4+} < Mn^{7+}$

B. $._{}^{35}Cl^{\ominus} < ._{}^{35}Cl^{\ominus}$

C. $K^{\ominus} > Cl^{\ominus}$

D. $P^{3+} > P^{5+}$

Answer: D

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Exercises (Archives) Single Correct

1. The correct order of the second ionisation potential of carbon, nitrogen, oxygen and fluorine is

A. $C > N > O > F$

B. $O > N > F > C$

C. $O > F > N > C$

D. $F > O > N > C$

Answer: C

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2. Which of the following element has the highest ionisation enregy ?

A. Boron

B. carbon

C. nitrogen

D. oxygen

Answer: C

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3. The first ionisation potential in electron volts of nitrogen and oxygen atoms are respectively given by

A. $14.6, 13.6$

B. $13.6, 14.6$

C. $13.6, 13.6$

D. $14.6, 14.6$

Answer: A

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4. Atomic radil of fluorine and neon in Angstrom units are respectively given by

A. $0.72, 1.60$

B. $16.0, 1.60$

C. $0.72, 0.72$

D. None of these

Answer: A

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5. The electronegativity of the following elements increases in the order

A. C,N,Si,P

B. N,Si,C,P

C. Si,P,C,N

D. P,Si,N,C

Answer: C

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6. The first ionisation potential of Na, Mg, Al and Si are in the order

A. $Na < Mg > Al < Si$

B. $Na > Mg > Al > Si$

C. $Na < Mg < Al > Si$

D. $Na > Mg > Al < Si$

Answer: A

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7. Which one of the following is the smallest in size?

A. N^{3-}

B. O^{2-}

C. $F^{\ominus}$

D. $Na^{\ominus}$

Answer: D

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8. Among the following statement is not correct for the periodic classification of elements?

A. $[Ne]3s^2 3p^1$

B. $[Ne]3s^2 3p^3$

C. $[Ne]3s^2 3p^2$

D. $[Ne]3d^{10} 4s^2 4p^3$

Answer: B

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9. Which of the following statements is not correct for the periodic classification of elements?

A. The properties of elements are the periodic functions of their atoms numbers.

B. Non-metallic elements are lesser in number than metallic elements.

C. The first ionisation energies of elements along a period do not vary in a regular manner with the increase in atomic number.

D. For transtion elements the d-subshells are filled with electrons monotonically with the increase in atomic number.

Answer: D

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10. Which has the most stable $+2$ oxidation state ?

A. Sn

B. Pb

C. Fe

D. Ag

Answer: B

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11. Which of the following has the maximum number of ampaired electrons ?

A. Mg^{2+}

B. Ti^{3+}

C. V^{3+}

D. Fe^{2+}

Answer: D

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12. Which of the following statements is wrong?

A. The first ionisationpotential of Al is less than the first ionisation potential of Mg.

B. The second ionisation potential of Mg is greater than the second ionisation potential of Na

C. The first ionisation potential of Na is less than the first ionsation potential of Mg.

D. The third ionisation potential of Mg is greater than the third ionisation potential of Na

Answer: B

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13. The correct order of acid strength is

A. $Cl_2O_7 > SO_3 > P_4O_{10}$

B. $CO_2 > N_2O > SO_3$

C. $Na_2O > MgO > Al_2O_3$

D. $K_2O > CaO > MgO$

Answer: A

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14. The correct order of radii is

A. $N < Be < B$

B. $F^{\ominus} < O^{2-} < N^{3-}$

C. $Na < Li < K$

D. $Fe^{3+} < Fe^{2+} < Fe^{4+}$

Answer: B

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15. Amongst H_2O, H_2S, H_2Se and H_2Te, the one with the highest boiling point is :

A. H_2O because of hydrogen bonding

B. H_2Te because of higher molecular weight

C. H_2S because of hydrogen boning

D. H_2Se because of lower molecular weight

Answer: A

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16. The set representing the correct order of the first ionisation potential is

A. $K > Na > Li$

B. $Be > Mg > Ca$

C. $B > C > N$

D. $Ge > Si > C$

Answer: B

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17. Which of the following represents the correct order of increasing first ionisation enthalpy for Ca, Ba, Se, and Ar?

A. $S < Se < Ca < Ba < Ar$

B. $Ba < Ca < Se < S < Ar$

C. $Ca < Ba < S < Se < Ar$

D. $Ca < S < Ba < Se < Ar$

Answer: B

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Exercises (Archives) Assertion Reasoning

1. Assertion: F atom has less negative electron gain enthaply than Cl atom.

Reason: Additional eletrons are repelled more

effectively by 3 p-electronic in Cl than by 2 p-electrons is F atom.

A. Statement-I is true, Statement-II is true ,Statement -II is the correct explanation for Statement-I

B. Statement-I is true ,Statement -II is true, Statement -II is not the correct explanation for statement -II

C. Statement-I is true. Statement -II is false.

D. Statement-I is false. Statement -II is true.

Answer: C

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2. Assertion: The first ionisation energy of Be is greater than that of B.

Reason: 2p-orbital is lower in energy than 2s-orbital.

A. Statement-I is true, Statement-II is true ,Statement -II is the correct explanation for Statement-I

B. Statement-I is true ,Statement -II is true, Statement -II is not the correct explanation for statement -II

C. Statement-I is true. Statement -II is false.

D. Statement-I is false. Statement -II is true.

Answer: C

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Exercises (Archives) Fill In The Blanks

1. The energy released when an electron is added to a neutral gaseous atom is called. . . .. .of atom

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2. On Mulliken scale the average of IP and EA is known as _____ .

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3. Ca^{2+} has a smaller ionic radius than $K^{\oplus}$ because it has `"....."` .

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4. Compounds that formally contain Pb^{4+} are easily reduced to Pb^{+} .The stability of the lower oxidation state is due to . . . . . .

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Exercises (Archives) True/False

1. The softness of group IA metals increase down the group with increasing atomic number.

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2. In group IA of alkali metals, the ionisation potential decrease down the group,Therefore ,lithium is a poor reducing agent.

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3. The decreasing order of electron affinity of F, Cl and Br is $F > Cl > Br$.

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4. The basic nature of the hydroxides of group 13 decreases progessively down the group.

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Exercises (Archives)Subjective

1. Arrange the following in the given order

(a) Decreasing ionic size, $Mg^{2+}, O^{2-}, Na^{\oplus}, F^{\oplus}$

(b)Increasing first ionisaiton energy : Mg, Al, Si, Na

(c) Increasing bond length F_2, N_2, Cl_2O_2

(d) The order of their increasing size:

$Cl^{\ominus}, S^{2-}, Ca^{2+}, Al^{3+}$

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2. The IE_1 of C atom is greater than that of boron (B) atom, whereas the reverse is true for IE_2. Explain?

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3. Arrange the following as stated: Increasing order of ionic size

$N^{3-}, Na^{\oplus}, F^{\ominus}, O^{2-}, Mg^{2+}$

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4. Arrange the following ions in order of their decreasing ionic radii.

$Li^{\oplus}, K^{\oplus}, Mg^{2+}, Al^{3+}$

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