CHEMISTRY

BOOKS - DISHA PUBLICATION CHEMISTRY (HINGLISH)

CLASSIFICATION OF ELEMENTS AND PERIODICITY IN PROPERTIES

Jee Main 5 Years At A Glance

1. For Na^+, Mg^{2+}, F^- and O^{2-}, the correct order of increasing ionic radii is :

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

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

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

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

Answer: C

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2. Consider the following ionization enthalpies of two elements 'A' and 'B'

Element	Ionization enthalpy (kJ/mol)		
	1st	2nd	3rd
A	899	1757	14847
B	737	1450	7731

Which of the following statements is correct ?

A. Both 'A' and 'B' belong to group -1 where 'B' comes below 'A'.

B. Both 'A' and 'B' belong to group -1 where 'A' comes below 'B'.

C. Both 'A' and 'B' belong to group -2 where 'B' comes below 'A'.

D. Both 'A' and 'B' belong to group -2 where 'A' comes below 'B'.

Answer: C

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3. Both lithium and magnesium display several similar properties due to the diagonal relationship , however, the one which is incorrect is

A. Both form basic carbonates

B. Both form soluble bicarbonates

C. Both form nitrides

D. Nitrates of both Li and Mg yield NO_2 and O_2 on heating

Answer: A

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4. The following statements concern elements in the periodic table. Which of the following is true ?

A. For Group 15 elements, the stability of $+5$ oxidation state increases down the group

B. Elements of Group 16 have lower ionization enthalpy values compared to those of Group 15 in the corresponding periods.

C. The Group 13 elements are all metals

D. All the elements in Group 17 are gases.

Answer: B

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5. Which of the following atoms has the highest first ionisation energy ?

A. K

B. Sc

C. Rb

D. Na

Answer: B

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6. In the long form of the periodic table the valence shell electronic configuration of $5s^2 5p^4$ corresponds to the element present in:

A. Group 16 and period 6

B. Group 17 and period 6

C. Group 16 and period 5

D. Group 17 and period 5

Answer: C

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7. The ionic radii of N^{3-}, O^{2-} and F^{-} are respectively given by:

A. 1.71, 1.40 and 1.36

B. 1.71, 1.36 and 1.40

C. 1.36, 1.40 and 1.71

D. 1.36, 1.71 and 1.40

Answer: A

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

A. Li^+

B. O_2^{2-}

C. B^{3+}

D. F^-

Answer: A

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9. Which of the following series correctly represents relations between the elements from X to Y ?

$X \to Y$

A. $._3 Li \rightarrow_{19} K$ Ionization enthalpy increases

B. $._9 F \rightarrow_{35} Br$ Electron gain enthalpy (negative sign) increases

C. $._6 C \rightarrow_{32} Ge$ Atomic radii increases

D. $._{18} Ar \rightarrow_{54} Xe$ Noble character increases

Answer: C

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Exercise 1 Concept Builder Topic 1

1. The electronic configuration of an element is $1s^2, 2s^2, 2p^6, 3s^2 3p^3$. The atomic number and the group number of the element X which is just below the above element in the periodic table respectively, are

A. 23 and 5

B. 23 and 15

C. 33 and 15

D. 33 and 5

Answer: C

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2. Representative elements belong to

A. s-and p-blocks

B. p-and d-blocks

C. f-block only

D. d-and f-blocks

Answer: A

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3. The tenth element in the periodic table resembles the elements with atomic number

A. 2 and 30

B. 8 and 18

C. 2 and 54

D. 8 and 54

Answer: C

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4. The elements with atomic numbers 9, 17, 35,53, 85 and all

A. alkali metals

B. alkaline earth metals

C. halogens

D. noble gases

Answer: C

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5. The element $Z = 114$ has been discovered recently. It will belong to which of the family/group and electronic configuration?

A. Halogen family $[R_n]15f^{14}6d^{10}7s^27p^5$

B. Carbon family $[R_n]15f^{14}6d^{10}7s^27p^2$

C. Oxygen family $[R_n]15f^{14}6d^{10}7s^27p^4$

D. Nitrogen family $[R_n]15f^{14}6d^{10}7s^27p^3$

Answer: B

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6. The most abundant element in the universe is thought to be

A. carbon

B. oxygen

C. hydrogen

D. nitrogen

Answer: C

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7. Element with atomic number belongs to the period.....and the group .....

A. $4^{th}, 12^{th}$

B. $4^{th}, 11^{th}$

C. $5^{th}, 12^{th}$

D. $5^{th}, 11^{th}$

Answer: D

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8. Which of the following is the atomic number of a metal?

A. 32

B. 34

C. 36

D. 38

Answer: D

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9. The element having the electronic configuration $[Kr]4d(10)4f^{14}5s^25p^65d^26s^2$ belongs to

A. s-block

B. p-block

C. d-block

D. f-block

Answer: C

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10. The element with atomic number 118, will be

A. alkali

B. noble gas

C. lanthanide

D. transition element

Answer: B

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

A. first group

B. third group

C. fifth group

D. seventh group

Answer: C

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12. Eka-aluminium and Eka -silicon are known as :

A. gallium and germanium

B. aluminium and silicon

C. iron and sulphur

D. manganese and magnesium

Answer: A

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13. Which of the following remains unchanged in descending in a group in the periodic table?

A. Valence electrons

B. Atomic size

C. Density

D. Metallic character

Answer: A

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14. The heaviest atom amongst the following is

A. U

B. Ra

C. Pb

D. Hg

Answer: A

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15. An atom has electronic configuration $1s^2 2s^2 2p^6 3s^2 3P^6 3d^3 4s^2$. In which group wouold it be placed ?

A. Fifth

B. Fifteenth

C. Second

D. Third

Answer: A

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16. The statement that is not correct for the periodic classification of elements is : a)The properties of elements are the periodic functions of their atomic numbers. b)non-metallic elements are lesser in number than metallic elements. c)the first ionisation energies of elements along a period do not vary in a regular manner with increase in atomic number. d)for transition elements the $d-$ subshells are filled with electrons monotonically with increase in atomic number.

A. the properties of elements are periodic function 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 increase in atomic number.

D. for ionisation elements the d-subshells are filled with electrons monotonically with increase in atomic number.

Answer: D

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17. The elements in which 4f orbitals are progressively field up are called as

A. actinoids

B. transition elements

C. lanthanoids

D. halogens

Answer: C

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18. The statement that is not correct for the periodic classification of elements is : a)The properties of elements are the periodic functions of their atomic numbers. b)non-metallic elements are lesser in number than metallic elements. c)the first ionisation energies of elements along a period do not vary in a regular manner with increase in

atomic number. d)for transition elements the $d-$ subshells are filled with electrons monotonically with increase in atomic number.

A. The properties of elements are periodic function of their atomic numbers.

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

C. For transition elements the $3d$ orbitals are filled with electrons after $3p$-orbitals and before $4s$- orbitals

D. The first ionisation enthalpies of elements generally increase with increase in atomic number as we go along a period

Answer: C

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19. The number of elements in each of the inner transition series is

A. 2

B. 8

C. 10

D. 14

Answer: D

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20. Which of the following elements is a lanthanide (Rare-earth element) ?

A. Cadmium

B. Californium

C. Cerium

D. Cesium

Answer: C

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21. Which of the following is the artificial element in the periodic table ?

A. Tc

B. Te

C. Ru

D. Os

Answer: A

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Exercise 1 Concept Builder Topic 2

1. The correct order of radii is

A. $N < Be < B$

B. $F^- < O^{2-} < N^{3-}$

C. $N < Li < K$

D. $Fe^{3+} < Fe^{2+} < Fe^{4+}$

Answer: B

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2. When an electron is removed from an atom, its energy

A. increase

B. decreases

C. remains the same

D. none of these

Answer: A

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

A. $M^{2+}(g) \rightarrow M^{3+}(g)$

B. $M^{+}(g) \rightarrow M^{2+}(g)$

C. $M(g) \rightarrow M^{+}(g)$

D. $M^{-}(g) \rightarrow M(g)$

Answer: A

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4. Ionisation energy decreases down the group due to

A. increase in charge

B. increase in atomic size

C. decrease in size

D. decrease in shielding effect

Answer: B

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5. Which one has least ionisation potential?

A. Ne

B. N

C. O

D. F

Answer: C

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6. $Na^+, Mg^{2+}, Al^{3+},$ and Si^{4+} are isoelectronic ions. Their ionic size will follow the order

A. $Na^+ > Mg^{2+} > Al^{3+} > Si^{4+}$

B. $Na^+ < Mg^{2+} < Al^{3+} < Si^{4+}$

C. $Na^+ > Mg^{2+} > Al^{3+} < Si^{4+}$

D. $Na^+ < Mg^{2+} > Al^{3+} < Si^{4+}$

Answer: A

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7. Ionic radii are

A. inversely porportional to effective nuclear charge

B. inversely proportional to square of effective nuclear charge

C. directly proportional to effective nuclear charge

D. directly proportional to square of effective nuclear charge

Answer: A

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8. Which one of the following ions has the highest value of ionic radius?

A. O^{2-}

B. B^{3+}

C. Li^{+}

D. F^{-}

Answer: A

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9. 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. None of these values

Answer: A

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10. The screening effect of inner electrons of an atom can cause

A. decreases in the ionization energy

B. increases in the ionization energy

C. no effect on the ionization energy

D. increases the attraction of the nucleus for the electrons

Answer: A

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11. The second ionization potential of elements is invariably higher than first ionization potential because:

A. less than the first ionization potential

B. equal to the first ionization potential.

C. greater than the first ionization potential

D. none of these

Answer: C

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12. The pair of elements having approximately equal ionisation potential is

A. Al,Ga

B. Al,Si

C. Al,Mg

D. Al,B

Answer: A

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13. Which of the following option is incorrect with respect to ionic radii ?

A. $Ti^{4+} < Mn^{2+}$

B. . $^{35}Cl^{-} <^{37} Cl^{-}$

C. $K^{+} > Cl^{-}$

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

Answer: D

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14. Which of the following element has maximum, first ionisation potential?

A. V

B. Ti

C. Cr

D. Mn

Answer: D

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15. The radii of F, F^-, O and O^{-2} are in the order of

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

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

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

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

Answer: A

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16. Which of the following has same size?

A. Fe^{2+}, Ni^{2+}

B. Zr^{4+}, Ti^{4+}

C. Zr^{4+}, Hf^{4+}

D. Zn^{2+}, Hf^{4+}

Answer: C

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17. The correct decreasing order of first ionisation enthalpies of five elements of second period is

A. $Be > B > C > N > F$

B. $N > F > C > B > Be$

C. $F > N > C > Be > B$

D. $N > F > B > C > Be$

Answer: C

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18. The correct order of second ionisation potential of C, N, O and F is:

A. $O > N > F > C$

B. $O > F > N > C$

C. $F > O > N > C$

D. $C > N > O > F$

Answer: B

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19. Which of the following arrangements represents the increasing order (smallest of

largest) of ionic radii of the given species $O^{2-}, S^{2-}, N^{3-}, P^{3-}$?

A. $O^{2-} < N^{3-} < S^{2-}, P^{3-}$

B. $O^{2-} < P^{3-} < N^{3-}, s^{2-}$

C. $N^{3} < O^{2-} < P^{3-} < S^{2-}$

D. $N^{3-} < S^{2-} < O^{2-} < P^{3-}$

Answer: A

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20. The atomic sizes are not significantly different for the series of elements

A. Bi, Na, K, Pb

B. Na, Mg,Al,Si

C. O,S,Sc,Te

D. Cr,Mn,Fe,Co

Answer: D

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21. The correct order of the ionic radii of the ions is

A. $Br^- > Cl^- > S^{2-} > O^{2-} > F^-$

B. $Br^- > S^{2-} > Cl^- > O^{2-} > F^-$

C. $Br^- > S^{2-} > Cl^- > F^- > O^{2-}$

D. none of these

Answer: B

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22. The decreasing order of the ionization potential of the following elements is

A. $Al > Ga > \ln > Tl$

B. $Al > Ga > Tl > \ln$

C. $Al \approx Ga > \ln > Tl$

D. $Al \approx Ga > Tl > \ln$

Answer: D

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Exercise 1 Concept Builder Topic 3

1. Electron affinity is maximum for

A. Cl

B. F

C. Br

D. I

Answer: A

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2. Which one of the following has the highest electronegativity?

A. Br

B. Cl

C. P

D. Si

Answer: B

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3. The electron affinity for the inert gases is

A. zero

B. high

C. negative

D. positive

Answer: A

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4. An atom with high electronegativity has

A. large size

B. high ionisation potential

C. low electron affinity

D. low ionisation potential

Answer: B

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5. The stability of $+1$ oxidation state increases in the sequence :

A. $Tl < \ln < Ga < Al$

B. $\ln < Tl < Ga < Al$

C. $Ga < \ln < Al < Tl$

D. $Al < Ga < \ln < Tl$

Answer: D

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6. The correct order of acidic strength is

A. $Cl_2O_7 > SO_2 > P_4O_{10}$

B. $K_2O > CaO > MgO$

C. $CO_2 > N_2O_5 > SO_3$

D. $Na_2O > MgO > Al_2O_3$

Answer: A

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7. Which one of the these is basic ?

A. SiO_2

B. SO_2

C. CO_2

D. Na_2O

Answer: D

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8. Most acidic oxide is

A. Na_2O

B. ZnO

C. MgO

D. P_2O_5

Answer: D

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9. Which one of the following is an amphoteric oxide?

A. Na_2O

B. SO_2

C. B_2O_3

D. ZnO

Answer: D

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10. An element X occurs in short period having configuration ns^2np^1. The formula and nature of its oxide is:

A. XO_3, basic

B. XO_3 acidic

C. X_2O_3, amphoteric

D. X_2O_3 basic

Answer: C

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11. Which is chemically most active non-metal ?

A. S

B. O

C. F

D. N

Answer: C

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12. Which group of the periodic table contains coinagemetal ?

A. IIA

B. IB

C. IA

D. None of these

Answer: B

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13. Pauling's electronegativity values for elements are useful in predicting

A. Polarity of the molecules

B. Position in the E.M.F series

C. Coordination numbers

D. Dipole moments

Answer: A

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14. In the periodic table, with the increase in atomic number the metallic nature of elements

A. Decreases in a period and increases in a group

B. Increases in a period and decreases in a group

C. Increases both in a period and the group

D. Decreases in a period and the group

Answer: A

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15. Which is true about the electronegativity order of the following elements ?

A. $P > Si$

B. $C > N$

C. $Br > Cl$

D. $Sr > Ca$

Answer: A

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16. The element having very high ionization enthalpy but zero electron affinity is :-

A. H

B. F

C. He

D. B

Answer: C

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17. In the process , $Cl(g) + e^- \xrightarrow{\Delta H} Cl^-(g)$, ΔH is

A. positive

B. negative

C. zero

D. unpredictable

Answer: B

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Exercise 2 Concept Applicator

1. Which group is called buffer group of the periodic table ?

A. I

B. VII

C. VIII

D. Zero

Answer: D

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2. The screening effect of d-electrons is

A. Much less than s-electrons

B. Much more than s-electrons

C. Equal to s- eletrons

D. Equal to p-electrons

Answer: A

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3. Which form coloured salts ?

A. Non-metals

B. Metals

C. p-block elements

D. Transitional elements

Answer: D

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4. The electronic configuration of four elements are given below. Which element does not belong to the same family as others ?

A. $[Xe]4f^{14}5d^{10}1s^2$

B. $[XKr]4d^{10}5s^2$

C. $[Ne]3s^23p^5$

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

Answer: C

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5. What is the atomic number of the next halogen if discovered ?

A. 85

B. 117

C. 167

D. 104

Answer: B

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6. The element having the lowest atomic number and a ground state electronic configuration of $(n-1)d^6ns^2$ is placed in:

A. third period

B. fourth period

C. fifth period

D. sixth period

Answer: B

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7. The ionisation potential order for which set is correct ?

A. $Cs < Li < K$

B. $Cs > Li > B$

C. $Li > K > Cs$

D. $B > Li > K$

Answer: C

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8. 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

9. Highest energy will be absorbed to eject out the electron in the configuration

A. $1s^2 2s^2 2p^1$

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

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

D. $1s^2 2s^2 2p^4$

Answer: B

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10. In which of the following process highest energy is absorbed?

A. $Cu \rightarrow Cu^{+}$

B. $Br \rightarrow Br^{-}$

C. $I \rightarrow I^{-}$

D. $Li \rightarrow Li^{+}$

Answer: A

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11. Which ionisation potential (IP) in the following equations atom experience the greatest amount of energy ?

A. $Na \rightarrow Na^{+} + e^{-}$

B. $K^{+} \rightarrow K^{2+} + e^{-}$

C. $C^{2+} \rightarrow C^{3+} + e^{-}$

D. $Ca^{+} \rightarrow Ca^{2+} + e^{-}$

Answer: B

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12. Identify the correct order of the size of the following

A. $Ca^{2+} < K^{+} < Ar < Cl^{-} < S^{2-}$

B. $Ar < Ca^{2+} < K^{+} < Cl^{-} < S^{2-}$

C. $Ca^{2+} < Ar < K^{+} < Cl^{-} < S^{2-}$

D. $Ca^{2+} < K^{+} < Ar < S^{2-} < Cl^{-}$

Answer: A

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13. Which electronic configuration of an element has abnormally high difference between second and third ionization energy?

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

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

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

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

Answer: D

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14. Which of the following order is wrong-

A. $NH_3 < PH_3 < AsH_3$-Acidic

B. $Li < Be < B < C$- First IP

C. $Al_2O_3 < MgO < Na_2O < K_2O$-Basic

D. $Li^+ < Na^+ < K^+ < Cs^+$-Ionic radius

Answer: B

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15. The incorrect statement among the following is

A. The first ionization potential of Al is less than the first ionization potential of Mg.

B. The second ionization potential of Mg is greater than the second ionization potential of Na.

C. The first ionization potential of Na is less than the first ionization potential of Mg.

D. The third ionization potential of Mg is greater than the third ionization potential of Al

Answer: B

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16. Three elements X , Y and Z have atomic numbers 19 , 37 and 55 respectively . Then the correct statements (s) is / are

A. Their ionization potential would increase with increasing atomic number

B. Y' would have an ionisation potential between those of 'X' and 'Z'

C. Z' would have the highest ionization potential

D. Y' would have the highest ionization potential

Answer: B

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17. For which of the following ionic species radius would be maximum?

A. C^{4-}

B. N^{3-}

C. O^{2-}

D. Mg^{2+}

Answer: A

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18. Among the following which has the highest cation to anion size ratio ?

A. CsI

B. CsF

C. LiF

D. NaF

Answer: B

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19. First, second & third ionization energies are 737, 1045 & 7733 KJ/mol respectively. The element can be :

A. Na

B. B

C. Al

D. Mg

Answer: D

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20. Which of the following sequence correctly represents the decreasing acidic nature of oxides?

A. $Li_2O > BeO > B_2O_3 > CO_2 > N_2O_3$

B. $N_2O_3 > CO_2 > B_2O_3 > BeO > Li_2O$

C. $CO_2 > N_2O_3 > B_2O_3 > BeO > Li_2O$

D. $B_2O_3 > CO_2 > N_2O_3 > Li_2O > BeO$

Answer: B

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21. Which of the following is not the correct order for the stated property?

A. $Ba > Sr > Mg$, atomic radius

B. $F > O > N$: first ionization enthalpy

C. $Cl > F > I$, electron affinity

D. $O > Se > Te$, electronegativity

Answer: B

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22. In which of the following arrangements the order is NOT according to the property indicated against it ?

A. $Li < Na < K < Rb$

Increasing metallic radius

B. $I < Br < F < Cl$

Increasing electron gain enthalpy

(with negative sign)

C. $B < C < N < O$

Increasing first ionization enthalpy

D. $Al^{3+} < Mg^{2+} < Na^{+} < F^{-}$

Increasing ionic size

Answer: C

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23. Amphoteric oxides is/are

A. ZnO, K_2O, SO_3

B. ZnO, P_2O_5, Cl_2O_7

C. SnO_2, Al_2O_3, ZnO

D. PbO_2, SnO_2, SO_3

Answer: C

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24. Consider the following statements :

(I) The radius of an anion is larger than that of the parent atom

(II) The ionization energy generally increases with increasing atomic number in a period.

(III) The electronegativity of an element is the tendency of an isolated atom to at tract an electron.

Which of the above statements is/are correct?

A. I alone

B. II alone

C. I and II

D. II and III

Answer: C

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25. The first $(\Delta_i H_1)$ and second $(\Delta_i H_2)$ ionisation enthalpies $\left(\text{in} kJmol^{-1}\right)$ and the $\left(\Delta_{eg} H^{\ominus}\right)$ electron gain enthalpy $\left(\text{in} kJmol^{-1}\right)$ of a few elements are given

below:

Elements	$(\Delta_i H_1)$	$(\Delta_i H_2)$	$\Delta_{eg} H^{\ominus}$
I	520	7300	-60
II	419	3051	-48
III	1681	3374	-328
IV	1008	1846	-295
V	2372	5251	$+48$
VI	738	1451	-40

Which of the above elements is likely to be

a. the least reactive element.

b. the most reactive metal.

c. the most reactive non-metal.

d. the least reactive non-metal.

e. the metal which can form a stable binary halide of the formula MX2 (X=halogen).

f. the metal which can form a predominantly

stable covalent halide of the formula MX(X=halogen).

A. I and V

B. V and II

C. II and V

D. IV and V

Answer: C

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26. The element with positive electron gain enthalpy is

A. hydrogen

B. sodium

C. oxygen

D. neon

Answer: D

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27. For which of the following processes, enthalpy change is positive

A. $F(g) + e^- \rightarrow F^-(g)$

B. $Cl(g) + e^- \rightarrow Cl^-(g)$

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

D. $H(g) + e^- \rightarrow H^-(g)$

Answer: C

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28. The electron affinity of Li is $-59.6kJmol^{-1}$ which suggests that formation of gaseous Li^- anion is favourable energetically . If ionization energies of Li,Na and K are 520, 496 and 419 $kJmol^{-1}$, which of the following compounds has the stability?

A. Na^+Li^-

B. K^+Li^-

C. Rb^+Li^-

D. None of these

Answer: D

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29. Beryillum resembles Aluminium in properties. This is mainly due to

A. same values of their electronegativities

B. similar polarising powers of Be^{2+} and Al^{3+}

C. almost the same values of oxidation potentials

D. all of the above

Answer: D

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Exercise 2 Concept Applicator

1. Among Al_2O_3, SiO_2, P_2O_3 and SO_2 the correct order of acidic strength is:

A. $Al_2O_3 < SiO_2 < SO_2 < P_2O_3$

B. $SiO_2 < SO_2 < Al_2O_3 < P_2O_3$

C. $SO_2 < P_2O_3 < SiO_2 < Al_2O_3$

D. $Al_2O_3 < SiO_2 < P_2O_3 < SO_2$

Answer: D

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