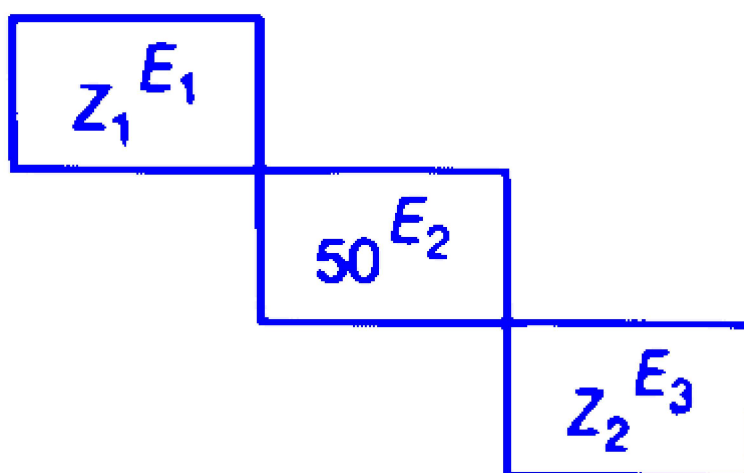


Periodic Table and Periodicity

Question1

Atomic numbers of three elements E_1 , E_2 and E_3 of periodic table are Z_1 , 50 and Z_2 respectively. From the position of the elements shown in figure, the values of $(Z_2 - Z_1)$ is



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Options:

A.

52

B.

46

C.

64

D.

34



Answer: A

Solution:

From periodic table,

E_1 will be Gallium with $Z_1 = 31$

E_2 will be Bismuth with $Z_2 = 83$

$$Z_2 - Z_1 = 83 - 31 = 52$$

Question2

Electron gain enthalpy values ($\Delta_{cg}H$) (in kJmol^{-1}) of elements X, Y and Z are $-349, -200$ and -295 respectively. X, Y and Z are respectively

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Options:

A.

Cl, I, S

B.

Cl, S, I

C.

S, Se, Te

D.

Na, K, Rb

Answer: B

Solution:

Element $X = \text{Cl}, Y = \text{S}, Z = \text{I}$

More the value of electron gain enthalpy, greater is the tendency to gain electron.



Question3

In which of the following options, elements are correctly arranged in the increasing order of their atomic radius?

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Options:

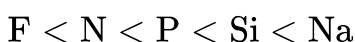
A.



B.



C.



D.



Answer: C

Solution:

The correct order of increasing atomic radius is $\text{F} < \text{N} < \text{P} < \text{Si} < \text{Na}$.

It is because atomic radius decreases across a period. While it increases down the group.

Question4

A, BC, D and *E* are elements with atomic numbers 13, 11, 9, 7 and 16 respectively. Among these elements, ion of an element *X* has largest size and ion of an element *Y* has smallest size. *X* and *Y* are respectively. (Assume that all ions have nearest inert gas configuration)



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Options:

A.

D, A

B.

A, D

C.

E, A

D.

D, A

Answer: C

Solution:

(i) Elements with atomic number 13, 11, 9, 7 and 16 are aluminium, sodium, fluorine, nitrogen and sulphur respectively. Thus, largest ions is S^{2-} , sulphide ion while smallest ion will be Al^{3+} ion. So, elements X and Y are E and A respectively.

Question5

The correct order of atomic radii of group 13 elements is

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Options:

A.

$Al > TI > Ga > In$

B.

$Al > Ga > In > TI$



C.

$\text{Tl} > \text{In} > \text{Ga} > \text{Al}$

D.

$\text{Tl} > \text{In} > \text{Al} > \text{Ga}$

Answer: D

Solution:

The correct order of atomic radii in group 13 elements is, $\text{Tl} > \text{In} > \text{Al} > \text{Ga}$.

Usually radii increases down the group, due to addition of shell, but Ga has smaller radii than Al due to poor shielding effect of *d*-electrons.

Question6

Observe the following oxides. The number of amphoteric oxides from the given list is CO , B_2O_3 , SnO_2 , PbO_2 , Ga_2O_3 , SnO , PbO , CO_2

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Options:

A.

3

B.

4

C.

5

D.

6



Answer: C

Solution:

Amphoteric oxide:

SnO, PbO, SnO₂, PbO₂, Ga₂O₃

Acidic oxide : CO₂, B₂O₃

Neutral : CO

Question 7

If first ionisation enthalpy ($\Delta_i H$) values of Na, Mg and Si are respectively 496, 737 and 786 kJ mol⁻¹, the first ionisation enthalpy value of Al (in kJ mol⁻¹) will be

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Options:

A. 575

B. 760

C. 400

D. 790

Answer: A

Solution:

The electronic configurations of the given elements are as follows:

Na (11): [Ne] 3s¹

Mg (12): [Ne] 3s²

Al (13): [Ne] 3s² 3p¹

Si (14): [Ne] 3s² 3p²

The ionization energy for Mg is greater than that for Na due to its fully filled 3s orbitals, which offer greater stability. In contrast, Al has a lower ionization energy than Mg because it has one electron more than a stable



configuration, making it easier to remove. However, Al's ionization energy is still less than that of Si because Si has a higher effective nuclear charge, which increases its ionization enthalpy.

Thus, the correct order of their first ionization enthalpies is:

$\text{Na} < \text{Mg} > \text{Al} < \text{Si}$

Among the options provided, only option (A) 575 kJ/mol conforms to this order.

Question8

The set containing the elements with positive electron gain enthalpies is

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Options:

A. S, Se, Te

B. Kr, Xe, Rn

C. Cl, Br, I

D. K, Rb, Cs

Answer: B

Solution:

Kr, Xe, Rn has positive electron gain enthalpies. All of above gases are noble gases. All the occupied subshell of noble gases are completely filled. Therefore, the additional electron has to be placed in an orbital of next higher shell. We can also say that energy has to be supplied to add an additional electron and hence, electron gain enthalpy of all noble gases are positive.

Question9

Assertion (A) : The ionic radii of Na^+ and F^- are same.

Reason (R) : Both Na^+ and F^- are isoelectronic species.

The correct answer is



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Options:

- A. Both A and R are correct and R is the correct explanation of A
- B. Both A and R are correct but R is not the correct explanation of A .
- C. A is correct but R is not correct.
- D. A is not correct but R is correct.

Answer: D

Solution:

A is not correct but R is correct.

The correct form of A is Na^+ has smaller size than F^- because after losing an electron Na will have less electron cloud and more effective nuclear charge whereas F after gaining an electron will have less effective nuclear charge than the parent atom.

Hence, F^- size increases.

Question 10

In which of the following ionic pairs, second ion is smaller in size than the first ion?

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Options:

- A. Al^{3+} , Mg^{2+}
- B. F^- , Na^+
- C. O^{2-} , N^{3-}
- D. Mg^{2+} , Na^+

Answer: B

Solution:

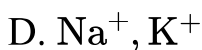
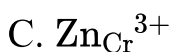
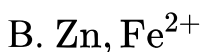
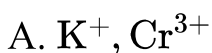
Na^+ has smaller size than F^- . It is because after losing an electron Na will have more effective nuclear charge whereas F after gaining an electron will have less effective nuclear charge than the parent atom so the size increases.

Question 11

In which of the following species, the ratio of *s*-electrons to *p*-electrons is same?

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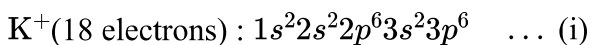
Options:



Answer: A

Solution:

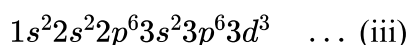
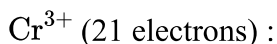
In the given species the ratio of *s*-electrons and *p*-electrons are same in K^+ , Cr^{3+} .



s-electrons = 6; *p*-electron = 12

$s : p = 6 : 12$ or $1 : 2$... (ii)

Similarly,



s-electrons = 6; *p*-electron = 12

$s : p = 6 : 12$ or $1 : 2$... (iv)



Question12

Identify the pair of elements in which the difference in atomic radii is maximum

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Options:

A. C, N

B. P, S

C. O, F

D. Li, Be

Answer: D

Solution:

In given set of options, the difference of atomic radius is largest in Li and Be . The reason is that these elements are in left corner of periodic table, although they have same number of shell, the electrostatic attraction between the electron and nucleus is much less as compared to others.

Question13

Match the following.

List I (Element) List II (Block)

A Ra I p - block

B Uuq II s- block

C Ds III f - block

D Fm IV d - block

The correct answer is

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Options:

A. A – II, B – III, C – IV, D – I

B. A – III, B – II, C – I, D – IV

C. A – III, B – IV, C – II, D – I

D. A - II, B-I, C-IV, D-III

Answer: D

Solution:

Option D is correct:

A - II: **Ra (Radium)** belongs to the **s-block** as it is an alkaline earth metal.

B - I: **Uuq (Ununquadium)** is now known as **Fl (Flerovium)** and belongs to the **p-block**, as it is a part of the post-transition metals.

C - IV: **Ds (Darmstadtium)** belongs to the **d-block**, as it is a transition metal.

D - III: **Fm (Fermium)** belongs to the **f-block**, as it is an actinide element.

These elements are classified based on their electron configurations, which determine their position in the periodic table's blocks.

Question14

Identify the pair of element in which the number of *s*-electrons to *p*-electrons ratio is 2 : 3

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Options:

A. P, Mg

B. P, Ca

C. O, Mg

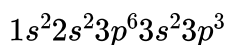
D. O, S

Answer: B



Solution:

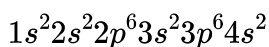
Electronic configuration of P



$$\Rightarrow s_{\text{electron}} = 6, p_{\text{electron}} = 9$$

$$s : p \Rightarrow 6 : 9 \text{ or } 2 : 3 \dots \text{(i)}$$

Electronic configuration of Ca



$$\Rightarrow s_{\text{electron}} = 8, p_{\text{electron}} = 12$$

$$s : p \Rightarrow 8 : 12 \text{ or } 2 : 3 \dots \text{(ii)}$$

Hence, P and Ca have same ratio of S_{electron} and p_{electron} .

Question 15

Which of the following has the least electron gain enthalpy?

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Options:

- A. Chlorine
- B. Iodine
- C. Oxygen
- D. Sulphur

Answer: C

Solution:

Electron gain enthalpy generally becomes more negative across a period as we move from left to right. Within a group, electron gain enthalpy becomes less negative down the group. However adding an electron to the $2p$ -orbital leads to greater repulsion than adding an electron to the larger $3p$ -orbital. Hence, most electronegative enthalpy is chlorine and least electron gain enthalpy is oxygen.



Question16

In which of the following options, the elements are correctly arranged with respect to their negative electron gain enthalpies?

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Options:

A. $P > S > Cl > F$

B. $S > P > F > Cl$

C. $Cl > F > S > P$

D. $F > Cl > P > S$

Answer: C

Solution:

The electron gain enthalpy (EA) increases along a period and decreases down the group. So, elements of group 17 i.e., Cl and F have more (-ve) EA than 16th group element i.e., S has more (-ve) EA than 15th group element P. However, EA of F is less than Cl due to small size of fluorine. Therefore, correct order of electron affinity is $Cl > F > S > P$.

Question17

In group 13 of the long form of periodic table an element X has a boiling point of T_2 (K) and melting point of T_1 (K). Identify the element X for which $T_2 - T_1$ (K) is maximum

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Options:

A. Al



B. Ga

C. In

D. B

Answer: B

Solution:

Elements	Boiling point (T_2 (K))	Melting point (T_1 (K))	$T_2 - T_1 = T$ (K)
Al	2740	933.5	1806.5
Ga	2478	302.92	2175.08
In	2350	429.78	1920.22
B	4275	2365	1910

From above table, it clearly seen that, $T_2 - T_1$ is maximum for Ga .

Question18

Consider the following.

(I) The order of first ionisation enthalpy of first three elements of 3rd period is $Mg > Al > Na$.

(II) The element with electronegativity of 3.5 is chlorine.

(III) The order of sizes of ions Mg^{2+} , Na^+ , F^- and O^{2-} is $Mg^{2+} < Na^+ < F^- < O^{2-}$.

(IV) The IUPAC name of the element with atomic number 106 is bohrium.

The correct statements are

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Options:

- A. I and II only
- B. II and III only
- C. I and III only
- D. II and IV only

Answer: C

Solution:

Let's analyze each statement one by one:

Statement (I): "The order of first ionisation enthalpy of first three elements of 3rd period is $\text{Mg} > \text{Al} > \text{Na}$."

The first three elements in the 3rd period are sodium (Na), magnesium (Mg), and aluminium (Al). The experimental ionisation energies are approximately:

Na: 496 kJ/mol

Mg: 738 kJ/mol

Al: 578 kJ/mol

Since magnesium has the highest ionisation energy, followed by aluminium and then sodium, the order $\text{Mg} > \text{Al} > \text{Na}$ is correct.

Statement (II): "The element with electronegativity of 3.5 is chlorine."

On the commonly used Pauli electronegativity scale, the values are approximately:

Fluorine: 4.0

Oxygen: 3.5

Chlorine: 3.16

Hence, an electronegativity of 3.5 corresponds more nearly to oxygen, not chlorine. This statement is incorrect.

Statement (III): "The order of sizes of ions Mg^{2+} , Na^+ , F^- , O^{2-} is $\text{Mg}^{2+} < \text{Na}^+ < \text{F}^- < \text{O}^{2-}$."

All these ions are isoelectronic (they each have 10 electrons). Their sizes depend on the nuclear charge. More protons pull the electrons closer, giving a smaller ionic radius.

Mg^{2+} (12 protons) is the smallest,

followed by Na^+ (11 protons),

then F^- (9 protons),

and finally O^{2-} (8 protons) is the largest.

Thus, the ordering given is correct.

Statement (IV): "The IUPAC name of the element with atomic number 106 is bohrium."

According to IUPAC, the element with atomic number 106 is called seaborgium (Sg). Bohrium (Bh) is element 107. Therefore, this statement is incorrect.

Since only Statements (I) and (III) are correct, the answer is:

Option C: I and III only.

Question19

Identify the correct statements from the following.

(I) Au is soluble in aqua regia but not Pt .

(II) Among the oxoacids of chlorine highest oxidation state possible for chlorine is +7 .

(III) Among the hydrogen halides lowest boiling point is for HCl .

(IV) The order of stability of oxides of halogens is $\text{Cl} > \text{Br} > \text{I}$.

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Options:

A. I and II only

B. II and III only

C. I and IV only

D. II and IV only

Answer: B

Solution:

Statements given in II and III are correct. While those in I and IV are incorrect. It is because Au and Pt both are soluble in aqua regia. Also, the correct stability order of oxides of halogens are $\text{I} > \text{Cl} > \text{Br}$.

