NARUMALAR ACADEMY – ONLINE COACHING CENTRE

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PGTRB – CHEMISTRY QUESTION BANK

UNIT -1 Periodic properties

TOPIC: Periodic properties – Atomic radius – ionic radius, ionization potential, electron affinity and electronegativity

Question

Q1. Assertion (A): The second ionization energy of Na is very high.
Reason (R): After removal of one electron, Na^+ has a stable noble gas configuration.
(A) Both A and R are true and R is the correct explanation.
(B) Both A and R are true but R is not the explanation.
(C) A is true but R is false.
(D) A is false but R is true.

Answer: Both A and R are true and R is the correct explanation.

Explanation: Removing the second electron breaks the stable Ne configuration, requiring very high energy.

Q2. Which of the following species has the largest radius?
(A) O^{2-}
(B) F^-
(C) Na^+
(D) Mg^{2+}

Answer: O^{2-}
Explanation: Negative ions are larger than their atoms. O^{2-} gains two electrons, causing maximum repulsion, hence largest.

Q3

Column A	**Column B**
(i) Na^+	A. Largest

Column A Column B

(ii) Mg^{2+} B. Smaller than atom

(iii) Cl^{-} C. Larger than atom

(iv) O^{2-} D. Smallest

Options:
(A) i–B, ii–D, iii–C, iv–A
(B) i–C, ii–D, iii–B, iv–A
(C) i–B, ii–C, iii–A, iv–D
(D) i–D, ii–B, iii–C, iv–A

Answer: i–B, ii–D, iii–C, iv–A
Explanation: Na^{+} smaller, Mg^{2+} smallest, Cl^{-} larger, O^{2-} largest.

Q4. Assertion (A): Electron affinity of chlorine is more negative than that of fluorine.
Reason (R): In F, extra electron enters a compact 2p orbital with strong electron repulsion.
(A) A and R true, R correct explanation.
(B) A and R true, R not explanation.
(C) A true, R false.
(D) A false, R true.

Answer: A and R true, R correct explanation
Explanation: Repulsions in fluorine's 2p orbitals make EA less negative than Cl.

Q5. Arrange the following in increasing order of electronegativity: N, O, C, F.
(A) C < N < O < F
(B) F < O < N < C
(C) N < C < O < F
(D) O < C < N < F

Answer: A and R true, R correct explanation
Explanation: Electronegativity increases across period: C (2.55) < N (3.04) < O (3.44) < F (3.98).

Q6. (Match the Following)

Column A	Column B
(i) Down group	A. Radius decreases
(ii) Across period	B. Electronegativity increases
(iii) Left to right	C. Ionization energy decreases
(iv) Top to bottom	D. Radius increases

Options:
(A) i–C, ii–A, iii–B, iv–D
(B) i–D, ii–B, iii–A, iv–C
(C) i–D, ii–B, iii–C, iv–A
(D) i–C, ii–D, iii–B, iv–A

Answer: i–D, ii–B, iii–A, iv–C
Explanation: Down group → radius ↑, IE ↓; Across → radius ↓, EN ↑.

Q7. Which one has the least electron affinity?
(A) Cl
(B) F
(C) Br
(D) I

Answer: I
Explanation: EA decreases down group → I has the least EA.

Q8. Assertion (A): Metallic character decreases across a period.
Reason (R): Electronegativity increases across a period.
(A) A and R true, R correct explanation.
(B) A and R true, R not explanation.
(C) A true, R false.
(D) A false, R true.

Answer: A and R true, R correct explanation.
Explanation: Increasing EN makes it harder to lose electrons → metallic nature decreases.

Q9. Which element has the highest ionization energy?
(A) Li

(B) Na
(C) K
(D) Cs

Answer: Li
Explanation: IE decreases down group → Li (smallest atom) has highest IE.

Q10.

Column A	Column B
(i) Li	A. Highest EA (halogens)
(ii) Cl	B. Lowest IE (Group 1)
(iii) Cs	C. Smallest radius (Group 1)
(iv) F	D. Highly electronegative

Options:
(A) i–C, ii–A, iii–B, iv–D
(B) i–B, ii–C, iii–D, iv–A
(C) i–C, ii–D, iii–A, iv–B
(D) i–A, ii–C, iii–B, iv–D

Answer: i–C, ii–A, iii–B, iv–D
Explanation: Li → smallest radius, Cl → highest EA, Cs → lowest IE, F → most EN.

Q11. Assertion (A): Atomic radius decreases across a period.
Reason (R): Effective nuclear charge increases across a period.
(A) A and R true, R correct explanation.
(B) A and R true, R not explanation.
(C) A true, R false.
(D) A false, R true.

Answer: A and R true, R correct explanation.
Explanation: More protons pull electrons inward, reducing size.

Q12. If the first ionization energy of Na is 496 kJ/mol, the second is expected to be:
(A) Slightly greater
(B) Much greater

(C) Same
(D) Less

Answer: Much greater
Explanation: Removing the 2nd electron breaks stable configuration → very high energy.

Q13. (Match the Following)

Column A	Column B
(i) C	A. 3.98
(ii) N	B. 3.44
(iii) O	C. 2.55
(iv) F	D. 3.04

Options:
(A) i–C, ii–D, iii–B, iv–A
(B) i–D, ii–C, iii–A, iv–B
(C) i–A, ii–B, iii–D, iv–C
(D) i–C, ii–B, iii–D, iv–A

Answer: i–C, ii–D, iii–B, iv–A
Explanation: Pauling values → C 2.55, N 3.04, O 3.44, F 3.98.

Q14. Which of the following shows correct order of atomic size?
(A) Mg > Al > Si
(B) Si > Al > Mg
(C) Mg < Al < Si
(D) Mg = Al = Si

Answer: Mg > Al > Si
Explanation: Across period size decreases: Mg > Al > Si.

Q15. Assertion (A): First ionization energy of Na is lower than that of Mg.
Reason (R): Na has larger radius and lower effective nuclear charge than Mg.
(A) A and R true, R correct explanation.
(B) A and R true, R not explanation.
(C) A true, R false.
(D) A false, R true.

Answer: A and R true, R correct explanation.
Explanation: Mg's stronger nuclear attraction → higher IE.

Q16. The atomic radius of O is 66 pm and F is 64 pm. Which is correct?
(A) O > F due to more electrons in O
(B) F < O due to greater nuclear charge in F
(C) O < F because O has smaller mass
(D) Both same because same period

Answer: F < O due to greater nuclear charge in F
Explanation: F has higher nuclear charge pulling electrons closer → smaller radius.

Q17. (Match the Following)

Column A	Column B
(i) Electron affinity	A. Decreases down group
(ii) Ionization energy	B. Increases across period
(iii) Atomic radius	C. Increases down group
(iv) Electronegativity	D. Decreases across period

Options:
(A) i–A, ii–B, iii–C, iv–B
(B) i–A, ii–B, iii–C, iv–A
(C) i–D, ii–A, iii–B, iv–C
(D) i–A, ii–B, iii–C, iv–B

Answer: i–A, ii–B, iii–C, iv–B
Explanation: EA ↓ down group, IE ↑ across, radius ↑ down, EN ↑ across.

Q18. Assertion (A): Ionic radius of an anion is larger than its parent atom.
Reason (R): Extra electrons increase repulsion, expanding the size.
(A) A and R true, R correct explanation.
(B) A and R true, R not explanation.
(C) A true, R false.
(D) A false, R true.

Answer: A and R true, R correct explanation
Explanation: Extra electrons → higher repulsion → larger radius.

Q19. Which of the following shows correct order of electron affinity (most negative → least)?
(A) Cl > F > Br > I
(B) F > Cl > Br > I
(C) Br > Cl > F > I
(D) I > Br > Cl > F

Answer: Cl > F > Br > I
Explanation: EA decreases down group; Cl slightly higher than F due to repulsion effects.

Q20

Column A	**Column B**
(i) Na	A. Highest electron affinity
(ii) Cl	B. Smallest radius
(iii) F	C. Low ionization energy
(iv) Ne	D. Zero electron affinity

Options:
(A) i–C, ii–A, iii–B, iv–D
(B) i–C, ii–B, iii–A, iv–D
(C) i–D, ii–C, iii–B, iv–A
(D) i–C, ii–A, iii–D, iv–B

Answer: i–C, ii–A, iii–B, iv–D
Explanation: Na → low IE, Cl → high EA, F → smallest, Ne → zero EA.