CHAPTER

3

CLASSIFICATION OF ELEMENTS AND PERIODICITY IN PROPERTIES

FACT/DEFINITION TYPE QUESTIONS

1. Periodic classification of elements is used to examine the
(a) periodic trends in physical properties of elements
(b) periodic trends in chemical properties of elements
(c) Both (a) and (b)
(d) None of the above

2. Cl, Br, I, if this is Dobereiner's triad and the atomic masses of Cl and I are 35.5 and 127 respectively the atomic mass of Br is
(a) 162.5 (b) 91.5
(c) 81.25 (d) 45.625

3. If the two members of a Dobereiner triad are phosphorus and antimony, the third member of this triad is
(a) arsenic (b) sulphur
(c) iodine (d) calcium

4. The law of triads is applicable to a group of
(a) Cl, Br, I (b) C, N, O
(c) Na, K, Rb (d) H, O, N

5. In 1800, only ....X.... elements were known. Here, X refers to
(a) 63 (b) 31
(c) 114 (d) 92

6. Johann Doberiner gave the idea of trends among physical and ...X... of several groups of three elements. Here, X refers to
(a) atomic number (b) atomic mass
(c) chemical properties (d) None of these

7. Which of the following is the correct set of elements to Dobereiner's triads ?
(a) Li 7, Na 23, K 39 (b) Br 80, Cl 35.5, I 127
(c) Fe 55.85, Ni 58.71, Co 58.93 (d) Data insufficient

8. On which of the following Dobereiner's Triad law is not applicable?
(a) Cl, Br, I (b) Ca, Sr, B
(c) F, Cl, Br (d) Li, Na, K

9. Newlands could classify elements only upto –
(a) copper (b) chlorine
(c) calcium (d) chromium

10. According to Newlands theory, when elements are arranged in the order of increasing atomic weight which number element had similar properties to the first element.
(a) third (b) seventh
(c) eighth (d) sixth

11. Lothar Meyer plotted the physical properties such as atomic volume, melting point and ...X... against atomic weight. Here, X refers to
(a) mass (b) boiling point
(c) surface tension (d) None of these

12. The most significant contribution towards the development of periodic table was made by
(a) Mendeleev (b) Avogadro
(c) Dalton (d) Cavendish

13. Noble gases were included in Mendeleev's periodic table in the
(a) 1st group (b) 7th group
(c) 8th group (d) None of these

14. Mendeleev classified elements in
(a) increasing order of atomic groups
(b) eight periods and eight groups
(c) seven periods and nine groups
(d) eight periods and seven groups

15. Select the correct chronological order for the discoveries of the following scientists.
Dobereiner, Newlands, Chancourtois, Mendeleev
(a) Chancourtois, Dobereiner, Newlands, Mendeleev
(b) Dobereiner, Chancourtois, Newlands, Mendeleev
(c) Dobereiner, Newlands, Chancourtois, Mendeleev
(d) Chancourtois, Newlands, Dobereiner, Mendeleev

16. The molecular formula of chloride of Eka-Aluminium and Eka-Silicon respectively are
(a) $GaCl_3$ and SiO_4 (b) $GaCl_3$ and $AlCl_3$
(c) $AlCl_3$ and $SiCl_4$ (d) $GaCl_3$ and $GeCl_4$

17. Who developed long form of the periodic table?
(a) Lothar Meyer (b) Neils Bohr
(c) Mendeleev (d) Moseley

18. At present, how many elements are known
(a) 110 (b) 112
(c) 113 (d) 118

19. Which of the scientists given below discovered that periodic table should be based on the atomic number ?
(a) Mendeleev (b) Newlands
(c) Moseley (d) Lothar Meyer

20. How many elements are there in 6^{th} period of periodic table?
(a) 18 (b) 8
(c) 30 (d) 32

21. Modern periodic table is based on the atomic number of the elements. The experiment which proved the significance of the atomic number was
(a) Mulliken's oil drop experiment
(b) Mosley's work on X-ray spectra
(c) Bragg's work on X-ray diffraction
(d) Discovery of X-rays by Rontgen

22. The period number in the periodic table corresponds to the ...A... principal quantum number (n) of the elements. Here, A refers to
(a) lowest (b) highest
(c) middle (d) None of these

23. The symbol and IUPAC name for the element with atomic number 120, respectively are
(a) Ubn and unbinilium (b) Ubn and unbiunium
(c) Ubn and unnibium (d) Ubn and unnilium

24. Element with which of the following atomic number was named by American Society as Rutherfordium, while by Soviet Society it was named as Kurchatovium?
(a) 108 (b) 104
(c) 114 (d) 110

25. What is the IUPAC name of the element with atomic number 114 ?
(a) Ununnnium (b) Unnilquadium
(c) Ununquadium (d) Unnilennium.

26. Element with electronic configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 5s^2\ 5p^3$ belongs to the following group of the periodic table
(a) 2nd (b) 5th
(c) 3rd (d) 7th

27. The long form of periodic table consists of
(a) seven periods and eight groups
(b) seven periods and eighteen groups
(c) eight periods and eighteen groups
(d) eighteen periods and eight groups

28. All the members in a group in long form of periodic table have the same
(a) valence
(b) number of valence electrons
(c) chemical properties
(d) All of the above

29. Elements of which group form anions most readily?
(a) Oxygen family (b) Nitrogen family
(c) Halogens (d) Alkali metals

30. Element having atomic no. of 56 belongs to which of the following block of periodic table?
(a) *p*- block (b) *d*-block
(c) *f*- block (d) *s*-block

31. In the modern periodic table one of the following does not have appropriate position –
(a) transition elements
(b) inert gases
(c) inner transition elements
(d) halogens

32. 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.

33. An atom has electronic configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^3\ 4s^2$, you will place it in which group?
(a) Fifth (b) Fifteenth
(c) Second (d) Third

34. Which of the following is not an actinoid ?
(a) Curium ($Z=96$) (b) Californium ($Z=98$)
(c) Uranium ($Z=92$) (d) Terbium ($Z=65$)

35. The period number in the long form of the periodic table is equal to
(a) magnetic quantum number of any element of the period.
(b) atomic number of any element of the period.
(c) maximum Principal quantum number of any element of the period.
(d) maximum Azimuthal quantum number of any element of the period.

36. The electronic configuration of four elements are given below. Which elements does not belong to the same family as others?
(a) $[Xe]4f^{14}\ 5d^{10}ls^2$ (b) $[Kr]4d^{10}\ 5s^2$
(c) $[Ne]3s^2 3p^5$ (d) $[Ar]\ 3d^{10}\ 4s^2$

37. The elements with atomic numbers 9, 17, 35, 53 and 85 belong to
(a) alkali metals (b) alkaline earth metals
(c) halogens (d) noble gases

38. Which of the following pairs has both members from the same period of the periodic table.
(a) Na – Ca (b) Na – Cl
(c) Ca – Cl (d) Cl – Br

39. The elements which are characterized by the outer electronic configuration ns^1 to $ns^2\ np^6$ are collectively called
(a) Transition elements
(b) Representative elements
(c) Lanthanides
(d) Inner transition elements

40. f-block elements are called inner transition elements because
(a) they have properties similar to those of transition elements
(b) they exist in between transition elements
(c) the last electron enters into the f-orbital of the penultimate shell
(d) the last electron enters into any orbital of penultimate shell

41. An element, which belongs to third period and group 16 in the periodic table has electronic configuration.
(a) $1s^2, 2s^2 2p^6, 3s^2 3p^3$ (b) $1s^2, 2s^2 2p^6, 3s^2 3p^4$
(c) $1s^2, 2s^2 2p^6, 3s^2 3p^5$ (d) $1s^2, 2s^2 2p^4$

42. Which of the following is non-metallic ?
(a) B (b) Be
(c) Mg (d) Al

43. Which group of the periodic table contains coinage metal ?
(a) IIA (b) IB
(c) IA (d) None of these

44. The only non-metal which is liquid at ordinary temperature is
(a) Hg (b) Br_2
(c) NH_3 (d) None of these

45. Which is a metalloid?
(a) Pb (b) Sb
(c) Bi (d) Zn

46. In the long form of the periodic table all the non-metals are placed in
(a) *s*-block (b) *p*-block
(c) *f*-block (d) *d*-block

47. Arrange the following elements in the order of their increasing non-metallic character
Li, O, C, Be, F
(a) F < O < C < Be < Li (b) Li < Be < C < O< F
(c) F < O < C < Be < Li (d) F < O < Be < C < Li

48. Which is the correct order of ionic sizes (At. No. : Ce = 58, Sn = 50, Yb = 70 and Lu = 71) ?
(a) Ce > Sn > Yb > Lu (b) Sn > Ce > Yb > Lu
(c) Lu > Yb > Sn > Ce (d) Sn > Yb > Ce > Lu

49. The order of increasing sizes of atomic radii among the elements O, S, Se and As is :
(a) As < S < O < Se (b) Se < S < As < O
(c) O < S < As < Se (d) O < S < Se < As

50. In the ions P^{3-}, S^{2-} and Cl^-, the increasing order of size is
(a) Cl^-, S^{2-}, P^{3-} (b) P^{3-}, S^{2-}, Cl^-
(c) S^{2-}, Cl^-, P^{3-} (d) S^{2-}, P^{3-}, Cl^-

51. Which of the following is correct ?
(a) Isoelectronic ions have same nuclear charge
(b) Isoelectronic ions have same neutrons
(c) Isoelectronic ions have same number of electrons
(d) All are correct

52. On going down a main sub-group in the periodic table (example *Li* to *Cs* in IA or *Be* to *Ra* in IIA), the expected trend of changes in atomic radius is a
(a) continuous increase
(b) continuous decrease
(c) periodic one, an increase followed by a decrease
(d) decrease followed by increase

53. Why the size of an anion is larger than the parent atom?
(a) Due to increased repulsion among the electrons.
(b) Due to decrease in effective nuclear charge.
(c) Due to increased in effective nuclear charge.
(d) Both (a) and (b)

54. Which ionisation potential (IP) in the following equations involves the greatest amount of energy ?
(a) $Na \rightarrow Na^+ + e^-$ (b) $K^+ \rightarrow K^{2+} + e^-$
(c) $C^{2+} \rightarrow C^{3+} + e^-$ (d) $Ca^+ \rightarrow Ca^{2+} + e^-$

55. Arrange S, P, As in order of increasing ionisation energy
(a) S < P < As (b) P < S < As
(c) As < S < P (d) As < P < S

56. The statement that is not correct for periodic classification of elements is :
(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 3*d*-orbitals are filled with electrons after 3*p*-orbitals and before 4*s*-orbitals.
(d) The first ionisation enthalpies of elements generally increase with increase in atomic number as we go along a period.

57. Consider the following changes
$A \rightarrow A^+ + e^- : E_1$ and $A^+ \rightarrow A^{2+} + e^- : E_2$
The energy required to pull out the two electrons are E_1 and E_2 respectively. The correct relationship between two energies would be
(a) $E_1 < E_2$ (b) $E_1 = E_2$
(c) $E_1 > E_2$ (d) $E_1 \geq E_2$

58. Of the given electronic configurations for the elements, which electronic configuration indicates that there will be abnormally high difference in the second and third ionization energy for the element?
(a) $1s^2 2s^2 2p^6 3s^2$ (b) $1s^2 2s^2 2p^6 3s^1$
(c) $1s^2 2s^2 2p^6 3s^2 3p^1$ (d) $1s^2 2s^2 2p^6 3s^2 3p^2$

59. Alkali metals are powerful reducing agents because
(a) these are metals
(b) their ionic radii are large
(c) these are monovalent
(d) their ionisation potential is low

60. Which of the following metals requires the radiation of highest frequency to cause the emission of electrons ?
(a) Na (b) Mg
(c) K (d) Ca

61. Halogens and chalcogens family have highly ...P.. electron gain enthalpy. Here, P refers to
(a) negative (b) positive
(c) zero (d) infinity

62. Which of the following represents the correct order of increasing electron gain enthalpy with negative sign for the elements O, S, F and Cl ?
(a) Cl < F < O < S (b) O < S < F < Cl
(c) F < S < O < Cl (d) S < O < Cl < F

63. The electron affinity for the inert gases is –
(a) zero (b) high
(c) negative (d) positive

64. The element with positive electron gain enthalpy is
(a) hydrogen (b) sodium
(c) oxygen (d) neon

65. Which of the following will have the least negative electron gain enthalpy?
(a) P (b) S
(c) Cl (d) F

66. Which is the correct order of electronegativity ?
(a) F > N < O > C (b) F > N > O > C
(c) F > N > O < C (d) F < N < O = C

67. The correct order of decreasing electronegativity values among the elements I-beryllium, II-oxygen, III-nitrogen and IV-magnesium is
(a) II > III > I > IV (b) III > IV > II > I
(c) I > II > III > IV (d) I > II > IV > III

68. An element having electronic configuration
$1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,4s^1$ forms
(a) Acidic oxide (b) Basic oxide
(c) Amphoteric oxide (d) Neutral oxide

69. Diagonal relationship is shown by
(a) All elements with their diagonally downward elements towards right
(b) Most of the elements of second period
(c) All 3d series elements
(d) None of the above

70. In any period the valency of an element with respect to oxygen
(a) Increases one by one from IA to VIIA
(b) Decreases one by one form IA to VIIA
(c) Increases one by one from IA to IVA and then decreases from VA to VIIA one by one
(d) Decreases one by one from IA to IVA and then increases from VA to VIIA one by one

71. What will be the formula of the compound formed by the silicon and bromine ?
(a) $SiBr_2$ (b) $SiBr_4$
(c) $SiBr_3$ (d) SiBr

72. 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) $B_2O_3 > CO_2 > N_2O_3 > Li_2O > BeO$

STATEMENT TYPE QUESTIONS

73. Choose the correct coding for following statements. Here T stands for True and F stands for False statement.
(i) Mendeleev left several gaps in his periodic table for the undiscovered elements.
(ii) The gap under aluminium and a gap under silicon was left and these elements were called Eka aluminium and Eka silicon.
(iii) Germanium was placed in place of Eka-aluminium and gallium was placed in place of Eka silicon.
(a) TTT (b) TFF
(c) TTF (d) TFT

74. Which of the following statement(s) about the modern periodic table is/are incorrect ?
(i) The elements in the modern periodic table are arranged on the basis of their decreasing atomic number
(ii) The elements in the modern periodic table are arranged on the basis of their increasing atomic masses
(iii) Isotopes are placed in adjoining group(s) in the periodic table
(iv) The elements in the modern periodic table are arranged on the basis of their increasing atomic number
(a) (i) only (b) (i), (ii) and (iii)
(c) (i), (ii) and (iv) (d) (iv) only

75. Consider the following statements:
(i) The discovery of inert gases later on did not disturb Mendeleev's arrangement.
(ii) In the present periodic table, periodicity in the properties of elements is related to the periodicity in their electronic configurations.
Which of these statement(s) is/are correct ?
(a) (i) only (b) (ii) only
(c) Both (i) and (ii) (d) Neither (i) nor (ii)

76. Which of the following statements are correct?
(i) The second period ($n = 2$) starts with lithium and third electron enters the 2*s* orbital. The next element, beryllium has four electrons and has the electronic configuration $1s^2 2s^2$. From the next element boron, the 2*p* orbitals are filled with electrons when the L shell is completed at neon ($2s^2 2p^6$). Thus there are 8 elements in the second period.
(ii) Successive filling of 3*s* and 3*p* orbitals gives rise to the third period of 8 elements from sodium to argon.
(iii) The fourth period ($n = 4$) starts at potassium and the added electron fill up the first 4*s* and 4*p* orbitals than 3*d* orbital is filled.
(iv) Fifth period begins with rubidium with the filling of 5*s* orbital and ends at xenon with the filling up of the 5*p* orbital.
(a) (i) and (ii) (b) (i), (ii) and (iii)
(c) (iii) and (iv) (d) (i), (ii) and (iv)

77. With reference to the chemical element with atomic number 17, consider the following statements:
(i) It belongs to second period in the periodic table of chemical elements.
(ii) It forms anion with unit negative charge.
Which of the statement(s) given above is/are correct ?
(a) (i) only (b) (ii) only
(c) Both (i) and (ii) (d) Neither (i) nor (ii)

78. Choose the correct codes for the following statements related to *s*-block elements. Here 'T' stands for true and F stands for false statement.
(i) They are all reactive metals with low ionization enthalpies.
(ii) Their metallic character and reactivity increase as we go down the group.
(iii) They are found in pure form in nature.
(iv) All the compounds of *s*-block elements are ionic in nature.
(a) TTFF (b) TTFT
(c) TTTF (d) TFFF

79. Consider the following statements:
(i) The elements silicon, germanium and arsenic are called metalloids.
(ii) Metalloids have properties quite different from those of metals and non-metals.
Which of these statement(s) is/are correct ?
(a) (i) only (b) (ii) only
(c) Both (i) and (ii) (d) Neither (i) nor (ii)

80. Consider the following statements:
(i) Metals will be found on the right side of the periodic table.
(ii) The element P, S and O belong to the same period.
Which of these statement(s) is/are correct ?
(a) (i) only (b) (ii) only
(c) Both (i) and (ii) (d) Neither (i) nor (ii)

81. Consider the following statements:
(i) Atomic radii decreases across a row of the periodic table when we move from left to right.
(ii) Atomic radii increases down the column as we move from top to bottom.
(iii) Although the order of elements is based on atomic numbers, vertical families share similar chemical properties.
Which of the statement(s) given above is/are correct?
(a) (i) and (ii) (b) (i) and (iii)
(c) (ii) and (iii) (d) (i), (ii) and (iii)

82. Consider the following statements:
(i) Fluorine has the highest electron affinity in the periodic table.
(ii) Noble gases are placed extremely left in periodic table.
(iii) Magnesium is more metallic in nature than sodium.
Which of these statement(s) is/are correct ?
(a) (i) and (ii) (b) (i) and (iii)
(c) Only (i) (d) Only (ii)

83. Which of the following statement(s) is/are incorrect?
(i) Ionization enthalpy is expressed in units of $kJmol^{-1}$.
(ii) Ionization enthalpy is always positive.
(iii) Second ionization enthalpy will be higher than the third ionization enthalpy.
(a) Only (ii) (b) Only (iii)
(c) (ii) and (iii) (d) None of these

84. Consider the following statements:
(i) There are 16 groups and 7 periods in the modern periodic table.
(ii) Electro-positive character decreases on moving down a group.
(iii) Electro-negativity in a period increases right from the alkali metal to the inert gas element.
Which of these statement(s) is/are correct ?
(a) (i) and (ii) (b) (i) and (iii)
(c) All are correct (d) All are incorrect

85. Read the following three statements and choose the correct option. Here T stands for true and F stands for false statement.
(i) Boron has a smaller first ionization enthalpy than beryllium.
(ii) Nitrogen has smaller first ionization enthalpy than oxygen.
(iii) The first ionization enthalpy increases across a period.
(a) FTT (b) TFT
(c) TFF (d) FFT

86. 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 elements increases on moving down across a group.
Which of the above statements is/are correct?
(a) (i) alone (b) (ii) alone
(c) (i) and (ii) (d) (ii) and (iii)

MATCHING TYPE QUESTIONS

87. Match the Column-I and Column-II and select correct answer by given codes.

Column-I (Year)	**Column-II (The number of elements discovered)**
(A) 1800	(p) 118
(B) 1865	(q) 63
(C) At present	(r) 31

(a) A – (q), B – (p), C – (r)
(b) A – (r), B – (p), C – (q)
(c) A – (q), B – (r), C – (p)
(d) A – (r), B – (q), C – (p)

88. Match the columns.

Column-I	**Column-II**
(A) Newland law of octaves	(p) Atomic mass vs Atomic volume
(B) Mendeleev	(q) Li, Na, K
(C) Electronic configuration	(r) One to seven groups sub-divided into group A and B
(D) Lother Meyer	(s) Periodic repetition of properties of elements
(E) Dobereiner's triad	(t) Only 56 elements known

(a) A–(t); B–(s); C–(r); D–(p); E–(q)
(b) A–(t); B–(r); C–(s); D–(p); E – (q)
(c) A–(t); B–(r); C–(s); D–(q); E – (p)
(d) A–(r); B–(t); C–(s); D–(p); E – (q)

89. Match the columns :

	Column-I		Column-II
(A)	On arraging in order of atomic weights, physical and chemical properties are repeated at regular intervals.	(p)	Mendeleev
(B)	Elements are arranged in the order of increasing atomic weights.	(q)	Lothar Meyer
(C)	Elements were arranged on the basis of similar properties ignoring order of atomic weights	(r)	Moseley
(D)	Atomic number is a more fundamental property of an element than its atomic mass	(s)	Chancourtois

(a) A – (p), B – (q), C – (s), D – (r)
(b) A – (r), B – (s), C – (r), D – (p)
(c) A – (q), B – (p), C – (s), D – (r)
(d) A – (q), B – (s), C – (p), D – (r)

90. Match Column-I (IUPAC nomenclature of element) with Column-II (IUPAC official name).

	Column-I		Column-II
(A)	Unnilhexium	(p)	Lawrencium
(B)	Unniltrium	(q)	Dubnium
(C)	Unnilunium	(r)	Seaborgium
(D)	Unnilpentium	(s)	Mendelevium

(a) A – (s), B – (p), C – (r), D – (q)
(b) A – (r), B – (p), C – (s), D – (q)
(c) A – (r), B – (s), C – (p), D – (q)
(d) A – (q), B – (r), C – (p), D – (s)

91. Match the columns.

	Column-I (Name of element)		Column-II (Group of element)
(A)	Nitrogen	(p)	15
(B)	Aluminium	(q)	16
(C)	Chlorine	(r)	17
(D)	Oxygen	(s)	13
(E)	Copper	(t)	11

(a) A – (p), B – (s), C – (r), D – (q), E – (t)
(b) A – (s), B – (p). C – (r), D – (q), E – (t)
(c) A – (p), B–(s), C – (q), D – (r), E – (t)
(d) A – (p), B – (s), C – (r), D – (t), E – (q)

92. Match the columns.

	Column-I (Name of element)		Column-II (Period of element)
(A)	Hydrogen	(p)	3
(B)	Sodium	(q)	4
(C)	Calcium	(r)	6
(D)	Barium	(s)	1
(E)	Iodine	(t)	5

(a) A – (p), B – (s), C – (q), D – (r), E – (t)
(b) A – (s), B – (p), C – (q), D – (r), E – (t)
(c) A – (s), B – (q), C – (p), D – (r), E – (t)
(d) A – (s), B – (p), C – (q), D – (t), E – (r)

93. Match the columns.

	Column-I		Column-II
(A)	's' block elements	(p)	Cr
(B)	'p' block elements	(q)	Na
(C)	'd' block elements	(r)	Ce
(D)	'f' block elements	(s)	Si

(a) A – (s), B – (q), C – (p), D – (r)
(b) A – (q), B – (s), C – (r), D – (p)
(c) A – (q), B – (p), C – (s), D – (r)
(d) A – (q), B – (s), C – (p), D – (r)

94. Match the columns.

	Column-I		Column-II
(A)	Element with largest size in second period	(p)	Boron
(B)	Element with smallest size in group 13	(q)	Fluorine
(C)	Element with maximum non-metallic character	(r)	Bromine
(D)	Element with smallest size in fourth period	(s)	Lithium
(E)	Element with most metallic character in group 14	(t)	Lead

(a) A – (s), B – (p), C – (q), D – (t), E – (r)
(b) A – (p), B – (s), C – (q), D – (r), E – (t)
(c) A – (s), B – (q), C – (p), D – (r), E – (t)
(d) A – (s), B – (p), C – (q), D – (r), E – (t)

95. Match the columns.

	Column-I		Column-II
(A)	Electronegativity	(p)	Isotopes
(B)	Lanthanides	(q)	increases along a period
(C)	Transition elements	(r)	*f*-group of elements
(D)	Ionisation energy	(s)	*d*-group of elements
(E)	Elements of same atomic number but different mass number	(t)	decreases along a group

(a) A – (q), B – (r), C – (s), D – (p), E – (t)
(b) A – (r), B – (q), C – (s), D – (t), E – (p)
(c) A – (q), B – (r), C – (s), D – (t), E – (p)
(d) A – (q), B – (s), C – (r), D – (t), E – (q)

96. Match Column-I with Column-II and select the correct answer by the given codes.

	Columnn-I (Atoms)		Column-II (Properties)
(A)	He	(p)	High electronegative
(B)	F	(q)	Most electropositive
(C)	Rb	(r)	Strongest reducing agent
(D)	Li	(s)	Highest ionisation energy

(a) A – (s), B – (q), C – (r), D – (p)
(b) A – (p), B – (s), C – (q), D – (r)
(c) A – (s), B – (p), C – (r), D – (q)
(d) A – (s), B – (p), C – (q), D – (r)

97. Match the Column-I and Column-II and select the correct answer by given codes.

Column-I (Elements)	Column-II (Properties)
(A) $Li^+ < Al^{3+} < Mg^{2+} < K^+$	(p) DEA (Electron affinity)
(B) $Li^+ > Al^{3+} > Mg^{2+} > K^+$	(q) Ionic radii
(C) Cl > F > Br > I	(r) EN (Electronegativity)
(D) F > Cl > Br > I	(s) Effective nuclear charge

(a) A – (q), B – (s), C – (r), D – (p)
(b) A – (q), B – (s), C – (p), D – (r)
(c) A – (s), B – (q), C – (r), D – (p)
(d) A – (s), B – (q), C – (p), D – (r)

98. Match the columns on the basis of diagonal relationship between elements.

Column-I	Column II
(A) Li	(p) Na
(B) Be	(q) Al
(C) B	(r) Si
	(s) Mg

(a) (A) – (s), B – (r), C – (p)
(b) (A) – (s), B – (q), C – (r)
(c) (A) – (s), B – (q), C – (p)
(d) (A) – (q), B – (s), C – (p)

99. Match the columns

Column-I	Column-II
(A) $[BF_4]^-$	(p) 7, +7
(B) $[A1F_6]^{3-}$	(q) 4, +4
(C) OF_2	(r) 6, +3
(D) SiF_4	(s) 2, +2
(E) IF_7	(t) 4, +3

(a) A – (s), B – (q), C – (t), D – (r), E – (p)
(b) A – (t), B – (r), C – (s), D – (q), E – (p)
(c) A – (q), B – (r), C– (t), D – (s), E – (p)
(d) A – (r), B – (q), C – (s), D – (p), E – (t)

ASSERTION-REASON TYPE QUESTIONS

Directions : Each of these questions contain two statements, Assertion and Reason. Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select one of the codes (a), (b), (c) and (d) given below.

(a) Assertion is correct, reason is correct; reason is a correct explanation for assertion.
(b) Assertion is correct, reason is correct; reason is not a correct explanation for assertion
(c) Assertion is correct, reason is incorrect
(d) Assertion is incorrect, reason is correct.

100. **Assertion :** In a triad, the three elements present have same gaps of atomic masses.
Reason : Elements in a triad have similar properties.

101. **Assertion :** According to Mendeleev, periodic properties of elements is a function of their atomic number.
Reason : Atomic number is equal to the number of protons.

102. **Assertion :** Atomic number of the element ununbium is 112.
Reason : Name for digits 1 and 2 is un- and bi-respectively in latin words.

103. **Assertion :** Second period consists of 8 elements.
Reason : Number of elements in each period is four times the number of atomic orbitals available in the energy level that is being filled.

104. **Assertion :** Helium is placed in group 18 along with p-block elements.
Reason : It shows properties similar to p-block elements.

105. **Assertion :** Hydrogen can be placed in group 1.
Reason : Hydrogen can gain an electron to achieve a noble gas arrangement.

106. **Assertion :** Atomic size increases along a period.
Reason : Effective nuclear charge increases as the atomic number increases resulting in the increased attraction of electrons to the nucleus.

107. **Assertion :** Second ionization enthalpy will be higher the first ionization enthalpy.
Reason : Ionization enthalpy is a quantitative measure of the tendency of an element to lose electron.

108. **Assertion :** Alkali metals have least value of ionization energy within a period.
Reason : They precede alkaline earth metals in periodic table.

109. **Assertion :** Electron gain enthalpy can be exothermic or endothermic.
Reason : Electron gain enthalpy provides a measure of the ease with which an atom adds an electron to form anion.

110. **Assertion :** Smaller the size of an atom greater is the electronegativity.
Reason : Electronegativity refers to the tendency of atom so share electrons with other atom.

CRITICAL THINKING TYPE QUESTIONS

111. Which fact is not valid for Dobereiner's triads?
(a) The atomic weight of middle element is roughly average of the other two elements
(b) The properties of middle element is roughly average of the other two elements
(c) The elements of triads belong to the same group of modern periodic table
(d) The elements of triads have same valency electrons.

112. In the Mendeleev periodic table, which of the following element instead of having lower atomic weight was placed after the element of higher atomic weight thereby ignoring the order of increasing atomic weights.
(a) Iodine (b) Antimony
(c) Bromine (d) Molybdenum

113. Which of the following is correct about Eka-Aluminium and Eka-Silicon ?
(a) Oxides of Eka-Aluminium is Al_2O_3 and Eka-Silicon is Si_2O_3
(b) Oxides of Eka-Aluminium is Ga_2O_3 and Eka-Silicon is GeO_2
(c) Melting point of Eka-Aluminium is lower than the melting point of Eka-Silicon
(d) Both (a) and (c)

114. Which of the following elements are found in pitch blende?
(a) Actinium and protoactinium
(b) Neptunium and plutonium
(c) Actinium only
(d) Both (a) and (b)

115. Which of the following period contain most of the man-made radioactive elements?
(a) Seventh (b) Fifth
(c) Sixth (d) Both (a) and (c)

116. The electronic configuration of an element is $1s^2 2s^2 2p^6 3s^2 3p^3$. What is the atomic number of the element, which is just below the above element in the periodic table?
(a) 33 (b) 34
(c) 36 (d) 49

117. Which of the following elements show the given properties?
(i) All elements are metals.
(ii) Most of the elements form coloured ions, exhibit variable valence and paramagnetism.
(iii) Oftently used as catalysts.
(a) Chalcogens
(b) Transition elements
(c) Inner transition elements
(d) Representative elements

118. Which of the given elements A, B, C, D and E with atomic number 2, 3, 7, 10 and 30 respectively belong to the same period?
(a) A, B, C (b) B, C, D
(c) A, D, E (d) B, D, E

119. According to Mendeleev's periodic classification, the electronic configuration of hydrogen atom resembles that of alkali metals, which are given below as :
$H = 1s^1$, $Li = 2s^1$, $Na = 3s^1$, $K = 4s^1$
On the other hand like halogens, hydrogen also exist as diatomic molecules, such as : H_2, Cl_2, Br_2, I_2, etc.
On the basis of above information hydrogen can be placed with :
(a) Alkali metals (b) Halogens
(c) Both (a) and (b) (d) None of these

120. Which of the following statements is **incorrect** from the point of view of modern periodic table ?
(a) Elements are arranged in the order of increasing atomic number
(b) There are eighteen vertical columns called groups
(c) Transition elements fit in the middle of long periods
(d) Noble gases are arbitrarily placed in eighteenth group

121. Element X forms a chloride with the formula XCl_2, which is a solid with a high melting point. X would most likely be in the same group of the periodic table as –
(a) Na (b) Mg
(c) Al (d) Si

122. An element X belongs to fourth period and fifteenth group of the periodic table. Which one of the following is true regarding the outer electronic configuration of X ? It has
(a) Partially filled *d*-orbitals and completely filled *s*-orbitals
(b) Completely filled *s*-orbital and completely filled *p*-orbitals
(c) Completely filled *s*-orbital and half-filled *p*-orbitals
(d) Half-filled *d*-robitals and completely filled *s*-orbitals

123. An element has electronic configuration $1s^2 2s^2 2p^6 3s^2 3p^4$.
(a) Period = 3rd, block = p, group = 16
(b) Period = 5th, block = s, group = 1
(c) Period = 3rd, block = p, group = 10
(d) Period = 4th, block = d, group = 12

124. The periodic table of elements does not
(a) include the inert gases
(b) tell us about the arrangement of atoms in a molecule
(c) allow us to make accurate guess of the properties of undiscovered elements
(d) reveal regularities in the occurance of elements with similar properties

125. The lightest liquid metal is
(a) Hg (b) Ga
(c) Cs (d) Fr

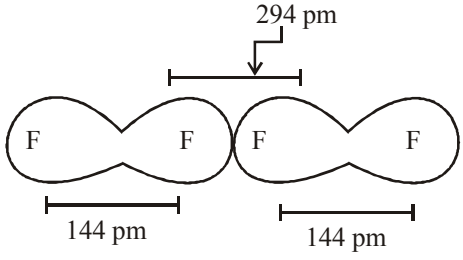
126. The correct sequence which shows decreasing order of the ionic radii of the elements is
(a) $Al^{3+} > Mg^{2+} > Na^+ > F^- > O^{2-}$
(b) $Na^+ > Mg^{2+} > Al^{3+} > O^{2-} > F^-$
(c) $Na^+ > F^- > Mg^{2+} > O^{2-} > Al^{3+}$
(d) $O^{2-} > F^- > Na^+ > Mg^{2+} > Al^{3+}$

127. The ionic radii (Å) of C^{4-} and O^{2-} respectively are 2.60 and 1.40. The ionic radius of the isoelectronic ion N^{3-} would be
(a) 2.6 (b) 1.71
(c) 1.4 (d) 0.95

128. Which of the following species will have the smallest and the largest size?
Cl, Na, Cl^-, Al^{3+}, Mg^{2+}, Na^+
(a) Smallest = Na^+, Largest = Cl^-
(b) Smallest = Al^{3+}, Largest = Cl^-
(c) Smallest = Al^{3+}, Largest = Cl
(d) Smallest = Na, Largest = Cl

129. Covalent radii of atoms varies in range of 72 pm to 133 pm from F to I while that of noble gases He to Xe varies from 120pm to 220pm. This is because in case of noble gases
(a) covalent radius is very large
(b) van der Waal radius is considered
(c) metallic radii is considered
(d) None of these

130. The van der Waal and covalent radii of fluorine atom respectively from the following figure are.



(a) 219pm, 72pm (b) 75pm, 72pm
(c) 147pm, 72pm (d) 147pm, 144pm

131. Arrange the following in increasing order of ionic radii? $C^{4-}, N^{3-}, F^{-}, O^{2-}$
(a) $C^{4-} < N^{3-} < O^{2-} < F^{-}$
(b) $N^{3-} < C^{4-} < O^{2-} < F^{-}$
(c) $F^{-} < O^{2-} < N^{3-} < C^{4-}$
(d) $O^{2-} < F^{-} < N^{3-} < C^{4-}$

132. The first ($\Delta_i H_1$) and second ($\Delta_i H_2$) ionization enthalpies (in kJ mol^{-1}) and the electron gain enthalpy ($\Delta_{eg} H$) (in kJ mol^{-1}) of the elements I, II, III, IV and V are given below

Element	$\Delta_i H_1$	$\Delta_i H_2$	$\Delta_{eg} H$
I	520	7300	– 60
II	419	3051	– 48
III	1681	3374	– 328
IV	1008	1846	– 295
V	2372	5251	+ 48

The most reactive metal and the least reactive non-metal of these are respectively
(a) I and V (b) V and II
(c) II and V (d) IV and V

133. Among the following transition elements, pick out the element/elements with highest second ionization energy.
(A) V (At. no = 23) (B) Cr (At. no = 24)
(C) Mn (At. no = 25) (D) Cu (At. no = 29)
(E) Zn (At. no = 30)
(a) (A) and (C) (b) (B) and (D)
(c) (B) and (E) (d) Only (D)

134. As we move across the second period from C to F ionisation enthalpy increases but the trend from C to F for ionisation enthalpy is C < O < N < F why it is not C < N < O < F. This is because
(a) atomic radii of O > atomic radii of N
(b) electronic configuration of N is more stable than electronic configuration of O
(c) atomic radii of N > atomic radii of O
(d) None of these

135. If ionisation enthalpy of oxygen is lesser than nitrogen because of two of the four 2p– electrons occupy same 2p-orbital than why such case is not possible with fluorine which contain greater no of paired electrons because.
(a) greater size of atomic orbitals
(b) smaller size of orbitals
(c) nuclear charge overpower electronic repulsions.
(d) None of these

136. Which of the following statements is wrong ?
(a) van der Waal's radius of iodine is more than its covalent radius
(b) All isoelectronic ions belong to same period of the periodic table
(c) $I.E._1$ of N is higher than that of O while $I.E._2$ of O is higher than that of N
(d) The electron gain enthalpy of N is almost zero while that of P is 74.3 kJ mol^{-1}

137. Which one of the following statements is incorrect ?
(a) Greater the nuclear charge, greater is the electron affinity
(b) Nitrogen has zero electron affinity
(c) Electron affinity decreases from fluorine to iodine in 17th group
(d) Chlorine has highest electron affinity

138. The elements with zero electron affinity are
(a) Boron and Carbon
(b) Beryllium and Helium
(c) Lithium and Sodium
(d) Fluorine and Chlorine

139. Which of the following property of element is directly related to electronegativity?
(a) Atomic radius (b) Ionization enthalpy
(c) Non-metallic character (d) None of these

140. Which 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

141. 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

142. The compounds of the s-block elements, with the exception of lithium and ...X... are predominantly ionic. Here, X refers to
(a) hydrogen (b) helium
(c) magnesium (d) beryllium

143. Among Al_2O_3, SiO_2, P_2O_3 and SO_2 the correct order of acid 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) $Al_2O_3 < SiO_2 < P_2O_3 < SO_2$

144. Observe the following periodic table :

H 1								He 2
Li 2, 1	Be 2, 2		B 2, 3	C 2, 4	Y 2, 5	O 2, 6	F 2, 7	Ne 2, 8
Na 2, 8, 1	Ag 2, 8, 2		Al 2, 8, 3	Z 2, 8, 4	P 2, 8, 5	S 2, 8, 6	Cl 2, 8, 7	Ar 2, 8, 8
K 2, 8, 8, 1	X 2, 8, 8, 2							

Arrange the following elements X, Y, Z in increasing order of their valencies :

(a) X > Z > Y (b) Y > Z > X

(c) Z > Y > X (d) X > Y > Z

145. Which of the following is the reason for the different chemical behaviour of the first member of a group of elements in the *s*- and *p*-blocks compared to that of the subsequent members in the same group?

(i) Small size

(ii) Large charge / radius ratio

(iii) Low electronegativity of the element

(a) (i) and (iii) (b) (i), (ii) and (iii)

(c) (i) and (ii) (d) (ii) and (iii)

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

(i) Aluminium react with HCl to form Al^{3+} and H_2 is liberated

(ii) Aluminium dissolve in NaOH to form $NaAl(OH)_4$ and H_2

(a) (i) and (ii) (b) Only (ii)

(c) Only (i) (d) Neither (i) nor (ii)

HINTS AND SOLUTIONS

FACT/DEFINITION TYPE QUESTIONS

1. (c) Periodic classification of elements follow a logical consequence of electronic configuration of atoms which is used to examine the physical and chemical properties of the elements.

2. (c) According to Dobereneir's triad the atomic mass of Br will be average of the atomic masses of Cl & I

$$= \frac{35.5 + 127}{2} = 81.25$$

3. (a)

4. (a) According to the law of triads the atomic wt of the middle element is arithmatic mean of I and III.

$$\text{At wt of Br} = \frac{\text{At.wt of Cl} + \text{At wt of I}}{2}$$

5. (b) In 1800, only 31 elements were known by 1865 the number of identified elements had more than doubled to 63. At present 116 elements are known. Of them the recently discovered elements are man-made.

6. (c) Johann Dobereiner in early 1800's was the first to consider the idea of trends among properties of elements. By 1829 he noted a similarity among the physical and chemical properties of several groups of three elements (triads).

7. (a) According to law of triad,

$$\underset{\downarrow}{\text{Li}} \quad \underset{\downarrow}{\text{Na}} \quad \underset{\downarrow}{\text{K}}$$

$$\frac{39 + 7}{2} = \frac{46}{2} = 23$$

8. (c) Arithmetic mean of atomic mass of F and Br

$$= \frac{19 + 80}{2} = 49.5.$$

Atomic mass of Cl = 35.5

$\therefore$ Arithmetic mean of atomic masses of F and Br $\neq$ Atomic mass of Cl.

9. (c)

10. (c) Every eighth element had the similar properties to the first element.

11. (b) Lothar Meyer plotted the physical properties such as atomic volume, melting point and boiling point against atomic weight and obtained a periodically repeated pattern.

12. (a) **13. (d)** **14. (c)**

15. (b) Correct order is Dobereiner, Chancourtois, Newlands, Mendeleev.

16. (d) Chloride formulas

(i) Eka-Aluminium = $GaCl_3(ECl_3)$

(ii) Eka-Silicon = $GeCl_4(ECl_4)$

Mendeleef arranged elements in horizontal rows and vertical columns of a table in order to their increasing atomic weights.

17. (b)

18. (d) 118 elements are known at present. The recently discovered elements are man-made.

19. (c) Moseley discovered that atomic number is more fundamental property than atomic mass.

20. (d) 6^{th} period consists of 32 elements.

21. (b)

22. (b) The period number corresponds to the highest principal quantum number (n) of the element.

23. (a) Atomic number (Z) = 120

IUPAC name = Unbinilium

Symbol = Ubn

24. (b) Element with atomic number 104 was named by American society as Rutherfordium and Kurchatovium by soviet society.

25. (c)

Digit	**Name**
1	un
4	quad

Using above notation IUPAC name of element 114 is Ununquadium.

26. (b) Its valence shell has 5 electrons (ns^2, np^3). It belongs to 5th group of the periodic table.

27. (b)

28. (d) Because of the presence of same number of valence electrons the elements of same group have similar chemical properties.

29. (c) Halogens are most electronegative elements i.e., they are likely to form anions most readily.

30. (d) Barium has atomic number 56. It is an alkaline earth metal i.e., found in *s*-block.

31. (c)

32. (c) Element with Z = 33

$(1s^2\,2s^2p^6\,3s^2p^6d^{10}\,4s^2p^3)$ lies in fifth (or 15th) group.

33. (a) The electronic configuration clearly suggest that it is a d-block element (having configuration $(n-1)\,d^{1-10}\,ns^{0-2}$) which starts from III B and goes till II B. Hence with d^3 configuration it would be classified in the group.

34. (d) **35. (c)**

36. **(c)** Elements (a), (b) and (d) belong to the same group since each one of them has two electrons in the s sub shell. In contrast, element (c) has seven electrons in the valence shell and hence does not lie in the same group in which elements (a), (b) and (d) lie.

37. **(c)**

38. **(b)** Na and Cl both belongs to III period.

39. **(b)** **40. (b)**

41. **(b)** $1s^2, 2s^2 2p^6, \underbrace{3s^2 3p^4}$

↓

Number of shell = 3

(Principal quantum number)

Number of period = 3

Valence electrons = 6 i.e., 2 + 4

Number of group = 16

42. **(a)** Metallic character decreases down group and increases along a period.

43. **(b)** Cu, Ag and Au are coinage metals. They belong to group IB (*d*-block) of periodic table.

44. **(b)** **45. (b)**

46. **(b)** Non-metals are mainly placed in p-block elements.

47. **(b)** Non-metallic character increases on moving from left to right in a period.

48. **(b)** Correct order of ionic size is Sn > Ce > Yb > Lu.

49. **(c)** On moving down in a group atomic radii increases due to successive addition of extra shell hence

O < S < Se

Further As is in group 15 having one less electron in its *p* orbital hence have higher atomic radii than group 16 elements.

i.e., O < S < Se < As

50. **(a)**

51. **(c)** Isoelectronic ions have same number of electrons.

52. **(a)** Continuous increase as no. of shells increases down the group.

53. **(d)** The size of an anion will be larger than that of the parent atom because the addition of one or more electron(s) would result in increased repulsion among the electrons and a decrease in effective nuclear charge.

54. **(b)** $K^+ \rightarrow K^{2+} + e^-$. Since e^- is to be removed from stable configuration.

55. **(c)** **56. (c)**

57. **(a)** IE_1 is always less than IE_2.

58. **(a)** $Mg = 1s^2 2s^2 2p^6 3s^2$

After removing of 2 electron, the magnesium acquired noble gas configuration hence removing of 3rd electron will require large amount of energy.

59. **(d)** ns^1 configuration and lesser IE.

60. **(b)** As I.E. of Mg is more

61. **(a)** The halogen (group-17) and the chalcogens (group-16) are two groups of elements having highly negative electron gain enthalpies.

62. **(b)** O < S < F < Cl

Electron gain enthalpy – 141, –200, –333, – 349 kJ mol^{-1}

63. **(a)**

64. **(d)** Noble gases have positive values of electron gain enthalpy because the anion is higher in energy than the isolated atom and electron.

65. **(a)** Within a group, electron gain enthalpy becomes less negative down a group. However, adding an electron to the 2*p*-orbital leads to greater repulsion than adding an electron to the larger 3*p*-orbital. Hence, phosphorus has the least negative electron gain enthalpy.

66. **(a)**

67. **(a)** Electronegativity values of given elements are as follows:

Be – 1.5 (I) Mg – 1.2 (IV)

O – 3.5 (II) N – 3.0 (III)

i.e. II > III > I > IV

68. **(b)** It is electronic configuration of alkali metal. Hence it will form basic oxide.

69. **(d)** **70. (c)**

71. **(b)** Silicon has valence of 4 and bromine has valence of 1. Hence formula of compound will be $SiBr_4$.

72. **(b)** On passing from left to right in a period acidic character of the normal oxides of the elements increases with increase in electronegativity.

STATEMENT TYPE QUESTIONS

73. **(c)** Gallium was placed in place of Eka aluminium and germanium was placed in place of Eka silicon.

74. **(b)** **75. (c)**

76. **(d)** In fourth period filling up of 3*d* orbital becomes energetically favourable before the 4*p* orbital is filled.

77. **(b)** The chemical element with atomic number 17 is chlorine. It belongs to third period in the periodic table and forms anion with unit negative charge (Cl^-).

78. **(a)** For statement (iii) the *s*-block elements because of their high reactivity are never found pure in nature. For statement (iv) the compounds of the *s*-block elements with the exception of lithium and beryllium are predominantly ionic.

79. **(c)** **80. (d)** **81. (d)**

82. **(c)** Noble gases are placed extremely right in periodic table. Sodium is more metallic than magnesium as it is more electropositive and has low ionisation energy.

83. **(b)** Second ionization enthalpy will be higher than the first ionization enthalpy but lower than the third ionization enthalpy.

84. **(d)**

85. **(b)** Oxygen has smaller first ionization enthalpy than nitrogen.

86. **(c)**

MATCHING TYPE QUESTIONS

87. (d) A. 1800 → 31 elements were known
B. 1865 → 63 elements
C. At present → 118

88. (b) **89. (d)** **90. (b)** **91. (a)** **92. (b)**

93. (d) **94. (d)** **95. (c)**

96. (d) Helium (He) $1s^2$ → Highest ionisation energy due to noble gas in nature.
Fluorine (F) $1s^2, 2s^2 2p^3$ → High electronegativity in nature due to small size and –1 oxidation state.
Rubidium (Rb) → Most electronegative element due to large atomic size.
Lithium (Li) → Strongest reducing agent due to small size and positive oxidation state (+1)

97. (b) A. $Li^+ < Al^{2+} < Mg^{2+} < K^+$
The cation with the greater positive charge will have a smaller radius because of the greater attraction of the electrons to the nucleus. Anion with the greater negative charge will have the larger radius.

$$\text{Positive charge} \propto \frac{1}{\text{ionic radius}}$$

Negative charge ∝ ionic radius
B. Greater positive charge, increases effective nuclear charge in case of isoelectronic species. While for same group elements effective nuclear charge decreases down the groups.
C. Cl > F > Br > I
electron affinity of Cl is highest in halogen family.
D. F > Cl > Br > I
electronegativity of fluorine (F) is higher than Cl, Br and I.

98. (b) **99. (b)**

ASSERTION-REASON TYPE QUESTIONS

100. (d) In a triad, the atomic mass of the middle element is the mean of the atomic masses of the first and third elements.

101. (d) According to Mendeleev, periodic properties of elements is a function of their atomic masses.

102. (a) Both assertion and reason are true and reason is the correct explanation of assertion.

103. (c) Number of elements in each period is twice the number of atomic orbitals available in the energy level that is being filled.

104. (c) He ($1s^2$) should be placed along with s-block elements because of its electronic configuration but it has a completely filled valence shell and as a result it exhibits properties of noble gases, thus it is placed along with noble gases (ns^2, np^6).

105. (b) Both the statements are correct but assertion is not correct explanation for reason.

106. (c) Atomic size generally decreases along a period.

107. (b) Both assertion and reason are true but reason is not the correct explanation of assertion.
It is difficult to remove an electron from a positively charged ion than a neutral atom.

108. (b) Both assertion and reason are true but reason is not the correct explanation of assertion.
Alkali metals belong to first group and have largest size in a period and hence low I.E.

109. (b) Both assertion and reason are true but reason is not the correct explanation of assertion.
Depending on the element, the process of adding an electron to the atom can be either endothermic or exothermic.

110. (c) Assertion is true but reason is false.
Electronegativity refers to the tendency of atom to attract bonding electrons.

CRITICAL THINKING TYPE QUESTIONS

111. (b)

112. (a) Iodine with lower atomic weight than that of tellurium (Group VI) was placed in Group VII along with fluorine, chlorine, bromine because of similarities in properties.

113. (d) Oxides of Eka-Aluminium = Ga_2O_3
Oxides of Eka-Silicon = SiO_2
Melting point of Eka-Aluminium = Low (302 K)
Melting point of Eka-Silicon = High (1231 K)

114. (d) Neptunium and plutonium like actinium and protoactinium are also found in pitch.

115. (a) Seventh period includes most of the man-made radio-active elements.

116. (a) Atomic number of the given element is 15 and it belongs to 5th group. Therefore atomic number of the element below the above element
= 15 + 18 = 33.

117. (b) These are characteristic properties of *d*-block elements.

118. (b) **119. (c)** **120. (d)** **121. (b)** **122. (c)**

123. (a) By observing principal quantum number (n). Orbital (s, p, d, f) and equating no. of e^-'s we are able to find the period, block and group of element in periodic table.

124. (b) Periodic table deals with elements and not molecules.

125. (c) Cs is a metal. It is liquid at room temperature. It is lighter than Hg (also a liquid metal).

126. (d) All the given species contains 10 e^- each i.e. isoelectronic.
For isoelectronic species anion having high negative charge is largest in size and the cation having high positive charge is smallest.

127. (b) The ionic radii of isoelectronic ions decrease with the increase in the magnitude of the nuclear charge.
So, decreasing order of ionic radii is $C^{4-} > N^{3-} > O^{2-}$.

128. (b) Anions will be larger and cations will be smaller than the parent atoms. Among isoelectronic species (Na^+, Mg^{2+} and Al^{3+}), the one with the larger positive nuclear charge will have a smaller radius.
$\therefore$ Largest = Cl^- and smallest = Al^{3+}

129. (b) In case of halogens covalent radius is considered this bond is formed by overlapping of electron clouds; while noble gases remain monoatomic, in this case only way to obtain radius is through van der Waal radii.

130. (c) Covalent radius is radius of an atom in its bound state i.e., in fluorine it is half of distance between two covalently bonded fluorine atoms; van der Waal radii is one-half of the distance between the nuclei of two identical non-bonded isolated atoms. These atoms are attracted toward each other through weak van der Waal's force hence van der Waal radii are very large.

131. (c) All the given species are isoelectronic. In case of isoelectronic species ionic radii increases with increase in negative charge on anions.

132. (c) I represents Li, II represents K
III represents Br, IV represents I
V represents He
So, amongst these, II represents most reactive metal and V represents least reactive non-metal.

133. (b) **134. (b)** **135. (c)**

136. (b) In the isoelectronic species, all isoelectronic anions belong to the same period and cations to the next period.

137. (c) Electron affinity of ^9F is less than that of ^{17}Cl

138. (b) Fully filled electronic configuration.

139. (c) The increase in the electronegativities across a period is accompanied by an increase in non-metallic properties (or decrease in metallic properties) of elements.

140. (b) On moving along the period, ionization enthalpy increases.
In second period, the order of ionization enthalpy should be as follows :
F > O > N.
But N has half-filled structure, therefore, it is more stable than O. That is why its ionization enthalpy is higher than O. Thus, the correct order of IE is
F > N > O.

141. (c) In a period the value of ionisation potential increases from left to right with breaks where the atoms have some what stable configuration. In this case N has half filled stable orbitals. Hence has highest ionisation energy. Thus the correct order is
B < C < O < N
and not as given in option (c)

142. (d) With the exception of lithium and beryllium compounds of s-block elements are predominantly ionic.

143. (d) As the size increases the basic nature of oxides changes to acidic nature i.e., acidic nature increases.

$$\underset{\text{Acidic}}{SO_2} > \underset{\text{Weak acidic}}{P_2O_3} > \underset{\text{Amphoteric}}{SiO_2} > Al_2O_3$$

SO_2 and P_2O_3 are acidic as their corresponding acids H_2SO_3 and H_3PO_3 are strong acids.

144. (c)

145. (c) The anomalous behaviour of first member of a group of element in the *s*- and *p*-block element is due to their small size, large charge/radius ratio and high electronegativity.

146. (a) Because Al is amphotoric in nature so it dissolve in both acid and base.