3 Classification of Elements and Periodicity in Properties

Conceptual MCQs

1. The element with atomic number 118, will be
(a) alkali (b) noble gas
(c) lanthanide (d) transition element

2. Which is chemically most active non-metal ?
(a) S (b) O (c) F (d) N

3. Which one of the following is smallest in size ?
(a) N^{3-} (b) O^{2-} (c) Na^{+} (d) F^{-}

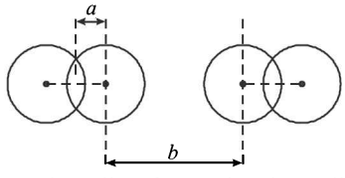
4. The first ionisation potential in electron volts of nitrogen and oxygen atoms are respectively given by
(a) 14.6, 13.6 (b) 13.6, 14.6
(c) 13.6, 13.6 (d) 14.6, 14.6

5. When an electron is removed from an atom, its energy
(a) increases (b) decreases
(c) remains the same (d) none of these

6. Which one of the following represents the electronic configuration of the most electropositive element ?
(a) [He] $2s^1$ (b) [Xe] $6s^1$
(c) [He] $2s^2$ (d) [Xe] $6s^2$

7. 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

8. What are the two radii shown as '*a*' and '*b*' in the figure known as?



(a) *a* = Atomic radius, *b* = Molecular radius
(b) *a* = Covalent radius, *b* = van der Waal's radius
(c) *a* = Ionic radius, *b* = Covalent radius
(d) *a* = Covalent radius, *b* = Atomic radius

9. If the difference in electronegativities of two elements is very large, then
(a) The bond is 50% ionic
(b) The bond is 100% covalent
(c) The bond is more covalent than ionic
(d) The bond is more ionic than covalent

10. Variable valency is a general feature of
(a) *s* – block elements (b) *p* – block elements
(c) *d* – block elements (d) All of these

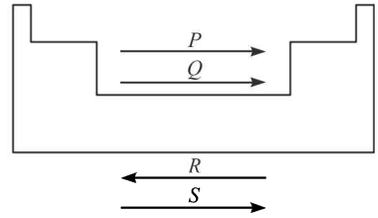
11. In general, the properties that decrease and increase down a group in the periodic table, respectively, are:
(a) atomic radius and electronegativity.
(b) electron gain enthalpy and electronegativity.
(c) electronegativity and atomic radius.
(d) electronegativity and electron gain enthalpy.

12. The pair of elements having approximately equal ionisation potential is
(a) Al, Ga (b) Al, Si (c) Al, Mg (d) Al, B

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

14. There are two rows of inner transition elements in the periodic table each containing 14 elements. The reason for this may be
(a) *f*-orbital has seven values for magnetic quantum number, hence total electrons are 14
(b) in the periodic table there is space to accommodate 14 electrons only
(c) only 28 inner transition elements have been discovered till date
(d) 28 is the maximum number of elements that any block can accommodate

15. Study the given diagram and fill up the blanks with appropriate choice.



	P	Q	R	S
(a)	Ionisation enthalpy	Electron gain enthalpy	Atomic radius	Electro-negativity
(b)	Atomic radius	Ionisation enthalpy	Electro-negativity	Electron gain enthalpy
(c)	Ionisation enthalpy	Atomic radius	Electro-negativity	Electron gain enthalpy
(d)	Electro-negativity	Electron gain enthalpy	Ionisation enthalpy	Atomic radius

Application Based MCQs

16. Calculate the bond length of C–X bond, if C–C bond length is 1.54 Å, X–X bond length is 1.00 Å and electronegativity values of C and X are 2.0 and 3.0 respectively
(a) 1.18 Å (b) 2.11 Å (c) 1.32 Å (d) 1.54 Å

17. 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

18. The statement that is not correct for the periodic classification of element 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.

19. The element X, Y, Z and T have the indicated electronic configurations. Starting with the innermost shell, which is the most metallic element
(a) X = 2, 8, 4 (b) Y = 2, 8, 8
(c) Z = 2, 8, 8, 1 (d) T = 2, 8, 8, 7

20. An element has electronic configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4$. Predict their period, group and block
(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

21. Elements A and B with their respective electronic configurations $3d^{10}\ 4s^1$ and $4d^{10}\ 5s^1$ in their outermost shell, are
(a) Both non-metals
(b) Both coinage metals
(c) A is a non-metal and B is coinage metal
(d) A is coinage metal and B is non-metal

22. The ionisation potential order for which set is correct?
(a) Cs < Li < K (b) Cs > Li > B
(c) Li > K > Cs (d) K > Li > B

23. Correct order of first IP among following elements Be, B, C, N, O is
(a) B < Be < C < O < N (b) B < Be < C < N < O
(c) Be < B < C < N < O (d) Be < B < C < O < N

24. Which of the following relation is correct with respect to first (I) and second (II) ionisation potentials of sodium and magnesium
(a) $I_{Mg} = II_{Na}$ (b) $I_{Na} > I_{Mg}$
(c) $II_{Mg} > II_{Na}$ (d) $II_{Na} > II_{Mg}$

25. The group having isoelectronic species is :
(a) O^{2-}, F^-, Na^+, Mg^{2+} (b) O^-, F^-, Na, Mg^+
(c) O^{2-}, F^-, Na , Mg^{2+} (d) O^-, F^-, Na^+, Mg^{2+}

26. 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

27. When the first electron gain enthalpy($\Delta_{eg}H$) of oxygen is – 141 kJ/mol, its second electron gain enthalpy is:
(a) a more negative value than the first
(b) almost the same as that of the first
(c) negative, but less negative than the first
(d) a positive value

28. The correct order of acidic strength :
(a) $Cl_2O_7 > SO_2 > P_4O_{10}$ (b) $K_2O > CaO > MgO$
(c) $CO_2 > N_2O_5 > SO_3$ (d) $Na_2O > MgO > Al_2O_3$

29. Which of the following transition involves maximum amount of energy
(a) $M^{2+}(g) \longrightarrow M^{3+}(g)$ (b) $M^+(g) \longrightarrow M^{2+}(g)$
(c) $M(g) \longrightarrow M^+(g)$ (d) $M^-(g) \longrightarrow M(g)$

30. 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

31. 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) $Al_2O_3 < SiO_2 < P_2O_3 < SO_2$

32. 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 ionisation enthalpy
(d) $Al^{3+} < Mg^{2+} < Na^+ < F^-$:
Increasing ionic size

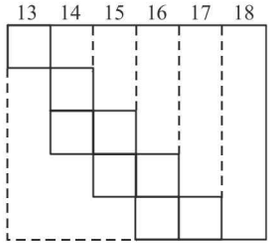
33. The correct statement among the following is
(a) The first ionisation potential of Al is greater than the first ionisation potential of Mg
(b) The second ionisation potential of Mg is greater than the second ionisation potential of Na

(c) The first ionisation potential of Na is greater than the first ionisation potential of Mg
(d) The third ionisation potential of Mg is greater than the third ionisation potential of Al.

34. In which of the following arrangements, the sequence is *not* strictly according to the property written against it?
(a) $HF < HCl < HBr < HI$: increasing acid strength
(b) $NH_3 < PH_3 < AsH_3 < SbH_3$: increasing basic strength
(c) $B < C < O < N$: increasing first ionisation enthalpy
(d) $CO_2 < SiO_2 < SnO_2 < PbO_2$: increasing oxidising power

35. Amphoteric-oxide combinations are in
(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

36. Part of the periodic table showing *p*-block is depicted below. What are the elements shown in the zig-zag boxes called? What is the nature of the elements outside this boundary on the right side of the table?



(a) Transition elements, metalloids
(b) Metalloids, non-metals
(c) Metals, non-metals
(d) Non-metals, noble gases

37. An element of atomic weight 40 has 2, 8, 8, 2 as the electronic configuration. Which one of the following statements regarding this element is not correct?
(a) it belongs to II group of the periodic table.
(b) it has 20 neutrons.
(c) the formula of its oxide is MO_2.
(d) it belongs to 4th period of the periodic table.

38. Following statements regarding the periodic trends of chemical reactivity of the alkali metals and the halogens are given. Which of these statements gives the correct picture?
(a) Chemical reactivity increases with increase in atomic number down the group in both the alkali metals and halogens.
(b) In alkali metals the reactivity increases but in the halogens it decreases with increase in atomic number down the group.
(c) The reactivity decreases in the alkali metals but increases in the halogens with increase in atomic number down the group.
(d) In both the alkali metals and the halogens the chemical reactivity decreases with increase in atomic number down the group.

39. Which of the following statement is correct with respect to the property of elements with an increase in atomic number in the carbon family (group 14)
(a) Atomic size decrease
(b) Ionisation energy increase
(c) Metallic character decrease
(d) Stability of +2 oxidation state increase

40. The first ($\Delta_i H_1$) and second ($\Delta_i H_2$) ionisation 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 III (b) V and II
(c) II and V (d) IV and V

Skill Based MCQs

41. Match the atomic numbers of the elements given in column I with the periods given in column II and mark the appropriate choice

Column-I (Atomic number)		Column-II (Period)	
(A)	31	(p)	5
(B)	50	(q)	3
(C)	56	(r)	4
(D)	14	(s)	6

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

42. If the difference in atomic size of
$Na - Li = x$ $Rb - K = y$ $Fr - Cs = z$
then the correct order will be
(a) $x = y = z$ (b) $x > y > z$
(c) $x < y < z$ (d) $x < y << z$

43. Few elements are matched with their successive ionisation energies. Identify the elements.

Element	IE_1 (kJ/mol)	IE_2 (kJ/mol)
X	2372	5251
Y	520	7297
Z	900	1758

	X	Y	Z
(a)	A noble gas	Alkali metal	Alkaline earth metal
(b)	Alkali metal	A nobel gas	Alkaline earth metal
(c)	Alkaline earth metal	Alkali metal	A noble gas
(d)	Alkali metal	Alkaline earth metal	A noble gas

44. Match the entries listed in **Column I** with appropriate properties listed in **Column II**

	Column I		**Column II**
(A)	He	(p)	High electron affinity
(B)	Cl	(q)	Most electropositive element
(C)	Ca	(r)	Strongest reducing agent
(D)	Li	(s)	Highest ionisation energy

The correct match of contents in **Column I** with those in **Column II** is

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

45. The ionic radii (in Å) of N^{3-}, O^{2-} and F^- are respectively :

(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

46. 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) $1s^2\ 2s^2\ 2p^6\ 3s^2$

47. An element X occurs in short period having configuration $ns^2\ np^1$. 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

48. Match the column I, II and III and mark the appropriate choice.

	Column I		**Column II**		**Column III**
(A)	Bromine	(i)	Noble metal	(p)	Amalgam
(B)	Gold	(ii)	Crystalline non-metal	(q)	$4s^2\ 4p^5$
(C)	Mercury	(iii)	Liquid non-metal	(r)	Transition metal
(D)	Iodine	(iv)	Liquid metal	(s)	Violet

(a) A – (iii, q); B – (i, r); C – (iv, p); D – (ii, s)
(b) A – (ii, p); B – (i, s); C – (iii, q); D – (iv, r)
(c) A – (i, s); B – (ii, p); C – (iv, r); D – (iii, q)
(d) A – (iv, r); B – (iii, q); C – (ii, s); D – (i, p)

49. The successive ionisation energy values for an element X are given below

(i) 1st ionisation energy = 410 kJ mol^{-1}
(ii) 2nd ionisation energy = 820 kJ mol^{-1}
(iii) 3rd ionisation energy = 1100 kJ mol^{-1}
(iv) 4th ionisation energy = 1500 kJ mol^{-1}
(v) 5th ionisation energy = 3200 kJ mol^{-1}

Find out the number of valence electron for the atom, X

(a) 4 (b) 3 (c) 5 (d) 2

50. First and second ionisation enthalpies (in kJ/mol) of few elements are given below:

Element	**IE_1**	**IE_2**
(i)	520	7300
(ii)	900	1760
(iii)	1680	3380
(iv)	2080	3963

Which of the above elements will form halides with formula MX_2?

(a) (i) and (ii) (b) (i) and (iii)
(c) (ii) and (iii) (d) (i) and (iv)

ANSWER KEY

Conceptual MCQs																			
1	(b)	**3**	(c)	**5**	(a)	**7**	(b)	**9**	(d)	**11**	(c)	**13**	(a)	**15**	(a)				
2	(c)	**4**	(a)	**6**	(b)	**8**	(b)	**10**	(c)	**12**	(a)	**14**	(a)						
Application Based MCQs																			
16	(a)	**19**	(c)	**22**	(c)	**25**	(a)	**28**	(a)	**31**	(d)	**34**	(b)	**37**	(c)	**40**	(c)		
17	(a)	**20**	(a)	**23**	(a)	**26**	(a)	**29**	(a)	**32**	(c)	**35**	(c)	**38**	(b)				
18	(d)	**21**	(b)	**24**	(d)	**27**	(d)	**30**	(b)	**33**	(d)	**36**	(b)	**39**	(d)				
Skill Based MCQs																			
41	(d)	**42**	(b)	**43**	(a)	**44**	(d)	**45**	(a)	**46**	(d)	**47**	(c)	**48**	(a)	**49**	(a)	**50**	(c)