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Content

TOPIC 1

MODERN PHYSICS

SECTION - I : STRAIGHT OBJECTIVE TYPE

1. If first excitation potential of a hydrogen like atom is V electron volt, then the ionization energy of this atom will be:

(1) V electron volt (2) $\frac{3V}{4}$ electron volt

(3) $\frac{4V}{3}$ electron volt (4) cannot be calculated by given information.

2. Two hydrogen atoms are in excited state with electrons residing in n = 2. First one is moving towards left and emits a photon of energy E_1 towards right. Second one is moving towards left with same speed and emits a photon of energy E_2 towards left. Taking recoil of nucleus into account during emission process

(1) $E_1 > E_2$ (2) $E_1 < E_2$ (3) $E_1 = E_2$ (4) information insufficient

3. In a hydrogen atom following the Bohr's postulates the product of linear momentum and angular momentum is proportional to $(n)^x$ where 'n' is the orbit number. Then 'x' is :

(1) 0 (2) 2 (3) –2 (4) 1

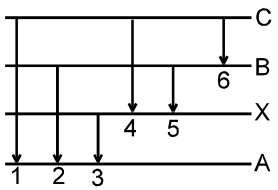
4. If the short wavelength limit of the continuous spectrum coming out of a coolidge tube is 10 Å, then the debroglie wavelength of the electrons reaching the target metal in the coolidge tube is approximately :

(1) 0.3 Å (2) 3 Å (3) 30 Å (4) 10 Å

5. A charge particle q_0 of mass m_0 is projected along the y-axis at t = 0 from origin with a velocity V_0. If a uniform electric field E_0 also exists along the x-axis, then the time at which debroglie wavelength of the particle becomes half of the initial value is :

(1) $\frac{m_0v_0}{q_0E_0}$ (2) $2\frac{m_0v_0}{q_0E_0}$ (3) $\sqrt{3}\frac{m_0v_0}{q_0E_0}$ (4) $3\frac{m_0v_0}{q_0E_0}$

6. In the figure six lines of emission spectrum are shown. Which of them will be absent in the absorbtion spectrum.

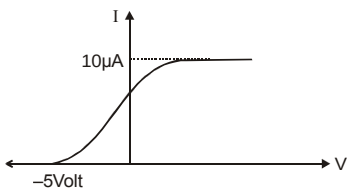


(1) 1, 2, 3 (2)1, 4, 6 (3) 4, 5, 6 (4) 1, 2, 3, 4, 5, 6

7. Consider atoms H, He^+, Li^{++} in their ground states. If L_1, L_2 and L_3 are magnitude of angular momentum of their electrons about the nucleus respectively then :

(1) $L_1 = L_2 = L_3$ (2) $L_1 > L_2 > L_3$ (3) $L_1 < L_2 < L_3$ (4) $L_1 = L_2 = L_3$

8. In the photoelectric experiment, if we use a monochromatic light, the I - V curve is as shown. If work function of the metal is 2eV, estimate the power of light used. (Assume efficiency of photo emission = 10^{-3} %, i.e. number of photoelectrons emitted are 10^{-3} % of number of photons incident on metal.)



(1) 2 W

(2) 5 W

(3) 7 W

(4) 10 W

9. Which one of the following is incorrect statement about a photon

(1) Photon's rest mass is zero (2) Photon's momentum is $h\nu/c$

(3) Photon's energy is $h\nu$ (4) Photon's exert no pressure

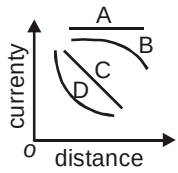
10. A monochromatic beam of electromagnetic radiation has an intensity of 1 W/m^2. Then the average number of photons per m^3 for a 10 MeV γ rays is

(1) 4166 (2) 3000 (3) 5000 (4) 2083

11. Yellow light of 557 nm wavelength is incident on a cesium surface. It is found that no photo electrons flow in the circuit when the cathode-anode voltage drops below 0.25V. Then the threshold wavelength for photo electric effect from cesium is

(1) 577 nm (2) 653 nm (3) 734 nm (4) 191 nm

12. A point source cause photoelectric effect from a small metal plate. Which of the following curves may represent the saturation photocurrent as a function of the distance between the source and the metal



(1) A (2) B (3) C (4) D

13. If n_r and n_b are respectively, the number of photons emitted by a red bulb and a blue of equal power in a given time, then

(1) $n_r = n_b$ (2) $n_r < n_b$ (3) $n_r > n_b$ (4) nothing can be predicted

14. When light of intensity 1 W/m^2 and wavelength 5×10^{-7} m is incident on a surface, it is completely absorbed by the surface. If 100 photons emit one electron and area of the surface is 1 cm^2, then the photoelectric current will be

(1) 2 mA (2) 0.4 μA (3) 4.0 mA (4) 4 μA

15. On increasing the wavelength of incident light

(1) The number of photoelectrons increases. (2) The kinetic energy of photoelectrons decreases.

(3) The number of photoelectrons decreases. (4) The kinetic energy of photoelectrons increases.

16. The energy E and momentum p of photon is given by $E = h\nu$ and $p = h/\lambda$, the velocity of photon will be-

(1) E/p (2) Ep (3) $[E/p]^2$ (4) $[E/p]^{1/2}$

17. Light of wavelength 5000Å falls on a sensitive plate with photoelectric work function of 1.9eV. The kinetic energy of the emitted photoelectron will be-

(1) 0.58 eV (2) 2.58 eV (3) 1.24 eV (4)1.16eV

18. Work function for aluminium metal is 4.125 eV. For Photo electric effect from aluminium metal, the cut off wavelength will be-

(1) 200 nm (2) 300 nm (3) 150 nm (4) 420 nm

19. The wavelength of a photon and the deBroglie wavelength of an electron and uranium atom are identical. Which one of them will have highest kinetic energy

(1) Photon (2) electron (3) U-atom (4) nothing can be predicted

20. The ratio of deBroglie wavelength of a proton and an α-particle accelerated through the same potential difference is

(1) 2 (2) $2\sqrt{2}$ (3) $1/2\sqrt{2}$ (4) $\sqrt{2}$

21. Electron microscope works on the principle of
(1) wave nature of light (2) particle nature of light
(3) wave nature of electron (4) particle nature of electron

22. What voltage must be applied to an electron microscope to produce electrons of λ. = 1.0 Å
(1) 190 volt (2) 180 volt (3) 160 volt (4) 150 volt

23. Linear momenta of a proton and an electron are equal. Relative to an electron
(1) Kinetic energy of proton is more. (2) De-Broglie wavelength of proton is more.
(3) De-Broglie wavelength of proton is less. (4) De-Broglie wavelength of proton and electron are equal.

24. Momentum of γ-ray photon of energy 3 keV in kg-m/s will be
(1) 1.6×10^{-19} (2) 1.6×10^{-21} (3) 1.6×10^{-24} (4) 1.6×10^{-27}

25. Wrong statement in connection with Davisson-Germer experiment is
(1) The inter-atomic distance in nickel crystal is of the order of the de-Broglie wavelength.
(2) Electrons of constant energy are obtained by the electron gun.
(3) Nickel crystal acts as a three dimensional diffracting grating.
(4) Davisson-Germer experiment is an interference experiment.

26. In Davisson-Germer experiment the relation between the angle of diffraction θ and the grazing angle $o\phi$ is
(1) $\theta = 90^\circ - \frac{\phi}{2}$ (2) $\phi = 90^\circ - \frac{\theta}{2}$ (3) $\theta = 90^\circ - \phi$ (4) $\phi = (90^\circ - \theta)/2$

27. In Davisson-Germer experiment an electron beam accelerated with 54 volt is diffracted at an angle of 50° by a nickel crystal and produces first diffraction maxima. The interatomic distance in Nickel crystal is
(1) 1 Å (2) 2 Å (3) 2.15 Å (4) 3.12 Å

28. Object are exposed to the X-rays in a dark room. They will appear
(1) invisible (2) white (3) yellow (4) red

29. The intensity of an X-ray beam reduces to 36.8% of its initial intensity after traversing a gold film of thickness 5×10^{-3} m. Its absorption coefficient is
(1) 50 m^{-1} (2) 100 m^{-1} (3) 150 m^{-1} (4) 200 m^{-1}

30. An X-ray tube operating at 50 kV converts 1% energy in the form of X-ray. If the amount of heat produced is 495 watt, then the number of electrons colliding with the target per second is
(1) 6.25×10^{16} (2) 4.15×10^{16} (3) 3.2×10^{16} (4) 1.2×10^{18}

31. In X-ray production an electron accelerated with voltage V strikes a metal target. For which of the following voltages X-rays of minimum wavelength will be produced
(1) 10 kV (2) 20 kV (3) 30 kV (4) 40 kV

32. Production of continuous X-rays is caused by
(1) Transition of electrons from higher levels to lower levels in target atoms.
(2) Retardiation of incident electron when it enters the target atom.
(3) Transition of electrons from lower levels to higher levels in target atoms.
(4) Neutralising the incident electron.

33. The minimum wavelength λ_{min} in the continuous spectrum of X-rays is
(1) Proportional to the potential difference V between the cathode and anode.
(2) Inversely proportional to potential difference V between the cathode and anode.
(3) Proportional to the square root of the potential difference V between the cathode and the anode.
(4) Inversely proportional to the square root of the potential difference V between the cathode and the anode.

34. X-rays and gamma rays are both electro-magnetic waves. Which of the following statement is true
(1) In general, X-rays have larger wavelength than that of gamma rays.
(2) X-rays have smaller wavelength than that of gamma rays.
(3) Gamma rays have smaller frequency than that of X-rays.
(4) Wavelength and frequency of X-rays are both larger than those of gamma rays.

35. On increasing the filament current, the
(1) wavelength of X-rays is increased
(2) penetration power of X-rays is decreased
(3) intensity of X-rays is decreased
(4) intensity of X-rays is increased.

36. X-ray is an electromagnetic radiation, so X-ray photons carry
(1) an electric charge
(2) a magnetic moment
(3) both the electric charge and magnetic moment
(4) neither electric charge nor magnetic moment.

37. If λ_r and λ_v and λ_x are wavelengths of red light, violet light and X-rays then-
(1) $\lambda_r > \lambda_y > \lambda_x$ (2) $\lambda_x > \lambda_y > \lambda_r$ (3) $\lambda_y > \lambda_r > \lambda_x$ (4) None of these

38. Characteristic X-rays of K-series are obtained when the electron transition is from higher orbits to -
(1) K-orbit (2) L-orbit (3) M-orbit (4) N-orbit

39. Which has the highest penetrating power
(1) γ-rays (2) β-rays (3) α-rays (4) cathode rays

40. The wavelength of L_α line in X-ray spectrum of $_{78}$Pt is 1.32 Å. The wavelength of L_α line in X-ray spectrum of another unknown element is 4.17 Å. If screening constant for L_α line is 7.4, then atomic number of the unknown element is
(1) 78 (2) 47 (3) 40 (4) 35

SECTION - II : ASSERTION/REASON

41. **Statement-1 :** In process of photoelectric emission, all emitted electrons do not have same kinetic energy.
Statement-2 : If radiation falling on photosensitive surface of a metal consists of different wavelengths, then energy acquired by electrons absorbing photons of different wavelengths shall be different.
(1) Statement-1 is True, Statement-2 is True; Statement-2 **is** a correct explanation for Statement-1
(2) Statement-1 is True, Statement-2 is True; Statement-2 **is NOT** a correct explanation for Statement-1
(3) Statement-1 is True, Statement-2 is False
(4) Statement-1 is False, Statement-2 is True.

42. **Statement-1 :** When a beam of highly energetic neutrons is incident on a tungsten target, no X-rays will be produced.
Statement-2 : Neutrons do not exert any electrostatic force on electrons or nucleus of an atom.
(1) Statement-1 is True, Statement-2 is True; Statement-2 **is** a correct explanation for Statement-1
(2) Statement-1 is True, Statement-2 is True; Statement-2 **is NOT** a correct explanation for Statement-1
(3) Statement-1 is True, Statement-2 is False
(4) Statement-1 is False, Statement-2 is True.

TOPIC 2 PERIODIC TABLE & PERIODICITY

SECTION : STRAIGHT OBJECTIVE TYPE

1. An element with atomic number 107 has recently been discovered. Its block, group number, period and outershell electronic configuration respectively are :
(1) s-block, group 2, period 6, $6s^2$ (2) p-block, group 13, period 5, $5s^2\ 5p^4$
(3) d-block, group 7, period 7, $7s^2$ (4) f-block, group 3, period 6, $6s^2$

2. In which one of the following pairs the radius of the second species is greater than that of first ?
(1) Ti^{4+}, Mn^{7+} (2) Na, Mg (3) Cl^-, K^+ (4) P^{5+}, P^{3+}

3. The chemical formula of Aluminium plumbate is -
(1) $Al_3(PbO_3)_3$ (2) $Al_2(PbO_3)_3$ (3) $Al_2(PbO_2)_3$ (4) $Al_3(PbO_2)_3$

4. The chemical name of K_2MnO_4 is -
(1) Potassium permangnate (2) Potassium magnate
(3) Potassium metamagnate (4) Potassium magnite

5. The chemical name of NaH_2PO_4 is -
(1) Sodium dihydrogen phosphite (2) Sodium dihydrogen phosphide
(3) Sodium hydrogen phosphate (4) Sodium dihydrogen phosphate

6. The five successive ionisation energies of an element 'X' are 800, 1427, 2658, 25024 and 32824 KJ $mole^{-1}$ respectively. The valency of 'X' is :
(1) 1 (2) 2 (3) 3 (4) 4

7. For an element 'A', the first ionisation energy will be numerically equal to :
(1) EA of A^+ (2) EA of A^{2+} (3) IE of A^{2+} (4) None of these

8. The first ionisation energy of Al is smaller than that of Mg because :
(1) the atomic number of Al is greater than that of Mg.
(2) the atomic size of Al is less than that of Mg.
(3) Penetration of s-subshell electrons in case of Mg is greater than that of p-subshell in Al
(4) Mg has incompletely filled s-orbital.

9. In which of the following pairs, the first member has higher first ionization energy ?
(1) N, O (2) B, Be (3) Al , Ga (4) Cl , F

10. Which of the following species will have the smallest size ?
(1) Li^+ (2) Mg^{2+} (3) Al^{3+} (4) K^+

11. The chemical formula of Permanganic acid is -
(1) $HMnO_4$ (2) H_2MnO_4 (3) $HMnO_3$ (4) H_2MnO_3

12. Which of the following is the correct order of ionisation enthalpy ?
(1) $Te^{2-} < I^- < Cs^+ < Ba^{2+}$ (2) $I^- < Te^{2-} < Cs^+ < Ba^{2+}$
(3) $Te^{2-} < Cs^+ < I^- < Ba^{2+}$ (4) $Ba^{2+} < Cs^+ < I^- < Te^{2-}$

13. The statement that is not correct for the periodic classification of elements is :
(1) the properties of elements are the periodic functions of their atomic numbers.
(2) non–metallic elements are lesser in number than metallic elements.
(3) the first ionisation energies of elements along a period do not vary in a regular manner with increase in atomic number.
(4) for transition elements the d–subshells are filled with electrons monotonically with increase in atomic number.

14. In the modern periodic table, the block indicates the value of ..... for the last subshell that received electrons in building up the electronic configuration. Fill in the blank with appropriate option.
(1) Atomic number (2) Azimuthal quantum number
(3) Principal quantum number (4) Atomic mass

15. Element with electronic configuration as $[Ar]^{18}\ 3d^5\ 4s^2$ is placed in :
(1) 1st group, s-block (2) 2nd group, s-block (3) 5th group, d-block (4) 7th group, d-block

16. Which set does not show correct matching ?
(1) Sc^{3+} [Ne] $3s^2\ 3p^6$ zero group (2) Fe^{2+} [Ar] $3d^6$ 8th group
(3) Cr [Ar] $3d^5\ 4s^1$ 6th group (4) All of the above

17. Atomic radii of F & Ne in Angstrom are respectively given by :
(1) 0.72, 1.60 (2) 1.60, 1.60 (3) 0.72, 0.72 (4) 1.60, 0.72.

18. Which of the following element has maximum first ionisation energy ?
(1) V (2) Ti (3) Sc (4) Mn

19. The set representing the correct order of first ionization potential is :
(1) K > Na > Li (2) Be > Mg > Ca (3) B > C > N (4) Ge > Si > C

20. Which of the following relation is correct with respect to first (I) and second (II) ionization energies of sodium and magnesium ?
(1) $I_{Mg} = II_{Na}$ (2) $I_{Na} > I_{Mg}$ (3) $II_{Mg} > II_{Na}$ (4) $II_{Na} > II_{Mg}$

21. First, second & third ionization energies are 737, 1045 & 7733 KJ/mol respectively. The element can be :
(1) Na (2) B (3) Al (4) Mg

22. For which of the following process, the value of electron gain enthalpy is positive ?
(1) $F(g) + e \longrightarrow F^-(g)$ (2) $Cl(g) + e^- \longrightarrow Cl^-(g)$
(3) $Be(g) + e^- \longrightarrow Be^-(g)$ (4) $B(g) + e \longrightarrow B^-(g)$

23. Which is the correct property mentioned -
(1) $Fe^+ < Fe^{2+} < Fe^{3+}$ — size (2) $Fe^+ < Fe^{2+} < Fe^{3+}$ — ionisation energy
(3) B < Be < C — size (4) N < O < F — ionisation energy

24. If ionisation energy of an atom is 10 eV & EA is 6.8 eV electronegativity of the species on pauling scale
(1) 4 (2) 3 (3) 2 (4) 1

25. Fluorine has the highest electronegativity among the $ns^2\ np^5$ group on the Pauling scale, but the electron affinity of fluorine is less than that of chlorine because :
(1) the atomic number of fluorine is less than that of chlorine.
(2) fluorine being the first member of the family behaves in an unusual manner.
(3) chlorine can accommodate an electron better than fluorine by utilising its vacant 3d–orbital.
(4) small size, high electron density and an increased electron repulsion makes addition of an electron to fluorine less favourable than that in the case of chlorine in isolated stage.

26. The order of first electron affinity of O, S and Se is :
(1) O > S > Se (2) S > Se > O (3) Se > O > S (4) S > O > Se

27. Electron addition will be easier in :-
(1) O (2) O^+ (3) O^{2+} (4) O^{2-}

28. Electron gain enthalpy of first element in the following pairs is higher.
(1) Cl, F (2) O, S (3) O, F (4) S, Cl

29. Following the Mulliken scale, what parameters are required to evaluate electronegativity ?
(1) Only electronegativity (2) Only electron affinity
(3) Electron affinity and ionization energy (4) Ionic potential and electronegativity

30. Which one of the following oxides is neutral ?
(1) CO (2) SnO_2 (3) ZnO (4) SiO_2

31. Which of the following orders is correct ?
(1) F > N > C > Si > Ga – non –metallic character. (2) F > Cl > O > N – oxidising property.
(3) S > Se > Te > O – electron affinity value. (4) All of these.

32. The correct order of radii is-
(1) N < Be < B (2) $F^- < O^{2-} < N^{3-}$ (3) Na < Li < K (4) $Fe^+ < Fe^{2+} < Fe^{3+}$

33. In which of the following compound Mn shows minimum radius?
(1) MnO_2 (2) $KMnO_4$ (3) MnO (4) None of these

34. The ionisation energy of A(g) is similar to in terms of magnitude -
(1) electron affinity of $A^+(g)$ (2) electron affinity of A(g)
(3) ionisation energy of $A^+(g)$ (4) ionisation energy of $A^{2+}(g)$

35. Which of the following statements is INCORRECT ?
(1) Generally the radius trend and the ionization energy trend across a period are opposites.
(2) Metallic and covalent radii of potassium are 2.3 Å and 2.03Å respectively.
(3) Amongst Li^-, Be^- , B^- and C^- , Li^- is least stable ion .
(4) Atomic and ionic radii of Niobium and Tantalum are almost same

36. Electron affinity is the :
(1) Energy absorbed when an electron is added to an isolated atom in the gaseous state
(2) Energy released when an electron is added to an isolated atom in the gaseous state
(3) Energy required to take out an electron from an isolated gaseous atom
(4) Power of an atom to attract an electron to itself

37. If x, y and z are electronegativity, ionisation potential and electron-affinity respectively. Then the electron affinity (z) in the terms of electronegativity (x) and ionisation potential (y) will be :

(1) $x = \frac{y+z}{2}$ (2) $z = \frac{x-y}{2}$ (3) $z = \frac{x^2-y^2}{2}$ (4) z = 2x + y

38. Which of the following statements is incorrect ?
(1) In the long form of periodic table, the number of period indicates the value of principal quantum number.
(2) There are four d-block series comprising of total 40 elements in the long form of periodic table.
(3) s-block, d-block and f-block elements are metals.
(4) All p-block elements are non-metal.

39. If the same element is forming oxides in different oxidation states then :
(1) that oxide will be neutral in nature in which element will be in its highest oxidation state.
(2) that oxide will be highest acidic in nature in which element will be in its highest oxidation state.
(3) that oxide will be amphoteric in nature in which element will be in its highest oxidation state.
(4) that oxide will be highly basic in nature in which element will be in its highest oxidation state.

40. Which of the following statement is correct ?
(1) Ionisation energies of elements decrease along the period.
(2) Ionisation energies of the IIA group elements are less than that of the corresponding III A group elements.
(3) Ionisation energies of group 15 elements are less than that of the corresponding group 16 elements.
(4) Ionisation energy of Ga is greater than Al.

41. The dominating factor responsible for the decreasing ionisation energies of the elements on moving down the group is :
(1) atomic radius (2) type of electron to be removed
(3) the valence shell electron configuration (4) all of these

42. Which of the following order is not correct ?
(1) IE(I) of Be > IE(I) of B but IE(II) of Be < IE(II) of B
(2) IE(I) of Be < IE(I) of B but IE(II) of Be < IE(II) of B
(3) IE(II) of O > IE(II) of N
(4) IE(I) of Mg > IE(I) of Al

43. The correct order of the metallic character is :
(1) Na > Mg > Al > Si (2) Mg > Na > Al > Si (3) Al > Mg > Na > Si (4) Si > Al > Na > Mg

44. The correct order of the non-metallic character is :
(1) B > C > N > F (2) C > B > N > F (3) F > N > C > B (4) F > N > B > C

45. Which of the following statement is incorrect ?
(1) Oxide of aluminium (Al_2O_3), and arsenic (As_2O_3) are amphoteric.
(2) Oxide of chlorine (Cl_2O_7) is less acidic than oxide of nitrogen (N_2O_5).
(3) Oxide of carbon (CO_2) is more acidic than oxide of silica (SiO_2).
(4) The correct increasing order of basic character of various oxides is $H_2O < CuO < MgO < CaO$.

46. Higher values of ionisation energies of the 5d-transition elements are consistent with the -
(1) relatively smaller effective nuclear charge
(2) relatively smaller size of their atoms
(3) relatively smaller penetration effect of inner orbitals
(4) all of the above

47. The correct decreasing order of size of a isoelectronic species is -
(1) $Se^{-2} > Br^- > Kr > Rb^+ > Sr^{+2}$ (2) $S^{-2} > Cl^- > K^+ > Ar > Ca^{+2}$
(3) $N^{-3} > O^{-2} > Ne > F^- > Ca^{+2}$ (4) $F^- > Ne > Na^+ > Al^{+3} > Mg^{+2}$

48. Which one of the following is not the representative element ?
(1) Fe (2) K (3) Ba (4) N

49. An element of atomic mass 40 has 2, 8, 8, 2 as the electronic configuration. Which one of the following statement regarding this element is not correct ?
(1) It forms an basic oxide (2) It belongs to II A group
(3) It belongs to IV period (4) It forms an acidic oxide

50. Ionic radii is/are :
(1) directly proportional to effective nuclear charge
(2) directly proportional to square of effective nuclear charge
(3) inversely proportional to effective nuclear charge
(4) inversely proportional to square of effective nuclear charge

51. Which of the following is not a correct match ?
(1) Cl^-, P^{3-}, Ar — Isoelectronics
(2) Size of Mo = size of W — Lanthanide contraction
(3) IP of 'Be' > IP of 'B' — Penetration effect
(4) Size of Ne > size of F — Due to complete octet of Ne

52. Find the atomic number of element belonging to 4th period and 17th group in Modern periodic table :
(1) 17 (2) 25 (3) 59 (4) 35

53. Correct order of the property indicated below -
(1) Na > Al > Mg > Si IE_1 (2) Cl > S > O > F ΔHeg_1
(3) F > O > Cl > S EN (4) Cl > O > F > S EA_1

54. Consider the following points :
(a) Cs is the strongest reducing agent in IA group element
(b) $Be(OH)_2$ is amphoteric
(c) The density of potassium is less than sodium
(d) In alkali metals Li, Na, K and Rb, lithium has the minimum value of M.P.
Correct statement are :
(1) (a) & (b) are correct (2) (a), (b) & (c) are correct
(3) (b) & (c) are correct (4) (b), (c) & (d) are correct

55. Atomic number of an element is 43. The correct set of it's period number, block and group number is :

	Period no.	Block	Group no.
(1)	5	d	5
(2)	4	d	7
(3)	5	d	7
(4)	5	s	7

56. The electronic configurations of four elements are given below. Arrange these elements in the correct order of the magnitude of their electron affinity.

(i) $2s^2\ 2p^3$ (ii) $3s^2\ 3p^5$ (iii) $2s^2\ 2p^4$ (iv) $3s^2\ 3p^4$

Select the correct answer using the codes given below :

(1) (ii) < (i) < (iv) < (iii) (2) (i) < (iii) < (iv) < (ii)

(3) (iii) < (iv) < (ii) < (i) (4) (iii) < (iv) < (i) < (ii)

57. What is the correct order of 2nd ionisation energy

(1) C < O < N < F (2) C < N < O < I (3) C < F < N < O (4) C < N < F < O

58. The electron affinity of a hypothetical element 'A' is 3 eV per atom. How much energy in kcal is released when 10g of 'A' is completely converted to A^- ion in a gaseous state?

(1 eV = 23 kcal mol^{-1}, Molar mass of A = 30 g)

(1) 23 kcal (2) 46 kcal (3) 50 kcal (4) 52 kcal

59. Which is not correctly matched ?

(a) Basic strength of oxides	$Cs_2O<Rb_2O< K_2O < Na_2O < Li_2O$
(b) Stability of peroxides	$Na_2O_2 < K_2O_2 < Rb_2O_2 < Cs_2O_2$
(c) Stability of bicarbonates	$LiHCO_3 < NaHCO_3 < KHCO_3 < RbHCO_3 < CsHCO_3$
(d) Melting point	NaF < NaCl < NaBr < NaI

(1) a and d (2) a and c (3) a and b (4) b and c

60. Match List I with List II and select the correct answer using the code given below the lists :

List I	**List II**
(a) SO_2, NO_3^-, CO_3^{2-}	(p) Semi-metals
(b) B, Si, Ge, As, Sb	(q) Isoelectronic species
(c) He, Ne, Ar, Kr, Xe	(r) Van der waal's radii
(d) $M(g) + \text{energy} \rightarrow M^+(g) + e^-$	(s) Ionisation energy

Code :

	(a)	(b)	(c)	(d)		(a)	(b)	(c)	(d)
(1)	q	p	r	s	(2)	p	q	r	s
(3)	q	p	s	r	(4)	r	p	q	s

61. Match List I (atomic number of the element) with List II (position in the periodic table) and select the correct answer using the codes given below the lists -

	List I		List II
(a)	52	(p)	s-block
(b)	56	(q)	p-block
(c)	57	(r)	d-block
(d)	60	(s)	f-block

	(a)	(b)	(c)	(d)		(a)	(b)	(c)	(d)
(1)	q	p	r	s	(2)	q	p	s	r
(3)	p	q	r	s	(4)	p	b	s	r

TOPIC 3 MATRICES & DETERMINANT

SECTION - I : STRAIGHT OBJECTIVE TYPE

Level : I (Easy/Moderate)

1. If $\Delta(x) = \begin{vmatrix} x^2+4x-3 & 2x+4 & 1 \\ 2x^2+5x-9 & 4x+5 & 2 \\ 8x^2-6x+1 & 16x-6 & 8 \end{vmatrix} = ax^3 + bx^2 - cx + d$, then

(1) a = 0 (2) b = 0 (3) c = 0 (4) d = 189

2. Matrix A is given by $A = \begin{bmatrix} 6 & 11 \\ 2 & 4 \end{bmatrix}$, then the determinant of $(A^{2005} - 6.A^{2004})$, is -

(1) 2^{2006} (2) $(-11).\ 2^{2005}$ (3) -2^{2005} (4) $(-9).\ (2)^{2004}$

3. If 3 digit numbers A28, 3B9 and 62C are divisible by a fixed constant 'K' where A, B, C are integers lying between 0 and 9 , then determinant $\begin{vmatrix} A & 3 & 6 \\ 8 & 9 & C \\ 2 & B & 2 \end{vmatrix}$ is always divisible by

(1) K (2) A (3) ABC (4) K^2

4. If $0 \le [x] < 2$; $-1 \le [y] < 1$ and $1 \le [z] < 3$ where [.] denotes the greatest integer function, then the maximum value of the determinant $\begin{vmatrix} [x]+1 & [y] & [z] \\ [x] & [y]+1 & [z] \\ [x] & [y] & [z]+1 \end{vmatrix}$ is -

(1) 2 (2) 4 (3) 6 (4) 8

5. If $\begin{vmatrix} 2bc-a^2 & c^2 & b^2 \\ c^2 & 2ac-b^2 & a^2 \\ b^2 & a^2 & 2ab-c^2 \end{vmatrix} = 0$ and a, b, c are different real numbers, then the value of $3(a + b + c) + 2$ is

(1) 5 (2) 0 (3) 2 (4) 6

6. If the system of equation

$\lambda p + q + r = 0$
$p + \lambda q + r = 0$
$p + q + \lambda r = 0$

has non trivial solution, then the value of λ can be the roots of quadratic equation, which is

(1) $x^2 + x - 2 = 0$ (2) $x^2 - x + 2 = 0$ (3) $x^2 + 4x + 1 = 0$ (4) $x^2 - 3x + 2 = 0$

7. If $f(x) = \begin{vmatrix} 1 & \cos x & 1-\cos x \\ 1+\sin x & \cos x & 1+\sin x-\cos x \\ \sin x & \sin x & 1 \end{vmatrix}$, $g(x) = \int_0^x f(t)\,dt$, then range of $g'(x)$ equal to

(1) $\left[0, \frac{1}{2}\right]$ (2) $\left[-\frac{1}{2}, \frac{1}{2}\right]$ (3) $(0, \infty)$ (4) none of these

8. If $\Delta_r = \begin{vmatrix} r\,.\,r! & {}^nC_r & 2r \\ (n+1)! & 2^n & n^2+n+2 \\ 1 & 1 & 2 \end{vmatrix}$, then $\sum_{r=1}^{n} \Delta_r$ is equal to

(1) 0 (2) $\frac{n(n+1)}{2}$ (3) n^2 (4) $\sum_{r=2}^{n} r$

9. If $\Delta_r = \begin{vmatrix} r & n & 6 \\ r^2 & 2n^2 & 4n-2 \\ r^3 & 3n^3 & 3n^2-3n \end{vmatrix}$, then $\sum_{r=0}^{n-1} \Delta_r$ equals to

(1) $n^2(n+2)$ (2) $n(n+2)^2$ (3) $\frac{1}{12}\, n(n^3+2)$ (4) none of these

10. If $\Delta = \begin{vmatrix} 2 & 2 & 2 \\ {}^nC_1 & {}^{n+3}C_1 & {}^{n+6}C_1 \\ {}^nC_2 & {}^{n+3}C_2 & {}^{n+6}C_2 \end{vmatrix}$ = x, then number of possible relative prime factors of 'x', is

(1) 0 (2) 2 (3) 4 (4) none of these

11. If A and B are two 3 × 3 order matrices, then which one of the following is not true.
(1) (A + B) = A′ + B′ (2) (AB)′ = A′ B′
(3) det (AB) = det (A) det B (4) A(adj A) = $|A|I_3$

12. If $A = \begin{bmatrix} x & 3 & 2 \\ -3 & y & -7 \\ -2 & 7 & 0 \end{bmatrix}$ and A = – A′ , then x + y is equal to

(1) 2 (2) – 1 (3) 0 (4) 12

13. If A is 3 × 3 skew symmetric matrix, then trace of A is equal to
(1) 1 (2) |A| (3) – 1 (4) none of these

14. The number of values of k for which the system of equation (k + 1) x + 8y = 4k, kx + (k + 3) y = 3k – 1 has no solution is
(1) 3 (2) 1 (3) 2 (4) infinite

15. The system of equations
$(p\alpha + q)\, x + py + qz = 0$
$(q\alpha + r)\, x + qy + rz = 0$
$(p\alpha + q)\, y + (q\alpha + r)\, z = 0$
has a non trivial solution if

(1) 2p = q + r (2) $\frac{p}{r} = \left(\frac{q}{p}\right)^2$ (3) $\frac{2}{q} = \frac{1}{p} + \frac{1}{r}$ (4) $p\alpha^2 + 2q\alpha + r = 0$

16. If a matrix A satisfy $A^2 - 5A + 7I = 0$ and $A^8 = pA + qI$ then the value of p is -
(1) 9621 (2) 1265 (3) 5299 (4) undefine

17. If A is a skew-symmetric matrix such that $A^2 + I = 0$, then
(1) A is nilpotent matrix of even order
(2) A is orthogonal matrix of even order
(3) A is involutory matrix of odd order
(4) A is singular matrix

18. If $f(\alpha) = \begin{bmatrix} \cos\alpha & -\sin\alpha & 0 \\ \sin\alpha & \cos\alpha & 0 \\ 0 & 0 & 1 \end{bmatrix}$, then $f(-\alpha)$ is equal to

(1) $f^{-1}(-\alpha)$ (2) $[f(\alpha)]^{-1}$ (3) $-f(\alpha)$ (4) none of these

19. If p is a constant and $f(x) = \begin{vmatrix} x^2 & x^3 & x^4 \\ 2 & 3 & 6 \\ p & p^2 & p^3 \end{vmatrix}$ if $f''(x) = 0$ have roots α, β, then

(1) α and β have opposite sign and equal magnitude at $p = \sqrt{3}$

(2) At p = 1, $f''(x) = 0$ represent an identity

(3) At p = 2, product of roots are unity

(4) At $p = -\sqrt{3}$ product of roots are positive

20. If $\Delta_r = \begin{vmatrix} a^r & b^r & c^r \\ a & b & c \\ 1-a & 1-b & 1-c \end{vmatrix}$. If $\sum_{r=0}^{\infty} \Delta_r = 0$, then

which statement is true.

(1) $a = b = c, a \in R$ (2) $a = b = c, |a| < 1$ (3) $a = b = c \neq 1$ (4) $a = b \neq c, |c| < 1$

21. If the matrix $A = \begin{bmatrix} 0 & 2b & c \\ a & b & -c \\ a & -b & c \end{bmatrix}$ is an orthogonal matrix, then

(1) $c = \frac{1}{\sqrt{3}}$ (2) $a = \frac{1}{\sqrt{6}}$ (3) $b = -\frac{1}{\sqrt{2}}$ (4) $c = -\frac{1}{\sqrt{6}}$

22. If AB = A and BA = B, then

(1) $A^2 = B$ (2) $A^2 = A$ (3) $B^2 = 2B$ (4) $B^2 = A$

Level : II (Tough)

23. The value of $\Delta = \begin{vmatrix} {}^{16}C_8 & {}^{16}C_8 & {}^{15}C_8 \\ {}^{14}C_7 & {}^{14}C_6 & {}^{13}C_5 \\ {}^{12}C_6 & {}^{12}C_5 & {}^{11}C_4 \end{vmatrix}$ is

(1) 25 (2) 52 (3) ${}^{14}C_8 - {}^{13}C_5$ (4) $2 \cdot {}^{13}C_6 - {}^{14}C_7$

24. If $a + b + c \neq 0$, then system of equation

$(b + c)(y + z) - ax = b - c$

$(c + a)(z + x) - by = c - a$

$(a + b)(x + y) - cz = a - b$

has

(1) a unique solution (2) no solution

(3) infinite number of solution (4) exactly two solution

25. If $\begin{pmatrix} 1 & -\tan\theta \\ \tan\theta & 1 \end{pmatrix} \begin{pmatrix} 1 & \tan\theta \\ -\tan\theta & 1 \end{pmatrix}^{-1} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$, then the number of values of 'θ' in $[-2\pi, 2\pi]$ satisfying it, is

(1) 0 (2) 3 (3) 5 (4) 7

26. If the rank of the matrix $\begin{bmatrix} 2 & -3 & 1 \\ 3 & 5 & 7 \\ 5 & 8 & 8 \end{bmatrix}$ is 'α', then find the value of $\int_0^{\sqrt{\alpha}} [x^2]\,dx$, where [.] denote greatest integer function.

(1) $\sqrt{8}-\sqrt{2}-1$ (2) $\sqrt{9}$ (3) $\sqrt{12}-\sqrt{2}-1$ (4) $\sqrt{9}-\sqrt{2}+1$

27. If $f(\sin x) = \begin{vmatrix} \sin x & 2\cos x & 2\tan x \\ 1 & \sin x & \cos x \\ \tan x & \cos x & \sin x \end{vmatrix}$ and $g(x) = \int f(x)dx$, $g\left(\sqrt{2}\right) = 0$, then

(1) g(x) is an odd function (2) $\lim\limits_{x\to 1} f(x) = 2$

(3) $g(2) = 9 + \ell n\, 3$ (4) Time period of f(sin x) is π

28. $\Delta(x) = \begin{vmatrix} \tan x & \sin x & \cos x \\ \sqrt{2} & 1 & 1 \\ 2 & \sqrt{3} & 3 \end{vmatrix}$, then $\Delta'(x) = 0$ has

(1) no solution in $\left(0, \frac{\pi}{4}\right)$ (2) Atleast two solution in $\left[0, \frac{\pi}{2}\right)$

(3) Atleast one solution in $\left(\frac{\pi}{6}, \frac{\pi}{2}\right)$ (4) No solution in $\left(\frac{\pi}{6}, \frac{\pi}{2}\right)$

29. Let P denotes the set of all values of λ for which the system of equation

$\lambda x_1 + x_2 + x_3 = 1$
$x_1 + \lambda x_2 + x_3 = 1$
$x_1 + x_2 + \lambda x_3 = 1$

is inconsistent, then

(1) $\sum\limits_{\lambda \in P} |\lambda| = 2$ (2) λ is an even prime number

(3) $\lim\limits_{x\to\lambda} \frac{|x+2|}{x^2-4} = \frac{1}{4}$ (4) Cube roots of λ are 1, ω, ω^2

30. If α, β, γ are the roots of the cubic equation $ax^3 + bx^2 + cx + d = 0$, then find the determinant $\Delta = \begin{vmatrix} \alpha & \beta & \gamma \\ \beta & \gamma & \alpha \\ \gamma & \alpha & \beta \end{vmatrix}$

(1) $\frac{b^3-3abc}{a^3}$ (2) $\frac{b^2-4ac}{a^2}$ (3) 0 (4) $\frac{b^3-4abc}{a^3}$

SECTION - II : ASSERTION & REASONING TYPE

31. **Statement-1 :** $\begin{vmatrix} i^{99} & 0 & 0 \\ -\omega^{20} & i^{98} & 0 \\ \omega & 20 & 2i^{97} \end{vmatrix}$ = – 2, where ω and i are cube and fourth root of unity respectively.

Statement-2 : If all the diagonal element of a determinant are zero and $a_{ij} = -a_{ji}$, then its value is always zero.

(1) Statement-1 is true, Statement-2 is true; Statement-2 is the correct explanation of Statement-1.
(2) Statement-1 is true, Statement-2 is true; Statement-2 is not the correct explanation of Statement-1
(3) Statement-1 is false, Statement-2 is true.
(4) Statement-1 is true, Statement-2 is false.

32. For a system of equation AX = B
Statement-1 : System have unique solution if B is a non singular matrix and matrix A can be singular.

Statement-2 : Singular matrix have value of its determinant equal to zero.

(1) Statement -1 is True, Statement -2 is True ; Statement -2 is a correct explanation for Statement -1
(2) Statement-1 is True, Statement-2 is True ; Statement-2 **is NOT** a correct explanation for Statement-1
(3) Statement -1 is True, Statement -2 is False
(4) Statement -1 is False, Statement -2 is True

33. **Statement-1 :** $A = \begin{bmatrix} 1 & 2 & 3 \\ 3 & 4 & 5 \\ 6 & 7 & 8 \end{bmatrix}$ and $B = \begin{bmatrix} a & b & c \\ b & c+1 & a-1 \\ c & a-1 & b+1 \end{bmatrix}$, then AB = BA is possible if $B = A^{-1}$ or value of a + b + c = 1.

Statement-2 : AI = IA is possible when I is the unit matrix of order '3' or $I = A^{-1}$

(1) Statement -1 is True, Statement -2 is True ; Statement -2 is a correct explanation for Statement -1
(2) Statement-1 is True, Statement-2 is True ; Statement-2 **is NOT** a correct explanation for Statement-1
(3) Statement -1 is True, Statement -2 is False
(4) Statement -1 is False, Statement -2 is True

34. **Statement-1 :** $\Delta = \begin{vmatrix} 1 & \log_x y & \log_x z \\ \log_y x & 1 & \log_y z \\ \log_z x & \log_z y & 1 \end{vmatrix} = 0$

Statement-2 : $\log_b a = \dfrac{\log a}{\log b}$ and if any two rows are identical then $\Delta = 0$

(1) Statement -1 is True, Statement -2 is True ; Statement -2 is a correct explanation for Statement -1
(2) Statement-1 is True, Statement-2 is True ; Statement-2 **is NOT** a correct explanation for Statement-1
(3) Statement -1 is True, Statement -2 is False
(4) Statement -1 is False, Statement -2 is True

35. **Statement 1 :** If $A = \begin{bmatrix} a^2+x^2 & ab-cx & ac+bx \\ ab+xc & b^2+x^2 & bc-ax \\ ac-bx & bc+ax & c^2+x^2 \end{bmatrix}$ and $B = \begin{bmatrix} x & c & -b \\ -c & x & a \\ b & -a & x \end{bmatrix}$, then $|A| = |B|^2$.

Statement 2 : If A^c is cofactor matrix of a square matrix A of order n then $|A^c| = |A|^{n-1}$.
(1) Statement-1 is true, statement-2 is true; statment-2 is a correct explanation for statement-1.
(2) Statement-1 is true, statement-2 is true; statement-2 is not a correct explanation for statement-1.
(3) Statement-1 is true, statement- is false.
(4) Statement-1 is false, statement-2 is true.

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