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PHYSICS, CHEMISTRY, MATHEMATICS

JEE (ADVANCED) RANK BOOSTER
(SAMPLE COPY)

Content

TOPIC 1

MODERN PHYSICS

SECTION - I : STRAIGHT OBJECTIVE TYPE

1. In an α-decay the Kinetic energy of α particle is 48 MeV and Q-value of the reaction is 50 MeV. The mass number of the mother nucleus is:- (Assume that daughter nucleus is in ground state)

(A) 96 (B) 100 (C) 104 (D) none of these

2. A sample of radioactive material decays simultaneously by two processes A and B with half lives $\frac{1}{2}$ and $\frac{1}{4}$ hr respectively. For first half hour it decays with the process A, next one hr with the process B and for further half an hour with both A and B. If originally there were N_0 nuclei, find the number of nuclei after 2 hr of such decay.

(A) $\frac{N_0}{(2)^8}$ (B) $\frac{N_0}{(2)^4}$ (C) $\frac{N_0}{(2)^6}$ (D) $\frac{N_0}{(2)^5}$

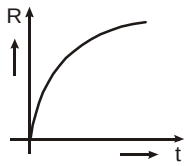
3. In which of the following process the number of protons in the nucleus increases .

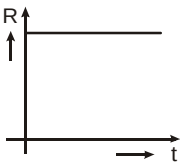
(A) α – decay (B) β^- – decay (C) β^+ – decay (D) k – capture

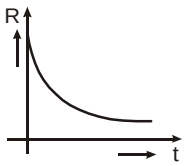
4. The angular momentum of an electron in first orbit of Li^{++} ion is :

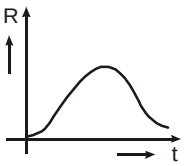
(A) $\frac{3h}{2\pi}$ (B) $\frac{9h}{2\pi}$ (C) $\frac{h}{2\pi}$ (D) $\frac{h}{6\pi}$

5. A radioactive nucleus ' X ' decays to a stable nucleus ' Y '. Then the graph of rate of formation of ' Y' against time ' t ' will be :

(A) 

(B) 

(C) 

(D) 

6. A heavy nucleus having mass number 200 gets disintegrated into two small fragments of mass number 80 and 120. If binding energy per nucleon for parent atom is 6.5 M eV and for daughter nuclei is 7 MeV and 8 MeV respectively, then the energy released in the decay will be:

(A) 200 MeV (B) – 220 MeV (C) 220 MeV (D) 180 MeV

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

(A) V electron volt (B) $\frac{3V}{4}$ electron volt

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

8. All electrons ejected from a surface by incident light of wavelength 200 nm can be stopped before travelling 1 m in the direction of uniform electric field of 4 N/C. The work function of the surface is:
(A) 4 eV (B) 6.2 eV (C) 2 eV (D) 2.2 eV

9. An electron of mass 'm', when accelerated through a potential V has de–Broglie wavelength λ. The de–Broglie wavelength associated with a proton of mass M accelerated through the same potential difference will be:

(A) $\lambda\sqrt{\frac{M}{m}}$ (B) $\lambda\sqrt{\frac{m}{M}}$ (C) $\lambda\left(\frac{M}{m}\right)$ (D) $\lambda\left(\frac{m}{M}\right)$

10. 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 right with same speed and emits a photon of energy E_2 towards right. Taking recoil of nucleus into account during emission process
(A) $E_1 > E_2$ (B) $E_1 < E_2$ (C) $E_1 = E_2$ (D) information insufficient

11. 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 :
(A) 0 (B) 2 (C) –2 (D) 1

12. The voltage applied to an X-ray tube is 18 kV. The maximum mass of photon emitted by the X-ray tube will be:
(A) 2×10^{-13} kg (B) 3.2×10^{-36} kg (C) 3.2×10^{-32} kg (D) 9.1×10^{-31} kg

13. The wavelengths of K_α x-rays of two metals 'A' and 'B' are $\frac{4}{1875\ R}$ and $\frac{1}{675\ R}$ respectively, where 'R' is Rydberg's constant. The number of elements lying between 'A' and 'B' according to their atomic numbers is
(A) 3 (B) 6 (C) 5 (D) 4

14. One of the lines in the emission spectrum of Li^{2+} has the same wavelength as that of the 2nd line of Balmer series in hydrogen spectrum. The electronic transition corresponding to this line is :
(A) $n = 4 \rightarrow n = 2$ (B) $n = 8 \rightarrow n = 2$ (C) $n = 8 \rightarrow n = 4$ (D) $n = 12 \rightarrow n = 6$

15. 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
(A) 0.3 Å (B) 3 Å (C) 30 Å (D) 10 Å

16. The photon radiated from hydrogen corresponding to 2nd line of Lyman series is absorbed by a hydrogen like atom 'X' in 2nd excited state. As a result the hydrogen like atom 'X' makes a transition to n^{th} orbit. Then,
(A) $X = He^+$, n = 4 (B) $X = Li^{++}$, n = 6 (C) $X = He^+$, n = 6 (D) $X = Li^{++}$, n = 9

17. In a photoelectric experiment, with light of wavelength λ, the fastest electron has speed v. If the exciting wavelength is changed to $\frac{3\lambda}{4}$, the speed of the fastest emitted electron will become

(A) $v\sqrt{\frac{3}{4}}$ (B) $v\sqrt{\frac{4}{3}}$ (C) less than $v\sqrt{\frac{3}{4}}$ (D) greater than $v\sqrt{\frac{4}{3}}$

18. An element X decays, first by positron emission and then two α-particles are emitted in successive radioactive decay. If the product nuclei has a mass number 229 and atomic number 89, the mass number and atomic number of element X are
(A) 237, 93 (B) 237, 94 (C) 221, 84 (D) 237, 92

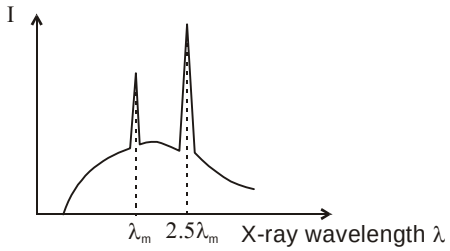
19. 1.5 MW of 400 nm light is directed at a photoelectric cell. If 0.10% of the incident photons produce photoelectrons, the current in the cell is
(A) 0.36 μA (B) 0.48 μA (C) 0.42 mA (D) 0.32 mA

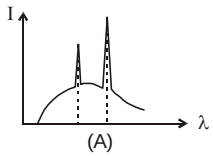
20. The element which has a k_α x-rays line of wavelength 1.8 Å is

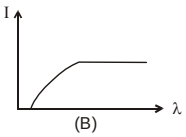
($R = 1.1 \times 10^7\ m^{-1}$, b = 1 and $\sqrt{5/33} = 0.39$)

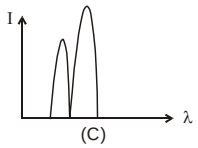
(A) Co, Z = 27 (B) Iron, Z = 26 (C) Mn, z = 25 (D) Ni, z = 28

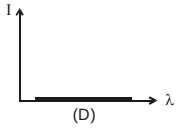
21. When an electron accelerated by potential difference U is bombarded on a specific metal, the emitted X-ray spectrum obtained is shown in adjoining graph. If the potential difference is reduced to U/3, the correct spectrum is



(A) 

(B) 

(C) 

(D) 

22. In the hydrogen atom, an electron makes a transition from n = 2 to n = 1. The magnetic field produced by the circulating electron at the nucleus

(A) decreases 16 times (B) increases 4 times

(C) decreases 4 times (D) increases 32 times

23. 90% of a radioactive sample is left undecayed after time t has elapsed. What percentage of the initial sample will decay in a total time 2t.

(A) 20% (B) 19% (C) 40% (D) 38%

24. A radioactive element X converts into another stable element Y. Half life of X is 2 hrs. Initially only X is present. After time t, the ratio of atoms of X and Y is found to be 1 : 4, then t in hours is :

(A) 2 (B) 4 (C) between 4 and 6 (D) 6

25. An electron in a hydrogen atom makes a transition from first excited state to ground state. The equivalent current due to circulating electron

(A) increases 2 times (B) increases 4 times (C) increases 8 times (D) remains the same

SECTION - II : MULTIPLE CORRECT ANSWER TYPE

26. When a hydrogen atom is excited from ground state to first excited state then

(A) its kinetic energy increases by 10.2 eV. (B) its kinetic energy decreases by 10 .2 eV.

(C) its potential energy increases by 20.4 eV. (D) its angular momentum increases by 1.05×10^{-34} J-s.

27. In an x–ray tube the voltage applied is 20KV. The energy required to remove an electron from L shell is 19.9 KeV. In the x–rays emitted by the tube

(A) minimum wavelength will be 62.1 pm

(B) energy of the characterstic x–rays will be equal to or less than 19.9 KeV

(C) L_α x–ray may be emitted

(D) L_α x–ray will have energy 19.9 KeV

28. Suppose the potential energy between electron and proton at a distance r is given by $-\frac{Ke^2}{3r^3}$. Application of Bohr's theory to hydrogen atom in this case shows that

(A) energy in the nth orbit is proportional to n^6

(B) energy is proportional to m^{-3} (m : mass of electron)

(C) energy of the nth orbit is proportional to n^{-2}

(D) energy is proportional to m^3 (m = mass of electron)

29. Let A_n be the area enclosed by the nth orbit in a hydrogen atom. The graph of $\ell n(A_n/A_l)$ against $\ell n(n)$
(A) will pass through origin
(B) will be a straight line with slope 4
(C) will be a monotonically increasing nonlinear curve
(D) will be a circle

SECTION - III : ASSERTION AND REASON TYPE

30. **Statement-1 :** Though light of a single frequency (monochromatic light) is incident on a metal, the energies of emitted photoelectrons are different.
Statement-2 : The energy of electrons just after they absorb photons incident on metal surface may be lost in collision with other atoms in the metal before the electron is ejected out of the metal.
(A) Statement-1 is True, Statement-2 is True; Statement-2 **is** a correct explanation for Statement-1
(B) Statement-1 is True, Statement-2 is True; Statement-2 **is NOT** a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True.

31. **Statement-1 :** The de-Broglie wavelength of a molecule (in a sample of ideal gas) varies inversely as the square root of absolute temperature.
Statement-2 : The rms velocity of a molecule (in a sample of ideal gas) depends on temperature.
(A) Statement-1 is True, Statement-2 is True; Statement-2 **is** a correct explanation for Statement-1
(B) Statement-1 is True, Statement-2 is True; Statement-2 **is NOT** a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True.

32. **Statement-1 :** Heavy nuclides tend to have more number of neutrons than protons.
Statement-2 : As there is coulombic repulsion between protons, so in heavy nuclei, excess of neutrons are preferable.
(A) Statement-1 is True, Statement-2 is True; Statement-2 **is** a correct explanation for Statement-1
(B) Statement-1 is True, Statement-2 is True; Statement-2 **is NOT** a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True.

33. **Statement–1 :** ${}_ZX^A$ undergoes 2 α decays, 2β decays (negative β) and 2 γ decays. As a result the daughter product is ${}_{Z-2}Y^{A-8}$.
Statement–2 : In α decay the mass number decreases by 4 unit and atomic number decreases by 2 unit. In β decay (negative β) the mass number remains unchanged and atomic number increases by 1 unit. In γ decay, mass number and atomic number remains unchanged.
(A) Statement-1 is True, Statement-2 is True; Statement-2 **is** a correct explanation for Statement-1
(B) Statement-1 is True, Statement-2 is True; Statement-2 **is NOT** a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True.

SECTION - IV : COMPREHENSION TYPE

Comprehension # 1

The radionuclide ^{56}Mn is being produced in a cyclotron at a constant rate P by bombarding a maganese target with deutrons. ^{56}Mn has a half life of 2.5 hours and the target contains large number of only the stable maganese isotope ^{55}Mn. The reaction that produces ^{56}Mn is :

$$^{55}Mn + d \rightarrow {}^{56}Mn + p$$

After being bombarded for a long time, the activity of ^{56}Mn becomes constant equal to $13.86 \times 10^{10}\ s^{-1}$. (Use $\ell n2 = 0.693$; Avogadro No = 6×10^{23}; atomic weight ^{56}Mn = 56 gm/mole)

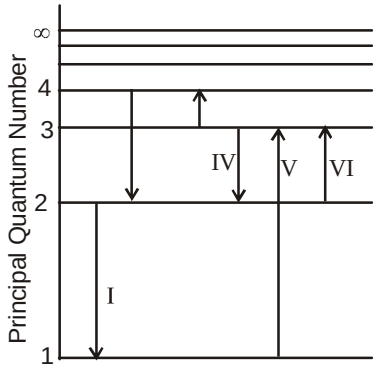
34. At what constant rate P, ^{56}Mn nuclei are being produced in the cyclotron during the bombardment ?
(A) 2×10^{11} nuclei/s (B) 13.86×10^{10} nuclei/s
(C) 9.6×10^{10} nuclei/s (D) 6.93×10^{10} nuclei/s

35. After the activity of ^{56}Mn becomes constant, number of ^{56}Mn nuclei present in the target, is equal to
(A) 5×10^{11} (B) 20×10^{11} (C) 1.2×10^{14} (D) 1.8×10^{15}

36. After a long time bombardment, number of ^{56}Mn nuclei present in the target depends upon
(a) the number of ^{56}Mn nuclei present at the start of the process.
(b) half life of the ^{56}Mn
(c) the constant rate of production P.
(A) All (a), (b) and (c) are correct (B) only (a) and (b) are correct
(C) only (b) and (c) are correct (D) only (a) and (c) are correct

Comprehension # 2

Pertain to the statement and diagram below :



The figure given shows an energy level diagram for the hydrogen atom. Several transitions are marked as I, II, III, _____ . The diagram is only indicative and not to scale.

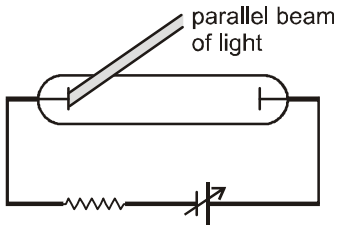
37. In which transition is a Balmer series photon absorbed ?
(A) II (B) III (C) IV (D) VI

38. The wavelength of the radiation involved in transition II is
(A) 291 nm (B) 364 nm (C) 487 nm (D) 652 nm

39. Which transition will occur when a hydrogen atom is irradiated with radiation of wavelength 103nm?
(A) I (B) II (C) IV (D) V

SECTION - V : MATRIX - MATCH TYPE

40. In the shown experimental setup to study photoelectric effect, two conducting electrodes arc enclosed in an evacuated glass-tube as shown. A parallel beam of monochromatic light, falls on photosensitive electrodes. The emf of battery shown is high enough such that all photoelectrons ejected from left electrode will reach the right electrode. Under initial conditions photoelectrons are emitted. As changes are made in each situation of column I; Match the statements in column I with results in column II.



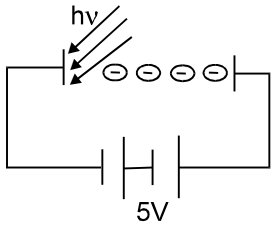
	Column-I		**Column-II**
(A)	If frequency of incident light is increased keeping number of photons per second constant	(p)	magnitude of stopping potential will increase
(B)	If frequency of incident light is increased and number of photons per second is decreased.	(q)	current through circuit may stop
(C)	If work function of photo sensitive electrode is increased	(r)	maximum kinetic energy of ejected photoelectrons will increase
(D)	If number of photons per second of incident light is increased keeping its frequency constant	(s)	saturation current will increase
		(t)	saturation current will decrease

41. In column-I, consider each process just before and just after it occurs. Initial system is isolated from all other bodies. Consider all product particles (even those having rest mass zero) in the system. Match the system in column-I with the result they produce in column-II.

	Column-I		**Column-II**
(A)	Spontaneous radioactive decay of an uranium nucleus initially at rest as given by reaction $^{238}_{92}U \rightarrow {}^{234}_{90}Th + {}^{4}_{2}He + ...$	(p)	Number of protons is increased
(B)	Fusion reaction of two hydrogen nuclei as given by reaction $^{1}_{1}H + {}^{1}_{1}H \rightarrow {}^{2}_{1}H + ...$	(q)	Momentum is conserved
(C)	Fission of U^{235} nucleus initiated by a thermal neutron as given by reaction $^{1}_{0}n + {}^{235}_{92}U \rightarrow {}^{144}_{56}Ba + {}^{89}_{36}Kr + 3{}^{1}_{0}n + ...$	(r)	Mass is converted to energy or vice versa
(D)	β^- decay (negative beta decay)	(s)	Charge is conserved
		(t)	No. of protons is decreased

SECTION - VI : INTEGER TYPE

42. Photons of energy 5 eV are incident on cathode as shown in the figure. Electrons reaching the anode have kinetic energies varying from 6eV to 8eV. Find the work function of the metal in ev. & state whether the current in the circuit is less than or equal to saturation current.



43. Consider a nuclear reaction A + B → C. A nucleus 'A' moving with kinetic energy of 5 MeV collides with a nucleus 'B' moving with kinetic energy of 3 MeV and form a nucleus 'C' in excited state. The kinetic energy of nucleus 'C' just after its formation is $\frac{265}{N}$ MeV then x is and it is formed in a state with excitation energy 10 MeV. Take masses of nuclei of A, B and C as 25.0, 10.0, 34.995 amu respectively. 1 amu = 930 MeV/c^2.

44. A sample has two isotopes A^{150} and B having masses 50 g and 30 g respectively. A is radioactive and B is stable. A decays to A′ by emitting α particles. The half life of A is 2 hrs. Find the mass of the sample after 4 hour in gm.

45. A radioactive source, in the form of a metallic sphere of radius 10^{-2} m emits β–particles at the rate of 5×10^{10} particles per second. The source is electrically insulated. How long in μ -sec.will it take for its potential to be raised by 2 volt, assuming that 40% of the emitted β–particles escape the source.

46. magnitude of Q value of the reaction is x/10 mev. then x is

$$N^{14} + \alpha \longrightarrow O^{17} + p$$

The masses of N^{14}, He^4, H^1, O^{17} are respectively
14.00307 u, 4.00260 u, 1.00783 u and 16.99913 u.

47. In previous question the total kinetic energy of the products if the striking α particle has the minimum kinetic energy required to initiate the reaction is x/100 mev. then x is.

48. A sample of hydrogen atom gas contains 100 atoms. All the atoms are excited to the same n^{th} excited state. The total energy released by all the atoms is $\frac{4800}{49}$ Rch (where Rch = 13.6 eV), as they come to the ground state through various types of transitions. Find then maximum energy of the emitted photon is x/49 Rch. then x is :

49. Value of 'n' in previous question.

50. In previous question, maximum total number of photons that can be emitted by this sample.

TOPIC 2 PERIODIC TABLE & PERIODICITY

SECTION - I : STRAIGHT OBJECTIVE TYPE

1. Consider the following statements;
(I) Rutherford name was associated with the development of periodic table.
(II) A metal M having electronic configuration $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^{10}, 4s^1$ is d-block element.
(III) Diamond is not an element.
(IV) The electronic configuration of the most electronegative element is $1s^2, 2s^2, 2p^5$,
Select the correct option from the given codes.
(A) I, II, IV (B) I, II, III, IV (C) II, IV (D) I, III, IV

2. There are four elements 'p', 'q', 'r' and 's' having atomic numbers Z-1, Z, Z+1 and Z+2 respectively. If the element 'q' is an inert gas, select the correct answers from the following statements.
(i) 'p' has most negative electron gain enthalpy in the respective period.
(ii) 'r' is an alkali metal
(iii) 's' exists in +2 oxidation state.
(A) (i) and (ii) only (B) (ii) and (iii) only (C) (i) and (iii) only (D) (i), (ii) and (iii)

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

4. The statement that is not correct for the periodic classification of elements 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.

5. The electron gain enthalpies of halogens in kJ mol^{-1} are as given below :
F = – 332, Cl = – 349, Br = – 324, I = – 295.
The less negative value for F as compared to that of Cl is due to :
(A) strong electron-electron repulsions in the compact 2p-sub shell of F.
(B) weak electron -electron repulsions in the bigger 3p-sub shell of Cl
(C) smaller electronegativity value of F than Cl
(D) (A) & (B) both

6. Which of the following statements is correct ?
(A) There is regular increase in negative value of electron gain enthalpy with increasing atomic number from left to right in the period.
(B) Electropositive nature of elements decrease with increasing atomic number from left to right in the period.
(C) Ionisation energies of elements decreases from left to right in the period.
(D) Effective nuclear charge of elements decreases from left to right in the period.

7. Which of the following statements is wrong for the transition elements ?
(A) Transition elements are placed from 3^{rd} to 6^{th} period.
(B) Last electron enters in (n – 1) d orbital.
(C) Exhibits variable valency.
(D) General electronic configuration is $(n-1)\,d^{1-10}\,ns^{0-2}$.

8. If the same element is forming oxides in different oxidation states then :
(A) that oxide will be neutral in nature in which element will be in its highest oxidation state.
(B) that oxide will be highest acidic in nature in which element will be in its highest oxidation state.
(C) that oxide will be amphoteric in nature in which element will be in its highest oxidation state.
(D) that oxide will be highly basic in nature in which element will be in its highest oxidation state.

9. The increasing order of acidic nature of Li_2O, BeO, B_2O_3, CuO is :
(A) $Li_2O < BeO < CuO < B_2O_3$ (B) $BeO < CuO < B_2O_3 < Li_2O$
(C) $Li_2O < CuO < BeO < B_2O_3$ (D) $B_2O_3 < CuO < BeO < Li_2O$

10. Consider the following statements and arrange in the order of true/false as given in the codes.
S_1 : In modern periodic table each block contains a number of columns equal to the number of electrons that can occupy that sub-shell.
S_2 : The greatest increase in ionization enthalpy is experienced on removal of electron from core noble gas configuration.
S_3 : The size of the isoelectronic species is effected by electron-electron interaction in the outer orbitals.
S_4 : Any thing that influences the valence electrons will affect the chemistry of the element and the valence shell is not affected by nuclear mass.
(A) FFTT (B) TTFT (C) FTFT (D) TTTT

11. Consider the following statements and arrange in the order of true/false as given in the codes.
S_1 : $Na_2O_2 < MgO < ZnO < P_4O_{10}$: Acidic property.
S_2 : Na < Si > Mg < Al : First ionisation energy.
S_3 : F > Cl > Br : Electron affinity.
(A) T T T (B) T T F (C) T F F (D) T F T

SECTION - II : MULTIPLE CORRECT ANSWER TYPE

12. Which of the following pair(s) represent(s) the isoelectronic species ?
(A) S^{2-} & Sc^{3+} (B) SO_2 & NO_3^- (C) N_2 & CN^- (D) NH_3 & H_3O^+

13. Which of the following represent(s) the correct order of electron affinities ?
(A) F > Cl > Br > I (B) C < N < Cl < F (C) N < C < O < F (D) C < Si > P > N

14. Which of the following statement(s) is(are) true ?
(A) ionisation energy $\propto \frac{1}{\text{Screening effect}}$
(B) The first ionisation energies of Be and Mg are more than ionisation energies of B and Al respectively
(C) Atomic and ionic radii of Niobium and Tantalum are almost same
(D) Metallic and covalent radii of potassium are 2.3 Å and 2.03Å respectively.

15. Select the incorrect statement(s).
(A) IE_1 of nitrogen atom is less than IE_1 of oxygen atom.
(B) Electron gain enthalpy of oxygen is less negative than selenium.
(C) Electronegativity on Pauling scale is 2.8 times the electronegativity on Mulliken scale.
(D) Cr^{6+} is smaller than Cr^{3+}.

SECTION - III : ASSERTION AND REASON TYPE

16. **Statement-1 :** The 5th period of periodic table contains 18 elements not 32.
Statement-2 : n = 5 , ℓ = 0 , 1 , 2 ,3 . The order in which the energy of available orbitals 4d , 5s and 5p increases is 5s < 4d < 5p and the total number of orbitals available are 9 and thus 18 electrons can be accomodated.
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True

17. **Statement-1 :** In general, for an element, $IE_1 < IE_2 < IE_3$ ..... .
Statement-2 : After the removal of each successive electron, remaining electrons are held more tightly by the nucleus. So removal of next electron becomes difficult.
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True

18. **Statement-1 :** Third ionisation energy of phosphorus is larger than sulphur.
Statement-2 : There is a larger amount of stability associated with filled s- and p- sub–shells (a noble gas electron configuration) which corresponds to having eight electrons in the valence shell of an atom or ion.
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True

19. **Statement-1 :** Manganese (atomic number 25) has a less favourable electron affinity than its neighbours on either side because .
Statement-2 : The manganese has stable, $[Ar]^{18}\ 3d^5\ 4s^2$ electrons configuration.
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True

20. **Statement-1 :** Electron gain enthalpy always becomes less negative as we go down a group in Modern periodic table.
Statement-2 : Size of the atom increases on going down the group in Modern periodic table and the added electron would be farther from the nucleus.
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True

SECTION - IV : COMPREHENSION TYPE

Comprehension # 1

The periodicity is related to the electronic configuration. That is, all chemical and physical properties are a manifestation of the electronic configurations of the elements.
The atomic and ionic radii generally decrease in a period from left to right. As a consequence, the ionization enthalpies generally increase and electron gain enthalpies become more negative across a period. In other words, the ionization enthalpy of the extreme left element in a period is the least and the electron gain enthalpy of the element on the extreme right is the highest negative. This results into high chemical reactivity at the two extremes and the lowest in the centre. Similarly down the group, the increase in atomic and ionic radii result in gradual decrease in ionization enthalpies and a regular decrease (with exception in some third period elements) in electron gain enthalpies in the case of main group elements.
These properties can be related with the:
(i) reducing and oxidising behaviour of the elements
(ii) metallic and non-metallic character of element
(iii) acidic, basic, amphoteric and neutral character of the oxides of the elements.

21. The correct order of the metallic character is:
(A) B > Al > Mg > K (B) Al > Mg > B > K (C) Mg > Al > K > B (D) K > Mg > Al > B

22. Which of the following statements is incorrect ?
(A) In general metallic character increases down the group and decreases across a period.
(B) In general reducing property decreases down the group and increases across a period.
(C) In general, the oxide formed by the element on extreme right of the periodic table is the most acidic.
(D) Chemical reactivity of non-metals in terms of oxidising power increases from nitrogen to fluorine across the period.

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

24. Which of the following pairs show reverse properties on moving along a period from left to right and from top to bottom in a group ?
(A) Atomic radius and electron gain enthalpy (negative value)
(B) Nuclear charge and ionisation enthalpy
(C) Ionisation enthalpy and electron gain enthalpy (negative value)
(D) None of the above.

Comprehension # 2

Two friends Rohit and John, students of chemistry once discussing on periodic table, reach to a conclusion that because of Aufbau rule and other principles their thoughts are restricted for further discussion on electronic arrangements of atoms. They decided not to obey Aufbau rule and capacity of each orbital is increased to three electrons i.e. instead of two each orbital can take maximum of three electrons. Now on the basis of new arrangement of rohit and john answer the following questions assuming the total no. of elements is 112.

25. What is the number of elements in third period and fifth period respectively ?
(A) 12, 27 (B) 27, 22 (C) 12, 22 (D) 22, 27

26. What is the block of the elements with atomic number 9, 28, 44 ?
(A) s, p, d (B) p, s, d (C) p, d, s (D) d, p, s

27. What is electric configuration of the element with atomic number 43 ?
(A) $1s^2 2s^3 3p^9 3s^3 3p^9 3d^{13}$ (B) $1s^3 2s^3 2p^9 3s^3 3p^9 3d^{15} 4s^1$
(C) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 5s^2 4d^2$ (D) $1s^2 2s^3 2p^9 3s^2 3p^9 3d^{15} 4s^1$

Comprehension # 3

The first ($\Delta_i H_1$) and second ($\Delta_i H_2$) ionisation enthalpies (in kJ mol^{-1}) and the (Δ_{eg} H) electron gain enthalpy (in kJ mol^{-1}) of a few elements are given below :

	Elements	$\Delta_i H_1$	$\Delta_i H_2$	$\Delta_{eg} H$
(A)	P	520	7300	- 60
(B)	Q	419	3051	- 48
(C)	R	1681	3374	- 328
(D)	S	1008	1846	- 295
(E)	T	2372	5251	+ 48
(F)	U	738	1451	- 40

28. The least reactive element is :
(A) P (B) Q (C) R (D) T

29. The most reactive metal is :
(A) P (B) Q (C) S (D) U

30. The most reactive non- metal is:
(A) R (B) S (C) P (D) U

Comprehension # 4

The amount of energy required to remove the most loosely bound electron from an isolated gaseous atom is called as first ionization energy (IE_1). Similarly the amount of energies required to knock out second, third etc. electrons from the isolated gasesous cation are called successive ionization energies and $IE_3 > IE_2 > IE_1$.
(i) Nuclear charge (ii) Atomic size (iii) penetration effect of the electrons (iv) shielding effect of the inner electrons and (v) electronic configurations (exactly half filled & completely filled configurations are considered extra stable) affect the ionisation energies.
On the other hand, the amount of energy released when a neutral isolated gaseous atom accepts an extra electron to form gaseous anion is called electron affinity.

$O(g) + e^- \xrightarrow{\text{Exothermic}} O^-(g)$; $\Delta H_{eg} = -141$ kJ mol^{-1} ..... (a)

$O^-(g) + e^- \xrightarrow{\text{Endothermic}} O^{2-}(g)$; $\Delta H_{eg} = +780$ kJ mol^{-1} ..... (b)

In (b) the energy has to be supplied for the addition of second electron due to electrostatic repulsion between an anion and extra electron (same charged species). The electron affinity of an element depends upon (i) atomic size (ii) nuclear charge & (iii) electronic configuration. In general, ionisation energy and electron affinity increases as the atomic radii decrease and nuclear charge increases across a period. In general, in a group, ionisation energy and electron affinity decrease as the atomic size increases.
The members of third period have some higher (e.g. S and Cl) electron affinity values than the members of second period (e.g. O and F) because second period elements have very small atomic size. Hence there is a tendency of electron-electron repulsion, which results in less evolution of energy in the formation of corresponding anion.

31. Which one of the following statements is correct ?
(A) The elements like F, Cl, Br etc having high values of electron affinity act as strong oxidising agent.
(B) The elements having low values of ionisation energies act as strong reducing agent.
(C) The formation of $Be^-(g)$ from Be (g) is an endothermic process
(D) All of these

32. Which one of the following statements is incorrect in relation to ionisation enthalphy ?
(A) Ionization enthalpy increases for each successive valence shell electron.
(B) The greatest increase in ionizaiton enthalpy is experienced on removal of electron from core of noble gas configuration.
(C) End of valence electrons is marked by a big jump in ionization enthalpy.
(D) Removal of electron from orbitals bearing lower n value is easier than from orbital having higher n value.

33. Considering the elements F, Cl, O and N, the correct order of their electron affinity values is :
(A) F > Cl > O > S (B) F > O > Cl > S (C) Cl > F > S > O (D) O > F > S > Cl

SECTION - V : MATRIX - MATCH TYPE

34. Match the values of ionization energy and electron gain enthalpy listed in column **I** with characteristic(s) of elements listed in column **II**.

Column – I				**Column – II**
	Δ_iH_1 ,	Δ_iH_2 ,	$\Delta_{eg}H$ (in KJ mol^{-1})	
(A)	2372	5251	+ 48	(p) Element which acts as a strong reducing agent
(B)	419	3051	– 48	(q) Element which exists as a monoatomic molecule.
(C)	1681	3374	– 333	(r) Least reactive non-metal
(D)	1008	1846	– 295	(s) Element which acts as a strong oxidising agent.
				(t) Element which oxide is a stronger basic in nature.

35. Match the increasing orders given in column **I** with the property(ies) given in column **II**.

Column – I	**Column – II**
(A) $Na^+ < F^- < O^{2-} < N^{3-}$	(p) Electronegativity
(B) $Li^+ < Na^+ < K^+ < Rb^+ < Cs^+$	(q) Nuclear charge
(C) O < S < F < Cl	(r) Size
(D) $Cl^- < K^+ < Ca^{2+} < Sc^{3+}$	(s) Electron affinity
	(t) Ionisation energy

SECTION - VI : INTEGER TYPE

36. A metal has electronic configuration $[Ar]^{18}\ 3d^7\ 4s^2$. On the basis of this electronic configuration find out the group number.

37. Amongst the following, the total number of orders which are correct with respect to the property indicated against each is :

(i) Mg > Al > Si > P	;	Covalent radius
(ii) $Na^+ < O^{2-} < F^- < N^{3-}$	;	Ionic size.
(iii) $Al^{3+} < Mg^{2+} < Li^+ < K^+$	;	Ionic size
(iv) C < Si > P > N	;	Electron affinity value.
(v) N < C < O < F	;	Electron affinity value
(vi) F > Cl > Br > I	;	Electron affinity value
(vii) Si > Mg > Al > Na	;	First ionisation energy
(viii) O > F > N > C	;	Second ionisation energy
(ix) N > P > Sb > As	;	Third ionisation energy

38. An ion having a 4+ charge and a mass of 51.99 amu has two electrons with n = 1, eight electrons with n = 2, and ten electrons with n = 3. Give the total number of protons present in the nucleus of the atom of metal.

39. Total Number of elements which are belong to same period (III).

40. The value of n (i.e. principal quantum number) for the valence shell of palladium is (atomic number = 46) :

TOPIC 3

MATRICES & DETERMINANT

SECTION - I : STRAIGHT OBJECTIVE TYPE

1. The system of equations $x + ky + 3z = 0$, $3x + ky - 2z = 0$, $2x + 3y - 4z = 0$ possess a non-trivial solution over the set of rationals, then $2k$ is an integral element of the interval
(A) [10, 20] (B) (20, 30) (C) [30, 40] (D) (40, 50)

2. If $p + q + r = 0 = a + b + c$, then the value of the determinant $\begin{vmatrix} pa & qb & rc \\ qc & ra & pb \\ rb & pc & qa \end{vmatrix}$ is
(A) 0 (B) pa + qb + rc (C) 1 (D) None of these

3. Let A and B are two non-singular square matrices, A^T and B^T are the transpose matrices of A and B respectively, then which of the following is correct
(A) $B^T AB$ is symmetric matrix if and only if A is symmetric
(B) $B^T AB$ is symmetric matrix if and only if B is symmetric
(C) $B^T AB$ is skew symmetric matrix for every matrix A
(D) $B^T AB$ is skew symmetric matrix if B is skew symmetric

4. If A and B are two square matrices of order 3 × 3 which satisfy AB = A and BA = B then $(A + B)^7$ is
(A) 7 (A + B) (B) $7.I_{3\times 3}$ (C) 64 (A + B) (D) $128\ I_{3\times 3}$

5. $|A_{3\times 3}| = 3$, $|B_{3\times 3}| = -1$ and $|C_{2\times 2}| = +2$ then $|2ABC| =$
(A) 2^3 (6) (B) 2^3 (– 6) (C) 2 (– 6) (D) None of these

6. If A is a non-diagonal involutory matrix, then
(A) $A - I = O$ (B) $A + I = O$
(C) $A - I$ is non zero singular (D) None of these

7. If $A^3 = O$, then $I + A + A^2$ equals
(A) $I - A$ (B) $(I - A)^{-1}$ (C) $(I + A)^{-1}$ (D) none of these

8. If a determinant of order 3 × 3 is formed by using the numbers 1 or – 1 then minimum value of determinant is
(A) – 2 (B) – 4 (C) 0 (D) – 8

9. If A is a diagonal matrix of order 3 × 3 is commutative with every square matrix of order 3 × 3 under multiplication and trace (A) = 12, then
(A) |A| = 64 (B) |A| = 16 (C) |A| = 12 (D) |A| = 0

10. If A is a square matrix of order 3 such that |A| = 2 then $|(\text{adj } A^{-1})^{-1}|$ is
(A) 1 (B) 2 (C) 4 (D) 8

11. If A and B are two matrices such that AB = B and BA = A, then
(A) $(A^5 - B^5)^3 = A - B$ (B) $(A^5 - B^5)^3 = A^3 - B^3$
(C) A – B is idempotent (D) A – B is nilpotent

12. Let $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ are two matrices such that AB = BA and $c \neq 0$, then value of $\frac{a-d}{3b-c}$ is :

(A) 0 (B) 2 (C) –2 (D) –1

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

(A) $f(\alpha)$ (B) $f(-\alpha)$ (C) $f(\alpha - 1)$ (D) none

14. A and B are square matrices and A is non-singular matrix, $(A^{-1} BA)^n$, $n \in I^+$, is equal to

(A) $A^{-n} B^n A^n$ (B) $A^n B^n A^{-n}$ (C) $A^{-1} B^n A$ (D) $A^{-n} BA^n$

15. If $\begin{bmatrix} 2 & 1 \\ 3 & 2 \end{bmatrix} A \begin{bmatrix} -3 & 2 \\ 5 & -3 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, then A =

(A) $\begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$ (B) $\begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ (C) $\begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$ (D) $-\begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$

16. **S1 :** Square matrix A is non-singular and symmetric then $((A^{-1})^{-1})^{-1}$ is skew symmetric
S2 : Adjoint of a symmetric matrix is a symmetric matrix
S3 : Adjoint of a diagonal matrix is diagonal matrix
S4 : Product of two invertible square matrices of same order is also invertible.

(A) FTFT (B) FTTF (C) FTTT (D) TFFT

17. **S1 :** The value of the determinant $D = \begin{vmatrix} \ell nx & \ell ny & \ell nz \\ \ell n2x & \ell n2y & \ell n2z \\ \ell n3x & \ell n3y & \ell n3z \end{vmatrix}$ is $\ell n\ 216\ xyz$.

S2 : The roots of $\begin{vmatrix} x & a & b & 1 \\ \lambda & x & b & 1 \\ \lambda & \mu & x & 1 \\ \lambda & \mu & \nu & 1 \end{vmatrix} = 0$ are independent of λ, μ, ν, a, b

S3 : If a, b, c, are sides of a scalene triangle, then value of $\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$ is negative

S4 : Let $f(x) = \begin{vmatrix} \frac{1}{x} & \ell n\, x & x^n \\ 1 & -\frac{1}{n} & (-1)^n \\ 1 & a & a^2 \end{vmatrix}$, if $f^n(x)$ is the n^{th} derivative of f(x) then $f^n(1)$ is independent of a.

(A) FFTT (B) FTTT (C) FFFT (D) TTTT

SECTION - II : MULTIPLE CORRECT ANSWER TYPE

18. Which of the following statement(s) is/are **INCORRECT?**

(A) Every skew-symmetric matrix is non-invertible.
(B) If A and B are two 3 × 3 matrices such that AB = O, then alteast one of A and B must be null matrix.
(C) If A is a 2 × 2 matrix, then adj(adj A) = A
(D) If A and B are two square matrices of order 3 such that |A| = 5 and |B| = 2, then |10AB| equals 100

19. For a given matrix $A = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$ which of the following statement not holds good? (where $n \in I$)

(A) $A = A^{-1}\ \forall \theta \in R$ (B) A is symmetric, for $\theta = (2n + 1)\frac{\pi}{2}$

(C) A is skew symmetric for $\theta = n\pi + \frac{\pi}{2}$ (D) A is skew symmetric for $\theta = n\pi$

20. In a square matrix A of order 3 each element a_{ij} is equal to the sum of the roots of the equation $x^2 - (a + b)x + ab = 0$, each $a_{i, i+1}$ is equal to the product of the roots, each $a_{i,i-1}$ is unity and the rest of the elements are all zero. then

(A) $|A| = (a^2 + b^2)(a + b)$ (B) A is a symetric matrix

(C) If a, b prime no. the A is imposible (D) $|\text{adj } A| = ((a + b)ab)^2$

21. Let $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$, then

(A) $A^2 - 4A - 5I_3 = 0$ (B) $A^{-1} = \frac{1}{5}(A - 4I_3)$ (C) A^3 is not invertible (D) A^2 is invertible

22. If A and B are invertible square matrices of the same order, then which of the following is correct ?

(A) adj(AB) = (adjB) (adjA)

(B) (adjA)′ = (adjA′)

(C) $|\text{adjA}| = |A|^{n-1}$, where n is the order of matrix A

(D) $\text{adj}(\text{adjB}) = |B|^{n-2}$ B, where n is the order of matrix B

23. If $A = \begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$, then

(A) adj(adjA) = A (B) |adj(adjA)| = 1 (C) |adjA| = 1 (D) None of these

24. System of equation $x + 3y + 2z = 6$
$x + \lambda y + 2z = 7$
$x + 3y + 2z = \mu$ has

(A) unique solution if $\lambda = 2, \mu \neq 6$ (B) infinitely many solution if $\lambda = 4, \mu = 6$

(C) no solution if $\lambda = 5, \mu = 7$ (D) no solution if $\lambda = 3, \mu = 5$

25. Which of the following statement is always true

(A) Adjoint of a symmetric matrix is a symmetric matrix

(B) Adjoint of a unit matrix is unit matrix

(C) A (adj A) = (adj A) A

(D) Adjoint of a diagonal matrix is diagonal matrix

26. If $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$, then

(A) $A^3 = 9A$ (B) $A^3 = 27A$ (C) $A + A = A^2$ (D) A^{-1} does not exist

SECTION - III : ASSERTION AND REASON TYPE

27. **Statement -1 :** The determinants of a matrix $A = [a_{ij}]_{5 \times 5}$ where $a_{ij} + a_{ji} = 0$ for i and j is zero
Statement -2 : The determinant of a skew symmetric matrix of odd order is zero.
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True

28. **Statement -1 :** The inverse of the matrix $A = [a_{ij}]_{n \times n}$ where $a_{ij} = 0$, $i \geq j$ is $B = [a_{ij}^{-1}]_{n \times n}$
Statement -2 : The inverse of singular matrix does not exist.
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True

29. **Statement -1 :** If $f_1(x)$, $f_2(x)$ ....., $f_9(x)$ are polynomials whose degree ≥ 1, where $f_1(\alpha) = f_2(\alpha) = f_2(\alpha) \ldots\ldots = f_9(\alpha) = 0$ and $A(x) = \begin{bmatrix} f_1(x) & f_2(x) & f_3(x) \\ f_4(x) & f_5(x) & f_6(x) \\ f_7(x) & f_8(x) & f_9(x) \end{bmatrix}$ and $\frac{A(x)}{x-\alpha}$ is also a matrix of 3 × 3 whose entries are also polynomials
Statement -2 : $x - \alpha$ is a factor of polynomial f(x) if $f(\alpha) = 0$
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True

30. **Statement -1 :** For a singular square matrix A, if AB = AC $\Rightarrow$ B = C
Statement -2 : If |A| = 0 then A^{-1} does not exist
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True

31. **Statement -1 :** $(a_{11}, a_{22}, \ldots\ldots, a_{nn})$ is a diagonal matrix then $A^{-1} = \text{dia}(a_{11}^{-1}, a_{22}^{-1}, \ldots\ldots, a_{nn}^{-1})$
Statement -2 : If A = dia (2, 1, –3) and B = dia (1, 1, 2) then det $(AB^{-1}) = 3$
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True

SECTION - IV : COMPREHENSION TYPE

Comprehension # 1

Consider the determinant

$$\Delta = \begin{vmatrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \\ d_1 & d_2 & d_3 \end{vmatrix}$$

M_{ij} = Minor of the element of i^{th} row and j^{th} column
C_{ij} = Cofactor of the element of i^{th} row and j^{th} column

32. Value of $b_1 \cdot C_{31} + b_2 \cdot C_{32} + b_3 \cdot C_{33}$ is
(A) 0 (B) Δ (C) 2Δ (D) Δ^2

33. If all the elements of the determinant are multiplied by 2, then the value of new determinant is
(A) 0 (B) 8Δ (C) 2Δ (D) $2^9 \cdot \Delta$

34. $a_3 M_{13} - b_3 \cdot M_{23} + d_3 \cdot M_{33}$ is equal to
(A) 0 (B) 4Δ (C) 2Δ (D) Δ

Comprehension # 2

Let A be a m × n matrix. If there exists a matrix L of type n × m such that LA = I_n, then L is called left inverse of A. Similarly, if there exists a matrix R of type n × m such that AR = I_m, then R is called right inverse of A.
For example to find right inverse of matrix

$$A = \begin{bmatrix} 1 & -1 \\ 1 & 1 \\ 2 & 3 \end{bmatrix} \text{ we take } R = \begin{bmatrix} x & y & z \\ u & v & w \end{bmatrix}$$

and solve AR = I_3 i.e.

$$\begin{bmatrix} 1 & -1 \\ 1 & 1 \\ 2 & 3 \end{bmatrix} \begin{bmatrix} x & y & z \\ u & v & w \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$\Rightarrow$ $x - u = 1$ $\quad y - v = 0$ $\quad z - w = 0$
$x + u = 0$ $\quad y + v = 1$ $\quad z + w = 0$
$2x + 3u = 0$ $\quad 2y + 3v = 0$ $\quad 2z + 3w = 1$

As this system of equations is inconsistent, we say there is no right inverse for matrix A.

36. Which of the following matrices is NOT left inverse of matrix $\begin{bmatrix} 1 & -1 \\ 1 & 1 \\ 2 & 3 \end{bmatrix}$

(A) $\begin{bmatrix} \frac{1}{2} & \frac{1}{2} & 0 \\ -\frac{1}{2} & \frac{1}{2} & 0 \end{bmatrix}$ (B) $\begin{bmatrix} 2 & -7 & 3 \\ -\frac{1}{2} & \frac{1}{2} & 0 \end{bmatrix}$ (C) $\begin{bmatrix} -\frac{1}{2} & \frac{1}{2} & 0 \\ -\frac{1}{2} & \frac{1}{2} & 0 \end{bmatrix}$ (D) $\begin{bmatrix} 0 & 3 & -1 \\ -\frac{1}{2} & \frac{1}{2} & 0 \end{bmatrix}$

36. The number of right inverses for the matrix $\begin{bmatrix} 1 & -1 & 2 \\ 2 & -1 & 1 \end{bmatrix}$

(A) 0 (B) 1 (C) 2 (D) infinite

37. For which of the following matrices number of left inverses is greater than the number of right inverses

(A) $\begin{bmatrix} 1 & 2 & 4 \\ -3 & 2 & 1 \end{bmatrix}$ (B) $\begin{bmatrix} 3 & 2 & 1 \\ 3 & 2 & 1 \end{bmatrix}$ (C) $\begin{bmatrix} 1 & 4 \\ 2 & -3 \\ 5 & 4 \end{bmatrix}$ (D) $\begin{bmatrix} 3 & 3 \\ 1 & 1 \\ 4 & 4 \end{bmatrix}$

Comprehension # 3

Let A = $[a_{ij}]_3$ be a square matrix of order 3 whose elements are distinct integers from 1, 2,.....9 the matrix is formed so that the sum of numbers in every row, column & diagonal is a multiple of 9.

38. The number of possible combinations of three distinct numbers from 1 to 9 that have a sum of 9 or 18 is
(A) 10 (B) 7 (C) 8 (D) 9

39. The element a_{22} must be a multiple of
(A) 2 (B) 3 (C) 4 (D) 9

40. The maximum value of trace of the matrix A is :
(A) 18 (B) 19 (C) 12 (D) None of these

SECTION - V : MATRIX - MATCH TYPE

41. Match the following

	Column - I		**Column - II**
(A)	A is a real skew symmetric matrix such that $A^2 + I = 0$. BA – AB Then	(p)	
(B)	A is a matrix such that $A^2 = A$. If $(I + A)^n = I + \lambda A$, then λ equals ($n \in N$)	(q)	A is of even order
(C)	If for a matrix A, $A^2 = A$, and $B = I - A$, then $AB + BA + I - (I - A)^2$ equals	(r)	A
(D)	A is a matrix with complex entries and A* stands for transpose of complex conjugate of A. If A* = A & B* = B, then (AB – BA)* equals	(s)	$2^n - 1$
		(t)	${}^nC_1 + {}^nC_2 .... + {}^nC_n$

42. Match the following

	Column - I		**Column - II**
(A)	Let $\|A\| = \|a_{ij}\|_{3\times 3} \neq 0$. Each element a_{ij} is multiplied by k^{i-j}. Let $\|B\|$ the resulting determinant, where $k_1\|A\| + k_2\|B\| = 0$. Then $k_1 + k_2$ =	(p)	0
(B)	The maximum value of a third order determinant each of its entries are ± 1 equals	(q)	4
(C)	$\begin{vmatrix} 1 & \cos\alpha & \cos\beta \\ \cos\alpha & 1 & \cos\gamma \\ \cos\beta & \cos\gamma & 1 \end{vmatrix} = \begin{vmatrix} 0 & \cos\alpha & \cos\beta \\ \cos\alpha & 0 & \cos\gamma \\ \cos\beta & \cos\gamma & 0 \end{vmatrix}$ if $\cos^2\alpha + \cos^2\beta + \cos^2\gamma$ =	(r)	1
(D)	$\begin{vmatrix} x^2+x & x+1 & x-2 \\ 2x^2+3x-1 & 3x & 3x-3 \\ x^2+2x+3 & 2x-1 & 2x-1 \end{vmatrix}$ = Ax + B where A and B are determinants of order 3. Then A + 2B =	(s)	2
		(t)	$\begin{vmatrix} 1 & 2 \\ 2 & 4 \end{vmatrix}$

SECTION - VI : INTEGER TYPE

43. Find the coefficient of x in the determinant $\begin{vmatrix} (1+x)^{a_1b_1} & (1+x)^{a_1b_2} & (1+x)^{a_1b_3} \\ (1+x)^{a_2b_1} & (1+x)^{a_2b_2} & (1+x)^{a_2b_3} \\ (1+x)^{a_3b_1} & (1+x)^{a_3b_2} & (1+x)^{a_3b_3} \end{vmatrix}$, where $a_i, b_j \in N$

44. If $f(x) = \begin{vmatrix} \cos(x+\alpha) & \cos(x+\beta) & \cos(x+\gamma) \\ \sin(x+\alpha) & \sin(x+\beta) & \sin(x+\gamma) \\ \sin(\beta-\gamma) & \sin(\gamma-\alpha) & \sin(\alpha-\beta) \end{vmatrix}$ and $f(2) = 6$, then find $\frac{1}{5}\sum_{r=1}^{25} f(r)$,

45. Let $f(x) = \begin{vmatrix} x & 1 & 1 \\ \sin 2\pi x & 2x^2 & 1 \\ x^3 & 3x^4 & 1 \end{vmatrix}$. If f(x) be an odd function and its odd values is equal g(x), then find the value of λ. If $f(1)\, g(1) = -4\lambda$

46. If f(x) satisfies the equation $\begin{vmatrix} f(x+1) & f(x+8) & f(x+1) \\ 1 & 2 & -5 \\ 2 & 3 & \lambda \end{vmatrix} = 0$ for all real x. If f is periodic with period 7, then find the value of $|\lambda|$.

47. If $A = \begin{bmatrix} 1 & -1 & 1 \\ 0 & 2 & -3 \\ 2 & 1 & 0 \end{bmatrix}$ and B = (adj A) and C = 5A, then find the value of $\frac{|\text{adj}B|}{|C|}$.

48. If $A = \begin{pmatrix} 1 & 2 \\ 1 & 1 \end{pmatrix}$ and $\phi(x) = (1+x)(1-x)^{-1}$ and $\phi(A) = -\lambda A$, then find the value of λ.

49. If $A = \begin{pmatrix} a & b & c \\ b & c & a \\ c & a & b \end{pmatrix}$, abc = 1, $A'A = I$, then find maximum value of $a^3 + b^3 + c^3$

50. If $A = \begin{bmatrix} 1 & 0 \\ -1 & 7 \end{bmatrix}$ and $A^2 = 8A + KI_2$, then find the value of |k|

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