MHT CET 2025 Memory Based Question Paper PDF (April 22, 2025) (Shift 2)

Questions:

1. In the logic circuit given, A, B and C are the inputs and Y is the output. The output Y is HIGH

(A) for all the HIGH inputs.

(B) for all the LOW inputs.

(C) when A = 1, B = 0, C = 0

(D) when A = 1, B = 0, C = 1

2. The graph given below represents I - V characteristics of zener diode. The part of the characteristics curve that is most relevant for its operation as a voltage regulator is

(A) ab

(B) bc

(C) cd

(D) de

3. In n-type semiconductor, free electrons donated by the impurity atoms occupy energy levels in

(A) the conduction band.

(B) the valence band.

(C) the band gap and are close to the conduction band.

(D) the band gap and are close to the valence band.

4. A radioactive element A decays into radioactive element C by the following processes in succession. $A \rightarrow B + {}_2H^4e$; $B \rightarrow C + 2e^-$. Then elements

(A) A and B are isobars.

(B) A and C are isobars.

(C) A and C are isotopes.

(D) A and B are isotopes.

5. When the electron orbiting in hydrogen atom goes from one orbit to another orbit (principal quantum number $= n$), the de-Broglie wavelength (λ) associated with it is related to n as

(A) $\lambda \propto \frac{1}{n^2}$

(B) $\lambda \propto n^2$

(C) $\lambda \propto \frac{1}{n}$

(D) $\lambda \propto n$

6. Photoelectric emission takes place from a certain metal at threshold frequency ν. If the radiation of frequency 4ν is incident on the metal plate, the maximum velocity of the emitted photoelectrons will be (m = mass of photoelectron, h = Planck's constant)

(A) $\sqrt{\frac{6h\nu}{m}}$

(B) $\sqrt{\frac{3h\nu}{m}}$

(C) $\sqrt{\frac{h\nu}{m}}$

(D) $\sqrt{\frac{5h\nu}{m}}$

7. The de-Broglie wavelength of a neutron at 27°C is 'λ_0'. What will be its wavelength at 927°C?

(A) $\frac{\lambda_0}{4}$

(B) $\frac{\lambda_0}{3}$

(C) $\frac{\lambda_0}{2}$

(D) $\frac{3\lambda_0}{2}$

8. Two polaroids are placed in the path of unpolarised beam of intensity 'I_0' such that no light is emitted from the second polaroid. If a third polaroid whose polarisation axis makes an angle 'θ' with the polarisation axis of first polaroid is placed between these polaroids then the intensity of light emerging from the last polaroid will be

(A) $\frac{I_0}{4}(\sin 2\theta)^2$

(B) $\frac{I_0}{8}(\sin 2\theta)^2$

(C) $\frac{I_0}{4}\sin^2\theta$

(D) $\frac{I_0}{8}\sin^2\theta$

9. In a single slit diffraction pattern, the distance between the plane of the slit and screen is 1.3 m. The width of the slit is 0.65 mm and the second maximum is formed at the distance of 2.6 mm from the centre of the screen. The wavelength of light used is

(A) 6500Å

(B) 6000Å

(C) 5200Å

(D) 4600Å

10. A ray of light from a monochromatic point source of light is incident at a point on the screen. If a thin mica film of thickness 't' and refractive index 'n' is introduced in its path, then the optical path

(A) is decreased by $(n-1)t$.

(B) is increased by $(n+1)t$.

(C) is not affected.

(D) is increased by $(n-1)t$.

11. A concave lens (refractive index $= 1.5$) has both surfaces of same radius of curvature R. If it is immersed in a liquid of refractive index 1.75 it will act as a

(A) concave lens of focal length $(3.5)R$

(B) concave lens of focal length $2R$

(C) convex lens of focal length $(3.5)R$

(D) convex lens of focal length $2R$

12. In an a.c. circuit containing L, C and R in series, the ratio of apparent power to the true power is (Z and R are the impedance and resistance respectively, $\phi =$ phase angle)

(A) $\cot\phi$

(B) $\cos\phi$

(C) RZ

(D) $\frac{Z}{R}$

13. When a capacitor is connected in series LR circuit, the alternating current flowing in the circuit

(A) remains constant

(B) increases

(C) decreases

(D) is zero

14. An alternating e.m.f. is given by $e = e_0 \sin\omega t$. In how much time the e.m.f. will have half its maximum value, if e starts from zero? ($T =$ time period, $\sin 30^\circ = \frac{1}{2}$)

(A) $\frac{T}{8}$

(B) $\frac{T}{4}$

(C) $\frac{T}{12}$

(D) $\frac{T}{16}$

15. A coil has inductance 2 H. The ratio of its reactance when it is connected first to an a.c. source and then to a d.c. source is

(A) -1

(B) zero

(C) ∞

(D) $+1$

16. A graph of magnetic flux (ϕ) versus current (I) is shown for four inductors P, Q, R, S. The largest value of self-inductance is for inductor

(A) R

(B) P

(C) Q

(D) S

17. A particle of charge q moves with a velocity $\vec{V} = a\hat{i}$ in a magnetic field $\vec{B} = b\hat{j} + c\hat{k}$, where '$a$', '$b$' and '$c$' are constants. The magnitude of force experienced by particle is

(A) $qa\sqrt{b^2 + c^2}$

(B) $qa(b + c)$

(C) $qa\sqrt{b^2 - c^2}$

(D) zero

18. A wire of length L carries current I along x-axis. A magnetic field $\vec{B} = B_0(\hat{i} - \hat{j} - \hat{k})T$ acts on the wire. The magnitude of magnetic force acting on the wire is

(A) $\frac{ILB_0}{2}$

(B) ILB_0

(C) $2ILB_0$

(D) $\sqrt{2}ILB_0$

19. Two similar wires of equal lengths are bent in the form of a square and a circular loop. They are suspended in a uniform magnetic field and same current is passed through them. Torque experienced by

(A) circular loop is greater.

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(B) square loop is greater.

(C) both loops is same.

(D) both will be zero.

20. Magnetic hysteresis is exhibited by magnetic materials which are

(A) only paramagnetic

(B) only diamagnetic

(C) only ferromagnetic

(D) both para and ferromagnetic

21. When cell of e.m.f. 'E_1' is connected to potentiometer wire, the balancing length is 'l_1'. Another cell of e.m.f. 'E_2' ($E_1 > E_2$) is connected so that two cells oppose each other, the balancing length is 'l_2'. The ratio $E_1 : E_2$ is

(A) $\frac{l_1}{l_1+l_2}$

(B) $\frac{l_1}{l_1-l_2}$

(C) $\frac{l_1-l_2}{l_1}$

(D) $\frac{l_1+l_2}{l_1-l_2}$

22. In the given circuit, current flowing through the circuit is

(A) 2 A

(B) 2.5 A

(C) 5 A

(D) 4 A

23. Initially n identical capacitors are joined in parallel and are charged to potential V. Now they are separated and joined in series. Then

(A) potential difference and total energy of the combination remain the same.

(B) potential difference remains the same and energy increases n times.

(C) potential difference becomes nV and energy remains the same.

(D) potential difference is nV and energy increases n times.

24. Earth is assumed to be a charged conducting sphere having volume V and surface area A. The capacitance of the earth in free space is (ε_0 = permittivity of free space)

(A) $\frac{2\varepsilon_0 V}{A}$

(B) $\frac{8\varepsilon_0 V}{A}$

(C) $\frac{12\varepsilon_0 V}{A}$

(D) $\frac{4\varepsilon_0 V}{A}$

25. Three charges each of magnitude 3μC, are placed on the vertices of an equilateral triangle of side 6 cm. The net potential energy of the system will be nearly $[\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9$ SI unit$]$

(A) 1.4 J

(B) 2.7 J

(C) 4.1 J

(D) 8.2 J

26. A charge $Q\mu$C is placed at the centre of a cube. The flux through two opposite faces of the cube is ($\varepsilon_0 =$ permittivity of free space)

(A) $\frac{Q}{6\varepsilon_0}$

(B) $\frac{Q}{3\varepsilon_0}$

(C) $\frac{Q}{\varepsilon_0}$

(D) $\frac{Q}{2\varepsilon_0}$

27. When source of sound and observer both are moving towards each other, the observer will hear

(A) low frequency, low wavelength.

(B) low frequency, high wavelength.

(C) high frequency, low wavelength.

(D) high frequency, high wavelength.

28. In a pipe closed at one end, air column is vibrating in its second overtone. The column has

(A) three nodes and three antinodes.

(B) three nodes and four antinodes.

(C) two nodes and three antinodes.

(D) four nodes and three antinodes.

29. The lengths of the two organ pipes open at both ends are 'L' and $(L+L_1)$. If they are sounded together, the beat frequency will be ($v =$ velocity of sound in air)

(A) $\frac{2vL_1}{L(L+L_1)}$

(B) $\frac{2L(L+L_1)}{vL_1}$

(C) $\frac{vL_1}{L(L+L_1)}$

(D) $\frac{vL_1}{2L(L+L_1)}$

30. The fundamental frequency of a sonometer wire is 50 Hz for some length and tension. If the length is increased by 25% by keeping tension same then frequency change of second harmonic is

(A) increased by 20%

(B) decreased by 20%

(C) increased by 10%

(D) decreased by 10%

31. A particle executes S.H.M. starting from the mean position. Its amplitude is 'a' and its periodic time is 'T'. At a certain instant, its speed 'v' is half that of maximum speed V_{max}. The displacement of the particle at that instant is

(A) $\frac{2a}{\sqrt{3}}$

(B) $\frac{\sqrt{2}a}{3}$

(C) $\frac{3a}{\sqrt{2}}$

(D) $\frac{\sqrt{3}a}{2}$

32. A small spherical ball of radius 'r' is rolling on a curved surface which is frictionless and has a radius of curvature 'R'. Its motion is simple harmonic. Then its time period of oscillation is proportional to (g = acceleration due to gravity)

(A) $\sqrt{\frac{R}{g}}$

(B) $\sqrt{\frac{r}{g}}$

(C) $\sqrt{\frac{R-r}{g}}$

(D) $\sqrt{\frac{R+r}{g}}$

33. A particle performing linear S.H.M. has period 8 second. At time $t = 0$, it is in the mean position. The ratio of the distances travelled by the particle in the 1^{st} and 2^{nd} second is ($\cos 45^\circ = 1/\sqrt{2}$)

(A) $1 : (\sqrt{2} - 1)$

(B) $1 : 2$

(C) $2:1$

(D) $1:(\sqrt{2}+1)$

34. When the pressure of the gas contained in a closed vessel is increased by 2.5%, the temperature of the gas increases by 4 K. The initial temperature of the gas is

(A) 80 K

(B) 150 K

(C) 160 K

(D) 320 K

35. A monoatomic ideal gas, initially at temperature T_1 is enclosed in a cylinder fitted with massless, frictionless piston. By releasing the piston suddenly, the gas is allowed to expand adiabatically to a temperature T_2. If L_1 and L_2 are the lengths of the gas columns before and after expansion respectively, then (T_2/T_1) is given by

(A) $\frac{L_1}{L_2}$

(B) $\frac{L_2}{L_1}$

(C) $(L_1/L_2)^{2/3}$

(D) $(L_2/L_1)^{2/3}$

36. In an isobaric process of an ideal gas, the ratio of heat supplied and work done by the system $(\frac{Q}{W})$ is $[\frac{C_p}{C_v}=\gamma]$

(A) 1

(B) γ

(C) $\frac{\gamma}{\gamma-1}$

(D) $\frac{\gamma-1}{\gamma}$

37. The two ends of a rod of length 'x' and uniform cross-sectional area 'A' are kept at temperatures 'T_1' and 'T_2' respectively $(T_1 > T_2)$. If the rate of heat transfer is 'Q/t', through the rod in steady state, then the coefficient of thermal conductivity 'K' is

(A) $\frac{AQ}{tx(T_1-T_2)}$

(B) $\frac{xQ}{tA(T_1-T_2)}$

(C) $\frac{xAQ}{t(T_1-T_2)}$

(D) $\frac{Q}{txA(T_1-T_2)}$

38. Two bodies A and B at temperatures $T_1'K$ and $T_2'K$ respectively have the same dimensions. Their emissivities are in the ratio 16 : 1. At $T_1 = xT_2$, they radiate the same amount of heat per unit area per unit time. The value of x is

(A) 8

(B) 4

(C) 2

(D) 0.5

39. Black bodies A and B radiate maximum energy with wavelength difference 4μm. The absolute temperature of body A is 3 times that of B. The wavelength at which body B radiates maximum energy is

(A) 4μm

(B) 6μm

(C) 2μm

(D) 8μm

40. Water rises in a capillary tube of radius r upto a height h. The mass of water in a capillary is m. The mass of water that will rise in capillary of radius $\frac{r}{5}$ will be

(A) $\frac{m}{5}$

(B) $\frac{m}{2}$

(C) m

(D) $\frac{m}{25}$

41. The excess pressure inside a soap bubble is 1.5 times the excess pressure inside a second soap bubble. The volume of the second bubble is 'x' times the volume of the first bubble. The value of 'x' is

(A) $\frac{3}{2}$

(B) $\frac{9}{4}$

(C) $\frac{8}{27}$

(D) $\frac{27}{8}$

42. The energy needed for breaking a liquid drop of radius 'R' into 'n' droplets each of radius 'r' is [T = surface tension of the liquid]

(A) $4\pi TR^2[\frac{R}{r}+1]$

(B) $4\pi TR^2[\frac{R}{r}-1]$

(C) $4\pi TR^2[\frac{r}{R}+1]$

(D) $4\pi Tr^2[\frac{R}{r}-1]$

43. The magnitude of gravitational potential energy of a body at a distance 'R' from the centre of the earth is 'E'. Its weight at a distance '$1.5R$' from the centre of the earth is

(A) $\frac{2E}{9R}$

(B) $\frac{4E}{5R}$

(C) $\frac{4E}{9R}$

(D) $\frac{2E}{7R}$

44. A solid cylinder of mass 'M' and radius 'R' is rotating about its geometrical axis. A solid sphere of same mass and same radius is also rotating about its diameter with an angular speed half that of the cylinder. The ratio of the kinetic energy of rotation of the sphere to that of the cylinder will be

(A) $2:3$

(B) $3:2$

(C) $1:5$

(D) $5:1$

45. A thin metal wire of length 'L' and mass 'M' is bent to form semicircular ring as shown. The moment of inertia about XX' is

(A) $\frac{ML^2}{4\pi^2}$

(B) $\frac{2ML^2}{\pi^2}$

(C) $\frac{ML^2}{2\pi^2}$

(D) $\frac{ML^2}{\pi^2}$

46. A constant force acts on two different masses independently and produces accelerations A_1 and A_2. When the same force acts on their combined mass, the acceleration produced is

(A) A_1-A_2

(B) A_1+A_2

(C) $\frac{A_1A_2}{A_1+A_2}$

(D) $\sqrt{A_1^2+A_2^2}$

47. A car is driven on the banked road of radius of curvature 20 m with maximum safe speed. In order to increase its safety speed by 20%, without changing the angle of banking, the increase in the radius of curvature will be [Assume friction is same on the road]

(A) 28.8 m

(B) 14.4 m

(C) 8.8 m

(D) 4.8 m

48. At any time 't', the co-ordinates of moving particle are $x = at^2$ and $y = bt^2$. The speed of the particle is

(A) $2t\sqrt{a^2+b^2}$

(B) $2t\sqrt{a^2-b^2}$

(C) $2t(a+b)$

(D) $\frac{2t}{\sqrt{a^2+b^2}}$

49. Given $\vec{A} = (2\hat{i} - 3\hat{j} + \hat{k})$, $\vec{B} = (3\hat{i} + \hat{j} - 2\hat{k})$ and $\vec{C} = (3\hat{i} + 2\hat{j} + \hat{k})$. $(\vec{A} + \vec{B}) \cdot \vec{C}$ will be

(A) 10

(B) 12

(C) 18

(D) 20

50. The percentage error in the measurement of mass and speed of a particular body is 3% and 4% respectively. The percentage error in the measurement of kinetic energy is

(A) 9%

(B) 10%

(C) 11%

(D) 12%

51. Which from following medicinal properties is exhibited by curcumin?

(A) Analgesic

(B) Antiseptic

(C) Antioxidant

(D) Antimicrobial

52. Which from following polymers contains $-CO-NH-$ linkage?

(A) Glyptal

(B) Thermocol

(C) Buna-N

(D) Urea-formaldehyde resin

53. Identify a monomer used in preparation of neoprene.

(A) 2-methyl-1,3-butadiene

(B) 2-chloro-1,3-butadiene

(C) Melamine

(D) 1,3-butadiene

54. Which amino acid from following contains $-CH_3$ as side chain?

(A) Leucine

(B) Alanine

(C) Serine

(D) Valine

55. Which carbon atoms of $\alpha-D$ glucose and $\beta-D$ fructose respectively forms glycosidic linkage in sucrose?

(A) $C-1$ and $C-2$

(B) $C-2$ and $C-1$

(C) $C-2$ and $C-6$

(D) $C-1$ and $C-5$

56. Identify the amine having highest pK_b value.

(A) $(CH_3)_3N$

(B) $C_6H_5CH_2NH_2$

(C) $C_6H_5NH_2$

(D) $(CH_3)_2NH$

57. Identify product 'B' in the following sequence of reaction: Aniline $\xrightarrow[273K]{NaNO_2+HCl} A \xrightarrow[\Delta]{H_2O} B+N_2\uparrow$

(A) Sodium phenoxide

(B) Nitrobenzene

(C) Benzenediazonium chloride

(D) Phenol

58. In a reaction, $(CH_3)_2CHMgBr + CO_2 \xrightarrow{\text{dry ether}} A \xrightarrow{\text{dil HCl}} B$. Find the product 'B'.

(A) Propanoic acid

(B) 2-Methyl propanoic acid

(C) Butanoic acid

(D) 2,2-dimethyl ethanoic acid

59. Identify the reagent used in the following reaction: Benzoic acid $\xrightarrow{\text{Reagent}}$ Benzoyl chloride + Phosphorus oxychloride + Hydrogen chloride

(A) PCl_3

(B) HCl

(C) PCl_5

(D) $SOCl_2$

60. Identify the substrate 'A' in the following conversion: $A \xrightarrow[H_3O^+]{AlH(i-Bu)_2}$ Pent-3-enal

(A) Pentanenitrile

(B) Pent-3-enenitrile

(C) Pent-3-en-1-amine

(D) Pent-3-ynenitrile

61. The common name of Benzene-1,4-diol is

(A) Catechol

(B) Resorcinol

(C) Quinol

(D) Pyrogallol

62. Which of the following is correct IUPAC name of catechol?

(A) Benzene-1,2-diol

(B) Benzene-1,3-diol

(C) Benzene-1,4-diol

(D) Benzene-1,3,5-triol

63. Which of the following has highest reactivity towards nucleophilic substitution reaction involving cleavage of $C-Cl$ bond?

(A) Chlorobenzene

(B) p-Nitrochlorobenzene

(C) 2,4-Dinitrochlorobenzene

(D) 2,4,6-trinitrochlorobenzene

64. Which among the following statements is true for haloalkyne?

(A) Halogen atom is bonded to 'sp' hybridised carbon atom.

(B) Halogen atom is bonded to 'sp^2' hybridised carbon atom of aliphatic chain.

(C) Halogen atom is bonded to 'sp^3' hybridised carbon atom next to a carbon-carbon double bond.

(D) Halogen atom is bonded to 'sp^2' hybridised carbon atom of aromatic ring.

65. Which among the following is NOT Allylic halide?

(A) $CH_2=CH-CH_2-X$

(B) $CH_3-CH=CH-CH_2-X$

(C) $CH_3-CH_2-CH=CH-CH_2-X$

(D) $CH_3-CH=CH-CH_2-CH_2-X$

66. Identify neutral ligand from following?

(A) Carbonyl

(B) Sulphato

(C) Oxalato

(D) Bromo

67. What is the coordination number of central metal ion if it forms octahedral complex?

(A) 4

(B) 6

(C) 8

(D) 12

68. Identify the element having highest ionisation enthalpy (IE_1) from following.

(A) Ce
(B) La
(C) Gd
(D) Yb

69. Which of the following halogen forms maximum number of oxoacids?

(A) F
(B) Cl
(C) Br
(D) I

70. Which of the following is the molecular formula of halous acid of chlorine?

(A) $HClO$
(B) $HClO_2$
(C) $HClO_3$
(D) $HClO_4$

71. Which of the following ion exihibits maximum power of coagulation for positively charged sol?

(A) SO_4^{2-}
(B) Cl^-
(C) PO_4^{3-}
(D) $[Fe(CN)_6]^{4-}$

72. The half life values for two different first order reaction A and B are 75 minute and 2.5 hour respectively. What is the $\frac{r_B}{r_A}$ ratio of rate constants?

(A) 2.0
(B) 4.5
(C) 14.2
(D) 22.0

73. For a reaction, $A + B \rightarrow$ product, it is found that rate law is $r = k[A]^{1.5}[B]^{2.5}$. What is the order of reaction?

(A) 1.5

(B) 2.5

(C) +1

(D) 4

74. Nitric oxide reacts with H_2 according to reaction $2NO_{(g)} + 2H_{2(g)} \rightarrow N_{2(g)} + 2H_2O_{(g)}$. Identify the correct relationship for consumption of reactant and formation of product.

(A) $-\frac{1}{2}\frac{d[NO]}{dt} = -\frac{d[H_2]}{dt}$

(B) $\frac{d[N_2]}{dt} = -\frac{1}{2}\frac{d[H_2]}{dt}$

(C) $\frac{d[H_2O]}{dt} = \frac{d[N_2]}{dt}$

(D) $\frac{d[H_2O]}{dt} = \frac{1}{2}\frac{d[N_2]}{dt}$

75. If $E^\circ(Al^{+3}_{(aq)} \mid Al_{(s)}) = -1.66V$. What is potential of $Al_{(s)} \rightarrow Al^{+3}(0.1M) + 3e^-$ at $298K$?

(A) +1.540 V

(B) −1.540 V

(C) +1.679 V

(D) −1.679 V

76. If $E^\circ(Fe^{+2}_{(aq)} \mid Fe_{(s)}) = -0.44V$ and $E^\circ(Sn^{+2}_{(aq)} \mid Sn_{(s)}) = -0.14V$. What is standard emf of cell containing the two electrodes?

(A) +0.30 V

(B) −0.30 V

(C) +0.58 V

(D) −0.58 V

77. Calculate the relative lowering of vapour pressure of solution containing 3 g urea in 50 g water. [molar mass of urea = 60 g mol^{-1}]

(A) 0.013

(B) 0.025

(C) 0.018

(D) 0.028

78. When 0.01 mole of nonvolatile solute is dissolved in certain solvent calculate the mass of solvent in kg if $\Delta T_b = 0.6$ K and K_b for solvent = 2 K kg mol^{-1}

(A) 0.014 kg

(B) 0.028 kg

(C) 0.033 kg

(D) 0.045 kg

79. Which from following solutions exhibits minimum boiling point elevation under identical conditions? (Assume complete dissociation)

(A) 0.2 m KCl

(B) 0.1 m $NaCl$

(C) 1 m $AlCl_3$

(D) 0.05 m $MgCl_2$

80. Which of the following is effectively used instead of DDT?

(A) BHC

(B) $CHCl_3$

(C) CH_2Cl_2

(D) Picric acid

81. Calculate the number of atoms present in 1 g of an element if it forms fcc unit cell structure. [$\rho \times a^3 = 6.8 \times 10^{-22}$ g]

(A) 7.125×10^{21}

(B) 4.548×10^{21}

(C) 6.815×10^{21}

(D) 5.882×10^{21}

82. Identify the type of defect in brass alloy.

(A) Interstitial impurity defect

(B) Schottky defect

(C) Substitutional impurity defect

(D) Metal deficiency defect

83. Calculate the volume occupied by a particle in fcc unit cell if volume of unit cell is 1.6×10^{-23} cm^3

(A) 5.44×10^{-24} cm^3

(B) 2.96×10^{-24} cm^3

(C) 8.37×10^{-24} cm^3

(D) 6.15×10^{-24} cm^3

84. Which from following is used as catalyst in Fisher Tropsch process for the synthesis of gasoline?

(A) $Fe - Cr$

(B) $Co - Th$

(C) Mo

(D) Ni

85. Which from following compounds can be obtained by azo coupling reaction.

(A) Benzenediazonium chloride

(B) Fluoroarene

(C) P-Hydroxyazobenzene

(D) N-Ethylbenzene sulfonamide

86. Which of the following alkenes does NOT exhibit cis-trans isomerism?

(A) But-1-ene

(B) But-2-ene

(C) 3,4-Dimethylhex-3-ene

(D) Pent-2-ene

87. A compound of Xe and F is found to have atomic ratio $Xe : F$ as 0.4 : 2.4. Find the oxidation number of Xe?

(A) -4

(B) Zero

(C) $+4$

(D) $+6$

88. Which of the following species acts as strongest oxidising agent?

(A) Li

(B) Li^+

(C) F_2

(D) F^-

89. A weak monoacidic base dissociates to 1.5% in 0.001 M solution at 298 K. Calculate the dissociation constant of weak base.

(A) 2.25×10^{-7}

(B) 3.05×10^{-7}

(C) 2.5×10^{-5}

(D) 3.725×10^{-6}

90. The solubility product of NiS is 4.9×10^{-5} at 298 K. Calculate its solubility in mol dm^{-3} at the same temperature?

(A) 1.69×10^{-3}

(B) 7.0×10^{-3}

(C) 2.45×10^{-3}

(D) 6.18×10^{-3}

91. Identify conjugate acid-base pair from following equilibrium reaction: $HSO_3^-(aq) + H_3O^+(aq) \rightleftharpoons H_2SO_3 + H_2O$

(A) H_2SO_3 and HSO_3^-

(B) HSO_3^- and H_3O^+

(C) H_2SO_3 and H_2O

(D) H_3O^+ and H_2SO_3

92. Calculate the change in internal energy of the system if 20 kJ work is done on the system and it releases 10 kJ heat in a particular reaction.

(A) 20 kJ

(B) 40 kJ

(C) 10 kJ

(D) 30 kJ

93. Calculate the enthalpy of solution of potassium chloride if its $\Delta_L H = 700$ kJ mol^{-1} and $\Delta_{hyd} H = -680$ kJ mol^{-1}

(A) 20 kJ mol^{-1}

(B) 345 kJ mol^{-1}

(C) 690 kJ mol^{-1}

(D) 1380 kJ mol^{-1}

94. Identify from following reactions that exhibits negative work done.

(A) $2H_2O_{2(\ell)} \rightarrow 2H_2O_{(\ell)} + O_{2(g)}$

(B) $NH_{3(g)} + HCl_{(g)} \rightarrow NH_4Cl_{(s)}$

(C) $H_{2(g)} + Cl_{2(g)} \rightarrow 2HCl_{(g)}$

(D) $N_{2(g)} + 3H_{2(g)} \rightarrow 2NH_{3(g)}$

95. Which of the following molecules contains maximum number of electrons in antibonding molecular orbitals?

(A) Li_2

(B) N_2

(C) O_2

(D) F_2

96. Identify isoelectronic pair from following.

(A) Ne and O^{--}

(B) Cl^- and Ca

(C) Ar and F^-

(D) K^+ and Al^{+3}

97. Which is the correct increasing order of atomic radii of Na, K, Mg, Rb?

(A) $Mg < K < Na < Rb$

(B) $Mg < Na < K < Rb$

(C) $Mg < Na < Rb < K$

(D) $Na < K < Rb < Mg$

98. What is the difference in molar masses of Undecane and Decane?

(A) 140 g mol^{-1}

(B) 70 g mol^{-1}

(C) 24 g mol^{-1}

(D) 14 g mol^{-1}

99. Find the number of water molecules in 1 mL of water vapours at STP?

(A) 1.69×10^{19}

(B) 2.00×10^{21}

(C) 1.05×10^{21}

(D) 2.69×10^{19}

100. A gaseous mixture of O_2 and CH_4 are in the ratio $1:4$ by mass. Find the ratio of their molecules.

(A) $1:4$

(B) $2:3$

(C) $1:8$

(D) $3:2$

101. The lines $x+2ay+a=0, x+3by+b=0, x+4cy+c=0$ are concurrent then a,b,c are in

(A) Harmonic progression

(B) Geometric progression

(C) Arithmetic progression

(D) Arithmetico geometric progression

102. If matrix $A = \frac{1}{11}\begin{bmatrix} -1 & 7 & -24 \\ 2 & a & 4 \\ 2 & -3 & 15 \end{bmatrix}$ and $A^{-1} = \begin{bmatrix} 3 & 3 & 4 \\ 2 & -3 & 4 \\ b & -1 & c \end{bmatrix}$, then the values of a,b,c respectively are .....

(A) $3,1,0$

(B) $-\frac{6}{11}, 0, \frac{1}{11}$

(C) $-3,0,1$

(D) $-\frac{3}{11}, 0, \frac{1}{11}$

103. If a random variable X has p.d.f. $f(x) = \begin{cases} \frac{ax^2}{2} + bx & , \text{ if } 1 \le x \le 3 \\ 0 & , \text{ otherwise} \end{cases}$ and $f(2) = 2$, then the values of a and b are, respectively

(A) $11, -10$

(B) $-9, 10$

(C) $\frac{1}{6}, \frac{5}{6}$

(D) $9, -8$

104. In a box containing 100 apples, 10 are defective. The probability that in a sample of 6 apples, 3 are defective is

(A) 0.1548

(B) 0.1458

(C) 0.01854

(D) 0.01458

105. Four defective oranges are accidentally mixed with sixteen good ones. Three oranges are drawn from the mixed lot. The probability distribution of defective oranges is (Referring to distributions A, B, C, D)

(A) (Distribution A)

(B) (Distribution B)

(C) (Distribution C)

(D) (Distribution D)

106. Three urns respectively contain 2 white and 3 black, 3 white and 2 black and 1 white and 4 black balls. If one ball is drawn from each urn, then the probability that the selection contains 1 black and 2 white balls is

(A) $\frac{13}{125}$

(B) $\frac{37}{125}$

(C) $\frac{28}{125}$

(D) $\frac{33}{125}$

107. The correct constraints for the given feasible region are .... (Referring to the graph and constraints A, B, C, D)

(A) $y-x \geq 1, x+5y \leq 10, x+y \geq 2, x, y \geq 0$

(B) $x-y \leq 1, 2x+5y \leq 10, x+y \geq 1, x, y \geq 0$

(C) $y-x \geq 1, 2x+5y \leq 10, x+y \geq 1, x, y \geq 0$

(D) $x-y \leq 1, 2x+5y \geq 10, x+y \leq 1, x, y \geq 0$

108. The line L is passing through $(1,2,3)$. The distance of any point on the line L from the line $\bar{r} = (3\lambda - 1)\hat{i} + (-2\lambda + 3)\hat{j} + (4+\lambda)\hat{k}$ is constant. Then the line L does not pass through the point

(A) $(4,0,4)$

(B) $(-2,4,2)$

(C) $(7,-2,5)$

(D) $(-5,6,2)$

109. If the angle between the line $x=\frac{y-1}{2}=\frac{z-3}{\lambda}$ and the plane $x+2y+3z=4$ is $\cos^{-1}\sqrt{\frac{5}{14}}$, then the value of λ is

(A) $\frac{1}{3}$

(B) $\frac{4}{5}$

(C) $\frac{2}{3}$

(D) $\frac{2}{5}$

110. The distance of the plane $\bar{r}=(\hat{i}-\hat{j})+\lambda(\hat{i}+\hat{j}+\hat{k})+\mu(\hat{i}-2\hat{j}+3\hat{k})$ from the origin is

(A) $\frac{7}{\sqrt{38}}$ units

(B) $\frac{1}{\sqrt{38}}$ units

(C) $\frac{5}{\sqrt{38}}$ units

(D) $\frac{2}{\sqrt{38}}$ units

111. The angle between the lines $x-3y-4=0,4y-z+5=0$ and $x+3y-11=0,2y-z+6=0$ is

(A) $\frac{\pi}{2}$

(B) $\frac{\pi}{4}$

(C) $\frac{\pi}{6}$

(D) $\frac{\pi}{3}$

112. If the point $(1,\alpha,\beta)$ lies on the line of the shortest distance between the lines $\frac{x+2}{-3}=\frac{y-2}{4}=\frac{z-5}{2}$ and $\frac{x+2}{-1}=\frac{y+6}{2},z=1$, then $\alpha+\beta=$

(A) 1

(B) -3

(C) 7

(D) -7

113. The projection of the line segment joining $P(2,-1,0)$ and $Q(3,2,-1)$ on the line whose direction ratios are $1,2,2$ is

(A) $\frac{1}{3}$

(B) $\frac{2}{3}$

(C) $\frac{4}{3}$

(D) $\frac{5}{3}$

114. If $\bar{p} = 2\hat{i} + \hat{k}$, $\bar{q} = \hat{i} + \hat{j} + \hat{k}$, $\bar{r} = 4\hat{i} - 3\hat{j} + 7\hat{k}$ and a vector $\bar{m}$ is such that $\bar{m} \times \bar{q} = \bar{r} \times \bar{q}$, $\bar{m} \cdot \bar{p} = 0$, then $\bar{m} = \ldots$

(A) $\hat{i} - 8\hat{j} - 2\hat{k}$

(B) $-10\hat{i} + 3\hat{j} + 7\hat{k}$

(C) $-\hat{i} - 8\hat{j} + 2\hat{k}$

(D) $2\hat{i} + 4\hat{j} + \hat{k}$

115. If the lengths of three vectors $\bar{a}, \bar{b}$ and $\bar{c}$ are $5, 12, 13$ units respectively, and each one is perpendicular to the sum of the other two, then $|\bar{a} + \bar{b} + \bar{c}| = \ldots\ldots$

(A) $\sqrt{338}$

(B) 169

(C) 338

(D) 676

116. If the area of parallelogram, whose diagonals are $\hat{i} - \hat{j} + 2\hat{k}$ and $2\hat{i} + 3\hat{j} + \alpha\hat{k}$ is $\frac{\sqrt{93}}{2}$ sq. unit, then $\alpha =$

(A) $-4, 2$

(B) $-3, -2$

(C) $2, 1$

(D) $4, 2$

117. The number of integral values of p for which the vector $(p+1)\hat{i} - 3\hat{j} + p\hat{k}, p\hat{i} + (p+1)\hat{j} - 3\hat{k}$ and $-3\hat{i} + p\hat{j} + (p+1)\hat{k}$ are linearly dependent vectors, are

(A) 0

(B) 1

(C) 2

(D) 3

118. The differential equation satisfied by $y = X\sin(6t+5) + Y\cos(6t+5)$ is (where X and Y are constants)

(A) $\frac{d^2y}{dt^2}+6y=0$

(B) $\frac{d^2y}{dt^2}=0$

(C) $\frac{d^2y}{dt^2}+36y=0$

(D) $\frac{d^2y}{dt^2}+25y=0$

119. The equation of the curve passing through $(2,\frac{9}{2})$ and having the slope $(1-\frac{1}{x^2})$ at (x,y) is

(A) $xy=x^2+2x+1$

(B) $xy=x^2+x+2$

(C) $xy=x^2+x+5$

(D) $xy=x^2+2x+5$

120. The general solution of the differential equation $\frac{dy}{dx}+\sin(\frac{x+y}{2})=\sin(\frac{x-y}{2})$ is

(A) $\log\tan(\frac{y}{2})=c-2\sin\frac{x}{2}$

(B) $\log\tan(\frac{y}{4})=c-2\sin(\frac{x}{2})$

(C) $\log[\tan(\frac{y}{2}+\frac{\pi}{4})]=c-2\sin x$

(D) $\log[\tan(\frac{y}{4}+\frac{\pi}{4})]=c-2\sin\frac{x}{2}$

121. A wet substance in the open air loses its moisture at a rate proportional to the moisture content. If a sheet, hung in the open air, loses half its moisture during the first hour, then 90% of the moisture will be lost in ..... hours.

(A) $2\log_2 10$

(B) $\frac{4\log 10}{\log 2}$

(C) $\log_2 10$

(D) $\frac{3\log 10}{\log 2}$

122. If a curve $y=a\sqrt{x}+bx$ passes through the point $(1,2)$ and the area bounded by this curve, line $x=4$ and the X -axis is 8 sq.units, then the value of $a-b$ is

(A) -2

(B) 2

(C) -4

(D) 4

123. $\int_0^{\pi/4}(\sqrt{\tan x}+\sqrt{\cot x})dx=$

(A) $\sqrt{2}\pi$

(B) $\frac{\pi}{2}$

(C) 2π

(D) $\frac{\pi}{\sqrt{2}}$

124. The value of the integral $\int_1^2 \frac{xdx}{(x+2)(x+3)}$ is

(A) $\log(\frac{125}{16})$

(B) $\log(\frac{1024}{1125})$

(C) $\log(\frac{16}{125})$

(D) $\log(\frac{1125}{1024})$

125. $\int e^{2x}\frac{(\sin 2x\cos 2x-1)}{\sin^2 2x}dx =$

(A) $e^{2x}\cot(2x)+c$

(B) $2e^{2x}\cot(2x)+c$

(C) $4e^{2x}\cot(2x)+c$

(D) $\frac{1}{2}e^{2x}\cot(2x)+c$

126. $\int \frac{x^3}{x^4+5x^2+4}dx =$

(A) $\frac{1}{3}\log(\frac{(x^2+4)^2}{\sqrt{x^2+1}})+c$

(B) $\log(\frac{(x^2+4)^2}{\sqrt{x^2+1}})+c$

(C) $3\log(\frac{(x^2+4)^2}{\sqrt{x^2+1}})+c$

(D) $\frac{2}{3}\log(\frac{(x^2+4)^2}{\sqrt{x^2+1}})+c$

127. $\int \sec^2\frac{x}{3}\cdot\csc^2\frac{x}{3}dx =$

(A) $3\tan\frac{x}{3}+c$

(B) $-3\tan\frac{x}{3}+c$

(C) $-3\cot\frac{x}{3}+c$

(D) $-\frac{3}{4}\tan\frac{4x}{3}+c$

128. Let f be a function which is continuous and differentiable for all x. If $f(1)=1$ and $f'(x)\leq 5$ for all x in $[1,5]$, then the maximum value of $f(5)$ is

(A) 5

(B) 20

(C) 6

(D) 21

129. An open tank with a square bottom is to contain 4000 cubic cm. of liquid. The dimensions of the tank so that the surface area of the tank is minimum, is

(A) side $= 20$ cm, height $= 10$ cm

(B) side $= 10$ cm, height $= 20$ cm

(C) side $= 10$ cm, height $= 40$ cm

(D) side $= 20$ cm, height $= 05$ cm

130. The function $f(x) = \sin^4 x + \cos^4 x$ increases if

(A) $0 < x < \frac{\pi}{8}$

(B) $\frac{\pi}{4} < x < \frac{\pi}{2}$

(C) $\frac{3\pi}{8} < x < \frac{5\pi}{8}$

(D) $\frac{5\pi}{8} < x < \frac{3\pi}{4}$

131. The normal to the curve $x = 9(1+\cos\theta), y = 9\sin\theta$ at θ always passes through the fixed point

(A) $(9,0)$

(B) $(8,9)$

(C) $(0,9)$

(D) $(9,8)$

132. Derivative of $x^{(x^x)}$ is

(A) $x^{(x^x)}(x^x + 1 + \log x)$

(B) $x^{(x^x)}(x^x + \log x)$

(C) $x^{(x^x)}(x^x + x^{x-1}\log x(1+\log x))$

(D) $x^{(x^x)}(x^{x-1} + x^x \log x(1+\log x))$

133. If $f(1) = 3, f'(1) = 2$, then $\frac{d}{dx}\{\log[f(e^x + 2x)]\}$ at $x = 0$ is

(A) $\frac{2}{3}$

(B) $\frac{3}{2}$

(C) 2

(D) 0

134. The values of b and c for which the identity $f(x+1)-f(x)=8x+3$ is satisfied, where $f(x)=bx^2+cx+d$, are

(A) $b=2, c=1$

(B) $b=4, c=-1$

(C) $b=1, c=2$

(D) $b=3, c=-1$

135. Considering only the principal values of the inverse trigonometric function, the value of $\tan(\cos^{-1}\frac{1}{5\sqrt{2}}-\sin^{-1}\frac{4}{\sqrt{17}})$ is

(A) $\frac{3}{34}$

(B) $\frac{1}{34}$

(C) $\frac{3}{29}$

(D) $\frac{1}{29}$

136. The number of solutions of $\tan^{-1}(x+\frac{2}{x})-\tan^{-1}(\frac{4}{x})-\tan^{-1}(x-\frac{2}{x})=0$ are

(A) 1

(B) 2

(C) 3

(D) 0

137. The derivative of $\tan^{-1}(\frac{\sqrt{1+x^2}-1}{x})$ w.r.t. $\tan^{-1}(\frac{2x\sqrt{1-x^2}}{1-2x^2})$ at $x=0$ is

(A) $\frac{1}{8}$

(B) $\frac{1}{4}$

(C) $\frac{1}{2}$

(D) 1

138. In a triangle ABC with usual notations, if $3a=b+c$, then $\cot\frac{B}{2}\cdot\cot\frac{C}{2}=$

(A) 1

(B) $\sqrt{2}$

(C) 2

(D) 3

139. In a triangle ABC with usual notations if, $\cot\frac{A}{2} = \frac{b+c}{a}$, then the triangle ABC is

(A) an isosceles triangle.

(B) an equilateral triangle.

(C) a right angled triangle.

(D) an obtuse angled triangle.

140. If p : switch S_1 is closed, q : switch S_2 is closed, r : switch S_3 closed, then the symbolic form of the following switching circuit (referring to circuit diagram) is equivalent to

(A) $p \wedge (q \vee r)$

(B) $q \vee r$

(C) p

(D) $(\sim q \wedge \sim r)$

141. p : If 7 is an odd number then 7 is divisible by 2. q : If 7 is prime number then 7 is an odd number. If V_1 and V_2 are respective truth values of contrapositive of p and q then $(V_1, V_2) \equiv$

(A) (T, T)

(B) (T, F)

(C) (F, T)

(D) (F, F)

142. $\lim_{x\to 0}(\log_3 3x)^{\log_x 8} = \ldots$

(A) $e^{\log_3 8}$

(B) $\log_8 3$

(C) $e^{\log_8 3}$

(D) $\log_3 8$

143. If $f(x) = \begin{cases} \frac{1-\cos 4x}{x^2} & \text{if } x < 0 \\ a & \text{if } x = 0 \\ \frac{\sqrt{x}}{(16+\sqrt{x})^{1/2}-4} & \text{if } x > 0 \end{cases}$ is continuous at $x = 0$ then $a =$

(A) 4

(B) 8

(C) -4

(D) -8

144. The foci of a hyperbola coincide with the foci of the ellipse $\frac{x^2}{25}+\frac{y^2}{9}=1$. The equation of the hyperbola with eccentricity 2 is

(A) $\frac{x^2}{12}-\frac{y^2}{4}=1$

(B) $\frac{x^2}{4}-\frac{y^2}{12}=1$

(C) $\frac{x^2}{12}-\frac{y^2}{16}=1$

(D) $\frac{x^2}{16}-\frac{y^2}{12}=1$

145. The equations of the tangents to the circle $x^2+y^2=36$ which are perpendicular to the line $5x+y=2$, are

(A) $x+5y\pm6\sqrt{26}=0$

(B) $x-5y\pm6\sqrt{26}=0$

(C) $5x-y\pm6\sqrt{26}=0$

(D) $5x+y\pm6\sqrt{26}=0$

146. The circumradius of the triangle formed by the lines $x+2y+2z+4=0$ and $x+y+2=0$ is

(A) 2 units

(B) 1 unit

(C) $\sqrt{2}$ units

(D) $\sqrt{3}$ units

147. If $\sin A=n\sin(A+2B)$, then $\tan(A+B)=$

(A) $\frac{1+n}{2-n}\cdot\tan B$

(B) $\frac{1-n}{1+n}\cdot\tan B$

(C) $\frac{1-n}{2+n}\cdot\tan B$

(D) $\frac{1+n}{1-n}\cdot\tan B$

148. If $\frac{1}{6}\sin\theta,\cos\theta,\tan\theta$ are in G.P., then the general solution of θ is

(A) $2n\pi\pm\frac{\pi}{3},n\in\mathbb{Z}$

(B) $n\pi+\frac{\pi}{3},n\in\mathbb{Z}$

(C) $n\pi + \frac{\pi}{4}, n \in \mathbb{Z}$

(D) $2n\pi \pm \frac{\pi}{6}, n \in \mathbb{Z}$

149. If four digit numbers are formed by using the digits $1,2,3,4,5,6,7$ without repetition, then out of these numbers, the numbers exactly divisible by 25 are

(A) 20

(B) 40

(C) 50

(D) 51

150. $z = \frac{3+2i\sin\theta}{1-2i\sin\theta}, (i = \sqrt{-1})$ will be purely imaginary if $\theta =$

(A) $2n\pi \pm \frac{\pi}{8}$, where $n \in \mathbb{Z}$

(B) $n\pi + \frac{\pi}{8}$, where $n \in \mathbb{Z}$

(C) $n\pi \pm \frac{\pi}{3}$, where $n \in \mathbb{Z}$

(D) $n\pi$, where $n \in \mathbb{Z}$