VITEEE 2013 Question Paper

PART - I (PHYSICS)

1. The amplitude of an electromagnetic wave in vaccum is doubled with no other changes made to the wave. As a result of this doubling of the amplitude, which of the following statement is correct?
(a) The frequency of the wave changes only
(b) The wave length of the wave changes only
(c) The speed of the wave propagation changes only
(d) Alone of the above is correct

2. An element with atomic number $Z = 11$ emits K_α – X-ray of wavelength λ. The atomic number which emits K_α – X-ray of wavelength 4λ is
(a) 4 (b) 6
(c) 11 (d) 44

3. Mobilities of electrons and holes in a sample of intrinsic germanium at room temperature are $0.36 m^2 V^{-1}s^{-1}$ and $0.17 m^2 V^{-1}s^{-1}$. The electron and hole densities are each equal to 2.5×10^{19} m^3. The electrical conductivity of germanium is
(a) $4.24\ Sm^{-1}$ (b) $2.12\ Sm^{-1}$
(c) $1.09\ Sm^{-1}$ (d) $0.47\ Sm^{-1}$

4. If a radio-receiever amplifiers all the signal frequencies equally well, it is said to have high
(a) sensitivity (b) selectivity
(c) distortion (d) fidelity

5. If a progressive wave is represented as $y = 2\sin\pi\left(\frac{t}{2} - \frac{x}{4}\right)$ where x is in metre and t is in second, then the distance travelled by the wave in 5 s is
(a) 5m (b) 10m
(c) 25m (d) 32m

6. The gravitational potential at a place varies inversely with x^2 (*i.e.*, $V = k/x^2$), the gravitational field at that place is
(a) $2k/x^3$ (b) $-2k/x^3$
(c) k/x (d) $-k/x$

7. A copper wire of length 2.2 m and a steel wire of length 1.6 m, both of diameter 3.0 mm are connected end to end. When stretched by a force, the elonation in length 0.50 mm is produced in the copper wire. The stretching force is
($Y_{cu} = 1.1 \times 10^{11}\ N/m^2$, $Y_{steel} = 2.0 \times 10^{11}\ N/m^2$)
(a) 5.4×10^2 N (b) 3.6×10^2 N
(c) 2.4×10^2 N (d) 1.8×10^2 N

8. If $\bar{v}$, v_{rms} and v_p represent the mean speed, root mean square and most probable speed of the molecules in an ideal monoatomic gas at temperature T and if m is mass of the molecule, then
(a) $v_p < v < v_{rms}$
(b) no molecule can have a speed greater than $\sqrt{2}v_{rms}$
(c) no molecule can have a speed less than $v_p/\sqrt{2}$
(d) None of the above

9. Two balls of equal masses are thrown upwards along the same vertical direction at an interval of 2 s, with the same initial velocity of 39.2 m/s. The two balls will collide at a height of
(a) 39.2m (b) 73.5m
(c) 78.4m (d) 117.6m

10. The dimensional formula of magnetic flux is
(a) $[M^1L^2T^{-1}\ A^{-2}]$ (b) $[M^1L^2T^{-2}\ A^{-1}]$
(c) $[M^1L^2T^{-1}\ A^{-1}]$ (d) $[M^1L^0T^{-2}\ A^{-1}]$

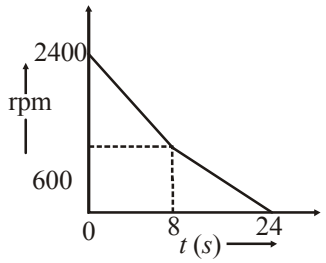
11. The time dependence of a physical quantity P is given by $P = P_0 e^{(-\alpha t^2)}$, where α is a constant and t is time. The constant α
(a) is a dimensionless
(b) has dimensions of P
(c) has dimensions of T^{-2}
(d) has dimensions of T^2

12. If the potential energy of a gas molecule is $U = \frac{M}{r^6} - \frac{N}{r^{12}}$, M and N being positive constants, then the potential energy at equilibrium must be

(a) zero (b) $NM^2/4$

(c) $MN^2/4$ (d) $M^2/4N$

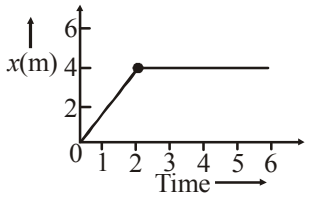
13. A table fan rotating at a speed of 2400 rpm is switched off and the resulting variation of revolution/minute with time is shown in figure. The total number of revolutions of the fan before it, comes to rest is



(a) 160 (b) 280

(c) 380 (d) 420

14. In the adjoining figure, the position time graph of a particle of mass 0.1 kg is shown. The impulse at $t = 2$ s is



(a) 0.02 kg m/s (b) 0.1 kg m/s

(c) 0.2 kg m/s (d) 0.4 kg m/s

15. The pressure on a square plate is measured by measuring the force on the plate. If the maximum error in the measurement of force and length are respectively 4% and 2%, then the maximum error in the measurement of pressure is

(a) 1% (b) 2%

(c) 4% (d) 8%

16. The centre of a wheel rolling on a plane surface moves with a speed ν_0. A particle on the rim of the wheel at the same level as the centre will be moving at speed

(a) zero (b) v_0

(c) $2v_0$ (d) $\sqrt{2v_0}$

17. A body of mass 5 m initially at rest explodes into 3 fragments with mass ratio 3:1:1. Two of fragments each of mass 'm' are found to move with a speed of 60 m/s is mutually perpendicular directions. The velocity of third fragment is

(a) $10\sqrt{2}$ (b) $20\sqrt{2}$

(c) $20\sqrt{3}$ (d) $60\sqrt{2}$

18. A body of mass 2 kg moving with velocity of 6 m/s strikes in elastically with another body of same mass mass at rest. The amount of heat evolved during collision is

(a) 18 J (b) 36 J

(c) 9 J (d) 3 J

19. Two particles of equal mass m go round a circle of radius R under the action of their mutual gravitational attraction. The speed of each particle is

(a) $\frac{1}{2}\sqrt{\frac{Gm}{R}}$ (b) $\sqrt{\frac{4Gm}{R}}$

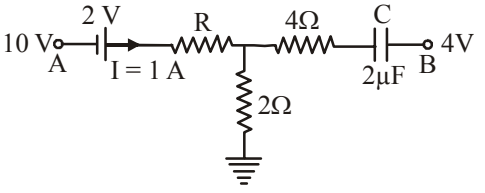
(c) $\sqrt{\frac{Gm}{2R}}$ (d) $\frac{1}{2R}\sqrt{\frac{1}{Gm}}$

20. Four equal charges Q each are placed at four corners of a square of side a each. Work done in carrying a charge –q from its centre to infinity is

(a) zero (b) $\frac{\sqrt{2}q}{\pi\varepsilon_0 a}$

(c) $\frac{q^2}{2\pi\varepsilon_0 a}$ (d) $\frac{\sqrt{2}q^2}{\pi\varepsilon_0 a}$

21. A network of resistances, cell and capacitor C(= 2 μ F) is shown in adjoining figure.In steady state condition, the charge on 2 μ F capacitor is Q, while R is unknown resistance. Values of Q and R are respectively



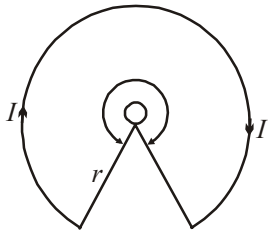
(a) 4 μ C and 10 Ω (b) 4 μ C and 4 Ω

(c) 2 μ C and 2 Ω (d) 8 μ C and 4 Ω

22. As the electron in Bohr's orbit of hydrogen atom passes from state $n = 2$ to, $n = 1$, the KE (K) and the potential energy (U) changes as
(a) K four fold, U also four fold
(b) K two fold, V also two fold
(c) K four fold, U two fold
(d) K two fold, U four fold

23. To get an OR gate from a NAND gate, we need
(a) Only two NAND gates
(b) Two NOT gates obtained from NAND gates and one NAND gate
(c) Four NAND gates and two AND gates obtained from NAND gates
(d) None of the above

24. If a current I is flowing in a loop of radius r as shown in adjoining figure, then the magnetic field induction at the centre O will be

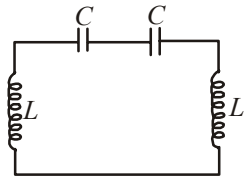


(a) Zero (b) $\frac{\mu_0 I\theta}{4\pi r}$

(c) $\frac{\mu_0 I\sin\theta}{4\pi r}$ (d) $\frac{2\mu_0 I\sin\theta}{4\pi r^2}$

25. Two indentical magnetic dipoles of magnetic moment 1.0 Am^2 each,placed at a separation of 2 m with their axes perpendicular to each other. The resultant magnetic field at a point midway between the dipoles is
(a) $\sqrt{5}\times10^{-7}\,T$ (b) $5\times10^{-7}\,T$
(c) $10^{-7}\,T$ (d) $2\times10^{-7}\,T$

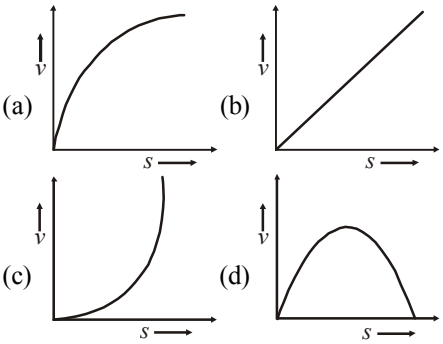
26. The natural frequency of the circuit shown in adjoining figure is



(a) $\frac{1}{2\pi\sqrt{LC}}$ (b) $\frac{1}{2\pi\sqrt{2LC}}$

(c) $\frac{2}{2\pi\sqrt{LC}}$ (d) zero

27. A lead shot of 1 mm diameter falls through a long column of glycerine. The variation of the velocity with distance covered (s) is correctly represented by

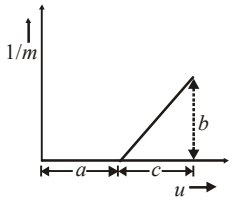


28. If ε_0 and μ_0 represent the permittivity and permeability of vaccum and ε and μ represent the permittivity and permeability of medium, then refractive index of the medium is given by

(a) $\sqrt{\frac{\varepsilon_0\mu_0}{\varepsilon\mu}}$ (b) $\sqrt{\frac{\varepsilon\mu}{\varepsilon_0\mu_0}}$

(c) $\sqrt{\frac{\mu_0\varepsilon_0}{\varepsilon}}$ (d) $\sqrt{\frac{\mu_0\varepsilon_0}{\mu}}$

29. A students plots a graph between inverse of magnification $1/m$ produced by a convex thin lens and the object distance u as shown in figure. What was the focal length of the lens used?



(a) $\frac{b}{ca}$ (b) $\frac{bc}{a}$

(c) $\frac{c}{b}$ (d) $\frac{b}{c}$

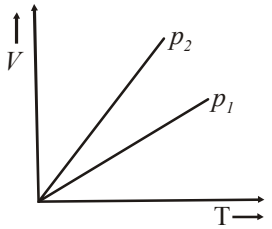
30. Two waves $y_1 = A_1 \sin(\omega t - \beta_1)$ and $y_2 = A_2 \sin(\omega t - \beta_2)$ superimpose to form a resultant wave whose amplitude is
(a) $A_1 + A_2$
(b) $|A_1 + A_2|$
(c) $\sqrt{A_1^2 + A_2^2 - 2A_1A_2\sin(\beta_1 - \beta_2)}$
(d) $\sqrt{A_1^2 + A_2^2 + 2A_1A_2\cos(\beta_1 - \beta_2)}$

31. When a certain metallic surface is illuminated with monochromatic light of wavelength λ, the stopping potential for photoelectric current $3V_0$. When the same surface is illuminated with a light of wave length 2λ, the stopping potential is V_0. The threshold wavelength for this surface to photoelectric effect is

(a) 4λ (b) 6λ

(c) 8λ (d) $\frac{4}{3}\lambda$

32. In the *V-T* diagram shown in adjoining figure, what is the relation between p_1 and p_2?



(a) $p_2 = p_1$ (b) $p_2 < p_1$

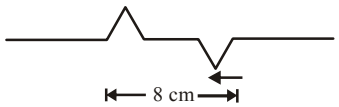
(c) $p_2 > p_1$ (d) insufficient data

33. If a gas mixture contains 2 moles of O_2 and 4 moles of Ar at temperature *T*, then what will be the total energy of the system (neglecting all vibrational modes)

(a) 11 *RT* (b) 15 *RT*

(c) 8 *RT* (d) *RT*

34. In the adjoining figure, two pulses in a stretched string are shown. If initially their centres are 8 cm apart and they are moving towards each other, with speed of 2cm/s, then total energy of the pulses after 2 s will be



(a) Zero

(b) Purely kinetic

(c) Purely potential

(d) Partly kinetic and partly potential

35. When two waves of almost equal frequency n_1 and n_2 are produced simultaneously, then the time interval between succesive maxima is

(a) $\frac{1}{n_1 + n_2}$ (b) $\frac{1}{n_1} + \frac{1}{n_2}$

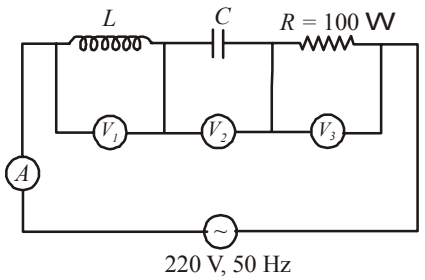
(c) $\frac{1}{n_1} - \frac{1}{n_2}$ (d) $\frac{1}{n_1 - n_2}$

36. A long glass capillary tube is dipped in water. It is known that water wets glass. The water level rises by *h* in the tube. The tube is now pushed down so that only a length *h/2* is outside the water surface. The angle of contact at the water surface at the upper end of the tube will be

(a) $\tan^{-1}\frac{1}{2}$ (b) 60º

(c) 30º (d) 15º

37. In the adjoining circuit, if the reading of voltmeter V_1 and V_2 are 300 volts each, then the reading voltmeter V_3 and ammeter A are respectively



(a) 220 V, 2.2 A (b) 100 V, 2.0 A

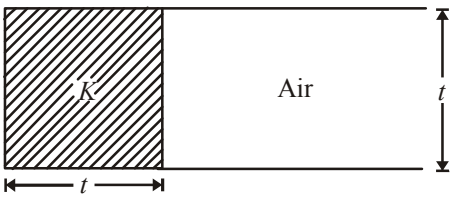
(c) 220 V, 2.0 A (d) 100 V, 2.2 A

38. If the work done in turning a magnet of magnetic moment *M* by an angle of 90º from the magnetic meridian is n times the corresponding work done to turn it through an angle of 60º, then the value of *n* is

(a) 1 (b) 2

(b) $\frac{1}{2}$ (d) $\frac{1}{4}$

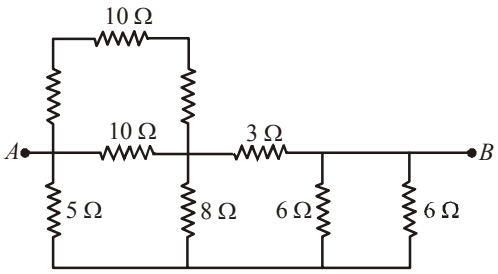
39. The capacitance of a parallel plate capacitor with air as dielectric is *C*. If a slab of dielectric constant *K* and of the same thickness as the separation between the plates is introduced so as to fill 1/4th of the capacitor (shown in figure), then the new capacitance is



(a) $(K+2)\frac{C}{4}$ (b) $(K+3)\frac{C}{4}$

(c) $(K+1)\frac{C}{4}$ (d) None of these

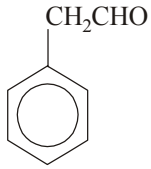
40. Seven resistance are connected between points *A* and *B* as shown in adjoining figure. The equivalent resistance between *A* and *B* is

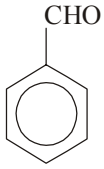


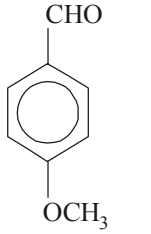
(a) 5 Ω (b) 4.5 Ω
(c) 4 Ω (d) 3 Ω

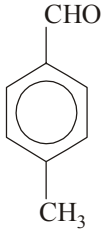
PART - II (CHEMISTRY)

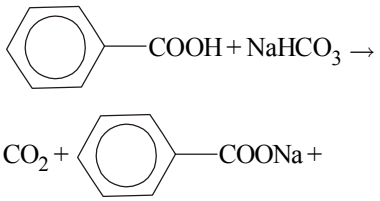
41. Which of the following does not undergo benzoin condensation?

(a) 

(b) 

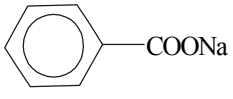
(c) 

(d) 

42. 

*
C is with the product

(a) CO_2

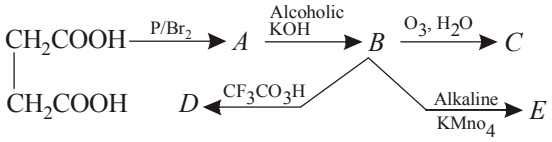
(b) 

(c) Both (a) and (b)
(d) None of the above

43. Benzene diazonium chloride on treatment with hypophosphorous acid and water yield benzene. Which of the following is used as a catalyst in this reaction?

(a) $LiAlH_4$ (b) Red p
(c) Zn (d) Cu+

44. Consider the following reaction sequence,



Isomers are

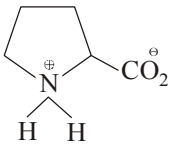
(a) C and E (b) C and D
(c) D and E (d) C,D and E

45. When a monosaccharide forms a cyclic hemiacetal, the carbon atom that contained the carbonyl group is identified as the …. Carbon atom,because

(a) D,the carbonyl group is drawn to the right
(b) L, the carbonyl group is drawn to the left
(c) acetal,it forms bond to an –OR and an –OR'
(d) anomeric, its substituents can assume an β or α position

46. Which of the following is/ are α - amino acid?

(a) 

(b) 

(c) Both (a) and (b) (d) None of these

47. Calculate pH of a buffer prepared by adding 10 mL of 0.10 M acetic acid to 20 mL of 0.1 M sodium acetate [pK_a (CH_3COOH) = 4.74]

(a) 3.00 (b) 4.44
(c) 4.74 (d) 5.04

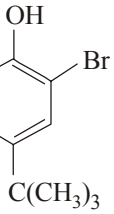
48. The equivalent conductance of silver nitrate solution at 250°C for an infinite dilution was found to be $133.3\Omega^{-1}$ cm^2 $equiv^{-1}$. The transport number of Ag^+ ions in very dilute solution of $AgNO_3$ is 0.464. Equivalent conductances of Ag^+ and NO^-_3 (in Ω^{-1} cm^2 $equiv^{-1}$) at infinite dilution are respectively

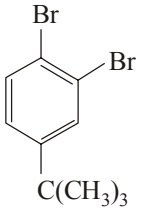
(a) 195.2, 133.3 (b) 61.9, 71.4
(c) 71.4, 61.9 (d) 133.3, 195.2

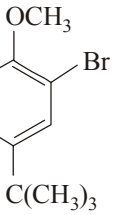
49. Treating anisole with the following reagents, the major product obtained is

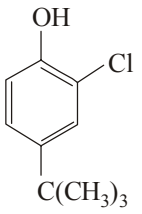
I. $(CH_3)_3CCl, AlCl_3$ II. $Cl_2, FeCl_3$

III. HBr, Heat

(a) 

(b) 

(c) 

(d) 

50. Ketones [R—C(=O)—R'] where, $R = R'$ = alkyl group can be obtained in one step by

(a) Hydrolysis of esters

(b) Oxidation of primary alcohols

(c) Oxidation of secondary alcohols

(d) Reaction of acid halide with alcohols

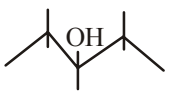
51. An optically active compound 'X' has molecular formula $C_4H_8O_3$. It evolves CO_2 with aqueous $NaHCO_3$. '*X*' reacts with $LiAlH_4$ to give an achiral compound.'*X*' is

(a) $CH_3CH_2CH(OH)COOH$

(b) $CH_3CH(OMe)COOH$

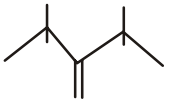
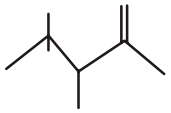
(c) $CH_3CH(CH_2OH)COOH$

(d) $CH_3CH(OH)CH_2COOH$

52. 

$\xrightarrow{conc.H_2SO_4}$ products.

Product is/are

(a)  (b) 

(c) Both (a) and (b) (d) None is correct

53. Glycerol $\xrightarrow{KHSO_4}$ A $\xrightarrow{HClO}$ B,

A –A and B respectively are

(a) $CH_2=CH\,C(=O)H$ $CH_2(Cl)-CH(OH)\,C(=O)H$

(b) $CH_2=CHC(=O)H$ $CH_2(OH)-CHC(=O)H$ (Cl)

(c) CH_3CH_2CHO $CH_3CH_2CH(OH)Cl$

(d) $CH_2=CHC(=O)H$ CH_2CH_2CHO (ClO)

54. Phenol is heated with phthalic anhydride in the presence of conc. H_2SO_4. The product gives pink colour with alkali. The product is

(a) phenolphthalein (b) bakelite

(c) salicylic acid (d) flurorescein

55. $C_6H_5NH_2 \xrightarrow[0°C]{NaNO_2/HCl} X \xrightarrow{CuCN}$

$Y \xrightarrow{H_2O/H^+}$ *Z*, *Z* is identified as

(a) $C_6H_5—NH—CH_3$

(b) $C_6H_5—CH_2—NH_2$

(c) $C_6H_5—CH_2—COOH$

(d) $C_6H_5—COOH$

56. *B* can be obtained from halide by van-Arkel method. This involves reaction

(a) $2BI_3 \xrightarrow[filament]{Red\ hot\ W\ or\ Ta} 2B + 3I_2$

(b) $2BCl_3 + 3H_2 \xrightarrow[filament]{Red\ hot\ W\ or\ Ta} 2B + 6HCl$

(c) Both (a) and (b)

(d) None of the above

57. $NH_4Cl(s)$ is heated in a test tube. Vapours are brought in contact with red litmus paper, which changes it to blue and then to red. It is because of

(a) formation of NH_4OH and HCl

(b) formation of NH_3 and HCl

(c) greater diffusion of NH_3 than HCl

(d) greater diffusion of HCl than NH_3

58. Out of $H_2S_2O_3$, $H_2S_2O_4$, H_2SO_5 and $H_2S_2O_8$ peroxy acids are

(a) $H_2S_2O_3$, $H_2S_2O_8$ (b) H_2SO_5, $H_2S_2O_8$

(c) $H_2S_2O_4$, H_2SO_5 (d) $H_2S_2O_3$, $H_2S_2O_4$

59. The density of solid argon is 1.65 g per cc at -233°C. If the argon atom is assumed to be a sphere of radius 1.54×10^{-8} cm, what per cent of solid argon is apparently empty space? (Ar = 40)

(a) 16.5% (b) 38%

(b) 50% (d) 62%

60. When 1 mole of $CO_2(g)$ occupying volume 10L at 27°C is expanded under adiabatic condition, temperature falls to 150 K. Hence,final volume is

(a) 5L (b) 20L

(c) 40L (d) 80L

61. Acid hydrolysis of ester is first order reaction and rate constant is given by $k = \frac{2.303}{t}\log\frac{V_\infty - V_0}{V_\infty - V_t}$ where, V_0, V_t and V_∞ are the volumle of standard NaOH required to neutralise acid present at a given time, if ester is 50% neutralised then

(a) $V_\infty = V_t$ (b) $V_\infty = (V_t - V_0)$

(c) $V_\infty = 2V_t - V_0$ (d) $V_\infty = 2V_t + V_0$

62. A near UV photon of 300 nm is absorbed by a gas and then re-emitted as two photons. One photon is red with wavelength of the second photon is

(a) 1060nm (b) 496nm

(c) 300nm (d) 215nm

63. Which of these ions is expected to be coloured in aqueous solution?

I. Fe^{3+} II. Ni^{2+} III. Al^{3+}

(a) I and II (b) II and III

(c) I and III (d) I, II and III

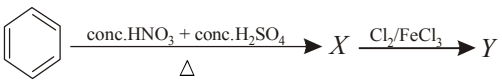
64. Select the correct statements(s).

(a) $LiAlH_4$ reduces methyl cyanide to methyl amine

(b) Alkane nitrile has electrophilic as well as nucleophilic centres

(c) saponification is a reversible reaction

(d) Alkaline hydrolysis of methane nitrile forms methanoic acids

65. 

The product Y is

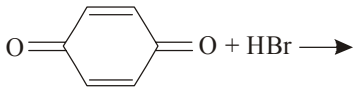
(a) *p*-chloro nitrobenzene

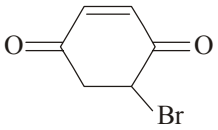
(b) *o*-chloro nitrobenzene

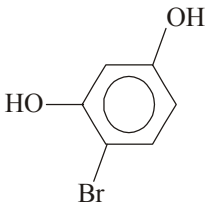
(c) *m*-chloro nitrobenzene

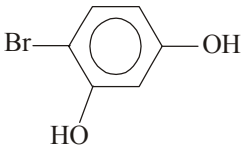
(d) *o, p*-dichloro nitrobenzene

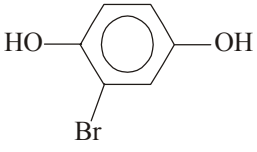
66. End product of the following reaction is



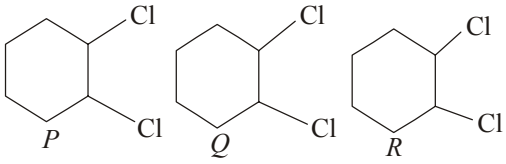
(a) 

(b) 

(c) 

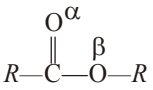
(d) 

67. Following compounds are respectively ... geometrical isomers



	P	Q	R
(a)	cis	cis	trans
(b)	cis	trans	trans
(c)	trans	cis	cis
(d)	cis	trans	cis

68. Which is more basic oxygen in an ester?



(a) Carbonyl oxygen, α
(b) Carboxyl oxygen, β
(c) Equally basic
(d) Both are acidic oxygen

69. In a Claisen condensation reaction (when an ester is treated with a strong base)
(a) a proton is removed from the α -carbon to form a resonance stabilised carbanion of the ester
(b) carbanion acts as a nucleophile in a nucleophilic acyl substitution reaction with another ester molecule
(c) a new C—C bond is formed
(d) All of the above statements are correct

70. An organic compound *B* is formed by the reaction of ethyl magnesium iodide with a substance *A*, followed by treatment with dilute aqueous acid, Compound B does not react with PCC or PDC in dichloromethane. Which of the following is a possible compound for *A*?

(a) $CH_2{=}CH_2$ (b) $CH_3CH_2CCH_3$ (O)

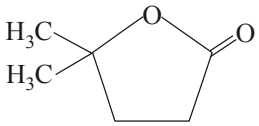
(c) CH_3CH (O) (d) $H_2C{=}O$

71. $CH_3C(=O)CH_2CH_2C(=O)OCH_2CH_3$

$\xrightarrow[\text{(ii) } H_2O^+]{\text{(i) } CH_3MgBr\text{(one mole)}}$ A formed in this reaction is

(a) $CH_3C(OH)(CH_3)CH_2CH_2COCH_2CH_3$

(b) $CH_3C(=O)CH_2CH_2C(=O)CH_3$

(c) 

(d) $CH_3C(CH_3)(OH)CH_2CH_2C(CH_3)(OH)CH_3$

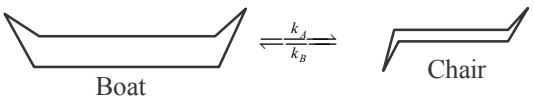
72. For the cell reaction $2Ce^{4+} + Co \rightarrow 2Ce^{3+} + Co^{3+}$; E°_{cell} cell is 1.89 V. If $E_{Co^{2+}/Co}$ is – 0.28 V, what is the value of $E^\circ_{Ce^{4+}/Ce^{3+}_{o}}$?

(a) 0.28 V (b) 1.61 V
(c) 2.17 V (d) 5.29 V

73. A constant current of 30 A is passed through an aqueous solution of NaCl for a time of 1.00 h. What is the volume of Cl_2 gas at STP produced?

(a) 30.00 L (b) 25.08 L
(c) 12.54 L (d) 1.12 L

74. Consider the following reaction,



The reaction is of first order in each diagram, with an equilibrium constant of 10^4. For the conversion of chair form to boat form $e^{-Ea/RT} = 4.35 \times 10^{-8}$ m at 298 K with pre-exponential factor of 10^{12} s^{-1}. Apparent rate constant (= *kA* / *kB*) at 298 K is

(a) 4.35×10^4 s^{-1} (b) 4.35×10^8 s^{-1}
(c) 4.35×10^{-8} s^{-1} (d) 4.35×10^{12} s^{-1}

75. If for the cell reaction, $Zn + Cu^{2+} \rightleftharpoons Cu + Zn^{2+}$ Entropy change $\triangle S^\circ$ is 96.5 J $mol^{-1}K^{-1}$, then temperature coefficient of the emf of a cell is

(a) 5×10^{-4} VK^{-1} (b) 1×10^{-3} VK^{-1}
(c) 2×10^{-3} VK^{-1} (d) 9.65×10^{-4} VK^{-1}

76. What transition in the hydrogen spectrum would have the same wavelength as the Balmer transition, $n = 4$ to $n = 2$ of He^+ spectrum?
(a) $n = 4$ to $n = 2$ (b) $n = 3$ to $n = 2$
(c) $n = 2$ to $n = 1$ (d) $n = 4$ to $n = 3$

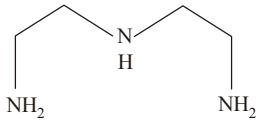
77. What is the degeneracy of the level of H-atom that has energy $\left(-\frac{R_H}{9}\right)$?
(a) 16 (b) 9
(c) 4 (d) 1

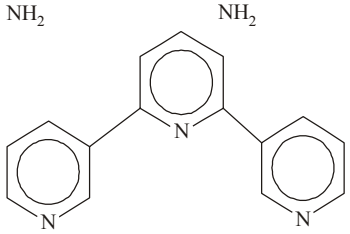
78. Match the following and choose the correct option given below.

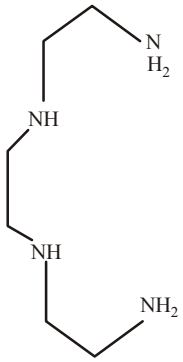
	Compound/Type	**Use**
A.	Dry ice	I. Anti-knocking compound
B.	Semiconductor	II. Electronic diode or triode
C.	Solder	III. Joining circuits
D.	TEL	IV. Referigerant for preserving food

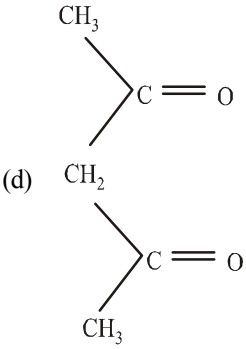
	A	B	C	D
(a)	I	II	IV	III
(b)	II	III	I	IV
(c)	IV	III	II	I
(d)	IV	II	III	I

79. Which of the following ligands is tetradentate?

(a) 

(b) 

(c) 

(d) 

80. What is the EAN of $[Al(C_4O_4)_3]^{3-}$?
(a) 28 (b) 22
(c) 16 (d) 10

PART - III (MATHEMATICS)

81. The relation R defined on set $A = \{x : |x| < 3, x \in I\}$ by $R = \{(x, y) : y = |x|\}$ is
(a) $\{-2, 2), (-1, 1), (0, 0), (1, 1), (2, 2)\}$
(b) $\{(-2, -2), (-2, 2), (-1, 1), (0, 0), (1, -2), (1, 2), (2, -1), (2, -2)\}$
(c) $\{0, 0), (1, 1), (2, 2)\}$
(d) None of the above

82. The solution of the differential equation $\frac{dy}{dx} = \frac{yf'(x) - y^2}{f(x)}$ is
(a) $f(x) = y + C$ (b) $f(x) = y(x + C)$
(c) $f(x) = x + C$ (d) None of the above

83. If a, b and c are in AP, then determinant $\begin{vmatrix} x+2 & x+3 & x+2a \\ x+3 & x+4 & x+2b \\ x+4 & x+5 & x+2c \end{vmatrix}$ is
(a) 0 (b) 1
(c) x (d) $2x$

84. If two events A and B. If odds against A are as 2:1 and those in favour of $A \cup B$ are as 3:1, then
(a) $\frac{1}{2} \le P(B) \le \frac{3}{4}$ (b) $\frac{5}{12} \le P(B) \le \frac{3}{4}$
(c) $\frac{1}{4} \le P(B) \le \frac{3}{5}$ (d) None of these

85. The value of $2 \tan^{-1}(\text{cosec} \tan^{-1} x - \tan \cot^{-1} x)$ is
(a) $\tan^{-1} x$ (b) $\tan x$
(c) $\cot x$ (d) $\text{cosec}^{-1} x$

86. The proposition $\sim (p \Leftrightarrow q)$ is equivalent to
(a) $(p \vee \sim q) \wedge (q \wedge \sim p)$
(b) $(p \wedge \sim q) \vee (q \wedge \sim p)$
(c) $(p \wedge \sim q) \wedge (q \wedge \sim p)$
(d) None of the above

87. If truth values of P be F and q be T. Then, truth value of $\sim(\sim p \vee q)$ is
(a) T (b) F
(c) Either T or F (d) Neither T not F

88. The rate of change of the surface area of a sphere of radius r, when the radius is increasing at the rate of 2 cm/s is proportional to
(a) $\frac{1}{r}$ (b) $\frac{1}{r^2}$
(c) r (d) r^2

89. If N denote the set of all natural numbers and R be the relation on $N \times N$ defined by $(a, b)\, R\, (c, d)$, if $ad\,(b + c) = bc\,(a + d)$, then R is
(a) symmetric only
(b) reflexive only
(c) transitive only
(d) an equivalence relation

90. A complex number z is such that $\arg\left(\frac{z-2}{z+2}\right)=\frac{z}{3}$. The points representing this complex number will lie on
(a) an ellipse (b) a parabola
(c) a circle (d) a straight line

91. If a_1, a_2 and a_3 be any positive real numbers, then which of the following statement is true?
(a) $3a_1a_2a_3 \le a_1^3 + a_2^3 + a_3^3$
(b) $\frac{a_1}{a_2}+\frac{a_2}{a_3}+\frac{a_3}{a_1} \ge 3$
(c) $(a_1 + a_2 + a_3)\left(\frac{1}{a_1}+\frac{1}{a_2}+\frac{1}{a_3}\right) \ge 9$
(d) $(a_1 . a_2 . a_3)\left(\frac{1}{a_1}+\frac{1}{a_2}+\frac{a_3}{a_3}\right)^3 \ge 27$

92. If $|x^2 - x - 6| = x + 2$, then the values of x are
(a) $-2, 2, -4$ (b) $-2, 2, 4$
(c) $3, 2, -2$ (d) $4, 4, 3$

93. The centres of a set of circles, each of radius 3, lie on the circle $x^2 + y^2 = 25$. The locus of any point in the set is
(a) $4 \le x^2 + y^2 \le 64$
(b) $x^2 + y^2 \le 25$
(c) $x^2 + y^2 \ge 25$
(d) $3 \le x^2 + y^2 \le 9$

94. A tower AB leans towards west making an angle α with the vertical. The angular elevation of B, the top most point of the tower is β as observed from a point C due east of A at a distance 'd' from A. If the angular elevation of B from a point D due east of C at a distance $2d$ from C is r, then $2 \tan \alpha$ can be given as
(a) $3 \cot \beta - 2 \cot \gamma$ (b) $3 \cot \gamma - 2 \cot \beta$
(c) $3 \cot \beta - \cot \gamma$ (d) $\cot \beta - 3 \cot \gamma$

95. If α and β are the roots of $x^2 - ax + b = 0$ and if $\alpha^n + \beta^n = V_n$, then
(a) $V_{n+1} = aV_n + bV_{n-1}$
(b) $V_{n+1} = aV_n + aV_{n-1}$
(c) $V_{n+1} = aV_n - bV_{n-1}$
(d) $V_{n+1} = aV_{n-1} - bV_n$

96. The sum of the series
$$\sum_{r=0}^{n}(-1)^r\, {}^nC_r\left(\frac{1}{2^r}+\frac{3^r}{2^{2r}}+\frac{7^r}{2^{3r}}+\frac{15^r}{2^{4r}}+...m \text{ terms}\right) \text{is}$$
(a) $\frac{2^{mn}-1}{2^{mn}(2^n-1)}$ (b) $\frac{2^{mn}-1}{2^n-1}$
(c) $\frac{2^{mn}+1}{2^n+1}$ (d) None of these

97. The angle of intersection of the circles $x^2 + y^2 - x + y - 8 = 0$ and $x^2 + y^2 + 2x + 2y - 11 = 0$ is
(a) $\tan^{-1}\left(\frac{19}{9}\right)$ (b) $\tan^{-1}(19)$
(c) $\tan^{-1}\left(\frac{9}{19}\right)$ (d) $\tan^{-1}(9)$

98. The vector $\mathbf{b} = 3\mathbf{j} + 4\mathbf{k}$ is to be written as the sum of a vector $\mathbf{b_1}$ parallel to $\mathbf{a} = \mathbf{i} + \mathbf{j}$ and a vector $\mathbf{b_2}$ perpendicular to $\mathbf{a}$. Then $\mathbf{b}_1$ is equal to
(a) $\frac{3}{2}(\mathbf{i}+\mathbf{j})$ (b) $\frac{2}{3}(\mathbf{i}+\mathbf{j})$
(c) $\frac{1}{2}(\mathbf{i}+\mathbf{j})$ (d) $\frac{1}{3}(\mathbf{i}+\mathbf{j})$

99. If the points (x_1, y_1), (x_2, y_2) and (x_3, y_3) are collinear, then the rank of the matrix

$$\begin{bmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{bmatrix}$$ will always be less than

(a) 3 (b) 2
(c) 1 (d) None of these

100. The value of the determinant

$$\begin{vmatrix} 1 & \cos(\alpha-\beta) & \cos\alpha \\ \cos(\alpha-\beta) & 1 & \cos\beta \\ \cos\alpha & \cos\beta & 1 \end{vmatrix}$$ is

(a) $\alpha^2+\beta^2$ (b) $\alpha^2-\beta^2$
(c) 1 (d) 0

101. The number of integral values of K, for which the equation $7\cos x + 5\sin x = 2K + 1$ has a solution, is

(a) 4 (b) 8
(c) 10 (d) 12

102. The line joining two points $A(2,0)$, $B(3,1)$ is rotated about A in anti-clockwise direction through an angle of 15°. The equation of the line in the now position,is

(a) $\sqrt{3}x-y-2\sqrt{3}=0$

(b) $x-3\sqrt{y}-2=0$

(c) $\sqrt{3}x+y-2\sqrt{3}=0$

(d) $x+\sqrt{3}y-2=0$

103. The line $2x+\sqrt{6}y=2$ is a tangent to the curve $x^2-2y^2=4$. The point of contact is

(a) $(4,-\sqrt{6})$ (b) $(7,-2\sqrt{6})$

(c) $(2,3)$ (d) $(\sqrt{6},1)$

104. The number of integral points (integral point means both the coordinates should be integer) exactly in the interior of the triangle with vertices (0, 0), (0, 21) and (21, 0) is

(a) 133 (b) 190
(c) 233 (d) 105

105. $\int (1+x-x^{-1})\, e^{x+x^{-1}}\, dx$ is equal to

(a) $(x+1)e^{x+x^{-1}}+C$

(b) $(x-1)e^{x+x^{-1}}+C$

(c) $xe^{x+x^{-1}}+C$

(d) $xe^{x+x^{-1}}x+C$

106. If $f(x)=x-[x]$, for every real number x, where $[x]$ is the integral part of x. Then, $\int_{-1}^{1} f(x)\, dx$ is equal to

(a) 1 (b) 2

(c) 0 (d) $\frac{1}{2}$

107. The value of the integral

$$\int_{-1/2}^{1/2}\left[\left(\frac{x+1}{x-1}\right)^2+\left(\frac{x-1}{x+1}\right)^2-2\right]^{1/2} dx$$ is

(a) $\log\left(\frac{4}{3}\right)$ (b) $4\log\left(\frac{3}{4}\right)$

(c) $4\log\left(\frac{4}{3}\right)$ (d) $\log\left(\frac{3}{4}\right)$

108. If a tangent having slope of $-\frac{4}{3}$ to the ellipse $\frac{x^2}{18}+\frac{y^2}{32}=1$ intersects the major and minor axes in points A and B respectively, then the area of ΔOAB is equal to (O is the centre of the ellipse)

(a) 12 sq units (b) 48 sq units
(c) 64 sq units (d) 24 sq units

109. The locus of mid points of tangents intercepted between the axes of ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ will be

(a) $\frac{a^2}{x^2}+\frac{b^2}{y^2}=1$ (b) $\frac{a^2}{x^2}+\frac{b^2}{y^2}=2$

(c) $\frac{a^2}{x^2}+\frac{b^2}{y^2}=3$ (d) $\frac{a^2}{x^2}+\frac{b^2}{y^2}=4$

110. If PQ is a double ordinate of hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$. Such that OPQ is an equilateral triangle, O being the centre of the hyperbola, then the eccentricity 'e' of the hyperbola satisfies

(a) $1 < e < \frac{2}{\sqrt{3}}$ (b) $e = \frac{2}{\sqrt{3}}$

(c) $e = \frac{\sqrt{3}}{2}$ (d) $e > \frac{2}{\sqrt{3}}$

111. The sides *AB, BC* and *CA* of a ΔABC have respectively 3, 4 and 5 points lying on them. The number of triangles that can be constructed using these points as vertices is

(a) 205 (b) 220

(c) 210 (d) None of these

112. In the expansion of $\frac{a+bx}{e^x}$, the coefficient of x^r is

(a) $\frac{a-b}{r!}$ (b) $\frac{a-br}{r!}$

(c) $(-1)^r \frac{a-br}{r!}$ (d) None of these

113. If $n = (1999)!$, then $\sum_{x=1}^{1999} \log_n x$ is equal to

(a) 1 (b) 0

(c) $\sqrt[1999]{1999}$ (d) –1

114. *P* is a fixed point (*a, a, a*) on a line through the origin equally inclined to the axes, then any plane through *P* perpendicular to *OP*, makes intercepts on the axes, the sum of whose reciprocals is equal to

(a) a (b) $\frac{3}{2a}$

(c) $\frac{3a}{2}$ (d) None of these

115. For which of the following values of m, the area of the region bounded by the curve $y = x - x^2$ and the line $y = mx$ equals $\frac{9}{2}$

(a) -4 (b) -2

(c) 2 (d) 4

116. If $f : R \to R$ be such that $f(1) = 3$ and $f'(1) = 6$. Then, $\lim_{x \to 0} \left\{ \frac{f(1+x)}{f(1)} \right\}^{1/x}$ equals to

(a) 1 (b) $e^{1/2}$

(c) e^2 (d) e^3

117. If $f(x) = \begin{cases} (1+|\sin x|)^{a/|\sin x|} & , -\frac{\pi}{6} < x < 0 \\ b & , x = 0 \\ e^{\tan 2x / \tan 3x} & , 0 < x < -\frac{\pi}{6} \end{cases}$, then the value of *a* and *b*, if f is continuous at $x = 0$, are respectively.

(a) $\frac{2}{3}, \frac{3}{2}$ (b) $\frac{2}{3}, e^{2/3}$

(c) $\frac{3}{2}, e^{3/2}$ (d) None of these

118. The domain of the function

$f(x) = \frac{1}{\log_{10}(1-x)} + \sqrt{x+2}$ is

(a) $]-3, -2.5[\cap]-2.5, -2[$

(b) $[-2, 0[\cup]0, 1[$

(c) $]0, 1[$

(d) None of the above

119. The solution of the differential equation $(1+y^2) + (x - e^{\tan^{-1} y})\frac{dy}{dx} = 0$, is

(a) $(x-2) = Ke^{\tan^{-1} y}$

(b) $2xe^{\tan^{-1} y} = e^2 \tan^{-1} y + K$

(c) $xe^{\tan^{-1} y} = \tan^{-1} y + K$

(d) $xe^{2\tan^{-1} y} = e^{\tan^{-1} y} + K$

120. If the gradient of the tangent at any point *(x, y)* of a curve which passes through the point $\left(1, \frac{\pi}{4}\right)$ is $\left\{ \frac{y}{x} - \sin^2 \left(\frac{y}{x} \right) \right\}$, then equation of the curve is

(a) $y = \cot^{-1}(\log_e x)$

(b) $y = \cot^{-1}\left(\log_e \frac{x}{e}\right)$

(c) $y = x \cot^{-1}(\log_e ex)$

(d) $y = \cot^{-1}\left(\log_e \frac{e}{x}\right)$