Brilliant
STUDY CENTRE
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27-03-2026 | Batch : ENGG.2026 | VERSION E1

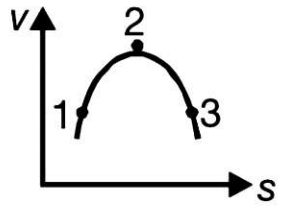
CEE KERALA ENGG. MODEL EXAM - ALL UNITS

PHYSICS + CHEMISTRY + MATHEMATICS

TEST ID 411

PHYSICS

1. The velocity displacement curve for an object moving along a straight line is shown in the given figure. At which of the marked point, the object is speeding up?



A) 1 B) 2 C) 1 and 3 D) 1, 2 and 3 E) 2 and 3

2. There is a hole in the bottom of tank having water. If total pressure at bottom is 5 atm (1atm=10^5N/m^2), then the velocity of water flowing from hole is

A) $\sqrt{400}$m/s B) $\sqrt{600}$m/s C) $\sqrt{60}$m/s D) $\sqrt{40}$ m/s E) None of these

3. Velocity of sound waves in air is 350 m/s. For particular sound in air, a path difference of 40cm is equivalent to a phase difference of 1.6π. The frequency of the wave is

A) 165 Hz B) 700 Hz C) 660 Hz D) 330 Hz E) 220 Hz

4. The time period of a mass suspended from a spring is T. If the spring is cut into four equal parts and the same mass is suspended from one of the parts, then the new time period will be

A) 2T B) $\frac{T}{4}$ C) 2 D) $\frac{T}{3}$ E) $\frac{T}{2}$

5. A parallel plate capacitor is charged to a certain voltage. Now, if the dielectric material (with dielectric constant k) is removed, without disconnecting battery

A) capacitance increases by a factor of k B) electric field reduces by a factor k

C) voltage across the capacitor decreases by a factor k D) energy stored decreases by factor k

E) No changes

6. The length of a given cylindrical wire is increased by 100% without changing volume. Then the change in the resistance of the wire will be

A) 20% B) 100% C) 400% D) 300% E) 50%

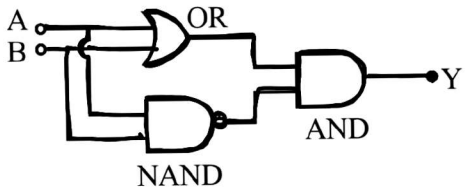
7. The amplitude of the electric field if the intensity of a plane electro- magnetic wave is given as 2.0 Wm^{-2} is

A) 38.8 NC^{-1} B) 48.3 NC^{-1} C) 50.2 NC^{-1} D) 68.8 NC^{-1} E) 24.2 NC^{-1}

8. If the momentum of electron is changed by P, then the de Broglie wavelength associated with it changes by 0.5%. The initial momentum of electron will be

A) 50P B) 400P C) $\frac{P}{200}$ D) 100P E) 200P

9. The following configuration of gate is equivalent to



A) NAND gate B) XOR gate C) OR gate D) NOR gate E) AND gate

10. A proton accelerated through a potential difference of 100V, has de-Broglie wavelength λ_0 . The de- Broglie wavelength of an α-particle, accelerated through 800V is

A) $\frac{\lambda_0}{\sqrt{2}}$ B) $\frac{\lambda_0}{2}$ C) $\frac{\lambda_0}{4}$ D) $\frac{\lambda_0}{8}$ E) λ_0

11. The radius of the earth is reduced by 4%. The mass of the earth remains unchanged. What will be the change in escape velocity?

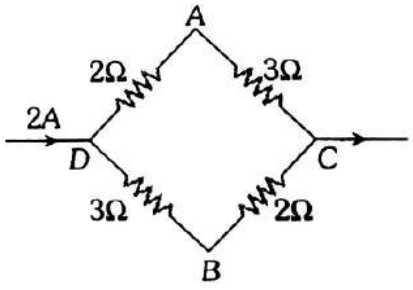
A) Increased by 2% B) Decreased by 4% C) Increased by 6%

D) Decreased by 8% E) Decreased by 5%

12. An organ pipe P_1, closed at one end vibrating in 1st harmonic and another pipe P_2, open at both ends vibrating in its third harmonic, are in resonance with a given tuning fork. The ratio of the lengths of P_1 and $P_2$is

A) $\frac{8}{3}$ B) $\frac{1}{6}$ C) $\frac{1}{2}$ D) $\frac{1}{3}$ E) $\frac{1}{4}$

13. A current of 2A flows in a system of conductors as shown. The potential difference ($V_A - V_B$) will be



A) +2V B) +1V C) –1 V D) –2V E) +3V

14. A perfect gas goes from state A to state B by absorbing 8×10^5 J of heat and doing 6.5×10^5J of external work. It is now transferred between the same two states in another process in which it absorbs 10^5J of heat. In the second process

A) work done on gas is 10^5J B) work done on gas is 0.5×10^5J

C) work done by gas is 10^5J D) work done by gas 0.5×10^5J

E) work done by gas is 10^6J

15. Which of the following sets have different dimensions?

A) pressure, Young's modulus, stress

B) Emf, potential difference, Electric potential

C) Heat, work done, Energy

D) Dipole moment, Electric Flux, Electric field

E) Angularmomentum, plank's constant

16. If a vector $\left(2\hat{i}+3\hat{j}+8\hat{k}\right)$ is perpendicular to the vector $-4\hat{i}+4\hat{j}+\alpha\hat{k}$, then the value of α is

A) -1 B) $\frac{1}{2}$ C) $\frac{-1}{2}$ D) 1 E) 2

17. A large number of bullets are fired in all the direction with the same speed v. The maximum area on the ground on which these bullets will spread is

A) $\frac{\pi v^2}{g}$ B) $\frac{\pi v^4}{g^2}$ C) $\frac{\pi^2 v^4}{g^2}$

D) $\frac{\pi^2 v^2}{g^2}$ E) $\frac{v^2}{g}$

18. The kinetic energy acquired by a body of mass m in travelling a certain distance starting from rest under a constant force is

A) directly proportional to m B) directly proportional to $\sqrt{m}$

C) inversely proportional to $\sqrt{m}$ D) independent of m

E) directly proportional to m^2

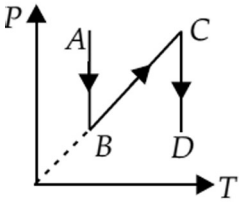
19. A long spring is stretched by 2 cm, its potential energy is u. If the spring is stretched by 10 cm, the potential energy stored in it will be

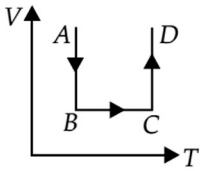
A) $\frac{u}{25}$ B) $\frac{u}{5}$ C) 5 u D) 25 u E) 4 u

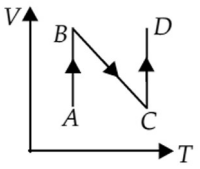
20. A force $\vec{F}=a\hat{i}+3\hat{j}+6\hat{k}$ is acting at a point $\vec{r}=2\hat{i}-6\hat{j}-12\hat{k}$. The value of a for which angular momentum about origin is conserved is

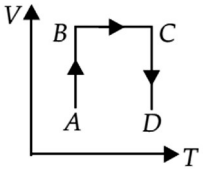
A) 0 B) 1 C) -1 D) 2 E) -2

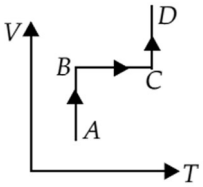
21. Select the corresponding V-T diagram for the P.T diagram shown in figure

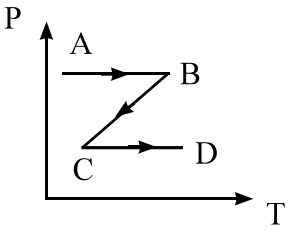


A) 

B) 

C) 

D) 

E) 

22. At ordinary temperature, the molecules of an ideal gas have only translational and rotational kinetic energies. At high temperature they may also have vibrational energy. As a result of this at high temperature (C_V= molar heat capacity at constant volume)

A) $C_v=\frac{3}{2}R$ for a monatomic gas B) $C_v>\frac{3}{2}R$ for a monatomic gas

C) $C_v<\frac{5}{2}R$ for a diatomic gas D) $C_v>\frac{5}{2}R$ for a diatomic gas

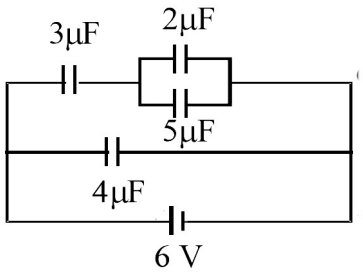
E) both a and d are correct

23. A point charge q is placed inside a conducting spherical shell of inner radius 2R and outer radius 3R at a distance R from the centre of the shell. The electric potential at the centre of the shell will be

A) $\frac{q}{3\pi\varepsilon_0 R}$ B) $\frac{q}{8\pi\varepsilon_0 R}$ C) $\frac{q}{6\pi\varepsilon_0 R}$

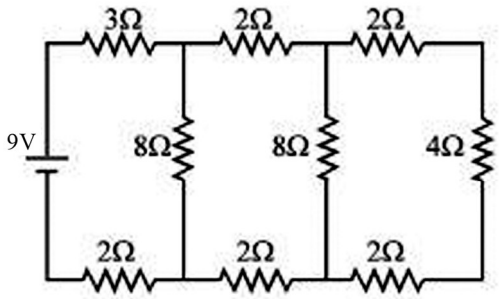
D) $\frac{5q}{24\pi\varepsilon_0 R}$ E) $\frac{6q}{\pi\varepsilon_0 R}$

24. In the circuit given below, the charge in μc, on the capacitor having capacitance 5μF is



A) 4.5 B) 9 C) 7 D) 7.5 E) 10

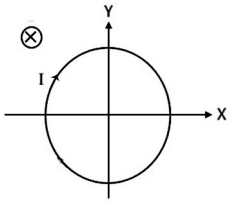
25. In the circuit shown in figure, the current through



A) the 3 Ω resistor is 0.5 A B) the 3 Ω resistor is 0.25A C) the 4 Ω resistor is 2.5 A

D) the 4 Ω resistor is 0.25 A E) the 4 Ω resistor is 1 A

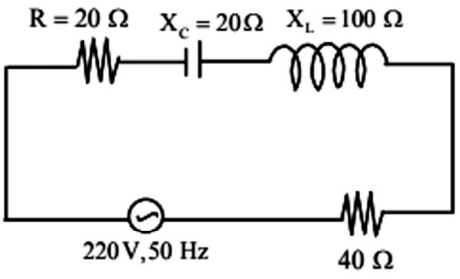
26. A conducting loop carrying a current I is placed in a uniform magnetic field pointing in to the plane of the paper as shown the loop will have a tendency to



A) contract B) expand C) move towards + ve x axis

D) move toward -ve x axis E) move towards +z axis

27. The power factor of the circuit shown in figure is

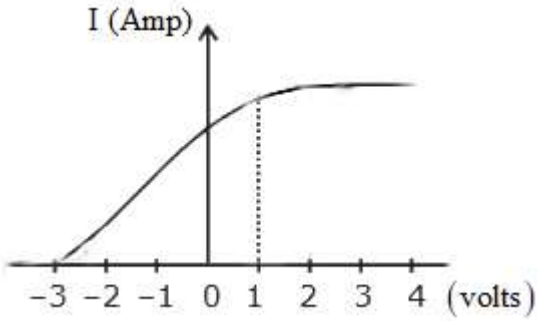


A) 0.2 B) 0.4 C) 0.3 D) 0.6 E) 0.8

28. A parallel beam of light incident on a concave lens of focal length 10 cm emerges as a parallel beam from a convex lens placed coaxially the distance between the lenses being 10 cm. The focal length of the convex lens in cm is

A) 5 cm B) 10 cm C) 20 cm D) 30 cm E) 40 cm

29. Figure represents the graph of photo current i versus applied voltage (v). The maximum energy of the emitted photo electron is

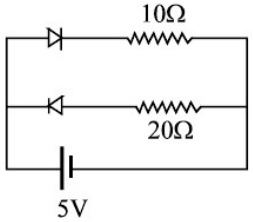


A) 1 eV B) 4 eV C) 3eV D) 0 eV E) 3J

30. The largest wavelength in the ultraviolet region of the hydrogen spectrum is 122nm. The smallest wavelength in the infrared region of the hydrogen spectrum (to the nearest integer) is

A) 800 nm B) 802 nm C) 1882 nm D) 823 nm E) 1648 nm

31. Two ideal diodes are connected to a battery as shown in the circuit. The current supplied by the battery is



A) 0.75 A B) Zero C) 0.25 A D) 0.5 A E) 1 A

32. A car of mass 1000 kg negotiates a banked curve of radius 90 m on a frictionless road. If the banking angle is 45^0 the speed of the car is (g = 10 ms^{-2})

A) 20 ms^{-1} B) 30 ms^{-1} C)5ms^{-1} D) 10ms^{-1} E) 15 ms^{-1}

33. A particle has initial velocity $(2\vec{i}+3\vec{j})$ and acceleration $(0.3\hat{i}+0.2\,\hat{j})$. The magnitude of velocity after 10 seconds will be

A) $9\sqrt{2}$units B) $5\sqrt{2}$ units C) 5 units D) 9 units E) 2 units

34. Young's double slit experiment is performed with light of wavelength 550nm. The separation between the slits is 1.10 mm and the screen is placed at a distance of 1m. What is the distance between the consecutive bright and dark fringes?

A) 0.25 mm B) 0.5 mm C) 1.5 mm D) 2mm E) 2.5mm

35. The work (W) in stretching a spring through a distance x is given by $W = \frac{1}{2}kx^2$. The dimensions of physical quantity K are

A) $[ML^0T^{-2}]$ B) $[M^0LT^{-1}]$ C) $[MLT^{-2}]$ D) $[ML^0T^{-1}]$ E) $[ML^2T^{-2}]$

36. Three capacitors each of capacitance C and of breakdown voltage V are joined in series. the capacitance and breakdown voltage of the combination will be

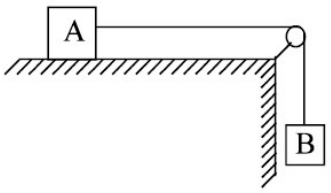
A) 3C, 3V B) $\frac{C}{3}, \frac{V}{3}$ C) $\frac{C}{3}, V$ D) $\frac{C}{3}, 3V$ E) $\frac{V}{3}, 3C$

37. A force of 98 N is required to pull a body of mass 100 kg over ice. The coefficient of friction is

A) 0.1 B) 0.98 C) 0.8

D) 0.7 E) Cannot be determined

38. Two blocks A and B are arranged as shown in fig. The pulley is frictionless. The mass of A is 10 kg. The coefficient of friction of A with the horizontal surface is 0.2 . The minimum mass of B to start the motion will be



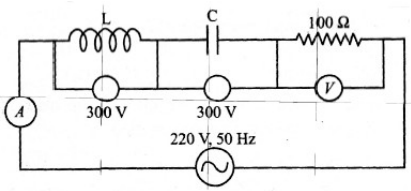
A) 5kg B) 2kg C) 0.2 kg D) 10 kg E)12 kg

39. Angle of deviation δ by a prism (refractive index = μ and supposing the angle of prism A to be small) can be given by

A) $\delta = (\mu - 1)A$ B) $\delta = (\mu + 1)A$ C) $\delta = \frac{(\mu + 1)A}{(\mu - 1)}$

D) $\delta = \frac{(\mu - 1)A}{(\mu + 1)}$ E) none of these

40. In the circuit shown in figure, what will be the reading of voltmeter and ammeter?



A) 800 V, 2A B) 220V, 2.2A C) 300 V, 2A

D) 100 V, 2A E) 350 V, 1A

41. A long solenoid has 200 turns per cm and carries a current i. The magnetic field at its centre is 6.28×10^{-2} weber/m^2. Another long solenoid has 100 turns per cm and it carries a current i/3. The value of the magnetic field at its centre is

A) 1.05×10^{-4} wb/m^2 B) 1.05×10^{-2} wb/m^2 C) 1.05×10^{-4} wb/m^2

D) 1.05×10^{-3}wb/m^2 E) 1.05×10^{-6} wb/m^2

42. A pin is placed 10cm infront of a convex lens of focal length 20 cm and refractive index 1.5 . The surface of the lens farther away from the pin is silvered and has a radius of curvature of 22cm. How far from the lens is the final image formed?

A) -10 cm B) -11 cm C) -12 cm D) -13 cm E) -5 cm

43. A prism is made up of material of refractive index $\sqrt{3}$. The angle of prism is A. If the angle of minimum deviation is equal to the angle of the prism, then the value of (A) is

A) 30^0 C B) 45^0C C) 60^0 D) 75^0 E) 80^0

44. If error in measurement of radius of sphere is \(1 \%\). What will be the error in the measurement of volume?

A) 1% B) 1 / 3 C) 3 % D) 10 % E) 7 %

45. Two slits in Young's double slit experiment have widths in the ratio 1: 25. The ratio of intensity at maxima and minima in the interference pattern is

A) 4: 9 B) 9: 4 C) 3: 2 D) 2: 3 E) 1: 1

CHEMISTRY

46. At a particular temperature, the vapour pressures of two liquids A and B are respectively 120 and 180 mm of mercury. If 2 moles of A and 3 moles of B are mixed to form an ideal solution, the vapour pressure of the solution at the same temperature will be (in mm of mercury)

A) 145 B) 150 C) 165 D) 108 E) 156

47. A current of 9.65 A is drawn from a Daniel cell for exactly 1 hour. The loss in mass of anode and gain in the mass of cathode will be (Given molar mass of Cu = 63.5 and Zn = 65.4 g mol^{-1})

A) 11.77 g, 11.43 g B) 11.43 g, 11.77 g

C) 23.54 g, 22.86 g D) 22.86 g, 23.54 g E) 11.43 g, 22.86 g

48. The basic character of hydrides of the 15th group elements decreases in the order

A) $SbH_3 > PH_3 > AsH_3 > NH_3$ B) $NH_3 > SbH_3 > PH_3 > AsH_3$

C) $NH_3 > PH_3 > AsH_3 > SbH_3$ D) $SbH_3 > AsH_3 > PH_3 > NH_3$

E) $PH_3 > SbH_3 > AsH_3 > NH_3$

49. Which transition in the hydrogen atomic spectrum will have the same wavelength as the balmer transition (ie, n = 4 to n = 2) of He^+ spectrum?

A) n = 4 to n = 3 B) n = 3 to n = 2

C) n = 4 to n = 2 D) n = 2 to n = 1 E) n = 3 to n = 1

50. A mixture of 0.3 mole of H_2 and 0.3 mole of I_2 is allowed to react in a 10 L evacuated flask at 500^0C. Equilibrium constant for the reaction $H_2 + I_2 \rightleftharpoons 2HI$ is found to be 64. The amount of unreacted I_2 at equilibrium is

A) 0.15 mole B) 0.06 mole C) 0.03 mole D) 0.2 mole E) 0.6 mole

51. Solubility of AgCl in 0.001 M NaCl, if solubility product of AgCl is 10^{-10} is

A) 10^{-5}M B) 10^{-7}M C) 10^{-8}M D) 10^{-10}M E) 10^{-14}M

52. The enthalpy of combustion of C_6H_6 is – 3250 kJ. When 0.39 g of C_6H_6 is burnt in excess of oxygen in an open vessel, the amount of heat evolved?

A) 8.32 kJ B) 12.36 kJ C) 16.25 kJ D) 20.74 kJ E) 10.5 kJ

53. Naphthalene has some sand impurity. It can be purified by as

A) Sublimation B) Steam distillation

C) TLC D) Column chromatography

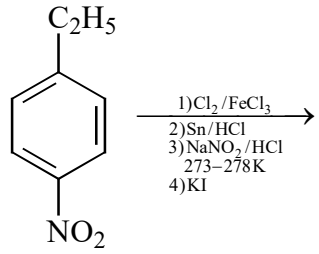
E) Fractional distillation

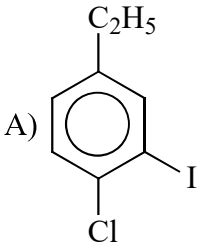
54. Trans-alkenes are formed by the reduction of alkynes with

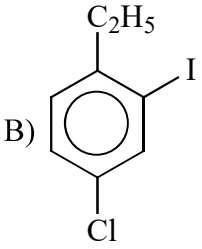
A) H_2–Pd/C $BaSO_4$ B) $NaBH_4$

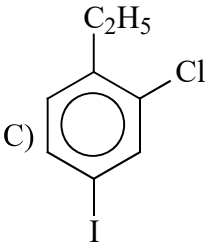
C) Na/liq.NH_3 D) Sn-C E) $LiAlH_4$

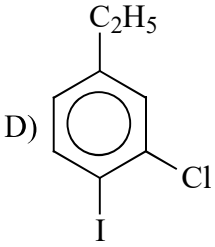
55. The major product 'X' formed in the following reaction sequence is

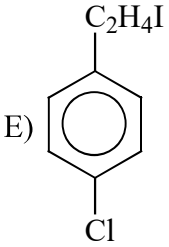


A) 

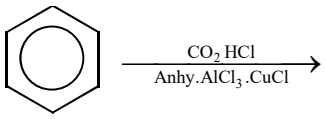
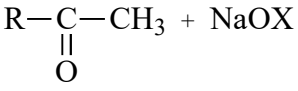
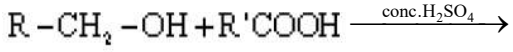
B) 

C) 

D) 

E) 

56. Match List I with List II

List I	List II
A) 	1) Hell-Volhard Zelinsky reaction
B) 	2) Gattermann-Koch reaction
C) 	3) Haloform reaction
D) 	4) Esterification

A) A-4, B-1, C-2, D-3

B) A-3, B-2, C-1, D-4

C) A-1, B-4, C-3, D-2

D) A-2, B-3, C-4, D-1

E) A-4, B-2, C-1, D-3

57. Which among the following is true?

A) Amylopectin have 1 → 4 α- linkage and 1 → 6 α-linkage

B) Amylose have 1 → 4 α-linkage and 1 →6 β linkage

C) Amylopectin have 1 →4 α linkage and 1 →6 β linkage

D) Amylose have 1 → 4 β linkage and 1 →6 α linkage

E) Amylose is made up of glucose and galactose

58. Identify incorrect statement about PCl_5

A) PCl_5 possess two different Cl – P – Cl bond angles

B) All five P – Cl bonds are identical in length

C) PCl_5 exhibit sp^3d hybridisation

D) PCl_5 consist of five P – Cl sigma bonds

E) All are incorrect

59. Geometry of $[NiCl_4]^{2-}$ and $[Ni(CN)_4]^{2-}$ ions are

A) Both tetrahedral

B) Both square planar

C) Both octahedral

D) Square planar and tetrahedral respectively

E) Tetrahedral and square planar respectively

60. In which one of the following reactions entropy decreases?

A) Sodium chloride is dissolved in water

B) Water is heated from 303 K to 353 K

C) Sodium bicarbonate is decomposed to $Na_2CO_{3(s)}$, $CO_{2(g)}$ and $H_2O_{(g)}$

D) Water crystallizes into ice

E) Dihydrogen molecule is decomposed into hydrogen atoms

61. $KMnO_4$ reacts with oxalic acid, according to the equation,

$$2MnO_4^- + 5C_2O_4^{2-} + 16H^+ \rightarrow 2Mn^{2+} + 10CO_2 + 8H_2O$$

20 mL of 0.1M $KMnO_4$ is equivalent to --------- oxalic acid.

A) 120 mL of 0.25 M B) 150 mL of 0.1 M

C) 50 mL of 0.1 M D) 50 mL of 0.2 M

E) 150 mL of 0.5 M

62. If $t_{1/2}$ = 4 min then the time after which the reaction is 99.9% completed is

A) 16min B) 8min C) 32 min

D) 40 min E) 80 min

63. One mole of an organic compound A with the formula C_3H_8O reacts completely with two mole, of HI to form X and Y. When Y is boiled with aqueous alkali it forms Z. Z gives the iodoform test. The compound A is

A) Propan-2-ol B) Propan-1-ol

C) Ethoxyethane D) Methoxyethane E) Propan-3-o1

64. Tertiary amines have lowest boiling points amongst isomeric amine because

A) They have highest molecular mass

B) They donot form hydrogen bonds

C) They are more polar in nature

D) They are most basic in nature

E) Both A and B

65. $CH_3 - CHO + H_2N - NH_2 \xrightarrow[\text{Diethyleneglycol}]{\text{KOH}} X$; X is

A) $CH_3 - CH_2 - OH$ B) $CH_3 - OH$

C) $CH_3 - CH_3$ D) $CH_3 - CO - NH_2$ E) $CH_3 - CH_2 - NH_2$

66. The observation that the ground state of nitrogen atom has 3 unpaired electrons in it's electronic configuration and not otherwise is associated with

A) Pauli's exclusion principle B) Hund's rule

C) Heisenberg's uncertainty principle D) Ritz combination principle

E) Valence bond method

67. Which one of the following arrangements doesn't give the correct picture of the trends indicated against it?

A) HF > HI > HBr > HCl : Boiling point/K

B) S > Se > Te > Po > O : Negative Electron gain enthalpy (kJ/mol)

C) $VO_2^+ < Cr_2O_7^{2-} < MnO_4^-$: Oxidising power

D) $Y^{3+} > Lu^{3+} > Eu^{3+} > La^{3+}$: Ionic radii

E) Cl > Br > F > I : Bond enthalpy

68. Which among the following is not a reducing sugar?

A) Glucose B) Sucrose C) Fructose D) Maltose E) Lactose

69. For the detection of halogen, Lassaigne's extract is treated with $AgNO_3$. But before the treatment with $AgNO_3$, Lassaigne's extract is boiled with Dil. HNO_3 to remove

I) NaCN II) NaCl III) NaI IV) Na_2S

A) II and III B) I and II C) III and IV D) I and IV E) Only I

70. The vapour pressure of a solvent A is 0.80 atm. When a non - volatile substance B is added to this solvent its vapour pressure drops to 0.60 atm. The mole fraction of B in the solution is :

A) 0.50 B) 0.25 C) 0.90 D) 0.75 E) 1

71. When Phenol is heated with $CHCl_3$ and alcoholic KOH then salicyladehyde is produced. The reaction is known as

A) Rosenmund's reaction B) Reimer - Tiemann reaction

C) Friedel - craft reaction D) Sommelet Reaction E) Mannich Reaction

72. The conductivity of 0.01 mol/dm^3 aqueous acetic acid at 300K is $19.5\times10^{-5}\Omega^{-1}cm^{-1}$ and the limiting molar conductivity of acetic acid at the same temperature is $390\Omega^{-1}cm^2mol^{-1}$. The degree of dissociation of acetic acid is:

A) 0.5 B) 0.05 C) 1×10^{-2} D) 3×10^{-2} E) 2×10^{-2}

73. The correct order of acid strength of following acids, O_2N-CH_2-COOH (I) FCH_2-COOH (II) Cl-CH_2COOH (III), CH_3-COOH (IV) is :

A) (I) > (II) > (III) > (IV) B) (III) > (II) > (I) > (IV)

C) (II) > (III) > (I) > (IV) D) (IV) > (III) > (II) > (I)

E) (IV) > (I) > (II) > (III)

74. The paramagnetism of O_2^+ is due to the presence of an odd electron in the MO.

A) $\sigma^* 2s$ B) $\pi 2p_y^1$ C) $\pi\, 2p_z$ D) $\sigma^* 2p_x$ E) $\pi^* 2p_y$

75. Gattermann-Koch reaction is

A) Benzene $\xrightarrow[AlCl_3/230^0C]{CH_3Cl}$ Toluene

B) Toluene $\xrightarrow{CrO_2Cl_2}$ Benzaldehyde

C) Benzaldehyde $\xrightarrow{NaOH}$ Benzylalcohol + Sodium benzoate

D) Benzene $\xrightarrow[Anhyd..AlCl_3]{CO,HCl}$ Benzaldehyde

E) Benzaldehyde $\xrightarrow[HCl]{Zn-Hg}$ Toluene

MATHEMATICS

76. Let $f: R \to R$ be defined by

$$f(x) = \begin{cases} 2x+3, & \text{when } x < -2 \\ x^2 - 2, & \text{when } -2 \le x \le 3 \\ 3x-1, & \text{when } x > 3 \end{cases}$$

Find f(3)?

A) 2 B) 1 C) -1 D) 0 E) 7

77. If $*$ be the binary operation on the set Z of all integers defined by $a * b = (a + 3b^2)$, find $2 * 4$

A) 20 B) 10 C) -10 D) 25 E) 50

78. Find $\tan^{-1}\sqrt{3} - \sec^{-1}(-2)$

A) $\frac{\pi}{2}$ B) π C) $-\frac{\pi}{3}$ D) $-\frac{\pi}{2}$ E) $\frac{\pi}{4}$

79. Find matrix X, if $x + \begin{bmatrix} 4 & 6 \\ -3 & 7 \end{bmatrix} = \begin{bmatrix} 3 & -6 \\ 5 & -8 \end{bmatrix}$

A) $\begin{bmatrix} -1 & -2 \\ 8 & -15 \end{bmatrix}$ B) $\begin{bmatrix} -12 & -1 \\ 8 & -15 \end{bmatrix}$ C) $\begin{bmatrix} -1 & -12 \\ 8 & -15 \end{bmatrix}$

D) $\begin{bmatrix} 1 & 12 \\ 8 & -15 \end{bmatrix}$ E) None of these

80. Find the inverse of a matrix $A=\begin{bmatrix}1 & -2\\ 2 & -6\end{bmatrix}$

A) $A=\begin{bmatrix}3 & -1\\ -1 & -\frac{1}{2}\end{bmatrix}$ B) $A=\begin{bmatrix}3 & -\frac{1}{2}\\ 1 & -1\end{bmatrix}$ C) $\begin{bmatrix}1 & -1\\ 1 & -1\end{bmatrix}$

D) $\begin{bmatrix}3 & -1\\ 1 & -\frac{1}{2}\end{bmatrix}$ E) $\begin{bmatrix}1 & 0\\ -1 & \frac{1}{2}\end{bmatrix}$

81. If $y=\sqrt{e^{\sqrt{x}}}$, find $\frac{dy}{dx}$

A) $\frac{e^{\frac{1}{2}\sqrt{x}}}{4\sqrt{x}}$ B) $e^{\frac{1}{3}\sqrt{x}}$ C) $e^{3x/2}$

D) $\frac{e^{\frac{1}{2}\sqrt{x}}}{2\sqrt{x}}$ E) $\frac{e^{\frac{1}{2}\sqrt{x}}}{\sqrt{x}}$

82. If the sum of the first n natural numbers is $\frac{1}{5}$ of the sum of their squares then n =

A) 7 B) 5 C) 6 D) 8 E) 10

83. Find the shortest distance between the lines

$$\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{4} \;\&\; \frac{x-2}{3}=\frac{y-4}{4}=\frac{z-5}{5}$$

A) $\frac{1}{\sqrt{6}}$ B) $\frac{1}{6}$ C) 1 D) 13 E) 5

84. Evaluate $\int\frac{\sin x}{1-4\cos^2 x}dx$

A) $-\frac{1}{2}\log\left|\frac{1+\cot x}{1-\cot x}\right|$ B) $-\frac{1}{3}\log\left|\frac{1+\cot x}{1-\cot x}\right|$

C) $-\frac{1}{4}\log\left|\frac{1+2\cos x}{1-2\cos x}\right|+C$ D) $\frac{-1}{2}\log\left|\frac{1-\cot x}{1+\cot x}\right|+C$ E) None of these

85. Evaluate $\int_0^{\frac{\pi}{2}} \cos^3 x\, dx$

A) $\frac{5}{4}$ B) $\frac{3}{4}$ C) $\frac{2}{3}$ D) $\frac{12}{5}$ E) 5

86. Find the area of the region bounded by the curve $y^2 = 2y - x$ and the y - axis

A) $\frac{4}{5}$ sq. units B) $\frac{3}{4}$ sq. units C) $\frac{4}{3}$ sq. units D) $\frac{2}{\pi}$ sq. units E) $\frac{4}{\pi}$ sq. units

87. An unbiased coin is tossed 8 times. Find, the probability of getting atleast 3 beads

A) $\frac{219}{256}$ B) $\frac{218}{209}$ C) $\frac{209}{201}$ D) $\frac{204}{113}$ E) $\frac{15}{11}$

88. Find the sum of all odd numbers between 1 and 1000 which are divisible by 3.

A) 83666 B) 86366 C) 86333 D) 83606 E) 83667

89. Evaluate $\cos(60^0)\cos(36^0)\cos(42^0)\cos(78^0)$?

A) $\frac{1}{16}$ B) $\frac{1}{10}$ C) $\frac{1}{15}$ D) $\frac{1}{3}$ E) $\frac{1}{11}$

90. Find the value of K so that the function by

$f(x) = \begin{cases} kx+1, & \text{if } x \le \pi \\ \cos x, & \text{if } x > \pi \end{cases}$ is continuous

A) $\frac{-2}{\pi}$ B) $\frac{2}{3}$ C) $\frac{-2}{\sqrt{3}}$ D) $\frac{1}{\pi}$ E) $\frac{2}{\pi}$

91. Find , $\lim_{x\to 2} \frac{3x^2 - x - 10}{x^2 - 4}$

A) $\frac{\pi}{3}$ B) π C) $\frac{12}{7}$ D) $\frac{\sqrt{21}}{7}$ E) $\frac{11}{4}$

92. The number of solutions of the equation $\text{Im}(Z^2) = 0$, $|Z| = 2$ is

A) 1 B) 2 C) 3 D) 4 E) 0

93. The integral part of $\left(\sqrt{2}+1\right)^6$ is

A) 198 B) 197 C) 196 D) 163 E) 188

94. If $\vec{a}\times\left(\vec{b}\times\vec{c}\right)+\vec{b}\times\left(\vec{c}\times\vec{a}\right)+\vec{c}\times\left(\vec{a}\times\vec{b}\right)=0$, then

A) $\vec{a}+\vec{b}+\vec{c}=0$ B) $\vec{a},\vec{b},\vec{c}$ are mutually perpendicular

C) $\vec{a},\vec{b},\vec{c}$ are parallel D) $\vec{a},\vec{b},\vec{c}$ can be any three arbitrary vectors

E) are coplanar vectors

95. Let f(x) = $\frac{4x+3}{x+2}$. Then the values of $f^{-1}(-2)$ is equal to :

A) $\frac{7}{5}$ B) $\frac{-7}{6}$ C) $\frac{-7}{5}$ D) $\frac{7}{6}$ E) $\frac{5}{6}$

96. Maximum value of the function $2x^3-15x^2+36x+4$ is attained at

A) 0 B) 3 C) 4 D) 5 E) 2

97. The general solution of the differential equation $xy'+y=x^2, x>0$ is :

A) $y=\frac{x^2}{2}+Cx$ B) $y=\frac{x^3}{3}+C$ C) $y=\frac{x^2}{3}+C$ D) $y=\frac{x^3}{3}+\frac{C}{x}$ E) $y=\frac{x^2}{3}+\frac{C}{x}$

98. The variance of first 20 natural numbers is :

A) $\frac{399}{2}$ B) $\frac{379}{12}$ C) $\frac{133}{2}$ D) $\frac{133}{4}$ E) $\frac{169}{2}$

99. The real part of the complex number $\frac{1}{1+i}$ is

A) 1 B) 2 C) $\frac{1}{2}$ D) $\frac{-1}{2}$ E) 0

100. Sum of infinite number of a G. P. is 20 and sum of their squares is 100. The common ratio of the G. P. is:

A) 5 B) 3/5 C) 8/5 D) 1/5 E) 2/5

101. Let $A=\{x : x \text{ is a root of } x^2-1=0\}$ and $B=\{x : x \text{ is a root of } x^2-2x+1=0\}$ Then,

A) $A\cap B=A$ B) $A\cup B=\phi$ C) $A\cup B=A$

D) $A\cap B=\phi$ E) $A=\phi$

102. The multiplicative inverse of 7+24i is

A) $\frac{7+24i}{625}$ B) $\frac{7-24i}{625}$ C) $\frac{24i-7}{625}$

D) $\frac{-24i-7}{625}$ E) None of these

103. The centroid of the triangle formed by the points (1, a), (2, b) and (c, -3) lies on the x-axis then

A) a = 3 B) b = 3 C) a+b = 3 D) a-b = 3 E) a+b = -3

104. The point on the line $3x+4y=5$ which is equidistant from (1, 2) and (3, 4) is

A) $(7,-4)$ B) $(15,-10)$ C) $\left(\frac{1}{7},\frac{8}{7}\right)$

D) $\left(0,\frac{5}{4}\right)$ E) $\left(\frac{5}{4},0\right)$

105. The equation of the circle which touches with the co-ordinate axes and passes through the point (1, 2) is

A) $x^2+y^2-10x-10y+1=0$ B) $x^2+y^2-10x-10y+25=0$

C) $x^2+y^2-x-2y+3=0$ D) $x^2-y^2-2x+y=0$

E) None of these

106. If α and β are the roots of the equation $4x^2+2x-1=0$ then $\beta=$

A) $\frac{-1}{4\alpha}$ B) $\frac{-1}{2\alpha}$ C) $\frac{-1}{2}$ D) $\frac{-1}{3\alpha}$ E) $\frac{1}{\alpha}$

107. The number of diagonals of a polygon with 15 sides is

A) 90 B) 45 C) 60 D) 70 E) 10

108. The co-efficient of x^4 in the expanssion of $(1-2x)^5$ is

A) 40 B) 320 C) −320 D) −32 E) 80

109. The reminder when 2^{2000} is divided by 17 is

A) 1 B) 2 C) 8 D) 12 E) 4

110 If $|x-3|<2x+9$ then x lies in the interval

A) $(-\alpha,-2)$ B) $(-2,0)$ C) $(-2,\alpha)$ D) $(2,\alpha)$ E) $(-12,-2)$

111 The value of $\tan 15^\circ+\tan 75^\circ$ is

A) $2\sqrt{3}$ B) 2 C) $2-\sqrt{3}$ D) $4\sqrt{3}$ E) 4

112. The value of $\cos^{-1}\left[\cos\left(\frac{7\pi}{6}\right)\right]$ is

A) $\frac{7\pi}{6}$ B) $\frac{\pi}{6}$ C) $\frac{\pi}{3}$ D) $\frac{2\pi}{3}$ E) $\frac{5\pi}{6}$

113. The distance between the directrics of the hyperbola $x^2 - y^2 = 9$ is

A) $9/\sqrt{2}$ B) $5/\sqrt{3}$ C) $3/\sqrt{2}$ D) $3\sqrt{2}$ E) $5\sqrt{3}$

114. If $|\bar{a}|=2, |\bar{b}|=3$ and $\bar{a}\,\bar{b}=4$ then $|\bar{a}-\bar{b}|$ is

A) $\sqrt{5}$ B) $\sqrt{7}$ C) $\sqrt{6}$ D) 5 E) 6

115. Which of the following points lies on the straight line $\frac{x-1}{2}=\frac{y+1}{4}=\frac{z-2}{-2}$?

A) (2, 6, -2) B) (4, 3, 1) C) (3, 4, -1)

D) (3, 3, 0) E) (6, 2, -1)

116. The probability of getting same numbers when two dices are tossed is

A) $\frac{1}{7}$ B) $\frac{1}{6}$ C) $\frac{1}{8}$ D) $\frac{1}{9}$ E) $\frac{1}{10}$

117. When a die is throws, find the probability of getting a prime number

A) $\frac{1}{2}$ B) $\frac{1}{3}$ C) $\frac{1}{4}$ D) $\frac{1}{5}$ E) $\frac{1}{7}$

118. The value of $\lim_{x\to 3}\frac{x^5-3^5}{x^8-3^8}$ is

A) $\frac{5}{8}$ B) $\frac{5}{64}$ C) $\frac{5}{216}$ D) $\frac{1}{27}$ E) $\frac{1}{63}$

119. If $f(x)=\sqrt{2x}+\frac{4}{\sqrt{2x}}$, then $f'(2)$ is

A) 0 B) -1 C) 1 D) 2 E) -2

120. The minimum value of the function sin x + cos x is

A) $\sqrt{2}$ B) $-\sqrt{2}$ C) $\frac{1}{\sqrt{2}}$ D) $\frac{-1}{\sqrt{2}}$ E) 1

121. $\int_0^{\pi/4} \log(1+\tan x)\,dx$ is

A) $\frac{\pi}{8}\log_e^2$ B) $\frac{\pi}{4}\log_e^2$ C) $\frac{-\pi}{8}\log_e^2$ D) $\frac{-\pi}{4}\log_e^2$ E) $\frac{-\pi}{2}\log_e^2$

122. The solution of the differential equation $\frac{dy}{dx}=\frac{1}{x+y^2}$ is

A) $y=x^2-2x+c$ B) $y=x^2+2x+2+ce^x$

C) $x=-y+xe^x$ D) $x=-y^2-2y-2+ce^y$ E) None of these

123. The maximum value of $P=6x+8y$ subject to constraints $2x+y\le 30, x+2y\le 24$ and $x\ge 0, y\ge 0$ is

A) 90 B) 120 C) 96 D) 240 E) 280

124. The domain of the function $f(x)=\frac{1}{\sqrt{[x]^2-[x]-6}}$ is

A) $(-\infty,-2)\cup[4,\infty)$ B) $(-\infty,-2)$ C) $(-\infty,-2)\cup(4,\infty)$

D) $(-\infty,-2]\cup[4,\infty)$ E) $(-\infty,-2]\cup(4,\infty)$

125. The Period of the function $f(x)=|\sin 4x|+|\cos 4x|$ is

A) $\frac{\pi}{2}$ B) $\frac{\pi}{8}$ C) $\frac{\pi}{4}$ D) $\frac{\pi}{3}$ E) π

126.. If $x=\theta-\frac{1}{\theta}$ and $y=\theta+\frac{1}{\theta}$ then $\frac{dy}{dx}=$:

A) y/x B) x/y C) -x/y D) -y/x E) 1

127. The circles $x^2 + y^2 + x + y = 0$ and $x^2 + y^2 + x - y = 0$ intersect at an angle of :

A) $\pi/6$ B) $\pi/4$ C) $\pi/3$ D) $\pi/2$ E) $\pi/7$

128. The value of f(0) so that the function $f(x) = \frac{1-\cos(1-\cos x)}{x^4}$ is continuous every where is:

A) 1/4 B) 1/2 C) 1/8 D) 1/10 E) 1/9

129. The probability that a non-leap year has 53 Sundays is :

A) 1/7 B) 2/7 C) 3/7 D) 4/7 E) 5/7

130. If $\vec{a} = 2\vec{i} + \vec{j} + \vec{k}$ and $\vec{b} = 4\vec{i} + 7\vec{j} + 3\vec{k}$ then cosine of the angle between $\vec{a}$ and $\vec{b}$ is:

A) $\frac{9}{\sqrt{111}}$ B) $\frac{11}{\sqrt{113}}$ C) $\frac{10}{\sqrt{114}}$ D) $\frac{8}{\sqrt{110}}$ E) $\frac{7}{\sqrt{114}}$

131. Let $\vec{a}$ be the vector of magnitude $\sqrt{75}$ which is perpendicular to both $2\vec{i} - \vec{j} + \vec{k}$ and $3\vec{i} + 2\vec{j} - \vec{k}$. Then $\vec{a}$ is equal to :

A) $-\vec{i} + 5\vec{j} + 7\vec{k}$ B) $7\vec{i} + 5\vec{j} + \vec{k}$ C) $\vec{i} + 5\vec{j} - 7\vec{k}$ D) $-7\vec{i} - 5\vec{j} - \vec{k}$ E) $7\vec{i} - 5\vec{j} + \vec{k}$

132. The foot of the perpendicular from (0, 2, 3) to the line $\frac{x+3}{5} = \frac{y-1}{2} = \frac{z+4}{3}$ is :

A) (-2, 3, 4) B) (2, -1, 3) C) (2, 3, -1) D) (3, 2, -1) E) (1, 2, -3)

133. If the line x–1=0 is the directrix of the parabola $y^2 - kx + 8 = 0$, then one of the values of k is

A) $\frac{1}{6}$ B) 8 C) 4 D) $\frac{1}{4}$ E) 9

134. Length of the major axis of the ellipse $9x^2+7y^2=63$ is

A) 3 B) 9 C) 6 D) $2\sqrt{7}$ E) $\sqrt{7}$

135. If a function f satisfies f(f(x)) = x + 1 for all real values of x and if $f(0) = \frac{1}{2}$, then f(1) is equal to

A) $\frac{1}{2}$ B) 1 C) $\frac{3}{2}$ D) 2 E) 0

136. $\int \frac{dx}{\sqrt{9-4x^2}} =$

A) $\frac{1}{3}\sin^{-1}\frac{2x}{3} + c$ B) $\frac{1}{2}\sin^{-1}\frac{3x}{2} + c$ C) $\frac{1}{2}\sin^{-1}\frac{2x}{3} + c$

D) $\frac{1}{2}\cos^{-1}\frac{2x}{3} + c$ E) $\frac{1}{2}\cos^{-1}\frac{7x}{5} + c$

137. If sinx is an integrating factor of $\frac{dy}{dx}+Py=Q$, then P is

A) log sin x B) cot x C) sin x

D) log cos x E) tan x

138. If $\sin^{-1}x+\sin^{-1}y+\sin^{-1}z=\frac{3\pi}{2}$ then $(x+y+z)^2=$

A) 1 B) 4 C) 3 D) 9 E) 2

139. The quadratic equation whose roots are $\left(\frac{\alpha}{\gamma}\right)^3$ and $\left(\frac{\beta}{\gamma}\right)^3$, where α,β,γ are roots of the equation $x^3-8=0$ is

A) $x^2+x+1=0$ B) $x^2+2x+4=0$ C) $x^2-2x+4=0$

D) $x^2-2x+1=0$ E) $x^2+2x-4=0$

140. $\underset{x\to 0}{Lt}(\cos x+\sin x)^{1/x}$ equals

A) e B) $\frac{1}{e}$ C) 1 D) 0 E) –1

141. The solution of the equation $\frac{dy}{dx}-1=\frac{1}{x-y}$ is

A) $(x-y)^2+2x=c$ B) $(x+y)^2=2x+c$

C) $(x+y)^2+2x=c$ D) $(x-y)^2=2x+c$ E) $(x+y)=3y^2+c$

142. The sum of the first three terms of a G.P is $\frac{39}{10}$ and their product is 1. Then the common ratio is

A) $\frac{1}{2}$ B) $\frac{1}{3}$ C) $\frac{5}{2}$

D) $\frac{2}{5}$ E) $\frac{5}{2}$ or $\frac{2}{5}$

143. For a given distribution of marks mean is 40 and its standard deviation is 20. The coefficient of variation is

A) 20 B) 40 C) 50 D) 200 E) 60

144. $\frac{\sin^2 3A}{\sin^2 A} - \frac{\cos^2 3A}{\cos^2 A} =$

A) cos2A B) $\frac{1}{8}\cos 2A$ C) 8cos2A D) 4 cos2A E) $\frac{1}{2}\cos 2A$

145. $\int_0^2 [2x]$ is equal to

A) 4 B) 2 C) 3 D) 1 E) 5

146. $\int \frac{(x+1)dx}{\sqrt{1+x^2}} =$

A) $\sqrt{1+x^2} + \log\left(x + \sqrt{1+x^2}\right) + c$

B) $\sqrt{1+x^2} + \tan^{-1} x + c$

C) $\sqrt{1+x^2} - \log\left[x + \sqrt{1+x^2}\right] + c$

D) $\sqrt{1+x^2} + \log(\sec x + \tan x) + c$

E) $2\sqrt{1+x^2} + \tan^{-1} x + c$

147. The differential equation whose solution is $ax^2 + by^2 = 1$ where a , and b are arbitrary constants is of

A) First order second degree B) First order first degree

C) Second order first degree D) Second order second degree

E) Second order third degree

148. If α and β are the roots of $ax^2 + bx + c = 0$ then the equation whose roots are $\frac{1}{\alpha+\beta}$ and $\frac{1}{\alpha} + \frac{1}{\beta}$ is

A) $bcx^2 + (ac + b^2)x + ab = 0$

B) $acx^2 + (a^2 + bc)x + bc = 0$

C) $abx^2 + (c^2 + ab)x + ca = 0$

D) $acx^2 + (a^2 + bc)x - bc = 0$

E) $acx^2 - (a^2 + bc)x - bc = 0$

149. If $\begin{vmatrix} 1+a & 1 & 1 \\ 1+b & 1+2b & 1 \\ 1+c & 1+c & 1+3c \end{vmatrix} = 0$ where a, b, c $\neq 0$ then $a^{-1}+b^{-1}+c^{-1} =$

A) 4 B) –3 C) –2 D) –1 E) –4

150. If $\cos\left(2\sin^{-1}x\right) = \frac{1}{9}$ then x =

A) $\frac{2}{3}$ B) $\pm\frac{2}{3}$ C) $-\frac{2}{3}$ D) $\pm\frac{1}{3}$ E) $\pm\frac{1}{9}$

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CEE KERALA ENGG. MODEL EXAM - ALL UNITS

PHYSICS + CHEMISTRY + MATHEMATICS

TEST ID 411

PHYSICS

1. A

2. E Applying Bernoulli's theorem

$P = P_0 + \frac{1}{2}\rho V^2$

$5\times10^5 = 10^5 + \frac{1}{2}\times10^3 . V^2$

$4\times10^5 = \frac{1}{2}\times10^3 \times V^2$

$8\times10^2 = V^2$

$V = \sqrt{800}$

3. B $\Delta\phi = \frac{2\pi}{\lambda}\cdot\Delta x$

$1.6\pi = \frac{2\pi}{\lambda}\times 40\,cm$

$\lambda = \frac{2\pi}{1.6\pi}\times40 = \frac{20}{16}\times40$

$= 50\,cm$

$\nu = \frac{v}{\lambda} = \frac{350\ ms^{-1}}{0.5m} = 700\ Hz$

4. E

$T = 2\pi\sqrt{\frac{M}{K}}$

$T' = 2\pi\sqrt{\frac{M}{K1}} = 2\pi\sqrt{\frac{M}{4K}} = \frac{T}{2}$

5. D

6. D $R = \frac{\rho\cdot L}{A}$

$R' = \frac{\rho\cdot(L\times2)}{(A/2)} = 4\cdot\frac{\rho L}{A} = 4R$

7. A $\frac{1}{2}\varepsilon_0 E_0^2 . c = 2$

$E_0^2 = \frac{2\times Q}{\varepsilon_0 . c} = \frac{4}{26.4\times10^{-4}}$

$E_0^2 = \frac{10^4}{6.6} = \frac{100}{6.6}\times10^2$

$E_0 = 38.8$

8. E

The de-Broglie's wavelength associated with the moving electron $\lambda = \frac{h}{P}$

Now, according to problem

$$\frac{d\lambda}{\lambda} = -\frac{dp}{P}; \qquad \frac{0.5}{100} = \frac{P}{P'} \Rightarrow P' = 200\,P$$

9. B

$Y = (A+B)\cdot(\bar{A}\bar{B})$

$Y = (A+B)\cdot(\bar{A}+\bar{B})$

$Y = A\bar{A} + A\bar{B} + B\bar{A} + B\bar{B}$

$= A\bar{B} + B\bar{A}$

10. D $\lambda_0 = \frac{h}{\sqrt{2meV}}$

$\lambda_\alpha = \frac{h}{\sqrt{2\times4\times m\times2q\times8V}} = \frac{\lambda_0}{8}$ //

11. A

12. B

$$\frac{v}{4\ell_1} = \frac{3v}{2\ell_2}, \qquad \therefore \quad \frac{\ell_1}{\ell_2} = \frac{1}{6}$$

13. B Current through each arm DAC and DBC = 1A

$V_D - V_A = 2$ *and* $V_D - V_B = 3$

$\Rightarrow V_A - V_B = +1V$

14. B

$$dU = dQ - dW = 8\times10^5 - 6.5\times10^5$$
$$= 1.5\times10^5\ \text{J}$$

In the second process, dU remains the same

$$\therefore\ dW = dQ - dU = 10^5 - 1.5\times10^5$$
$$= -0.5\times10^5\ \text{J}$$

15. D

16. C $(2\hat{i}+3\hat{j}+8\hat{k}).(-4\hat{i}+4\hat{j}+\alpha\hat{k})=0$

$-8+12+8\alpha=0$

$4+8\alpha=0$

$\alpha=\frac{-4}{8}=\frac{-1}{2}$

17. B $R_{max}=\frac{v^2}{g}$

$A=\pi R_{max}^2$

$=\pi\frac{v^2}{g}$

18. D Work done by force = gain in K.E

$K.E=FS$

F is contant

$K.E\ \alpha m^a$

19. D $\frac{1}{2}k(2)^2=u$

$k=\frac{u}{2}$

$u'=\frac{1}{2}kx^2=\frac{1}{2}\frac{u}{2}\times(10)^2=\frac{100}{4}u=25u$

20. C L = Conserved

$\vec{C}=\frac{dL}{dt}=\vec{r}\times\vec{F}=0$

$\begin{vmatrix} i & j & k \\ 2 & -6 & -12 \\ a & 3 & 6 \end{vmatrix}=0$

$\hat{i}(-36+36)-\hat{j}(12+12a)+\hat{k}(6+6a)=0$

$12+12a=0$

$a=-1$

21. D <u>A→B</u>

T = Constant

PV = Constant $\Rightarrow P_A>P_B\Rightarrow V_A<V_B$

<u>B→C</u>

$P\alpha T\Rightarrow V=$Constant

C→D

T = Constant $\Rightarrow PV = \text{constant}$

$P_C > P_D \Rightarrow V_C < V_D$

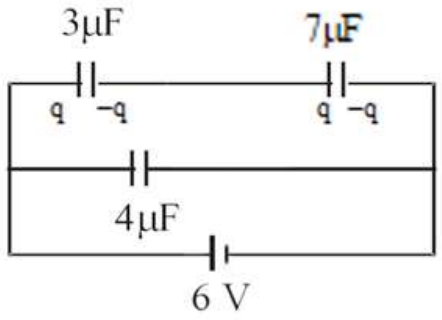
22. E For a monatomic gas, vibrational k.t. is zero at all temperature. So $C_v = \frac{3}{2}R$ for even at high temperature

In case of a diatomic gas, $C_v = \frac{5}{2}R$ at low temperature and $C_v > \frac{5}{2}R$ at high temperature

on account of vibrational K.E.

23. D

24. B



25. D

26. B $F = I(\ell \times B) \Rightarrow \text{radially outward} \Rightarrow \text{expand}$

27. D Power factor, $\cos\phi = \frac{R}{Z}$

$Z^2 = (X_L - X_c)^2 + R^2$

$= (100-20)^2 + (40+20)^2$

$Z = 100\Omega$

$\cos\phi = \frac{40+20}{100} = 0.6$

28. C $\frac{1}{F} = \frac{1}{f_1} + \frac{1}{f_2} - \frac{d}{f_1 f_2} = 0$

$\frac{1}{f_1} + \frac{1}{f_2} = \frac{d}{f_1 f_2}$

$\frac{f_2 + f_1}{f_1 f_2} = \frac{d}{f_1 f_2}$

$f_2 = d - f_1 = 10 - (-10) = 20\text{cm}$

$f_1 = -10\text{cm}$

$d = 10\text{cm}$

29. C $k_{max} = e(\text{stopping potential})$
$= 3eV$

30. D The series in U-V region is Lyman series longest wavelength corresponds to mimimum energy which occurs in transition from n=2 to n=1

$$122 = \frac{\frac{1}{R}}{\frac{1}{1^2} - \frac{1}{2^2}} \quad .....(1)$$

The smallest wavelength in the infrared region corresponds to maximum energy of paschern series

$$\lambda = \frac{\frac{1}{R}}{\frac{1}{3^2} - \frac{1}{\infty}} \quad .....(2)$$

solving (1) and (2)

λ = 823.5nm

31. D $I = \frac{5V}{10\Omega} = \frac{1}{2}A = 0.5A$

32. B Hence, $m = 1000kg$, $R = 90$ m, $\theta = 45^0$; $\tan\theta = \frac{v^2}{Rg}$

33. B

Hence, $\vec{u} = 2\hat{i} + 3\hat{j}, \vec{a} = 0.3\hat{i} + 0.2\hat{j}, t = 10s$ As $\vec{v} = \vec{u} + \vec{at}$

$\therefore \vec{V} = \left(2\hat{i} + 3\hat{j}\right) + \left(0.3\hat{i} + 0.2\hat{j}\right)(10); = 2\hat{i} + 3\hat{j} + 3\hat{i} + 2\hat{j} = 5\hat{i} + 5\hat{j}$

$|\vec{v}| = \sqrt{5^2 + 5^2} = 5\sqrt{2}$units

34. A $\beta = \frac{\lambda D}{d} \quad = 500 \times 10^{-6} = 0.5 \times 10^{-3} = 0.5mm$

35. A

36. D

37. A $F = \mu mg \Rightarrow \mu = \frac{F}{Mg} = \frac{98}{100 \times 9.8} = 0.1$

38. B $\mu M_a g = T$; Also $M_B g = T \Rightarrow M_B = \mu M_A = 0.2 \times 10 = 2$ kg

39. A

40. B As $V_L = V_C = 300V$ and $V = \sqrt{V_R{}^2 + (V_L - V_C)^2} \therefore V_R = V = 220V$ Also $I = \frac{V}{R} = \frac{220}{100} = 2.2A$

41. B $\frac{B_2}{B_1}=\frac{n_2}{n_1}\times\frac{I_2}{I_1}=\frac{1}{6}$; $B_2=\frac{B_1}{6}=\frac{6.28\times10^{-2}}{6}=1.05\times10^{-2}\,wb/m^2$

42. B $F=\frac{110}{21}$; $U=-10$ cm; $\frac{1}{V}+\frac{1}{U}=\frac{1}{F}$; $\frac{1}{V}=\frac{-21}{110}+\frac{1}{10}$; $V=-11$cm

43. C $\mu=\sin\frac{\frac{A+\delta m}{2}}{\sin A/2}=2\cos(A/2)$; $2\cos A/2=\sqrt{3}$; $A=60^0$

44. C $v=\frac{4}{3}\pi r^3$; Error in volume = 3 x 1 = 3%

45. B $\frac{I_1}{I_2}=\frac{1}{25}$; $\therefore\frac{a_1}{a_2}=\frac{1}{5}$; $\therefore\ \frac{I_{max}}{I_{min}}=\frac{(a_1+a_2)^2}{(a_1-a_2)^2}=\frac{6^2}{4^2}=\frac{36}{16}=\frac{9}{4}$

CHEMISTRY

46. E $P_A^0=120$ mm $\quad P_B^0=180$ mm

$n_A=2$ mole $\quad n_B=3$ mole

$P_{mix}=P_A^0\chi_A+P_B^0\chi_B=\left(120\times\frac{2}{5}\right)+\left(180\times\frac{3}{5}\right)=156$ mm

47. A $Zn\rightarrow Zn^{2+}+2e^-$ $\quad Cu^{2+}+2e\rightarrow Cu$

$2F\rightarrow 1$ mol Zn

$2\times96500C\rightarrow 65.4$g Zn

$9.65\times1\times60\times60\rightarrow\frac{65.4\times9.65\times60\times60}{2\times96500}=11.77$g Zn

$2F\rightarrow 1$ mol Cu

$2\times96500C\rightarrow 63.5$g Cu

$9.65\times60\times60\rightarrow\frac{63.5\times9.65\times60\times60}{2\times96500}=11.43$g Cu

48. C

49. D $R_H\left[\frac{1}{n_1^2}-\frac{1}{n_2^2}\right]=R_H\left[\frac{1}{4}-\frac{1}{16}\right]\times z^2$

$\left[\frac{1}{n_1^2}-\frac{1}{n_2^2}\right]=\frac{12}{4\times16}\times4=\frac{3}{4}$

When $n=1, n=2$ $\quad\frac{1}{\lambda}=R_H\left[\frac{1}{1}-\frac{1}{4}\right]=\frac{3}{4}\times R_H$

50. B

	H_2 +	$I_2 \rightleftharpoons$	$2HI$
t = 0	0.3	0.3	0
eq	0.3 − x	(0.3 − x)	2x

$$K_c = \frac{[HI]^2}{[H_2][I_2]} = \frac{\left(\frac{2x}{10}\right)^2}{\left(\frac{0.3-x}{10}\right)\left(\frac{0.3-x}{10}\right)} = 64$$

$$\left(\frac{2x}{0.3-x}\right)^2 = 64$$

$$\frac{2x}{0.3-x} = 8 \qquad 2x = 2.4 - 8x \qquad 10x = 2.4 \qquad x = 0.24$$

51. B

$$AgCl \rightleftharpoons Ag^+ + Cl^-$$
S S (S + 0.001)

$$NaCl \rightarrow Na^+ + Cl^-$$
S S S

$$K_{sp} = [S][S + 0.001] = S^2 + 0.001S = 10^{-10}$$

$$S^2 <<<< 1 \qquad \therefore 0.001S = 10^{-10} \qquad S = \frac{10^{-10}}{10^{-3}} = 10^{-7}$$

52. C At constant pressure; $q_p = \Delta H$

1 mole $C_6H_6 \rightarrow$ 3250 kJ

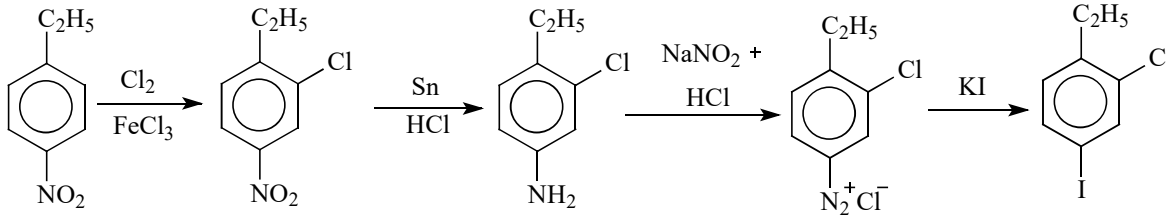
78 g $C_6H_6 \rightarrow$ 3250 kJ

0.39 g $C_6H_6 \rightarrow$ 16.25 kJ

53. A

54. C

55. C



56. D

57. A

58. B Axial bonds in PCl_5 are longer than equitorial bonds.

59. E Cl^- is a weak field ligand so pairing will not takes place and CN^- is strong field ligand so pairing takes place.

60. D When liquid changes to solid degree of randomness decreases so entropy decreases

61. C 20 mL of 0.1 M = 20 mL × 0.1 × 5 N = 10 meq
For $KMnO_4$, N = 5 × M. For oxalic acid N = 2 × M
10 meq. of $KMnO_4$ = 10 meq of oxalic acid ; 50 × 0.1 × 2 = 10 meq

62. D

63. B

64. B

65. C Wolf - kishner reduction

66. B

67. D $Y^{3+} < Lu^{3+} < Eu^{3+} < La^{3+}$
70 88 95 106 Pm

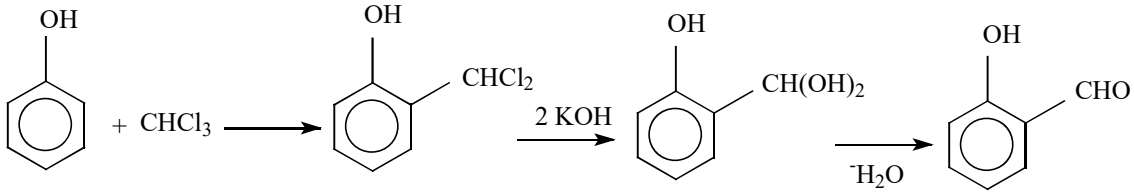
68. B Sucrose is not a reducing sugar

69. D $NaCN + HNO_3 \longrightarrow NaNO_3 + HCN\uparrow$

$Na_2S + 2HNO_3 \longrightarrow 2NaNO_3 + H_2S\uparrow$

70. B $\frac{P^0 - Ps}{P^0} = x_2$ ie $x_2 = \frac{0.80 - 0.60}{0.80} = 0.25$

71. B



72. B $\wedge_m = K \times \frac{1000}{M} = 1.95 \times 10^{-5} \times \frac{1000}{0.01} = 19.5$; $\alpha = \frac{19.5}{390} = 0.05$

73. A Acid strength decreases as +I effect of alkyl group decreases

74. E

75. D

MATHEMATICS

76. E

77. E

78. C Let $\tan^{-1}\sqrt{3}=\theta_1$; $\tan\theta_1=\sqrt{3}=\tan\frac{\pi}{3}$; Let $\sec^{-1}(-2)=\theta_2$

79. C $A=\begin{bmatrix}4 & 6\\ -3 & 7\end{bmatrix}$; $B=\begin{bmatrix}3 & -6\\ 5 & -8\end{bmatrix}$

$X+A=B \quad \Rightarrow X=B+(-A)$

$=\begin{bmatrix}3 & -6\\ 5 & -8\end{bmatrix}+\begin{bmatrix}-4 & -6\\ 3 & -7\end{bmatrix} =\begin{bmatrix}-1 & -12\\ 8 & -15\end{bmatrix}$; $X=\begin{bmatrix}-1 & -12\\ 8 & -15\end{bmatrix}$

80. D

$\begin{bmatrix}1 & -2\\ 2 & -6\end{bmatrix}=\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}A$

$\Rightarrow \begin{bmatrix}1 & -2\\ 0 & -2\end{bmatrix}=\begin{bmatrix}1 & 0\\ 2 & 1\end{bmatrix}\cdot A \quad R_2\to R_2-2R_1$

$\Rightarrow \begin{bmatrix}1 & -2\\ 0 & 1\end{bmatrix}=\begin{bmatrix}1 & 0\\ 1 & -\frac{1}{2}\end{bmatrix}\cdot A\left[R_2\to -\frac{1}{2}R_2\right]$

$\Rightarrow \begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}=\begin{bmatrix}3 & -1\\ 1 & -\frac{1}{2}\end{bmatrix}\cdot A\left[R_1\to R_1+2R_2\right]$

$A^{-1}=\begin{bmatrix}3 & -1\\ 1 & -\frac{1}{2}\end{bmatrix}$

81. A

Put $\sqrt{x}=t$, $e^{\sqrt{x}}=e^t=u$,

$y=\sqrt{u}$, $u=e^t$ $t=\sqrt{x}$

$\frac{dy}{dx}=\left(\frac{dy}{du}\times\frac{du}{dt}\times\frac{dt}{dx}\right)$

82. D $\dfrac{\frac{m}{2}\left[qa+(m-1)d\right]}{\frac{m}{2}\left[2a+(n-1)d\right]}=\dfrac{m^2}{n^2}$

83. A

84. C

$$\int \frac{dt}{(1-4t^2)} = -\frac{1}{4}\int \frac{dt}{\left(\frac{1}{4}-t^2\right)}$$

$$= -\frac{1}{4}\int \frac{dt}{\left\{\left(\frac{1}{2}\right)^2 - t^2\right\}}$$

$$= -\frac{1}{4}\log\left|\frac{1+2t}{1-2t}\right|$$

85. C

$$\int_0^{\frac{\pi}{2}} \cos^3 x\,dx$$

$$= \int_0^{\frac{\pi}{2}} \left(\frac{3\cos x + \cos 3x}{4}\right) dx$$

$$= \frac{3}{4}\left[\sin x\right]_0^{\pi/2} + \frac{1}{4}\left[\frac{\sin 3x}{3}\right]_0^{\pi/2}$$

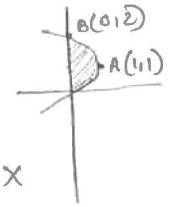
$$= \frac{2}{3}$$

86. C

$y^2 = 2y - x$

$\Rightarrow y^2 = -x$,

$y-1 = Y$ & $x-1 = X$



required area

$$= \int_0^2 x\,dy = \int_0^2 (2y - y^2)\,dy$$

$$= \frac{4}{3} \text{ sq units.}$$

87. A

$S = \{H, T\}$.

$P(X = x) = {}^nC_x\, p^x q^{(n-x)}$

$= {}^8C_x \left(\frac{1}{2}\right)^x \left(\frac{1}{2}\right)^{(8-x)}$

$= {}^8C_x \left(\frac{1}{2}\right)^8$

$\therefore$ P(getting atleast 3 heads)

$= P(X \geq 3)$

$= 1 - \frac{1}{256}(1+8+28) = \frac{219}{256}$

88. E

$a=3,\ d=6$

$l=999$

$\therefore n=167$

$S=\frac{n}{2}[a+l]$

89 A

$\cos(60^\circ)\cos(36^\circ)\cos(42^\circ)\cos(18^\circ)$

$=\frac{1}{2}\left(\frac{\sqrt{5}+1}{4}\right)\frac{1}{2}(2\cos 78^\circ\cos 42^\circ)$

$=\frac{1}{4}\left(\frac{\sqrt{5}+1}{4}\right)\left(\frac{\sqrt{5}-1}{4}\right)$

$=\frac{5-1}{64}=\frac{4}{64}=\frac{1}{16}$

90. A

$\lim_{h\to 0}\{k(\pi-h)+1\}$

$=k\pi+1$

$k\pi+1=-1$

$k=-2/\pi$

91. E

92. D

93. B

$(\sqrt{2}+1)^6$ lies between 197 and 198. So the required integer is 197.

94. D

95. B

$$y=\frac{4x+3}{x+2};\ yx+2y=4x+3$$

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

$$f^{-1}(-2)=\frac{3+4}{-6}=\frac{-7}{6}$$

96. E $f(x) = 2x^3 - 15x^2 + 36x + 4$

$$f'(x) = 6x^2 - 30x + 36 = \underbrace{6\left[x^2 - 5x + 6\right]}_{\downarrow x=2, x=3}$$

$f''(x) = 12x - 30$ $f''(2) = 24 - 30 < 0$

97. E $xy' + y = x^2$

$$\frac{d}{dx}(xy) = x^2;\ xy = \frac{x^3}{3} + c$$

98. D Since, varlance of first n natural number is

$$(S.D)^2 = \frac{n^2 - 1}{12}$$

Variance of first 20 natural number is,

$$(S.D)^2 = \frac{20^2 - 1}{12} = \frac{133}{14}$$

99. C

100. B

101. C $A = \{1, -1\}, B = \{1\} \ \therefore A \cup B = \{1, -1\} = A$

102. B $(7 + 24i)\left(\frac{7 - 24i}{625}\right) = 1$

103. C Centroid is $\left(\frac{1 + 2 + C^2}{3}, \frac{a + b - 3}{3}\right)$

lies on X-axis $\Rightarrow \frac{a + b - 3}{3} = 0 \Rightarrow a + b = 3$

104. B let (x, y) be the point on the line

$3x+4y=5 \Rightarrow 3x_1+4y_1=5-(1)$

given $(x_1-1)^2+(y_1-2)^2=(x_1-3)^2+(y_1-4)^2$

$\Rightarrow x_1+y_1-5=0 \Rightarrow y_1=5-x_1$

$(1) \Rightarrow x_1=15$ and $y_1=5-15=-10$

$\therefore$ point is $(15,-10)$

105. B circle touching both the axes is

$x^2+y^2-2ax-2ay+a^2=0$. This passes through

$(1,2) \Rightarrow 1+4-2a-4a+a^2=0 \Rightarrow a=5,1$

$\therefore x^2+y^2-10x-10y+25=0$ is the req. circle

106. A $\alpha.\beta=-1/4 \Rightarrow \beta=-\dfrac{1}{42}$

107. A

108. E $(1-2x)^5=5C_0-5C_1(2x)+.....+5C_5(2x)^5$

$\therefore$ Co-efficient of x^4 is $5C_4.2^4=80$

109. A $2^{2000}=\left(2^4\right)^{500}=(17-1)^{500}=1-17k$ $\therefore$ Remainder = 1

110. C $|x-3|<2x+9$

$\Rightarrow -(2x+9)<x-3<2x+9$

$\Rightarrow x>-2$ or $x>-12$

$\Rightarrow x>-2$

111. E $\tan 15^\circ+\tan 75^\circ=2-\sqrt{3}+2+\sqrt{3}=4$

112. E $\cos^{-1}\left(\cos\dfrac{7\pi}{6}\right)=\cos^{-1}\left(\cos\left(2\pi-\dfrac{5\pi}{6}\right)\right)=\dfrac{5\pi}{6}$

113. D $a=3, b=3,\ e=\sqrt{1+\dfrac{b^2}{a^2}}=\sqrt{1+1}=\sqrt{2}$

$\therefore$ Distance between directrices $=\dfrac{2a}{e}=\dfrac{2.3}{\sqrt{2}}$

114. A $|\bar{a}-\bar{b}|^2=|\bar{a}|^2+|\bar{b}|^2-2(\bar{a}.\bar{b})$

$=5$ $\therefore |\bar{a}-\bar{b}|=\sqrt{5}$

115. D

116. B $P(A)=\frac{6}{36}=\frac{1}{6}$

117. A $P(A)=\frac{3}{6}=\frac{1}{2}$

118. C $\lim_{x\to 3}\frac{x^5-3^5}{x^8-3^8}=\frac{5.3^4}{8.3^7}=\frac{5}{216}$

119. A $f'(x)=\frac{1}{\sqrt{2x}}-\frac{\sqrt{2}}{x^{3/4}}\Rightarrow f'(2)=\frac{1}{2}-\frac{1}{2}=0$

120. B $\min \sin x+\cos x=-\sqrt{1^2+1^2}=-\sqrt{2}$

121. A $I=\int_0^{\pi/4}\log(1+\tan x)\,dx-(1)$

$\Rightarrow I=\int_0^{\pi/4}\log\left(1+\tan\left(\frac{\pi}{4}-x\right)\right)dx$

$\Rightarrow I=\int_0^{\pi/4}\log\left(\frac{2}{1+\tan x}\right)dx-(2)$

$(1)+(2)\Rightarrow 2I=\int_0^{\pi/4}\log 2\,dx$

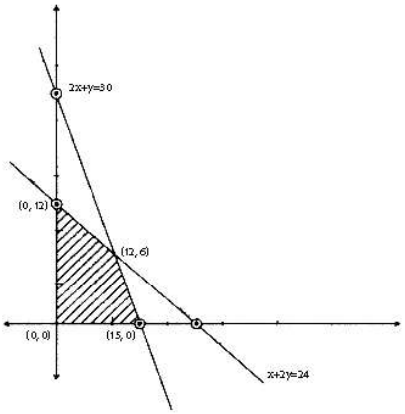
$\therefore I=\frac{\pi}{8}.\log_e^2$

122. D $\frac{dx}{dy}\overline{\omega}x=y^2$

$\therefore$ Solution is $xe^{-y}=\int_c^{-y}y^2\,dy$

$\Rightarrow x=-y^2-2y-2y-2+ce^{-y}$

123. B



Max $P=120$ at $(12,6)$

124. A $[x]^2-[x]-6>0 \Rightarrow ([x]-3)([x]+2)>0$

$\Rightarrow [x]<-2$ or $[x]>3$

$\Rightarrow x<-2$ or $x\geq 4$

125. B $|\sin x|+|\cos x|$ is periodic with period $\pi/2$.

$\therefore |\sin 4x|+|\cos 4x|$ is periodic with period $\frac{1}{4}.\frac{\pi}{2}=\frac{\pi}{8}$

126. B

127. D

128. C $f(0)=\lim\limits_{x\to 0}\frac{1-\text{Cos}(1-\text{Cos}x)}{x^4}=\lim\limits_{x\to 0}\frac{\text{Sin}(1-\text{Cos}x)}{4x^3}.\text{Sin}x$

$$=\frac{1}{4}\lim_{x\to 0}\left[\frac{\text{Sin}\left(2\text{Sin}^2 x/2\right)}{2\text{Sin}^2 x/2}.\frac{2\text{Sin}^2 x/2}{\left(\frac{x}{2}\right)^2}.\frac{1}{4}\frac{\text{Sin}x}{x}\right]=\frac{1}{8}$$

129. A A non leap year contains 365 days. ie, 52 weeks and one day. This one day can be any one of seven days of the week.

$\therefore$ Required probability = 1/7

130. A $\cos\theta=\frac{8+7+3}{\sqrt{6}\sqrt{16+49+9}}=\frac{9}{\sqrt{111}}$

131. A $|\vec{a}|=\sqrt{75}$

Let $\vec{a}=x\vec{i}+y\vec{j}+2\vec{k}$ By the given $2x-y+z=0$

$3x+2y-z=0$ $\therefore \frac{x}{-1}=\frac{y}{5}=\frac{z}{7}=k(\text{say})$

$x=-k$, $y=5k$, $2=7k$; $\vec{a}=-k\vec{i}+5k\vec{j}+7k\vec{k}$

$|\vec{a}|=-\sqrt{k^2+25k^2+49k^2}=\sqrt{75}$

$\Rightarrow 75k^2=75;\ k=\pm 1;$ $k=+1$ (*since we take for* $|\vec{a}|$)

$\Rightarrow \vec{a}=-i+5\vec{j}+7\vec{k}$

132. C

133. C $y^2-K\left(x-\frac{8}{k}\right), V(8k,0)$; E4 of directrix $x=\frac{8}{k}-\frac{k}{4}=1$; $32-k^2=4k$; $k^2+4k-32=0$

$(k+8)(k-4)=0, k=-8,4$

134. C

135. C

136. C

137. B

138. D $x = y = z = 1$

139. D α, β, γ are $2, 2w, 2w^2$

140. A

141. A

142. E Let the terms be $\frac{a}{r}, a, ar$; Product $= \frac{a}{r}.a.ar = a^3 = 1 \Rightarrow a = 1$

$\text{Sum} = \frac{a}{r} + a + ar \Rightarrow 10r^2 - 29r + 10 = 0 \Rightarrow r = \frac{5}{2} \text{or} \frac{2}{5}$

143. C $2x < 18$, $3x < -9$

144. C $E = \left(3 - 4\sin^2 A\right)^2 - \left(4\cos^2 A - 3\right)^2$

145. C

146. A $I = \int \frac{x\,dx}{\sqrt{1+x^2}} + \int \frac{dx}{\sqrt{1+x^2}}$

147. C $xy\frac{d^2y}{dx^2} + x\left(\frac{dy}{dx}\right)^2 - y\frac{dy}{dx} = 0$

148. A Sum of the roots $= \text{Sum}\frac{-\left(ac+b^2\right)}{bc}$ product $= \frac{a}{c}$

149. B $ab + bc + ca = -3abc$

150. B $\text{Sin}^{-1} x = \theta \Rightarrow n = \text{Sin}\theta\ E = \text{Cos}2\theta = 1 - 2\text{Sin}^2\theta$