2nd April Shift 2

Q1 When a concentrated solution of sulphanilic acid and 1-naphthylamine is treated with nitrous acid (273 K) and acidified with acetic acid, the mass (g) of 0.1 mole of product formed is :
(Given molar mass in
$\mathrm{gmol}^{-1}\,\mathrm{H}:1, \mathrm{C}:12,\ \mathrm{N}:14, O:16, S:32)$
(A) 343   (B) 330
(C) 33   (D) 66

Q2 The d-orbital electronic configuration of the complex among $[\mathrm{Co(en)_3}]^{3+}$, $[\mathrm{CoF_6}]^{3-}$, $[\mathrm{Mn\,(H_2O)_6}]^{2+}$ and $[\mathrm{Zn\,(H_2O)_6}]^{2+}$ that has the highest CFSE is
(A) $t_{2g}^6 e_g^0$ (B) $t_{2g}^6 e_g^4$
(C) $t_{2g}^3 e_g^2$ (D) $t_{2g}^4 e_g^2$

Q3 Given below are two statements :
Statement (I) : Neopentane forms only one monosubstituted derivative.
Statement (II) : Melting point of neopentane is higher than n-pentane
In the light of the above statements, choose the most appropriate answer from the options given below :
(A) Statement I is correct but Statement II is incorrect
(B) Both Statement I and Statement II are correct
(C) Both Statement I and Statement II are incorrect
(D) Statement I is incorrect but Statement II is correct

Q4 Which among the following molecules is (a) involved in $\mathrm{sp^3\ d}$ hybridization, (b) has different bond lengths and (c) has lone pair of electrons on the central atom?
(A) $\mathrm{PF_5}$ (B) $\mathrm{XeF_4}$
(C) $\mathrm{SF_4}$ (D) $\mathrm{XeF_2}$

Q5

Formation of $\mathrm{Na_4\,[Fe(CN)_5\,NOS]}$, a purple coloured complex formed by addition of sodium nitroprusside in sodium carbonate extract of salt indicates the presence of :
(A) $\mathrm{Sodium\ ion}$
(B) Sulphate ion
(C) Sulphide ion
(D) Sulphite ion

Q6 In 3,3-dimethylhex-1-ene-4-yne, there are
_____ $\mathrm{sp^3}$, _____ $\mathrm{sp^2}$ and _____ sp
hybridised carbon atoms respectively :
(A) 4, 2, 2   (B) 3, 3, 2
(C) 2, 4, 2   (D) 2, 2, 4

Q7 Which of the following statements are true ?
(A) The subsidiary quantum number l describes the shape of the orbital occupied by the electron.
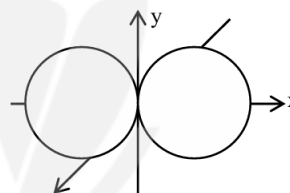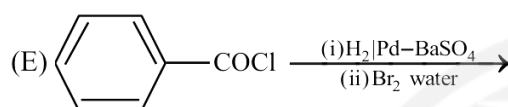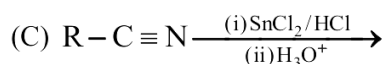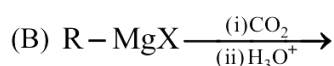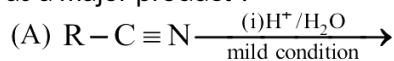

(B)   is the boundary
surface diagram of the $2\mathrm{p_x}$ orbital.
(C) The + and - signs in the wave function of the $2\mathrm{p_x}$ orbital refer to charge.
(D) The wave function of $2p_x$ orbital is zero everywhere in the xy plane.
(A) (B) and (D) only
(B) (A), (B) and (C) only
(C) (C) and (D) only
(D) (A) and (B) only

Q8 The type of hybridization and the magnetic property of $[\mathrm{MnCl_6}]^{3-}$ are :
(A) $\mathrm{d^2\,sp^3}$, paramagnetic with four unpaired electrons
(B) $\mathrm{sp^3\ d^2}$, paramagnetic with four unpaired electrons

(C) $d^2 sp^3$, paramagnetic with two unpaired electrons

(D) $sp^3 d^2$, paramagnetic with two unpaired electrons

Q9 Consider the following reactions. From these reactions which reaction will give carboxylic acid as a major product ?

(A) $R-C \equiv N \xrightarrow[\text{mild condition}]{\text{(i)} H^+/H_2O}$

(B) $R-MgX \xrightarrow[\text{(ii)} H_3O^+]{\text{(i)} CO_2}$

(C) $R-C \equiv N \xrightarrow[\text{(ii)} H_3O^+]{\text{(i)} SnCl_2/HCl}$

(D) $R \cdot CH_2 \cdot OH \xrightarrow{PCC}$

(E)

$-COCl \xrightarrow[\text{(ii)} Br_2 \text{ water}]{\text{(i)} H_2|Pd-BaSO_4}$

Choose the correct answer from the options given below :

(A) A and D only

(B) A, B and E only

(C) B, C and E only

(D) B and E only

Q10 Electronic configuration of four elements A, B, C and D are given below :

(A) $1s^2 2s^2 2p^3$

(B) $1s^2 2s^2 2p^4$

(C) $1s^2 2s^2 2p^5$

(D) $1s^2 2s^2 2p^2$

Which of the following is the correct order of increasing electronegativity (Pauling's scale)?

(A) A < D < B < C

(B) A < C < B < D

(C) A < B < C < D

(D) D < A < B < C

Q11

Match **List-I** with **List-II**

	List-I (Purification technique)		List-II (Mixture of organic compounds)
(A)	Distillation (simple)	(I)	Diesel + Petrol
(B)	Fractional distillation	(II)	Aniline + Water
(C)	Distillation under reduced pressure	(III)	Chloroform + Aniline
(D)	Steam distillation	(IV)	Glycerol + Spent-lye

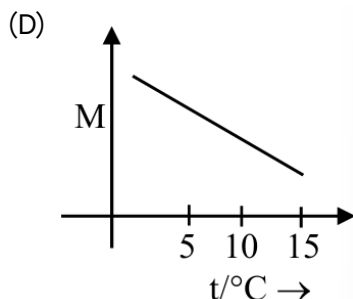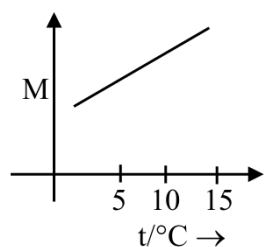Choose the correct answer from the options given below :

(A) (A)-(II), (B)-(III), (C)-(IV), (D)-(I)

(B) (A)-(II), (B)-(IV), (C)-(I), (D)-(III)

(C) (A)-(III), (B)-(IV), (C)-(II), (D)-(I)

(D) (A)-(III), (B)-(I), (C)-(IV), (D)-(II)

Q12 ' x ' g of $NaCl$ is added to water in a beaker with a lid. The temperature of the system is raised from $1°C$ to $25°C$. Which out of the following plots, is best suited for the change in the molarity (M) of the solution with respect to temperature? [Consider the solubility of NaCl remains unchanged over the temperature range]

(A)

(B)

(C)

(D)
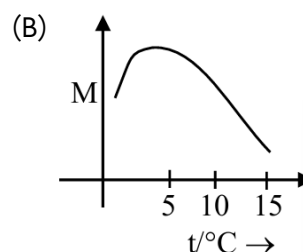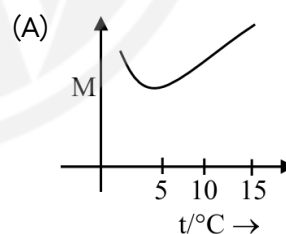
Q13 Arrange the following in order of magnitude of work done by the system / on the system at constant temperature :

(a) $|w_{reversible}|$ for expansion in infinite stage.

(b) $|w_{irreversible}|$ for expansion in single stage.

(c) $|w_{reversible}|$ for compression in infinite stage.
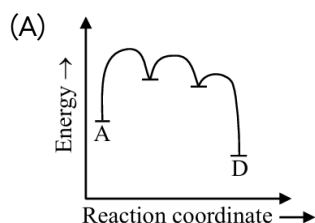
(d) $|W_{irreversible}|$ for compression in single stage.

Choose the **correct** answer from the options given below :

(A) a > b > c > d
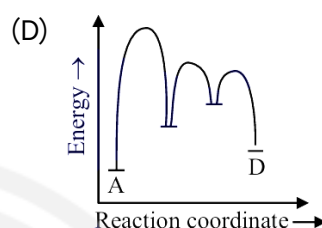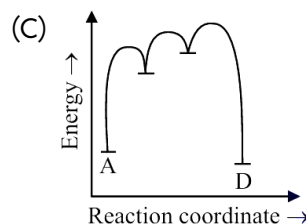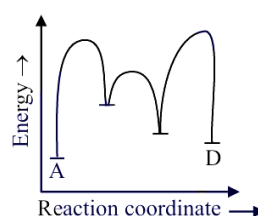
(B) d > c = a > b

(C) c = a > d > b

(D) a > c > b > d

Q14 Reactant A converts to product D through the given mechanism (with the net evolution of heat) :

$A \rightarrow B$ slow; $\quad \Delta H = + ve$

$B \rightarrow C$ fast; $\Delta H = - ve$

$C \rightarrow D$ fast; $\Delta H = - ve$
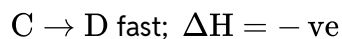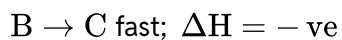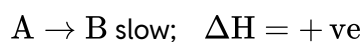
Which of the following represents the above reaction mechanism?

(A)

(B)

(C)

(D)

Q15 The nature of oxide (TeO_2) and hydride (TeH_2) formed by Te , respectively are :

(A) Oxidising and acidic

(B) Reducing and basic

(C) Reducing and acidic

(D) Oxidising and basic

Q16 Match **List-I** with **List-II**

List-I (Reaction)		List-II (Name of reaction)	
(A)	$2\langle\text{C}_6\text{H}_5\rangle\text{—X}+2\text{Na} \xrightarrow[\text{Ether}]{\text{Dry}} \langle\text{C}_6\text{H}_5\text{—C}_6\text{H}_5\rangle +2\text{Na}$	(I)	Lucas reaction
(B)	$ArN_2^+X^- \xrightarrow[\text{HCl}]{\text{Cu}} ArCl + N_2 \uparrow + CuX$	(II)	Finkelstein reaction
(C)	$C_2H_5Br + NaI \xrightarrow[\text{Acetone}]{\text{Dry}} C_2H_5I + NaBr$	(III)	Fittig reaction
(D)	$CH_3C(OH)(CH_3)CH_3 \xrightarrow[\text{ZnCl}_2]{\text{HCl}}$ $CH_3C(Cl)(CH_3)CH_3$	(IV)	Gatterman reaction

Choose the correct answer from the options given below :

(A) (A)-(III), (B)-(II), (C)-(IV), (D)-(I)

(B) (A)-(III), (B)-(IV), (C)-(II), (D)-(I)

(C) (A)-(IV), (B)-(III), (C)-(I), (D)-(II)

(D) (A)-(IV), (B)-(I), (C)-(II), (D)-(III)

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Q17 Consider the following chemical equilibrium of the gas phase reaction at a constant temperature :

$$A(g) \rightleftharpoons B(g) + C(g)$$
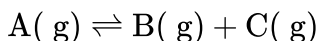
If p being the total pressure, K_p is the pressure equilibrium constant and α is the degree of dissociation, then which of the following is true at equilibrium ?

(A) If p value is extremely high compared to $K_p, \alpha \approx 1$

(B) When p increases α decreases

(C) If k_p value is extremely high compared to p, α becomes much less than unity

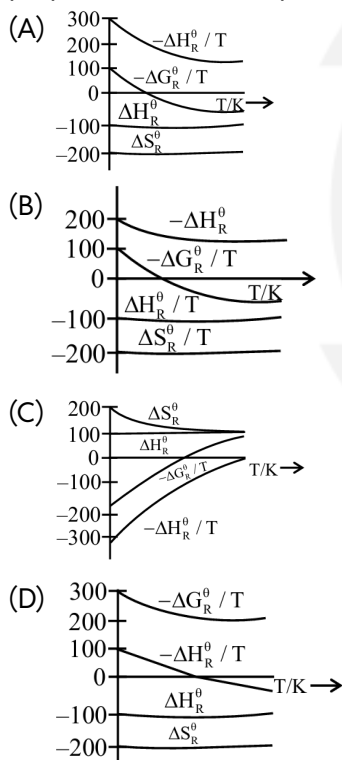(D) When p increases α increases

Q18 Which of the following graphs correctly represents the variation of thermodynamic properties of Haber's process ?

(A)

(B)

(C)

(D)

Q19 A tetrapeptide "x " on complete hydrolysis produced glycine (Gly), alanine (Ala), valine (Val), leucine (Leu) in equimolar proportion each. The number of tetrapeptides (sequences) possible involving each of these amino acids is

(A) 16   (B) 32

(C) 8   (D) 24

Q20 In Dumas method for estimation of nitrogen, 0.5 gram of an organic compound gave 60 mL of nitrogen collected at 300 K temperature and 715 mm Hg pressure. The percentage composition of nitrogen in the compound (Aqueous tension at 300 K = 15 mmHg) is

(A) 1.257   (B) 20.87

(C) 18.67   (D) 12.57

Q21 For the reaction $A \rightarrow B$ the following graph was obtained. The time required (in seconds) for the concentration of A to reduce to 2.5 g L^{-1} (if the initial concentration of A was 50 g L^{-1}) is

------ . (Nearest integer)

Given : $\log 2 = 0.3010$
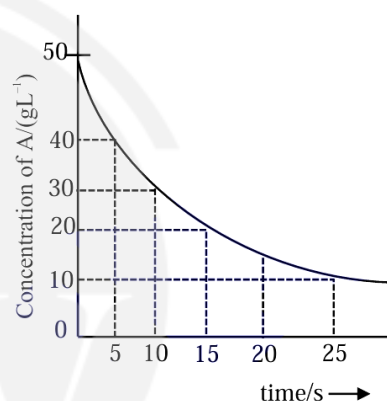
Q22 $0.2\%(w/v)$ solution of $NaOH$ is measured to have resistivity 870.0 mΩ m. The molar conductivity of the solution will be _____ $\times 10^2$ mS dm^2 mol^{-1}. (Nearest integer)

Q23
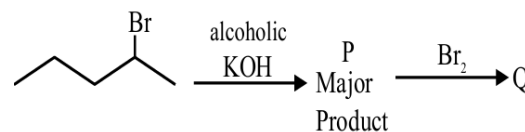
Consider the above sequence of reactions. 151 g of 2-bromopentane is made to react. Yield of major product P is 80% whereas Q is 100%. Mass of product Q obtained is _____ g. (Given molar mass in gmol^{-1} H : 1, C : 12, O : 16, Br : 80)

Q24 When 1 g each of compounds AB and AB_2 are dissolved in 15 g of water separately, they increased the boiling point of water by 2.7 K

and 1.5 K respectively. The atomic mass of A (in amu) is _____ $\times 10^{-1}$ (Nearest integer)
(Given : Molal boiling point elevation constant is 0.5 K kg mol^{-1})

Q25 The spin-only magnetic moment value of M^{n+-} ion formed among Ni, Zn, Mn and Cu that has the least enthalpy of atomisation is _____. (in nearest integer)
Here n is equal to the number of diamagnetic complexes among
$K_2\left[NiCl_4\right]$, $\left[Zn\left(H_2O\right)_6\right]Cl_2$, $K_3\left[Mn(CN)_6\right]$ and $\left[Cu\left(PPh_3\right)_3I\right]$

Q26 Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A) : Net dipole moment of a polar linear isotropic dielectric substance is not zero even in the absence of an external electric field.
Reason (R) : In absence of an external electric field, the different permanent dipoles of a polar dielectric substance are oriented in random directions.
In the light of the above statements, choose the most appropriate answer from the options given below :
(A) (A) is correct but (R) is not correct
(B) Both (A) and (R) are correct but (R) is not the correct explanation of (A)
(C) Both (A) and (R) are correct and (R) is the correct explanation of (A)
(D) (A) is not correct but (R) is correct

Q27 In a moving coil galvanometer, two moving coils M_1 and M_2 have the following particulars :
$R_1 = 5\Omega$, $N_1 = 15$, $A_1 = 3.6 \times 10^{-3}$ m^2, $B_1 = 0.25$ T
$R_2 = 7\Omega$, $N_2 = 21$, $A_2 = 1.8 \times 10^{-3}$ m^2, $B_2 = 0.50$ T
Assuming that torsional constant of the springs are same for both coils, what will be the ratio of voltage sensitivity of M_1 and M_2?
(A) 1 : 1   (B) 1 : 4
(C) 1 : 3   (D) 1 : 2

Q28 The moment of inertia of a circular ring of mass M and diameter r about a tangential axis lying in the plane of the ring is :
(A) $\frac{1}{2}Mr^2$ (B) $\frac{3}{8}Mr^2$
(C) $\frac{3}{2}Mr^2$ (D) $2Mr^2$

Q29 Two water drops each of radius 'r' coalesce to from a bigger drop. If ' T ' is the surface tension, the surface energy released in this process is :
(A) $4\pi r^2$ T $\left[2 - 2^{\frac{2}{3}}\right]$
(B) $4\pi r^2 T \left[2 - 2^{\frac{1}{3}}\right]$
(C) $4\pi r^2 T \left[1 + \sqrt{2}\right]$
(D) $4\pi r^2 T \left[\sqrt{2} - 1\right]$

Q30 An electron with mass 'm' with an initial velocity $(t = 0)$ $\vec{v} = v_0\hat{i}$ $(v_0 > 0)$ enters a magnetic field $\vec{B} = B_0\hat{j}$. If the initial de-Broglie wavelength at $t = 0$ is λ_0 then its value after time ' t ' would be :
(A) $\dfrac{\lambda_0}{\sqrt{1 - \frac{e^2\,B_0^2 t^2}{m^2}}}$
(B) $\dfrac{\lambda_0}{\sqrt{1 + \frac{e^2\,B_0^2 t^2}{m^2}}}$
(C) $\lambda_0\sqrt{1 + \frac{e^2\,B_0^2 t^2}{m^2}}$
(D) λ_0

Q31 A sinusoidal wave of wavelength 7.5 cm travels a distance of 1.2 cm along the x -direction in 0.3 sec . The crest P is at x = 0 at $t = 0$ sec and maximum displacement of the wave is 2 cm . Which equation correctly represents this wave ?
(A) $y = 2\cos(0.83x - 3.35t)$ cm
(B) $y = 2\sin(0.83x - 3.5t)$ cm
(C) $y = 2\cos(3.35x - 0.83t)$ cm
(D) $y = 2\cos(0.13x - 0.5t)$ cm

Q32 Given a charge q, current I and permeability of vacuum μ_0. Which of the following quantity has the dimension of momentum?
(A) qI/μ_0 (B) $q\mu_0 I$
(C) $q^2\mu_0 I$ (D) $q\mu_0/I$

Q33 A solenoid having area A and length 'l' is filled with a material having relative permeability 2. The magnetic energy stored in the solenoid is :

(A) $\dfrac{B^2 \, Al}{\mu_0}$

(B) $\dfrac{B^2 \, Al}{2\mu_0}$

(C) $B^2 \, Al$

(D) $\dfrac{B^2 \, Al}{4\mu_0}$

Q34 Two large plane parallel conducting plates are kept 10 cm apart as shown in figure. The potential difference between them is V. The potential difference between the points A and B (shown in the figure) is :
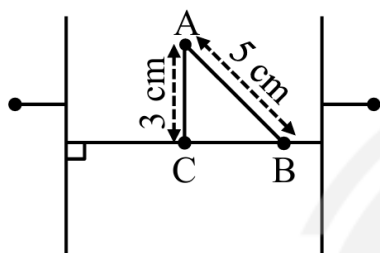
(A) $\dfrac{1}{4} V$

(B) $\dfrac{2}{5} V$

(C) $\dfrac{3}{4} V$

(D) $1 V$

Q35 Identify the characteristics of an adiabatic process in a monoatomic gas.

(A) Internal energy is constant.

(B) Work done in the process is equal to the charge in internal energy.

(C) The product of temperature and volume is a constant.

(D) The product of pressure and volume is a constant.

(E) The work done to change the temperature from T_1 to T_2 is proportional to $(T_2 - T_1)$

Choose the **correct** answer from the options given below :

(A) (A), (C), (D) only

(B) (A), (C), (E) only

(C) (B), (E) only

(D) (B), (D) only

Q36 Assuming the validity of Bohr's atomic model for hydrogen like ions the radius of Li^{++} ion in its ground state is given by $\dfrac{1}{X} a_0$, where X=_____ . (Where a_0 is the first Bohr's radius.)

(A) 2   (B) 1

(C) 3   (D) 9

Q37 Energy released when two deuterons $\left({}_1H^2\right)$ fuse to form a helium nucleus $\left({}_2He^4\right)$ is : (Given : Binding energy per nucleon of ${}_1H^2 = 1.1 \, MeV$ and binding energy per nucleon of ${}_2He^4 = 7.0 \, MeV$)

(A) $8.1 \, MeV$

(B) $5.9 \, MeV$

(C) $23.6 \, MeV$

(D) $26.8 \, MeV$

Q38 In the digital circuit shown in the figure, for the given inputs the P and Q values are :
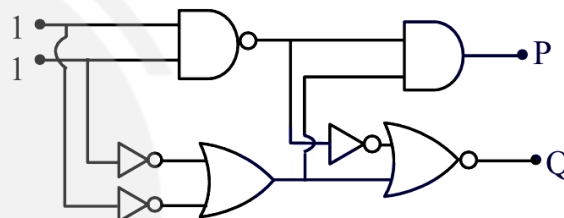
(A) P = 1, Q = 1

(B) P = 0, Q = 0

(C) P = 0, Q = 1

(D) P = 1, Q = 0

Q39 Two identical objects are placed in front of convex mirror and concave mirror having same radii of curvature of 12 cm, at same distance of 18 cm from the respective mirrors. The ratio of sizes of the images formed by convex mirror and by concave mirror is :

(A) 1/2   (B) 2

(C) 3   (D) 1/3

Q40 A sportsman runs around a circular track of radius r such that he traverses the path ABAB. The distance travelled and displacement,

respectively, are
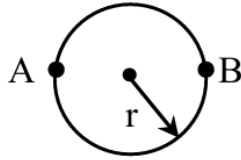
(A) $2r, \; 3\pi r$
(B) $3\pi r, \; \pi r$
(C) $\pi r, \; 3r$
(D) $3\pi r, \; 2r$

Q41
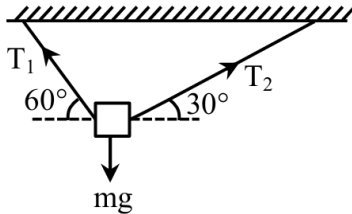
A body of mass 1kg is suspended with the help of two strings making angles as shown in figure. Magnitude of tensions T1 and T2, respectively, are (in N):

(A) $5, \; 5\sqrt{3}$
(B) $5\sqrt{3}, \; 5$
(C) $5\sqrt{3}, \; 5\sqrt{3}$
(D) $5, \; 5$

Q42 A bi-convex lens has radius of curvature of both the surfaces same as $1/6$ cm. If this lens is required to be replaced by another convex lens having different radii of curvatures on both sides $(R_1 \neq R_2)$, without any change in lens power then possible combination of R_1 and R_2 is :

(A) $\frac{1}{3}$ cm and $\frac{1}{3}$ cm
(B) $\frac{1}{5}$ cm and $\frac{1}{7}$ cm
(C) $\frac{1}{3}$ cm and $\frac{1}{7}$ cm
(D) $\frac{1}{6}$ cm and $\frac{1}{9}$ cm

Q43 If μ_0 and ε_0 are the permeability and permittivity of free space, respectively, then the dimension of $\left(\frac{1}{\mu_0 \varepsilon_0}\right)$ is :

(A) L/T^2 (B) L^2/T^{-2}
(C) T^2/L (D) T^2/L^2

Q44

Match List-I with List-II.

List-I	List-II
(A) Heat capacity of body	(I) J kg^{-1}
(B) Specific heat capacity of body	(II) JK^{-1}
(C) Latent heat	(III) J kg^{-1} K^{-1}
(D) Thermal conductivity	(IV) Jm^{-1}K^{-1}s^{-1}

Choose the correct answer from the options given below :
(A) (A)–(III), (B)–(I), (C)–(II), (D)–(IV)
(B) (A)–(IV), (B)–(III), (C)–(II), (D)–(I)
(C) (A)–(III), (B)–(IV), (C)–(I), (D)–(II)
(D) (A)–(II), (B)–(III), (C)–(I), (D)–(IV)

Q45 Consider a circular loop that is uniformly charged and has a radius $a\sqrt{2}$. Find the position along the positive z -axis of the cartesian coordinate system where the electric field is maximum if the ring was assumed to be placed in xy-plane at the origin :

(A) $\frac{a}{\sqrt{2}}$ (B) $\frac{a}{2}$
(C) a (D) 0

Q46
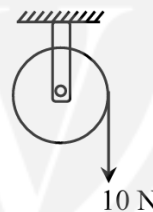
A wheel of radius $0.2 \; m$ rotates freely about its center when a string that is wrapped over its rim is pulled by force of 10 N as shown in figure. The established torque produces an angular acceleration of $2 \, \text{rad}/s^2$. Moment of inertia of the wheel is _____ kgm^2.
(Acceleration due to gravity $= 10 \, \text{m}/s^2$)

Q47 The internal energy of air in $4 \, \text{m} \times 4 \, \text{m} \times 3 \, \text{m}$ sized room at 1 atmospheric pressure will be ____ $\times 10^6$ J. (Consider air as diatomic molecule)

Q48 A ray of light suffers minimum deviation when incident on a prism having angle of the prism equal to $60°$. The refractive index of the prism

material is $\sqrt{2}$. The angle of incidence (in degrees) is_____.

Q49 The length of a light string is $1.4\ m$ when the tension on it is $5\ N$. If the tension increases to $7\ N$, the length of the string is $1.56\ m$. The original length of the string is _____ m.

Q50 A satellite of mass 1000 kg is launched to revolve around the earth in an orbit at a height of $270\ km$ from the earth's surface. Kinetic energy of the satellite in this orbit is _____ $\times 10^{10}$ J. (Mass of earth $= 6 \times 10^{24}$ kg, Radius of earth $= 6.4 \times 10^6$ m, Gravitational constant $= 6.67 \times 10^{-11}\ \mathrm{Nm^2\ kg^{-2}}$)

Q51 If the image of the point $\mathrm{P}(1, 0, 3)$ in the line joining the points $\mathrm{A}(4, 7, 1)$ and $\mathrm{B}(3, 5, 3)$ is $\mathrm{Q}(\alpha, \beta, \gamma)$, then $\alpha + \beta + \gamma$ is equal to
(A) $\frac{47}{3}$
(B) $\frac{46}{3}$
(C) 18
(D) 13

Q52 Let $\mathrm{f} : [1, \infty) \to [2, \infty)$ be a differentiable function, If $10 \int_1^x f(t)\mathrm{dt} = 5\mathrm{x}f(\mathrm{x}) - \mathrm{x}^5 - 9$ for all $\mathrm{x} \geq 1$, then the value of $f(3)$ is :
(A) 18
(B) 32
(C) 22
(D) 26

Q53 The number of terms of an A.P. is even; the sum of all the odd terms is 24, the sum of all the even terms is 30 and the last term exceeds the first by $\frac{21}{2}$. Then the number of terms which are integers in the A.P. is :
(A) 4
(B) 10
(C) 6
(D) 8

Q54 Let $\mathrm{A} = \{1, 2, 3, \ldots, 100\}$ and R be a relation on A such that $\mathrm{R} = \{(a, b) : a = 2b + 1\}$. Let $(a_1, a_2), (a_2, a_3), (a_3, a_4), \ldots, (a_k, a_{k+1})$ be a sequence of k elements of R such that the second entry of an ordered pair is equal to the first entry of the next ordered pair. Then the largest integer k, for which such a sequence exists, is equal to :
(A) 6
(B) 7
(C) 5
(D) 8

Q55 If the length of the minor axis of an ellipse is equal to one fourth of the distance between the foci, then the eccentricity of the ellipse is :
(A) $\frac{4}{\sqrt{17}}$
(B) $\frac{\sqrt{3}}{16}$
(C) $\frac{3}{\sqrt{19}}$
(D) $\frac{\sqrt{5}}{7}$

Q56 The line L_1 is parallel to the vector $\vec{a} = -3\hat{i} + 2\hat{j} + 4\hat{k}$ and passes through the point $(7, 6, 2)$ and the line L_2 is parallel to the vector $\vec{b} = 2\hat{i} + \hat{j} + 3\hat{k}$ and passes through the point $(5, 3, 4)$. The shortest distance between the lines L_1 and L_2 is :
(A) $\frac{23}{\sqrt{38}}$
(B) $\frac{21}{\sqrt{57}}$
(C) $\frac{23}{\sqrt{57}}$
(D) $\frac{21}{\sqrt{38}}$

Q57 Let (a, b) be the point of intersection of the curve $x^2 = 2y$ and the straight line $y - 2x - 6 = 0$ in the second quadrant. Then the integral $I = \int_a^b \frac{9x^2}{1+5^x}dx$ is equal to :
(A) 24
(B) 27
(C) 18
(D) 21

Q58 If the system of equation
$2\mathrm{x} + \lambda\mathrm{y} + 3\mathrm{z} = 5$
$3\mathrm{x} + 2\mathrm{y} - \mathrm{z} = 7$
$4\mathrm{x} + 5\mathrm{y} + \mu\mathrm{z} = 9$
has infinitely many solutions, then $(\lambda^2 + \mu^2)$ is equal to :
(A) 22
(B) 18
(C) 26
(D) 30

Q59 If $\theta \in \left[-\frac{7\pi}{6}, \frac{4\pi}{3}\right]$, then the number of solutions of $\sqrt{3}\operatorname{cosec}^2\theta - 2(\sqrt{3} - 1)\operatorname{cosec}\theta - 4 = 0$, is equal to
(A) 6
(B) 8
(C) 10
(D) 7

Q60 Given three indentical bags each containing 10 balls, whose colours are as follows :

	Red	Blue	Green
Bag I	3	2	5
Bag II	4	3	3
Bag III	5	1	4

A person chooses a bag at random and takes out

a ball. If the ball is Red, the probability that it is from bag I is p and if the balls is Green, the probability that it is from bag III is q , then the value of $\left(\frac{1}{p} + \frac{1}{q}\right)$ is:

(A) 6   (B) 9

(C) 7   (D) 8

Q61 If the mean and the variance of $6, 4, a, 8, b, 12, 10, 13,$ are 9 and 9.25 respectively, then $a + b + ab$ is equal to :

(A) 105   (B) 103

(C) 100   (D) 106

Q62 If the domain of the function $f(x) = \frac{1}{\sqrt{10 + 3x - x^2}} + \frac{1}{\sqrt{x + |x|}}$ is (a, b), then $(1 + a)^2 + b^2$ is equal to :

(A) 26   (B) 29

(C) 25   (D) 30

Q63 $4 \int_0^1 \left(\frac{1}{\sqrt{3 + x^2} + \sqrt{1 + x^2}}\right) dx - 3 \log_e\left(\sqrt{3}\right)$ is equal to :

(A) $2 + \sqrt{2} + \log_e(1$ (B) $2 - \sqrt{2} - \log_e(1$
    $+ \sqrt{2})$ $+ \sqrt{2})$

(C) $2 + \sqrt{2} - \log_e(1$ (D) $2 - \sqrt{2} + \log_e(1$
    $+ \sqrt{2})$ $+ \sqrt{2})$

Q64 If $\lim\limits_{x \to 0} \frac{\cos(2x) + a\cos(4x) - b}{x^4}$ is finite, then $(a + b)$ is equal to :
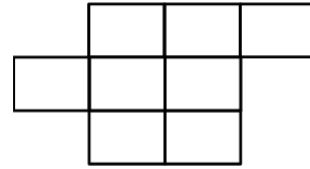
(A) $\frac{1}{2}$ (B) 0

(C) $\frac{3}{4}$ (D) -1

Q65 If $\sum_{r=0}^{10} \left(\frac{10^{r+1} - 1}{10^r}\right) \cdot {}^{11}C_{r+1} = \frac{\alpha^{11} - 11^{11}}{10^{10}}$, then α is equal to :

(A) 15   (B) 11

(C) 24   (D) 20

Q66 The number of ways, in which the letters A, B, C, D, E can be placed in the 8 boxes of the figure below so that no row remains empty and at most one letter can be placed in a box, is :

(A) 5880   (B) 960

(C) 840   (D) 5760

Q67 Let the point P of the focal chord PQ of the parabola $y^2 = 16x$ be $(1, -4)$. If the focus of the parabola divides the chord PQ in the ratio $m : n$, $\gcd(m, n) = 1$, then $m^2 + n^2$ is equal to :

(A) 17   (B) 10

(C) 37   (D) 26

Q68 Let $\vec{a} = 2\hat{i} - 3\hat{j} + \hat{k}, \vec{b} = 3\hat{i} + 2\hat{j} + 5\hat{k}$ and a vector $\vec{c}$ be such that $\left(\vec{a} - \vec{c}\right) \times \vec{b} = -18\hat{i} - 3\hat{j} + 12\hat{k}$ and $\vec{a} \cdot \vec{c} = 3$. If $\vec{b} \times \vec{c} = \vec{d}$, then $\left|\vec{a} \cdot \vec{d}\right|$ is equal to :

(A) 18   (B) 12

(C) 9   (D) 15

Q69 Let the area of the triangle formed by a straight Line $L : x + by + c = 0$ with co-ordinate axes be 48 square units. If the perpendicular drawn from the origin to the line L makes an angle of $45°$ with the positive x-axis, then the value of $b^2 + c^2$ is:

(A) 90   (B) 93

(C) 97   (D) 83

Q70 Let A be a 3×3 real matrix such that $A^2(A - 2I) - 4(A - I) = O$, where I and O are the identity and null matrices, respectively. If $A^5 = \alpha A^2 + \beta A + \gamma I$, where $\alpha, \ \beta$ and γ are real constants, then $\alpha + \beta + \gamma$ is equal to:

(A) 12   (B) 20

(C) 76   (D) 4

Q71

Let $y = y(x)$ be the solution of the differential equation

$$\frac{dy}{dx} + 2\,y\sec^2 x = 2\sec^2 x + 3\tan x \cdot \sec^2 x$$

such that $y(0) = \frac{5}{4}$. Then $12\left(y\left(\frac{\pi}{4}\right) - e^{-2}\right)$ is equal to _____ .

Q72 If the sum of the first 10 terms of the series

$$\frac{4.1}{1+4.1^4} + \frac{4.2}{1+4.2^4} + \frac{4.3}{1+4.3^4} + \ldots \text{ is } \frac{m}{n}, \text{ where}$$

$gcd\,(m, n) = 1$, then $m + n$ is equal to

_____ .

Q73 If $y = \cos\left(\frac{\pi}{3} + \cos^{-1}\frac{x}{2}\right)$, then

$(x - y)^2 + 3y^2$ is equal to_____ .

Q74 Let $A(4, -2),\ B(1, 1)$ and $C(9, -3)$ be the vertices of a triangle ABC. Then the maximum area of the parallelogram AFDE, formed with vertices D, E and F on the sides BC, CA and AB of the triangle ABC respectively, is _____ .

Q75 If the set of all $a \in R - \{1\}$, for which the roots of the equation

$(1 - a)x^2 + 2(a - 3)x + 9 = 0$ are positive is $(-\infty, -\alpha] \cup [\beta, \gamma)$, then $2\alpha + \beta + \gamma$ is equal to _____ .

Answer Key

Q1	(C)		Q31	(A)
Q2	(A)		Q32	(B)
Q3	(B)		Q33	(D)
Q4	(C)		Q34	(B)
Q5	(C)		Q35	(C)
Q6	(A)		Q36	(C)
Q7	(D)		Q37	(C)
Q8	(B)		Q38	(B)
Q9	(D)		Q39	(A)
Q10	(D)		Q40	(D)
Q11	(D)		Q41	(B)
Q12	(B)		Q42	(B)
Q13	(B)		Q43	(B)
Q14	(A)		Q44	(D)
Q15	(A)		Q45	(C)
Q16	(B)		Q46	1
Q17	(B)		Q47	12
Q18	(A)		Q48	45
Q19	(D)		Q49	1
Q20	(D)		Q50	3
Q21	43		Q51	(B)
Q22	23		Q52	(B)
Q23	184		Q53	(A)
Q24	25		Q54	(C)
Q25	0		Q55	(A)
Q26	(D)		Q56	(A)
Q27	(A)		Q57	(A)
Q28	(B)		Q58	(C)
Q29	(A)		Q59	(A)
Q30	(D)		Q60	(C)

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Q61 **(B)**

Q62 **(A)**

Q63 **(B)**

Q64 **(A)**

Q65 **(D)**

Q66 **(D)**

Q67 **(A)**

Q68 **(D)**

Q69 **(C)**

Q70 **(A)**

Q71 21

Q72 441

Q73 3

Q74 3

Q75 7

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Hints & Solutions

Note: scan the QR code to watch video solution

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Q2 Video Solution:

Q3 Video Solution:

Q4 Video Solution:

Q5 Video Solution:

Q6 Video Solution:

Q7 Video Solution:

Q8 Video Solution:

Q9 Video Solution:

Q10 Video Solution:

Q11 Video Solution:

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Q12   Video Solution:

Q13   Video Solution:

Q14   Video Solution:

Q15   Video Solution:

Q16   Video Solution:

Q17   Video Solution:

Q18   Video Solution:

Q19   Video Solution:

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Q65   Video Solution:

Q66   Video Solution:

Q67   Video Solution:

Q68   Video Solution:

Q69   Video Solution:

Q70   Video Solution:

Q71   Video Solution:

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Q72 Video Solution:

Q73 Video Solution:

Q74 Video Solution:

Q75 Video Solution:

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