JEE MAIN 2020

FULL TEST-1

CHEMISTRY , PHYSICS, MATHEMATICS

Time : - 3 Hours **Max. Marks:- 300** **Date : .....**

INSTRUCTIONS :

1. The test is of 3 hours duration.
2. The Test Booklet consists of 75 questions. The maximum marks are **300.**
3. There are three parts in the question paper A, B, C consisting of Chemistry, Physics and Mathematics having **25 questions** in each part of equal weightage. **20 questions** will be **MCQs** and **5 questions** will have answer to be filled as **numerical value**.
   Marking Scheme for MCQs
   Correct Answer Four mark (+4), Incorrect Answer Minus one mark (–1), Unanswered No mark (0)
   Marking Scheme for questions for which answer is a **Numerical value**
   Correct Answer Four mark (+4), Incorrect Answer No mark (0), Unanswered No mark (0)
4. There is only one correct response for each question. Filling up more than one response in each question will be treated as wrong response and marks for wrong response will be deducted accordingly.

Take risks: if you win, you will be happy ; if you lose, you will be wise.

An obstacle is often a Stepping stone.

Every person is born with the talent.

Name : .....

Address : .....

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Phone/Mobile No. .....

Roll No. .....

PART A – CHEMISTRY

SECTION - 1 (Q.1 - Q.20)

Each question has FOUR options (1), (2), (3) and (4). ONLY ONE of these four options is correct.

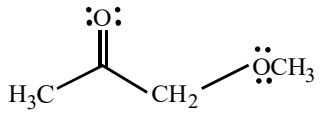
Q.1 The conductivity measurement of a coordination compound of Cobalt (III) shows that it dissociates into 3 ions in solution. The compound is
(1) Hexaamminecobalt(III) chloride
(2) Pentaamminesulphatocobalt(III) chloride
(3) Pentaamminechloridocobalt(III) sulphate
(4) Pentaamminechloridocobalt(III) chloride

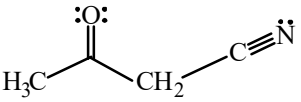
Q.2 Which is the major product obtained by hydrolysis of compound formed by reaction between formaldehyde and ethyl magnesium bromide?
(1) Ethan-1-ol
(2) Propan-2-ol
(3) Propan-1-ol
(4) 2-Methyl-propan-2-ol

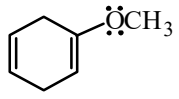
Q.3 The total number of isomeric liner dipeptide which can be synthesized from racemic alanine is
(1) 1 (2) 2
(3) 3 (4) 4

Q.4 The charge carried by 1 millimole of M^{n+} ions is 193 coulombs. The value of n is
(1) 1 (2) 2
(3) 3 (4) 4

Q.5 The molecule/molecules that has/have delocalised lone pair(s) of electrons is/are

(I) 

(II) 

(III) 

(IV) $CH_3CH = CHCH_2\ddot{N}HCH_3$

(1) I, II and III (2) I, II and IV
(3) I and III (4) only III

Q.6 Which one of the following electronic arrangements is absurd?
(1) n = 3, ℓ = 1, m = –1 (2) n = 3, ℓ = 0, m = 0
(3) n = 2, ℓ = 0, m = –1 (4) n = 2, ℓ = 1, m = 0

Q.7 In order to oxidise a mixture one mole of each of FeC_2O_4, $Fe_2(C_2O_4)_3$, $FeSO_4$ and $Fe_2(SO_4)_3$ in acidic medium , the number of moles of $KMnO_4$ required is -
(1) 3 (2) 2
(3) 1 (4) 1.5

Q.8 Which one of the following is likely to give a precipitate with $AgNO_3$ solution ?
(1) $(CH_3)_3CCl$ (2) $CHCl_3$
(3) $CH_2 = CH - Cl$ (4) CCl_4

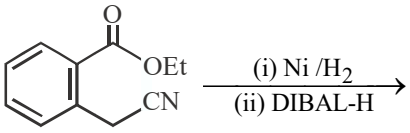
Q.9 1 g of non-volatile non-electrolyte solute is dissolved in 100g of two different solvents A and B whose ebullioscopic constants are in the ratio of 1 : 5. The ratio of the elevation in their boiling points, $\frac{\Delta T_{b\,(A)}}{\Delta T_{b\,(B)}}$, is :
(1) 5 : 1 (2) 10 : 1
(3) 1 : 5 (4) 1 : 0.2

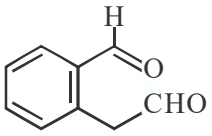
Q.10 Among the following, the INCORRECT statement about colloids is :
(1) They can scatter light.
(2) They are larger than small molecules and have high molar mass.
(3) The range of diameters of colloidal particles is between 1 and 1000 nm.
(4) The osmotic pressure of a colloidal solution is of higher order than the true solution at the same concentration.

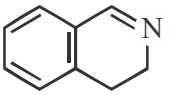
Q.11 The radius of the largest sphere which fits properly at the centre of the edge of body centred cubic unit cell is : (Edge length is represented by 'a') :-
(1) 0.134 a (2) 0.027 a
(3) 0.067 a (4) 0.047 a

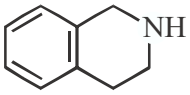
SPACE FOR ROUGH WORK

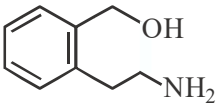
Q.12 The major product of the following reaction is:



(1) 

(2) 

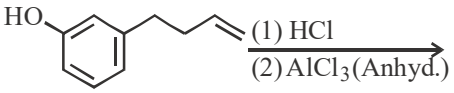
(3) 

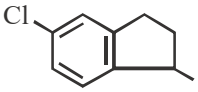
(4) 

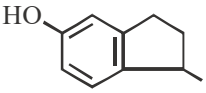
Q.13 Three complexes, $[CoCl(NH_3)_5]^{2+}$ (I), $[Co(NH_3)_5H_2O]^{3+}$ (II) and $[Co(NH_3)_6]^{3+}$ (III) absorb light in the visible region. The correct order of the wavelength of light absorbed by them is :

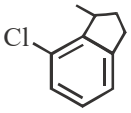
(1) (III) > (I) > (II) (2) (I) > (II) > (III)
(3) (II) > (I) > (III) (4) (III) > (II) > (I)

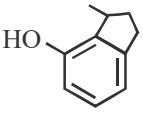
Q.14 The major product of the following reaction is :



(1) 

(2) 

(3) 

(4) 

Q.15 The primary pollutant that leads to photochemical smog is :

(1) Sulphur dioxide (2) Acrolein
(3) Ozone (4) Nitrogen oxides

Q.16 NaH is an example of :

(1) Electron-rich hydride (2) Molecular hydride
(3) Saline hydride (4) Metallic hydride

Q.17 For the reaction of H_2 with I_2, the rate constant is $2.5 \times 10^{-4} dm^3\ mol^{-1}\ s^{-1}$ at 327°C and 1.0 $dm^3\ mol^{-1}\ s^{-1}$ at 527°C. The activation energy for the reaction, in kJ mol^{-1} is:
($R = 8.314\ J\ K^{-1}\ mol^{-1}$)

(1) 72 (2) 166
(3) 150 (4) 59

Q.18 Which of the following order is **incorrect** :

(1) Ionic character – $MCl > MCl_2 > MCl_3$
(2) Polarizability – $F^- < Cl^- < Br^- < I^-$
(3) Polarising power – $Na^+ < K^+ < Mg^{+2} < Al^{+3}$
(4) Polarising power – $Li^+ < Be^{+2} < B^{+3}$

Q.19 $(CH_3)_2CHBr \xrightarrow[(ii)\ CuI]{(i)\ Li} A \xrightarrow{(CH_3)_2CHCH_2Br} B$

'B' is -

(1) $(CH_3)_2CHCH_2CH_3$
(2) $(CH_3)_2CHCH(CH_3)_2$
(3) $(CH_3)_2CHCH_2CH(CH_3)_2$
(4) $(CH_3)_2CHCH_2CH_2CH(CH_3)_2$

Q.20 Calculate the potential of an indicator electrode versus the standard hydrogen electrode, which originally contained 0.1 M MnO_4^- and 1.72 M H^+ and which was treated with Fe^{2+} necessary to reduce 90% of $KMnO_4$ to Mn^{2+}

$E^0_{MnO_4^-/Mn^{2+}} = 1.51V$

(1) 1.4 V (2) 1.5 V
(3) 1.6 V (4) 1.3 V

SECTION - 2 (Q.21 - Q.25)

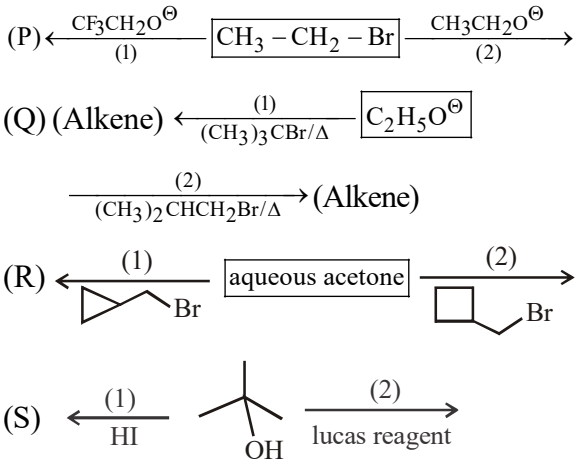
The answer to each question is a SINGLE DIGIT INTEGER ranging from 0 to 9, both inclusive.

Q.21 An adiabatic container fitted with a movable adiabatic piston (operating at 1 atm) is filled with 2 litre of 2M H_2O_2(aq) solution at 300 K. If H_2O_2 dissociates following first order decay with a half life of 10min then value of [Magnitude of change in internal energy (in cal) ÷ 100] in first 20 min will be

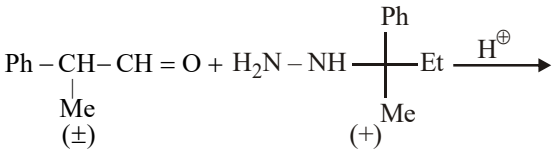
Q.22 Number of compounds which are planar ?
XeF_2, ClF_3, H_2O, $[XeF_5]^-$, I_3^-, BCl_3, XeF_4, SF_4, PCl_5, SF_6, IF_7.

SPACE FOR ROUGH WORK

Q.23 In how many reactions the 1st reaction is faster than 2nd reaction ?



Q.24 The number of stereoisomers of the product obtained in the following reaction is :



Q.25 Na_2SO_3, NaCl, $Na_2C_2O_4$, Na_2HPO_4, Na_2CrO_4, $NaNO_2$, CH_3COONa are separately treated with $AgNO_3$ solution. In how many cases white ppt. is/ are obtained?

PART B – PHYSICS

SECTION - 1 (Q.26 - Q.45)

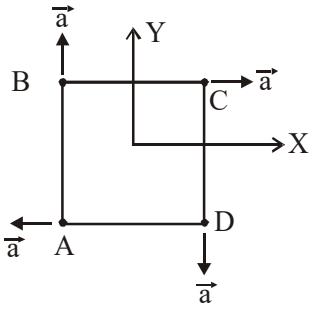
Each question has FOUR options (1), (2), (3) and (4). ONLY ONE of these four options is correct.

Q.26 To which of the following the angular velocity of the electron in the n-th Bohr orbit is proportional ?

(1) n^2 (2) $1 / n^2$

(3) $1 / n^{3/2}$ (4) $1/n^3$

Q.27 Four particles A, B, C and D with masses $m_A = m$, $m_B = 2m$, $m_C = 3m$ and $m_D = 4m$ are at the corners of a square. They have accelerations of equal magnitude with directions as shown. The acceleration of the centre of mass of the particles is :



(1) $\frac{a}{5}(\hat{i} - \hat{j})$ (2) $\frac{a}{5}(\hat{i} + \hat{j})$

(3) Zero (4) $a\,(\hat{i} + \hat{j})$

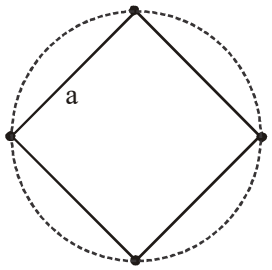
Q.28 A horizontal fire hose with a nozzle of cross-sectional area $\frac{5}{\sqrt{21}} \times 10^{-3} m^2$ delivers a cubic metre of water in 10s. What will be the maximum possible increase in the temperature of water while it hits a rigid wall (neglecting the effect of gravity)?

(1) 1°C (2) 0.1°C

(3) 10°C (4) 0.01°C

Q.29 Four identical particles of mass M are located at the corners of a square of side 'a'. What should be their speed if each of them revolves under the influence of other's gravitational field in a circular orbit circumscribing the square?

SPACE FOR ROUGH WORK



(1) $1.21\sqrt{\frac{GM}{a}}$ (2) $1.41\sqrt{\frac{GM}{a}}$

(3) $1.16\sqrt{\frac{GM}{a}}$ (4) $1.35\sqrt{\frac{GM}{a}}$

Q.30 A moving coil galvanometer has a coil with 175 turns and area 1 cm^2. It uses a torsion band of torsion constant 10^{-6} N-m/rad. The coil is placed in a magnetic field B parallel to its plane. The coil deflects by 1° for a current of 1 mA. The value of B (in Tesla) is approximately :

(1) 10^{-3} (2) 10^{-1}

(3) 10^{-4} (4) 10^{-2}

Q.31 The temperature, at which the root mean square velocity of hydrogen molecules equals their escape velocity from the earth, is closest to :

[Boltzmann Constant $k_B = 1.38 \times 10^{-23}$ J/K

Radius of Earth : 6.4×10^6 m

Gravitational acceleration on Earth = $10 ms^{-2}$]

(1) 650 K (2) 3×10^5 K

(3) 10^4 K (4) 800 K

Q.32 A massless spring (k = 800 N/m), attached with a mass (500 g) is completely immersed in 1 kg of water. The spring is stretched by 2 cm and released so that it starts vibrating. What would be the order of magnitude of the change in the temperature of water when the vibrations stop completely ? (Assume that the water container and spring receive negligible heat and specific heat of mass = 400 J/kg K, specific heat of water = 4184 J/kg K)

(1) 10^{-3} K (2) 10^{-4} K

(3) 10^{-1} K (4) 10^{-5} K

Q.33 A plane electromagnetic wave having a frequency ν = 23.9 GHz propagates along the positive z-direction in free space. The peak value of the electric field is 60 V/m. Which among the following is the acceptable magnetic field component in the electromagnetic wave ?

(1) $\vec{B} = 2\times10^{7} \sin(0.5\times10^{3}z + 1.5\times10^{11}t)\,\hat{i}$

(2) $\vec{B} = 2\times10^{-7} \sin(1.5\times10^{2}x + 0.5\times10^{11}t)\,\hat{j}$

(3) $\vec{B} = 2\times10^{-7} \sin(0.5\times10^{3}z - 1.5\times10^{11}t)\,\hat{i}$

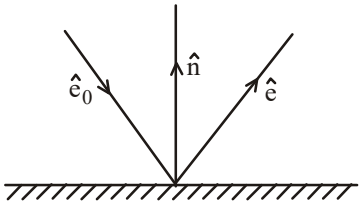
(4) $\vec{B} = 60\sin(0.5\times10^{3}x + 1.5\times10^{11}t)\,\hat{k}$

Q.34 In an electron microscope, the resolution that can be achieved is of the order of the wavelength of electrons used. To resolve a width of 7.5×10^{-12} m, the minimum electron energy required is close to :

(1) 100 keV (2) 500 keV

(3) 25 keV (4) 1 keV

Q.35 A ray of light is reflected by a plane mirror. $\hat{e}_0$, $\hat{e}$ and $\hat{n}$ be the unit vectors along the incident ray, reflected ray and the normal to the reflecting surface respectively. Which of the following gives an expression for $\hat{e}$?



(1) $\hat{e}_0 + 2(\hat{e}_0 \cdot \hat{n})\,\hat{n}$ (2) $\hat{e}_0 - 2(\hat{e}_0 \cdot \hat{n})\,\hat{n}$

(3) $\hat{e}_0 - (\hat{e}_0 \cdot \hat{n})\,\hat{n}$ (4) $\hat{e}_0 + (\hat{e}_0 \cdot \hat{n})\,\hat{n}$

Q.36 A square loop is carrying a steady current I and the magnitude of its magnetic dipole moment is m. If this square loop is changed to a circular loop and it carries the same current, the magnitude of the magnetic dipole moment of circular loop will be :

(1) $3m/\pi$ (2) $4m/\pi$

(3) $2m/\pi$ (4) m/π

SPACE FOR ROUGH WORK

Q.37 The resistance of a galvanometer is 50 ohm and the maximum current which can be passed through it is 0.002 A. What resistance must be connected to it in order to convert it into an ammeter of range 0 – 0.5 A ?

(1) 0.2 ohm (2) 0.002 ohm
(3) 0.02 ohm (4) 0.5 ohm

Q.38 A submarine (A) travelling at 18 km/hr is being chased along the line of its velocity by another submarine (B) travelling at 27 km/hr. B sends a sonar signal of 500 Hz to detect A and receives a reflected sound of frequency n. The value of n is close to : (Speed of sound in water = 1500 ms^{-1})

(1) 499 Hz (2) 502 Hz
(3) 507 Hz (4) 504 Hz

Q.39 Young's moduli of two wires A and B are in the ratio 7 : 4. Wire A is 2 m long and has radius R. Wire B is 1.5 m long and has radius 2 mm. If the two wires stretch by the same length for a given load, then the value of R is close to :-

(1) 1.9 mm (2) 1.7 mm
(3) 1.5 mm (4) 1.3 mm

Q.40 In SI units, the dimensions of $\sqrt{\frac{\varepsilon_0}{\mu_0}}$ is –

(1) $A^{-1}TML^3$ (2) $A^2T^3M^{-1}L^{-2}$
(3) $AT^2M^{-1}L^{-1}$ (4) $AT^{-3}ML^{3/2}$

Q.41 Eleven equal point charges, all of them having a charge +Q, are placed at all the hour positions of a circular clock of radius r, except at the 10 hour position. What is the electric field strength at the centre of the clock ?

(1) $\frac{Q}{4\pi\varepsilon_0 r^2}$ from the centre towards the mark 10

(2) $\frac{Q}{4\pi\varepsilon_0 r^2}$ from the mark 10 towards the centre

(3) $\frac{Q}{4\pi\varepsilon_0 r^2}$ from the centre towards the mark 6

(4) Zero

Q.42 A stone falls from a balloon that is descending at a uniform rate of 12 m/s. The displacement of the stone from the point of release after 10 s is (Take g = 10 ms^2) :

(1) 490 m (2) 510 m
(3) 620 m (4) 725 m

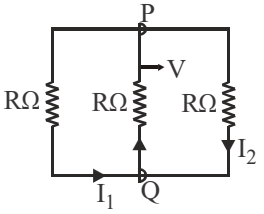
Q.43 If the kinetic energy of the particle is increased by 16 times, the percentage change in the de Broglie wavelength of the particle is :

(1) 25 % (2) 75 %
(3) 60 % (4) 50 %

Q.44 Two identical metal plates show photoelectric effect by a light of wavelength λ_A falling on plate A and λ_B on plate B ($\lambda_A = 2\lambda_B$). The maximum kinetic energy is :

(1) $2K_A = K_B$ (2) $K_A < K_B / 2$
(3) $K_A = 2K_B$ (4) $K_A > K_B/2$

Q.45 A rectangular loop has a sliding connector PQ of length ℓ and resistance RΩ and it is moving with a speed v as shown. The set-up is placed in a uniform magnetic field going into the plane of the paper. The three currents I_1, I_2 and I are:



(1) $I_1 = I_2 = \frac{B\ell v}{6R}$, $I = \frac{B\ell v}{3R}$

(2) $I_1 = -I_2 = \frac{B\ell v}{R}$, $I = \frac{2B\ell v}{R}$

(3) $I_1 = I_2 = \frac{B\ell v}{3R}$, $I = \frac{2B\ell v}{3R}$

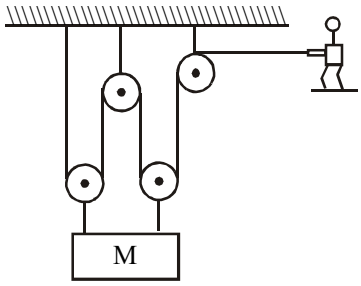
(4) $I_1 = I_2 = I = \frac{B\ell v}{R}$

SPACE FOR ROUGH WORK

SECTION - 2 (Q.46 - Q.50)

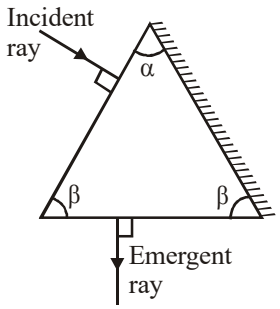
The answer to each question is a SINGLE DIGIT INTEGER ranging from 0 to 9, both inclusive.

Q.46 Mechanical advantage for pulling mass M by the person is

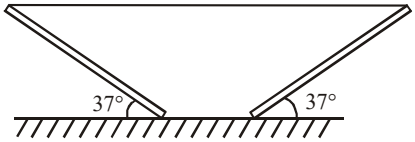


Q.47 A radioactive sample consists of two distinct species having equal number of N_0 atoms initially. The mean-life of one species is τ and of the other is 5τ. The decay products in both cases is stable. The total number of radioactive nuclei at $t = 5\tau$ is $N_0\left(\frac{e^A+1}{e^5}\right)$. Find the value of A.

Q.48 The cross-section of a glass prism has the form of an isosceles triangles. One of the equal faces is coated with silver. A ray is normally incident on another unsilvered face and being reflected twice emerges through the base of the prism perpendicular to it. Then find the value of x if angle $\alpha = 18x$, where α is in degree :



Q.49 Two uniform rods tied together with the help of a string are balanced as shown in the figure. The minimum coefficient of friction for which the system will remain in equilibrium in the position is 2/x. The value of 'x' is –



Q.50 What is the ratio of powers delivered by 20 V dc and 20 V peak ac to the same load ?

PART C – MATHEMATICS

SECTION - 1 (Q.51 - Q.70)

Each question has FOUR options (1), (2), (3) and (4). ONLY ONE of these four options is correct.

Q.51 The direction ratios of the normal of the plane passing through the points (1, 2, 3), (–1, –2,1) and parallel to $\frac{x-2}{2}=\frac{y+1}{3}=\frac{z}{4}$ is –

(1) (2, 3, 4) (2) (14, –8, –1)
(3) (–2, 0, –3) (4) (1, –2, –3)

Q.52 Let A be a square matrix of order 3 whose all entries are 1 and let I_3 be the identity matrix of order 3. Then the matrix $A - 3I_3$ is
(1) invertible
(2) orthogonal
(3) non-invertible
(4) real skew symmetric matrix

Q.53 A point on the straight line, $3x + 5y = 15$ which is equidistant from the coordinate axes will lie only in
(1) 1^{st} and 2^{nd} quadrants
(2) 4^{th} quadrant
(3) 1^{st}, 2^{nd} and 4^{th} quadrant
(4) 1^{st} quadrant

Q.54 Let z be a complex number such that the principal value of argument, $\arg z > 0$. Then $\arg z - \arg(-z)$ is –

(1) $\pi/2$ (2) $\pm\pi$
(3) π (4) $-\pi$

SPACE FOR ROUGH WORK

Q.55 The sum of the series
$2.{}^{20}C_0 + 5.{}^{20}C_1 + 8.{}^{20}C_2 + 11.{}^{20}C_3 + ... + 62.{}^{20}C_{20}$
is equal to :
(1) 2^{24} (2) 2^{25}
(3) 2^{26} (4) 2^{23}

Q.56 Let S, T, U be three non-void sets and $f : S \to T$, $g : T \to U$ be so that $g \circ f : S \to U$ is surjective. Then
(1) g and f are both surjective.
(2) g is surjective, f may not be so.
(3) f is surjective, g may not be so.
(4) f and g both may not be surjective.

Q.57 S and T are the foci of an ellipse and B is the end point of the minor axis. If STB is equilateral triangle, the eccentricity of the ellipse is
(1) 1/4 (2) 1/3
(3) 1/2 (4) 2/3

Q.58 If $f(x) = [x] - \left[\frac{x}{4}\right]$, $x \in R$, where [x] denotes the greatest integer function, then :
(1) Both $\lim\limits_{x\to4^-} f(x)$ and $\lim\limits_{x\to4^+} f(x)$ exist but are not equal.
(2) $\lim\limits_{x\to4^-} f(x)$ exists but $\lim\limits_{x\to4^+} f(x)$ does not exist.
(3) $\lim\limits_{x\to4^+} f(x)$ exists but $\lim\limits_{x\to4^-} f(x)$ does not exist.
(4) f is continuous at x = 4

Q.59 General solution of $(x+y)^2 \frac{dy}{dx} = a^2$, $a \neq 0$ is (c is arbitrary constant)
(1) $\frac{x}{a} = \tan\frac{y}{a} + c$ (2) $\tan xy = c$
(3) $\tan(x+y) = c$ (4) $\tan\frac{y+c}{a} = \frac{x+y}{a}$

Q.60 The mean and variance of seven observations are 8 and 16, respectively. If 5 of the observations are 2, 4, 10, 12, 14, then the product of the remaining two observations is :
(1) 40 (2) 49
(3) 48 (4) 45

Q.61 Let $\hat{\alpha}, \hat{\beta}, \hat{\gamma}$ be three unit vectors such that where
$\hat{\alpha} \times (\hat{\beta} \times \hat{\gamma}) = \frac{1}{2}(\hat{\beta} \times \hat{\gamma}) = (\hat{\alpha} \cdot \hat{\gamma})\hat{\beta} - (\hat{\alpha} \cdot \hat{\beta})\hat{\gamma}$
If $\hat{\beta}$ is not parallel to $\hat{\gamma}$, then the angle between $\hat{\alpha}$ and $\hat{\beta}$ is –
(1) $5\pi/6$ (2) $\pi/6$
(3) $\pi/3$ (4) $2\pi/3$

Q.62 For any two statements p and q, the negation of the expression $p \vee (\sim p \wedge q)$ is
(1) $p \wedge q$ (2) $p \leftrightarrow q$
(3) $\sim p \vee \sim q$ (4) $\sim p \wedge \sim q$

Q.63 If the tangent to the parabola $y^2 = x$ at a point (α, β), $(\beta > 0)$ is also a tangent to the ellipse, $x^2 + 2y^2 = 1$, then α is equal to :
(1) $2\sqrt{2}+1$ (2) $\sqrt{2}-1$
(3) $\sqrt{2}+1$ (4) $2\sqrt{2}-1$

Q.64 The area bounded by y = x + 1 and y = cos x and the x-axis, is
(1) 1 sq. unit (2) (3/2) sq. unit
(3) (1/4) sq. unit (4) (1/8) sq. unit

Q.65 $\lim\limits_{x\to0^+} (x^n \ln x)$, $n > 0$
(1) does not exist (2) exists and is zero
(3) exists and is 1 (4) exists and is e^{-1}

Q.66 Let the sum of the first n terms of a non-constant A.P., $a_1, a_2, a_3, ...$ be $50n + \frac{n(n-7)}{2}A$, where A is a constant. If d is the common difference of this A.P., then the ordered pair (d, a_{50}) is equal to
(1) (A, 50 + 46A) (2) (A, 50+45A)
(3) (50, 50+46A) (4) (50, 50+45A)

SPACE FOR ROUGH WORK

Q.67 The value of the integral

$$\int_0^1 x\cot^{-1}(1-x^2+x^4)\,dx \text{ is}$$

(1) $\frac{\pi}{4}-\frac{1}{2}\log_e 2$ (2) $\frac{\pi}{2}-\log_e 2$

(3) $\frac{\pi}{2}-\frac{1}{2}\log_e 2$ (4) $\frac{\pi}{4}-\log_e 2$

Q.68 Let P and T be the subsets of X-Y plane defined by $P = \{(x,y) : x > 0, y > 0 \text{ and } x^2 + y^2 = 1\}$
$T = \{(x,y) : x > 0, y > 0 \text{ and } x^8 + y^8 < 1\}$
Then $P \cap T$ is
(1) the void set ϕ (2) P
(3) T (4) $P - T^C$

Q.69 The probability that an event A occurs in a single trial of an experiment is 0.6. In the first three independent trials of the experiment, the probability that A occurs atleast once is –
(1) 0.930 (2) 0.936
(3) 0.925 (4) 0.927

Q.70 If the length of the subnormal at any point of the curve is constant, then the eccentricity of this curve is –
(1) $e = \sqrt{2}$ (2) $e > 1$
(3) $0 < e < 1$ (4) $e = 1$

SECTION - 2 (Q.71 - Q.75)

The answer to each question is a SINGLE DIGIT INTEGER ranging from 0 to 9, both inclusive.

Q.71 Number of real solutions of the equation $x^4 + 8x^2 + 16 = 4x^2 - 12x + 9$ is equal to -

Q.72 The number of solutions of the equation $\tan^2 x - \sec^{10} x + 1 = 0$ in (0, 10) is -

Q.73 If a circle C passing through the point (4,0) touches the circle $x^2 + y^2 + 4x - 6y = 12$ externally at the point (1, –1), then the radius of C is :

Q.74 Let f be a differentiable function such that

$$f'(x) = 7 - \frac{3}{4}\frac{f(x)}{x}, (x > 0) \text{ and } f(1) \neq 4.$$

$$\lim_{x\to 0^+} x\, f\left(\frac{1}{x}\right) = A. \text{ Find the value of A.}$$

Q.75 The number of values of $\theta \in (0, \pi)$ for which the system of linear equations

$x + 3y + 7z = 0$
$-x + 4y + 7z = 0$
$(\sin 3\theta)\, x + (\cos 2\theta)\, y + 2z = 0$

has a non-trivial solution, is :

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