

JEE (MAIN)

TEST PAPER

SUBJECT : PHYSICS,CHEMISTRY, MATHEMATICS **TEST CODE : TEST PAPER-3**

QUESTION PAPER

TIME : 3 HRS **MARKS : 300**

INSTRUCTIONS

GENERAL INSTRUCTIONS :

- 1. This test consists of 75 questions.
- 2. There are three parts in the question paper A, B, C consisting of Physics, Chemistry and Mathematics having 25 questions in each part
- 3. 20 questions will be Multiple choice questions & 5 questions will have answer to be filled as numerical value.
- 4. Marking scheme :

Type of Questions	Total Number of Questions	Correct Answer	Incorrect Answer	Unanswered
MCQ's	20	+4	Minus One Mark(-1)	No Mark (0)
Numerical Values	5	+4	No Mark (0)	No Mark (0)

- 5. 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 as per instruction 4 above.

OPTICAL MARK RECOGNITION (OMR) :

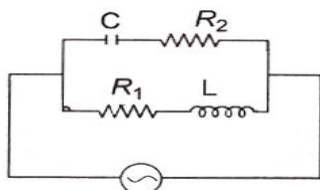
- 6. The OMR will be provided to the students.
- 7. Darken the appropriate bubbles on the OMR sheet by applying sufficient pressure.
- 8. The OMR sheet will be collected by the invigilator at the end of the examination.
- 9. Do not tamper with or mutilate the OMR. Do not use the OMR for rough work.
- 10. Write your name, Batch name, name of the center, Test Code, roll number and signature with pen in the space provided for this purpose on the OMR. Do not write any of these details anywhere else on the OMR.

DARKENING THE BUBBLES ON THE OMR :

- 11. Use a BLACK BALL POINT PEN to darken the bubbles on the OMR.
- 12. Darken the bubble COMPLETELY.
- 13. Darken the bubbles ONLY IF you are sure of the answer. There is NO WAY to erase or "un-darken" a darkened bubble.

Part A - PHYSICS

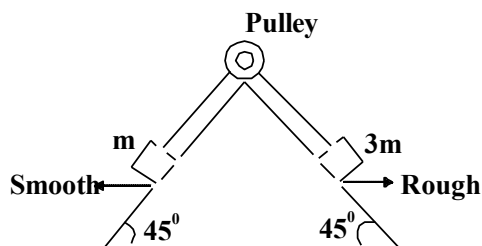
- Q.1 If a body is positively charged, then
 (a) It may have more number of protons
 (b) It may have only protons
 (c) It may have only electrons
 (d) Both (a) and (b)
- Q.2 In the circuit shown in figure, $R_1 = 10\Omega$, $L = \frac{\sqrt{3}}{10}$ H, $R_2 = 20\Omega$ and $C = \frac{\sqrt{3}}{2}$ mF. The current in LR_1 circuit is I_1 , in CR_2 circuit is I_2 and the main current is I .



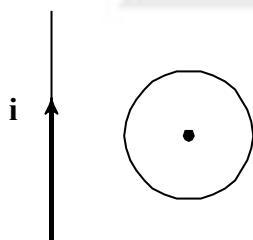
$V_t = 200\sqrt{2} \sin(100t)$ volt The phase difference between I_1 and I_2 is
 (a) 90° (b) 45° (c) 30° (d) 75°

- Q.3 The percentage errors in the measurement of mass and speed are 2% and 3% respectively. How much will be the maximum error in the estimation of kinetic energy obtained by measuring mass and speed ?
 (a) 11 % (b) 8 % (c) 5 % (d) 1 %
- Q.4 In determination of refractive index of glass slab using travelling microscope, first of all we took a reading when the microscope is focussed on a mark. This reading comes out to be s_1 , then we place a glass slab on the surface covering the mark. Now, the microscope is readjusted to focus the mark through the slab and this time reading come out to be s_2 . Then we place an opaque object on the glass slab and adjust the microscope to focus on opaque object. This time the reading of microscope is s_3 . The refractive index of the glass slab is
 (a) $\frac{s_3 - s_1}{s_2 - s_1}$ (b) $\frac{s_3 - s_2}{s_2 - s_1}$ (c) $\frac{s_3 - s_1}{s_3 - s_2}$ (d) $\frac{s_3}{s_3 - s_2}$
- Q.5 Why the capacitance of a capacitor is not affected by surrounding conducting bodies?
 (a) From the formula $C = Q / V$, if Q changes, V changes and hence C remains same
 (b) The plates of the capacitor are arranged in such a way that the field created by charges accumulated on the plate is concentrated almost completely inside the capacitor
 (c) Capacitance changes due to induction phenomenon
 (d) Both (a) and (b)
- Q.6 Two spherical vessels of equal volume are connected by a narrow tube. The apparatus contains an ideal gas at 1 atm and 300 K. Now if one vessel is immersed in a bath of constant temperature 600 K and other in a bath of constant temperature 300 K, then common pressure will be
 (a) 1 atm (b) $4/5$ atm (c) $4/3$ atm (d) $3/2$ atm
- Q.7 A block is moving with constant velocity on a horizontal surface, then which one is incorrect ?
 (a) Some force must act on the body (b) Some forces may act on the body
 (c) Net force on the body must be zero (d) the body is in equilibrium

- Q.8 Acceleration of each block is given as $g / 5\sqrt{2}$. Find the magnitude and direction of force exerted by string on pulley

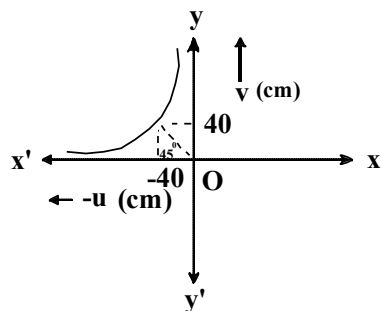


- (a) $6 mg/5$, downward direction
 (b) $6 mg/5$, upward direction
 (c) $6 mg/5$, horizontal direction
 (d) Not possible to have acceleration
- Q.9 A particle is moving along x -axis, under the action of a variable force which is providing position varying acceleration described by the equation, $a = 3x - 4$ at $t = 0$, $x = \frac{4}{3}$ m and $v = 0$. Find the velocity and position of particle at $t = 5$ s.
- (a) 0 m/s, 0 m (b) 0 m/s, $-\frac{8}{3}$ m (c) 0 m/s, $4/3$ m (d) None of these
- Q.10 A pulse or a wave train travels along a stretched string and reaches the fixed end of the string. It will be reflected back with
- (a) The same phase as the incident pulse but with velocity reversed
 (b) A phase change of 180° with no reversal of velocity
 (c) The same phase as the incident pulse with no reversal of velocity
 (d) A phase change of 180° with velocity reversed
- Q.11 If we consider the Rutherford model of atom, then from classical theory the electron will follow a spiral path due to continuously radiated energy and finally falls to nucleus, then the wavelength of continuously emitted electromagnetic radiation [Assume speed of electron to be constant as electron is going towards the centre]
- (a) remains constant
 (b) continuously decreasing as electron is coming closer to nucleus
 (c) continuously increasing as electron is coming closer to nucleus
 (d) randomly changes
- Q.12 If i is increasing continuously, then find the direction of induced current in the loop.



- (a) Anti-clockwise (b) Clockwise
 (c) In any direction (d) No current will be induced
- Q.13 A body of mass m is placed on the earth's surface. It is taken from the earth's surface to a height $h = 3R$. The change in gravitational potential energy of the body is
- (a) $\frac{2}{3} mgR$ (b) $\frac{3}{4} mgR$ (c) $\frac{mgR}{2}$ (d) $\frac{mgR}{4}$

- Q.14 Consider the following u-v diagram regarding the experiment to determine the focal length of a convex lens.

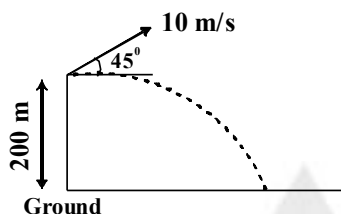


At the point A, the values of u and v are equal. The focal length of the lens is

- (a) 40 cm (b) 20 cm (c) 10 cm (d) 15 cm
- Q.15 A uniform rope, of mass m per unit length, hangs vertically from a support so that the lower end just touches the table top. If it is released, then at the time a length y of the rope has fallen, the force on the table is equivalent to the weight of the length Ky of the rope. Find the value of K .
- (a) 1 (b) 2 (c) 3 (d) 3.5
- Q.16 A body when projected vertically up covers a total distance s , during its time of flight. If we neglect gravity then how much distance, the particle, will travel during the same time. Will it fall back ?
- (a) s , Yes (b) s , No (c) $2s$, Yes (d) $2s$, No
- Q.17 Electric flux crossing the surface S , which encloses a charge q , will be maximum if surface S is
- (a) Spherical (b) Cube (c) Cylindrical (d) Same in all three
- Q.18 Regarding ideal gas, mark the incorrect option.
- (a) Internal energy is comprising of PE and KE
 (b) Monatomic gas has zero PE, because it is having single atom
 (c) Vibration energy may have non-zero value for monoatomic gas
 (d) At room temperature, the internal energy is comprising of translational and rotational KE only.
- Q.19 $dQ = nCdT$ represents the
- (a) Change in amount of heat contained in a body, as a result of temperature change
 (b) Amount of heat energy, which transits from one body to other due to temperature difference
 (c) Both (a) and (b) are correct
 (d) None of the above
- Q.20 If an isolated charge particle is moving in a magnetic field, then
- (a) Its kinetic energy remains constant (b) Work done by magnetic force is zero
 (c) Velocity of particle must vary with time (d) All of the above
- Q.21 Two parallel and opposite forces, each 4000 N, are applied tangentially to the upper and lower faces of a cubical metal block 25 cm on a side. Find the angle of shear and the displacements of the upper surface relative to the lower surface. The shear modulus for the metal is 80 Gpa?
- Q.22 The magnetic field in a region between the poles of an electromagnet is uniform at any time, but its magnitude is increasing at the rate of 0.02 T/s. A conducting loop is placed in this region, whose plane is perpendicular to direction of magnetic field. Calculate the emf

induced and induced current in the loop. Take cross-section area of loop as 120 cm^2 and resistance of loop as 5Ω ?

- Q.23 What force is exerted on a stationary flat plate held perpendicular to jet of water ? The horizontal speed of the water is 80 cm/s and 30 cm^3 of the water hits the plate each second. Assume that the water moves parallel to the plate after striking it. One cubic centimetre of water has a mass of one gram.
- Q.24 A particle has been projected from the top of tower as shown in figure. Find the time taken by the particle to reach the ground. (Take $g = 10 \text{ m/s}^2$)

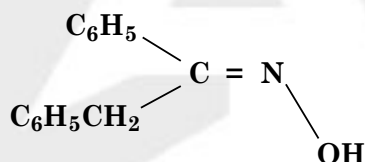


- Q.25 A uniform rectangular marble slab is 3.4 m long and 2.0 m wide. It has a mass of 180 kg . If it is originally lying on the flat ground, how much work is needed to stand it on one end ?

Part - B - CHEMISTRY

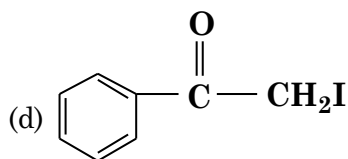
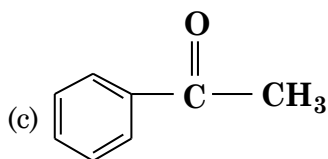
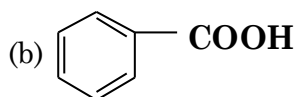
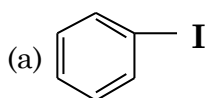
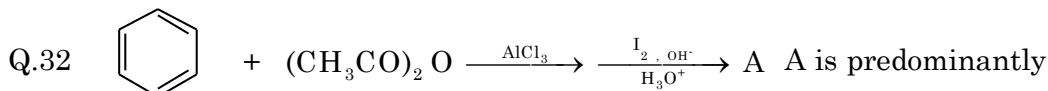
- Q.26 The separation of lanthanides by ion exchange method is based on
 (a) Size of the ions (b) Oxidation state of the ions
 (c) The solubility of their nitrates (d) Basicity of hydroxides of lanthanides
- Q.27 Dimethyl glyoxime in a suitable solvent was refluxed for 10 min with pure pieces of Nickel sheet, it will result in
 (a) Red precipitate (b) Blue precipitate
 (c) Yellow precipitate (d) No precipitate

- Q.28 Beckman transformation of



Followed by hydrolysis will yield

- (a) Benzoic acid + benzylamine (b) Phenylacetic acid + benzylamine
 (c) Aniline + phenylacetic acid (d) Benzoic acid + aniline
- Q.29 The wavelength of spectral line for an electronic transition is inversely related to
 (a) The number of electrons undergoing transition
 (b) The nuclear charge of the atom
 (c) The difference in the energy levels involved in the transition
 (d) The velocity of electron undergoing transition
- Q.30 A deliquescent white crystalline hydroxide X reacts with a nitrate Y to form another hydroxide which decomposes to give an insoluble brown layer of its oxide. X is a powerful caustic and breaks down the proteins of skin flesh to a pasty mass. X and Y are.
 (a) NaOH , AgNO_3 (b) NaOH , $\text{Zn(NO}_3)_2$
 (c) NaOH , $\text{Al(NO}_3)_3$ (d) Ca(OH)_2 , HgNO_3
- Q.31 Substances like sulphur and phosphorus are fairly soluble in alcohol but less soluble in water. If their alcoholic solution is poured in water, colloidal solutions of sulphur and phosphorus are obtained. This method can be called
 (a) Peptisation (b) Disintegration
 (c) Condensation (d) Dispersion



Q.33 Two hybrid orbitals have a bond angle of 120° , The percentage of s-character in the hybrid orbital is nearly

- (a) 25% (b) 33% (c) 50% (d) 66%

Q.34 The only cations present in a slightly acidic solution are Fe^{3+} , Zn^{2+} and Cu^{2+} . The reagent that when added in excess to this solution would identify and separate Fe^{3+} in one step is

- (a) 2M HCl (b) 6 M NH_3
(c) 6 M NaOH (d) H_2S gas

Q.35 In analogy to $\text{O}_2^+[\text{PtP}_6]^-$ a compound $\text{N}_2^+[\text{PtP}_6]^-$ will not be formed because

- (a) The ionisation enthalpy of N_2 gas is higher than that of O_2 gas
(b) The ionisation enthalpy of N_2 gas is lower than that of O_2 gas
(c) The ionisation enthalpy of N_2 gas is higher than that of N atom
(d) None of the above

Q.36 Gold (I) thiomaleate is used as medicine for the treatment of which one of the following ?

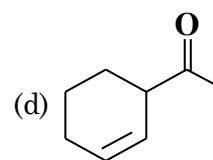
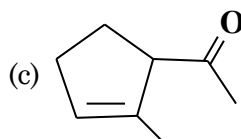
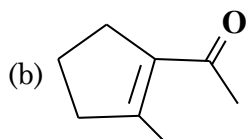
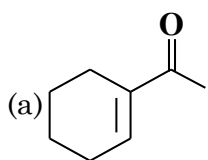
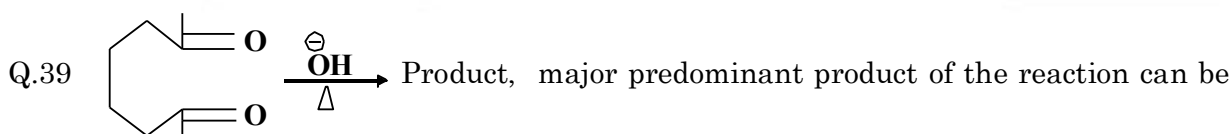
- (a) Malaria (b) Arthritis (c) Diabetes (d) Ulcer

Q.37 Which of the following is not a functional isomer of $\text{C}_3\text{H}_6\text{O}$?

- (a) Prop -2-en-1-ol (b) 1, 2-epoxy propane
(c) Propanol (d) Prop - 2 - one

Q.38 An element (X) forms compounds of the formula XCl_3 , X_2O_5 , and Ca_3X_2 , but does not form XCl_5 . Which of the following is the element X ?

- (a) B (b) A (c) N (d) P



Q.40 A hydrogen gas electrode has potential of -0.118 V when H_2 gas is bubbled at 298 K and 1 atm, in HCl solution. The pH of HCl solution is.

- (a) 2 (b) 1 (c) 7 (d) 2.7

Q.41 In the photo-electric effect, the number of photoelectrons emitted per unit time depends upon the

- (a) Energy of incident radiations
 (b) Frequency of incident radiations
 (c) Intensity of incident radiations
 (d) Both frequency and intensity of incident radiations

- Q.42 On the following reactions $C_2H_2 \longrightarrow C_2H_4 \xrightarrow{H_2} C_2H_6$ the state of hybridisation of carbon changes from
 (a) $sp \rightarrow sp^2 \rightarrow sp^3$ (b) $sp^3 \rightarrow sp^2 \rightarrow sp$
 (c) $sp^2 \rightarrow sp^2 \rightarrow sp$ (d) $sp^3 \rightarrow sp \rightarrow sp^2$
- Q.43 The correct order of dipole moment is
 (a) $CH_4 < NF_3 < NH_3 < H_2O$ (b) $NF_3 < CH_4 < NH_3 < H_2O$
 (c) $NH_3 < NF_3 < CH_4 < H_2O$ (d) $H_2O < NH_3 < NF_3 < CH_4$
- Q.44 An aqueous solution of a substance gives a white precipitate on treatment with dil. HCl which dissolves on heating. When H_2S is passed through the hot acidic solution, a black precipitate is obtained. The substance is a
 (a) Hg_2^{2+} salt (b) Cu^{2+} salt (c) Ag^+ salt (d) Pb^{2+} salt
- Q.45 Bicyclohexane was found to increase two parallel first order rearrangements. At 730 K, the first order rate constant for the formation of cyclohexane was measured as $1.26 \times 10^{-4} s^{-1}$, and for the formation of methylcyclopentane the rate constant was $3.8 \times 10^{-5} s^{-1}$. The percentage of the cyclohexane is
 (a) 20 % (b) 77 % (c) 23 % (d) 50%
- Q.46 The pH 0.10 M NH_3 solution is [Given $K_b = 1.8 \times 10^{-5}$; $\log 1.35 = 0.13$]
- Q.47 3.7 g of an oxide of a metal was heated with charcoal. The liberated CO_2 was absorbed in caustic soda solution and weighed 1.0 g. If the specific gravity of the metal is 0.095, the exact atomic weight of the metal is _____?
- Q.48 The standard heat of combustion of carbon(s), sulphur (s) and carbon disulphide (l) are -393.3, -293.72 and -1108.76 kJ/mol respectively. The standard heat of formation of carbon disulphide (l) is Given ?
- Q.49 The reaction of primary aliphatic amines with nitrous acid gives a quantitative yield of nitrogen gas and is the basis of the van. Slyke determination of amino nitrogen. What volume of nitrogen gas at STP would be liberated from 0.001 mole of proline ?
- Q.50 In an aqueous solution $AgNO_3$ and $CuSO_4$ are connected in series. If Ag deposited at cathode is 1.08 g, Then Cu deposited is _____?

Part - C - MATHEMATICS

- Q.51 If the roots of the equation $x^2 - 2ax + a^2 + a - 3 = 0$ are real and less than 3, then
 (a) $-4 < a < 2$ (b) $2 \leq a \leq 3$ (c) $3 < a \leq 4$ (d) $a > 4$
- Q.52 If $\int \frac{2^x}{\sqrt{1-4^x}} dx = k \sin^{-1}(2^x) + C$, then k is equal to
 (a) $\log 2$ (b) $\frac{1}{2} \log 2$ (c) $\frac{1}{2}$ (d) $\frac{1}{\log 2}$

- Q.53 Let P be any point on the curve $x^{2/3} + y^{2/3} = a^{2/3}$ then, the length of the segment of the tangent between the coordinates axes of length
 (a) $3a$ (b) $4a$ (c) $5a$ (d) a
- Q.54 If $y = f(x)$ is an even function such that $f'(0)$ exists, then $f'(0)$ equals
 (a) 0 (b) -1 (c) 1 (d) none of these
- Q.55 The set of points where $x^2|x|$ is thrice differentiable is
 (a) \mathbb{R} (b) $\mathbb{R} - \{0, \pm 1\}$ (c) $\mathbb{R} - \{0\}$ (d) none of these
- Q.56 There is a point $P(a, a, a)$ on the line passing through the origin and equally inclined with axes. The equation of plane perpendicular to OP and passing through P cuts the intercepts on axes the sum of whose reciprocal is
 (a) $\frac{3}{2a}$ (b) $\frac{3a}{2}$ (c) a (d) $\frac{1}{a}$
- Q.57 The angle of elevation of the top of a TV tower from three points A, B and C in a straight line through the foot of the tower are $\alpha, 2\alpha$ and 3α , respectively. If $AB = a$, then height of the tower is
 (a) $a \tan \alpha$ (b) $a \sin \alpha$ (c) $a \sin 2\alpha$ (d) $a \sin 3\alpha$
- Q.58 Let \mathbb{R} be set of real numbers. If $f : \mathbb{R} \rightarrow \mathbb{R}$ is defined by $f(x) = e^x$, then f is
 (a) Surjective but not injective (b) injective but not surjective
 (c) Bijective (d) Neither surjective nor injective
- Q.59 A ladder rests against a wall at an angle α to the horizontal. Its foot is pulled away from the wall through a distance a , so that it slides a distance b down the wall making an angle β with the horizontal. Then, a is equal to
 (a) $b \tan \frac{1}{2}(\alpha + \beta)$ (b) $b \tan \frac{1}{2}(\alpha - \beta)$
 (c) $a \tan \frac{1}{2}(\alpha - \beta)$ (d) None of these
- Q.60 If the coordinates of the vertex A of a ΔABC are (1, 2) and equation of the perpendicular bisectors of AB and AC are $3x + 4y - 1 = 0$ and $4x + 3y - 5 = 0$, then the area of ΔABC is
 (a) 2 sq units (b) 3 sq units (c) 1 sq units (d) None of these
- Q.61 $\int \sqrt{\frac{\cos x - \cos^3 x}{1 - \cos^3 x}} dx$ is equal to
 (a) $\frac{2}{3} \sin^{-1}(\cos^{3/2} x) + C$ (b) $\frac{3}{2} \sin^{-1}(\cos^{3/2} x) + C$
 (c) $\frac{2}{3} \cos^{-1}(\cos^{3/2} x) + C$ (d) None of the above
- Q.62 If $\cot^{-1}(\sqrt{\cos \alpha}) - \tan^{-1}(\sqrt{\cos \alpha}) = x$ then $\sin x$ is equal to
 (a) $\cot^2\left(\frac{\alpha}{2}\right)$ (b) $\tan^2\left(\frac{\alpha}{2}\right)$ (c) $\tan \alpha$ (d) $\cot\left(\frac{\alpha}{2}\right)$

- Q.63 If $x > 1, y > 1, z > 1$ are in GP, then $\frac{1}{1 + \ln x}, \frac{1}{1 + \ln y}, \frac{1}{1 + \ln z}$ are in
 (a) AP (b) HP (c) GP (d) None of these
- Q.64 The value of the integral $\int_0^{\pi/2} \frac{\sqrt{\cot x}}{\sqrt{\cot x} + \sqrt{\tan x}} dx$ is
 (a) $\frac{\pi}{4}$ (b) $\frac{\pi}{2}$ (c) π (d) None of these
- Q.65 The vector b which is collinear with the vector $a = 2\hat{i} + \hat{j} - \hat{k}$ and satisfies the condition $a \cdot b = 3$, is
 (a) $\frac{1}{2}a$ (b) a (c) $2a$ (d) None of these
- Q.66 The general solution of the differential equation $\frac{dy}{dx} + \sin\left(\frac{x+y}{2}\right) = \sin\left(\frac{x-y}{2}\right)$ is
 (a) $\log \tan\left(\frac{y}{2}\right) = C - 2 \sin x$ (b) $\log \tan\left(\frac{y}{4}\right) = C - 2 \sin\left(\frac{x}{2}\right)$
 (c) $\log \tan\left(\frac{y}{2} + \frac{\pi}{4}\right) = C - 2 \sin x$ (d) $\log \tan\left(\frac{y}{4} + \frac{\pi}{4}\right) = C - 2 \sin\left(\frac{x}{2}\right)$
- Q.67 If p : it rains today, q : I go to school, r : I shall meet any friends and s : I shall go for a movie, then which of the following is the proportion, 'if it does not rain or if it I do not go to school, then I shall meet my friend and go for a movie' ?
 (a) $(\sim p \wedge \sim q) \Rightarrow (r \wedge s)$ (b) $\sim (p \wedge q) \Rightarrow (r \wedge s)$
 (c) $\sim (p \vee q) \Rightarrow (r \vee s)$ (d) None of these
- Q.68 For $a \in [\pi, 2\pi] n \in I$, the critical points of $f(x) = \frac{1}{3} \sin a \tan^3 x + (\sin a - 1) \tan x + \sqrt{\frac{a-2}{8-a}}$ are
 (a) $x = n\pi$ (b) $x = 2n\pi$ (c) $x = (2n+1)\pi$ (d) None of these
- Q.69 If the roots of the equation $x^2 - 2ax + a^2 + a - 3 = 0$ are real and less than 3 then
 (a) $a < 2$ (b) $2 \leq a \leq 3$ (c) $3 < a \leq 4$ (d) $a > 4$
- Q.70 The equation of the common tangent touching the circle $(x-3)^2 + y^2 = 9$ and the parabola $y^2 = 4x$ above the X-axis is
 (a) $\sqrt{3} y = 3x + 1$ (b) $\sqrt{3} y = -(x+3)$
 (c) $\sqrt{3} y = x + 3$ (d) $\sqrt{3} y = -(3x+1)$
- Q.71 If $3^{49}(x+iy) = \left(\frac{3}{2} + \frac{\sqrt{3}}{2}i\right)^{100}$ and $x = ky$, then k is We know that, $i = \sqrt{-1}$?

- Q.72 Let y be an implicit function of x defined by $x^{2x} - 2x^x \cot y - 1 = 0$ then y (1) equals?
- Q.73 A five digit number divisible by 3 is to be formed using the digits 0, 1, 2, 3, 4 and 5 without repetition. The total number of ways this can be done is_____?
- Q.74 The value of $\lim_{x \rightarrow 0} \frac{\int_0^{x^2} \cos^2 t dt}{x \sin x}$ is _____?
- Q.75 Let $L = \{x : x \in \text{club cards in a pack of cards}\}$
 $M = \{y : y \text{ appears on the face of a die}\}$
The number of elements in the cartesian product of L and M is_____?
