

JEE (MAIN)

TEST PAPER

SUBJECT : PHYSICS, CHEMISTRY, MATHEMATICS

TEST CODE : TSJMT212

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) :

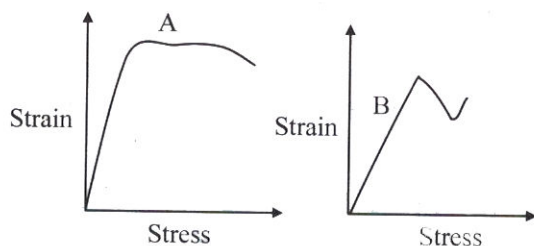
6. The OMR will be provided to the students.
7. Darken the appropriate bubbles on the OMR sheet by applying sufficient pressure.
8. The OMR sheet will be collected by the invigilator at the end of the examination.
9. Do not tamper with or mutilate the OMR. Do not use the OMR for rough work.
10. Write 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 From the options given, the most likely reason to maintain the national standard of time interval second through four cesium atomic clocks is
 (a) having only 1 clock reduces precision.
 (b) having only 1 clock reduces accuracy.
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- Q.2 The vector sum of two velocities is perpendicular to their vector differences. In this case, the velocities
 (a) are equal to each other in magnitude.
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 (a) equal to the time of fall.
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- Q.4 A body of mass M at rest explodes into three pieces, two of which of mass $M/3$ each, are thrown-off in perpendicular directions with velocities of 6 m/s and 8 m/s respectively. The third piece will be thrown-off with a velocity of
 (a) 15 m/s (b) 10 m/s (c) 2.8 m/s (d) 3.3 m/s
- Q.5 What is the minimum velocity with which a body of mass m must enter a vertical loop of radius R so that it can complete the loop?
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- Q.6 A particle of mass m is driven by a machine that delivers a constant power k watt. If the particle starts from rest the force on the particle at time t is
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- Q.7 Two rotating bodies A and B of masses m and $2m$ with moments of inertia I_A and I_B ($I_B > I_A$) have equal kinetic energy of rotation. If L_A and L_B be their angular momentum respectively, then
 (a) $L_A > L_B$ (b) $L_A = \frac{L_B}{2}$ (c) $L_A = 2L_B$ (d) $L_B > L_A$
- Q.8 The stress-strain graphs for materials A and B are shown in figure. The graphs are drawn to the same scale. Select the CORRECT statement



- (a) $Y_A > Y_B$ and material A has weaker strength than material B.
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- Q.9 A solid spherical object of radius r and density σ is dropped in identical viscous fluid lakes on 5 different planets. On which of the planets terminal velocity attained by the object will be maximum? (Assume value of g_{planet} doesn't change inside the lake)
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- Q.10 A reversible engine and an irreversible engine are operating between the same temperatures. The efficiency of
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- Q.12 A transverse wave is described by the equation, $y = y_0 \sin 2\pi \left(ft - \frac{x}{\lambda} \right)$. The maximum particle velocity is equal to twice the wave velocity, if
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- Q.14 Which of the following characteristics of electrons determines the current in a conductor?
- (a) Drift velocity alone. (b) Thermal velocity alone.
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- Q.16 The power factor of a CR circuit is $\frac{1}{\sqrt{2}}$. If the frequency of ac signal is halved, then the power factor of the circuit becomes
- (a) $\frac{1}{\sqrt{5}}$ (b) $\frac{1}{\sqrt{7}}$ (c) $\frac{1}{\sqrt{3}}$ (d) $\frac{1}{\sqrt{11}}$

- Q.17 A plane polarised light is incident normally on a tourmaline plate. Its E vectors make an angle of 60° with the optic axis of the plate. Find the percentage difference between initial and final intensities.
 (a) 25% (b) 50% (c) 75% (d) 90%
- Q.18 Order of magnitude of density of thorium nucleus is ($m_p = 1.67 \times 10^{-27} \text{ kg}$)
 (a) 10^{20} kg/m^3 (b) 10^{17} kg/m^3 (c) 10^{14} kg/m^3 (d) 10^{11} kg/m^3
- Q.19 When only carrier is transmitted, antenna current observed is 10 A. When it is modulated with 500 Hz sine wave antenna, current becomes 12A. Find % modulation.
 (a) 70% (b) 62% (c) 94% (d) 84%
- Q.20 For CE transistors amplifiers, the audio signal voltage across the collector resistance of $2 \text{ k}\Omega$ is 4V. If the current amplification factor of the transistor is 100 and the base resistance is $1 \text{ k}\Omega$, then the input signal voltage is
 (a) 15mV (b) 10 mV (c) 20 mV (d) 30 mV
- Q.21 The de Broglie wavelength of an electron accelerated to a potential of 400 V is approximately
- Q.22 A thin plastic sheet of refractive index 1.6 is used to cover one of the slits of a double slit arrangement. The central point on the screen is now occupied by what would have been the 7th bright fringe before the plastic was used. If the wavelength of light is 600 nm, what is the thickness (in μm) of the plastic?
- Q.23 A 20 cm long bar magnet is placed in magnetic meridian with its north pole pointing south. The neutral point is observed at a distance of 30 cm from its centre. Then the pole strength of the magnet is [Horizontal component of earth's field is 0.3 G.]
- Q.24 The excess pressure inside a soap bubble is thrice the excess pressure inside a second soap bubble. The volume of the first bubble is n times the volume of the second, where n is_____?
- Q.25 Two identical rods of copper and iron are coated with wax uniformly. When one end of each is kept at temperature of boiling water, the length upto which wax melts are 6.2 cm and 3.1 cm respectively. If thermal conductivity of copper is 0.9, then thermal conductivity of iron is_____?

Part - B - CHEMISTRY

- Q.26 The ratio of the frequency of radiation with wavelength 400 nm to the frequency of radiation with wavelength 760 nm is _____
 (a) 3:2 (b) 2:1 (c) 3:1 (d) 4:3
- Q.27 Which of the following atoms don't have valence electrons in 4d-subshell?
 (a) Mo (b) Tc (c) Ru (d) As
- Q.28 The geometry of BrO_3^- ion according to VSEPR theory will be _____.
 (a) trigonal planar (b) trigonal pyramidal
 (c) see-saw (d) square planar
- Q.29 When heat is absorbed during the reaction, it is denoted as _____ and when work is done by the system on the surroundings, it is denoted as _____.
 (a) positive; positive (b) negative; negative
 (c) positive; negative (d) negative; positive

- Q.30 Under given conditions, which of the following reactions can reach a state of equilibrium?
 (a) Formation of rust on old bicycles.
 (b) Decomposition of calcium carbonate in an open vessel
 (c) Decomposition of N_2O_4 in a closed vessel.
 (d) Reaction between hydrogen and iodine in an open vessel.
- Q.31 Which of the following is TRUE for a Daniel cell?
 (a) Electron flow from cathode to anode. (b) Electrons flow through the salt bridge.
 (c) Current flows from anode to cathode. (d) Oxidation occurs at the anode.
- Q.32 Which of the following is TRUE for a Daniel cell?
 (a) Electron flow from cathode to anode. (b) Electrons flow through the salt bridge.
 (c) Current flows from anode to cathode. (d) Oxidation occurs at the anode.
- Q.33 Assertion: But-2-ene shows geometrical isomerism.
 Reason: Both the C-atoms have $-CH_3$ groups attached to them.
 (a) Assertion and Reason are true. Reason is the correct explanation of Assertion.
 (b) Assertion and Reason are true. Reason is not the correct explanation of Assertion.
 (c) Assertion is true. Reason is false.
 (d) Assertion is false. Reason is true.
- Q.34 The type of hybridization of the carbon atoms in the product, formed by heating ethylidene dibromide with alcoholic potash is _____.
 (a) sp (b) sp^3 (c) sp^2 (d) dsp^2
- Q.35 According to Huckel rule, cyclooctatetraene shows _____ character.
 (a) antiaromatic (b) aromatic (c) non-aromatic (d) none of these
- Q.36 A mixed oxide has oxide ions arranged in ccp array, 'A' occupies 1/3 of all the octahedral voids and 'B' occupies 1/2 of all the tetrahedral voids. The formula of this oxide is
 (a) $A_4B_9O_6$ (b) AB_3O_3 (c) AB_4O_2 (d) $A_2B_3O_6$
- Q.37 When initial concentration of a reactant is doubled in a reaction, its half-life period is not affected. The order of the reaction is _____.
 (a) zero (b) first
 (c) second (d) more than zero but less than first
- Q.38 Which of the following indicates positive deviation from Raoult's law?
 (a) When 10 cc of a liquid is mixed with 10 cc of other liquid, the volume of resulting solution is 19 cc.
 (b) Two liquids produce warm solution on mixing.
 (c) Mixing of chloroform with acetone.
 (d) mixing of carbon disulphide with acetone.
- Q.39 When aqueous $CuSO_4$ solution is electrolyzed using platinum electrode, the blue colour of the solution disappear with the liberation of gas at electrode. The colourless solution is _____.
 (a) Cu_2SO_4 (b) $CuSO_4$ (c) H_2SO_4 (d) $PtSO_4$
- Q.40 Which is CORRECT statement for the given acids?
 (a) Phosphinic acid is a monoprotic acid while phosphonic acid is a diprotic acid.
 (b) Phosphonic acid is a diprotic acid while phosphinic acid is a monoprotic acid.
 (c) Both are diprotic acids.
 (d) Both are triprotic acids.

- Q.41 Both methane and ethane can be prepared in one step from _____ .
 (a) C_2H_4 (b) CH_3OH (c) CH_3Br (d) CH_3CH_2OH
- Q.42 Lower ethers are volatile liquids which on evaporation produce cooling. Therefore, they are used as _____.
 (a) lubricants for motors (b) refrigerants
 (c) ointments and creams (d) all of these
- Q.43 The stability of arenediazonium salts is due to _____.
 (a) its tendency to eliminate a nitrogen molecule
 (b) dispersal of negative charge over the benzene ring
 (c) its tendency to form a stable salt with halogens
 (d) dispersal of positive charge over the benzene ring
- Q.44 The following statements are TRUE about crystal field theory EXCEPT _____.
 (a) It does not explain π bonding in complexes.
 (b) Satisfactory explanation is not provided for the fact that water is a stronger ligand than OH^-
 (c) It considers s, p and d orbitals of the central metal.
 (d) Partial covalent nature of metal ligand bond is not explained.
- Q.45 Action of ammonia on 4-methylpent-3-en-2-one forms _____.
 (a) hemiacetal (b) diacetone amine
 (c) urotropine (d) pinacol
- Q.46 How many grams of caustic potash is required to completely neutralize 25.2 g HNO_3 ?
- Q.47 Praveen went to a hill station where he experienced some breathing problems due to low density of oxygen. If at NTP density of oxygen is 1.520 g L^{-1} , what is the difference in densities, if the temperature at the hill station is 3°C and pressure is 705 mm. The hill is at a height of 2173 m.
- Q.48 1 g of activated charcoal at STP undergoes monolayer of adsorption of NH_3 . If 1 g of charcoal has surface area of $2 \times 10^2 \text{ m}^2$ and effective surface area of NH_3 molecule is 0.172 nm^2 , the moles of NH_3 adsorbed on 20 g of charcoal is _____.
- Q.49 The possible number of tetrapeptides from four different amino acids is _____.
- Q.50 How much faster would a reaction proceed at 25°C than if the activation energy is 65 kJ?

Part - C - MATHEMATICS

- Q.51 Consider the inequation $\frac{(2x+1)(x+4)}{x^2} \geq 0$.
 Which of the following is correct?
 (a) All negative integers satisfy the inequation.
 (b) There is an isolated integer that does not satisfy the inequation.
 (c) Not all positive integers satisfy the inequation.
 (d) The greatest negative integer satisfying
- Q.52 The greatest negative integer satisfying the inequation $\log_{\frac{1}{3}} \left(\frac{3x-1}{x+2} \right) < 1$ is
 (a) -1 (b) -2 (c) -3 (d) -7

- Q.53 The domain of the function $f(x) = \sin^{-1}\left(\frac{8 \cdot 3^{x-2}}{1 - 3^{2(x-1)}}\right)$ is
 (a) $(-\infty, 0]$ (b) $[2, \infty)$ (c) $(-\infty, 0] \cup [2, \infty)$ (d) $(-\infty, -1] \cup [1, \infty)$
- Q.54 The points on the line $x+y=4$ which lie at a unit distance from the line $4x+3y=10$ are
 (a) $(3, 1), (-7, 11)$ (b) $(3, 1), (7, 11)$ (c) $(-3, 1), (-7, 11)$ (d) $(1, 3), (-7, 11)$
- Q.55 L is a line whose complex slope is m. The complex slope of the reflection of line L in imaginary axis, is
 (a) -m (b) $\frac{1}{m}$ (c) $\frac{1}{m^2}$ (d) $-\frac{1}{m}$
- Q.56 The equation of the circle passing through the origin and cutting intercepts of length 3 and 4 units from the positive axes, is
 (a) $x^2 + y^2 + 6x + 9 + 8y + 1 = 0$ (b) $x^2 + y^2 - 6x - 8y = 0$
 (c) $x^2 + 3x + 4y = 0$ (d) $x^2 + y^2 - 3x - 4y = 0$
- Q.57 The line $2x+y=1$ is tangent to the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$. If this line passes through the point of intersection of the nearest directrix and the x-axis, then the eccentricity of the hyperbola is
 (a) $\sqrt{2}$ (b) 2 (c) $\sqrt{3}$ (d) 3
- Q.58 Between two junction stations A and B there are 12 intermediate stations. The number of ways in which a train can be made to stop at 4 of these stations so that no two of these halting stations are consecutive is
 (a) 6C_4 (b) 5C_4 (c) 8C_4 (d) 9C_4
- Q.59 The coefficient of x^{99} in $(x+1)(x+3)(x+5)\dots(x+199)$ is
 (a) 40000 (b) $\frac{200!}{2^{100}(100!)}$ (c) 10000 (d) 39601
- Q.60 The probability of India winning a test match against West Indies is $\frac{1}{2}$. Assuming independence from match to match, the probability that in a 5-match series India's second win occurs at the third test, is
 (a) $\frac{2}{3}$ (b) $\frac{1}{2}$ (c) $\frac{1}{4}$ (d) $\frac{1}{8}$
- Q.61 If the letters of the word 'BEAUTIFUL' be arranged at random, the probability that there will be exactly 3 letters between E and T is
 (a) $\frac{5}{72}$ (b) $\frac{5}{36}$ (c) $\frac{5}{19}$ (d) $\frac{4}{9}$
- Q.62 Let n be an odd number and $S(n)$ denote the sum of the unordered products of all the pairs of positive integers whose sum = n . Then $\lim_{n \rightarrow \infty} \frac{S(n)}{n^3}$ is
 (a) $\frac{1}{4}$ (b) $\frac{1}{3}$ (c) $\frac{1}{12}$ (d) $\frac{1}{24}$

- Q.63 Let $f(x) = |x^2 - 3|x| + 2|$, then which of the following is NOT correct?
- (a) $f'(x) = 2x - 3, x \in (0, 1) \cup (2, \infty)$ (b) $f'(x) = 2x + 3, x \in (-\infty, -2) \cup (-1, 0)$
(c) $f'(x) = -2x - 3, x \in (-2, -1)$ (d) $f'(x) = 2x + 3, x \in (1, 2)$

- Q.64 $\lim_{x \rightarrow 0} \left(\frac{1}{x^2} - \frac{1}{\sin^2 x} \right)$ equals
- (a) $-\frac{1}{12}$ (b) $\frac{1}{3}$ (c) $\frac{1}{6}$ (d) $-\frac{1}{3}$

- Q.65 $\int \frac{dx}{(x+1)\sqrt{4x+3}}$ is equal to
- (a) $\tan^{-1} \sqrt{4x+3} + c$ (b) $3 \tan^{-1} \sqrt{4x+3} + c$
(c) $2 \tan^{-1} \sqrt{4x+3} + c$ (d) $4 \tan^{-1} \sqrt{4x+3} + c$

- Q.66 $\lim_{n \rightarrow \infty} \left(\frac{(n+1)(n+2)\dots 3n}{n^{2n}} \right)^{\frac{1}{n}}$ is equal to
- (a) $\frac{27}{e^2}$ (b) $\frac{9}{e^2}$ (c) $3 \log 3 - 2$ (d) $\frac{18}{e^4}$

- Q.67 The value of determinant $\begin{vmatrix} yz & zx & xy \\ p & q & r \\ 1 & 1 & 1 \end{vmatrix}$ where x, y, z are $p^{th}, (2q)^{th}, (3r)^{th}$ terms, respectively of an H.P., is
- (a) -1 (b) 0 (c) 1 (d) none

- Q.68 If the image of the point $P(1, -2, 3)$ in the plane $2x+3y-4z+22=0$ measured parallel to the line, $\frac{x}{1} = \frac{y}{4} = \frac{z}{5}$ is Q , then PQ is equal to
- (a) $6\sqrt{5}$ (b) $3\sqrt{5}$ (c) $2\sqrt{42}$ (d) $\sqrt{42}$

- Q.69 If the points $(-2, 3, 5), (1, 2, 3)$ and $(\lambda, 0, -1)$ are collinear, then the value of λ is
- (a) 5 (b) -5 (c) 7 (d) -7

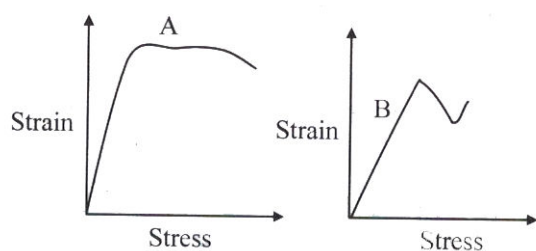
- Q.70 Which of the following quantified statement is true?
- (a) The square of every real number is positive
(b) There exists a real number whose square is negative
(c) There exists a real number whose square is not positive
(d) Every real number is rational

- Q.71 The area (in sq. units) of the parallelogram whose diagonals are along the vectors $8\hat{i} - 6\hat{j}$ and $3\hat{i} + 4\hat{j} - 12\hat{k}$, is _____?

- Q.72 The order of the differential equation whose general solution is given by $y = (c_1 + c_2) \cos(x + c_3) - c_4 \sin x + c_5 e^{-x+c_6}$ is_____?
- Q.73 S is a circle (radius=13) and P is a point at a distance of 12 from the centre os S. Using continuity considerations, the numbers of chords of the circle through P, which have integral lengths, is_____?
- Q.74 The area bounded by the curve $y=x(x-3)^2$ and $y=x$, in square units, is_____?
- Q.75 The nubner of common terms to the two sequences 11, 15, 19, 23,, 411 and 6, 11, 16, 21,, 431 is_____?

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 (d) the body of galvanometer should be earthed.
- Q.16 The power factor of a CR circuit is $\frac{1}{\sqrt{2}}$. If the frequency of ac signal is halved, then the power factor of the circuit becomes
- (a) $\frac{1}{\sqrt{5}}$ (b) $\frac{1}{\sqrt{7}}$ (c) $\frac{1}{\sqrt{3}}$ (d) $\frac{1}{\sqrt{11}}$

- Q.17 A plane polarised light is incident normally on a tourmaline plate. Its E vectors make an angle of 60° with the optic axis of the plate. Find the percentage difference between initial and final intensities.
(a) 25% (b) 50% (c) 75% (d) 90%
- Q.18 Order of magnitude of density of thorium nucleus is ($m_p = 1.67 \times 10^{-27} \text{ kg}$)
(a) 10^{20} kg/m^3 (b) 10^{17} kg/m^3 (c) 10^{14} kg/m^3 (d) 10^{11} kg/m^3
- Q.19 When only carrier is transmitted, antenna current observed is 10 A. When it is modulated with 500 Hz sine wave antenna, current becomes 12A. Find % modulation.
(a) 70% (b) 62% (c) 94% (d) 84%
- Q.20 For CE transistors amplifiers, the audio signal voltage across the collector resistance of $2 \text{ k}\Omega$ is 4V. If the current amplification factor of the transistor is 100 and the base resistance is $1 \text{ k}\Omega$, then the input signal voltage is
(a) 15mV (b) 10 mV (c) 20 mV (d) 30 mV
- Q.21 The de Broglie wavelength of an electron accelerated to a potential of 400 V is approximately
- Q.22 A thin plastic sheet of refractive index 1.6 is used to cover one of the slits of a double slit arrangement. The central point on the screen is now occupied by what would have been the 7th bright fringe before the plastic was used. If the wavelength of light is 600 nm, what is the thickness (in μm) of the plastic?
- Q.23 A 20 cm long bar magnet is placed in magnetic meridian with its north pole pointing south. The neutral point is observed at a distance of 30 cm from its centre. Then the pole strength of the magnet is [Horizontal component of earth's field is 0.3 G.]
- Q.24 The excess pressure inside a soap bubble is thrice the excess pressure inside a second soap bubble. The volume of the first bubble is n times the volume of the second, where n is _____?
- Q.25 Two identical rods of copper and iron are coated with wax uniformly. When one end of each is kept at temperature of boiling water, the length upto which wax melts are 6.2 cm and 3.1 cm respectively. If thermal conductivity of copper is 0.9, then thermal conductivity of iron is _____?

Part - B - CHEMISTRY

- Q.26 The ratio of the frequency of radiation with wavelength 400 nm to the frequency of radiation with wavelength 760 nm is _____
(a) 3:2 (b) 2:1 (c) 3:1 (d) 4:3
- Q.27 Which of the following atoms don't have valence electrons in 4d-subshell?
(a) Mo (b) Tc (c) Ru (d) As
- Q.28 The geometry of BrO_3^- ion according to VSEPR theory will be _____.
(a) trigonal planar (b) trigonal pyramidal
(c) see-saw (d) square planar
- Q.29 When heat is absorbed during the reaction, it is denoted as _____ and when work is done by the system on the surroundings, it is denoted as _____.
(a) positive; positive (b) negative; negative
(c) positive; negative (d) negative; positive

- Q.30 Under given conditions, which of the following reactions can reach a state of equilibrium?
(a) Formation of rust on old bicycles.
(b) Decomposition of calcium carbonate in an open vessel
(c) Decomposition of N_2O_4 in a closed vessel.
(d) Reaction between hydrogen and iodine in an open vessel.
- Q.31 Which of the following is TRUE for a Daniel cell?
(a) Electron flow from cathode to anode. (b) Electrons flow through the salt bridge.
(c) Current flows from anode to cathode. (d) Oxidation occurs at the anode.
- Q.32 Which of the following is TRUE for a Daniel cell?
(a) Electron flow from cathode to anode. (b) Electrons flow through the salt bridge.
(c) Current flows from anode to cathode. (d) Oxidation occurs at the anode.
- Q.33 Assertion: But-2-ene shows geometrical isomerism.
Reason: Both the C-atoms have $-CH_3$ groups attached to them.
(a) Assertion and Reason are true. Reason is the correct explanation of Assertion.
(b) Assertion and Reason are true. Reason is not the correct explanation of Assertion.
(c) Assertion is true. Reason is false.
(d) Assertion is false. Reason is true.
- Q.34 The type of hybridization of the carbon atoms in the product, formed by heating ethylidene dibromide with alcoholic potash is _____.
(a) sp (b) sp^3 (c) sp^2 (d) dsp^2
- Q.35 According to Huckel rule, cyclooctatetraene shows _____ character.
(a) antiaromatic (b) aromatic (c) non-aromatic (d) none of these
- Q.36 A mixed oxide has oxide ions arranged in ccp array, 'A' occupies 1/3 of all the octahedral voids and 'B' occupies 1/2 of all the tetrahedral voids. The formula of this oxide is
(a) $A_4B_9O_6$ (b) AB_3O_3 (c) AB_4O_2 (d) $A_2B_3O_6$
- Q.37 When initial concentration of a reactant is doubled in a reaction, its half-life period is not affected. The order of the reaction is _____.
(a) zero (b) first
(c) second (d) more than zero but less than first
- Q.38 Which of the following indicates positive deviation from Raoult's law?
(a) When 10 cc of a liquid is mixed with 10 cc of other liquid, the volume of resulting solution is 19 cc.
(b) Two liquids produce warm solution on mixing.
(c) Mixing of chloroform with acetone.
(d) mixing of carbon disulphide with acetone.
- Q.39 When aqueous $CuSO_4$ solution is electrolyzed using platinum electrode, the blue colour of the solution disappears with the liberation of gas at electrode. The colourless solution is _____.
(a) Cu_2SO_4 (b) $CuSO_4$ (c) H_2SO_4 (d) $PtSO_4$
- Q.40 Which is CORRECT statement for the given acids?
(a) Phosphinic acid is a monoprotic acid while phosphonic acid is a diprotic acid.
(b) Phosphonic acid is a diprotic acid while phosphinic acid is a monoprotic acid.

- (c) Both are diprotic acids.
(d) Both are triprotic acids.
- Q.41 Both methane and ethane can be prepared in one step from _____ .
(a) C_2H_4 (b) CH_3OH (c) CH_3Br (d) CH_3CH_2OH
- Q.42 Lower ethers are volatile liquids which on evaporation produce cooling. Therefore, they are used as _____ .
(a) lubricants for motors (b) refrigerants
(c) ointments and creams (d) all of these
- Q.43 The stability of arenediazonium salts is due to _____ .
(a) its tendency to eliminate a nitrogen molecule
(b) dispersal of negative charge over the benzene ring
(c) its tendency to form a stable salt with halogens
(d) dispersal of positive charge over the benzene ring
- Q.44 The following statements are TRUE about crystal field theory EXCEPT _____.
(a) It does not explain π bonding in complexes.
(b) Satisfactory explanation is not provided for the fact that water is a stronger ligand than OH^-
(c) It considers s, p and d orbitals of the central metal.
(d) Partial covalent nature of metal ligand bond is not explained.
- Q.45 Action of ammonia on 4-methylpent-3-en-2-one forms _____.
(a) hemiacetal (b) diacetone amine
(c) urotropine (d) pinacol
- Q.46 How many grams of caustic potash is required to completely neutralize 25.2 g HNO_3 ?
- Q.47 Praveen went to a hill station where he experienced some breathing problems due to low density of oxygen. If at NTP density of oxygen is 1.520 g L^{-1} , what is the difference in densities, if the temperature at the hill station is 3°C and pressure is 705 mm. The hill is at a height of 2173 m.
- Q.48 1 g of activated charcoal at STP undergoes monolayer of adsorption of NH_3 . If 1 g of charcoal has surface area of $2 \times 10^2 \text{ m}^2$ and effective surface area of NH_3 molecule is 0.172 nm^2 , the moles of NH_3 adsorbed on 20 g of charcoal is _____.
- Q.49 The possible number of tetrapeptides from four different amino acids is _____.
- Q.50 How much faster would a reaction proceed at 25°C than if the activation energy is 65 kJ?

Part - C - MATHEMATICS

- Q.51 Consider the inequation $\frac{(2x+1)(x+4)}{x^2} \geq 0$.
Which of the following is correct?
(a) All negative integers satisfy the inequation.
(b) There is an isolated integer that does not satisfy the inequation.
(c) Not all positive integers satisfy the inequation.
(d) The greatest negative integer satisfying
- Q.52 The greatest negative integer satisfying the inequation $\log_{\frac{1}{3}}\left(\frac{3x-1}{x+2}\right) < 1$ is
(a) -1 (b) -2 (c) -3 (d) -7

- Q.53 The domain of the function $f(x) = \sin^{-1}\left(\frac{8 \cdot 3^{x-2}}{1 - 3^{2(x-1)}}\right)$ is
 (a) $(-\infty, 0]$ (b) $[2, \infty)$ (c) $(-\infty, 0] \cup [2, \infty)$ (d) $(-\infty, -1] \cup [1, \infty)$
- Q.54 The points on the line $x+y=4$ which lie at a unit distance from the line $4x+3y=10$ are
 (a) $(3, 1), (-7, 11)$ (b) $(3, 1), (7, 11)$ (c) $(-3, 1), (-7, 11)$ (d) $(1, 3), (-7, 11)$
- Q.55 L is a line whose complex slope is m . The complex slope of the reflection of line L in imaginary axis, is
 (a) $-m$ (b) $\frac{1}{m}$ (c) $\frac{1}{m^2}$ (d) $-\frac{1}{m}$
- Q.56 The equation of the circle passing through the origin and cutting intercepts of length 3 and 4 units from the positive axes, is
 (a) $x^2 + y^2 + 6x + 9 + 8y + 1 = 0$ (b) $x^2 + y^2 - 6x - 8y = 0$
 (c) $x^2 + 3x + 4y = 0$ (d) $x^2 + y^2 - 3x - 4y = 0$
- Q.57 The line $2x+y=1$ is tangent to the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$. If this line passes through the point of intersection of the nearest directrix and the x-axis, then the eccentricity of the hyperbola is
 (a) $\sqrt{2}$ (b) 2 (c) $\sqrt{3}$ (d) 3
- Q.58 Between two junction stations A and B there are 12 intermediate stations. The number of ways in which a train can be made to stop at 4 of these stations so that no two of these halting stations are consecutive is
 (a) 6C_4 (b) 5C_4 (c) 8C_4 (d) 9C_4
- Q.59 The coefficient of x^{99} in $(x+1)(x+3)(x+5)\dots(x+199)$ is
 (a) 40000 (b) $\frac{200!}{2^{100}(100!)}$ (c) 10000 (d) 39601
- Q.60 The probability of India winning a test match against West Indies is $\frac{1}{2}$. Assuming independence from match to match, the probability that in a 5-match series India's second win occurs at the third test, is
 (a) $\frac{2}{3}$ (b) $\frac{1}{2}$ (c) $\frac{1}{4}$ (d) $\frac{1}{8}$
- Q.61 If the letters of the word 'BEAUTIFUL' be arranged at random, the probability that there will be exactly 3 letters between E and T is
 (a) $\frac{5}{72}$ (b) $\frac{5}{36}$ (c) $\frac{5}{19}$ (d) $\frac{4}{9}$
- Q.62 Let n be an odd number and $S(n)$ denote the sum of the unordered products of all the pairs of positive integers whose sum = n . Then $\lim_{n \rightarrow \infty} \frac{S(n)}{n^3}$ is

- (a) $\frac{1}{4}$ (b) $\frac{1}{3}$ (c) $\frac{1}{12}$ (d) $\frac{1}{24}$

Q.63 Let $f(x) = |x^2 - 3|x| + 2|$, then which of the following is NOT correct?

- (a) $f'(x) = 2x - 3, x \in (0, 1) \cup (2, \infty)$ (b) $f'(x) = 2x + 3, x \in (-\infty, -2) \cup (-1, 0)$
 (c) $f'(x) = -2x - 3, x \in (-2, -1)$ (d) $f'(x) = 2x + 3, x \in (1, 2)$

Q.64 $\lim_{x \rightarrow 0} \left(\frac{1}{x^2} - \frac{1}{\sin^2 x} \right)$ equals

- (a) $-\frac{1}{12}$ (b) $\frac{1}{3}$ (c) $\frac{1}{6}$ (d) $-\frac{1}{3}$

Q.65 $\int \frac{dx}{(x+1)\sqrt{4x+3}}$ is equal to

- (a) $\tan^{-1} \sqrt{4x+3} + c$ (b) $3 \tan^{-1} \sqrt{4x+3} + c$
 (c) $2 \tan^{-1} \sqrt{4x+3} + c$ (d) $4 \tan^{-1} \sqrt{4x+3} + c$

Q.66 $\lim_{n \rightarrow \infty} \left(\frac{(n+1)(n+2)\dots 3n}{n^{2n}} \right)^{\frac{1}{n}}$ is equal to

- (a) $\frac{27}{e^2}$ (b) $\frac{9}{e^2}$ (c) $3 \log 3 - 2$ (d) $\frac{18}{e^4}$

Q.67 The value of determinant $\begin{vmatrix} yz & zx & xy \\ p & q & r \\ 1 & 1 & 1 \end{vmatrix}$ where x, y, z are $p^{\text{th}}, (2q)^{\text{th}}, (3r)^{\text{th}}$ terms, respectively of an

H.P., is

- (a) -1 (b) 0 (c) 1 (d) none

Q.68 If the image of the point $P(1, -2, 3)$ in the plane $2x + 3y - 4z + 22 = 0$ measured parallel to the line,

$\frac{x}{1} = \frac{y}{4} = \frac{z}{5}$ is Q , then PQ is equal to

- (a) $6\sqrt{5}$ (b) $3\sqrt{5}$ (c) $2\sqrt{42}$ (d) $\sqrt{42}$

Q.69 If the points $(-2, 3, 5), (1, 2, 3)$ and $(\lambda, 0, -1)$ are collinear, then the value of λ is

- (a) 5 (b) -5 (c) 7 (d) -7

Q.70 Which of the following quantified statement is true?

- (a) The square of every real number is positive
 (b) There exists a real number whose square is negative
 (c) There exists a real number whose square is not positive
 (d) Every real number is rational

Q.71 The area (in sq. units) of the parallelogram whose diagonals are along the vectors

$8\hat{i} - 6\hat{j}$ and $3\hat{i} + 4\hat{j} - 12\hat{k}$, is _____?

- Q.72 The order of the differential equation whose general solution is given by $y = (c_1 + c_2)\cos(x + c_3) - c_4 \sin x + c_5 e^{-x+c_6}$ is_____?
- Q.73 S is a circle (radius=13) and P is a point at a distance of 12 from the centre os S. Using continuity considerations, the numbers of chords of the circle through P, which have integral lengths, is_____?
- Q.74 The area bounded by the curve $y=x(x-3)^2$ and $y=x$, in square units, is_____?
- Q.75 The nuber of common terms to the two sequences 11, 15, 19, 23,, 411 and 6, 11, 16, 21,, 431 is_____?



ROUGH WORK

ROUGH WORK