

SHIKSHA CLASSES, BHANDARA

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 90 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 **30 questions** in each part of equal weightage. **20 questions** will be **MCQs** and **10 questions (ATTEMPT ANY FIVE QUESTIONS OUT OF 10)** 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

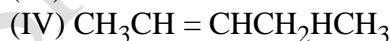
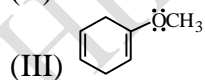
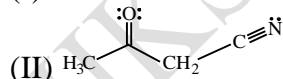
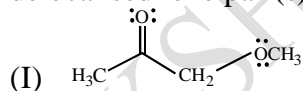
Q.3 The total number of isomeric linear dipeptide which can be synthesized from racemic alanine is

- (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



- (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) $n = 3, \ell = 1, m = -1$ (2) $n = 3, \ell = 0, m = 0$
(3) $n = 2, \ell = 0, m = -1$ (4) $n = 2, \ell = 1, m = 0$

Q.7 In order to oxidise a mixture one mole of each of FeC_2O_4 , $\text{Fe}_2(\text{C}_2\text{O}_4)_3$, FeSO_4 and $\text{Fe}_2(\text{SO}_4)_3$ 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) $(\text{CH}_3)_3\text{CCl}$ (2) CHCl_3
(3) $\text{CH}_2=\text{CH}-\text{Cl}$ (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.

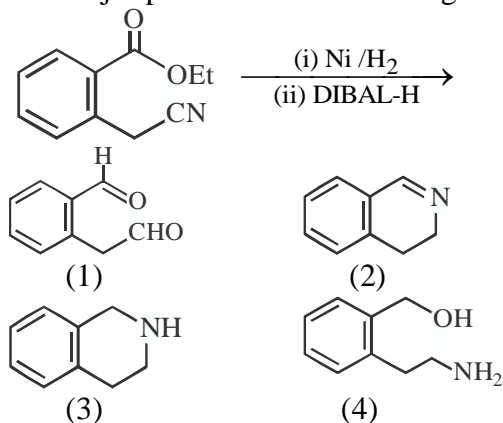
Q.11 The radius of the largest sphere which fits properly at the centre of the edge of body centred cubic unit cell is :

(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

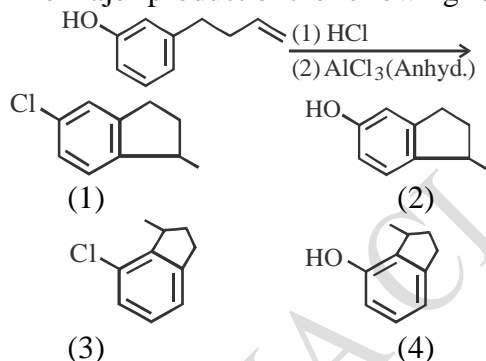
Q.12 The major product of the following reaction is:



Q.13 Three complexes, $[\text{CoCl}(\text{NH}_3)_5]^{2+}$ (I), $[\text{Co}(\text{NH}_3)_5\text{H}_2\text{O}]^{3+}$ (II) and $[\text{Co}(\text{NH}_3)_6]^{3+}$ (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 :



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

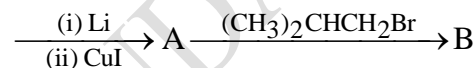
Q.17 For the reaction of H_2 with I_2 , the rate constant is $2.5 \times 10^{-4} \text{ dm}^3 \text{ mol}^{-1} \text{ s}^{-1}$ at 327°C and $1.0 \text{ dm}^3 \text{ mol}^{-1} \text{ s}^{-1}$ at 527°C . The activation energy for the reaction, in kJ mol^{-1} is:
 ($R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$)

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

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

- (1) Ionic character – $\text{MCl} > \text{MCl}_2 > \text{MCl}_3$
 (2) Polarizability – $\text{F}^- < \text{Cl}^- < \text{Br}^- < \text{I}^-$
 (3) Polarising power – $\text{Na}^+ < \text{K}^+ < \text{Mg}^{2+} < \text{Al}^{3+}$
 (4) Polarising power – $\text{Li}^+ < \text{Be}^{2+} < \text{B}^{3+}$

Q.19 $(\text{CH}_3)_2\text{CHBr}$



'B' is -

- (1) $(\text{CH}_3)_2\text{CHCH}_2\text{CH}_3$
 (2) $(\text{CH}_3)_2\text{CHCH}(\text{CH}_3)_2$
 (3) $(\text{CH}_3)_2\text{CHCH}_2\text{CH}(\text{CH}_3)_2$
 (4) $(\text{CH}_3)_2\text{CHCH}_2\text{CH}_2\text{CH}(\text{CH}_3)_2$

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+}

$$E^0_{\text{MnO}_4^-/\text{Mn}^{2+}} = 1.51 \text{ V}$$

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

SECTION - 2 (Q.21 - Q.30)

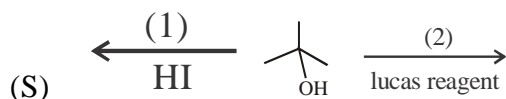
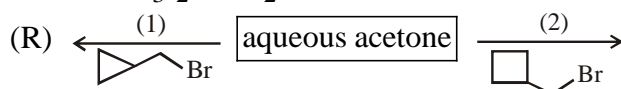
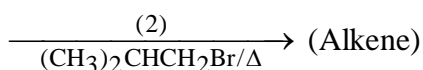
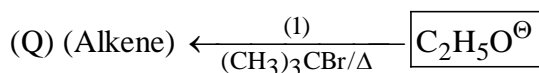
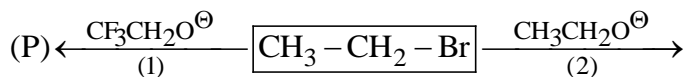
This section contains TEN (10) questions. ATTEMPT ANY FIVE (05) QUESTIONS. The answer to each question is NUMERICAL VALUE. If the numerical value has more than two decimal places truncate/round-off the value upto TWO decimal places.

Q.21 An adiabatic container fitted with a movable adiabatic piston (operating at 1 atm) is filled with 2 litre of $2 \text{ M H}_2\text{O}_2(\text{aq})$ 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) \div 100] in first 20 min will be

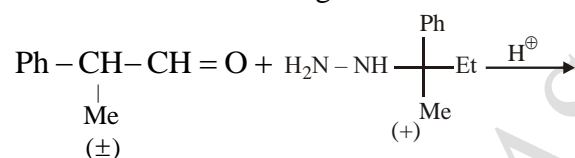
SPACE FOR ROUGH WORK

Q.22 Number of compounds which are planar ?
XeF₂, ClF₃, H₂O, [XeF₅]⁻, I₃⁻, BCl₃, XeF₄, SF₄, PCl₅, SF₆, IF₇.

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 Na₂SO₃, NaCl, Na₂C₂O₄, Na₂HPO₄, Na₂CrO₄, NaNO₂, CH₃COONa are separately treated with AgNO₃ solution. In how many cases white ppt. is/are obtained?

Q.26 A sample consisting of chocolate-brown powder of PbO₂ is allowed to react with excess of KI and iodine liberated is reacted with N₂H₄ in another container. The volume of gas liberated from this second container at STP was measured out to be 1.12 litre. Find out volume of decimolar NaOH (in litre) required to dissolve PbO₂ completely. (Assume all reactions are 100% complete)

Q.27 The ionization energy of the Be³⁺ ion with the electron in its ground state is 2.10 × 10^A kJ/mol. Find the value of A.

Q.28 By how many times the absolute temperature of a gas when U_{rms} of a gas in a container of fixed volume is increased from 5 × 10⁴ cm/sec to 10 × 10⁴ cm/sec.

Q.29 A sample of HI(g) is placed in flask at a pressure of 0.2 atm. At equilibrium, the partial pressure of HI(g) is 0.04 atm. What is K_p for the given equilibrium ? 2HI(g) ⇌ H₂(g) + I₂(g)

Q.30 In 100 ml sample of hard water, 100 ml of (N/50) Na₂CO₃ was added and the mixture was boiled and filtered. The filtrate was neutralized with 60 ml of (N/50) HCl. Calculate the permanent hardness of water (in ppm). (sp. gr. of hard water = 1).

PART B – PHYSICS

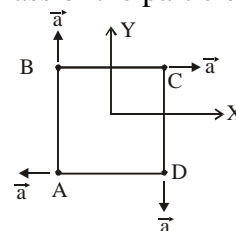
SECTION - 1 (Q.31 - Q.50)

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

Q.31 To which of the following the angular velocity of the electron in the n-th Bohr orbit is proportional ?

- (1) n² (2) 1 / n²
(3) 1 / n^{3/2} (4) 1/n³

Q.32 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 :



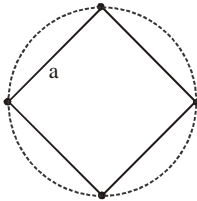
- (1) $\frac{a}{5}(\hat{i} - \hat{j})$ (2) $\frac{a}{5}(\hat{i} + \hat{j})$
(3) Zero (4) $a(\hat{i} + \hat{j})$

SPACE FOR ROUGH WORK

Q.33 A horizontal fire hose with a nozzle of cross-sectional area $\frac{5}{\sqrt{21}} \times 10^{-3} \text{ m}^2$ 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.34 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?



- (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.35 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.36 The temperature, at which the root mean square velocity of hydrogen molecules equals their escape velocity from the earth, is closest to :

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

Radius of Earth : $6.4 \times 10^6 \text{ m}$

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

- (1) 650 K (2) $3 \times 10^5 \text{ K}$
 (3) 10^4 K (4) 800 K

Q.37 A massless spring ($k = 800 \text{ N/m}$), 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

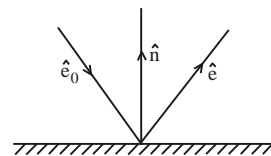
Q.38 A plane electromagnetic wave having a frequency $\nu = 23.9 \text{ GHz}$ propagates along the positive z -direction in free space. The peak value of the electric field is 60 V/m . Which among the following is the acceptable magnetic field component in the electromagnetic wave ?

- (1) $\vec{B} = 2 \times 10^7 \sin(0.5 \times 10^3 z + 1.5 \times 10^{11} t) \hat{i}$
 (2) $\vec{B} = 2 \times 10^{-7} \sin(1.5 \times 10^2 x + 0.5 \times 10^{11} t) \hat{j}$
 (3) $\vec{B} = 2 \times 10^{-7} \sin(0.5 \times 10^3 z - 1.5 \times 10^{11} t) \hat{i}$
 (4) $\vec{B} = 60 \sin(0.5 \times 10^3 x + 1.5 \times 10^{11} t) \hat{k}$

Q.39 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 $7.5 \times 10^{-12} \text{ m}$, the minimum electron energy required is close to :

- (1) 100 keV (2) 500 keV
 (3) 25 keV (4) 1 keV

Q.40 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) $\hat{e}_0 + (\hat{e}_0 \cdot \hat{n}) \hat{n}$

SPACE FOR ROUGH WORK

Q.41 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

Q.42 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.43 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.44 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.45 In SI units, the dimensions of $\sqrt{\frac{\epsilon_0}{\mu_0}}$ is –

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

Q.46 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) $\frac{Q}{4\pi\epsilon_0 r^2}$ from the centre towards the mark 10

(2) $\frac{Q}{4\pi\epsilon_0 r^2}$ from the mark 10 towards the centre

(3) $\frac{Q}{4\pi\epsilon_0 r^2}$ from the centre towards the mark 6

(4) Zero

Q.47 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 $g = 10 \text{ ms}^{-2}$) :

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

Q.48 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.49 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) $K_A > K_B / 2$

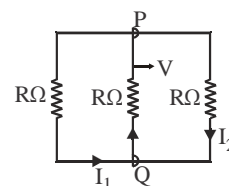
Q.50 A rectangular loop has a sliding connector PQ of length ℓ and resistance $R\Omega$ and it is moving with a speed v as shown. The set-up is placed in a uniform magnetic field going into the plane of the paper. The three currents I_1 , I_2 and I are:

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

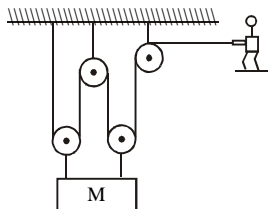


SPACE FOR ROUGH WORK

SECTION - 2 (Q.51 - Q.60)

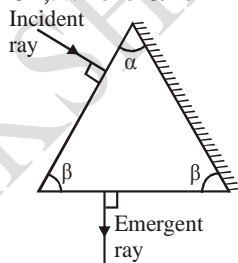
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Q.51 Mechanical advantage for pulling mass M by the person is

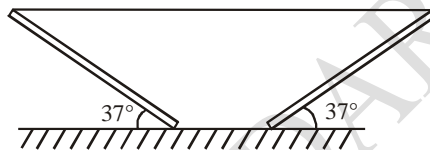


Q.52 A radioactive sample consists of two distinct species having equal number of N_0 atoms initially. The mean-life of one species is τ and of the other is 5τ . The decay products in both cases is stable. The total number of radioactive nuclei at $t = 5\tau$ is $N_0 \left(\frac{e^A + 1}{e^5} \right)$. Find the value of A.

Q.53 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.54 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.55 What is the ratio of powers delivered by 20 V dc and 20 V peak ac to the same load ?

Q.56 A cylinder contains hydrogen gas at pressure of 249 kPa and temperature 27°C . Its density is (X) kg/m^3 . Find the value of $10X$. ($R = 8.3 \text{ J mol}^{-1} \text{ K}^{-1}$)

Q.57 An electron is accelerated from rest through a potential difference of V volt. If the de Broglie wavelength of the electron is $1.227 \times 10^{-2} \text{ nm}$, the potential difference is 10^X V . Find the value of X.

Q.58 A particle undergoes SHM with a time period of 2 seconds. In $\frac{1}{X}$ sec it travel from its mean position to a displacement equal to half of its amplitude. Find the value of X.

Q.59 Ionized hydrogen atoms and α -particles with same momenta enters perpendicular to a constant magnetic field, B. The ratio of their radii of their paths $r_H : r_\alpha$ is X :Y. Find minimum sum of X and Y.

Q.60 A soap bubble, having radius of 1 mm, is blown from a detergent solution having a surface tension of $2.5 \times 10^{-2} \text{ N/m}$. The pressure inside the bubble equals at a point Z_0 below the free surface of water in a container. Taking $g = 10 \text{ m/s}^2$, density of water = 10^3 kg/m^3 , the value of Z_0 (in cm) is :

SPACE FOR ROUGH WORK

PART C – MATHEMATICS

SECTION - 1 (Q.61 - Q.80)

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

- Q.61** 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.62** 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.63** A point on the straight line, $3x + 5y = 15$ which is equidistant from the coordinate axes will lie only in
(1) 1st and 2nd quadrants
(2) 4th quadrant
(3) 1st, 2nd and 4th quadrant
(4) 1st quadrant
- Q.64** 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) $-\pi$
- Q.65** The sum of the series $2 \cdot {}^{20}C_0 + 5 \cdot {}^{20}C_1 + 8 \cdot {}^{20}C_2 + 11 \cdot {}^{20}C_3 + \dots + 62 \cdot {}^{20}C_{20}$ is equal to :
(1) 2^{24} (2) 2^{25}
(3) 2^{26} (4) 2^{23}
- Q.66** Let S, T, U be three non-void sets & $f : S \rightarrow T$, $g : T \rightarrow U$ be so that $g \circ f : S \rightarrow U$ 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.67** 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.68** If $f(x) = [x] - \left[\frac{x}{4} \right]$, $x \in \mathbb{R}$, where $[x]$ denotes the greatest integer function, then :
(1) Both $\lim_{x \rightarrow 4^-} f(x)$ and $\lim_{x \rightarrow 4^+} f(x)$ exist but are not equal.
(2) $\lim_{x \rightarrow 4^-} f(x)$ exists but $\lim_{x \rightarrow 4^+} f(x)$ does not exist.
(3) $\lim_{x \rightarrow 4^+} f(x)$ exists but $\lim_{x \rightarrow 4^-} f(x)$ does not exist.
(4) f is continuous at $x = 4$
- Q.69** 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.70** 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.71** 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) $2\pi/3$

SPACE FOR ROUGH WORK

Q.72 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.73 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.74 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.75 $\lim_{x \rightarrow 0^+} (x^n \ln x)$, $n > 0$

- (1) does not exist (2) exists and is zero
 (3) exists and is 1 (4) exists and is e^{-1}

Q.76 Let the sum of the first n terms of a non-constant A.P., a_1, a_2, a_3, \dots 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) $(50, 50 + 45A)$

Q.77 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.78 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.79 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.80 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.81 - Q.90)

This section contains TEN (10) questions. ATTEMPT ANY FIVE (05) QUESTIONS. The answer to each question is NUMERICAL VALUE. If the numerical value has more than two decimal places truncate/round-off the value upto TWO decimal places..

Q.81 Number of real solutions of the equation $x^4 + 8x^2 + 16 = 4x^2 - 12x + 9$ is equal to -

Q.82 The number of solutions of the equation $\tan^2 x - \sec^{10} x + 1 = 0$ in $(0, 10)$ is -

Q.83 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.84 Let f be a differentiable function such that

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

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

Q.85 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 :

Q.86 Two integers x and y are chosen (with replacement) from the set $\{0, 1, 2, \dots, 10\}$. If P be the probability that $|x - y|$ is less than or equal to 5, then find the value of $121P$.

Q.87 If the function $y = e^{4x} + 2e^{-x}$ is a solution of the differential equation $\frac{d^3y}{dx^3} - 13\frac{dy}{dx} = K$ then the value of K is –

Q.88 Let $\vec{A} = \hat{i} - 2\hat{j} + 3\hat{k}$, $\vec{B} = 2\hat{i} + \hat{j} - \hat{k}$, $\vec{C} = \hat{j} + \hat{k}$. If the vector $\vec{B} \times \vec{C}$ can be expressed as a linear combination $\vec{B} \times \vec{C} = x\vec{A} + y\vec{B} + z\vec{C}$ where x, y, z are scalars, then find the value of $(100x + 10y + 8z)$.

Q.89 If A be the area bounded by the curves $y = |x - 1|$ and $y + \frac{3}{|x+1|} = 2$, then find the value of $(2A + 3 \ln 3)$.

Q.90 If $f(x) = 7e^{\sin^2 x} - e^{\cos^2 x} + 2$, then find the value of

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