A Division of Aggarwal Educare
Aggarwal CLASSES™

JEE (MAIN)

TEST PAPER

SUBJECT : PHYSICS,CHEMISTRY, MATHEMATICS ***TEST CODE : TSJMT215***

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 quetions 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 responce for each question. Filling up more than one responce 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 A particle of mass m is moving in a circuular path of constant radius r such that is centripetal acceleration a_c is varying with time r as $a_c = k^2rt^2$, where k is a constant. The power delivered to the particle by the forces acting on it is

(a) $2\pi nk^2r^2t$ (b) mk^2t^2t (c) $\frac{mk^4r^2t^5}{3}$ (d) zero

Q.2 A body of mass 3 kg moving with a speed of 4 m/s, collides head on with a stationary body of mass 2 kg. Their relative velocity of separation after the collision, is 2 m/s . Then
(a) The coefficient of restitution is 0.5
(b) The impulse of the collision is 7.2 N^{-s}
(c) The loss of kinetic energy due to collision is 3.6 J
(d) All of the above

Q.3 If g_E and g_M are the acceleration due to gravity on the Earth and Moon, respectively, and if Millikan oil drop experiment could be performed on the two surfaces, one will find the ratio $\left(\frac{\text{electronic charge on moon}}{\text{electronic charge on earth}}\right)$ to be

(a) 0 (b) g_E/g_M (c) g_M/g_E (d) 1

Q.4 In which one of the following cases will the liquid flow in a pipe be most streamlined ?
(a) Liquid of high viscosity and high density flowing through a pipe of small radius
(b) Liquid of high viscosity and low density flowing through a pipe of small radius.
(c) Liquid of low viscosity and low density flowing through a pipe of large radius.
(d) Liquid of low viscosity and high density flowing through a pipe of large radius.

Q.5 A cylinder of radius R made of material of thermal conductivityf K_1 is surrounded by a cylinderical shell of inner radius R and outer radius 2R made of material of thermal conductivity K_2. The two ends of the combined system are maintained at two different temperatures. There is no loss of heat across the cylindirical surface and the system is a steady state. The effective thermal conductivity of the system is

(a) $K_1 + K_2$ (b) $\frac{K_1K_2}{K_1+K_2}$ (c) $\frac{K_1+3K_2}{4}$ (d) $\frac{3K_1+K_2}{4}$

Q.6 A Carnot engine takes 103 kcal of heat from a reservoir at 627°C and exhausts it to a sink a 27°C. The efficiency of the engine will be
(a) 22.2 % (b) 33.3 % (c) 44.4 % (d) 66.6 %

Q.7 Read the given statements and decide which is/are correct on the basis of kinetic energy theory of gases.
(I) Energy of one molecular at absolute temperature is zero.
(II) rms spreeds of different gases are same at same temeperature
(III) For 1 g of all ideal gases kinetic energy is same at same temperature.
(IV) For 1 mol of all ideal gases, kinetic energy is same at same temperature.
(a) All are correct (b) I and IV are correct
(c) IV is correct (d) None of these

Q.8 The kinetic energy and potential energy of a particle executing SHM will be equal, when displacement is (amplitude = a)

(a) $a/2$ (b) $a\sqrt{2}$ (c) $\frac{a}{\sqrt{2}}$ (d) $\frac{a\sqrt{2}}{3}$

Q.9 When two sound waves with a phase difference of $\pi/2$ and each having amplitude A and frequency ω are superimposed on each other, then maximum amplitude and frequency of resultant wave is

(a) $\frac{A}{\sqrt{2}}; \frac{\omega}{2}$ (b) $\frac{A}{\sqrt{2}}; \omega$ (c) $\sqrt{2}A; \frac{\omega}{2}$ (d) $\sqrt{2}A; \omega$

Q.10 Two spherical conductors B and C having equal radii and carrying equal charges on them repel each other with a force F when kept apart at some distance. A third spherical conductor having same radius as that B but uncharged is brought in contact with B, then brought in contact with C and finally removed away from both. The new force of repulsion between B and C is

(a) F/4 (b) 3F/4 (c) F/8 (d) 3F/8

Q.11 This question contains Statement -1 and Statement -2. Of the four choices given after the statement, choose the one that first desecribes the two statements.

Statements- 1 : For a chargd particle moving from pint P to point Q, the net work done by an electrostatic field on the particle is independent of the path connecting point P to point Q.

Satatement 2 : The net work done by a conservative force on a object moving along a closed loop is zero.

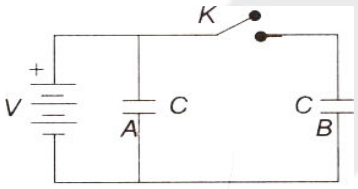
(a) Statement -1 is true, Statement-2 is false

(b) Statement-1 is true, Statement-2 is true; Statement-2 is correct explanation of Statement-1

(c) Statement-1 is true, Statement-2 is true; Statement-2 is not the correct explanation of Statement-1.

(d) Statement-1 is false, Statement-2 is true.

Q.12 As shown in Figure two identical capacitors are connected to a battery of V volts in parallel. When capacitors are fully charged, their stored energy is U_1. if the K is opened and material of dielectric constant $K = 3$ is inserted in each capacitor, their stored energy is now U_2. U_1/U_2 will be



(a) $\frac{3}{5}$ (b) $\frac{5}{3}$ (c) 3 (d) $\frac{1}{3}$

Q.13 A charged particle moves through a magnetic field perpendicular to its direction. Then

(a) Both momentum and kinetic energy of the particle are not constant.

(b) Both momentum and kinetic energy of the particle are constant

(c) The kinetic energy changes but the moment is constant

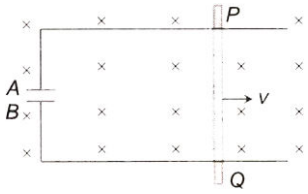
(d) The momentum changes but kinetic energy is constant

Q.14 The plane of dip circle is set in the geographic meridian and the apparent dip is θ_1. It is then set in a vertical plane perpendicular to the geographic meridian. Now, The apparent dip is θ_2. The angle of declination α at that place is

(a) $\tan\alpha = \sqrt{\tan\theta_1 \tan\theta_2}$ (b) $\tan\alpha = \sqrt{(\tan\theta_1)^2 + (\tan\theta_2)^2}$

(c) $\tan\alpha = \dfrac{\tan\theta_1}{\tan\theta_2}$ (d) $\tan\alpha = \dfrac{\tan\theta_2}{\tan\theta_1}$

Q.15 A conducting rod PQ of length $L = 1.0$ m is moving with a uniform speed $v = 2$ m/s in a uniform magentic field $B = 4.0$ T directed into the paper. A capacitor of capacity $C = 10$ μF is connected as shown in figure. Then



(a) $q_A = +80$ μC and $q_B = -80$μC

(b) $q_A = -80$ μC and $q_B = +80$μC

(c) $q_A = 0 = q_B$

(d) Charge stored in the capacitor increases exponentially with time

Q.16 Primary voltage is V_p, resistance of the primary winding is R_p. Turns in primary and secondary are respectively N_p and N_s. then secondary current in terms of primary voltage and secondary voltage, respectively, will be

(a) $\dfrac{V_pN_p}{R_pN_s}, \dfrac{V_sN_P^2}{R_pN_s^2}$ (b) $\dfrac{V_pN_p^2}{R_pN_s}, \dfrac{V_s^2N_P^2}{R_pN_s^2}$ (c) $\dfrac{V_pN_p}{R_p^2N_s}, \dfrac{V_sN^2}{R_p^2N_s^2}$ (d) $\dfrac{V_pN_p^2}{R_pN_s^2}, \dfrac{V_s^2N_p}{R_p^2N_s}$

Q.17 Light from the constellation Vigro is observed to increase in wavelength by 0.4 %. With respect to Earth the constellation is

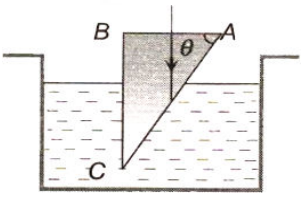
(a) Moving away with velocity 1.2×10^6 m/s

(b) Coming closer with velocity 1.2×10^6 m/s

(c) Moving away with velocity 4×10^6 m/s

(d) Coming closer with velocity 4×10^6 m/s

Q.18 A glass prism of refractive index 1.5 is immersed in water $(\mu = 4/3)$ figure. A light beam incident normally on the face AB is totally reflected to reach the face BC if



(a) $\sin\theta > 8.9$ (b) $2/3 < \sin\theta < 8/9$

(c) $\sin\theta \le 2/3$ (d) $\cos\theta \ge 8/9$

Q.19 An electron is acceleration through a potential difference of V volt. It has a wavelength λ associated with it. Through what potential difference and electron must be accelerated so that its de-Broglie wavelength is the same as that of a proton ? Take mass of proton to be 1837 times larger than the mass of electron.

(a) V volt (b) 1837 V volt (c) $\dfrac{V}{1837}$ volt (d) $\sqrt{1837}$ V volt

Q.20 The electric potential between a proton and an electron is given by $V = V_0 r$, where r is a constant. Assuming Bohr's model to be applicable, write variationof r, with n, n being the principle quantum number?

(a) $r_n \propto n$ (b) $r_n \propto 1/n$ (c) $r_n \propto n^2$ (d) $r_n \propto 1/n^2$

Q.21 An LC current contains inductance $L = 1\mu H$ and capacitance $C = 0.01\mu H$. The wavelength of electromagnetic wave generated is nearly?

Q.22 A wire of length L and three identical cells of negligible internal resistances are connected in series. Due to this current, the temperature of the wire is raised by ΔT in time t. A number N of similar cells is now connected in series with a wire of the same material and cross-section but of length 2L. The temeperature of wire is reaised by same amount ΔT in the same time t. The value of N is?

Q.23 Three equal resistors connected in series across a source of emf together dissipate 10 W. If the same resistors are connected in parallel across the same emf, then the power dissipiated will be ?

Q.24 A-2 kg block slides on a horizontal floor with a speed of 4 m/s. It strikes an uncompressed spring, and compresses it till the block is motionless. The kinetic friction force is 15 N and spring constant is 10.000 N/m. The spring compresses by (in cm)

Q.25 The moment of inertia of rod of length l about an axis passing through its centre of mass and perpendicular to rod is I. The moment of inertia of hexagonal shape formed by six such rods about an axis passing through its centre of mass and perpendicular to its plane will be ?

Part - B - CHEMISTRY

Q.26 The mass of Mg_3N_2 produced if 48 g of Mg metal is reacted with 34 g NH_3 gas is :

$Mg + NH_3 \rightarrow Mg_3N_2 + H_2$

(a) $\frac{200}{3}$ (b) $\frac{100}{3}$ (c) $\frac{400}{3}$ (d) $\frac{150}{3}$

Q.27 Assuming pure 2*s* and 2*p* orbitals of carbon are used in forming, CH_4, molecule, which of the following statements is false ?

(a) Three $C-H$ bonds will be at right angle

(b) Once $C-H$ bond will be weaker than other three $C-H$ bonds

(c) The shape of molecule wll be tetrahedral

(d) The angle $C-H$ bond formed by $s-\overline{s}$ overlapping will be uncertain with respect to other three bonds.

Q.28 In the reaction : $CS_{2(l)} + 3O_{2(g)} \rightarrow CO_{2(g)} + 2SO_{2(g)}$; $\Delta H = -265$ kcal

The enthalpis of formation of CO_2 and SO_2 are both negative and are in the ratio 4 : 3. The enthalpy of formation of CS_2 is +26 kcal/mol. Calculate the entahlpy of formation of SO_2.

(a) -90 kcal/ mol (b) -52 kcal/mol (c) -78 kcal/mol (d) -71.7 kcal/mol

Q.29 Ferrous oxide has a cubic structure, and the edge length of the unit cell is 5.0 A. Assuming the density of ferrous oxide to be 3.84 g/cm^3, the number of Fe^{2+} and O^{2-} ions present in each unit cell will be : (use $N_A = 6 \times 10^{23}$)

(a) 4 Fe^{2+} and 4 Q^{2-} (b) 2 Fe^{2+} and 2 O^{2-} (c) 1 Fe^{2+} and O^{2-} (d) 3 Fe^{2+} and 4 O^{2-}

Q.30 The EMF of given cell $Pt, H_{2(P_1)} | H^+ | | H^+ | H_{2(P_2)}, Pt$ is :

(a) $\frac{RF}{F} \log \frac{P_1}{P_2}$ (b) $\frac{RF}{2F} \log \frac{P_1}{P_2}$

(c) $\frac{RF}{F} \log \frac{P_2}{P_1}$ (d) None of these

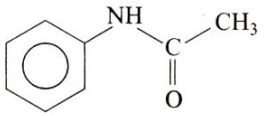
Q.31 Inversion of cane sugar proceeds with half life of 500 min at pH = 5 for any concentration of sugar. However, if pH = 6 , the half life changes to 50 min. The rate law expression for sugar inversion can be written as :

(a) $r = K[sugar]^2 [H^+]^0$ (b) $r = K[sugar]^1 [H^+]^0$

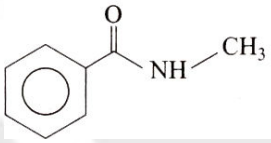
(c) $r = K[sugar]^1 [H^+]^1$ (d) $r = K[sugar]^0 [H^+]^0$

Q.32 Point of false statement :
(a) Brownian movement and Tyndall effect are shown by colloidal systems
(b) Gold number is a measure of the protective power of a lyophilic colloidal
(c) The colloidal solution of a liquid in liquid is called gel
(d) Hardy-Schulze rule is related with coagulation

Q.33 The correct basic strength order is :



I



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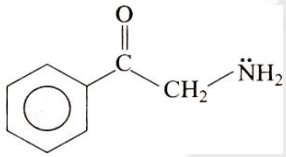
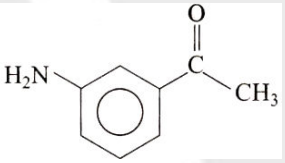


III



IV

(a) I > II > IV > III (b) IV > III > II > I
(c) III > II > IV > I (d) III > IV > II > I

Q.34 Two isomers can be metamers if they have :
(a) equal distribution of alkyl group on either side of the functional group
(b) unequal distribution of alkyl group on either side of the functional group
(c) different functional group
(d) different positions of an atom or group on the rings of same side

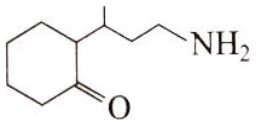
Q.35 Rank the following organometallic compounds in the increasing order of nuclephilicity
(A) H_3CMgBr (B) $(CH_3)_2Cd$ (C) CH_3Na (D) CH_3Li
(a) B < C > D < A (b) B < A < D < C (c) C < D < A < B (d) D < A < B < C

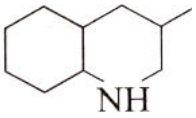
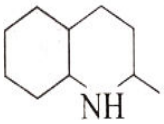
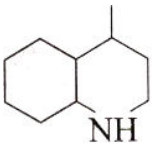
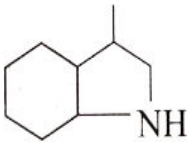
Q.36 The most suitable method for the separation of a 1 : 1 mixture of ortho and *para-nitrophenols* is :
(a) distillation (b) sublimation
(c) crystallization (d) chromatography

Q.37 A substance $C_6H_{12}O$ does not react with Fehling's solution but gives positive reactions for a carbonyl group. It also gives positive iodoform reaction. Which of the following structure will best

correspond to the above statements ?
(a) $CH_3CH_2CH(CH_3)COCH_3$ (b) $CH_3CH_2COCH_2CH_2CH_3$
(c) $CH_3CH_2COCH(CH_3)_2$ (d) $CH_3CH_2CH(CH_3)CH_2CHO$

Q.38 Reductive amination of A form :

(A) : 

(a)  (b)  (c)  (d) 

Q.39 A mixture containing primary, secondary, and tertiary amines is treated with diethyl oxalate. Choose the correct statement.
(a) The distilate of the mixture after treatment mainly contains 1^o amine
(b) 3^o amine do not react with diethyl glyoxalate
(c) This is Hinsberg method of separating 1^o, 2^o, and 3^o amines
(d) 3^o amine is removed by filtration

Q.40 An organic compound contains C = 36%, H = 6%, and rest oxygen. Its empirical formula is :
(a) CH_2O (b) $C_2H_3O_3$ (c) CH_2O_2 (d) $C_2H_2O_2$

Q.41 Sucrose molecule is made up of :
(a) a glucopyranose and fructopyranose
(b) a glucopyranose and fructofuranose
(c) a glucofuranose and a fructopyranose
(d) a glucofuranose and a fructofuranose

Q.42 High-density polyethylene (HDPE) can be prepared from ethylene by :
(a) Ziegler- Natta process (b) Heating with peroxides
(c) Condensing in sealed tubes (d) Condensing with styrenes

Q.43 (i) $A + Na_2CO_3 \rightarrow B + C$, (ii) $A \xrightarrow{CO_2}$ (Milky) C
The chemical formulas of A and B are respectively :
(a) NaOH and $Ca(OH)_2$ (b) $Ca(OH)_2$ and NaOH
(c) NaOH and CaO (d) CaO and $Ca(OH)_2$

Q.44 Na_2CO_3 can be manufactured by Solvey's process but K_2CO_3 cannot be prepared because :
(a) K_2CO_3 is more soluble
(b) K_2CO_3 is less soluble
(c) $KHCO_3$ is more soluble than $NaHCO_3$
(d) $KHCO_3$ is less soluble than $NaHCO_3$

Q.45 In nitroprusside ion, the iron and NO exist, respectively as Fe^{II} and NO^+ rather than Fe^{III} and NO. These forms can be differentiated by :
(a) estimating the concentration of iron
(b) measuring the concentration of CN^-
(c) measuring the solid state magnetic moment
(d) thermally decomposing the compound

Q.46 Vapor pressure of a solution of 5 g of non-electrolyte in 100 g of water at a particular temperature is 2985 N/m^2. The vapor pressure of pure water is 3000 N/m^2. The molecular weight of the solute is :

Q.47 ow many grams of CaC_2O_4 (molecular weight $=128$) on dissolving in distilled water will give a saturated $[K_{sp}(CaC_2O_4) = 2.5 \times 10^{-9} mol^2 / L^2]$

Q.48 What is likely to be principal quantum number for a circular orbit of diameter 20 nm of the hydrogen atom if we assume Bohr orbit to be the same as that represented by the principlal quantum number ?

Q.49 A sample of O_2 gas is collected over water at 23°C at a baromatric pressure of 751 mm Hg (vapor pressure of water at 23°C is 21 mm Hg.). The partial pressure of O\ gas in the sample collector is ?
(a) 21 mm Hg (b) 751 mm Hg (c) 0.96 atm (d) 1.02 atm

Q.50 A metal electrode has a reduction potential of 0.136 V when measured against a standard calomel electrode (E^0 calomel (oxid^n) = -0.244 V). The potential of metal electrode against SHE is?

Part - C - MATHEMATICS

Q.51 If the 4th term in the expansion of $\left(ax + \frac{1}{x}\right)$ is $\frac{5}{2}$, then the values of a and n are :

(a) $\frac{1}{2}, 6$ (b) 1, 3 (c) $\frac{1}{2}, 3$ (d) cannot be found

Q.52 If a, b, c are consecutive positive integers and log $(1 + ac) = 2K$ then the value of K is
(a) log b (b) log a (c) 2 (d) 1

Q.53 If a, b, c are consecutive positive integers and log $(1 + ac) = 2K$ then the value of K is
(a) log b (b) log a (c) 2 (d) 1

Q.54 A light ray coming along the line $3x + 4y = 5$ gets reflected from the line $ax + by = 1$ and goes along the line $5x + 12y = 10$ then

(a) $a = \frac{64}{115}, b = \frac{112}{15}$ (b) $a = \frac{14}{15}, b = -\frac{8}{115}$

(c) $a = \frac{64}{115}, b = -\frac{8}{115}$ (d) $a = \frac{64}{15}, b = \frac{14}{15}$

Q.55 Let AB be a chord of the circle $x^2 + y^2 = r^2$ subtending a right angle at the centre. Thus the locus of the centroid of the triangle PAB as P moves on the circle is
(a) a parabola (b) a circle (c) an ellips (d) a pair of the straight line

Q.56 Let A and B be two distinct points on the parabola $y^2 = 4x$. If the axis of the parabola touches a circle of radius r having AB as its diameter, then the slope of the line joining A and B can be

(a) $-\frac{1}{r}$ (b) $\frac{1}{r}$ (c) $\frac{2}{r}$ (d) none of these

Q.57 The equation of the ellipse (referred to its axes as the axes of x and y respectively) Whose foci are $(\pm 2, 0)$ and eccentricity 1/2, is

(a) $\frac{x^2}{12}+\frac{y^2}{16}=1$ (b) $\frac{x^2}{16}+\frac{y^2}{12}=1$ (c) $\frac{x^2}{16}+\frac{y^2}{8}=1$ (d) none of these

Q.58 If the latus rectum of a hyperbola through one focus subtends 60^o angle at the other focus, then its ecentricity is

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

Q.59 Let S be a non-empty subset of R. Consider the following statements :

P : There is a rational number $x \in S$ such that $x > 0$ which of the following statements is the negation of the statement P ?

(a) $x \in S$ and $x \leq 0 \Rightarrow x$ is not rational

(b) There is a rational number $x \in S$ such that $x \leq 0$

(c) There is no rational number $x \in S$ such that $x \leq 0$.

(d) Every rational number $x \in S$ satisfies $x \leq 0$.

Q.60 The function f : R $\rightarrow$ R defined by $f(x) = x(x-1)(x-2)(x-3)$ is

(a) one -one but not onto (b) onto but not one-one

(c) both one -one and onto (d) neither one-one nor onto

Q.61 $\lim\limits_{x\to\frac{\pi}{2}} \frac{\sin x}{\cos^{-1}\left[\frac{1}{4}(3\sin x-\sin 3x)\right]}$, Where [ ] denotes the greatest integer function, is

(a) $\frac{2}{\pi}$ (b) 1 (c) $\frac{4}{\pi}$ (d) does not exist

Q.62 If $x^y = e^{x-y}$, then $\frac{dy}{dx}$ is

(a) $\frac{1+x}{1+\log x}$ (b) $\frac{1-\log x}{1+\log x}$ (c) not defined (d) $\frac{\log x}{(1+\log x)^2}$

Q.63 Let $f(x)=\begin{cases}(x-1)\sin\left(\frac{1}{x-1}\right), & \text{if } x\neq 1\\ 0, & \text{if } x=1.\end{cases}$ Then which one of the following is true ?

(a) f is neither differentiable at $x = 0$ and at $x = 1$

(b) f is differentiable at $x = 0$ and at $x = 1$

(c) f is differentiable at $x = 0$ but not at $x = 1$

(d) f is differentiable at $x = 1$ but not at $x = 0$

Q.64 If the curve $y = ax^2 - 6x + b$, passes through (0, 2) and has its tangent parallel to the x-axis at $x = 3/2$, then the values of a and b are respectively

(a) 2 and 2 (b) -2 and -2 (c) -2 and 2 (d) 2 and -2

Q.65 Let $f(x) = \frac{a}{x} + x^2$. If it has a maximum at $x = -3$ then a is

(a) -1 (b) -16 (c) 1 (d) none of these

Q.66 $\int \frac{dx}{\cos x - \sin x}$ is equal to

(a) $\frac{1}{\sqrt{2}} \log \left|\tan\left(\frac{x}{2} - \frac{\pi}{8}\right)\right| + c$ (b) $\frac{1}{\sqrt{2}} \log \left|\cot\left(\frac{x}{2}\right)\right| + c$

(c) $\frac{1}{\sqrt{2}} \log \left|\tan\left(\frac{x}{2} - \frac{3\pi}{8}\right)\right| + c$ (d) $\frac{1}{\sqrt{2}} \log \left|\tan\left(\frac{x}{2} + \frac{3\pi}{8}\right)\right| + c$

Q.67 Let $f:(-1, 2) \to [0, \infty]$ be a continuous function such that $f(x) = f(1 - x)$ for all $x \in [-1, 2]$.

Let $R_1 = \int_{-1}^{2} xf(x)\,dx$, and R_2 be the area of the region bounded by $y = f(x)$, $x = -1$, $x = 2$, and the x-axis. Then,

(a) $R_1 = 2R_2$ (b) $R_1 = 3R_2$ (c) $2R_1 = R_2$ (d) $3R_1 = R_2$

Q.68 An object falling from rest in the air is subject not only to the gravitational force but also to the air resistance. Assume that the air resistance is proportional to the velocity with constant of proportionality as k > 0, and acts in a directions opposite to motion ($g = 9.8\ m/\sec^2$). Then velocity cannot exceed

(a) 9.8/k m/sec (b) 98/k m/sec (c) $\frac{k}{9.8}$ m/sec (d) none of these

Q.69 If $\sin(x + 20^o) = 2 \sin x \cos 40^o$ where $x \in \left(0, \frac{\pi}{2}\right)$ then which of the following dose not hold good

(a) $\cot \frac{x}{2} = (2 + \sqrt{3})$ (b) $\operatorname{cosec}\ 4x = 2\sqrt{3}$

(c) $\sec \frac{x}{2} = \sqrt{6} - \sqrt{2}$ (d) $\tan 4x = \sqrt{3}$

Q.70 The base of cliff is circular. From the extremities of a diameter of the base that angles of elevation of the top of the cliff are 30^o and 60^o. If the height of the cliff is 500 m. then the diameter of the base of the cliff is

(a) $1000/\sqrt{3}\ m$ (b) $2000/\sqrt{3}\ m$ (c) $1000\sqrt{2}\ m$ (d) $2000\sqrt{2}\ m$

Q.71 Consider the frequency distribution of the given numbers

Value	1	2	3	4
Frequency	5	4	6	***f***

If the mean is known to be 3, then the volue of f is

Q.72 Two persons A and B get together once a week to play a game. They always play 4 games. From past experience Mr. A wins 2 of the 4 games just as often as he win 3 of the 4 games. If Mr. A does not alway win or always lose, then the probability that Mr. A wins any one game is (given the probability of A's wining a game is a non-zero constant less than one).

Q.73 The letters of the word COCHIN are permuted and all the permutations are arranged in an alphabetical order as in an English dictionary. The number of words that appear before the word COCHIN is

Q.74 $\lim\limits_{x\to 0} \dfrac{x^n - \left[\sin(x)^n\right]}{x - (\sin x)^n}$ is non-zero finite, then n must be equal to

Q.75 The number of real solutions of the equation $|x|^2 - 3|x| + 2 = 0$ is

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ROUGH WORK