JEE MAIN 2020

FULL TEST-5

CHEMISTRY , PHYSICS, MATHEMATICS

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

INSTRUCTIONS :

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

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

An obstacle is often a Stepping stone.

Every person is born with the talent.

Name : .....

Address : .....

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Phone/Mobile No. .....

Roll No. .....

PART A – CHEMISTRY

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

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

Q.1 On addition of NaOH to CH_3COOH solution, 60% of the acid is neutralised. If pK_a of CH_3COOH is 4.7 then the pH of the result ion solution is –

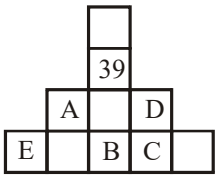
(1) More than 4.7 but less than 5.0.

(2) Less than 4.7 but more than 5.0.

(3) More than 5.0.

(4) Remains unchanged.

Q.2



On the basis of given part of periodic table, **incorrect** statement is

(1) A is an alkaline earth metal.

(2) Atomic number of B is 103 which belongs to III B group.

(3) Atomic number, group no. and period number of D are 72 IV B and 6^{th} respectively.

(4) C is a transuranic element.

Q.3 In which following set of compound/ion has linear shape

(1) CH_4, NH_4^+, BH_4^- (2) CO_3^{-2}, NO_4^-, BF_3

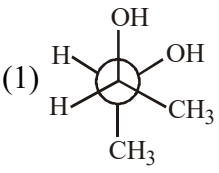
(3) NO_2^+, CO_2, XeF_2 (4) $BeCl_2, BCl_3, CH_4$

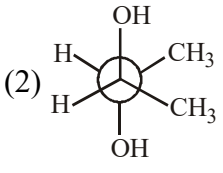
Q.4 Which one of the following molecules is expected to exhibit diamagnetic behaviour?

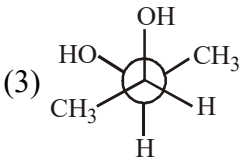
(1) C_2 (2) N_2^-

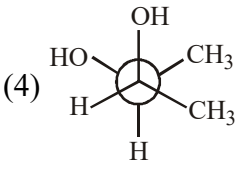
(3) O_2 (4) S_2

Q.5 Which one of the following is the most stable conformation of 2,3-butanediol :

(1) 

(2) 

(3) 

(4) 

Q.6 Which of the following product will be obtained when neopentyl alcohol is treated with conc. HCl in presence of $ZnCl_2$.

(1) t-butyl chloride (2) isobutylene

(3) t-pentyl chloride (4) Neo pentyl chloride

Q.7 $MeCH_2C \equiv CH \xrightarrow{NH_3/NaNH_2} a \xrightarrow{EtBr} b$,

a and b are –

(1) $MeCH_2C \equiv CNa$, $MeCH_2C \equiv C - Et$

(2) $MeCH_2CH = CH_2$, $MeCH_2 - CHEt - CH_3$

(3) $MeCH_2CH = CHNH_2$,
$MeCH_2CH = CH - NHBr$

(4) $MeCH_2C \equiv C–NH_2$, $MeC \equiv C - NH - Br$

Q.8 A substance 'A' decomposes in solution following the first order kinetics flask I contains 1 litre of 1M solution of A and flask II contains 100 ml of 0.6 M solution. After 8 hr. the concentration of A in flask I become 0.25 M, what will be the time for concentration of A in flask II to become 0.3 M.

(1) 0.4 hr.

(2) 2.4 hr.

(3) 4.0 hr.

(4) Unpredictable as rate constant is not given

Q.9 The standard reduction potentials of Cu^{2+}/Cu and Cu^{2+}/Cu^+ are 0.337 and 0.153 V respectively. The standard electrode potential of Cu^+/Cu half cell is

(1) 0.184 V (2) 0.827 V

(3) 0.521 V (4) 0.490 V

Q.10 Which of the following statements is incorrect in relation to the structure of diborane

(1) All the terminal B–H bond length are equal.

(2) The terminal B–H bond is a 2-centre 3-electron bond.

(3) The terminal B–H bond is a 2-centre 2-electron bond.

(4) The bridge  is a 3-centre 2-electron bond.

SPACE FOR ROUGH WORK

Q.11 Which of the following f-block elements, will change its group on emmitting α-particle –

(a) $_{58}Ce$ (b) $_{70}Lu$

(c) $_{90}Th$ (d) $_{92}U$

Correct answer is :

(1) Only a and c (2) Only b and d

(3) All (4) None

Q.12 Which of the following contains one unpaired electron in the 4p orbitals :

(1) $[Cu(NH_3)_2]^+$ (2) $[Cu(NH_3)_4]^{2+}$

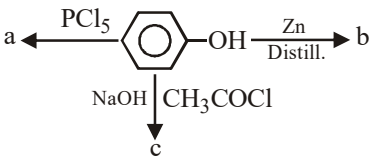
(3) $[Cu(CN)_4]^{3-}$ (4) $[Ni(CN)_4]^{2-}$

Q.13 Acetone is obtained by the hydrolysis of the addition product of methyl magnesium iodide and

(1) HCHO (2) CH_3CHO

(3) Acetone (4) Ethanenitrile

Q.14



The compounds a, b and c in the above reaction sequence are

(1) Chlorobenzene, benzene, methyl benzoate.

(2) Triphenyl phosphate, benzene, phenyl acetate.

(3) Benzyl chloride, benzene, phenyl acetate.

(4) Benzyl chloride, benzene, phenylacetyl chloride

Q.15 The reagents a and b in the reaction sequence

$$CH_3COOC_2H_5 \xrightarrow{a} CH_3COOC(CH_3)_3$$
$$\xrightarrow{b} CH_3CONHNH_2$$

are given by the set

(1) Isopropyl alcohol, hydrazine

(2) Isopropyl alcohol, hydroxylamine

(3) t-butyl alcohol, hydrazine

(4) t-butyl alcohol, hydroxylamine

Q.16 The correct set of the products obtained in the following reactions

$$RCN \xrightarrow{\text{Reduction}} (a), \quad RCN \xrightarrow[(ii)\ H_2O]{(i)\ CH_3MgBr} (b),$$

$$RNC \xrightarrow{\text{Hydrolysis}} (c), \quad RNH_2 \xrightarrow{HNO_2} (d)$$

The answer is –

(1) a-2°Amine, b-Methyl ketone, c-1°Amine d-Alcohol.

(2) a-1°Amine, b-Methyl ketone, c-1°Amine d-Alcohol.

(3) a-2°Amine, b-Methyl ketone, c-2° Amine d-Acid.

(4) a-2°Amine, b-Methyl ketone, c-2° Amine d-Aldehyde.

Q.17 Which one of the following sets of monosaccharides forms sucrose ?

(1) α-D-Galactopyranose & α-D-Glucopyranose

(2) α-D-Glucopyranose and β-D-fructofuranose

(3)β-D-Glucopyranose and α-D-fructofuranose

(4) α-D-Glucopyranose and β-D-fructopyranose

Q.18 Which is the monomer of Neoprene in the following

(1) $CH_2 = CH - C \equiv CH$

(2) $CH_2 = CH - CH = CH_2$

(3) $CH_2 = \underset{\displaystyle CH_3}{\underset{|}{C}} - CH = CH_2$

(4) $CH_2 = \underset{\displaystyle Cl}{\underset{|}{C}} - CH = CH_2$

Q.19 In the Kjeldahl's method for estimation of nitrogen present in a soil sample, ammonia evolved from 0.75 g of sample neutralized 10mL of 1 M H_2SO_4. The percentage of nitrogen in the soil is –

(1) 37.33 (2) 45.33

(3) 35.33 (4) 43.33

Q.20 In which of the following arrangements the given sequence is not strictly according to the property indicated against it ?

(1) Increasing acidic strength : $HF < HCl < HBr < HI$

(2) Increasing pK_a values : $H_2O < H_2S < H_2Se < H_2Te$

(3) Increasing acidic character : $NH_3 < PH_3 < AsH_3 < SbH_3$

(4) Increasing oxidising power : $CO_2 < SiO_2 < SnO_2 < PbO_2$

SPACE FOR ROUGH WORK

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

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

Q.21 K_c for the esterification reaction :
$CH_3COOH + C_2H_5OH \rightleftharpoons CH_3COOC_2H_5 + H_2O$
is 4. If 4 mol each of acid and alcohol are taken initially, the equilibrium concentration of the acid is (A/3). Find the value of A.

Q.22 If number of moles of $KMnO_4$ reduced by 1 mole of ferrous oxalate in acidic medium is (A/5). Find the value of A.

Q.23 A football bladder contains equimolar proportions of H_2 and O_2. The composition by mass of the mixture effusing out of punctured football is in the ratio (H_2 : O_2) is (1 : X). Find the value of X.

Q.24 An element, density 6.8 g cm^{-3} occurs in bcc structure with cell edge 290 pm. The number of atoms present in 200g of the element is $2.4 \times 10^{4\times X}$. Find the value of X.

Q.25 The number of S–S bonds in sulphur trioxide trimer (S_3O_9) is

PART B – PHYSICS

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

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

Q.26 The dimensions of (a/b) in the equation

$P = \dfrac{a - t^2}{bx}$ where P is pressure, x is distance and t is time, are:

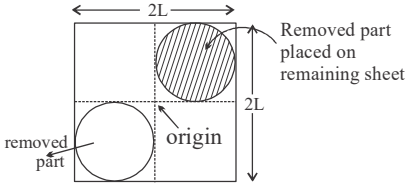
(1) $[M^2L\,T^{-3}]$ (2) $[MT^{-2}]$
(3) $[LT^{-3}]$ (4) $[ML^3T^{-1}]$

Q.27 In a meter bridge experiment the resistance of resistance box is 16Ω, which is inserted in right gap. The null point is obtained at 36cm from the left end. The least count of meter scale is 1mm. What is the value of unknown resistance? (Error = L.C. or L.C./2)

(1) $9 \pm \dfrac{5}{128}\Omega$ (2) $9 \pm \dfrac{1}{5120}\Omega$
(3) $9 \pm \dfrac{5}{512}\Omega$ (4) $\dfrac{128}{9} \pm \dfrac{1}{2560}\Omega$

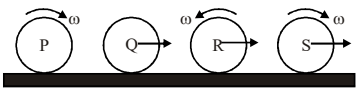
Q.28 A projectile is to be projected towards enemy territory at the same horizontal level. The initial velocity of the projectile is known to be 100 ± 1 m/s. Initial angle of the projectile is known to be projected $45° \pm 1°$.
What is the possible range of the projectile?
(1) 990 m ≤ R ≤ 1010 m
(2) 980 m ≤ R ≤ 1020 m
(3) 970 m ≤ R ≤ 1030 m
(4) 930 m ≤ R ≤ 970 m

Q.29 Figure shows a square lamina with a disc of radius L/2 removed from it which is now placed symmetrically over upper right quarter. What is location of centre of mass of system relative to origin shown in figure.



(1) $\dfrac{\pi L}{12}(\hat{i}+\hat{j})$ (2) $\dfrac{\pi L}{8}(\hat{i}+\hat{j})$
(3) $\dfrac{\pi L}{4}(\hat{i}+\hat{j})$ (4) $\dfrac{\pi L}{16}(\hat{i}+\hat{j})$

Q.30 Four solid spheres are made to move a rough horizontal surface. Sphere P is given a spin and released. Sphere Q is given a forward linear velocity. Spheres R and S are given linear and rotational motions as shown in the figure. Directions of the friction force on spheres P, Q, R, S are respectively –



(1) Right, Left, Right, Left
(2) Right, Left, Left, Right
(3) Left, Right, Left, either Left or Right
(4) Right, Left, Left, either Left or Right

SPACE FOR ROUGH WORK

Q.31 The young's modulus of material of a thin ring shaped elastic body is Y. The mass of ring is m, area of cross section is A, It's initial radius is R. Ring is a little elongated, then left alone. At what time will ring circumference be same as it was initially. Neglect loss of energy.

(1) $\sqrt{\frac{\pi mR}{8YA}}$ (2) $\frac{3}{2}\sqrt{\frac{\pi mR}{YA}}$

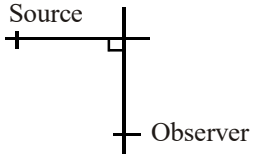
(3) $2\sqrt{\frac{\pi mR}{YA}}$ (4) $\sqrt{\frac{\pi mR}{2YA}}$

Q.32 Two satellites S_1 and S_2 revolve around a planet in coplanar circular orbits in the same sense. Their periods of revolution are 1 hour and 8 hours respectively. The radius of the orbit of S_1 is 10^4 km. When S_1 is closest to S_2, the angular speed of S_2 as observed by an astronaut in S_1 is :

(1) π rad/hr (2) $\pi/3$ rad/hr

(3) 2π rad/hr (4) $\pi/2$ rad/hr

Q.33 A source and an observer are situated on two perpendicular tracks as shown in the figure. The observer is at rest and source is moving with a speed 50 m/s. The source emits sound waves of frequency 90 Hz which travel in the medium with velocity 200m/s. The frequency of sound heard by observer when the source crosses the origin is



(1) 84 Hz (2) 88 Hz

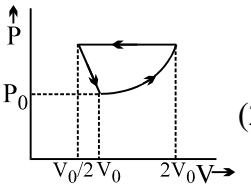
(3) 92 Hz (4) 96 Hz

Q.34 Two identical heaters are coated with paint. In 1st case $e_1 = 1.0$ and in 2nd case $e_2 = 0.5$. Both are kept in identical chambers which are in similar surroundings. If the heaters are switched on, in steady state 1st heater has temperature T_1 on surface and θ_1 of its chamber. 2nd heater has temperature T_2 on surface and θ_2 of its chamber.

(1) $\theta_1 = \theta_2$; $T_1 < T_2$ (2) $\theta_1 > \theta_2$; $T_1 = T_2$

(3) $\theta_1 = \theta_2$; $T_1 > T_2$ (4) $\theta_1 < \theta_2$; $T_1 = T_2$

Q.35 One mole of an ideal gas at pressure P_0 and temperature T_0 volume V_0 is expanded isothermally to twice its volume and then compressed at constant pressure to $(V_0/2)$ and the gas is brought to original state by a process in which P α V (Pressure is directly proportional to volume). The correct representation of process is –

(1)


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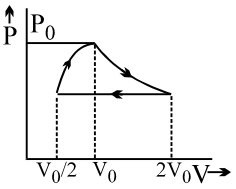

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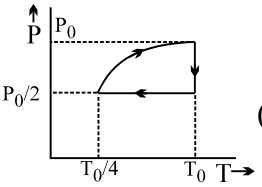

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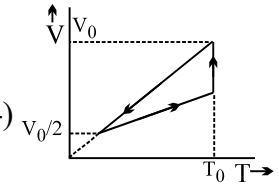
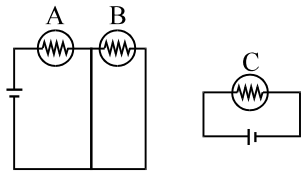


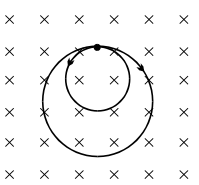
Q.36 In the two circuits shown, all the light bulbs and batteries are identical. If A, B and C respectively denotes the brightness of light bulbs A, B & C then

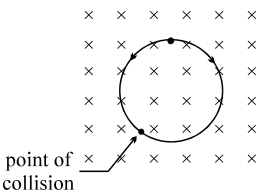


(1) C > A = B (2) C < A = B

(3) C = A > B (4) C = A < B

Q.37 A neutral particle at rest in a magnetic field decays into two charged particles of different mass. The energy released goes into their kinetic energy. Then what can be the path of the two particles. Neglect any interaction between the two charges.

(1)


(2)


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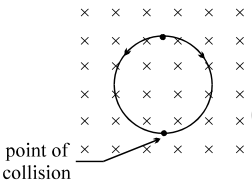
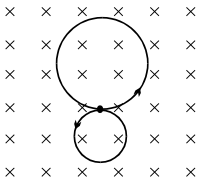
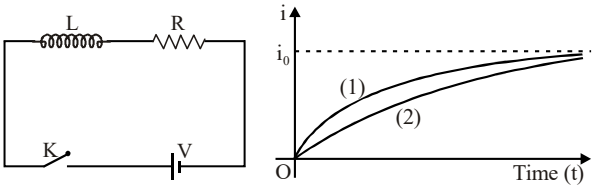
(3) 

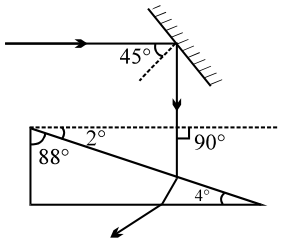
(4) 

Q.38 Refer to the circuit diagram and the corresponding graphs. The current rises when key K is pressed. With $R = R_1$ and $L = L_1$ the rise of current is shown by curve (1), while curve (2) shows the rise of current when $R = R_2$ and $L = L_2$. The maximum current is same for both curves, then :



(1) $R_1 = R_2, L_1 > L_2$ (2) $R_1 > R_2, L_1 = L_2$
(3) $R_1 > R_2, L_1 < L_2$ (4) $R_1 = R_2, L_1 < L_2$

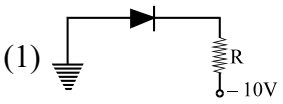
Q.39 A ray of light strikes a plane mirror at an angle of incidence 45º as shown in the figure. After reflection, the ray passes through a prism of refractive index 1.5, whose apex angle is 4º. The angle through which the mirror should be rotated if the total deviation of the ray is to be 90º is

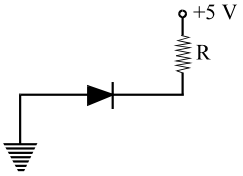


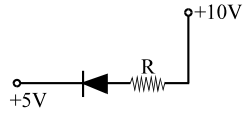
(1) 1° clockwise (2) 1° anticlockwise
(3) 2° clockwise (4) 2° anticlockwise

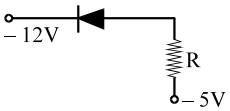
Q.40 In young's double slit experiment a coordinate axis is printed on the screen. The y co-ordinates of central maxima and 10th maxima are 2cm and 5cm respectively. When the YDSE apparatus is immersed in a liquid of refractive index 1.5, the corresponding y-co-ordinates will be
(1) 2cm, 7.5 cm (2) 3cm, 6cm
(3) 4/3 cm, 10/3 cm (4) 2 cm, 4 cm

Q.41 In the following, which one of the diodes is reverse biased –

(1) 

(2) 

(3) 

(4) 

Q.42 Modulation factor determines –
(1) only the strength of the transmitted signal
(2) only the quality of the transmitted signal
(3) both the strength and quality of the signal
(4) none of the above

Q.43 If the momentum of electron is changed by P, then the de Broglie wavelength associated with it changes by 0.5%. The initial momentum of electron will be
(1) 200 P (2) 400 P
(3) P/200 (4) 100 P

Q.44 The half life of a radioactive nucleus is 50 days. The time interval $(t_2 - t_1)$ between the time t_2 when 2/3 of it has decayed and the time t_1 when 1/3 of it had decayed is :
(1) 30 days (2) 50 days
(3) 60 days (4) 15 days

Q.45 The binding energy per nucleon of $^{7}_{3}\text{Li}$ and $^{4}_{2}\text{He}$ nuclei are 5.60 MeV & 7.06 MeV, respectively. In the nuclear reaction

$^{7}_{3}\text{Li} + {}^{1}_{1}\text{H} \rightarrow {}^{4}_{2}\text{He} + {}^{4}_{2}\text{He} + Q$, the value of energy Q released is –
(1) 19.6 MeV (2) –2.4 MeV
(3) 8.4 MeV (4) 17.3 MeV

SPACE FOR ROUGH WORK

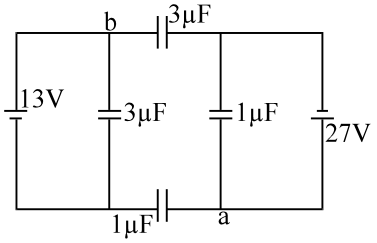
SECTION - 2 (Q.46 - Q.50)

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

Q.46 The rear side of a truck is open and a box of mass 20kg is placed on the truck 4 meters away from the open end. Coefficient of friction between truck and block is 0.15. The truck starts from rest with an acceleration of $2m/sec^2$ on a straight road. The box will fall off the truck when truck is at a distance from the starting point equal to $(4 \times X)$ metres. Find the value of X. $(g = 10\ m/s^2)$

Q.47 A closed organ pipe of length L is vibrating in its first overtone. There is a point Q inside the pipe at a distance 7 L/9 from the open end. The ratio of pressure amplitude at Q to the maximum pressure amplitude in the pipe is (1 : X). Find the value of X.

Q.48 Four capacitors and two sources of e.m.f. are connected as shown in the figure. The potential difference in volts between the points a and b is (10 + X). Find the value of X.



Q.49 If light of wavelength of maximum intensity emitted from surface at temperature T_1 is used to cause photoelectric emission from a metallic surface, the maximum kinetic energy of the emitted electron is 6 eV, which is 3 time the work function of the metallic surface. If light of wavelength of maximum intensity emitted from a surface at temperature $T_2 (T_2 = 2T_1)$ is used, the maximum kinetic energy of the photoelectrons emitted is (10 + X) eV. Find the value of X.

Q.50 Electron in hydrogen atom first jumps from third excited state to second excited state and then from second excited to the first excited state. The ratio of the wavelength $\lambda_1 : \lambda_2$ emitted in the two cases is (20 : X). Find the value of X.

PART C – MATHEMATICS

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

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

Q.51 The sum of all the roots of the equation

$$\sin\left(\pi \log_3\left(\frac{1}{x}\right)\right) = 0 \text{ in } (0, 2\pi) \text{ is}$$

(1) 3/2 (2) 4
(3) 9/2 (4) 13/3

Q.52 The vertices of a triangle are $\left(1, \sqrt{3}\right)$, $(2\cos\theta, 2\sin\theta)$ and $(2\sin\theta, -2\cos\theta)$ where $\theta \in R$. The locus of orthocentre of the triangle is

(1) $(x-1)^2 + (y-\sqrt{3})^2 = 4$

(2) $(x-2)^2 + (y-\sqrt{3})^2 = 4$

(3) $(x-1)^2 + (y-\sqrt{3})^2 = 8$

(4) $(x-2)^2 + (y-\sqrt{3})^2 = 8$

Q.53 The equations $3x + 2y + 1 = 0$, $2x + 4y - 1 = 0$ and $3x^2 + 4xy + 4y^2 + 2x - 2y + 1 + \alpha = 0$ will have a unique solution if α equals

(1) 2/3 (2) 4/5
(3) 3/8 (4) 3/5

Q.54 The locus of the midpoints of the chords drawn from the point M (1, 8) to the circle $x^2 + y^2 - 6x - 4y - 11 = 0$, is equal to

(1) $x^2 + y^2 - 4x + 10y - 19 = 0$
(2) $x^2 + y^2 + 4x + 10y - 19 = 0$
(3) $x^2 + y^2 + 4x - 10y - 19 = 0$
(4) $x^2 + y^2 - 4x - 10y + 19 = 0$

Q.55 The constant term in the expansion of

$$\left(x^2 + \frac{1}{x^2} + y + \frac{1}{y}\right)^8 \text{ is}$$

(1) 4900 (2) 4950
(3) 5050 (4) 5151

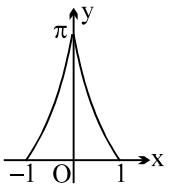
SPACE FOR ROUGH WORK

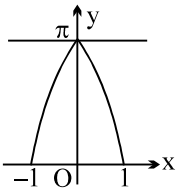
Q.56 Let W denote the words in the English dictionary. Define the relation R by

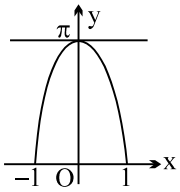
$$R = \left\{ \begin{matrix} (x, y) \in W \times W \mid \text{the words x and y} \\ \text{have atleast one letter in common} \end{matrix} \right\}$$

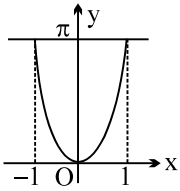
Then R is
(1) not reflexive, symmetric and transitive.
(2) reflexive, symmetric and transitive.
(3) reflexive, symmetric and not transitive.
(4) reflexive, not symmetric and transitive.

Q.57 Which one of the following can best represent the graph of the function, $f(x) = \cos^{-1}(2x^2 - 1)$?

(1) 

(2) 

(3) 

(4) 

Q.58 Which one of the following function is not differentiable at $x = 2$?
(1) $f(x) = (x^2 - 4) \mid (x - 1)(x - 2) \mid$
(2) $f(x) = \sin(\mid x - 2 \mid) - \mid x - 2 \mid$
(3) $f(x) = \sin(\mid x - 2 \mid) + \mid x - 2 \mid$
(4) $f(x) = \mid x - 2 \mid \tan \pi x$

Q.59 Let $f : (-3, 3) \to R$ be a differentiable function with $f(0) = -2$ and $f'(0) = -1$ and $g(x) = \left(f(3f(x) + 6)\right)^3$. Then $g'(0)$ is equal to
(1) 0 (2) 9
(3) 36 (4) – 36

Q.60 The value of $\lim\limits_{x \to 0} \dfrac{1}{x^3(x - \sin x)} \int\limits_0^{x^2} t^2 \cos^5 t \, dt$ is equal to
(1) 0 (2) 1/3
(3) 2 (4) non-existent

Q.61 Let $f(x) = \int\limits_0^x \dfrac{dt}{\sqrt{1 + t^3}}$ and g (x) be the inverse of f (x), then which one of the following holds good?
(1) $2g'' = g^2$ (2) $2g'' = 3g^2$
(3) $3g'' = 2g^2$ (4) $3g'' = g^2$

Q.62 $\int\limits_0^\infty f\left(x + \dfrac{1}{x}\right) \cdot \dfrac{\ln x}{x} dx$
(1) is equal to zero (2) is equal to one
(3) is equal to 1/2 (4) can not be evaluated

Q.63 If A is a non singular matrix satisfying $A = AB - BA$, then which one of the following holds true
(1) det. B = 0
(2) B = 0
(3) det. A = 1
(4) det. (B + I) = det. (B – I)

Q.64 If 2d be the S.D. between the lines $\dfrac{y}{b} + \dfrac{z}{c} = 1$; $x = 0$ and $\dfrac{x}{a} - \dfrac{z}{c} = 1$; $y = 0$ (a, b, c > 0) such that $d = \dfrac{k \cdot abc}{\sqrt{a^2b^2 + b^2c^2 + c^2a^2}}$ then k equals
(1) 1 (2) 2
(3) 3 (4) 4

Q.65 If the three points with position vectors (1, a, b); (a, 2, b) and (a, b, 3) are collinear in space, then the value of (a + b) is
(1) 3 (2) 4
(3) 5 (4) none

Q.66 Suppose $y = f(x)$ and $y = g(x)$ are two continuous functions whose graphs intersect at the three points (0, 4), (2, 2) and (4, 0) with $f(x) > g(x)$ for $0 < x < 2$ and $f(x) < g(x)$ for $2 < x < 4$. If $\int\limits_0^4 [f(x) - g(x)]dx = 10$ and $\int\limits_2^4 [g(x) - f(x)]dx = 5$, the area between two curves for $0 < x < 2$, is
(1) 5 (2) 15
(3) 10 (4) 20

SPACE FOR ROUGH WORK

Q.67 Two unequal parabolas have the same common axis which is the x-axis and have the same vertex which is the origin with their concavities in opposite direction. If a variable line parallel to the common axis meet the parabolas in P and P' the locus of the middle point of PP' is

(1) a parabola (2) a circle

(3) an ellipse (4) a hyperbola

Q.68 The area of the rectangle formed by the perpendiculars from the centre of the standard ellipse to the tangent and normal at its point whose eccentric angle is $\pi/4$ is :

(1) $\frac{(a^2-b^2)\,ab}{a^2+b^2}$ (2) $\frac{(a^2-b^2)}{(a^2+b^2)\,ab}$

(3) $\frac{(a^2-b^2)}{ab\,(a^2+b^2)}$ (4) $\frac{a^2+b^2}{(a^2-b^2)\,ab}$

Q.69 Eccentricity of the hyperbola conjugate to the hyperbola $\frac{x^2}{4}-\frac{y^2}{12}=1$ is

(1) $\frac{2}{\sqrt{3}}$ (2) 2

(3) $\sqrt{3}$ (4) 4/3

Q.70 If $p \Rightarrow (q \vee r)$ is false, then the truth values of p, q, r are respectively

(1) F, T, T (2) T, T, F

(3) T, F, F (4) F, F, F

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

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

Q.71 Number of ordered pairs (x, y) of real numbers satisfying the system of equations $\sin x = \sin 2y$ and $\cos x = \sin y$ where $0 \le x \le \pi$ and $0 \le y \le \pi$,is

Q.72 Let P_n denotes the number of ways of selecting 3 people out of 'n' sitting in a row, if no two of them are consecutive and Q_n is the corresponding figure when they are in a circle. If $P_n - Q_n = 6$, then n is equal to (11 – X). Find the value of X.

Q.73 At the point $P(a, a^n)$ on the graph of $y = x^n$ $(n \in N)$ in the first quadrant a normal is drawn. The normal intersects the y-axis at the point (0, b).

If $\lim_{a\to 0} b = \frac{1}{2}$, then n equals

Q.74 Suppose families always have one, two or three children, with probabilities 1/4, 1/2 and 1/4 respectively. Assume everyone eventually gets married and has children, the probability of a couple having exactly four grandchildren is $\frac{9\times X}{128}$. Find the value of X.

Q.75 If the standard deviation of a set of observations is 4 and if each observation is divided by 4, the standard deviation of the new set of observations will be

SPACE FOR ROUGH WORK