JEE MAIN 2020

FULL TEST-4

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.

Always desire to learn something **U**seful.

Wake up every morning with the thought that something **W**onderful is about to happen.

The difference between ordinary and e**X**traordinary is that little extra.

Name : .....

Address : .....

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Phone/Mobile No. .....

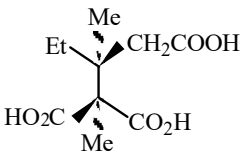
Roll No. .....

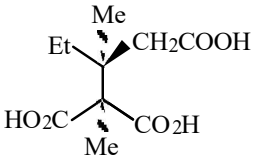
PART A – CHEMISTRY

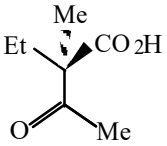
SECTION - 1 (Q.1 - Q.20)

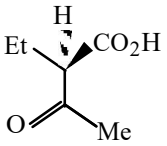
Each question has FOUR options (1), (2), (3) and (4). ONLY ONE of these four options is correct.

Q.1 The compounds(s), capable of producing achiral compound on heating at 100ºC is/are

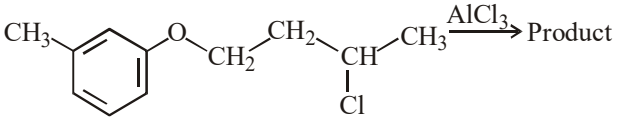
(1) 

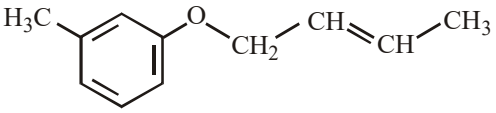
(2) 

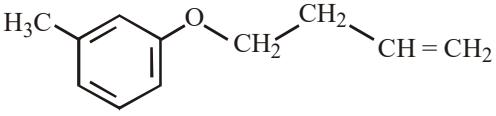
(3) 

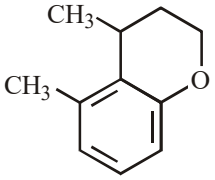
(4) 

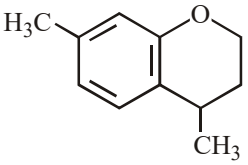
Q.2 The major product obtained in the given reaction is :



(1) 

(2) 

(3) 

(4) 

Q.3 Which of the given statements is INCORRECT about glycogen ?

(1) It is a straight chain polymer similar to amylose.

(2) Only α-linkages are present in the molecule.

(3) It is present in animal cells

(4) It is present in some yeast and fungi

Q.4 The pair of metal ions that can give a spin only magnetic moment of 3.9 BM for the complex $[M(H_2O)_6]Cl_2$, is :

(1) Cr^{2+} and Mn^{2+} (2) V^{2+} and Co^{2+}

(3) V^{2+} and Fe^{2+} (4) Co^{2+} and Fe^{2+}

Q.5 Among the colloids cheese (C), milk (M) and smoke (S), the correct combination of the dispersed phase and dispersion medium, respectively is :-

(1) C : solid in liquid; M : solid in liquid; S : solid in gas

(2) C : solid in liquid; M : liquid in liquid; S : gas in solid

(3) C : liquid in solid; M : liquid in solid; S : solid in gas

(4) C : liquid in solid; M : liquid in liquid; S : solid in gas

Q.6 Match the ores (Column A) with the metals (column B) :

Column-A Ores	**Column-B Metals**
(I) Siderite	(a) Zinc
(II) Kaolinite	(b) Copper
(III) Malachite	(c) Iron
(IV) Calamine	(d) Aluminium

(1) I-b ; II-c ; III-d ; IV-a

(2) I-c ; II-d ; III-a ; IV-b

(3) I-c ; II-d ; III-b ; IV-a

(4) I-a ; II-b ; III-c ; IV-d

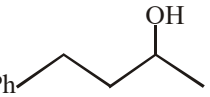
Q.7 Decomposition of X exhibits a rate constant of 0.05 mg/year. How many years are required for the decomposition of 5 mg of X into 2.5 μg ?

(1) 50 (2) 25

(3) 20 (4) 40

SPACE FOR ROUGH WORK

Q.8 Heating of 2-chloro-1-phenylbutane with EtOK/EtOH gives X as the major product.Reaction of X with $Hg(OAc)_2 / H_2O$ followed by $NaBH_4$ gives Y as the major product. Y is :

(1) 
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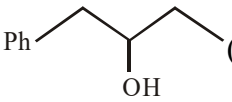
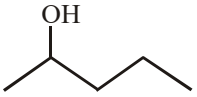
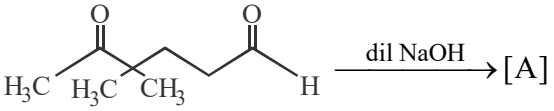
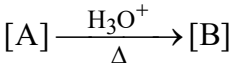
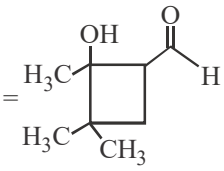
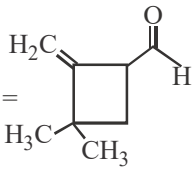
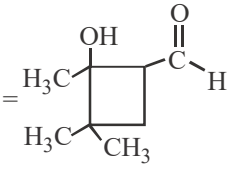
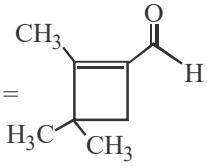
(3) 
(4) 

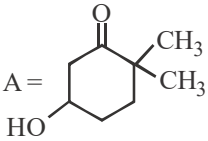
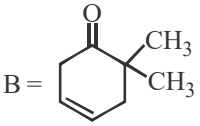
Q.9 In the following reactions, products A and B are :

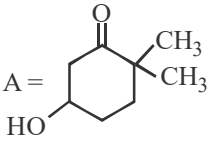
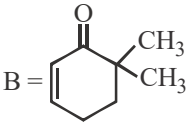




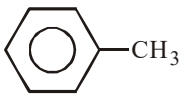
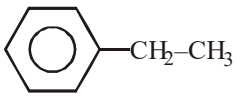
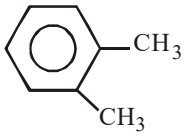
(1) A =  ; B = 

(2) A =  ; B = 

(3) A =  ; B = 

(4) A =  ; B = 

Q.10 n-heptane $\xrightarrow[600°C]{Cr_2O_3 \backslash V_2O_3}$?

(1) 
(2) 
(3) 
(4) 

Q.11 In which of the following pairs geometry around central atom is not same ?

(1) CH_4, SiH_4 (2) As_4O_{10},P_4O_{10}
(3) CO_2, SiO_2 (4) NO_2, ClO_2

Q.12 Select the incorrect statement :

(a) PCl_5 form weak monobasic acid during hydrolysis.
(b) In $B_3N_3H_6$ nucleophile attack on B-atom.
(c) Al_2Cl_6 is a polar & planar molecule.
(d) In AlF_3, hybridisation of Al is sp^2

(1) b, c, d (2) a, b, c
(3) a, c, d (4) a, b, c, d

Q.13 3.00 mol of PCl_5 kept in 1L closed vessel was allowed to attain equilibrium at 380 K. If K_C= 1.80 then calculate equilibrium concentrations of PCl_3 & Cl_2 respectively :

(1) 1.59 M, 1.59 M (2) 2.28 M, 2.28 M
(3) 3 M, 3 M (4) 2.28 M, 3 M

Q.14 A 250.0 mL sample of a 0.20 M Cr^{3+} is electrolyzed with a current of 96.5 A. If the remaining $[Cr^{3+}]$ is 0.1 M the duration of process is : (Atomic weight of Cr = 52)

(1) 25 s (2) 225 s
(3) 150 s (4) 75 s

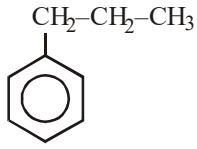
Q.15 Which of the following order is/are correct :

(a) Li < Be < B < C (IE_1)
(b) Li < Na < K < Rb < Cs
(Reducing power in gaseous state)
(c) $Li^+ < Na^+ < K^+ < Rb^+ < Cs^+$
(Ionic mobility in aqueous solution)
(d) S > Se > Te > O [EA]

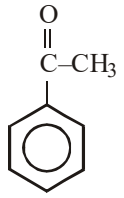
(1) a, b, c, d (2) a, b, d
(3) b, c, d (4) b, d

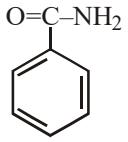
SPACE FOR ROUGH WORK

Q.16 In which of the following benzoic acid will be not formed as a major product :

(1)  $\xrightarrow[(ii)\ H^{\oplus}/\Delta]{(i)\ KMnO_4-KOH}$

(2) $Ph - MgX + CO_2 \xrightarrow[(ii)\ H_3O^{\oplus}]{(i)\ Dry\ ether}$

(3)  $\xrightarrow{H_2CrO_4}$

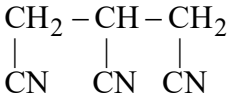
(4)  $\xrightarrow{NaOH/Br_2}$

Q.17 How much time is required for complete decomposition of 4 moles of water using 4 ampere current ?

(1) 3.86×10^5 sec (2) 1.93×10^5 sec

(3) 96500 sec (4) 48250 sec

Q.18 The IUPAC name of the following compound is



(1) 1, 2, 3-tricyano propane

(2) propane tricarbylamine

(3) propane–1, 2, 3-tricarbonitrile

(4) 3-cyano propane-1, 5-dinitrile

Q.19 A solution of polystyrene in benzene contains 10g/L the equilibrium height of the column of solution having density 0.9 g/ml in the osmometer having capillary rise 11 cm at 27°C what is average molar mass of polystyrene (Assume solution is ideal)

(1) 2340 g/mol (2) 25.2×10^3 g/mol

(3) 55.3×10^7 g/mol (4) 100 g/mol

Q.20 Which of the following reaction can give hydrogen gas.

(1) Zn + conc. H_2SO_4

(2) C + very dil H_2SO_4

(3) Mn + extremely dil HNO_3(2%)

(4) Pb + dil HNO_3

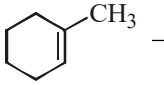
SECTION - 2 (Q.21 - Q.25)

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

Q.21 10 moles of an ideal diatomic gas ($\gamma = 1.4$) at 300K and 6atm is expanded irreversibly and adiabatically to a final pressure of 1.2 atm against a constant pressure of 1 atm. Calculate the value of ΔH for the above process. Report your answer as X, where $X \times 300\ R$ = (magnitude of ΔH).

(Given : ln 2 = 0.7, ln 10 = 2.3, R = gas constant)

Q.22 Find the total number of major product(s) formed in the following reaction ?

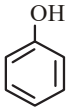
 $\xrightarrow[(ii)\ H_2O_2/OH^-]{(i)\ BH_3/THF}$

Q.23 Which of the following ores do not contain more than one metal in their composition. Argentite, Barytes, Magnesite, Fluorspar, Carnalite, Dolomite, Chalcocite, Asbestos, Calamine.

Q.24 Ammonium molybdate + HNO_3 + H_3AsO_4 $\rightarrow$ Yellow ppt.

Difference in number of atoms of elements having maximum and minimum oxidation number in yellow precipitate = ?

Q.25 What is the degree of unsaturation in compound (x).

 $\xrightarrow[H_2SO_4]{Na_2CrO_4}$ X

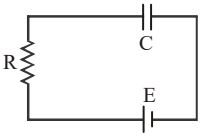
SPACE FOR ROUGH WORK

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 A capacitor of capacitance C is connected in series with a resistance R and a DC source of emf E through a key.



The capacitor starts charging when the key is closed. By the time capacitor has been fully charged, what amount of energy is dissipated in the resistance R?

(1) $(1/2)CE^2$ (2) 0

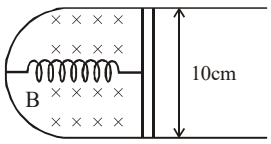
(3) CE^2 (4) E^2/R

Q.27 The focal length of a thin lens made from the material of refractive index 1.5 is 15 cm. When it is placed in a liquid of refractive index 4/3, its focal length will be_____ cm.

(1) 80.31 (2) 50

(3) 78.23 (4) 60

Q.28 A thin strip 10 cm long is on a U shaped wire of negligible resistance and it is connected to a spring of spring constant 0.5 Nm^{-1} (see figure). The assembly is kept in a uniform magnetic field of 0.1T. If the strip is pulled from its equilibrium position and released, the number of oscillation it performs before its amplitude decreases by a factor of e is N. If the mass of the strip is 50 grams, its resistance 10Ω and air drag negligible, N will be close to :



(1) 50000 (2) 5000

(3) 10000 (4) 1000

Q.29 The electron in a hydrogen atom first jumps from the third excited state to the second excited state and subsequently to the first excited state. The ratio of the respective wavelengths, λ_1/λ_2, of the photons emitted in this process is :

(1) 9/7 (2) 7/5

(3) 27/5 (4) 20/7

Q.30 A coil of self inductance 10 mH and resistance 0.1 Ω is connected through a switch to a battery of internal resistance 0.9 Ω. After the switch is closed, the time taken for the current to attain 80% of the saturation value is : (Take ln 5 = 1.6)

(1) 0.103 s (2) 0.016 s

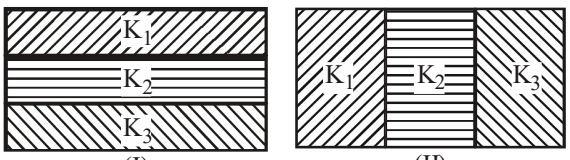
(3) 0.002 s (4) 0.324 s

Q.31 A metal wire of resistance 3Ω is elongated to make a uniform wire of double its previous length. This new wire is now bent and the ends joined to make a circle. If two points on this circle make an angle 60° at the centre, the equivalent resistance between these two points will be :

(1) (12/5) Ω (2) (5/3) Ω

(3) (5/2) Ω (4) (7/2) Ω

Q.32 Two identical parallel plate capacitors, of capacitance C each, have plates of area A, separated by a distance d. The space between the plates of the two capacitors, is filled with three dielectrics, of equal thickness and dielectric constants K_1, K_2 and K_3. The first capacitor is filled as shown in fig. I, and the second one is filled as shown in fig. II. If these two modified capacitors are charged by the same potential V, the ratio of the energy stored in the two, would be (E_1 refers to capacitor (I) and E_2 to capacitor (II)) :



(1) $\frac{E_1}{E_2}=\frac{9K_1K_2K_3}{(K_1+K_2+K_3)(K_2K_3+K_3K_1+K_1K_2)}$

(2) $\frac{E_1}{E_2}=\frac{K_1K_2K_3}{(K_1+K_2+K_3)(K_2K_3+K_3K_1+K_1K_2)}$

(3) $\frac{E_1}{E_2}=\frac{(K_1+K_2+K_3)(K_2K_3+K_3K_1+K_1K_2)}{K_1K_2K_3}$

(4) $\frac{E_1}{E_2}=\frac{(K_1+K_2+K_3)(K_2K_3+K_3K_1+K_1K_2)}{9K_1K_2K_3}$

SPACE FOR ROUGH WORK

Q.33 A negative charge is placed at the midpoint between two fixed equal positive charges, separated by a distance 2d. If the negative charge is given a small displacement x ($x << d$) perpendicular to the line joining the positive charges, how the force (F) developed on it will approximately depend on x ?

(1) $F \propto x$ (2) $F \propto 1 / x$

(3) $F \propto x^2$ (4) $F \propto 1 / x^2$

Q.34 A message signal of frequency 100 MHz and peak voltage 100 V is used to execute amplitude modulation on a carrier wave of frequency 300 GHz and peak voltage 400 V. The modulation index and difference between the two side band frequencies are :

(1) 4 ; 1×10^8 Hz (2) 0.25 ; 1×10^8 Hz

(3) 4 ; 2×10^8 Hz (4) 0.25 ; 2×10^8 Hz

Q.35 A test particle is moving in a circular orbit in the gravitational field produced by a mass density $\rho(r) = K / r^2$. Identify the correct relation between the radius R of the particle's orbit and its period T

(1) T / R^2 is a constant

(2) TR is a constant

(3) T^2 / R^3 is a constant

(4) T/R is a constant

Q.36 When 100V DC is applied across a solenoid, a current of 1 A flows in it. When 100V AC is applied across the same coil, the current drops to 0.5 A. If the frequency of the AC source is 50 Hz, the impedance and inductance of the solenoid are :

(1) 200 Ω and 0.55 H (2) 200 Ω and 0.8 H

(3) 100 Ω and 0.55 H (4) 200 Ω and 0.89 H

Q.37 A particle of mass m is moving in a circular path of constant radius r such that its tangential acceleration varies with time as $a_t = K^2rt^2$ (K is a constant)
Select the correct statement :

(1) Centripetal acceleration remains constant.

(2) Power delivered by tangential force will be zero.

(3) Power delivered by Net force will be zero.

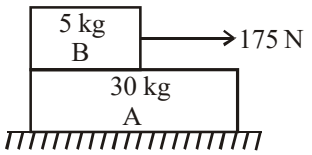
(4) Power delivered by centripetal force will always be zero.

Q.38 Air is blowing across the horizontal wings of an aeroplane is such a way that its speeds below and above wings are 90 m/s and 120 m/s respectively. If density of air is 1.3 kg/m^3, then the pressure difference between lower and upper sides of wings will be :

(1) 4819 N/m^2 (2) 481.90 N/m^2

(3) 409.5 N/m^2 (4) 4095 N/m^2

Q.39 Block A of mass 30 kg. is resting on a frictionless floor. Another block B of mass 5 kg is resting on it as shown in the figure. The coefficient of static friction between the blocks is 0.4 while kinetic friction is 0.3. If a horizontal force of 175 N is applied to block B, then the acceleration of the block A will be ($g = 10$ m/s^2) :



(1) 0.5 m/s^2 (2) 0.67 m/s^2

(3) 5 m/s^2 (4) 10 m/s^2

Q.40 A particle of mass m moving with velocity $(3\hat{i} + 2\hat{j})$ m/s, collides with another body of mass M and finally moves with velocity $(-2\hat{i} + \hat{j})$ m/s, then during the collision :

(1) impulse received by m is m $[5\hat{i} + \hat{j}]$

(2) impulse received by m is m $[-5\hat{i} - \hat{j}]$

(3) impulse received by M is M $[-5\hat{i} - \hat{j}]$

(4) impulse received by M is m $[-5\hat{i} - \hat{j}]$

Q.41 In the relation $P = \frac{\alpha}{\beta} e^{-\frac{\alpha z}{k\theta}}$, P is pressure, z is distance, k is boltzmann constant and θ is the temperature. The dimensional formula of β will be

(1) $[M^0L^2T^0]$ (2) $[ML^2T]$

(3) $[ML^0T^{-1}]$ (4) $[M^0L^2T^{-1}]$

SPACE FOR ROUGH WORK

Q.42 A light whose frequency is equal to 6×10^{14} Hz is incident on a metal whose work function is 2 eV. [$h = 6.63 \times 10^{-34}$ Js, 1 eV = 1.6×10^{-19} J). The maximum energy of the electrons emitted will be:

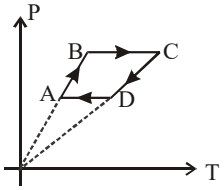
(1) 2.49 eV (2) 4.49 eV
(3) 0.49 eV (4) 5.49 eV

Q.43 A person running horizontally observes that rain is falling on his head vertically with speed 10 m/s. He stops and observes that rain is coming at an angle 30° with vertical. Find the speed of rain w.r.t. ground

(1) 20 m/s (2) $\frac{20}{\sqrt{3}}$ m / s

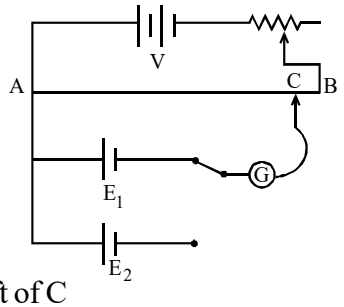
(3) $10\sqrt{3}$ m / s (4) $\frac{10}{\sqrt{3}}$ m / s

Q.44 Six moles of an ideal gas performs cycle shown in figure. If the temperature $T_A = 600$ K, $T_B = 800$K, $T_C = 2200$ K and $T_D = 1200$ K, the work done per cycle is :



(1) 20 kJ (2) 30 kJ
(3) 40 kJ (4) 60 kJ

Q.45 The circuit shown here is used to compare the emf of two cells E_1 and E_2 ($E_1 > E_2$). The null point is at C when the galvanometer is connected to E_1. When the galvanometer is connected to E_2, the null point will be



(1) to the left of C
(2) to the right of C
(3) at C itself
(4) no change in null point

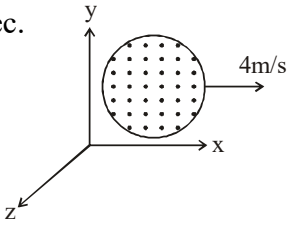
SECTION - 2 (Q.46 - Q.50)

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

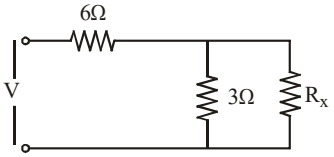
Q.46 A wagon of 200 kg is moving on a smooth track with a velocity of 2 m/s. A man of 80 kg also runs in the wagon with a velocity such that the speed of centre of mass of the system is zero. The relative velocity (in m/s) of man w.r.t. wagon is

Q.47 The potential energy of a particle of mass m is given by $U(x) = \begin{cases} E_0 & 0 \le x \le 1 \\ 0 & x > 1 \end{cases}$ λ_1 and λ_2 are the de-Broglie wavelengths of the particle, when $0 \le x \le 1$ and $x > 1$ respectively. If the total energy of particle is $2E_0$, find $(\lambda_1 / \lambda_2)^2$.

Q.48 A uniform magnetic field $\vec{B} = 0.25\,\hat{k}$ T exists in a circular region of radius R = 5 m. A loop of radius R = 5m lying in x-y plane encloses the magnetic field at t = 0 and then pulled at uniform velocity $\vec{v} = 4\hat{i}$ m/ s. Find the emf induced (in volts) is the loop at t = 2 sec.



Q.49 In the circuit shown, find the value of R_x (in ohm) such that thermal power generated in it is practically independent of small variations of that resistance.



Q.50 A long capillary glass tube of uniform diameter of 1mm is filled completely with water and then held vertically in air. It is now opened at both ends. Find the length of the water column remaining in the glass tube. Surface tension of water is 0.075 N/m. ($g = 10$ m/s^2) and density of water is 10^3 Kg/m^3.

SPACE FOR ROUGH WORK

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 A point is in motion along a hyperbola $y = 10/x$ so that its abscissa x increases uniformly at a rate of 1 unit per second. Then, the rate of change of its ordinate, when the point passes through (5, 2).
(1) increases at the rate of 1/2 unit per second.
(2) decreases at the rate of 1/2 unit per second.
(3) decreases at the rate of 2/5 unit per second
(4) increases at the rate of 2/5 unit per second

Q.52 The shortest distance between the line $y = x$ and the curve $y^2 = x - 2$ is :

(1) $\frac{7}{4\sqrt{2}}$ (2) $\frac{7}{8}$

(3) $\frac{11}{4\sqrt{2}}$ (4) 2

Q.53 If the eccentricity of the standard hyperbola passing through the point (4,6) is 2, then the equation of the tangent to the hyperbola at (4,6) is-
(1) $2x - y - 2 = 0$ (2) $3x - 2y = 0$
(3) $2x - 3y + 10 = 0$ (4) $x - 2y + 8 = 0$

Q.54 Consider the function $f(x) = \cos x^2$. Then
(1) f is of period 2π (2) f is of period $\sqrt{2\pi}$
(3) f is not periodic (4) f is of periodic π

Q.55 The position vectors of the points A, B, C and D are $3\hat{i} - 2\hat{j} - \hat{k}$, $2\hat{i} - 3\hat{j} + 2\hat{k}$, $5\hat{i} - \hat{j} + 2\hat{k}$ and $4\hat{i} - \hat{j} + \lambda\hat{k}$ respectively. If the points A, B, C and D lie on a plane, the value of λ is
(1) 0 (2) 1
(3) 2 (4) – 4

Q.56 If the tangent to the curve, $y = x^3 + ax - b$ at the point (1, –5) is perpendicular to the line, $-x + y + 4 = 0$, then which one of the following points lies on the curve ?
(1) (–2, 2) (2) (2, –2)
(3) (2, –1) (4) (–2, 1)

Q.57 Let $f : R \to R$ be a differentiable function satisfying $f'(3) + f'(2) = 0$. Then

$\lim\limits_{x\to 0}\left(\frac{1+f(3+x)-f(3)}{1+f(2-x)-f(2)}\right)^{1/x}$ is equal to

(1) e^2 (2) e
(3) e^{-1} (4) 1

Q.58 If some three consecutive in the binomial expansion of $(x + 1)^n$ is powers of x are in the ratio 2: 15 : 70, then the average of these three coefficient is :
(1) 964 (2) 625
(3) 227 (4) 232

Q.59 If the truth value of the statement $P \to (\sim p \vee r)$ is false (F), then the truth values of the statements p, q, r are respectively :
(1) F, T, T (2) T, F, F
(3) T, T, F (4) T, F, T

Q.60 Let $A = \begin{pmatrix} 3 & 0 & 3 \\ 0 & 3 & 0 \\ 3 & 0 & 3 \end{pmatrix}$. Then the roots of the equation $\det(A - \lambda I_3) = 0$ (where I_3 is the identity matrix of order 3) are
(1) 3, 0, 3 (2) 0, 3, 6
(3) 1, 0, – 6 (4) 3, 3, 6

Q.61 The value of $\int_0^{\pi/2} \frac{\sin^3 x}{\sin x + \cos x} dx$ is

(1) $\frac{\pi - 2}{4}$ (2) $\frac{\pi - 2}{8}$

(3) $\frac{\pi - 1}{4}$ (4) $\frac{\pi - 1}{2}$

Q.62 If for some $x \in R$, the frequency distribution of the marks obtained by 20 students in a test is :

Marks	2	3	5	7
Frequency	$(x+1)^2$	$2x - 5$	$x^2 - 3x$	x

then the mean of the marks is :
(1) 2.8 (2) 3.2
(3) 3.0 (4) 2.5

SPACE FOR ROUGH WORK

Q.63 A variable circle passes through the fixed point A (p, q) and touches x-axis. The locus of the other end of the diameter through A is

(1) $(x-p)^2 = 4qy$ (2) $(x-q)^2 = 4py$

(3) $(y-p)^2 = 4qx$ (4) $(y-q)^2 = 4px$

Q.64 Two vertical poles of heights, 20m and 80m stand a part on a horizontal plane. The height (in meters) of the point of intersection of the lines joining the top of each pole to the foot of the other, from this horizontal plane is :

(1) 12 (2) 15

(3) 16 (4) 18

Q.65 The general solution of the differential equation

$$(1+e^{x/y})\,dx+\left(1-\frac{x}{y}\right)e^{x/y}dy=0 \text{ is}$$

(c is an arbitrary constant)

(1) $x - ye^{x/y} = c$ (2) $y - xe^{x/y} = c$

(3) $x + ye^{x/y} = c$ (4) $y + xe^{x/y} = c$

Q.66 All the points in the set

$$S=\left\{\frac{\alpha+i}{\alpha-i}:\alpha\in R\right\}(i=\sqrt{-1}) \text{ lie on a}$$

(1) circle whose radius is 1.

(2) straight line whose slope is 1.

(3) straight line whose slope is –1

(4) circle whose radius is $\sqrt{2}$

Q.67 There are 7 greetings cards, each of a different colour and 7 envelopes of same 7 colours as that of the cards. The number of ways in which the cards can be put in envelopes, so that exactly 4 of the cards go into envelopes of respective colour is

(1) ${}^7C_3$ (2) $2.\ {}^7C_3$

(3) $3!\ {}^4C_4$ (4) $3!\ {}^7C_3\ {}^4C_3$

Q.68 The mean and variance of a random variable X having a binomial distribution are 6 and 3 respectively. The probability of variable X less than 2 is –

(1) $\frac{13}{2048}$ (2) $\frac{13}{4096}$

(3) $\frac{15}{4096}$ (4) $\frac{25}{2048}$

Q.69 $\tan\left(\cos^{-1}\frac{4}{5}+\tan^{-1}\frac{2}{3}\right)=?$

(1) 3/17 (2) 17/6

(3) 17/4 (4) 6/17

Q.70 Consider $f(x) =$

$$\begin{cases}\left[\dfrac{2(\sin x-\sin^3 x)+|\sin x-\sin^3 x|}{2(\sin x-\sin^3 x)-|\sin x-\sin^3 x|}\right], & x\neq\dfrac{\pi}{2}\\ 3, & x=\dfrac{\pi}{2}\end{cases} \text{ for } x\in(0,\pi)$$

where [ ] denotes the greatest integer function, then

(1) f is continuous & differentiable at $x = \pi/2$

(2) f is continuous but not differentiable at $x = \pi/2$

(3) f is neither continuous not differentiable at $x=\pi/2$

(4) none of these

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 The derivative of $\tan^{-1}\left(\frac{\sin x-\cos x}{\sin x+\cos x}\right)$, with respect to x/2, where $x \in (0, \pi/2)$ is –

Q.72 The sum of an infinite geometric series with positive terms is 3 and the sum of the cubes of its terms is 27/19. The common ratio of this series is (A/3). Find the value of A.

Q.73 Let A and B be two invertible matrices of order 3×3. If $\det(ABA^T) = 8$ and $\det(AB^{-1}) = 8$, $\det(BA^{-1}B^T) = \frac{1}{4\times X}$. Find the value of X.

Q.74 If the straight line, $2x - 3y + 17 = 0$ is perpendicular to the line passing through the points (7, 17) and (15, β), then β equals :

Q.75 If an angle between the line, $\frac{x+1}{2}=\frac{y-2}{1}=\frac{z-3}{-2}$ and the plane, $x - 2y - kz = 3$ is $\cos^{-1}\left(\frac{2\sqrt{2}}{3}\right)$, then a value of k is $\sqrt{A/3}$. Find the value of A.

SPACE FOR ROUGH WORK