JEE MAIN 2020

FULL TEST-6

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 Useful.

Wake up every morning with the thought that something Wonderful is about to happen.

The difference between ordinary and eXtraordinary is that little extra.

Name : .....

Address : .....

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Phone/Mobile No. .....

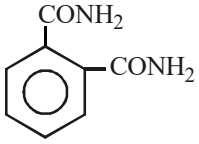
Roll No. .....

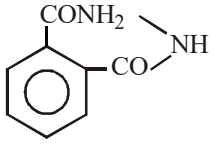
PART A – CHEMISTRY

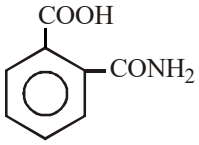
SECTION - 1 (Q.1 - Q.20)

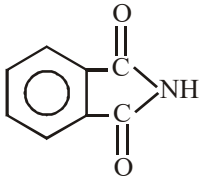
Each question has FOUR options (1), (2), (3) and (4). ONLY ONE of these four options is correct.

Q.1 If phthalic acid is treated with NH_3 and then it is first heated weakly then strongly, the final product formed is

(1) 

(2) 

(3) 

(4) 

Q.2 $X_2 + Y_2 \rightleftharpoons 2XY$ reaction was studied at a certain temperature. In the beginning 1 mole of X_2 was taken in a one litre flask and 2 moles of Y_2 was taken in another 2 litre flask. What is the equilibrium concentration of X_2 and Y_2 ? (Given equilibrium concentration of [XY = 0.6 mol L^{-1}]

(1) $\left(\frac{1}{3}-0.3\right),\left(\frac{2}{3}-0.3\right)$

(2) $\left(\frac{1}{3}-0.6\right),\left(\frac{2}{3}-0.6\right)$

(3) (1 – 0.3), (2 – 0.3)

(4) (1 – 0.6), (2 – 0.6)

Q.3 The pK_a of a weak acid HA is 4.80. The pK_b of weak base BOH is 4.78. The pH of an aqueous solution of the corresponding salt BA will be –

(1) 9.58 (2) 4.79

(3) 7.01 (4) 9.22

Q.4 The heat of combustion of ethanol determined in a bomb calorimeter is –670.48 KCals $mole^{-1}$ at 25°C. What is ΔH at 25°C for the reaction

(1) –335.24 K. Cals. (2) – 671.08 K. Cals.

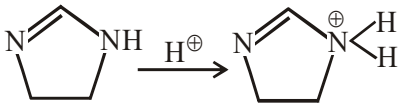
(3) –670.48 K Cals. (4) + 670.48 K. Cals.

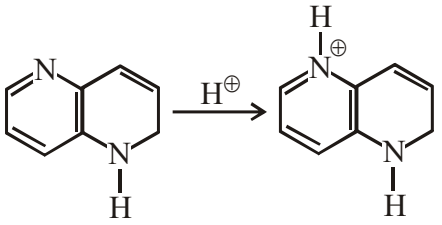
Q.5 To a clear solution of a complex (X), a solution of $BaCl_2$ is added and a white ppt. is formed, which does not dissolves in dilute HCl. The compound X is:

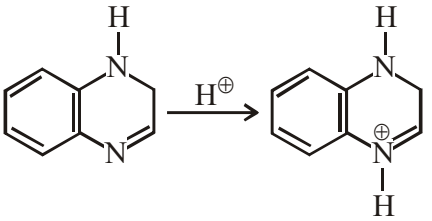
(1) Nitrate (2) Bromide

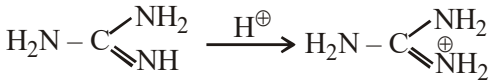
(3) Carbonate (4) Sulphate

Q.6 Which of the following acid-base reaction is not feasible :

(1) 

(2) 

(3) 

(4) 

Q.7 The major product obtained from the heating of 3,3-dimethyl-2-butanol with H_2SO_4 is –

(1) 3,3-dimethyl-1-butene

(2) 2,3-dimethyl-2-butene

(3) 2,3-dimethyl-1-butene

(4) cis and trans isomers of product (2).

Q.8 The standard electrode potential (E°) for OCl^-/Cl^- and $Cl^-/\frac{1}{2}Cl_2$ respectively are 0.94 V and –1.36 V. The E° value of $OCl^-/\frac{1}{2}Cl_2$ will be

(1) – 2.20 V (2) – 0.42 V

(3) 0.52 V (4) 1.04 V

SPACE FOR ROUGH WORK

Q.9 According to following reactions,

$CHF_3 \xrightarrow{K\alpha} CF_3^- + H^+$

$CHCl_3 \xrightarrow{K'\alpha} CCl_3^- + H^+$

correct statement(s) is

(1) $K_\alpha > K'_\alpha$

(2) CHF_3 act as a stronger bronsted acid than $CHCl_3$

(3) CCl_3^- is more stable than CF_3^-

(4) None of these

Q.10 Which of the following halides cannot be hydrolysed?

(i) TeF_6 (ii) SF_6 (iii) NCl_3 (iv) NF_3

Choose the correct code

(1) iii and iv (2) i, ii and iii

(3) i, ii and iv (4) ii and iv

Q.11 ZnO is white when cold and yellow when heated. It is due to the development of

(1) Frenkel defect

(2) metal excess defect

(3) Schottky defect

(4) metal deficiency defect.

Q.12 $CuSO_4$ when reacts with KCN forms CuCN, which is insoluble in water. It is soluble in excess of KCN, due to formation of the following complex :

(1) $K_2[Cu(CN)_4]$ (2) $K_3[Cu(CN)_4]$

(3) $CuCN_2$ (4) $Cu[KCu(CN)_4]$

Q.13 An organic compound 'a' upon reacting with NH_3 gives 'b'. On heating, 'b' gives 'c'. 'c' in presence of KOH reacts with Br_2 to give $CH_3CH_2NH_2$. 'a' is –

(1) CH_3COOH (2) $CH_3CH_2CH_2COOH$

(3) $CH_3 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - COOH$ (4) CH_3CH_2COOH

Q.14 Calcium Imide on hydrolysis gives gas B which on oxidation by bleaching powder gives gas C. Gas C on reaction with magnesium gives compound D which on hydrolysis gives again gas B. Identify B, C and D.

(1) NH_3, N_2 and Mg_3N_2

(2) N_2, NH_3, MgNH

(3) N_2, N_2O_5, $Mg(NO_3)_2$

(4) NH_3, NO_2, $Mg(NO_2)_2$

Q.15 Methyl α–D–glucoside and methyl β–D–glucoside does not test by followings –

(1) Fehling's solution (2) Hydrogen cyanide

(3) Both of these (4) None of these

Q.16 Phenol $\xrightarrow[\text{conc.}H_2SO_4]{NaNO_2}$ Green colour $\xrightarrow{H_2O}$ red colour $\xrightarrow{NaOH}$ Blue colour

This reaction is associated with the name of :-

(1) Gattermann (2) Hofmann

(3) Liebermann (4) Reimer–Tiemann

Q.17 Which of the following compounds does not give aldol condensation :-

(1) Ethanal (2) Propanal

(3) Methanal (4) Butanal

Q.18 Which of the following will give maximum number of isomers :-

(1) $[Co(py)_3(NH_3)_3]^{3+}$

(2) $[Ni(en)(NH_3)_4]^{2+}$

(3) $[Fe(C_2O_4)(en)_2]^{2-}$

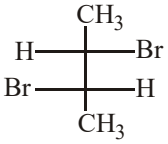
(4) $[Cr(NO_2)_2(NH_3)_4]^{+}$

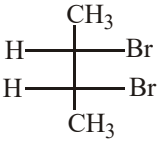
Q.19 pK_a increases in benzoic acid when substituent "x" is bonded at para-position, then "x" is

(1) – COOH (2) $-NO_2$

(3) – CN (4) $-OCH_3$

Q.20 When trans-2-butene is reacted with Br_2 then product formed is

(1) 

(2) 

(3) Meso compounds (4) both (2) and (3)

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 If 1.2 g of a metal displaces 1.12 litre of hydrogen at NTP, equivalent mass of the metal would be (10 + X) gm. Find the value of X.

Q.22 The number of antibonding electron pair in O_2^- is

Q.23 From the following data; the activation energy for the reaction (cal/mol) $H_2 + I_2 \rightarrow 2HI$ is 4×10^X. Find the value of X.

T (in K)	1 / T (in K^{-1})	$\log_{10}$ K
769	1.3×10^{-3}	2.9
667	1.5×10^{-3}	1.1

Q.24 Boiling point of benzene is 353.23 K. When 1.8 g of non-volatile solute is dissolved in 90 g of benzene, boiling point is raised to 354.11 K. If K_b (benzene) = 2.53 kg mol^{-1} the molecular mass of non-volatile substance is (50 + X) g mol^{-1}. Find the value of X.

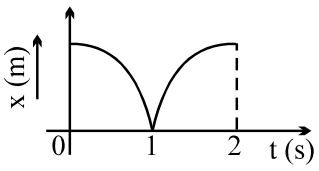
Q.25 The oxidation state of chromium in the final product formed by the reaction between KI and acidified potassium dichromate solution is (+X). Find the value of X.

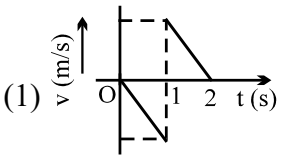
PART B – PHYSICS

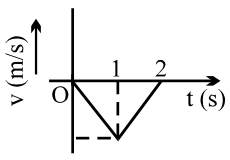
SECTION - 1 (Q.26 - Q.45)

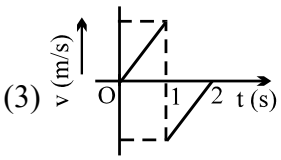
Each question has FOUR options (1), (2), (3) and (4). ONLY ONE of these four options is correct.

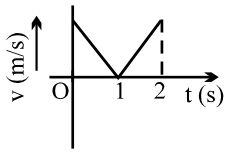
Q.26 The displacement-time graph of a moving particle with constant acceleration is shown in the figure. The velocity-time graph is best given by



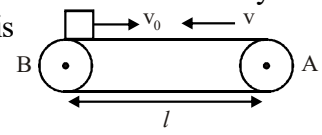
(1) 

(2) 

(3) 

(4) 

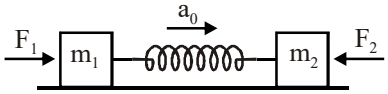
Q.27 A conveyer belt of length *l* is moving with velocity v. A block of mass m is pushed against the motion of conveyer belt with velocity v_0 from end B. Coefficient of friction between block and belt is μ. The value of v_0 so that the amount of heat liberated as a result of retardation of the block by conveyer belt is maximum is



(1) $\sqrt{\mu gl}$ (2) $\sqrt{2\mu gl}$

(3) $2\sqrt{\mu gl}$ (4) $\sqrt{3\mu gl}$

Q.28 Two blocks m_1 and m_2 are connected with a compressed spring and placed on a smooth horizontal surface as shown in figure. Force constant of spring is k. Under the influence of forces F_1 and F_2, at an instant blocks move with common acceleration a_0. At that instant force F_2 is suddenly withdrawn. Mark correct option.



(1) Instantaneous acceleration of m_1 is $a_0 - \frac{F_1}{m_1}$

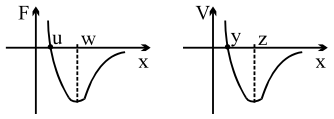
(2) Instantaneous acceleration of m_2 is $a_0 + \frac{F_2}{m_2}$

(3) Instantaneous acceleration of m_1 is $a_1 = 0$

(4) Instantaneous acceleration of m_2 is $a_2 = 0$

SPACE FOR ROUGH WORK

Q.29 Two atoms interact with each other according to the following force F and potential energy V diagrams. What is their equilibrium separation?

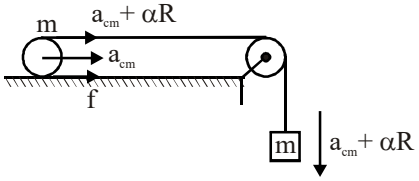


(1) the separation u which is equal to y.
(2) the separation u which is equal to z.
(3) the separation w which is equal to y.
(4) the separation w which is equal to z.

Q.30 A 5000 kg rocket is set for vertical firing. The relative speed of burnt gas is 800 ms^{-1}. To give an initial upwards acceleration of 20 ms^{-2}, the amount of gas ejected per second to supply the needed thrust will be

(1) 127.5 kg s^{-1} (2) 187.5 kg s^{-1}
(3) 185.5 kg s^{-1} (4) 137.5 kg s^{-1}

Q.31 In the given figure a ring of mass m is kept on a horizontal surface while a body of equal mass 'm' attached through a string. Which is wounded on the ring. When the system is released the ring rolls without slipping.



Consider the following statements and choose the correct option.
(i) acceleration of the centre of mass of ring is 2g/3
(ii) acceleration of the hanging particle is 4g/3
(iii) frictional force (on the ring) acts along forward direction
(iv) frictional force (on the ring) acts along backward direction
(1) Statement (i) and (ii) only
(2) Statement (ii) and (iii) only
(3) Statement (i) and (iv) only
(4) none of these

Q.32 A particle performs harmonic oscillations along a straight line with a period T and amplitude a. The mean velocity of the particle averaged over the time interval during which it travels a distance a/2 starting from the extreme position is :

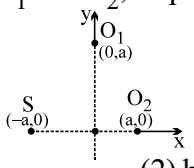
(1) a / T (2) 2a / T
(3) 3a / T (4) a / 2T

Q.33 A string of length 3L is fixed at both ends. It resonates with a tuning fork in third harmonic with amplitude at antinode equal to A_0. At time t = 0, a string element at position of antinode is at half its positive amplitude and moving towards mean position. Displacement of a string element at L/2 is given by

(1) $\frac{A_0}{2}\sin\left(\omega t+\frac{11\pi}{6}\right)$ (2) $\frac{\sqrt{3}A_0}{2}\sin\left(\omega t+\frac{5\pi}{6}\right)$

(3) $A_0\sin\left(\omega t+\frac{5\pi}{6}\right)$ (4) $\frac{A_0}{2}\sin\left(\omega t+\frac{5\pi}{6}\right)$

Q.34 A sound source S and observers O_1, O_2 are placed as shown. S is always at rest and O_1, O_2 start moving with velocity v_0 at t = 0. At any later instant, let f_1 and f_2 represent apparent frequencies of sound received by O_1 and O_2, respectively. The ratio f_1/f_2 is



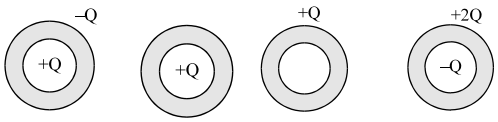
(1) zero (2) between 0 and 1
(3) 1 (4) > 1

Q.35 A steel rod is 4.000 cm in diameter at 30ºC. A brass ring has an interior diameter of 3.992 cm at 30 ºC. In order that the ring just slides onto the steel rod, the common temperature of the two should be nearly (α_{steel}= 11 × 10^{-6}/ºC and α_{brass}= 19 × 10^{-6}/ºC)

(1) 200 ºC (2) 250 ºC
(3) 280 ºC (4) 400 ºC

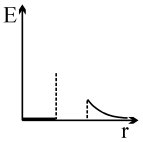
SPACE FOR ROUGH WORK

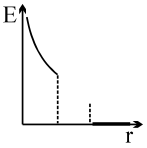
Q.36

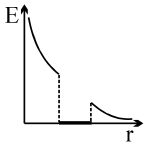


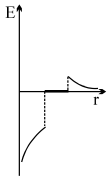
(W) (X) (Y) (Z)

Figure shows charged hollow metal spheres (except X) each with internal radius a and external radius b. Match each charge distribution with the corresponding E - field graph.

(I) 

(II) 

(III) 

(IV) 

(1) W – II; X – I; Y – III; Z – IV
(2) W – III; X – I; Y – II; Z – IV
(3) W – I; X – II; Y – III; Z – IV
(4) W – II; X – III; Y – I; Z – IV

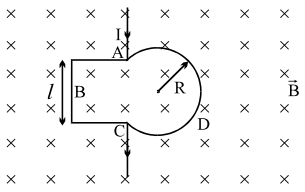
Q.37 A 3 μF and a 5μF capacitor are connected in series across a 30 V battery. A 7μF capacitor is then connected in parallel across the 3μF capacitor. Choose the **INCORRECT** option.

(1) Voltage across 3μF capacitor before connecting 7μF capacitor is 18.75V,
(2) Charge flown through battery after connecting 7μF capacitor is 43.75 μC.
(3) 5μF capacitor and 7μF capacitor can be said to be in series.
(4) After connecting 7μF capacitor, it has charge of 70μC.

Q.38 Two scales on a voltmeter measure voltages up to 20.0 V and 30.0 V. The resistance connected in series with the galvanometer is 1680Ω for the 20.0V scale and 2930 Ω for the 30.0 V scale. The resistance of the galvanometer and the full scale current are respectively

(1) 320Ω and 8 mA (2) 70Ω and 10 mA
(3) 820Ω and 10 mA (4) 820Ω and 8 mA

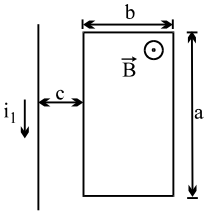
Q.39 The figure shows a conducting loop ABCDA placed in a uniform magnetic field perpendicular to its plane. The part ABC is the $(3/4)^{th}$ portion of the square of side length *l*. The part ADC is a circular arc of radius R. The points A and C are connected to a battery which supply a current I to the circuit. The magnetic force on the loop due to the field B is



(1) zero (2) BI *l*

(3) 2BIR (4) $\frac{BIl/R}{l+R}$

Q.40 The mutual inductance between the rectangular loop and the long straight wire as shown in figure is M.



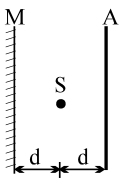
(1) M = Zero (2) $M = \frac{\mu_0 a}{2\pi}\ln\left(1+\frac{c}{b}\right)$

(3) $M = \frac{\mu_0 b}{2\pi}\ln\left(\frac{a+c}{b}\right)$ (4) $M = \frac{\mu_0 a}{2\pi}\ln\left(1+\frac{b}{c}\right)$

Q.41 A coil of inductance L = 0.2 H and of resistance R = 62.8 Ω is connected to the mains alternating voltage of frequency 50 Hz. What can be the capacitance of the capacitor connected in series with the coil if the useful power has to remain unchanged?

(1) 10 μF (2) 50 μF
(3) 25 μF (4) 100 μF

Q.42 A point source of light 'S' at a distance d from the screen A produces light intensity I_0 at the centre of the screen.



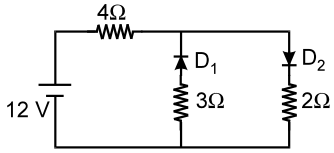
SPACE FOR ROUGH WORK

If a completely reflecting mirror M is placed at a distance d behind the source as shown in the figure, find the intensity at the centre of the screen

(1) $\frac{9}{10}I_0$ (2) $\frac{10}{9}I_0$

(3) $\frac{8}{9}I_0$ (4) $\frac{9}{8}I_0$

Q.43 The circuit has two oppositely connected ideal diodes in parallel. What is the current flowing in the circuit ?



(1) 2.31 A (2) 1.33 A

(3) 1.71 A (4) 2.00 A

Q.44 The frequency of the incident light falling on a photosensitive metal plate is doubled, the kinetic energy of the emitted photoelectrons is

(1) Double of the earlier value

(2) Unchanged

(3) More than double

(4) Less than double

Q.45 In a mean life of a radioactive sample :

(1) About 1/3 of substance disintegrate

(2) About 2/3 of substance disintegrate

(3) About 90% of the substance disintegrate

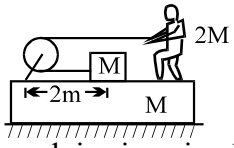
(4) Almost all the substance disintegrates

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 block of mass M is tied to one end of a massless rope. The other end of the rope is in the hands of a man of mass 2M as shown in the figure. The block and the man are resting on a rough plank of mass M as shown in the figure. The whole system is resting on a smooth horizontal surface. The man pulls the rope. Pulley is massless and frictionless. The displacement of the plank when the block meets the pulley is (X/2) m. Find the value of X.

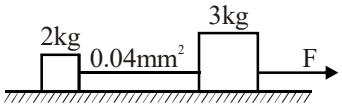
(Man does not leave his position on plank during the pull)



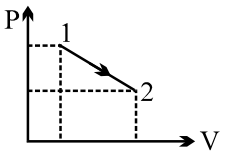
Q.47 A satellite revolving in a circular equatorial orbit from west to east appears over a certain point on the equator every 8 hours. Therefore it's period (in hr) is

Q.48 A cubical block of wood of specific gravity 0.5 and chunk of concrete of specific gravity 2.5 are fastened together. The ratio of mass of wood to the mass of concrete which makes the combination to float with entire volume of the combination submerged in water is X : 5. Find the value of X.

Q.49 Two bodies of masses 2kg and 3kg are connected by a metal wire of cross section 0.04 mm^2. Breaking stress of metal wire is 2.5 GPa. The maximum force F that can be applied to 3kg block so that wire does not break is (50 × X) N. Find the value of X. (Neglect friction)



Q.50 A process 1→2 using monoatomic gas is shown on the P-V diagram on the right. $P_1 = 2P_2 = 10^6$ N/m^2, $V_2 = 4V_1 = 0.4\ m^3$. The heat absorbed by the gas in this process is (75 × X) kJ. Find the value of X.



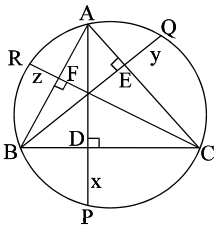
SPACE FOR ROUGH WORK

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 As shown in the figure AD is the altitude on BC and AD produced meets the circumcircle of ΔABC at P where DP = x. Similarly EQ = y and FR = z. If a,b, c respectively denotes the sides BC, CA and AB then $\frac{a}{2x}+\frac{b}{2y}+\frac{c}{2z}$ has the value equal to



(1) tanA + tanB + tanC
(2) cotA + cotB + cotC
(3) cosA + cosB + cosC
(4) cosec A + cosecB + cosecC

Q.52 The radius of the circle which touches the line $x + y = 0$ at M (– 1, 1) and cuts the circle $x^2 + y^2 + 6x - 4y + 18 = 0$ orthogonally, is

(1) $3\sqrt{2}$ (2) $4\sqrt{2}$
(3) $\sqrt{2}$ (4) $5\sqrt{2}$

Q.53 Which of the following function is surjective but not injective

(1) $f : R \to R;\ f(x) = x^4 + 2x^3 - x^2 + 1$
(2) $f : R \to R;\ f(x) = x^3 + x + 1$
(3) $f : R \to R^+;\ f(x) = \sqrt{1+x^2}$
(4) $f : R \to R;\ f(x) = x^3 + 2x^2 - x + 1$

Q.54 Which one of the following function is discontinuous for atleast one real value of x?

(1) $f(x) = \sqrt{1+\text{sgn}\,x}$ (2) $g(x) = \frac{e^x+1}{e^x+3}$

(3) $h(x) = \left(\frac{2^{2x}+1}{2^{3x}+5}\right)^{\frac{5}{7}}$ (4) $k(x) = \sqrt{3+2\sin x}$

[**Note :** sgn x denotes signum function of x.]

Q.55 $\underset{x\to\infty}{\text{Limit}} \frac{\cot^{-1}\left(\sqrt{x+1}-\sqrt{x}\right)}{\sec^{-1}\left\{\left(\frac{2x+1}{x-1}\right)^x\right\}}$ is equal to

(1) 1 (2) 0
(3) π/2 (4) non existent

Q.56 Let $u = \int_0^{\pi/2} \cos\left(\frac{2\pi}{3}\sin^2 x\right)dx$ and

$v = \int_0^{\pi/2} \cos\left(\frac{\pi}{3}\sin x\right)dx$, then the relation between u and v is

(1) 2u = v (2) 2u = 3v
(3) u = v (4) u = 2v

Q.57 For $x \in \left(0, \frac{5\pi}{2}\right)$, define $f(x) = \int_0^x \sqrt{t}\ \cos t\ dt$. Then f has

(1) local minimum at π/2 and 3π/2.
(2) local minimum at π/2 and local maximum at 3π/2.
(3) local maximum at π/2 and 3π/2.
(4) local maximum at π/2 and local minimum at 3π/2.

Q.58 $\vec{a}$, $\vec{b}$ and $\vec{c}$ be three vectors having magnitudes 1, 1 and 2 respectively. If $\vec{a} \times (\vec{a} \times \vec{c}) + \vec{b} = 0$, then the acute angle between $\vec{a}$ & $\vec{c}$ is :

(1) π/6 (2) π/4
(3) π/3 (4) 5π/12

Q.59 Consider two planes $P_1 : 2x - y + z - 2 = 0$ and $P_2 : x + 2y - z = 3$. The equation of plane passing through the intersection of P_1 and P_2 and the point (3, 2, 1) is

(1) 3x – y + 2z – 9 = 0
(2) x – 3y + 2z + 1 = 0
(3) 2x – 3y + z – 1 = 0
(4) 4x – 3y + 2z – 8 = 0

SPACE FOR ROUGH WORK

Q.60 Mr. Dupont is a professional wine taster. When given a French wine, he will identify it with probability 0.9 correctly as French, and will mistake it for a Californian wine with probability 0.1. When given a Californian wine, he will identify it with probability 0.8 correctly as Californian, and will mistake it for a French wine with probability 0.2. Suppose that Mr. Dupont is given ten unlabelled glasses of wine, three with French and seven with Californian wines. He randomly picks a glass, tries the wine, and solemnly says : "French". The probability that the wine he tasted was Californian, is nearly equal to

(1) 0.14 (2) 0.24
(3) 0.34 (4) 0.44

Q.61 The area bounded by the curves $y = -\sqrt{-x}$ and $x = -\sqrt{-y}$ where $x, y \le 0$

(1) cannot be determined
(2) is 1/3
(3) is 2/3
(4) is same as that of the figure bounded by the curves $y = \sqrt{-x}$; $x \le 0$ and $x = \sqrt{-y}$; $y \le 0$

Q.62 PQ is a chord of parabola $x^2 = 4y$ which subtends right angle at vertex. Then locus of centroid of triangle PSQ, where S is the focus of given parabola, is

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

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

Q.63 The foci of a hyperbola coincide with the foci of the ellipse $\frac{x^2}{25} + \frac{y^2}{9} = 1$. Then the equation of the hyperbola with eccentricity 2 is

(1) $\frac{x^2}{12} - \frac{y^2}{4} = 1$ (2) $\frac{x^2}{4} - \frac{y^2}{12} = 1$
(3) $3x^2 - y^2 + 12 = 0$ (4) $9x^2 - 25y^2 - 225 = 0$

Q.64 If $z = (3 + 7i)(p + iq)$ where $p, q \in I - \{0\}$, is purely imaginary then minimum value of $|z|^2$ is

(1) 0 (2) 58
(3) 3364 / 3 (4) 3364

Q.65 Let R be a relation on the set N defined by $\{(x, y): x, y \in N \text{ and } 2x + y = 41\}$. Then R is

(1) reflexive (2) symmetric
(3) transitive (4) none of these

Q.66 The variable x takes two values x_1 and x_2 with frequencies f_1 and f_2 respectively. If σ denotes the standard deviation of x, then

(1) $\sigma^2 = \frac{f_1x_1^2 + f_2x_2^2}{f_1 + f_2} - \left(\frac{f_1x_1 + f_2x_2}{f_1 + f_2}\right)^2$

(2) $\sigma^2 = \frac{f_1f_2}{(f_1 + f_2)^2}(x_1 + x_2)^2$

(3) $\sigma^2 = \frac{(x_1 - x_2)^2}{f_1 + f_2}$

(4) None of these

Q.67 If p : Ram works hard
q : Ram gets good grade
Then the verbal form for $(\sim p \to q)$ is

(1) If Ram works hard, then he gets good grade.
(2) If Ram does not work hard, then he gets good grade.
(3) Ram works hard if and only if he gets good grade.
(4) If Ram does not work hard, then he does not get good grade.

Q.68 The value of the definite integral

$$\int_e^{e^{2010}} \frac{1}{x}\left(1 + \frac{1 - \ell nx}{\ell nx\,\ell n\left(\frac{x}{\ell nx}\right)}\right) dx =$$

(1) 2009 – ℓn (2010 – ℓn 2010)
(2) 2010 – ℓn (2009 – ℓn 2009)
(3) 2009 – ℓn (2010 – ℓn 2009)
(4) 2010 – ℓn (2010 – ℓn 2010)

SPACE FOR ROUGH WORK

Q.69 The locus of a point $P(\alpha,\beta)$ moving under the condition that the line $y = \alpha x + \beta$ is a tangent to the hyperbola $\frac{x^2}{4} - \frac{y^2}{9} = 1$ is-

(1) circle (2) ellipse
(3) parabola (4) hyperbola

Q.70 Let $\vec{a}, \vec{b}$ and $\vec{c}$ be three non-coplanar unit vectors such that the angle between every pair of them is $\pi/3$. If $\vec{a}\times\vec{b} + \vec{b}\times\vec{c} = p\vec{a} + q\vec{b} + r\vec{c}$, where p, q and r are scalars, then the value of $\frac{p^2 + 2q^2 + r^2}{q^2}$ is –

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

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 integral values of c for which both roots of the equation $x^2 - 2cx + c^2 = 1$ are greater than -2 but less than 4, are

Q.72 Let P_n denotes the number of ways in which three people can be selected out of 'n' people sitting in a row, if no two of them are consecutive. If, $P_{n+1} - P_n = 15$ then the value of 'n' is

Q.73 Number of solutions of the equation $2\cot^{-1}2 + \cos^{-1}(3/5) = \text{cosec}^{-1} x$ is

Q.74 Let $A = \begin{bmatrix} \sin\theta & 0 \\ 0 & -\sin\theta \end{bmatrix}$. If $A + A^T$ is a null matrix, then the number of values of θ in (0, 6), is

Q.75 Let $\frac{x\,dy}{dx} - y = x^2(xe^x + e^x - 1)$ for all $x \in R - \{0\}$ such that $y(1) = e - 1$. If $y(2) = k\,y(1)\,(y(1) + 2)$, then the value of k is

SPACE FOR ROUGH WORK