JEE Mains (12th)

Sample Paper - V

DURATION : 180 Minutes   **M. MARKS : 300**

General Instructions:

1. Immediately fill in the particulars on this page of the test booklet.

2. The test is of **3 hours** duration.

3. The test booklet consists of **90** questions **(75 to attempt)**. The maximum marks are **300**.

4. There are three subjects in the question paper, Subject I, II and III consisting of Section-I **(Physics)**, Section-II **(Chemistry)**, Section-III **(Mathematics)**, and having **30 questions** in each part.

5. There will be a total of **20 MCQs** and **10 Numerical** Value Based Questions **(attempt any 5)**.

6. Each correct answer will give 4 marks while 1 Marks will be deducted for a wrong response.

7. No student is allowed to carry any textual material, printed or written, bits of papers, pager, mobile phone, any electronic device, etc. inside the examination room/hall.

8. On completion of the test, the candidate must hand over the Answer Sheet to the Invigilator on duty in the Room/Hall. However, the candidates are allowed to take away this Test Booklet with them.

9. **Do not fold or make any stray mark on the Answer Sheet (OMR).**

Name of the Student (In CAPITALS): _____

Roll Number: _____

Candidate's Signature: _____

Section-I (PHYSICS)

Section-A

1. In a particular system, the unit of length, mass and time are chosen to be 10 cm, 10 g and 0.1 s respectively. The unit of force in this system will be equivalent to
(1) 0.1 N
(2) 1 N
(3) 10 N
(4) 100 N

2. A cyclotron is operated at an oscillator frequency of 24 MHz and has a dee radius $R = 60$ cm. What is magnitude of the magnetic field B (in tesla) to accelerate deuterons (mass $= 3.34 \times 10^{-27}$ kg)?
(1) 9.5
(2) 7.2
(3) 5.0
(4) 3.2

3. The speed of a projectile at its maximum height is $\dfrac{\sqrt{3}}{2}$ times its initial speed. If the range of the projectile is P times the maximum height attained by it, then P equals
(1) $\dfrac{4}{3}$
(2) $2\sqrt{3}$
(3) $4\sqrt{3}$
(4) $\dfrac{3}{4}$

4. The total intensity of the earth's magnetic field at equator is 5 units. What is its value at the poles?
(1) 5
(2) 4
(3) 3
(4) 2

5. A uniform solid cylinder has a radius R and length L. If the moment of inertia of this cylinder about an axis passing through its centre and normal to its circular face is equal to the moment of inertia of the same cylinder about an axis passing through its centre and perpendicular to its length, then
(1) $L = R$
(2) $L = \sqrt{3}R$
(3) $L = \dfrac{R}{\sqrt{3}}$
(4) $L = \sqrt{\dfrac{3}{2}}R$

6. A coil of inductance 300 mH and resistance 2Ω is connected to a source of voltage 2 V. The current reaches half of its steady state value in time t is
(1) 0.05 s
(2) 0.1 s
(3) 0.15 s
(4) 0.3 s

7. A body is projected up with a velocity equal to $\left(\dfrac{3}{4}\right)^{th}$ of the escape velocity from the surface of the earth. The height it reaches is (Radius of the earth = R)
(1) $\dfrac{10}{9}R$
(2) $\dfrac{9}{7}R$
(3) $\dfrac{9}{8}R$
(4) $\dfrac{10}{3}R$

8. Radius of a circular ring is changing with time and the ring is placed in a uniform magnetic field perpendicular to its plane. The variation of r with time t as shown in the figure. The magnitude of induced emf (ε) is best represented by
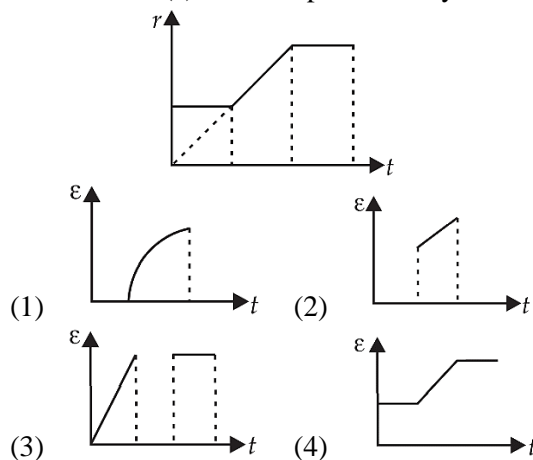

9. A gaseous mixture consists of 16 g of helium and 16 g of oxygen. The ratio C_P/C_V of the mixture is
(1) 1.4
(2) 1.54
(3) 1.59
(4) 1.62

10. A ray incident at a point at an angle of incidence of 60° enters a glass sphere of refractive index $\mu = \sqrt{3}$ and is reflected and refracted at the further surface of the sphere. The angle between the reflected and refracted rays at this surface is
(1) 50°
(2) 60°
(3) 90°
(4) 40°

11. The number of significant figures in the numbers 4.8000×10^4 and 48000.50 are respectively
(1) 5 and 6
(2) 5 and 7
(3) 2 and 7
(4) 2 and 6

12. The length of a potentiometer wire is l. A cell of emf e is balanced at a length $l/5$ from the positive end of the wire. If length of the wire is increased by $l/2$. At what distance will the same cell give a balance point?
(1) $\dfrac{2}{15}l$
(2) $\dfrac{3}{15}l$
(3) $\dfrac{3}{10}l$
(4) $\dfrac{4}{10}l$

13. A body A starts from rest with an acceleration a_1. After 2 seconds, another body B starts from rest with an acceleration a_2. If they travel equal distances in the 5th second, after the start of A, then the ratio $a_1 : a_2$ is equal to
(1) 5 : 9
(2) 5 : 7
(3) 9 : 5
(4) 9 : 7

14. A particle of charge q and mass m moves in a circular orbit of radius r with angular speed ω. The ratio of the magnitude of its magnetic moment to that of its angular momentum depends on

(1) ω and q　　　　(2) ωq and m

(3) q and m　　　　(4) ω and m

15. A machine gun is mounted on a 2000 kg car on a horizontal frictionless surface. At some instant, the gun fires 10 bullets/second and each of mass 10 g with a velocity of 500 m s^{-1}. The acceleration of the car is

(1) 0.025 m s^{-2}　　　　(2) 0.25 m s^{-2}

(3) 0.50 m s^{-2}　　　　(4) 500 m s^{-2}

16. What will happen to the inductance L of a solenoid when the number of turns and the length are doubled keeping the area of cross-section same?

(1) $\dfrac{L}{2}$　　　　(2) L

(3) $2L$　　　　(4) $4L$

17. A bomb moving with velocity $(40\hat{i}+50\hat{j}-25\hat{k})$ m s^{-1} explode into two pieces of mass ratio 1 : 4. After explosion the smaller piece moves away with velocity $(200\hat{i}+70\hat{j}+15\hat{k})$ m s^{-1}. The velocity of larger piece after explosion is

(1) $45\hat{j}-35\hat{k}$　　　　(2) $45\hat{i}-35\hat{k}$

(3) $45\hat{k}-35\hat{j}$　　　　(4) $-45\hat{i}+45\hat{k}$

18. A ray of light is incident normally on one of the faces of a prism of apex angle 30° and refractive index $\sqrt{2}$. The angle of deviation of the ray is

(1) 0°　　　　(2) 12.5°

(3) 15°　　　　(4) 22.5°

19. Particles of masses m, $2m$, $3m$ … nm grams are placed on the same line at distance l, $2l$, $3l$ … nl cm from a fixed point. The distance of centre of mass of the particles from the fixed point in centimetre is

(1) $\dfrac{(2n+1)l}{3}$　　　　(2) $\dfrac{l}{n+1}$

(3) $\dfrac{n(n^2+1)l}{2}$　　　　(4) $\dfrac{2l}{n(n^2+1)}$

20. When one of the slits of Young's experiment is covered with a transparent sheet of thickness 4.8 mm, the central fringe shifts to a position originally occupied by the 30th bright fringe. What should be the thickness of the sheet if the central fringe has to shift to the position occupied by 20th bright fringe?

(1) 3.8 mm　　　　(2) 1.6 mm

(3) 7.6 mm　　　　(4) 3.2 mm

Section - B

21. There are two radioactive substances A and B. Decay constant of B is two times that of A. Initially, both have equal number of nuclei. After n half lives of A, rate of disintegration of both are equal. The value of n is _____.

22. Two masses of 10 kg and 20 kg respectively are connected by a massless spring. A force of 200 N is applied on the 20 kg mass as shown in the figure. At the instant shown, the 10 kg mass has acceleration 12 m s^{-2}. For 20 kg mass the acceleration is _____ m s^{-2}.
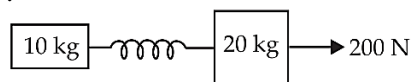

23. One end of a spring of natural length $l_0 = 0.1$ m and spring constant $k = 80$ N m^{-1} is fixed to the ground and the other end is fitted with a smooth ring of mass $m = 2$ g, which is allowed to slide on a horizontal rod fixed at a height $h = 0.1$ m.
Initially the spring makes an angle of 37° with the vertical when the system is released from rest.
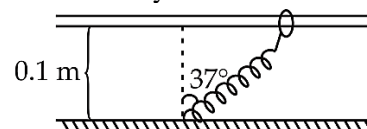
When the spring becomes vertical, if the speed of ring is v, then the value of v is _____ m s^{-1}.

(Given $\cos 37° = \dfrac{4}{5}$)

24. In the network shown in the figure, the value of current through 4 V battery is _____ A.
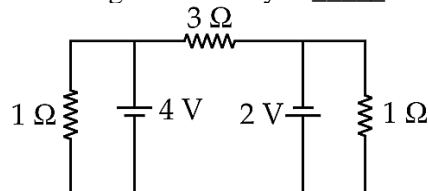
25. In brass, the velocity of longitudinal wave is 100 times the velocity of the transverse wave. If $Y = 1 \times 10^{11}$ N m^{-2}, then stress in the wire is $x \times 10^7$ N m^{-2}. The value of x _____.

26. A parallel plate capacitor is maintained at a certain potential difference. When a 3 mm thick slab is introduced between the plates, in order to maintain the same potential difference, the distance between the plates is increased by 2.4 mm. The dielectric constant of the slab is _____.

27. A silver sphere of radius 1 cm and work function 4.7 eV is suspended from an insulating thread in free-space. It is under continuous illumination of light of wavelength 200 nm. As photoelectrons are emitted, the sphere gets charged and acquires a potential. The maximum number of photoelectrons emitted from the sphere is $A \times 10^Z$ (where $1 < A < 10$). The value of Z is _____.

28. The activity of a freshly prepared radioactive sample is 10^{10} disintegrations per second, whose mean life is 10^9 s. The mass of an atom of this radioisotope is 10^{-25} kg. The mass of the radioactive sample is _____ mg.

29. The period of revolution of planet A around the sun is 8 times that of B. The distance of A from the sun is _____ times that of B from the sun.

30. In a car race sound signals emitted by the two cars are detected by the detector on the straight track at the end point of the race. Frequency observed are 330 Hz and 360 Hz and the original frequency is 300 Hz of both cars. Race ends with the separation of 100 m between the cars. Assume both cars move with constant velocity and velocity of sound is 330 m s^{-1}. The time taken by winning car is _____ s.

Section-II (CHEMISTRY)

Section - A

31. If first excitation potential of H-like sample is 15 volt then find out ionization energy of sample

(1) $\dfrac{160}{9}$ eV   (2) 20 eV

(3) 13.6 eV   (4) 15 eV

32. At what temperature O_2 molecules have same average momentum as helium molecule at 27ºC

(1) 27ºC   (2) 37.5K

(3) 40ºC   (4) 54ºC

33. Oxygen diffuses from two different vessels 'A' and 'B' under identical conditions but 'A' has circular orifice while 'B' has square orifice. The ratio of rate of diffusion in the two vessel will be: (Given: Diagonal of square = Diameter of circle)

(1) $2:\pi$ (2) $4:\pi$

(3) $\pi:4$ (4) $\pi:2$

34. In the reaction, $PCl_5 \rightleftharpoons PCl_3 + Cl_2$, the amounts of PCl_5, PCl_3 and Cl_2 at equilibrium are 2 mole each and the total pressure is 3 atm. The equilibrium constant K_p is:

(1) 1.0 atm

(2) 2.0 atm

(3) 3.0 atm

(4) 6.0 atm

35. N_2O_4 is dissociated to 33% and 40% at total pressure P_1 and P_2 respectively at equilibrium. The ratio of $\dfrac{P_1}{P_2}$ is:

(1) 2.0

(2) 1.55

(3) 2.5

(4) 3.0

36. The value of K_w at the physiological temperature (37ºC) is 2.56×10^{-14}. What is the pH at the neutral point of water at this temperature, where there are equal number of H$^+$ and OH$^-$?

(1) 6.81   (2) 7.0

(3) 7.19   (4) 6.48

37. An aqueous solution of a solute AB has b.p. of 101.08º (AB is 100% ionised at boiling point of the solution) and freezes at–1.80ºC. Hence, AB ($K_b/K_f = 0.3$)

(1) is 100% ionised at the f.p. of the solution

(2) behaves as non-electrolyte at the f.p. of the solution

(3) forms dimer

(4) none of the above

38. For the reaction, $4A + B \longrightarrow 2C + 2D$, the statement not correct is:

(1) The rate of disappearance of B is one fourth the rate of disappearance of A

(2) The rate of appearance of C is half the rate of disappearance of B

(3) The rate of formation of D is half the rate of consumption of A

(4) The rates of formation of C and D are equal

39. At the point of intersection of the two curves shown, the concentration of B is given as (A → nB) (consider the reaction to be I order)
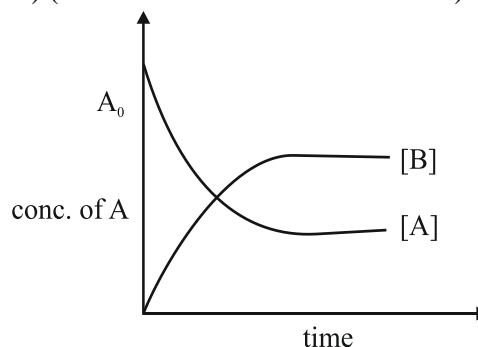
(1) $\dfrac{A_0}{n}$ (2) $\dfrac{A_0}{n-1}$

(3) $\dfrac{nA_0}{n+1}$ (4) $\dfrac{n-1}{n+1}A_0$

40. Which of the following statement are true:
(I) order of a reaction is a unitless quantity, which is independent of reaction conditions
(II) For a complex reaction $A_2 + B_2 \longrightarrow 2AB$; rate law can never be $r = K[A_2][B_2]$.
(III) A zero order reaction is a complex reaction $(A \rightarrow products)$
(IV) For a elementary reaction $A_2 + B_2 \rightarrow 2AB$; rate law can be written as $f = k[A_2]^{3/2}[B_2]^{1/2}$
(1) II, III, IV (2) III, IV
(3) Only III (4) II & III

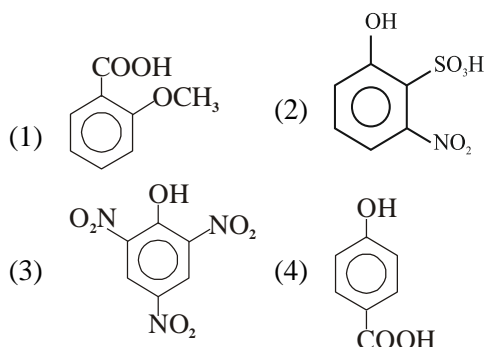**41.** The correct stability order of the following resonance structure is

$$CH_2 = C = O \qquad H_2\bar{C} - C^+ = O$$
$$\text{(I)} \qquad\qquad \text{(II)}$$

$$H_2C = \overset{+}{C} - \bar{O} \qquad H_2\bar{C} - C \equiv \overset{+}{O}$$
$$\text{(III)} \qquad\qquad \text{(IV)}$$

(1) IV>I>III>II (2) II>IV>I>III
(3) III>II>IV>I (4) I>IV>III>II

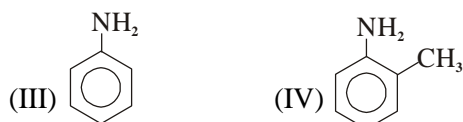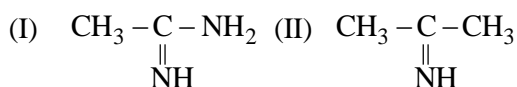**42.** What is the correct IUPAC name of
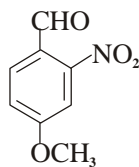
(1) 4-methoxy-2-nitrobenzaldehyde
(2) 4-formyl-3-nitro anisole
(3) 4-methoxy-6-nitrobenzaldehyde
(4) 2-formyl-5-methoxy nitrobenzene.
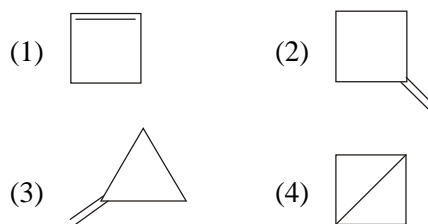
43. Which is less acidic than Benzoic acid?

44. Which of the following is correct order of basic strength for the given compounds?
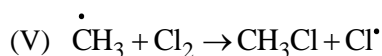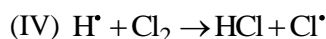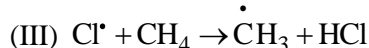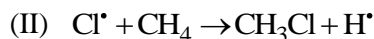
$$\text{(I)} \quad CH_3 - \underset{\underset{NH}{\|}}{C} - NH_2 \quad \text{(II)} \quad CH_3 - \underset{\underset{NH}{\|}}{C} - CH_3$$

(1) I>II>III>IV (2) IV>III>II>I
(3) IV>II>III>I (4) I>II>IV>III

45. Which of the following is impossible structure for the molecular formula C_4H_6?

46. Select the chain propagation steps in the free radical chlorination of methane
(I) $Cl_2 \rightarrow 2Cl^{\bullet}$
(II) $Cl^{\bullet} + CH_4 \rightarrow CH_3Cl + H^{\bullet}$
(III) $Cl^{\bullet} + CH_4 \rightarrow \overset{\bullet}{C}H_3 + HCl$
(IV) $H^{\bullet} + Cl_2 \rightarrow HCl + Cl^{\bullet}$
(V) $\overset{\bullet}{C}H_3 + Cl_2 \rightarrow CH_3Cl + Cl^{\bullet}$
(1) II, III, V (2) I, III, V
(3) III, V (4) II, III, IV

47. A plot of $\log \dfrac{x}{m}$ v.s $\log P$ for the adsorption of a gas on solid gives a straight line with slope equal to
(1) $\dfrac{1}{n}$ (2) $\log k$
(3) $-\log k$ (4) n

48. Which of the following forms interstitial compounds?
(1) Fe (2) Co
(3) Ni (4) All

49. Which of the following ions will liberate iodine when treated with KI?
(1) Cu^{2+} (2) Fe^{2+}
(3) Pb^{2+} (4) Sn^{2+}

50. Which of the following is only acidic in nature?
(1) $Be(OH)_2$ (2) $Mg(OH)_2$
(3) $B(OH)_3$ (4) $Al(OH)_3$

Section - B

51. No. of electrons transfer when $KMnO_4$ is reduced in to $MnSO_4$.

52. In blue vitriol, copper is coordinated to —— water molecules.

53. $[Ti(H_2O)_6]^{3+}$ absorbs energy equal to wavelength 498 nm. On this basis crystal field splitting energy comes out to be a $\times 10^{-19}$ J. What is the value of a?

54. The Hydration energy of alkaline earth metal ions is higher than that of alkali metal ions. So $MgCl_2 . XH_2O$ and $CaCl_2 . YH_2O$ can exist. What is the value of $X + Y$?

[5]

55. How many moles of Grignard reagent can react with one mole of the given compound?
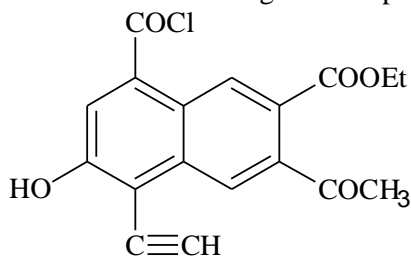
56. How many factors are of importance for S_N1 reaction.
1. Nature of solvent
2. Concentration of substrate
3. Contraction of nucleophile
4. Nature of alkyl group in the substrate
5. Nature of nucleophile
6. Nature of leaving group

57. Calculate the isoelectric point of lysine COO^-CH $(\overset{+}{N}H_3)$ $(CH_2)_4NH_2$. The pka_1, pka_2 and pka_3 of the di-cation of lysine are 2, 8, 10

58. Number of N-atoms present in Arginine is ….

59. The solubility product of MOH is 1×10^{-10} mol^2 dm^{-6}. What would be the pH of aqueous solution of MOH?

60. What is the number of Faraday's of charge, that should be required to convert one mole of $FeCr_2O_4$ to Fe^{3+} an CrO_4^{2-} through an electrolytic oxidation process consider the current efficiency to be 87.5%?

Section-III (MATHEMATICS)

Section A

61. If $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ are two matrices such that $AB = BA$ and $c \neq 0$, then value of $\dfrac{3a - 3d}{3b + c}$ is

(1) 0
(2) 2
(3) -2
(4) -1

62. $\displaystyle\lim_{x \to 0^+} \dfrac{e^{\left(x^x - 1\right)} - x^x}{\left(\left(x^2\right)^x - 1\right)^2} =$

(1) 1
(2) 1/8
(3) -1
(4) does not exist

63. The set of values of $'a'$ for which
$x^2 + ax + \sin^{-1}(x^2 - 4x + 5) + \cos^{-1}(x^2 - 4x + 5) = 0$
has at least one solution is

(1) $(-\infty, -\sqrt{2\pi}] \cup [\sqrt{2\pi}, \infty)$
(2) $(-\infty, -\sqrt{2\pi}) \cup (\sqrt{2\pi}, \infty)$
(3) R
(4) $-\left(\dfrac{\pi + 8}{4}\right)$

64. Let $\alpha = \log_{10}15$ and $\beta = \log_{10} 16$, a set $A = \{\log_{10}1, \log_{10}2, \ldots\ldots \log_{10} 50\}$ the number of elements in set A which can be written in the form $a\alpha + b\beta + c$ where a, b, c, are rational numbers is

(1) 23
(2) 24
(3) 25
(4) None of these

65. If $\displaystyle\int \dfrac{\sec^2 x - 2010}{\sin^{2010} x} dx = \dfrac{P(x)}{(\sin x)^{2010}} + C$, then the value of $P\left(\dfrac{\pi}{3}\right)$ is

(1) 0
(2) $\dfrac{1}{\sqrt{3}}$
(3) $\sqrt{3}$
(4) $\dfrac{3\sqrt{3}}{2}$

66. If $\hat{i} + j$ bisects the angle between $\hat{c}$ and $j + k$, then value of $\hat{c} \cdot j$ is equal to

(1) 0
(2) $\dfrac{1}{\sqrt{2}}$
(3) $-\dfrac{1}{\sqrt{2}}$
(4) 1

67. If A and B are two square matrices such that $B = -A^{-1}BA$, then $(A + B)^2$ is equal to
(1) O
(2) $A^2 + B^2$
(3) $A^2 + 2AB + B^2$
(4) $A + B$

68. The value of θ where
$\theta = \sin^{-1}\sqrt{\dfrac{2 - \sqrt{3}}{4}} + \cos^{-1}\dfrac{\sqrt{12}}{4} + \sec^{-1}\left(\sqrt{2}\right)$
is equal to

(1) 0
(2) $\dfrac{\pi}{4}$
(3) $\dfrac{\pi}{6}$
(4) $\dfrac{\pi}{2}$

69. Let $f(x) = \int_x^2 \dfrac{dy}{\sqrt{1+y^3}}$. The value of the integral $\int_0^2 xf(x)dx$ is equal to

(1) 1

(2) $\dfrac{4}{3}$

(3) $\dfrac{2}{3}$

(4) $\dfrac{1}{3}$

70. Let P be a point on ellipse $4x^2 + y^2 = 8$ with eccentric angle $\dfrac{\pi}{4}$. If tangent at P intersects the x-axis at A and y-axis at B and normal at P intersect the x-axis at A' and y-axis at B'. The ratio of the area of triangle APA' to area of triangle BPB' is

(1) 1 : 1

(2) 2 : 1

(3) 3 : 1

(4) 4 : 1

71. $\int \dfrac{\sqrt{1-\sin x}}{1+\cos x} e^{-x/2} dx, x \in \left(\dfrac{5\pi}{2}, \dfrac{9\pi}{2} \right)$

(1) $e^{-x/2} \sin \dfrac{x}{2} + C$

(2) $-e^{-x/2} \sec \dfrac{x}{2} + C$

(3) $-e^{x/2} \sin \dfrac{x}{2} + C$

(4) $-e^{-x/2} \cos \dfrac{x}{2} + C$

72. If $1, \alpha_1, \alpha_2, \alpha_3, \ldots \alpha_{2008}$ are $(2009)^{\text{th}}$ roots of unity, then the value of $\sum_{r=1}^{2008} r(\alpha_r + \alpha_{2009-r})$ is equal to

(1) 2009

(2) 2008

(3) 0

(4) -2009

73. The principle argument of $z = x + iy$. If it lies in second quaderant is equal to

(1) $\dfrac{\pi}{2} + \tan^{-1}\left|\dfrac{y}{x}\right|$

(2) $\pi - \tan^{-1}\left|\dfrac{y}{x}\right|$

(3) $\pi + \tan^{-1}\left|\dfrac{y}{x}\right|$

(4) $\dfrac{\pi}{2} - \tan^{-1}\left|\dfrac{y}{x}\right|$

74. If $a = 2$, then sum of series $\cot^{-1}\left(2a^{-1}+a\right) + \cot^{-1}\left(2a^{-1}+3a\right) + \cot^{-1}\left(2a^{-1}+6a\right) + \cot^{-1}\left(2a^{-1}+10a\right) + \ldots$upto infinite term is

(1) $\dfrac{\pi}{4}$

(2) $\dfrac{\pi}{2}$

(3) $\dfrac{\pi}{3}$

(4) $\dfrac{\pi}{6}$

75. If $f(x+y+1) = (\sqrt{f(x)} + \sqrt{f(y)})^2$ and $f(0) = 1, \forall x, y \in R$ then $f(x)$ can be

(1) $1 - x^2$

(2) $1 - x$

(3) $(x+1)^2$

(4) $x^2 - 1$

76. Let $p(x)$ be a real polynomial of least degree which has a local maximum at $x = 2$ and a local minimum at $x = 4$. If $p(2) = 8$, $p(4) = 1$, then $p'(0)$ is

(1) $\dfrac{168}{5}$

(2) 42

(3) 43

(4) 45

77. $\cot^{-1}\left(\dfrac{9}{2}\right) + \cot^{-1}\left(\dfrac{33}{4}\right) + \cot^{-1}\left(\dfrac{129}{8}\right) \ldots \ldots \infty =$

(1) $\dfrac{\pi}{4}$

(2) $\dfrac{\pi}{2}$

(3) $-\dfrac{\pi}{4}$

(4) None of these

78. $\sim[\sim p \wedge (p \Leftrightarrow q)] =$

(1) $p \vee q$

(2) $q \wedge p$

(3) T

(4) F

79. If $\sum_{i=1}^9 (x_i - 5) = 9$ and $\sum_{i=1}^9 (x_i - 5)^2 = 45$, then the standard deviation of the 9 the times $x_1, x_2, \ldots x_9$ is

(1) 4

(2) 2

(3) 3

(4) 9

80. A rocket of height h metres is fired vertically upwards. Its velocity at time t seconds is $(2t + 3)$ metres/second. If the angle of elevation of the top of the rocket from a point on the ground after 1 second of firing $\dfrac{\pi}{6}$ and after 3. seconds it is $\dfrac{\pi}{3}$ then the distance of the point from the rocket is

(1) $14\sqrt{3}$ metres

(2) $7\sqrt{3}$ metres

(3) $2\sqrt{3}$ metres

(4) cannot be found without the value of h

Section - B

81. If sum of the series $\cot^{-1} 2.1^2 + \cot^{-1} 2.2^2 + \cot^{-1} 2.3^2 + \ldots \infty$ is equal to $k\pi$, then find the value of $[k]$, where [.] denotes greatest integer function.

82. Sum of all elements in range of $f(x) = {}^{16-x}C_{2x-1} + {}^{20-3x}C_{4x-5}$ is λ then find the value of $\dfrac{\lambda}{469}$.

83. If x, y, z are non-negative integers such that $2(x^3 + y^3 + z^3) = 3(x+y+z)^2$ then maximum value of $x+y+z$ is

84. Eccentricity of an ellipse of minimum area, circumscribing two circles, of equal radius, touch externally, is $\sqrt{\dfrac{22}{\mu}}$. Find the value of μ.

85. Range of $f(x) = l\,\mathrm{n}\left(2\sin x + \tan x - \dfrac{3x}{\pi} + 1\right)$,

$\forall x \in \left[\dfrac{\pi}{6}, \dfrac{\pi}{3}\right]$ is $[a, b]$ then find the value of $11[a+b]$.

[.] represents greatest integer function

86. If the funciton $f(x) = \sin(l\,\mathrm{n}\,x) - \cos(l\,\mathrm{n}\,x)$, where $-\pi \le l\,\mathrm{n}\,x \le \pi$, strictly increases in interval $\left[e^\lambda, e^\mu\right]$ and the length of $\left[e^\lambda, e^\mu\right]$ is greatest possible, then find the value of $-5\cos(\mu - \lambda)$.

87. If $\displaystyle\int \dfrac{\cos 5x - \cos 4x}{2\cos 3x + 1}\,dx = \dfrac{\sin 2x}{a} - \sin x + c$, find a

88. If largest subset of $(0, \pi)$ at each point of which the function $f(x) = 3\cos^4 x + 10\cos^3 x + 6\cos^2 x$ is decreasing is $\left(0, \dfrac{\pi}{p}\right) \cup \left(\dfrac{2\pi}{r}, \pi\right)$, then find the value of $(p+r)$

89. If $S = \displaystyle\sum_{n=2}^{\infty} \dfrac{3n^2 + 1}{\left(n^2 - 1\right)^3}$ then $\dfrac{9}{S} =$

90. If $\displaystyle\lim_{n\to\infty}\left(\dfrac{^{3n}C_n}{^{2n}C_n}\right)^{\frac{1}{n}} = \dfrac{A}{B}$ where A & B are relatively prime numbers, then $A+B$ is equal to