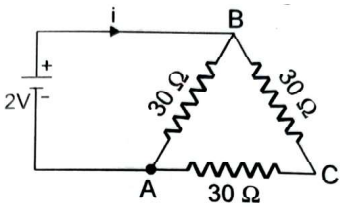
PHYSICS

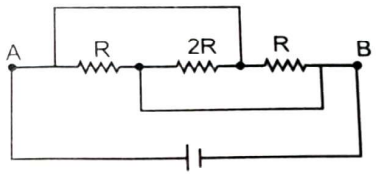
1. The current i in the circuit of figure is -



(1) $\frac{1}{45}$ amp (2) $\frac{1}{15}$ amp

(3) $\frac{1}{10}$ amp (4) $\frac{1}{5}$ amp

2. In the figure shown the current flowing through 2 R is



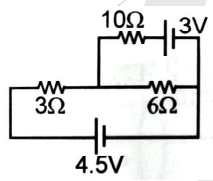
(1) from left to right

(2) from right to left

(3) no current

(4) None of these

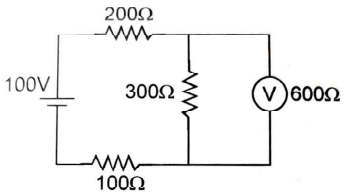
3. Find the current through the 10Ω resistor shown in figure



(1) zero (2) 1 A

(3) 2 A (4) 5 A

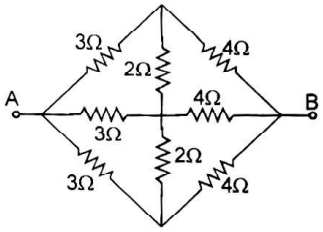
4. The reading of voltmeter is



(1) 50 V (2) 60 V

(3) 40 V (4) 80 V

5. The equivalent resistance between A and B will be (in)



(1) 2/7 (2) 8

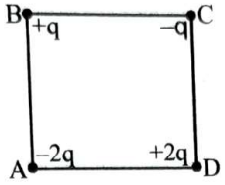
(3) 4/3 (4) 7/3

6. One quantum of charge should be a least be equal to the charge in coloumb.

(1) 1.6×10^{-17} C (2) 1.6×10^{-19} C

(3) 1.6×10^{-10} C (4) 4.8×10^{-10} C

7. Four charges are arranged at the corners of a square ABCD, as shown. The force on +ve charge kept at the centre of the square is



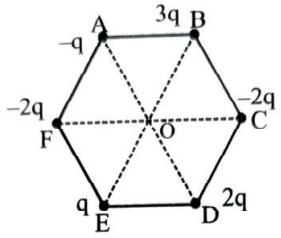
(1) zero

(2) along diagonal AC

(3) along diagonal BD

(4) prependicular to the side AB

8. Six charge are placed at the cornerof a regular hexagon as shown. If an electron is placed at its centre O, force on it will be



(1) Zero (2) Along OF

(3) Along OC (4) None of these

Rough Work

9. In a region of space , the electric field is in the x direction and is given as $\vec{E} = E_0 x\hat{i}$. Consider an imaginary cubical volume of edge a, with its edges parllel to the axes of coordinates. The charge inside this volume is

(1) zero (2) $\varepsilon_0 E_0 a^3$

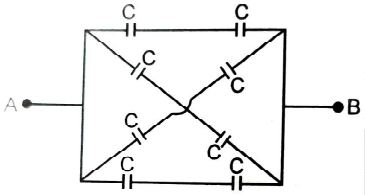
(3) $\frac{1}{\varepsilon_0} E_0 a^3$ (4) $\frac{1}{6}\varepsilon_0 E_0 a^2$

10. Electircity flux through a surface of area 100 m^2 lying in the xy plane is (in V-m) if $\vec{E} = \hat{i} + \sqrt{2}\,\hat{j} + \sqrt{3}\,\hat{k}$

(1) 100 (2) 141.4

(3) 173.2 (4) 200

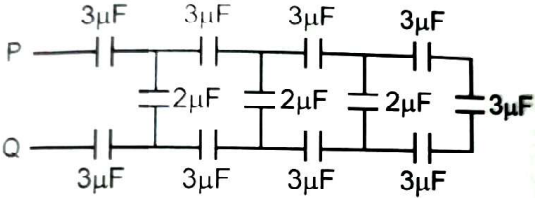
11. In the adjoining cicrcuti, the capacity between the points A and B will be-



(1) C (2) 2C

(3) 3C (4) 4C

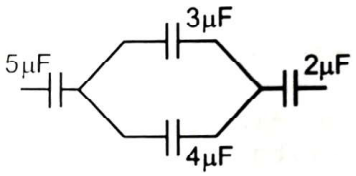
12. The effective capacity in the following figure between the point P and Q will be-



(1) $3\mu F$ (2) $5\mu F$

(3) $2\mu F$ (4) $1\mu F$

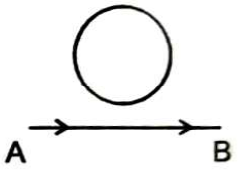
13. If charge on left plane of the $5\mu F$ capacitor in the circuit segment shown in the figure is $20\,\mu$C, the charge on the right place of $3\mu F$ capacitor is:-



(1) +8.57 μC (2) -8.57 μC

(3) +11.42 μC (4) -11.42 μC

14. In the arrangment shown in given figure current from A to B is increasing in magnitude. Induced current in the loop will



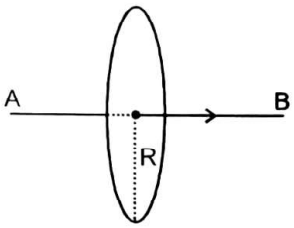
(1) have clockwise direction

(2) have anticlockwise direction

(3) be zero

(4) oscillate between clockwise and anticlockwise

15. A long conductor AB lies along the axis of a circular loop of radius R. If the current in the conductor AB varies at the rate of I ampere/ second, the the induced emp in the loop is

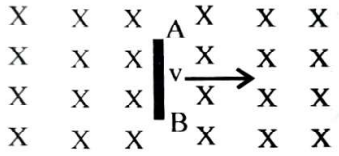


(1) $\frac{\mu_0 IR}{2}$ (2) $\frac{\mu_0 IR}{4}$

(3) $\frac{\mu_0 \pi IR}{2}$ (4) zero

Rough Work

16. A conducting rod AB moves with a uniform velocity v in a constant magnetic field as shown in fig



(1) The rod becomes hot because of Joule heating

(2) The end A become positively charged

(3) The end B become positively charged

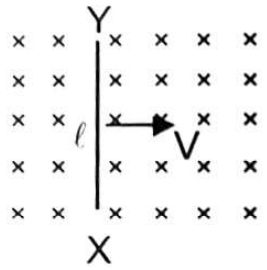
(4) The rod become electrically charged

17. A wire of length ℓ is moved with a constant velocity $\vec{v}$ in a magnetic field. A potential difference appears across the two ends

(1) if $\vec{v} \| \vec{\ell}$ (2) if $\vec{v} \| \vec{B}$

(3) if $\vec{\ell} \| \vec{B}$ (4) none of these

18. A small conducting rod of length 1, moves with a uniform velocity v in a uniform magnetic field B as shown in fig-



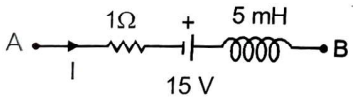
(1) Then the end X of the rod becomes positively charged

(2) the end Y of the rod becomes positively charged

(3) the entire rod is negatively charged

(4) the rod becomes hot due to joule heating.

19. The network shown in the figure is part of a complete circuit. If at a certain instant, the current I is 5A and it is decreasing at a rate of $10^3 As^{-1}$ then $V_B - V_A$ equals



(1) 20 V (2) 15 V

(3) 10 V (4) 5 V

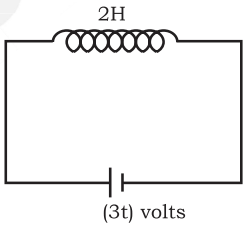
20. When current in a coil changes from 5 A to 2 A in 0.1 s, an average voltage of 50V is produced. The self-inductanceof the coil is

(1) 0.67H (2) 1.67H

(3) 3H (4) 6H

21. In the given circuit, find energy in J stored in circuit at t = 4 sec?

[A t t = 0 s, circuit si closed]



22. The magnet can be completely demagnetized by

(1) heating it slightly

(2) dropping it into ice cold water

(3) a reverse field of appropriate strength

(4) breaking the magnet into small pieces

23. Which of the following is most suitable for the core of electromagnets

(1) Soft iron (2) Steel

(3) Copper-nickel alloy (4) Air

Rough Work

24. The magnetic susceptibility is

(1) $\chi = \frac{I}{H}$ (2) $\chi = \frac{B}{H}$

(3) $\chi = \frac{M}{V}$ (4) $\chi = \frac{M}{H}$

25. A bar magnet of magnetic moment vec M is placed in a magnetic field of induction vec B The torque exerted on it is

(1) $\vec{M}.\vec{B}$ (2) $-\vec{M}.\vec{B}$

(3) $\vec{M}\times\vec{B}$ (4) $\vec{B}\times\vec{M}$

26. Weber/m² is equal to

(1) Volt (2) Henry

(3) Tesla (4) All of these

27. Magnetic dipole moment is a

(1) Scalar quantity (2) Vector quantity

(3) Constant quantity (4) None of these

28. Magnetic lines of force

(1) Always intersect

(2) Are always closed

(3) Tend to crowd far away from the poles of magnet

(4) Do not pass through vacuum

29. The magnetic field to a small magnetic dipole of magnetic moment M, at distance r from the centre on 28 the equatorial line is given by (in M.K.S. system)

(1) $\frac{\mu_0}{4\pi}\times\frac{M}{r^2}$ (2) $\frac{\mu_0}{4\pi}\times\frac{M}{r^3}$

(3) $\frac{\mu_0}{4\pi}\times\frac{2M}{r^2}$ (4) $\frac{\mu_0}{4\pi}\times\frac{2M}{r^3}$

30. A magnet of magnetic moment $50\hat{i}\ A-m^2$ is placed along the x-axis in a magnetic field $\vec{B}=\left(0.5\hat{i}+3.0\hat{j}\right)T$. The torque acting on the magnet is :

(1) $175\,\hat{k}\ N-m$ (2) $150\,\hat{k}\ N-m$

(3) $75\,\hat{k}\ N-m$ (4) $25\sqrt{37}\,\hat{k}\ N-m$

CHEMISTRY

31. For the reaction A + B → C starting with different initial concentration of A and B, initial rate of reaction were determined graphically in four experiments.

S.N.	$[A]_0$/M (Initial conce.)	$[B]_0$/M (initial conce.)	Rate / (M sec–1)
1	1.6×10^{-3}	5×10^{-2}	10^{-3}
2	3.2×10^{-3}	5×10^{-2}	4×10^{-3}
3	$1.6–10^{-3}$	10^{-1}	2×10^{-3}
4	3.2×10^{-3}	10^{-1}	8×10^{-3}

Rate law for reaction from above data is

(1) $r = k[A]^2\,[B]^2$ (2) $r = k[A]^2[B]$

(3) $r = k[A][B]^2$ (4) $r = k[A][B]$

32. For the reaction, $2NO(g)+2H_2(g) \longrightarrow N_2(g) + 2H_2O(g)$ the rate expression can be written in the following ways:

$\{d[N_2]/dt\} = k_1[NO][H_2]; \{d[H_2O]/dt\} = k[NO][H_2];$

$\{-d[NO]/dt\} = k'_1[NO][H_2]; \{-d[H_2]/dt\} = k''_1[NO][H_2]$

The relationship between k, k_1, k'1 and k"$_1$ is:

(1) $k = k_1 = k'_1 = k''_1$ (2) $k = 2k_1 = k'_1 = k''_1$

(3) $k = 2k'_1 = k_1 = k''_1$ (4) $k = k_1 = k'_1 = 2k''_1$

33. For the reaction $H_2 + Br_2 \rightarrow 2HBr$ overall order is found to be 3/2. The rate of reaction can be expressed as:

(1) $[H_2][Br_2]^{1/2}$ (2) $[H_2]^{(1/2)}[Br_2]$

(3) $[H_2]^{3/2}[Br_2]^0$ (4) All of these

34. The rate of production of NH_3 in $N_2 + 3H_2 \rightarrow 2NH_3$ is 3.4kg min⁻¹. The rate of consumption of H_2 is:

(1) 5.1 kg min⁻¹ (2) 0.01 kg sec⁻¹

(3) 0.6 kg hr⁻¹ (4) None of these

Rough Work

35. In a certain reaction, 10% of the reactant decomposes in one hour, 20% in two hours, 30% in three hours and so on the dimensions of the rate constant is :
(1) hour^{-1} (2) mole litre^{1} sec^{-1}
(3) litre mole^{-1} sec^{-1} (4) mole sec^{-1}

36. For a given reaction of first order it takes 20 min. for the conc. to drop from 1.0 M to 0.60 M. The time required for the conc. to drop from 0.60 M to 0.36 M will be :
(1) more than 20 min
(2) 20 min
(3) less than 30 min
(4) cannot tell.

37. The half - life of a radioactive isotope is three hours. If the initial mass of isotope were 256g, the mass of it remaining undecayed after 18 hours would be :
(1) 16.0 g (2) 4.0g
(3) 8.0 g (4) 12.0 g

38. Pressure over ideal binary liquid mixture containing 10 moles each of liquid A and B is gradually decreased isothermally. If $P_A^0 = 200mm$ Hg and $P_B^0 = 100mmHg$, Find the pressure at which half of the liquid is converted into vapour
(1) 150mm Hg (2) 166.5mm Hg
(3) 133mm Hg (4) 141.4mm Hg

39. A complex containing K^+,Pt(IV) and Cl^- is 100% ionised giving i = 3. Thus, complex is
(1) $K_2[PtCl_4]$ (2) $K_2[PtCl_6]$
(3) $K_3[PtCl_5]$ (4) $K[PtCl_3]$

40. Elevation of boiling point of 1 molar aqueous glucose solution(density = 1.2g/ml)is
(1) K_b (2) 1.20 K_b
(3) 1.02 K_b (4) 0.98 K_b

41. The fraction of phenol dimerised in benzene if 20 g of phenol in 1 kg benzene exhibits a freezing point depression of 0.69K.(K_f benzene = 5.12 $\frac{K-kg}{mol}$),(MW phenol = 94)
(1) 0.74 (2) 0.37
(3) 0.46 (4) 0.64

42. 25 mL of an aqueous solution of KCL was found to requires 20 mL of 1M $AgNO_3$ solution when titrated using a K_2CrO_4 as indicator. Depression in freezing point of KCl solution with 100% ionization will be [$K_f = 2.0^\circ mol^{-1}$ kg and molarity = molality]
(1) 20/45 (2) 80/45
(3) 40/45 (3) 160/45

43. Elevation in the boiling point for 1 molal solution of glucose is 2 K. The depression in the freezing point for 2 molar solution of glucose in the same solvent is 2K The relation between K_b and K_f
(1) $K_b = 1.5\,K_f$ (2) $K_b = K_f$
(3) $K_b = 0.5\,K_f$ (4) $K_b = 2\,K_f$

44. In electrolysis of a fused salt, the weight deposited on an electrode will not depend on-
(1) Temperature
(2) Current intensity
(3) Electrochemical equivalent of ions
(4) Time of electrolysis

45. During electrolysis of an aqous solution of sodium sulphate if 2.4L of oxygen at STP was liberated at anode. The volume of hydrogen at STP, liberated at cathode would be :
(1) 1.2L (2) 2.4L
(3) 2.6L (4) 4.8L

Rough Work

46. A current of 2.6 ampere is passed through $CuSO_4$ solution for 6 minutes 20 seconds. The amount of Cu deposited is (At. wt. of Cu = 63.5, Faraday = 96500 C)
(1) 6.35g (2) 0.635g
(3) 0.325g (4) 3.175g

47. The quantity of electricity required to liberate 0.01g equivalent of an element at the electrode is-
(1) 9650C (2) 96500C
(3) 965C (4) 96.5C

48. Which one of the following will increase the voltage of the cell ? (T=298 K)
$Sn + 2Ag^+ \rightarrow Sn^2 + 2Ag$
(1) increase in the size of silver rod
(2) increase in the concentration of Sn^{+2}ions
(3) increase in the concentration of Ag^{+2}ions
(4) none of the above

49. If 0.224L of H_2 gas is formed at the cathode, the volume of O_2 gas formed at the anode under identical conditions, is
(1) 0.224 L (2) 0.448 L
(3) 0.112 L (4) 1.12 L

50. A conductance cell was filled with a 0.02 M KCI solution which has a specific conductance of $2.768\times10^{-3} ohm^{-1}cm^{-1}$. If resistance is 82.4 ohm at 25°C, the cell constant is-
(1) 0.2182cm^{-1} (2) 0.2281cm^{-1}
(3) 0.2821cm^{-1} (4) 0.2381cm^{-1}

51. What is the standard reduction potential (E°)for $Fe^{3+} \rightarrow Fe$? Given that :
$Fe^{2+} + 2e^- \rightarrow Fe; E^\circ_{Fe^{2+}/Fe} = -0.47V$
$Fe^{3+} + e^- \rightarrow Fe^{2+}; E^\circ_{Fe^{3+}/Fe^{2+}} = +0.77V$
(1) +0.057 V (2) +0.30 V
(3) -0.30 V (4) -0.057 V

52. When 9.65 ampere current was passed for 1.0 hour into nitrobenzene in acidic medium, the amout of p-aminophenol produced is :
(1) 10.9 g (2) 98.1 g
(3) 109.0 g (4) 9.81 g

53. Given below are two statements.
Statements I : The E° value of Ce^{4+}/Ce^{3+} is +1.74 V.
Statement II : Ce is more stable in Ce^{4+} state than Ce^{3+} state.
In the light of the above statements, choose the most appropriate answer from the options given below.
(1) Both statement I and statement II are correct.
(2) Statement I is incorrect but statement II is correct.
(3) Both statement I and statement II are incorrect
(4) Statement I is correct but statement II is incorrect.

54. Match List-I with List-II

List-I (Parameter)	**List-II** (Unit)
(a) Cell constant	(i) S cm^2mol^{-1}
(b) Molar conductivity	(ii) Dimensionless
(c) Conductivity	(iii) m^{-1}
(d) Degree of dissociation	(iv) $cm^{-1}m^{-1}$

Choose the most appropriate answer from the options given below.
(1) (a)-(iii), (b)-(i), (c)-(iv), (d)-(ii)
(2) (a)-(iii), (b)-(i), (c)-(ii), (d)-(iv)
(3) (a)-(i), (b)-(iv), (c)-(iii), (d)-(ii)
(4) (a)-(ii), (b)-(i), (c)-(iii), (d)-(iv)

Rough Work

55. **Statement-I:** Ag is a transition element.
Statement-II: Ag atom has completely filled d orbital ($4d^{10}$) in it's ground state.
In the light of the above statements, choose the most appropriate answer from the options given below.
(1) Both statement I and statement II are correct.
(2) Statement I is incorrect but statement II is correct.
(3) Both statement I and statement II are incorrect
(4) Statement I is correct but statement II is incorrect.

56. **Statement-I :** Transition elements exhibit higher enthalpies of atomisation.
Statement-II: Transition elements have stronger inter atomic interaction.
In the light of the above statements, choose the most appropriate answer from the options given below.
(1) Both statement I and statement II are correct.
(2) Statement I is incorrect but statement II is correct.
(3) Both statement I and statement II are incorrect
(4) Statement I is correct but statement II is incorrect.

57. A pink coloured salt turns blue on heating. The presence of which cation is most likely
(1) Cu^{2+} (2) Fe^{2+}
(3) Zn^{2+} (4) Co^{2+}

58. The colour of $KMnO_4$ is due to :
(1) M $\rightarrow$ L charge transfer transition
(2) d – d_4 transition
(3) L $\rightarrow$ M charge transfer transition
(4) $\sigma - \sigma$ transition

59. The pair of compounds having metals in their highest oxidation state is
(1) $[Fe(CN)_6]^{3-}$ and $[Cu(CN)_4]^{2-}$
(2) $[FeCl_4]^-$ and Co_2O_3
(3) $[NiCl_4]^{2-}$ and $[CoCl_4]^{2-}$
(4) MnO_2 and CrO_2Cl_2

60. The statement that is incorrect about the interstitial compounds is
(1) they are chemically reactive
(2) they have matallic conductivity
(3) they are very hard
(4) they have high melting point

MATHS

61. If $f(x) = \cos\left[\frac{x^2}{2}\right]x + \sin\left[-\frac{\pi^2}{2}\right]x$, where [.] denotes the greatest integer function, then which of the following is not correct.
(a) f(0) = 1 (b) $f\left(\frac{\pi}{3}\right) = \frac{1}{\sqrt{3}+1}$
(c) $f\left(\frac{\pi}{2}\right) = 0$ (d) $f(\pi) = 0$

62. $f(x) = |x-1|, f: R^+ \rightarrow R, g(x) = e^x, g:[-1, \infty) \rightarrow R.$
if the function fog (x) is defined, then its domain and range respectively are :
(a) $(0, \infty)$ and $[0, \infty)$
(b) $[-1, \infty)$ and $[0, \infty)$
(c) $[-1, \infty)$ and $\left[1-\frac{1}{e}, \infty\right)$
(d) $[-1, \infty)$ and $\left[\frac{1}{e}-1, \infty\right)$

Rough Work

63. If for all x different from both 1 and 0 we have $f_1(x)=\frac{x}{x-1}$, $f_2(x)=\frac{1}{1-x}$, and for all integers $n \geq 1$, we have

$$f_{n+2}(x)=\begin{cases} f_{n+1}(f_1(x)) \text{ if n is odd} \\ f_{n+1}(f_2(x)) \text{ if n is even} \end{cases}$$ then

f_4(x) equals

(a) x (b) x-1

(c) f_1(x) (d) f_2(x)

64. If $f(x)=\sqrt{3|x|-x-2}$ and g(x) = sinx, then domain of fog(x) is

(a) $\left\{2n\pi+\frac{\pi}{2}\right\}$, where $n \in I$

(b) $\left[2n\pi+\frac{7\pi}{6}, 2n\pi+\frac{11\pi}{6}\right]$, where $n \in I$

(c) $\left\{2n\pi+\frac{\pi}{6}\right\}$, $where\, n \in I$

(d) $\left\{(4m+1)\frac{\pi}{2}; m \in I\right\} \cup$

65. If $f(x)+2f\left(\frac{1}{x}\right)=3x,\ x \neq 0$ and $S=\{x \in R: f(x)=f(-x)\}$ then S :

(a) is an empty set.

(b) contains exactly one element

(c) contains exactly two elements

(d) contains more than two elements

66. Let f(x) = a^x (a > 0) be written as f(x) = f_1(x) + f_2 (x), where f_1(x) is an even function or f_2(x) is an odd function.

Then f_1(x+y) + f_1(x–y) equals

(a) 2f_1 (x) f_1 (y) (b) 2f_1 (x) f_2(y)

(c) 2f_1 (x+y) f_2(x-y) (d) 2f_1 (x+y) f_1 (x-y)

67. Let $f: R \to R$ be defined as f(x + y) + f(x - y) = 2 f(x) f(y), f $\left(\frac{1}{2}\right)$ = - 1. Then, the value of

$$\sum_{k=1}^{20} \frac{1}{\sin(k)\sin(k+f(k))}$$

(a) $cosec^2$ (21) cos(20) cos(2)

(b) sec^2(1)sec(21)cos(20)

(c) $cosec^2$(1) cosec(21) sin(20)

(d) sec^2(21) sin(20) sin(2)

68. The function $f: \to \left[-\frac{1}{2}, \frac{1}{2}\right]$ defind as $f(x)=\frac{x}{1+x^2}$. is :

(a) neither injective nor surjective

(b) invertible

(c) injective but not surjective

(d) surjective but not injective

69. $\sin^{-1}\left(\sin\frac{2\pi}{3}\right)+\cos^{-1}\left(\cos\frac{7\pi}{6}\right)+\tan^{-1}\left(\tan\frac{3\pi}{4}\right)$ is equal to

(a) $\frac{11\pi}{12}$ (b) $\frac{17\pi}{12}$

(c) $\frac{31\pi}{12}$ (d) $-\frac{3\pi}{4}$

70. Let [x] denotes the greatest integer $\leq x$, where $x \in R$. If the domain of the real valued function

$f(x)=\sqrt{\frac{|[x]-2}{|[x]|-3}}$ is

$(-\infty, a) \cup [b, c) \cup [4, \infty), a < b < c,$

(a) 8 (b) 1

(c) –2 (d) –3

Rough Work

71. Let $f: R-\left\{\frac{\alpha}{6}\right\} \to R$ be defined by $f(x)=\frac{5x+3}{6x-\alpha}$. Then the value of a for which (fof) (x) = x, for all $x \in R-\left\{\frac{\alpha}{6}\right\}$, is -

(a) No Such a exists (b) 5

(c) 8 (d) 6

72. If $0<x<\frac{1}{\sqrt{2}}$ and $\frac{\sin^{-1}}{\alpha}=\frac{\cos^{-1}x}{\beta}$, then a value of $\sin\left(\frac{2\pi\alpha}{\alpha+\beta}\right)$ is

(a) $4\sqrt{\left(1-x^2\right)}\left(1-2x^2\right)$

(b) $4x\sqrt{\left(1-x^2\right)}\left(1-2x^2\right)$

(c) $2x\sqrt{\left(1-x^2\right)}\left(1-4x^2\right)$

(d) $4\sqrt{\left(1-x^2\right)}\left(1-4x^2\right)$

73. The value of $\cot\left(\sum_{n=1}^{50}\tan^{-1}\left(\frac{1}{1+n+n^2}\right)\right)$ is

(a) $\frac{26}{25}$ (b) $\frac{25}{26}$

(c) $\frac{50}{51}$ (d) $\frac{52}{51}$

74. The domain of the function $f(x)=\sin^{-1}\left(\frac{x^2-3x+2}{x^2+2x+7}\right)$ is

(a) $[1,\infty)$ (b) $[-1,2)$

(c) $[-1,\infty)$ (d) $(-\infty,2]$

75. Let a_1 = 1, a2, a_3, a_4, ... be consecutive natural numbers. Then $\tan^{-1}\left(\frac{1}{1+a_1a_2}\right)+\tan^{-1}\left(\frac{1}{1+a_2a_3}\right)+.....+\tan^{-1}\left(\frac{1}{1+a_{2021}a_{2022}}\right)$

(a) $\frac{\pi}{4}-\cot^{-1}(2022)$

(b) $\cot^{-1}(2022)-\frac{\pi}{4}$

(c) $\tan^{-1}(2022)-\frac{\pi}{4}$

(d) $\frac{\pi}{4}-\tan^{-1}(2022)$

76. Let S be the set of all solution of the equation $\cos^{-1}(2x)-2\cos^{-1}\left(\sqrt{1-x^2}\right)=\pi, x\in\left[-\frac{1}{2},\frac{1}{2}\right]$. Then $\sum_{x\in s}2\sin^{-1}\left(x^2-1\right)$ is equal to

(a) 0 (b) $\frac{-2\pi}{3}$

(c) $\pi-\sin^{-1}\left(\frac{\sqrt{3}}{4}\right)$ (d) $\pi-2\sin^{-1}\left(\frac{\sqrt{3}}{4}\right)$

77. If $\sin^{-1}\frac{\alpha}{17}+\cos^{-1}\frac{4}{5}-\tan^{-1}\frac{77}{36}=0$, $0<\alpha<13$, then $\sin^{-1}(\sin\alpha)+\cos^{-1}(\cos\alpha)$ is equal to

(a) π (b) 16

(c) 0 (d) $16-5\pi$

78. If $\alpha=3\sin^{-1}\left(\frac{6}{11}\right)$ and $\beta=3\cos^{-1}\left(\frac{4}{9},\right)$ where the inverse trigonometric function take only the principal values, then the correct opiton (s) is (are)

(a) $\cos\beta>0$ (b) $\sin\beta<0$

(c) $\cos(\alpha+\beta)>0$ (d) $\cos\alpha<0$

Rough Work

79. For $x \in R, f(x)=|\log 2-2-\sin x|$ and $g(x)=f(f(x))$, then :

(a) g is not differentiable at x =0

(b) g' (0) = cos(log2)

(c) g'(0) = –cos(log2)

(d) g is differentiable at x = 0 and g'(0) = –sin (log 2)

80. If $y=\left[x+\sqrt{x^2-1}\right]^{15}+\left[x-\sqrt{x^2-1}\right]^{15}$, then $\left(x^2-1\right)\frac{d^2y}{dx^2}+x\frac{dy}{dx}$

(a) $225y^2$ (b) $224y^2$

(c) 125y (d) 225y

81. If $f(x)=\begin{vmatrix}\cos x & x & 1\\ 2\sin x & x^2 & 2x\\ \tan x & x & 1\end{vmatrix}$ then $\lim\limits_{x\to\infty}\frac{f'(x)}{x}$.

(1) exists and equal to 0

(2) exists and equal to –2

(3) exists and equal to 2

(4) does not exist

82. Let f: R $\to$ R be a function such that $f(x)=x^3+x^2f'(1)+xf''(2)+f'''(3), x\in R$

Then f (2) equals:

(1) –4 (2) 30

(3) –2 (4) 8

83. If $2y=\left(\cot^{-1}\left(\frac{\sqrt{3}\cos x+\sin x}{\cos x-\sqrt{3}\sin x}\right)\right)^2, x\in\left(0,\frac{\pi}{2}\right)$, then $\frac{dy}{dx}$ is equal to :

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

(3) $\frac{\pi}{6}-x$ (4) $x-\frac{\pi}{6}$

84. If $f(1) = 1, f'(1) = 3$, then the derivative of $f(f(f(x))) + (f(x))^2$ at x = 1 is .

(1) 12 (2) 33

(3) 9 (4) 15

85. If $y(\alpha)=\sqrt{2\left(\frac{\tan\alpha+\cot\alpha}{1+\tan^2\alpha}\right)+\frac{1}{\sin^2\alpha}}$, $\alpha\in\left(\frac{3\pi}{4},\pi\right)$ then $\frac{dy}{d\alpha}$ at $\alpha=\frac{5\pi}{6}$ is :

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

(3) $\frac{-1}{4}$ (4) –4

86. If $A_1, A_3, A_5, \ldots\ldots, A_{2n-1}$ are n skew symmetric matrices of same order then $B=\sum_{r=1}^{n}(2r-1)\left(A_{2r-1}\right)^{2r-1}$ will be

(A) symmetric

(B) skew symmetric

(C) neither symmetric nor skew symmetric

(D) data is inadequate

87. Let A be matrix of order 3×3 such that |A|=1.Let B = $2A^{-1}$ and $C=\frac{adj.\,A}{2}$. Then the value of $|AB^2C^3|$, is

(where |A| represent det.A)

(A) 1 (B) $\frac{1}{8}$

(C) 8 (D) 64

88. If $P=\begin{bmatrix}1 & c & 3\\ 1 & 3 & 3\\ 2 & 4 & 4\end{bmatrix}$ is the adjoint of a 3×3 matrix Q and det.(Q) = 4, then c is equal to

(A) 0 (B) 4

(C) 5 (D) 11

Rough Work

89. If M and N are orthogonal square matrices of same order satisfying det. (M) + det. (N) = 0 then the value of det. (M + N) is equal to
(A) det. (M) (B) det. (N)
(C) det. (M) +det. (N) (D) (det M) (det N)

90. Let a square matrix A of order 3 be the zero of the polynomial $f(x) = x^3 - 5x^2+7x-6$. If l = Tr(A) and m = det.(A) then (l + m) equals
(A) 5 (B)-2
(C) 11 (D) 18

91. If $A=\begin{bmatrix}1 & 0 & 2\\ 0 & 2 & 1\\ 2 & 0 & 3\end{bmatrix}$ is a root of polynomial
$x^3-6x^2 + 7x + k = 0$, then the value of k is
(A) 2 (B) 4
(C) -2 (D) 1

92. If $A=\begin{pmatrix}2 & -2 & -4\\ -1 & 3 & 4\\ 1 & -2 & -3\end{pmatrix}$ and $B=\begin{pmatrix}-4 & -3 & -3\\ 1 & 0 & 1\\ 4 & 4 & 3\end{pmatrix}$
the value of determinant
$(AB^2 + A^2B^4+A^3B^6+.....+ 101$ terms) is
(A) 0 (B) 101
(C) 5049 (D) 5050

93. The number of distinct real solution of equation $\begin{vmatrix}\sin x & \cos x & \cos x\\ \cos x & \sin x & \cos x\\ \cos x & \cos x & \sin x\end{vmatrix}=0$ in the interval $[0, 100\pi]$.
(A) 0 (B) 100
(C) 50 (D) 200

94. The system of equations :
$2x\cos^2\theta + y\sin 2\theta - 2\sin\theta = 0$
$x\sin 2\theta + 2y\sin^2\theta = -2\cos\theta$
$x\sin\theta - y\cos\theta = 0$ for all values of θ, can
(A) have a unique non - trivial solution
(B) not have a solution
(C) have infinite solutions
(D) have a trivial solution

95. If product of the roots of the equation
$\begin{vmatrix}1+3x^2 & 1-2x & 2+x\\ 2-x & -1+3x & 6-x\\ 3+x & -x+2 & 3-x^2\end{vmatrix}=0$ is p then 9p equals
(A) 18 (B) 17
(C) 13 (D) 11

96. If the lines x+ay+a=0, bx+y+b=0, cx+cy+1=0 where a, b, c are non-zero and non-unity, pass through the same point then the value of $\frac{a}{1-a}+\frac{b}{1-b}+\frac{c}{1-c}$ is equal to
(A) –1 (B) 2
(C) 1 (D) 3

97. The sum of all value of λ for which the lines 2x+y+1=0, 3x+2λy+4=0, x+y–3λ=0 are conceurrent, is
(A) $\frac{1}{4}$ (B) $\frac{1}{2}$
(C) $\frac{7}{2}$ (D) $\frac{7}{12}$

Rough Work

98. If A_{11} , A_{12} , A_{13} are the cofactors of the elements of the first row of the determinant $A=(a_{ij})$ and Δ is the value of the determinant then
(A) $a_{21}A_{11}+ a_{22}A_{12} + a_{23}A_{13} = 0$
(B) $a_{11}A_{11}+ a_{12}A_{12} + a_{13}A_{13} = \Delta$
(C) $a_{11}A_{11}- a_{12}A_{12} + a_{13}A_{13} = \Delta$
(D) $a_{31}A_{11}+ a_{32}A_{12} + a_{33}A_{13} = 0$

99. The solution(s) of the equation $\begin{vmatrix} x & a & b \\ a & x & a \\ b & b & x \end{vmatrix} = 0$ is/are
(1) x = –(a+b) (2) x = a
(3) x = b (4) –b

100. If $\Delta = \begin{vmatrix} x & 2y-z & -z \\ y & 2x-z & -z \\ y & 2y-z & 2x-2y-z \end{vmatrix}$, then
(1) x – y is a factor of Δ
(2) $(x-y)^2$ is a factor of Δ
(3) $(x-y)^3$ is a factor of Δ
(4) Δ is independent of z

Rough Work