SRIGAYATRI EDUCATIONAL INSTITUTIONS

INDIA

JEE MAIN TOT GT-10

Time: 3 Hours **Max. Marks: 300 M**

SECTION – I
(SINGLE CORRECT ANSWER TYPE)

This section contains 20 multiple choice questions. Each question has 4 options (A), (B), (C) and (D) for its answer, out of which **ONLY ONE** option can be correct.
Marking scheme: +4 for correct answer, 0 if not attempted and -1 if not correct.

MATHEMATICS

1. **The incentre of the triangle formed by the coordinate axes and** $3x+4y=12$ **is**

A) $\left(\frac{1}{2},\frac{1}{2}\right)$ B) $(1,1)$ C) $\left(1,\frac{1}{2}\right)$ D) $\left(\frac{1}{2},1\right)$

2. **If the line** $y=x\sqrt{3}$ **cuts the curve** $x^3+y^3+3xy+5x^2+3y^2+4x+5y-1=0$ **at the points A, B and C then OA.OB.OC (where O is (0, 0))**

A) $\frac{4}{13}\left(3\sqrt{3}-1\right)$ B) $3\sqrt{3}+1$ C) $\frac{1}{\sqrt{3}}\left(2+7\sqrt{3}\right)$ D) $3\sqrt{3}-1$

3. **The length of projection of the segment joining the points** $(1,-1,0)$ **and** $(-1,0,1)$ **to the plane** $2x+y+6z=1$ **is equal to**

A) $\sqrt{\frac{255}{61}}$ B) $\sqrt{\frac{237}{41}}$ C) $\sqrt{\frac{137}{41}}$ D) $\sqrt{\frac{155}{61}}$

4. **The straight lines** $\frac{x-2}{1}=\frac{y-3}{1}=\frac{z-4}{-k}$ **and** $\frac{x-1}{k}=\frac{y-4}{2}=\frac{z-5}{1}$ **will intersect provided**

A) $k=\{3,-3\}$ B) $k=\{0,-1\}$ C) $k=\{-1,1\}$ D) $k=\{0,-3\}$

5. **The Boolean expression** $(p\wedge \sim q)\vee q\vee(\sim p\wedge q)$ **is equivalent to**

A) $\sim p\wedge q$ B) $p\wedge q$ C) $p\vee q$ D) $p\vee \sim q$

6. **Minimum distance between the curves** $y^2=4x$ **and** $x^2+y^2-12x+31=0$ **is equal to**

A) $\sqrt{20}$ B) $\sqrt{26}-\sqrt{5}$ C) $\sqrt{20}-\sqrt{5}$ D) $\sqrt{5}+\sqrt{20}$

7. **Tangents drawn from the point** $(4,4)$ **to the circle** $x^2+y^2-2x-2y-7=0$ **meets the circle at A and B. The length of the chord AB equals**

A) $4\sqrt{3}$ B) $2\sqrt{3}$ C) $2\sqrt{6}$ D) $3\sqrt{2}$

8. $\int \frac{dx}{4\sin^2 x+4\sin x\cos x+5\cos^2 x}=ATan^{-1}\left(B\tan x+c\right)$ then

A) $A=\frac{1}{4};B=\frac{1}{2};C=1$ B) $A=\frac{1}{2};B=\frac{1}{4};C=1$

C) $A=1;B=\frac{1}{2};C=\frac{1}{4}$ D) $A=\frac{1}{4};B=1;C=\frac{1}{2}$

9. **The solution of the differential equation** $\frac{x\frac{dy}{dx}-y}{\sqrt{x^2-y^2}}=10x^2$ **is**

A) $\sin^{-1}\left(\frac{y}{x}\right)=5x^2+c$ B) $\sin^{-1}\left(\frac{y}{x}\right)=10x^2+c$

C) $\frac{y}{x}=5x^2+c$ D) $\sin^2\left(\frac{y}{x}\right)=10x^2+cx$

10. **If $[x]$ stands for the greatest integer function, the value of** $\int_5^{20} \frac{[x^2]dx}{[x^2-50x+625]+[x^2]}$ **is**

A) 0 B) 1/2 C) 2/15 D) 15/2

11. **The following information relates to a sample of size 60.** $\sum x^2 = 18000, \sum x = 960.$ **The variance is**

A) 6.63 B) 16 C) 22 D) 44

12. **Let** $A = \begin{pmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{pmatrix}, (\alpha \in R)$ **such that** $A^{64} = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$. **Then a value of** α **is**

A) $\frac{\pi}{32}$ B) $\frac{\pi}{64}$ C) $\frac{\pi}{128}$ D) 0

13. **In a group of 65 people, 40 like cricket, 10 like both cricket and tennis no. of people like tennis only**

A) 23 B) 24 C) 25 D) 26

14. **Inverse of the function** $f(x) = \frac{e^x - e^{-x}}{e^x + e^{-x}} + 3$ **is**

A) $\log\left(\frac{x-2}{4-x}\right)^{\frac{1}{2}}$ B) $\log\left(\frac{x-3}{4-x}\right)^{\frac{1}{2}}$ C) $\log\left(\frac{x-1}{4-x}\right)^{\frac{1}{2}}$ D) $\log\left(\frac{x-4}{4+x}\right)^{\frac{1}{2}}$

15. **If** $S = \tan^{-1}\left(\frac{1}{n^2+n+1}\right) + \tan^{-1}\left(\frac{1}{n^2+3n+3}\right) + ... + \tan^{-1}\left(\frac{1}{1+(n+18)(n+19)}\right)$**, then** $\tan S =$

A) $\frac{17}{n^2+20n+1}$ B) $\frac{20}{n^2+20n+1}$ C) $\frac{18}{n^2+19n+1}$ D) $\frac{19}{n^2+19n+1}$

16. **If the vectors** $a\bar{i} + \bar{j} + \bar{k}, \bar{i} + b\bar{j} + \bar{k}, \bar{i} + \bar{j} + c\bar{k}$ $(a \neq b \neq c)$ **are coplanar , then** $\frac{a}{1-a} + \frac{1}{1-b} + \frac{1}{1-c} =$

A) 0 B) – 1 C) 1 D) 2

17. **The sum of first four terms of AP is 56. The sum of last four terms is 112. If its first term is 11, then the number of terms is**

A) 10 B) 11 C) 12 D) 13

18. **The no. of zeros at the end of 130! is**

A) 31 B) 32 C) 33 D) 34

19. $\sum_{r=0}^{n} (-1)^r \, {}^nc_r \left[\frac{1}{2^r} + \frac{3^r}{2^{2r}} + \frac{7^r}{2^{3r}} + \frac{15^r}{2^{4r}} + ... + \infty\right]$

A) $\frac{1}{2^n - 1}$ B) $\frac{2^n}{2^n - 1}$ C) $\frac{2^n}{2^n + 1}$ D) $\frac{3^n}{3^n + 1}$

20. **If** $|z| = 5$**, then the points representing the complex number** $-i + \frac{15}{z}$ **lies on the circle**

A) whose centre is (0, 1) and radius = 3
B) whose centre is (0, -1) and radius = 3
C) whose centre is (1, 0) and radius = 15
D) whose centre is (-1, 0) and radius = 15

SECTION-II

(Numerical Value Answer Type)

This section contains 5 questions. The answer to each question is a Numerical values comprising of positive or negative decimal numbers.
Marking scheme: +4 for correct answer, 0 in all other cases.

21. Length of common tangent to the curves $x^2 + y^2 = 2$ and $x^2 + 4y^2 = 4$ is equal to

22. **Area between the curves** $y = x^3$ **and** $y = x$ **is**

23. **The maximum value of** $3\cos\theta + 5\cos\left(\theta - \frac{\pi}{3}\right)$ **for any real value of** θ **is**

24. **If a, b, c are in A.P and one root of the equation** $ax^2 + bx + c = 0$ **is 2 then the other root is**

25. **If** $f(x)=\begin{vmatrix} 1+\sin^2 x & \cos^2 x & 2\sin 2x \\ \sin^2 x & 1+\cos^2 x & 2\sin 2x \\ \sin^2 x & \cos^2 x & 1+2\sin 2x \end{vmatrix}$ **then the maximum value of** $f(x)$ **is**

SECTION – I
(SINGLE CORRECT ANSWER TYPE)

This section contains 20 multiple choice questions. Each question has 4 options (A), (B), (C) and (D) for its answer, out of which **ONLY ONE** option can be correct.
Marking scheme: +4 for correct answer, 0 if not attempted and -1 if not correct.

PHYSICS

26. **In S.I, the dimensions of** $\sqrt{\frac{\mu_0}{\in_0}}$ **is**

A) $A^{-2}T^{-\frac{1}{2}}L^2M^1$ B) $A^{-3}T^{-3}L^2M^1$ C) $A^2T^{\frac{1}{2}}L^{-2}M^1$ D) $A^2T^{\frac{1}{2}}L^2M^{-1}$

27. **A ball rolling off the top of a staircase of each step of height 20cm. width 60cm, with initial velocity 54 kmph will just hit nth step, then n = ____ ? (g = 10 m/sec^2)**

A) 30 B) 20 C) 10 D) 25

28. **A body of mass 2 kg makes an elastic collision with a second body at rest and continues to move in the original direction but with 1/3rd of original speed. What is the mass of second body.**

A) 1 kg B) 3 kg C) 5 kg D) 6 kg

29. **A force acts on a 4 kg object so that its position is given as a function of time as** $x=5t^2+6.$ **What is the work done by this force in first 5 seconds**

A) 4500 J B) 5000 J C) 3000 J D) 5500 J

30. **A simple harmonic motion is represented by** $y=5\left[\sin 3\pi t+\sqrt{3}\cos 3\pi t\right]cm.$ **the initial phase of particle is**

A) $\frac{\pi}{2}$ B) $\frac{\pi}{4}$ C) $\frac{\pi}{3}$ D) π

31. **The work done to increase radius of the orbit of a satellite of mass m from 3r to 4r**

A) $\frac{GMm}{3r}$ B) $\frac{GMm}{24r}$ C) $\frac{GMm}{6r}$ D) $\frac{GMm}{r}$

32. **If '2M' is the mass of water that rises in a capillary tube of radius '2r' then mass of water which will rise in a capillary tube of radius 'r' is**

A) 4M B) M C) 2M D) M/2

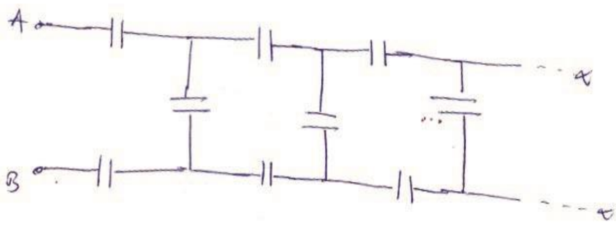
33. **Two rods A and B of identical dimensions are at temperature 40^{0}C. If A is heated up to 200^{0}C and B up to T^{0}C, Then the new lengths are same. If ratio of the coefficients of linear expansion of A and B is 3 : 4. Then the value of T is**

A) 160^{0}C B) 230^{0}C C) 250^{0}C D) 200^{0}C

34. **1 mole of an ideal monoatomic gas is heated at constant pressure of 1 atm from 20^{0}C to 80^{0}C. Work done by gas is close to (Gas constant R = 8.31 J/mol. k)**

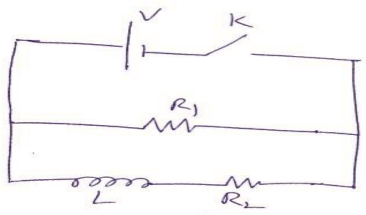
A) 450 J B) 600 J C) 499 J D) 291 J

35. **The equivalent capacity of the infinite network shown in figure (across AB) is (Capacity of each capacitor is** $2\mu F$ **)**



A) ∞ B) $\left(\sqrt{3}-1\right)\mu F$ C) $\left(\frac{\sqrt{3}-1}{2}\right)\mu F$ D) $\left(\frac{\sqrt{3}+1}{2}\right)\mu F$

36. In the circuit shown below, the key k is closed at t =0. The current through the battery is



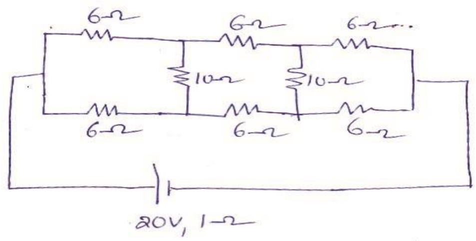
A) $\frac{VR_1R_2}{\sqrt{R_1^2+R_2^2}}$ at $t=0$, $\frac{V}{R_2}$ at $t=\infty$

B) $\frac{V}{R_1}$ at $t=0$, $\frac{VR_1R_2}{\sqrt{R_1^2+R_2^2}}$ at $t=\infty$

C) $\frac{V}{R_1}$ at $t=0$, $\frac{V(R_1+R_2)}{R_1R_2}$ at $t=\infty$

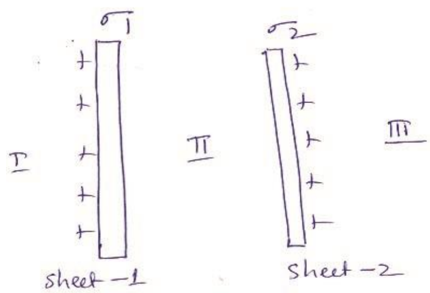
D) $\frac{V}{R_2}$ at $t=0$, $\frac{V(R_1+R_2)}{R_1R_2}$ at $t=\infty$

37. Current in the circuit shown is



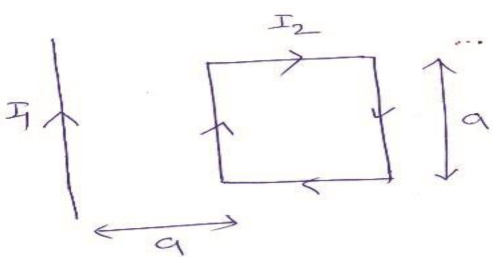
A) 1.5 A B) 2A C) 0.6 A D) 1 A

38. Two parallel plane sheets 1 and 2 carry uniform charge densities σ_1 and σ_2 (see figure). The electric field in the region marked II is $(\sigma_1 > \sigma_2)$



A) $-\frac{\sigma}{2\in_0}$ B) $-\frac{\sigma_2}{2\in_0}$ C) $\left(\frac{\sigma_1-\sigma_2}{2\in_0}\right)$ D) $\left(\frac{\sigma_1+\sigma_2}{2\in_0}\right)$

39. A rigid square loop of side a and carring current i_2 is lying on a horizontal surface near a long current I_1 carring wire in the same plane as shown in fig. The net force on the loop due to the wire will be?



A) Attractive and equal to $\frac{\mu_0 I_1 I_2}{4\pi}$

B) zero

C) Repulsive and equal to $\frac{\mu_0 I_1 I_2}{2\pi}$

D) Repulsive and equal to $\frac{\mu_0 I_1 I_2}{4\pi}$

40. A plane electromagnetic wave travels in free space along the z – direction. The electric field component of the wave at a particular point of space and time is $E = 6V/m$ along x-direction. Its corresponding magnetic field component B would be

A) $2\times10^{-8}T$ along z – directions B) $6\times10^{-8}T$ along x – directions

C) $6\times10^{-8}T$ along z – directions D) $2\times10^{-8}T$ along y – directions

41. A proton and α – particle are accelerated from by the same potential difference then the ratio of their de –Broglie wavelength is?

A) $2\sqrt{2}:1$ B) $1:2\sqrt{2}$ C) $1:2$ D) $2:1$

42. In a radioactive decay chain the initial nucleus is $^{232}_{90}Th$. At the end there are 8α particle and 4β particles. Which are emitted if the end nuclei is $^{A}_{Z}X, A$ and Z are given by?

A) A = 202, Z = 80 B) A = 208, Z = 80 C) A = 200, Z = 81 D) A = 208, Z = 82

43. A bird in air is at a height y from the surface of water. A fish is at a depth x below the surface of water. The refractive index of water is μ. The apparent distance of fish from the bird is?

A) $\mu y + x$ B) $\mu x + y$ C) $\frac{x}{\mu} + y$ D) $\frac{x}{\mu} - y$

44. Two coherent sources produce waves of different intensities which interfere. After interference, the ratio of the maximum intensity to the minimum intensity is 9. The intensity of the waves are in the ratio

A) $4:1$ B) $16:9$ C) $5:3$ D) $25:9$

45. A homogeneous solid cylindrical roller of radius R and mass m is pulled on a cricket pitch by a horizontal force. Assuming rolling without slipping, angular acceleration of the cylinder is

A) $\frac{3F}{2mR}$ B) $\frac{F}{3mR}$ C) $\frac{2F}{3mR}$ D) $\frac{F}{2mR}$

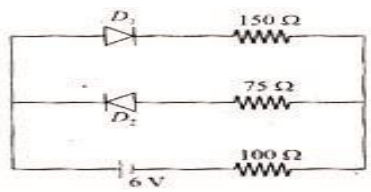
SECTION- II

(Numerical Value Answer Type)

This section contains 5 questions. The answer to each question is a Numerical values comprising of positive or negative decimal numbers.
Marking scheme: +4 for correct answer, 0 in all other cases.

46. A magnetic compass needle oscillates 30 times per minute at a place where the dip is 45^0, and 40 times per minute where the dip is 30^0. If B_1 and B_2 are respectively the total magnetic field due to the earth at the two places, then the ratio B_1 / B_2 is best given by

47. The circuit shown below contains two ideal diodes, each with a forward resistance of 50 Ω. If the battery voltage is 6V, the current through the 100 Ω resistance (in amperes) is



48. In a line of sight radio communication, a distance of about 50 km is kept between the transmitting and receiving antennas. If the height of the receiving antenna is 70m, then the minimum height of the transmitting antenna should be in metre is -----
(Radius of the Earth = 6.4 x 10^6m)

49. A solid metal cube of edge length 2cm is moving in a positive y - direction at a constant speed of 6 m/s. There is a uniform magnetic field of 0.1 T in the positive z – direction. The potential difference between the two faces of the cube perpendicular to the x – axis, is in mV is -----

50. A moving coil galvanometer has resistance 50 Ω and it indicates full deflection at 4 mA current. A voltmeter is made using this galvanometer and a 5 kΩ resistance. The maximum voltage, that can be measured using this voltmeter, will be close to in volt is -------

SECTION – I
(SINGLE CORRECT ANSWER TYPE)

This section contains 20 multiple choice questions. Each question has 4 options (A), (B), (C) and (D) for its answer, out of which **ONLY ONE** option can be correct.
Marking scheme: +4 for correct answer, 0 if not attempted and -1 if not correct.

CHEMISTRY

SYLLABUS:

51. Given

$$H_{2(g)} + \frac{1}{2}O_{2(g)} \rightarrow H_2O_{(l)}; \Delta H = -268 KJ/mol$$

$$H_{2(g)} + \frac{1}{2}O_{2(g)} \rightarrow H_2O_{(g)}; \Delta H = -214 KJ/mol$$

The molar enthalpy of vapourisation of water will be

A) $214 KJ/mol$ B) $-482 KJ$ C) $-54 KJ/mol$ D) $-46 KJ/mol$

52. At 300K, in one litre vessel N_2O_4 is allowed to attain equilibrium $N_2O_{4(g)} \rightleftharpoons 2NO_2$. At equilibrium, the total pressure is 500 mm Hg. When 40% N_2O_4 is dissociated, the Kp value for the reaction is

A) 100 B) 280 C) 380 D) 200

53. If the solubility of $Al_2(SO_4)_3$ in water is 'X' mol L^{-1}, then its solubility product in mol^{5}L^{-5} is

A) $36X^5$ B) $108X^5$ C) $64X^3$ D) $180X^5$

54. A Hydrocarbon 'X' decolourises bromine water. On hydrogenation, 'X' gives 2 – methyl propane. On ozonolysis, 'X' gives acetone as one of the products. The hydrocarbon 'X' is

A) $CH_3-CH=CH_2$

B) $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\underset{|}{\overset{|}{C}}}}-CH=CH_2$

C) $CH_3-CH=CH-CH_3$

D) $CH_3-\overset{\displaystyle CH_3}{\overset{|}{C}}=CH_2$

55. Which of the following carbonium ions is most stable?

A) $CH_3\ \overset{+}{C}H_2$

B) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{\overset{+}{C}}}-CH_3$

C) $CH_3-\overset{+}{C}H-CH_3$

D) $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\underset{|}{\overset{|}{C}}}}-\overset{+}{C}H_2$

56. In the presence of anhydrous $AlCl_3$, benzene reacts with acetyl chloride to give

A) Acetophenone B) Toluene C) Ethyl benzene D) Chloro benzene

57. Which of the following is the example of S$_N$2 reaction?

A) $CH_3\underset{\displaystyle Br}{\underset{|}{C}}HCH_3 + OH^- \rightarrow CH_3\underset{\displaystyle OH}{\underset{|}{C}}HCH_3 + Br^-$

B) $CH_3Br + OH^- \rightarrow CH_3OH + Br^-$

C) $CH_3CH_2OH \xrightarrow{-H_2O} CH_2=CH_2$

D) $CH_3-\underset{\displaystyle Br}{\overset{\displaystyle CH_3}{\underset{|}{\overset{|}{C}}}}-CH_3 + OH^- \rightarrow CH_3-\underset{\displaystyle H}{\overset{\displaystyle CH_3}{\underset{|}{\overset{|}{C}}}}-O-CH_3 + Br^-$

58. The gas bleaches the colour of flowers by reduction, while the other gas by oxidation respectively are

A) CO and Cl_2 B) SO_2 and Cl_2 C) H_2S and Br_2 D) NH_3 and SO_2

59. The first, second, third and fourth ionization potential values of an elements are 8.3 e.V, 25.15 e.V, 37.92 e.V and 259.3 e.V respectively, the element is

A) Aluminium B) Silicon C) Magnesium D) Sodium

60. How many d – electrons in Cu^+ (atomic number Z = 29) can have the spin quantum number $\left(-\frac{1}{2}\right)$?

A) 4 B) 6 C) 9 D) 5

61. Match the ores (column A) with the metals (column B)

Column A	**Column B**
I) Siderite	**a) Zinc**
II) Kaolinite	**b) copper**
III) Malachite	**c) Aluminium**
IV) Calamine	**d) Iron**

A) I – b, II – c, III –d, IV –a B) I – c, II – d, III –a, IV –b

C) I – a, II – b, III –c, IV –d D) I – d, II – c, III –b, IV –a

62. The compound that inhibits the growth of tumors is

A) $Cis^{-}\left[pdCl_2\left(NH_3\right)_2\right]$ B) $Cis\left[ptCl_2\left(NH_3\right)_2\right]$

C) $trans\left[pd\left(Cl\right)_2\left(NH_3\right)_2\right]$ D) $trans\left[ptCl_2\left(NH_3\right)_2\right]$

63. The increasing order of the P^{ka} values of the following compounds is

A) B < C < D < A B) D < A < C < B C) C < B < A < D D) A < B < C < D

64. Consider the following reduction processes

$Ca^{+2}+2e^{-}\rightarrow Ca, E^0=-2.87V$, $Mg^{+2}+2e^{-}\rightarrow Mg, E^0=-2.36V$

$Ni^{+2}+2e^{-}\rightarrow Ni, E^0=-0.25V$, $Zn^{+2}+2e^{-}\rightarrow Zn, E^0=-0.76V$

The reducing power of the metals increases in the order

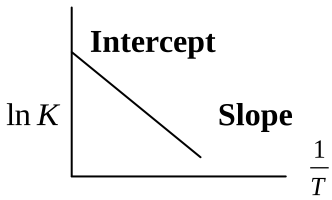
A) $Ca<Zn<Mg<Ni$ B) $Ni<Zn<Mg<Ca$

C) $Ca<Mg<Zn<Ni$ D) $Zn<Ni<Ca<Mg$

65. At high pressure, vanderwaal's equation becomes

A) PV = RT B) PV = RT + $\frac{a}{V}$ C) PV = RT - $\frac{a}{V}$ D) PV = RT + Pb

66. In this curve, the intercept and slope respectively are



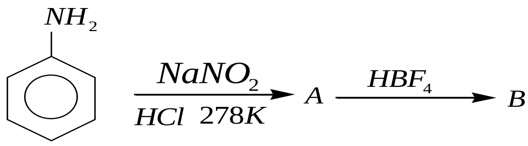
A) Intercept $=\frac{-Ea}{R}$, slope = $\ln A$ B) Intercept $=\ln A$, slope = $\frac{-Ea}{R}$

C) Intercept $=\frac{Ea}{R}$, slope = $-\ln A$ D) Intercept $=Ea$, slope = $\ln A$

67. The emulsifier for olive oil in water emulsion is

A) Soap B) Mercuric oxide C) egg albumin D) Kerosene

68. In the chemical reaction



The compounds "A" and "B" respectively are

A) Nitrobenzene and fluorobenzene B) Phenol and benzene

C) Benzene diazonium chloride and flurobenzene D) Nitrobenzene and chlorobenzene

69. Which of the following undergoes cannizaro reaction?

a) $HCHO$ **b)** C_6H_5CHO **c)** Cl_3C-CHO **d)** $(CH_3)_3C-CHO$

A) Only a and b B) Only b and c C) Only c and d D) All a, b, c, d

70. Consider the acidity of the carboxylic acids

I $PhCOOH$ **II** $o-NO_2C_6H_4COOH$

III $p-NO_2C_6H_4COOH$ **IV** $m-NO_2C_6H_4COOH$

Which of the following order is correct?

A) II > III > IV > I B) II > IV > III > I C) II > IV > I > III D) I > II > III > IV

SECTION-II
(Numerical Value Answer Type)

This section contains 5 questions. The answer to each question is a Numerical values comprising of positive or negative decimal numbers
Marking scheme: +4 for correct answer, 0 in all other cases.

71. The number of octahedral voids present per unit cell in a f.c.c arrangement are

72. The number of P – O – P bonds in cyclic metaphosphoric acid is

73. The spin magnetic moment of $\left[Ti\left(H_2O\right)_6\right]^{+3}$ is $\sqrt{x}$. What is the value of 'x'.

74. How long in hours (approximately) should water be electrolyzed by passing through 100 Ampere current so that the oxygen released can completely burn 27.66 g of diborane? (Atomic weight of boron 10.8)

75. The number of alcoholic isomers with the formula $C_4H_{10}O$ is