

TEST ID : 121
MAX. MARKS : 300
EXAM DURATION : 3 HOURS

Roll No.

Name :

Exam Date :

M-STAR[★]

Momentum Scholarship Test for Admission & Rewards

8th Edition, 2023-24

Talent HUNT Exam



Class XII Studying Students (JEE Aspirants)
Physics, Chemistry & Mathematics

INSTRUCTIONS FOR CANDIDATE

1. This booklet is your Question Paper. Do not open this booklet before being instructed to do so by the invigilator.
2. You may complete Your Name, Roll No. on the cover page.
3. Blank spaces and blank pages are provided in this booklet for your rough work. No Additional sheet will be provided for rough work.
4. Blank papers, clipboards, log tables, slide rules, calculators, cameras, cellular phones, pagers and electronic gadgets are NOT allowed inside the examination hall.
5. **Using a Blue/Black Pen, Darken the bubbles on the OMR sheet**
6. DO NOT TAMPER WITH/MUTILATE THE OMR OR THE BOOKLET
7. In the booklet, check that all the 90 questions and corresponding answer choices are legible.
8. Write your name, class and the Father's name in the boxes provided on the right part of the OMR. Do not write any of this information anywhere else. Darken the appropriate bubble under each digit of your Roll Number and Test ID Number.
9. The question paper consists of three parts. **Part - I** consists of **Physics**, **Part - II** consists of **Chemistry** and **Part - III** consists **Mathematics**.
10. **Part - I Physics** contain 30 multiple choice questions in which 25 questions need to attempt **Part - II Chemistry** contain 30 multiple choice questions in which 25 questions need to attempt and **Part - III Mathematics** contains 30 multiple choices questions out of that 25 questions are to be attempted.
11. Marking Scheme: **+4** for correct answer, **0** for unattempted and **-1** for wrong attempt.
12. On completion of the test, the candidate must hand over the **OMR** Sheet to the invigilator on duty in the Room/Hall.



MOMENTUM

छात्रसंघ चौक, गोरखपुर | बस्ती | देवरिया

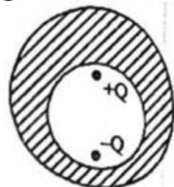


PART-I : PHYSICS

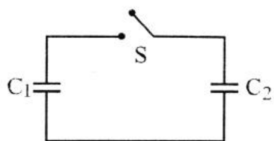
SECTION (A)

Single Type Questions

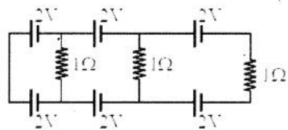
1. Shown in the figure are two point charges +Q and -Q inside the cavity of a spherical shell. The charges are kept near the surface of the cavity on opposite sides of the centre of the shell. If σ_1 is the surface charge on the inner surface and Q_1 net charge on it and σ_2 the surface charge on the outer and Q_2 net charge on it then:



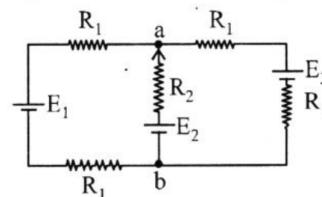
- a) $\sigma_1 \neq 0, Q_1 = 0$ b) $\sigma_1 \neq 0, Q_1 = 0$
 $\sigma_2 \neq 0, Q_2 = 0$ $\sigma_2 \neq 0, Q_2 = 0$
 c) $\sigma_1 = 0, Q_1 = 0$ d) $\sigma_1 \neq 0, Q_1 \neq 0$
 $\sigma_2 = 0, Q_2 = 0$ $\sigma_2 \neq 0, Q_2 \neq 0$
2. The bob of a simple pendulum has mass 2 g and a charge of $5.0 \mu\text{C}$. It is at rest in a uniform horizontal electric field of intensity 2000 V/m. At equilibrium, the angle that the pendulum makes with the vertical is: (take $g = 10\text{m/s}^2$)
 a) $\tan^{-1}(2.0)$ b) $\tan^{-1}(0.2)$
 c) $\tan^{-1}(5.0)$ d) $\tan^{-1}(0.5)$
3. Two capacitors having capacitance C_1 and C_2 respectively are connected as shown in figure. Initially, capacitor C_1 is charged to a potential difference V volt by a battery. The battery is then removed and the charged capacitor C_1 is now connected to uncharged capacitor C_2 by closing the switch S. The amount of charge on the capacitor C_2 , after equilibrium is:



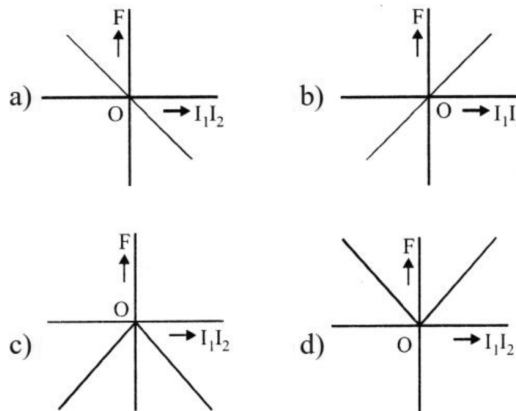
- a) $\frac{C_1 C_2}{(C_1 + C_2)} V$ b) $\frac{(C_1 + C_2)}{C_1 C_2} V$
 c) $(C_1 + C_2) V$ d) $(C_1 - C_2) V$
4. In the above circuit the current in each resistance is



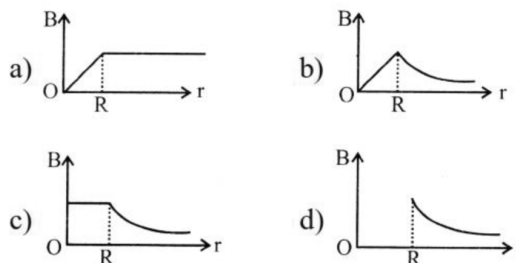
5. For the circuit shown, with $R_1 = 1.0 \Omega$, $R_2 = 2.0 \Omega$, $E_1 = 2\text{V}$ and $E_2 = E_3 = 4\text{V}$, the potential difference between the points 'a' and 'b' is approximately (in V) :



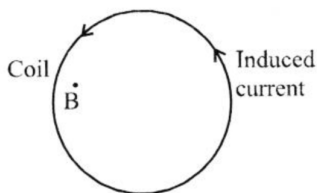
- a) 2.7 b) 2.3
 c) 3.7 d) 3.4
6. Two long straight parallel wires, carrying (adjustable) current I_1 and I_2 , are kept at a distance d apart. If the force 'F' between the two wires is taken as 'positive' when the wires repel each other and 'negative' when the wires attract each other, the graph showing the dependence of 'F', on the product $I_1 I_2$, would be :



7. A moving coil galvanometer has resistance 50Ω and it indicates full deflection at 4 mA current. A voltmeter is made using this galvanometer and a $5 \text{ k}\Omega$ resistance. The maximum voltage, that can be measured using this voltmeter, will be close to:
 a) 40 V b) 15 V
 c) 20 V d) 10 V
8. An infinitely long hollow conducting cylinder with radius R carries a uniform current along its surface. Choose the correct representation of magnetic field (B) as a function of radial distance (r) from the axis of cylinder.



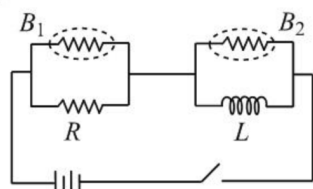
9. A coil is placed in a magnetic field \vec{B} as shown below :



A current is induced in the coil because \vec{B} is :

- a) Outward and decreasing with time
- b) Parallel to the plane of coil and decreasing with time
- c) Outward and increasing with time
- d) Parallel to the plane of coil and increasing with time

10. If the switch in the following circuit is turned off, then



- a) The bulb B_1 will go out immediately whereas B_2 after sometimes
- b) The bulb B_2 will go out immediately whereas B_1 after sometime
- c) Both B_1 and B_2 will go out immediately
- d) Both B_1 and B_2 will go out after sometime

11. The current in series LCR circuit will be maximum when ω is

- a) As large as possible
- b) Equal o natural frequency of LCR system
- c) \sqrt{LC}
- d) $\sqrt{1/LC}$

12. In an Electromagnetic Wave, direction of propagation is in the direction of

- a) \vec{E}
- b) \vec{B}
- c) $\vec{E} \times \vec{B}$
- d) None of these

13. Two coherent sources of light interfere. The intensity ratio of two sources is 1: 4 For this interference

pattern if the value of $\frac{I_{\max} + I_{\min}}{I_{\max} - I_{\min}}$ is equal to $\frac{2\alpha + 1}{\beta + 3}$,

then $\frac{\alpha}{\beta}$ will be :

- a) 1.5
- b) 2
- c) 0.5
- d) 1

14. In a double slit experiment, when a thin film of thickness t having refractive index μ is introduced in front of one of the slits, the maximum at the centre of

the fringe pattern shifts by one fringe width. The value of t is (λ is the wavelength of the light used):

- a) $\frac{2\lambda}{(\mu - 1)}$
- b) $\frac{\lambda}{2(\mu - 1)}$
- c) $\frac{\lambda}{(\mu - 1)}$
- d) $\frac{\lambda}{(2\mu - 1)}$

15. An object is placed on the principal axis of a concave mirror at a distance of $1.5f$ (f is the focal length). The image will be at.

- a) $3f$
- b) $-3f$
- c) $1.5f$
- d) $-1.5f$

16. One face of a rectangular glass plate 6 cm thick is silvered. An object held 8 cm in front of the first face forms an image 12 cm behind the silvered face. The refractive index of the glass is

- a) 0.4
- b) 0.8
- c) 1.2
- d) 1.6

17. A nucleus of mass M at rest splits into two parts

having masses $\frac{M'}{3}$ and $\frac{2M'}{3}$ ($M' > M$). The ratio of

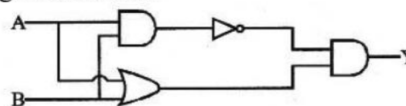
de Broglie wavelength of two parts will be :

- a) 1:2
- b) 2:1
- c) 1:1
- d) 2:3

18. In photoelectric effect the work function of a metal is 3.5 eV. The emitted electrons can be stopped by applying a potential of -1.2 V. Then

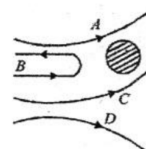
- a) the energy of the incident photon is 4.7 eV
- b) the energy of the incident photon is 2.3 eV
- c) if higher frequency photon be used, the photoelectric current will rise
- d) when the energy of photon is 3.5 eV, the photoelectric current will be maximum

19. Which one of the following will be the output of the given circuit?



- a) NAND Gate
- b) XOR Gate
- c) NOR Gate
- d) AND Gate

20. In the Rutherford experiment, α -particles are scattered from a nucleus as shown. Out of the four paths, which path is not possible ?



- a) D
- b) B
- c) C
- d) A

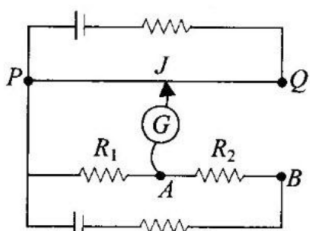
SECTION (B)

Integer Type Questions

21. Two plane parallel conducting plates 1.5×10^{-2} m apart are held horizontal one above the other in air. The upper plate is maintained at positive potential of 1.5 kV while the other plate is earthed.

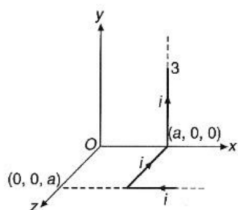
If v_T is the terminal velocity of the drop, in μms^{-1} if its radius is 5×10^{-6} m and the coefficient of viscosity of air is 1.8×10^{-5} Nsm⁻². Find $v_T/29$. (Take $g = 10 \text{ ms}^{-2}$)

22. In the figure shown PQ is a potentiometer wire. When galvanometer is connected at A, When galvanometer is connected at A, it shows zero deflection when $PJ = x$. Now the galvanometer is connected to B and it shows zero deflection when $PJ = 3x$. Find the ratio of unknown resistance R_x and R ($R_x/R = ?$)

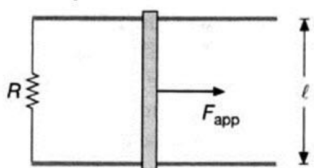


23. An infinite current carrying conductor is bent into three segments as shown in Figure. If it carries current i , the magnetic field at the origin is found to

be $\frac{\mu_0 i}{4\pi a} [(\sqrt{x} - 1)\hat{j} + \hat{k}]$. Calculate x .



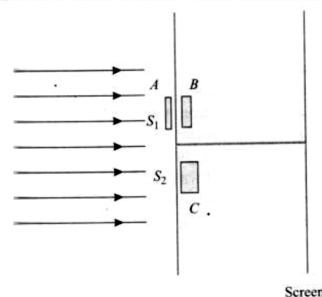
24. Figure shows a top view of a bar of length $l = 1.2$ m that can slide without friction. The resistor is 6Ω and a 2.5 T magnetic field is directed perpendicularly downward, into the paper.



At what rate, in SI units, is energy delivered to the resistor?

25. In YDSE setup, a light of wavelength 6000 \AA is used. Calculate the separation between the slits (in mm rounded off to nearest integer) so that at a point (on the screen 1 m from the sources) in front of one of the slits, a third bright fringe is obtained.

26. Three slabs A, B and C are placed in front of slits in YDSE as shown in figure. Refractive index of slabs A, B and C are $4/3$, $5/3$ and $8/3$ respectively and thickness of A, B and C are 2 mm, 1 mm and 1.5 mm respectively. A liquid of refractive index $2\mu/3$ is filled between slits and screen. A monochromatic light of wavelength 5000 \AA is incident on the slits. If the central bright fringe is obtained at C then find the value of ' μ '.



27. A hydrogen like atom (described by the Bohr model) is observed to emit six wavelengths, originating from all possible transitions between a group of levels. These levels have energies between -0.85 eV and -0.544 eV (including both these values). Find the atomic number of the atom.

28. Emission spectrum of hydrogen atom has two lines of Balmer series with wavelength 4102 \AA and 4861 \AA . To what series does a spectral line belong if its wave number is equal to the difference of wave numbers of the above two lines? If λ is the wavelength of this line in \AA ? Find $(\lambda - 26200)$. Given, $R = 1.097 \times 10^7 \text{ m}^{-1}$.

29. If photos of ultraviolet light of energy 12 eV are incident on a metal surface of work function of 4 eV , then find the stopping potential (in V).

30. The work functions of Silver and Sodium are 4.6 and 2.3 eV , respectively. Find the ratio of the slope of the stopping potential versus frequency plot for Silver to that of Sodium.

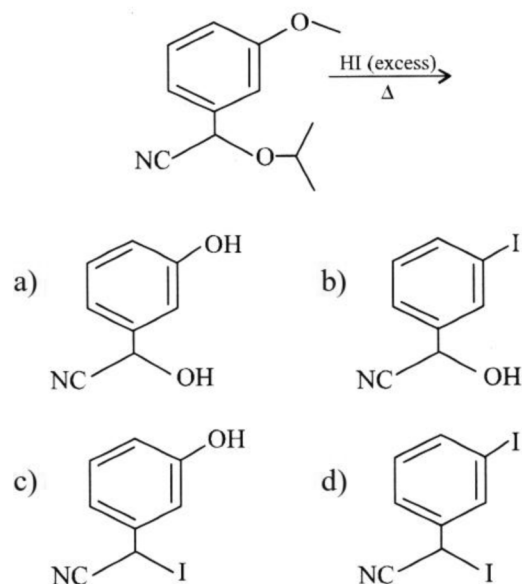
PART-II : CHEMISTRY

SECTION (A)

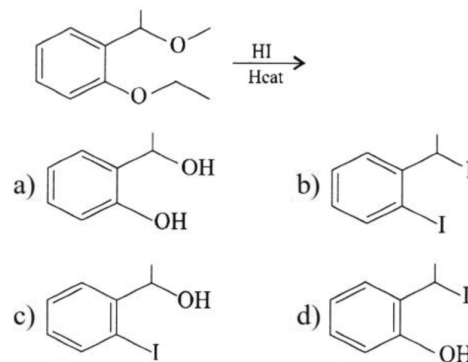
Single Type Questions

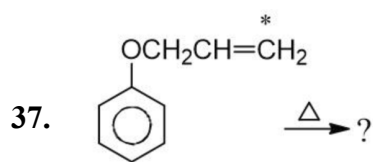
31. How many isomers are possible for the alkane C_4H_{10} ?
- a) 3
b) 5
c) 2
d) 4
32. How many geometrical isomers are possible for $CH_3 - CH = C = CH - CH = CH - CH_3$?
- (a) 0
(b) 1
(c) 2
(d) 3
33. In a solid AB having the NaCl structure, A atom occupies the corners of the cubic unit cell. If all the face-centered atoms along one of the axes are removed, then the resultant stoichiometry of the solid is
- a) AB_2
b) A_2B
c) A_4B_3
d) A_3B_4
34. Match the catalyst to the correct processes :
- | Catalyst | Process |
|--------------|-------------------------------------|
| (A) $TiCl_4$ | (i) Wacker process |
| (B) $PdCl_2$ | (ii) Ziegler - Natta polymerization |
| (C) $CuCl_2$ | (iii) Contact process |
| (D) V_2O_5 | (iv) Deacon's process |
- a) (A)-(ii), (B)-(iii), (C)-(iv), (D)-(i)
b) (A)-(iii), (B)-(i), (C)-(ii), (D)-(iv)
c) (A)-(iii), (B)-(ii), (C)-(iv), (D)-(i)
d) (A)-(ii), (B)-(i), (C)-(iv), (D)-(iii)

35. The major product of the following reaction is :

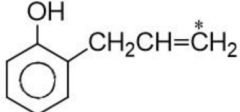
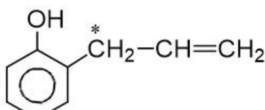
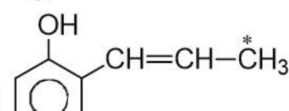
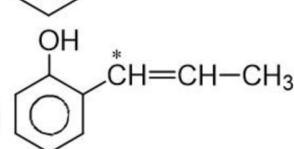


36. The major product formed in the following reaction is :



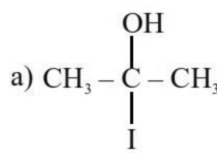


Product is

- a) 
- b) 
- c) 
- d) 

38. Consider the following transformations :

The molecular formula of **C** is

- a)  b) $\text{ICH}_2 - \text{COCH}_3$
- c) CHI_3 d) CH_3I

39. Two substances A and B are present such that $[A] = 4[B]$ and half-life of A is 5 minute and of B is 15 minute. If they start decaying at the same time following first order, how much time later will the concentration of both of them would be same?
- a) 15 minute b) 10 minute
c) 5 minute d) 12 minute

40. The differential rate law for the reaction,
 $4\text{NH}_3(g) + 5\text{O}_2(g) \rightarrow 4\text{NO}(g) + 6\text{H}_2\text{O}(g)$

- a) $-\frac{d[\text{NH}_3]}{dt} = -\frac{d[\text{O}_2]}{dt} = -\frac{d[\text{NO}]}{dt} = -\frac{d[\text{H}_2\text{O}]}{dt}$
- b) $\frac{d[\text{NH}_3]}{dt} = \frac{d[\text{O}_2]}{dt} = -\frac{1}{4} \frac{d[\text{NO}]}{dt} = -\frac{1}{6} \frac{d[\text{H}_2\text{O}]}{dt}$
- c) $\frac{1}{4} \frac{d[\text{NH}_3]}{dt} = \frac{1}{5} \frac{d[\text{O}_2]}{dt} = \frac{1}{4} \frac{d[\text{NO}]}{dt} = \frac{1}{6} \frac{d[\text{H}_2\text{O}]}{dt}$
- d) $-\frac{1}{4} \frac{d[\text{NH}_3]}{dt} = -\frac{1}{5} \frac{d[\text{O}_2]}{dt} = \frac{1}{4} \frac{d[\text{NO}]}{dt} = \frac{1}{6} \frac{d[\text{H}_2\text{O}]}{dt}$

41. Molar conductivities (Λ_m°) at infinite dilution of NaCl, HCl and CH_3COONa are 126.4, 425.9 and 91.0 $\text{S cm}^2 \text{mol}^{-1}$ respectively. Λ_m° for CH_3COOH will be :
- a) 425.5 $\text{S cm}^2 \text{mol}^{-1}$ b) 180.5 $\text{S cm}^2 \text{mol}^{-1}$
c) 290.8 $\text{S cm}^2 \text{mol}^{-1}$ d) 390.5 $\text{S cm}^2 \text{mol}^{-1}$

42. The equivalent conductance of $\frac{M}{32}$ solution of a weak monobasic acid is 8.0 mho cm^2 and at infinite dilution is 400 mho cm^2 . The dissociation constant of this acid is :
- a) 1.25×10^{-6} b) 6.25×10^{-4}
c) 1.25×10^{-4} d) 1.25×10^{-5}

43. On passing 0.1 F of electricity through aluminium metal deposited at cathode is (Al = 27)
- a) 0.3 g b) 0.6 g
c) 0.9 g d) 1.2 g
44. If α is the degree of dissociation of Na_2SO_4 the van't Hoff factor (i) used for calculating the molecular mass is
- a) $1 - 2\alpha$ b) $1 + 2\alpha$
c) $1 - \alpha$ d) $1 + \alpha$

45. Two substances A and B are present such that $[A] = 4[B]$ and half-life of A is 5 minute and of B is 15 minute. If they start decaying at the same time following first order, how much time later will the concentration of both of them would be same?
- a) 15 minute b) 10 minute
c) 5 minute d) 12 minute

46. The differential rate law for the reaction,
 $4\text{NH}_3(g) + 5\text{O}_2(g) \rightarrow 4\text{NO}(g) + 6\text{H}_2\text{O}(g)$

a) $-\frac{d[\text{NH}_3]}{dt} = -\frac{d[\text{O}_2]}{dt} = -\frac{d[\text{NO}]}{dt} = -\frac{d[\text{H}_2\text{O}]}{dt}$

b) $\frac{d[\text{NH}_3]}{dt} = \frac{d[\text{O}_2]}{dt} = -\frac{1}{4} \frac{d[\text{NO}]}{dt} = -\frac{1}{6} \frac{d[\text{H}_2\text{O}]}{dt}$

c) $\frac{1}{4} \frac{d[\text{NH}_3]}{dt} = \frac{1}{5} \frac{d[\text{O}_2]}{dt} = \frac{1}{4} \frac{d[\text{NO}]}{dt} = \frac{1}{6} \frac{d[\text{H}_2\text{O}]}{dt}$

d) $-\frac{1}{4} \frac{d[\text{NH}_3]}{dt} = -\frac{1}{5} \frac{d[\text{O}_2]}{dt} = \frac{1}{4} \frac{d[\text{NO}]}{dt} = \frac{1}{6} \frac{d[\text{H}_2\text{O}]}{dt}$

47. Molar conductivities (Λ_m°) at infinite dilution of NaCl, HCl and CH_3COONa are 126.4, 425.9 and 91.0 $\text{S cm}^2 \text{mol}^{-1}$ respectively. Λ_m° for CH_3COOH will be :

- a) 425.5 $\text{S cm}^2 \text{mol}^{-1}$ b) 180.5 $\text{S cm}^2 \text{mol}^{-1}$
 c) 290.8 $\text{S cm}^2 \text{mol}^{-1}$ d) 390.5 $\text{S cm}^2 \text{mol}^{-1}$

48. The equivalent conductance of $\frac{M}{32}$ solution of a weak monobasic acid is 8.0 mho cm^2 and at infinite dilution is 400 mho cm^2 . The dissociation constant of this acid is :

- a) 1.25×10^{-6} b) 6.25×10^{-4}
 c) 1.25×10^{-4} d) 1.25×10^{-5}

49. On passing 0.1 F of electricity through aluminium metal deposited at cathode is (Al = 27)

- a) 0.3 g b) 0.6 g
 c) 0.9 g d) 1.2 g

50. If α is the degree of dissociation of Na_2SO_4 the van't Hoff factor (i) used for calculating the molecular mass is

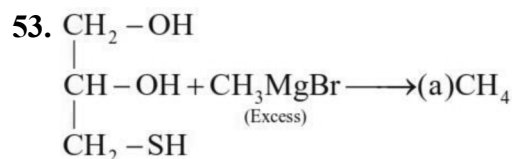
- a) $1 - 2\alpha$ b) $1 + 2\alpha$
 c) $1 - \alpha$ d) $1 + \alpha$

SECTION (B)

Integer Type Questions

51. Give the ratio of trans-isomers in $[\text{M}(\text{AA})_2\text{b}_2\text{c}_2]$ (A) and $[\text{Ma}_4\text{b}_2]$, (B) respectively.

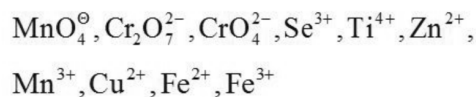
52. Give the number of unpaired electron(s) in the complex ion $[\text{CoCl}_6]^{3-}$.



What is the value of (a) in the above reactions ?

54. Solutions A and B have osmotic pressures of 2.4 atm and 4.2 atm, respectively, at a certain temperature. The osmotic pressure (in atm) of a solution prepared by mixing the solutions is 2:1 volume ratio, respectively, at the same temperature is

55. Out of the following how many of them are coloured compounds:



56. Chloropicrin contains types of functional groups.

57. How many σ -bonds are present in N_2O_3 ?

58. How many lone pairs are present in white phosphorous ?

59. Chiral centre (s) in glycine is

60. Number of -OH group (s) in tartaric acid is

Space for rough work

PART-III : MATHEMATICS

SECTION (A)

Single Type Questions

61. Let $A = [a_{ij}]$ be a 3×3 matrix, where

$$a_{ij} = \begin{cases} 1 & , \text{ if } i = j \\ -x & , \text{ if } |i - j| = 1 \\ 2x + 1 & , \text{ otherwise} \end{cases}$$

Let a function $f : \mathbb{R} \rightarrow \mathbb{R}$ defined as $f(x) = \det(A)$. Then the sum of maximum and minimum values of f on \mathbb{R} is equal to :

- a) $-\frac{20}{27}$ b) $\frac{88}{27}$
c) $\frac{20}{27}$ d) $-\frac{88}{27}$

62. Let $f(x) = 3 \sin^4 x + 10 \sin^3 x + 6 \sin^2 x - 3$,

$$x \in \left[-\frac{\pi}{6}, \frac{\pi}{2}\right]. \text{ Then, } f \text{ is :}$$

- a) increasing in $\left(-\frac{\pi}{6}, \frac{\pi}{2}\right)$
b) decreasing in $\left(0, \frac{\pi}{2}\right)$
c) increasing in $\left(-\frac{\pi}{6}, 0\right)$
d) decreasing in $\left(-\frac{\pi}{6}, 0\right)$

63. If $f(x)$ is continuous and $f\left(\frac{9}{2}\right) = \frac{2}{9}$, then

$$\lim_{x \rightarrow 0} f\left(\frac{1 - \cos 3x}{x^2}\right) \text{ is equal to :}$$

- a) $\frac{9}{2}$ b) $\frac{2}{9}$
c) 2 d) $\frac{8}{9}$

64. If $f(1) = 1, f'(1) = 3$, then the derivative of

$$f(f(f(x))) + (f(x))^2 \text{ at } x = 1 \text{ is :}$$

- a) 33 b) 12
c) 15 d) 9

65. Let $f : \mathbb{R} - \{3\} \rightarrow \mathbb{R} - \{1\}$ be defined by $f(x) = \frac{x-2}{x-3}$.

Let $g : \mathbb{R} \rightarrow \mathbb{R}$ be given as $g(x) = 2x - 3$. Then, the sum

$$\text{of all the values of } x \text{ for which } f^{-1}(x) + g^{-1}(x) = \frac{13}{2}$$

is equal to.

- a) 3 b) 5
c) 7 d) 2

66. Let the line $\frac{x-2}{3} = \frac{y-1}{-5} = \frac{z+2}{2}$ lie in the plane

$$x + 3y - \alpha z + \beta = 0. \text{ Then } (\alpha, \beta) \text{ equals}$$

- a) $(-6, 7)$ b) $(5, -15)$
c) $(-5, 5)$ d) $(6, -17)$

67. If the lines $\vec{r} = (\hat{i} - \hat{j} + \hat{k}) + \lambda(3\hat{j} - \hat{k})$ and

$\vec{r} = (\alpha\hat{i} - \hat{j}) + \mu(2\hat{i} - 3\hat{k})$ are co-planar, the distance of the plane containing these two lines from the point $(\alpha, 0, 0)$ is :

- a) $\frac{2}{9}$ b) $\frac{2}{11}$
c) $\frac{4}{11}$ d) 2

68. Let \vec{a} and \vec{b} be two unit vectors such that $|\vec{a} + \vec{b}| = \sqrt{3}$.

If $\vec{c} = \vec{a} + 2\vec{b} + 3(\vec{a} \times \vec{b})$, then $2|\vec{c}|$ is equal to :

- a) $\sqrt{55}$ b) $\sqrt{37}$
c) $\sqrt{51}$ d) $\sqrt{43}$

69. The general solution of the differential equation,

$$\sin 2x \left(\frac{dy}{dx} - \sqrt{\tan x} \right) - y = 0, \text{ is :}$$

- a) $y\sqrt{\tan x} = x + c$ b) $y\sqrt{\cot x} = \tan x + c$
c) $y\sqrt{\tan x} = \cot x + c$ d) $y\sqrt{\cot x} = x + c$

70. The differential equation whose solution is $Ax^2 + By^2 = 1$

where A and B are arbitrary constants is of

- a) second order and second degree
b) first order and second degree
c) first order and first degree
d) second order and first degree

71. The value of $\int_{-\pi/2}^{\pi/2} \frac{\sin^2 x}{1+2^x} dx$ is:

- a) π b) $\frac{\pi}{2}$
 c) 4π d) $\frac{\pi}{4}$

72. The area of the region bounded by $y^2 = 8x$ and $y^2 = 16(3-x)$ is equal to

- a) $\frac{32}{3}$ b) $\frac{40}{3}$
 c) 16 d) 9

73. The odd natural number a , such that the area of the region bounded by $y = 1, y = 3, x = 0, x = y^a$ is $\frac{364}{3}$,

is equal to :

- a) 3 b) 5
 c) 7 d) 9

74. The integral $\int \sec^{2/3} x \operatorname{cosec}^{4/3} x dx$ is equal to :

- a) $-3 \tan^{-1/3} x + C$ b) $-\frac{3}{4} \tan^{-4/3} x + C$
 c) $-3 \cot^{-1/3} x + C$ d) $3 \tan^{-1/3} x + C$

75. If $B = \begin{bmatrix} 5 & 2\alpha & 1 \\ 0 & 2 & 1 \\ \alpha & 3 & -1 \end{bmatrix}$ is the inverse of a 3×3 matrix A ,

then the sum of all values of α for which $\det(A) + 1 = 0$, is :

- a) 0 b) -1
 c) 1 d) 2

76. Let $A + 2B = \begin{bmatrix} 1 & 2 & 0 \\ 6 & -3 & 3 \\ -5 & 3 & 1 \end{bmatrix}$ and $2A - B = \begin{bmatrix} 2 & -1 & 5 \\ 2 & -1 & 6 \\ 0 & 1 & 2 \end{bmatrix}$.

If $\operatorname{Tr}(A)$ denotes the sum of all diagonal elements of the matrix A , then $\operatorname{Tr}(A) - \operatorname{Tr}(B)$ has value equal to :

- a) 1 b) 3
 c) 0 d) 2

77. Let $P = \begin{bmatrix} 1 & 0 & 0 \\ 3 & 1 & 0 \\ 9 & 3 & 1 \end{bmatrix}$ and $Q = [q_{ij}]$ be two 3×3

matrices such that $Q - P^5 = I_3$. Then $\frac{q_{21} + q_{31}}{q_{32}}$ is equal

to :

- a) 10 b) 135
 c) 15 d) 9

78. Let A and B be two events such that the probability that exactly one of them occurs is $\frac{2}{5}$ and the probability that

A or B occurs is $\frac{1}{2}$, then the probability of both of them occur together is :

- a) 0.02 b) 0.20
 c) 0.01 d) 0.10

79. Bag I contains 3 red, 4 black and 3 white balls and Bag II contains 2 red, 5 black and 2 white balls. One ball is transferred from Bag I to Bag II and then a ball is drawn from Bag II. The ball so drawn is found to be black in colour. Then the probability, that the transferred ball is

- a) $\frac{4}{9}$ b) $\frac{5}{18}$
 c) $\frac{1}{6}$ d) $\frac{3}{10}$

80. Let $A = \{x \in \mathbb{R} : x \text{ is not a positive integer}\}$. Define a

function $f: A \rightarrow \mathbb{R}$ as $f(x) = \frac{2x}{x-1}$, then f is:

- a) not injective
 b) neither injective nor surjective
 c) surjective but not injective
 d) injective but not surjective

SECTION (B)

Integer Type Questions

81. If θ is the angle between the lines AB and AC , where A, B and C are the three points with coordinates $(1, 2, -1)$ and $(2, 0, 3)$ and $(3, -1, 2)$ respectively,

then $\frac{\sqrt{462} \cos \theta}{10}$ is equal to _____.

82. Two cards are drawn from a well-shuffled pack of 52 cards. The probability that one is a heart card and the other is a king, is p , then the value of $104p$ is _____.

83. If A and B are two events such that $P(A) = 0.6$ and $P(B) = 0.8$ and the greatest value that $P\left(\frac{A}{B}\right)$ can have, is p , then the value of $8p$ is _____.
84. Find the degree of the following differential equations :

$$\left(\frac{dy}{dx}\right)^4 - 2x\left(\frac{d^3y}{dx^3}\right)^2 = x^2y\frac{d^2y}{dx^2} - \frac{d^3y}{dx^3}$$
85. If $\frac{d^2x}{dy^2}\left(\frac{dy}{dx}\right)^3 + \frac{d^2y}{dx^2} = k$, then find the value of k .
86. Let $f(x) = x - [x]$, for every real number x , where $[x]$ denotes integral part of x , then $\int_{-1}^1 f(x)dx$ is _____.
87. The distance of the point $(2,3)$ from the line $2x - 3y + 9 = 0$ measured along a line $x - y + 1 = 0$, is $2A\sqrt{A}$. Find A .
88. If $y = \frac{a + bx^{3/2}}{x^{5/4}}$ and $y' = 0$ at $x = 5$, then the value of $\frac{a^2}{b^2}$ is _____.
89. A function is represented parametrically by the equations $x = \frac{(1+t)}{t^3}$ and $y = \frac{3}{2t^2} + \frac{2}{t}$, then the value of $\left|\frac{dy}{dx} - x\left(\frac{dy}{dx}\right)^3\right|$ is _____.
90. Find the value of $-4x$ for which $\sin(\cot^{-1}(1+x)) = \cos(\tan^{-1} x)$. is

Space for rough work

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