Sri Chaitanya IIT Academy.,India.

✪ A.P ✪ T.S ✪ KARNATAKA ✪ TAMILNADU ✪ MAHARASTRA ✪ DELHI ✪ RANCHI

A right Choice for the Real Aspirant

ICON Central Office - Madhapur - Hyderabad

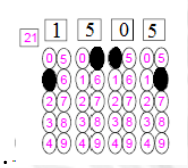
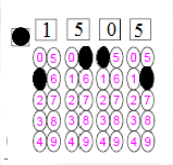
SEC: Sr.Super60_NUCLEUS&STERLING_BT **JEE-MAIN** **Date: 30-09-2023**

Time: 09.00Am to 12.00Pm **RPTM-09** **Max. Marks: 300**

IMPORTANT INSTRUCTION:

1. Immediately fill in the Admission number on this page of the Test Booklet with **Blue/Black** Ball Point **Pen** only.
2. The candidates should not write their Admission Number anywhere (except in the specified space) on the Test Booklet/ Answer Sheet.
3. The test is of **3 hours** duration.
4. The Test Booklet consists of 90 questions. The maximum marks are **300.**
5. There are **three** parts in the question paper 1,2,3 consisting of **Physics, Chemistry** and **Mathematics** having **30 questions** in each subject and subject having **two sections.**
   (I) Section –I contains 20 **multiple choice** questions with only one correct option.
   Marking scheme: +4 for correct answer, 0 if not attempt and -1 in all other cases.
   (II) Section-II contains 10 **Numerical Value Type** questions. Attempt any 5 questions only, if more than 5 questions attempted, First 5 attempted questions will be considered.
   - The Answer should be within **0 to 9999.** If the Answer is in **Decimal** then round off to the **nearest Integer** value (Example i,e. If answer is above **10** and less than **10.5** round off is **10** and If answer is from **10.5** and less than **11** round off is **11).**

   To cancel any attempted question bubble on the question number box.
   For example: To cancel attempted question 21. Bubble on 21 as shown below

Question Answered for Marking **Question Cancelled for Marking**

Marking scheme: +4 for correct answer, 0 if **not attempt** and **-1** in all other cases.

6. Use **Blue / Black Point Pen only** for writing particulars / marking responses on the Answer Sheet. **Use of pencil is strictly prohibited.**
7. No candidate is allowed to carry any textual material, printed or written, bits of papers, mobile phone any electron device etc, except the Identity Card inside the examination hall.
8. Rough work is to be done on the space provided for this purpose in the Test Booklet only.
9. On completion of the test, the candidate must hand over the Answer Sheet to the invigilator on duty in the Hall. **However, the candidate are allowed to take away this Test Booklet with them.**
10. **Do not fold of make any stray marks on the Answer Sheet**

Name of the Candidate (in Capital): _____

Admission Number: | | | | | | | | | |

Candidate's Signature:_____ **Invigilator's Signature:** _____

30-09-23_Sr.Super60_ NUCLEUS&STERLING_BT _ Jee-Main_RPTM-09_Test Syllabus

PHYSICS : Fluid statics & Dynamics: Pressure in a fluid; Pascal's law; Buoyancy, Streamline flow, equation of continuity, Bernoulli's theorem and its applications.

RPTM-09(15Q-RPTM.8 SYLLABUS+15Q CUMULATIVE SYLLABUS)

CHEMISTRY : 1.s-Block Elements: General properties,diagonal similarities between Li ,Mg and Be,Al ; anomalous properties of Li ,Be ; Alkali and alkaline earth metals-reactivity towards air, water, dihydrogen, halogens, acids; their reducing nature including solutions in liquid ammonia; uses of these elements; general characteristics of their oxides, hydroxides, halides, salts of oxoacids; anomalous behaviour of lithium and beryllium; preparation, properties, and uses of compounds of sodium (sodium carbonate, sodium chloride, sodium hydroxide, sodium hydrogen carbonate) and calcium (calcium oxide, calcium hydroxide, calcium carbonate, calcium sulphate).

2.Group-13: Oxidation state and trends in chemical reactivity of elements of groups 13; anomalous properties of boron with respect to other elements in their respective groups,Reactivity towards acids, alkalies, and halogens; preparation, properties and uses of borax, orthoboric acid, diborane, boron trifluoride, aluminium chloride and alums; uses of boron and aluminium

3.Group 14: Oxidation states and trends in chemical reactivity of elements of groups 14; anomalous properties of carbon with respect to other elements in their respective groups, Reactivity towards water and halogen; allotropes of carbon and uses of carbon; preparation, properties and uses of carbon monoxide, carbon dioxide, silicon dioxide, silicones, silicates, zeolites.

RPTM-09(15Q-RPTM.8 SYLLABUS+15Q CUMULATIVE SYLLABUS)

MATHEMATICS : Matrices & Determinants

RPTM-09(15Q-RPTM.8 SYLLABUS+15Q CUMULATIVE SYLLABUS)

PHYSICS **Max Marks: 100**

(SINGLE CORRECT ANSWER TYPE)

This section contains 20 multiple choice questions. Each question has 4 options (1), (2), (3) and (4) for its answer, out of which ONLY ONE option can be correct.

Marking scheme: +4 for correct answer, 0 if not attempted and –1 in all other cases.

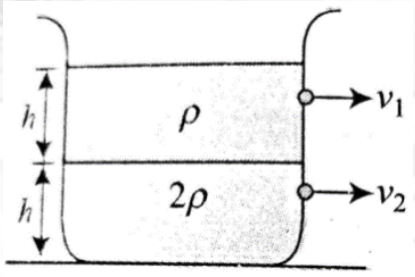
1. Water is filled in a flask up to a height of 50cm. The bottom of the flask is circular with radius 10cm. If the atmospheric pressure is 1.01×10^5 Pa. The force exerted by the water on the bottom is (Take $g=10\,m/s^2$ and density of water = 1000 kg $/m^3$)

1) 3328N **2)** 2200N **3)** 1000N **4)** 3420N

2. A block of silver of mass 5 kg hanging from a string is immersed in a liquid of relative density 0.72. If relative density of silver is 10, then tension in the string will be

1) 46.4.N **2)** 42 N **3)** 73 N **4)** 21 N

3. Equal volume of two immiscible liquids of densities ρ and 2ρ are filled in a vessel as shown in the figure. Two small holes are punched at depths h/2 and 3h/2 from the surface of lighter liquid. If v_1 *and* v_2 are the velocities of efflux at these two holes, then v_1 / v_2 is



1) $\frac{1}{2\sqrt{2}}$ **2)** $\frac{1}{2}$ **3)** $\frac{1}{4}$ **4)** $\frac{1}{\sqrt{2}}$

4. A large cylindrical tank has a hole of area A at its bottom and water is poured into the tank through a tube of cross-sectional area 'A' ejective water at the speed 'V'. Which statement of the following is true?

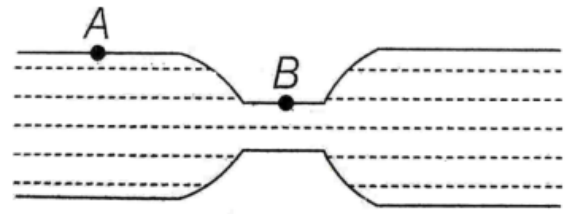
1) Water level will rise to a height $\frac{v^2}{2g}$ and then stop

2)The water level will be oscillating

3) Water level in tank keeps on rising

4) No water can be stored in the tank

5. Water flows in a horizontal tube (see figure). The pressure of water change by 500 Nm^{-2} between A and B where the area of cross-section are 40 cm^2 and 20 cm^2, respectively. Find the rate of flow of water through the tube. (Take, density of water = 1000 kgm^{-3})

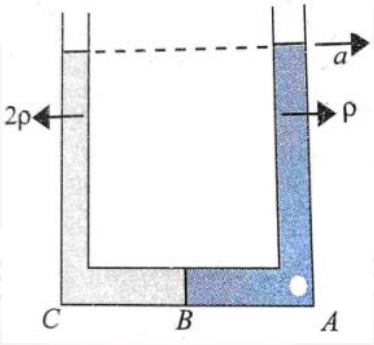


1) 3020 cm^3/s **2)** 2420 cm^3/s **3)** 2308 cm^3/s **4)** 1810 cm^3/s

6. A cylindrical block is floating (partially submerged) in a vessel containing water. Initially, the platform on which the vessel is mounted is at rest. Now the platform along with the vessel is allowed to fall freely under gravity. As a result, the buoyancy force

1) becomes zero **2)** decreases **3)** increases **4)** information is insufficient

7. A U-tube of base length 'l' filled with the same volume of two liquids of densities ρ and 2ρ is moving with an acceleration 'a' on the horizontal plane. If the height difference between the two surfaces (open to atmosphere) becomes zero, then the height h is given by



1) $\frac{a}{2g}l$ **2)** $\frac{3a}{2g}l$ **3)** $\frac{a}{g}l$ **4)** $\frac{2a}{3g}l$

8. Given below are two statement

Statement I: Pressure in a reservoir of water is same at all points at the same level of water

Statement II: The pressure applied to enclosed water is transmitted in all directions equally.

In the light of the above statements, choose the correct answer from the options given below:

1) Both statement I and statement II are false

2) Statement I is false but statement II is true

3) Both statement I and statement II are true

4) Statement I is true but statement II is false

9. When equal volumes of two metals are mixed together, the specific gravity of alloy is 4. When equal masses of the same two metals are mixed together the specific gravity of the alloy now becomes 3. The specific gravity of metals are

1) 3 and 6 **2)** 2 and 6 **3)** 4 and 3 **4)** 3 and 5

10. A wooden block is floating in a liquid. 50% of its volume is inside the liquid when the vessel is stationary. Percentage of volume immersed when the vessel moves upwards with an acceleration $a = g/2$ is :

1) 75 % **2)** 25 % **3)** 50 % **4)** 33.33%

11. A ball of mass m and density ρ is immersed in a liquid of density 3ρ at a depth h and released. To what height will the ball jump up above the surface of liquid? (neglect the resistance of water and air)

1) $H = 4h$ **2)** $H = \frac{h}{2}$ **3)** $H = 2h$ **4)** $H = 3h$

12. Assertion (A): moment of inertia of a circular disc of mass M and radius R about X, Y –axes (passing through its plane) and Z-axis which is perpendicular to its plane were found to be I_x, I_y *and* I_z, respectively. The respective radii of gyration about all the three axes will be the same.

Reason (R): A rigid body making rotational motion has fixed mass and shape. In the light of the above statements, choose the most appropriate answer from the options given below.

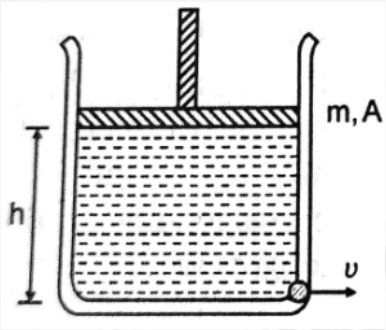
1) Both A and R are correct and R is the correct explanation of A

2) Both A and R are correct but R is not the correct explanation of A

3) A is correct but R is not correct.

4) A is not correct but R is correct.

13. A cylindrical vessel contains a liquid of density ρ upto a height h. The liquid is closed by a piston of mass m and area of cross-section A. There is a small hole at the bottom of the vessel.



The speed v with the liquid comes out of the hole is :

1) $\sqrt{2gh}$ **2)** $\sqrt{2\left(gh+\frac{mg}{\rho A}\right)}$ **3)** $\sqrt{2\left(gh+\frac{mg}{A}\right)}$ **4)** $\sqrt{2gh+\frac{mg}{A}}$

14. One main scale division of a vernier calipers is a cm and nth division of the vernier scale coincide with $(n-1)^{th}$ division of the main scale. The least count of the calipers (in mm) is

1) $\frac{10na}{(n-1)}$ **2)** $\frac{10a}{(n-1)}$ **3)** $\left(\frac{n-1}{10n}\right)a$ **4)** $\frac{10a}{n}$

15. Statement I : An object subjected to velocities V_1 *and* V_2 has a resultant velocity with magnitude $|V|=|V_1|+|V_2|$

Statement II : The magnitude of displacement is either less or equal to the path length of an object between two points.

Statement III : The instantaneous acceleration is the limiting value of the average acceleration as the time interval approaches zero.

Which of the following is correct?

1) Statements I, II and III are true

2) Statements I, II are true but statement III is false

3) Statements II, III are true but statement I is false

4) Statements I, II and III are false

16. Assertion (A): The zero velocity of a particle at any instant always implies zero acceleration at that instant

Reason(R): A body is momentarily at rest when it reverses its direction of motion. The correct option among the following is

1) Assertion is true Reason is true and reason is the correct explanation for assertion

2) Assertion is true Reason is true but reason is not the correct explanation for (A)

3) Assertion is false but Reason is true

4) Assertion is true but Reason is false

17. A plate of thickness t made of a material of refractive index μ is placed in front of one of the slits in a double-slit experiment. What should be the minimum thickness t which will make the intensity at the center of the fringe pattern zero?

1) $(\mu-1)\frac{\lambda}{2}$ **2)** $(\mu-1)\lambda$ **3)** $\frac{\lambda}{2(\mu-1)}$ **4)** $\frac{\lambda}{(\mu-1)}$

18. Assertion (A): In an elastic collision of two billiard balls both kinetic energy and linear momentum remain conserved.

Reason (R): During the collision of the balls, as the collision is elastic there is no exchange of energy. Therefore, both energy and momentum are conserved.

The correct option among the following is

1) A is true, R is true and R is the correct explanation for A

2) A is true, R is true and R is not the correct explanation for A

3) A is true but R is false

4) A is false but R is true

19. A body X with a momentum p collides with another identical stationary body Y one dimensionally. During the collision, Y gives an impulse J to body X. Then coefficient of restitution is

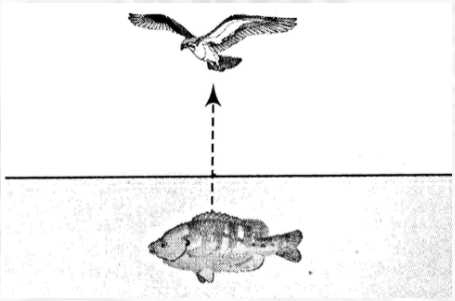
1) $\frac{2J}{p}-1$ **2)** $\frac{J}{p}+1$ **3)** $\frac{J}{p}-1$ **4)** $\frac{J}{2p}-1$

20. Assertion (A): Heat and work are modes of energy transfer to a system resulting in change in its internal energy.
Reason (R): Heat and work in thermodynamics are state variables.
The correct option among the following is
1) Assertion is true Reason is true and reason is the correct explanation for assertion
2) Assertion is true Reason is true but reason is not the correct explanation for (A)
3) Assertion is false but Reason is true
4) Assertion is true but Reason is false

(NUMERICAL VALUE TYPE)

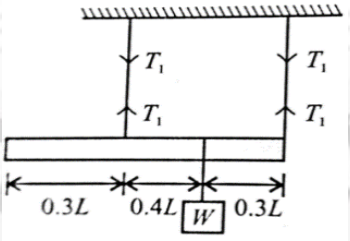
Section-II contains 10 **Numerical Value Type** questions. Attempt any 5 questions only. First 5 attempted questions will be considered if more than 5 questions attempted. The Answer should be within **0 to 9999.** If the Answer is in **Decimal** then round off to the **nearest Integer** value (Example i,e. If answer is above **10** and less than **10.5** round off is **10** and If answer is from **10.5** and less than **11** round off is **11**).
Marking scheme: +4 for correct answer, 0 if **not attempt** and **-1** in all other cases.

21. A fish rising up vertically toward the surface of water with speed 3 ms^{-1} observes a bird diving down vertically towards it with speed $6ms^{-1}$. The actual velocity of bird is (m/s)



22. A wooden cube just floats inside water when a 800g mass is placed on it. When the mass is removed, the cube is 2cm above the water level. What is the size of each sides of the cube? (cm)(Density of water=1gm/cm^3).

23. In figure, the bar is uniform and weighing 200N. How large must W be if T_1 *and* T_2 are to be equal? (N)

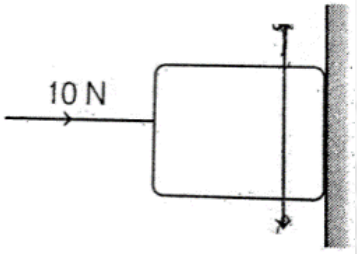


24. Two discs, each having moment of inertia 5 kg m^2 about its central axis, rotating with speeds 10 $rad\ s^{-1}$ *and* 20 $rad\ s^{-1}$, are brought in contact face to face with their axes of rotation coincided. The loss of kinetic energy in the process is (J)

25. A calorimeter of water equivalent 20 g contains 180 g of water at 25^0C. 'm' grams of steam at 100^0C is mixed in it till the temperature of the mixture is 31^0C. The value of m is close to (gm)

(Take, latent heat of steam $= 540\ cal\ g^{-1}$, specific heat of water $= 1cal\ g^{-1}\ {}^0C^{-1}$)

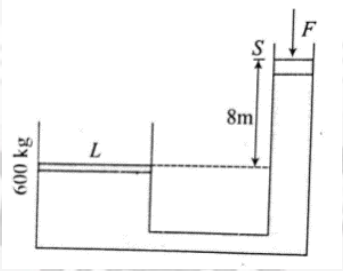
26. A horizontal force of 10 N is necessary to just hold a block stationary against a wall. The coefficient of friction between the block and the wall is 0.5. The weight of the block is (in N)



27. A cubical block of ice floating in water has to support a metal piece weighing 0.5 kg. What can be the minimum edge of the block so that it does not sink in water (in cm)? Specific gravity of ice = 0.9

28. In a certain thermodynamical process, the pressure of a gas depends on its volume as kV^3. The work done when the temperature changes from 100^0C *to* 300^0C will be ……..nR, when n denotes number of moles of a gas.

29. For the system shown in the figure, the cylinder on the left at L has a mass of 600 kg and a cross-sectional area of 800 cm^2. The piston on the right, at S, has cross-sectional area 25 cm^2 and negligible weight. If the apparatus is filled with oil $\left(\rho = 0.75\ g/cm^3\right)$ Find the force F (in N) required to hold the system in equilibrium. Take $g = 10\ m/s^2$.



30. A car is moving with speed of 150 km/h and after applying the break it will move 54 m before it stops. If the same car is moving with a speed of one-third the reported speed, then it will stop after travelling ……m distance.

CHEMISTRY

Max Marks: 100

(SINGLE CORRECT ANSWER TYPE)

This section contains 20 multiple choice questions. Each question has 4 options (1), (2), (3) and (4) for its answer, out of which ONLY ONE option can be correct.

Marking scheme: +4 for correct answer, 0 if not attempted and –1 in all other cases.

31. An element 'x' atomic number equals to ionic radii (P.M) of element which shows brick red colour on its flame colour test then 'x' atomic number equals to:

1) 100 **2)** 72 **3)** 88 **4)** 138

32. Which of the following statements is incorrect about borazine or borazole

1) Each B and N atoms is sp^2 hybridised

2) borazine gives boric acid, ammonia and hydrogen gas on its complete hydrolysis

3) Like benzene, borazine does not give addition product

4) Borazine contains dative $p\pi - p\pi$ bonds

33. Graphite heat of formation is 'X' K.J/mole, diamond heat of formation is 'Y' K.J/mole and Fullarenes heat of formation is 'Z' K.J/mole. Then X+Y+Z is

1) 20 K.J/mole **2)** 30 K.J/mole **3)** 40 K.J/mole **4)** 50 K.J/mole

34. A: The melting point of diamond is high even it is covalent compound
R: Diamond has three-dimensional network involving strong C-C bonds which are very difficult to break

1) A is true R is true and R is correct explanation of A

2) A is true R is true but R is not correct explanation of A

3) A is true R is false

4) A is false R is true

35. Borax bead is heated with Co^{2+} salt, select correct statement is :

1) In oxidizing flame, hot condition gives yellow colour

2) In reducing flame, hot condition gives green colour

3) In oxidizing flame, cold condition gives blue colour

4) In reducing flame, cold condition gives brown colour

36. S_1 : Alkali metals are not generally extracted electrolysis of their aqueous solutions
S_2 : The electro positivity of alkali metals decreases with increase in atomic number
S_3 : Lithium is hardest metal in alkali metals
S_4 : Potassium carbonate cannot be prepared by solvay's process

1) T F T F **2)** T F T T **3)** T T T T **4)** F T F T

37. What happens if more alkali metal is allowed to react with concentrated liquidammonia

1) Para magnetic nature of solvated electrons is retained

2) Solvated electrons associate to form electron pairs and paramagnetic character decreases

3) Reducing character increases

4) No change of its colour

38.

Column I (Salt)	Column – II (properties)
A) Na_2CO_3	**P)** Produce CO_2 on heating above 120^0C
B) $NaHCO_3$	**Q)**Exists in solid state
C) $CaCO_3$	**R)** Water soluble
D) $Ca(HCO_3)_2$	**S)** Produce CO_2 with dil HCl
	T) Does not react with $KMnO_4$ solution

1) A–PRST; B-PQST; C-PST; D-PQS

2) A-QRST; B-PQRST; C-PQST; D-PRST

3) A-PTQ; B-PS; C-PRS; D-PRST

4) A-PRST; B-PQRT; C-QRS; D-PQRST

39. Select incorrect statement is

1) The no. s-block metals (excluding radio active metals) which are denser then H_2O_2 equals to 5

2) The no. s-block metals (excluding radio active metals) which are denser then D_2O equals to 7

3) The no. s-block metals (excluding radio active metals) which are denser then H_2O equals to 7

4) The no. s-block metals (excluding radio active metals) which are denser then H_2O_2 equals to 4

40. $Na_2[B_4O_5(OH)_4]8H_2O$, $Ca_2[B_6(OH_6O_8)]2H_2O$, $Na_2[B_4O_5(OH)_4]2H_2O$, $Na_2[B_2(O_2)_2(OH)_4].6H_2O$

In the above structures, the sum of trigonal planar and tetrahedral boron units equals to :

1) 16 **2)** 14 **3)** 12 **4)** 10

41. A: Beryllium chloride has much lower electrical conductivity than calcium and magnesium chlorides (salts are exist in fused state)

R : Berillium exists as $[Be(H_2O)_4]^{++}$ in acid medium and $[Be(OH)_4]^-$ in basic medium

1) A is true R is true but R in not correct explanation of A

2) A is true R is true R is correct explanation of A

3) A is true R is false

4) A is false R is true

42. 1, 2 glycosidic linkage is present in

1) Lactose **2)** Sucrose **3)** Maltose **4)** Amylose

43. Williamson's ether synthesis

$RO^- + RX \rightarrow ROR + X^-$

1) SN^1 reaction mechanism **2)** SN^2 reaction mechanism

3) SN_i reaction mechanism **4)** E^1 reaction mechanism

44. Chlordiazepoxide is

1) Mild tranquilizer **2)**Mild antiseptic

3) Antacid **4)** Antipyratic

45. Cyclohexane libarates 28.6 K.cal/mol when hydrogenated anthracene has actual heat of hydrogenation 116.2 K cal/mole. (Anthracene has seven double bonds)

The resonance energy of anthracene is

1) 96 K.cal/mole **2)** 8.4 K.cal/mole

3) 184 K.cal/mole **4)** 84 K.cal/mole

46. **Assertion:** 3-methyl-1- butane on acid catalysed hydration gives mainly 2-methyl-2-butanol as major product while the same alkene on treatment with $(CH_3COO)_2 Hg - H_2O$ followed by reduction with $NaBH_4$ gives mainly 3-methyl-2-butanol.

Reason: Acid catalyzed hydration involve carbocation intermediate while the other does not.

1) A is true R is true and R is correct explanation of A

2) A is true R is true but R is not correct explanation A

3) A is true R is false

4) A is false R is true

47. $R-Cl$ is treated with Zn in the presence of dry ether to give 2, 7 – dimethyl octane when $R-Cl$ is treated with Li to form RLi, RLi when treated with water gives isopentane. When structure of $R-Cl$ is

1) $CH_3-CH_2-CH_2-Cl$

2) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2-CH_2Cl$

3) $CH_3-CH_2-CH_2-\underset{\displaystyle CH_3}{\underset{|}{CH}}-Cl$

4) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2-CH_2-Cl$

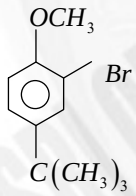
48. Biphenyl is an example for

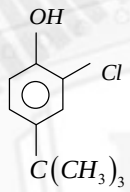
1) Benzenoids **2)** Quinonoid

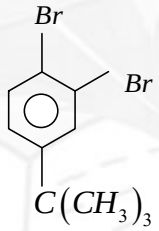
3) Non aromatic **4)** Anti aromatic

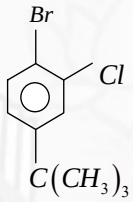
49. Anisole $\xrightarrow[AlCl_3]{(CH_3)_3CCl} A \xrightarrow{Cl_2/FeCl_3} B \xrightarrow[\Delta]{HBr} C$

The 'C' in the above series of reactions is

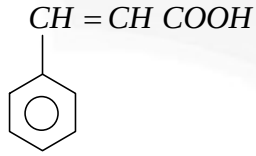
1) 

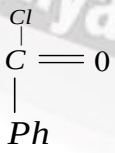
2) 

3) 

4) 

50. Compound (A), having an empirical formula C_7H_8, is chlorinated in sunlight to give a product (B), which on hydrolysis gives a compound(C). (C) gives a positive test with Tollens' reagent and with sodium acetate and acetic anhydride gives an acid (D), with equivalent weight 148.15. Identify the compound

1) 

2) 

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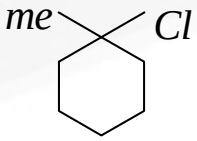
4) 

(NUMERICAL VALUE TYPE)

Section-II contains 10 **Numerical Value Type** questions. Attempt any 5 questions only. First 5 attempted questions will be considered if more than 5 questions attempted. The Answer should be within **0 to 9999.** If the Answer is in **Decimal** then round off to the **nearest Integer** value (Example i,e. If answer is above **10** and less than **10.5** round off is **10** and If answer is from **10.5** and less than **11** round off is **11).**

Marking scheme: +4 for correct answer, 0 if **not attempt** and **-1** in all other cases.

51. Three moles of diborane on reaction with excess of ethyl alcohol gives …….. moles of H_2 gas

52. The total number of boran atoms in anionic part of borax which participate in back bonding

53. How many of the following undergoes decomposition on heating at 600^0C is ……..

Na_2CO_3, $MgCO_3$, $BaCO_3$, K_2CO_3, Rb_2CO_3, Cs_2CO_3, Li_2CO_3, $CaCO_3$

54. 1720 gr. of pure gypsum is heated at 200^0C and converts into dead burnt plaster. number of moles of steam evolved equals to ….

55. How many of the following exist with +2 as most common oxidation state

Al, Si, Pb, B, Zn, Ca, Ba and Ubn

56. How many of the following polymers are biodegradable

$PHBV$, Nylon 6,6, Teflon, Nylon 2- Nylon 6

57. The number of alkene products formed when 3-chloro-3-cyclobutyl hexane react with alcoholic KOH and heat (including stereo)

58. Among the following the no.of compounds which will give +ve iodoform reaction?

1) 1-phenyl Butan – 2- one
2) 2-methyl Butan – 2- ol
3) 3-methyl Butan – 2 -ol
4) 1-pheny ethanol
5) 3, 3 dimethyl Butan – 2 –one
6) 1 – Phenyl propan – 2- ol

59. From the following species the number of planar species is

$\overset{\oplus}{C}H_3, BF_3, \overset{\bullet}{C}H_3, H_3O^+, CCl_4, SO_3$

60. How many aldol products are formed with two different types of aldehydes (propionaldehyde acetaldehyde) including stereo isomers

MATHEMATICS **Max Marks: 100**

(SINGLE CORRECT ANSWER TYPE)

This section contains 20 multiple choice questions. Each question has 4 options (1), (2), (3) and (4) for its answer, out of which ONLY ONE option can be correct.

Marking scheme: +4 for correct answer, 0 if not attempted and –1 in all other cases.

61. Statement-1 : The determinant of a matrix $A=\left[a_{ij}\right]$ of order 5×5 where $a_{ij}+a_{ji}=0$ *for* $i\neq j$ is zero

Statement-2 : The determinant of a skew symmetric matrix of odd order is zero.

1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct a explanation for Statement1.

2) Statement-1 is True, Statement-2 is True; STatement-2 is NOT a correct explanation for Statement-1

3) Statement-1 is True, Statement-2 is False

4) Statement-1 is False, Statement-2 is True

62. Let $A=\begin{bmatrix} i & -i \\ -i & i \end{bmatrix}, i=\sqrt{-1}$ Then, the system of linear equations $A^8\begin{bmatrix} x \\ y \end{bmatrix}=\begin{bmatrix} 8 \\ 64 \end{bmatrix}$ has

1) A unique solution **2)** Infinitely many solutions

3) No solution **4)** Exactly two solutions

63. If the system of equations $x+2y+3z=3;\ 4x+3y-4z=4;\ 8x+4y-\lambda z=\mu+9$ has infinitely many solutions then the ordered pair (λ,μ) is equal to

1) (72/5, 21/5) **2)** (–72/5, –21/5)

3) (72/5, –21/5) **4)** (–72/5, 21/5)

64. Set of all values of $t\in R$ for which the matrix

$$\begin{bmatrix} e^t & e^{-t}(\sin t-2\cos t) & e^{-t}(-2\sin t-\cos t) \\ e^t & e^{-t}(2\sin t+\cos t) & e^{-t}(\sin t-2\cos t) \\ e^t & e^{-t}\cos t & e^{-t}\sin t \end{bmatrix}$$ is invertible, is

1) $\left\{(2k+1)\frac{\pi}{2}, k\in Z\right\}$ **2)** $\left\{k\pi+\frac{\pi}{4}, k\in Z\right\}$

3) $\{k\pi, k\in Z\}$ **4)** R

65. Let a matrix $A=\begin{bmatrix}2 & 3\\ 1 & 2\end{bmatrix}$ then it will satisfy the equation

1) $A^2-4A+I=0$ **2)** $A^2+4A+I=0$

3) $A^2-4A-5I=0$ **4)** $A^2-4A+5I=0$

66. A,B,C,D be real matrices (not necessarily square matrices) such that $A^T=BCD, B^T=CDA, C^T=DAB, D^T=ABC$ and matrix $S=ABCD$ then consider the statements

$I:\ S^3=S$

$II:\ S^2=S^4$

1) II is true, but not I **2)** I is true but not II

3) both I and II are true **3)** both I and II are false

67. The equation $\begin{vmatrix}(1+x)^2 & (1-x)^2 & -\left(2+x^2\right)\\ 2x+1 & 3x & 1-5x\\ x+1 & 2x & 2-3x\end{vmatrix}+\begin{vmatrix}(1+x)^2 & 2x+1 & x+1\\ (1-x)^2 & 3x & 2x\\ 1-2x & 3x-2 & 2x-3\end{vmatrix}=0$

1) has no real solution

2) has 4 real solutions

3) has two real and two non real solutions

4) has infinite number of solutions, real or non real

68. Assertion(A): $A=\left[a_{ij}\right]_{4\times4}$ such that $a_{ij}=\begin{cases}2 & when\ i=j\\ 0 & when\ i\neq j\end{cases}$ then $\det\left(adj\left(adj\ A\right)\right)=2^{30}$

Reason(R): If A is $n\times n$ matrix and K is a scalar then $|kA|=k^n|A|,\ |Adj\ A|=|A|^{n-1}$

1) both A, R true and R is correct explanation of A

2) Both A, R true, but R is not correct explanation of A

3) A is true, R is false

4) A is false, R is true

69. If $\begin{bmatrix} \lambda^2-2\lambda+1 & \lambda-2 \\ 1-\lambda^2+3\lambda & 1-\lambda^2 \end{bmatrix} = A\lambda^2+B\lambda+C$ where A, B, C are matrices then B + C =

1) $\begin{bmatrix} -1 & -1 \\ 4 & 1 \end{bmatrix}$ **2)** $\begin{bmatrix} 1 & -1 \\ 4 & 1 \end{bmatrix}$ **3)** $\begin{bmatrix} 1 & 1 \\ -4 & 1 \end{bmatrix}$ **4)** $\begin{bmatrix} -1 & -1 \\ -4 & 1 \end{bmatrix}$

70. The number of value of k for which the system of equations $(k+1)x+8y=4k$ and $kx+(k+3)y=3k-1$ has infinitely many solutions is

1) 0 **2) 1** **3)2** **4)** infinite

71. $\lim_{t\to 0}\left(\frac{1}{1^{\sin^2 t}}+\frac{1}{2^{\sin^2 t}}+\text{-----}+\frac{1}{n^{\sin^2 t}}\right)^{\sin^2 t}$ is equal to

1) n^2+n **2)** n **3)** n(n+1) / 2 **4)** n^2

72. If $\bar{a}$ *and* $\bar{b}$ are unit vectors and $\bar{c}$ is a vector such that $\bar{c}=\bar{a}\times\bar{c}+\bar{b}$ then

1) $\left[\bar{a}\ \bar{b}\ \bar{c}\right]=\bar{b}.\bar{c}-(\bar{a}.\bar{b})^2$ **2)** $\left[\bar{a}\ \bar{b}\ \bar{c}\right]=0$

3) Maximum value of $\left[\bar{a}\ \bar{b}\ \bar{c}\right]=2$ **4)** Minimum value of $\left[\bar{a}\ \bar{b}\ \bar{c}\right]$ is $\frac{1}{2}$

73. The Area bounded by the curves $y^2+4x=4$ *and* $y-2x=2$ is

1) 25/3 **2)** 22/3 **3)** 9 **4)** 23/3

74. A wire of length of 20 m is to be cut into two pieces. A piece of length l_1 is bent to make a square of area A_1 and other piece of length of l_2 is made into a circle of area A_2. If $2A_1+3A_2$ is minimum then $(\pi l_1):l_2$ is

1) 6:1 **2)** 3:1 **3)** 1:6 **4)** 4:1

75. Statement-1**:** A period of $f(x)=\sin\left(4\pi\left\{\frac{x}{4}\right\}\right)$ is 4, $\{.\}$ denotes fractional part function

Statement-2:If fundamental period of f(x) is m and fundamental period of g(x) is n then fundamental period of f(g(x)) is *l.c.m* of m, n

1) Statement-1 is True, Statement-2 is False

2) Statement-1 is True, Statement-2 is True; Statement-2 is a correct a explanation for Statement1.

3) Statement-1 is True,Statement-2 is True; STatement-2 is NOT a correct explanation for Statement-1

4) Statement-1 is False, Statement-2 is True

76. Let the functions $f:R\to R,\ g:R\to R$ be defined as $f(x)=\begin{cases}x+2, & x<0\\ x^2, & x\geq 0\end{cases}$ and

$g(x)=\begin{cases}x^3, & x<1\\ 3x-2, & x\geq 1\end{cases}$

Then the number of points in R where (fog) (x) is NOT differentiable, is equal to

1) 3 **2) 1** **3) 0** **4) 2**

77. If $f(x+y)=f(x)+f(y)+6xy(x+y)\forall x,y\in R$ *and* $f'(0)=-8$ then which of the following Statements is TRUE?

1) The slopes of the tangents at the points where $y=f(x)$ cuts X-axis have same sign

2) The tangents at the points where $y=f(x)$ cuts X-axis are parallel

3) The slope of the tangent where x=1 is equal to -2

4) The slope of the tangent is zero when $x=\pm 4/3$

78. The solution curve of the differential equation $\left(\left(\frac{y^2}{x^2}+\frac{1}{8}\right)^2-\frac{1}{64}\right)\frac{dy}{dx}=\frac{x}{2}+\frac{2y^2}{x}$ passes through the point (2,3) , the curve is given by

1) $3(x-2)^4-2(y-3)^3=0$ **2)** $3x^4-2y^3+6=0$

3) $2x^4-2y^3-5=0$ **4)** $x^4+y^3=43$

79. The length of the perpendicular drawn from the point (2, 1, 4) to the plane containing the lines $\vec{r}=(\hat{i}+\hat{j})+\lambda(\hat{i}+2\hat{j}-\hat{k})$ and $\vec{r}=(\hat{i}+\hat{j})+\mu(-\hat{i}+\hat{j}-2\hat{k})$ is

1) $\sqrt{3}$ **2)** $1/\sqrt{3}$ **3)** 1/3 **4)** 3

80. Let $f(x)=x^4-4x^3+12x^2+x-1$. Then which of the following statements are True

S_1: $f(x)=0$ has two real and distinct roots

S_2: $f^1(x)=0$ has one real root

S_3: $f^{11}(x)=0$ has two real and distinct roots

1) S_1, S_2 are true **2)** S_2, S_3 are true

3) S_1, S_3 are true **4)** S_1, S_2, S_3 are true

(NUMERICAL VALUE TYPE)

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Marking scheme: +4 for correct answer, 0 if **not attempt** and **-1** in all other cases.

81. If A is 6×6 matrix and $\left|A\left|adj(|A|A)\right|\right|=|A|^n$, then n is _____

82. The system of linear equations: $x+y+z=6, \alpha x+\beta y+7z=3,\ x+2y+3z=14$ has infinitely many solutions then the value of $4\beta-2\alpha$ is equal to

83. If $A=\begin{bmatrix} a & b \\ c & d \end{bmatrix}$ (where $bc\neq0$) satisfies the algebraic equation $x^2+5=0$ then the value of Trace A+ Det A is equal to

84. Let $f(x)=\begin{vmatrix} \sec x & \cos x & \sec^2 x+\cot x.\operatorname{cosec} x \\ \cos^2 x & \cos^2 x & \operatorname{cosec}^2 x \\ 1 & \cos^2 x & \cos^2 x \end{vmatrix}$

If $\int_0^{\pi/2} f(x)dx=-\left(\frac{\pi}{4}+\frac{a}{b}\right)$ where a, b are relatively prime natural numbers, then b–a=

85. If p,q,r,s are in A.P and $f(x)=\begin{vmatrix} p+\sin x & q+\sin x & p-r+\sin x \\ q+\sin x & r+\sin x & -1+\sin x \\ r+\sin x & s+\sin x & s-q+\sin x \end{vmatrix}$ such that $\int_0^2 f(x)dx=-4$

then the positive value of the common difference of the A.P is _____

86. If [x] is greatest integer function then Square of $\int_{-20\pi}^{20\pi} |\sin x|[\sin x]\,dx =$ _____

87. If $\int \frac{1}{\cos^3 x - \sin^3 x}dx = A\tan^{-1}(\sin x + \cos x) + B\ln\left|\frac{\sqrt{2}+(\sin x+\cos x)}{\sqrt{2}-(\sin x+\cos x)}\right| + C$ then the value of $12A + 9\sqrt{2}\,B$ is equal to

88. For the function $f(x) = 4x^5 - 25x^4$, number of points of inflections is m, number of points of extremum is n then m + n is equal to _____

89. The value of p exists so that the straight lines $\vec{r} = \left(2\hat{i}+9\hat{j}+13\hat{k}\right) + t\left(\hat{i}+2\hat{j}+3\hat{k}\right)$ *and* $\vec{r} = \left(-3\hat{i}+7\hat{j}+p\hat{k}\right) + s\left(-\hat{i}+2\hat{j}-3\hat{k}\right)$ are coplanar. If the point of intersection of the two lines is (α,β,γ) then the value of $\alpha+\beta+\gamma-p$ is equal to

90. If $x = e^{2t+2} + \cos\left(\frac{\pi t}{3}\right) + \sin\left(\frac{2\pi t}{3}\right)$; $y = 2e^{t+1} - \frac{1}{2}\sin\left(\frac{\pi t}{3}\right) + \frac{1}{2}\cos\left(\frac{2\pi t}{3}\right)$ and the value of $\frac{dy}{dx}$ at $t = -1$ is given as $\frac{A+(B\sqrt{C}-D)\pi}{A+(B\sqrt{C}-E)\pi}$ where A, B, C, D, E are natural numbers and C is prime, then the value of A+B+C+D+E is _____

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