Sri Chaitanya IIT Academy.,India.

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A right Choice for the Real Aspirant

ICON Central Office - Madhapur - Hyderabad

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

Time: 09.00Am to 12.00Pm **RPTM-06** **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:** _____

09-09-23_Sr.Super60_ NUCLEUS&STERLING_BT _ Jee-Main_RPTM-06_Test Syllabus

PHYSICS : COM & Collisions, Conservation of linear momentum and mechanical energy. Systems of particles; Centre of mass and its motion; Impulse; Elastic and inelastic collisions.

RPTM-06(15Q-RPTM.6 SYLLABUS+15Q CUMULATIVE SYLLABUS)

CHEMISTRY : Aldehydes & Ketones, Carboxylic acid & Derivatives: Aldehydes & Ketones: Preparation of aldehydes and ketones from acid chlorides and nitriles; aldehydes from esters; benzaldehyde from toluene and benzene; conversion of alcohols into aldehydes and ketones Reactions: oxidation, reduction, oxime and hydrazone formation; Aldol condensation and Family aldol reactions,.Cannizzaro reaction; haloform reaction and nucleophilic addition reactions with RMgX, NaHSO3, HCN, water , alcohol, RSH ,amine and derivatives Carboxylic acids & derivatives: Physical properties; Preparation: from nitriles, Grignard reagents, hydrolysis of esters and amides; Formation of esters, acid chlorides , and amides, Preparation of benzoic acid from alkylbenzenes;

Reactions: reduction, halogenation, formation of esters, acid chlorides, anhydrides and amides

RPTM-06(15Q-RPTM.6 SYLLABUS+15Q CUMULATIVE SYLLABUS)

MATHEMATICS : Areas & Differential Equations

RPTM-06(15Q-RPTM.6 SYLLABUS+15Q CUMULATIVE SYLLABUS)

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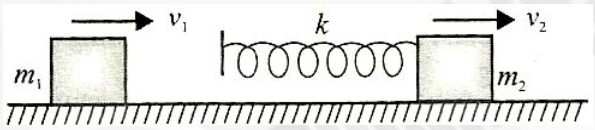
PHYSICS **Max Marks: 100**

(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.

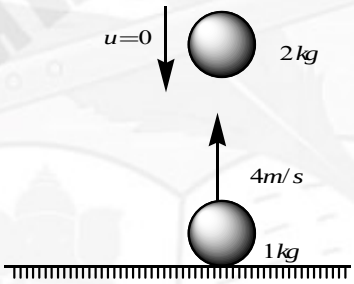
Marking scheme: +4 for correct answer, 0 if not attempted and –1 in all other cases.

1. Two blocks of masses $m_1 = 2kg$ and $m_2 = 4kg$ are moving in the same direction with speeds $v_1 = 6m/s$ and $v_2 = 3m/s$, respectively on a frictionless surface as shown in figure. An ideal spring with spring constant $k = 30000N/m$ is attached to the back side of m_2. Then the maximum compression of the spring after collision will be



1) 0.06 m **2)** 0.04 m **3)** 0.02 m **4)** None of these

2. A ball of mass 1 kg is thrown up with an initial speed of 4 m/s. A second ball of mass 2 kg is released from rest from some height as shown in fig. Choose the correct statement



1) The centre of mass of the two balls comes down with acceleration g/3

2) The centre of mass first moves up and then comes down

3) The acceleration of the centre of mass is g upwards

4) The centre of mass of the two balls remains stationary

3. STATEMENT -1: In an elastic collision in one dimension between two bodies, neither of which was at rest before collision, total momentum remains the same before, during and after the collision.

STATEMENT -2: In an elastic collision in one dimension between two bodies, neither of which was at rest before collision, total kinetic energy remains the same before, during and after the collision.

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1) Statement-1is true, statement -2 is true; statement-2 is a correct explanation for Statement-1.

2) Statement-1 is true, Statement-2 is true; Statement -2 is not a correct explanation for Statement-1.

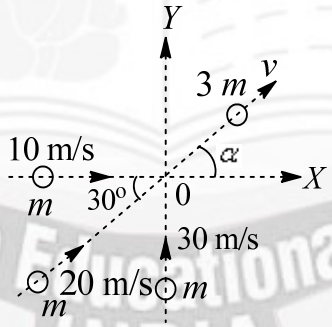
3) Statement-1 is true, Statement-2 is False.

4) Statement-1 is false, Statement-2 is true.

4. Two identical balls, each of mass m, are tied with a string and kept on a frictionless surface. Initially, the string is slack. They are given velocities $2u$ and u in the same direction. Collision between the balls is perfectly elastic, after the first collision, what is the total loss in kinetic energy of the balls?

1) $2\ mu^2$ **2)** mu^2 **3)** $3\ mu^2$ **4)** 0

5. Three particles of equal masses travelling with velocities of 10 m/s, 20 m/s and 30 m/s, respectively, along x -axis, at an angle of 30^0 to the direction of positive x -axis and y -axis (as shown in Fig.) collide simultaneously and get sticked to each other The combined particle will move with velocity



1) $\frac{10}{3}\sqrt{20+2\sqrt{3}}m/s$ **2)** $\frac{10}{3}\sqrt{20-2\sqrt{3}}m/s$

3) $\frac{10}{3}\sqrt{\left(5-\sqrt{3}\right)}m/s$ **4)** $\frac{10}{3}\sqrt{\left(5+\sqrt{3}\right)}m/s$

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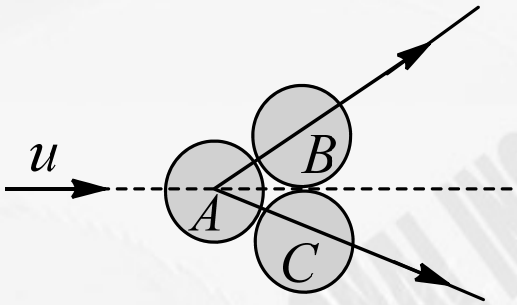
6. Two identical spheres B and C, each of mass m, are in contact on a smooth horizontal table. A third sphere A of same size as that of B and C but mass $m/2$ impinges symmetrically on them with a velocity u and is itself brought to rest. The coefficient of restitution between the two spheres A and B (or between A and C) is

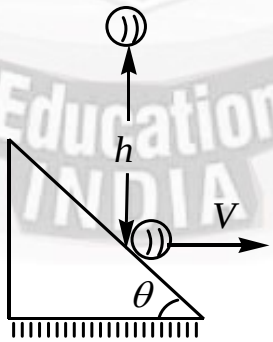


1) $\frac{1}{3}$ **2)** $\frac{1}{4}$ **3)** $\frac{2}{3}$ **4)** $\frac{3}{4}$

7. Two blocks of equal mass m are connected by an unstretched spring and the system is kept at rest on a frictionless horizontal surface. A constant force F is applied on the first block pulling away from the other as shown in Fig. Then the displacement of the centre of mass of blocks at time t is

1) $\frac{Ft^2}{2m}$ **2)** $\frac{Ft^2}{3m}$ **3)** $\frac{Ft^2}{4m}$ **4)** $\frac{Ft^2}{m}$

8. A smooth ball is dropped from height h on a smooth fixed incline as shown in Fig. After collision, the velocity of the ball is directed horizontally then coefficient of restitution is



1) $\cot^2\theta$ **2)** $\sin^2\theta$ **3)** $\tan^2\theta$ **4)** $\cos^2\theta$

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9. Statement 1 : If no external force acts on a system of particles, then the centre of mass will not move in any direction.

Statement II : If net external force is zero, then the linear momentum of the system remains Constant.

1) Statement 1 is True, Statement 2 is True; Statement 2 **is** correct explanation for Statement 1

2) Statement 1 is True, Statement 2 is True; Statement 2 **is not** correct explanation for Statement 1

3) Statement 1 is True, Statement 2 is False

4) Statement 1 is False, Statement 2 is True

10. A particle strikes a horizontal smooth floor with velocity u making an angle θ with the floor and rebounds with velocity v making an angle ϕ with the floor. If the coefficient of restitution between the particle and the floor is e, then, pick the wrong statement

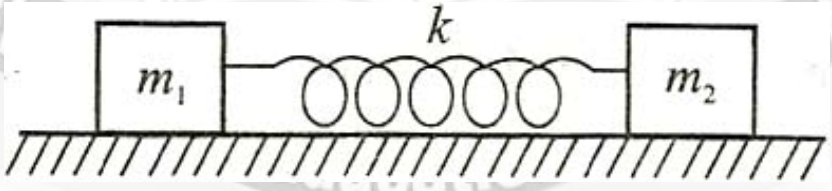
1) The impulse delivered by the floor to the body is $mu(1+e)\sin\theta$

2) $\tan\phi = e\tan\theta$

3) $v = u\sqrt{1-(1-e)^2\sin^2\theta}$

4) The ratio of final kinetic energy to the initial kinetic energy is $(cos^2\theta + e^2 sin^2\theta)$

11. Two blocks m_1 and m_2 are pulled on a smooth horizontal surface, and are joined together with a spring of stiffness k as shown in fig. Suddenly, block m_2 receives a horizontal velocity v_0, then the maximum extension x_m in the spring is



1) $v_0\sqrt{\dfrac{m_1m_2}{m_1+m_2}}$

2) $v_0\sqrt{\dfrac{2m_1m_2}{(m_1+m_2)k}}$

3) $v_0\sqrt{\dfrac{m_1m_2}{2(m_1+m_2)k}}$

4) $v_0\sqrt{\dfrac{m_1m_2}{(m_1+m_2)k}}$

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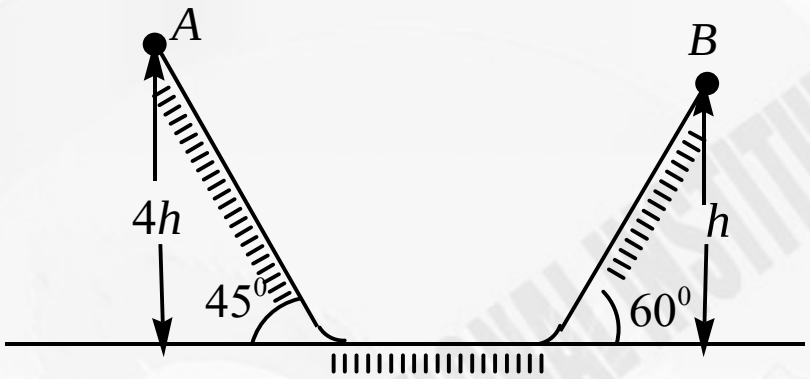
12. Two identical balls A and B are released from the position shown in fig. They collide elastically with each other on the horizontal portion. The ratio of heights attained by A an B after collision is (neglect friction and neglect collision of balls at corners with horizontal surface)



1) 1 :4 **2)** 2: 1 **3)** 4 :13 **4)** 2:5

13. The acceleration of a particle as seen from two frames S_1 *and* S_2 have equal magnitudes $4\,m/s^2$

1) The frames must be at rest with respect each other.

2) The frames may be moving with respect to each other but neither should be accelerated with respect to the other.

3) The acceleration of S_2 with respect to S_1 may be either zero or $8m/s^2$

4) The acceleration of S_2 with respect to S_1 may have any value between zero and $8m/s^2$

14. Assertion : Resolving power of a telescope is more if the diameter of the objective lens is less.
Reason : Objective lens of larger diameter collects more light.

1) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion

2) If both Assertion and Reason are correct and the Reason is not a correct explanation of the Assertion.

3) If the Assertion is correct but Reason is incorrect

4) If the Assertion is incorrect and Reason is correct

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15. **Statement 1 :** Work done by a gas in isothermal expansion is more than the work done by the gas in the same expansion, adiabatically

Statement 2 : Temperature remains constant in isothermal expansion, and not in adiabatic expansion

STATEMENT 1(Assertion) and STATEMENT 2(Reason). question has the 4 choices (a), (b), (c) and (d) out of which **ONLY ONE** is correct.

1)Statement 1 is True, Statement 2 is True;Statement 2 **is** correct explanation for Statement 1

2) Statement 1 is True, Statement 2 is True; Statement 2 **is not** correct explanation for Statement 1

3) Statement 1 is True, Statement 2 is False

4) Statement 1 is False, Statement 2 is True

16. Images formed of an object placed between two plane mirrors at an angle lie on a

1) Circle **2)** ellipse **3)** straight line **4)** none of these

17. STATEMENT -1: For an observer looking out through the window of a fast-moving train, the nearby objects appear to move in the opposite direction to the train, while the distant objects appear to the stationary.

STATEMENT -2: If an observer and the object are moving with the velocities V_1 and V_2 respectively with reference to a laboratory frame, the velocity of the object with respect to the observer is $V_1 - V_2$.

1) Statement-1is true, statement -2 is true; statement-2 is a correct explanation for Statement-1.

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.

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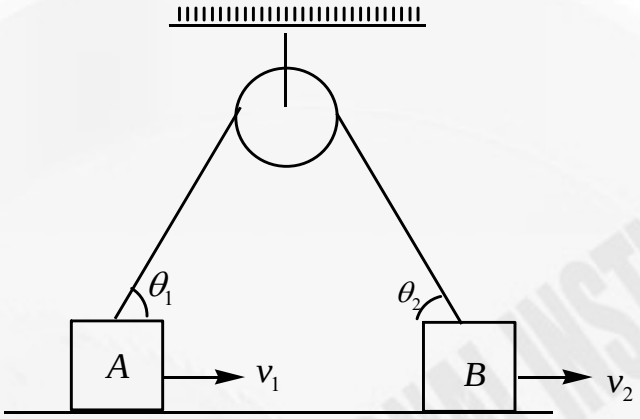
18. In the figure shown, blocks A and B move with velocities v_1 and v_2 along horizontal direction. Find the ratio of v_1 / v_2

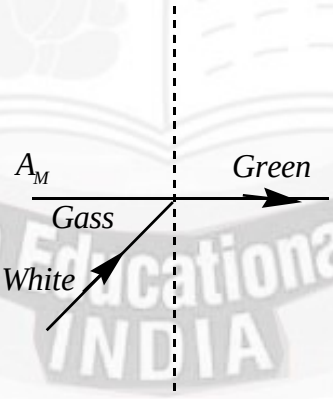


1) $\frac{\sin\theta_1}{\sin\theta_2}$ **2)** $\frac{\sin\theta_2}{\sin\theta_1}$ **3)** $\frac{\cos\theta_2}{\cos\theta_1}$ **4)** $\frac{\cos\theta_1}{\cos\theta_2}$

19. A given object takes n times more time to slide down 45^0 rough inclined plane as it takes to slide down a perfectly smooth 45^0 incline of same dimensions. The coefficient of kinetic friction between the object and the incline is

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

20. White light is incident on the interface of glass and air as shown in the figure. If green light is just grazing the interface then the emerging ray in air contains



1) Yellow, orange, red **2)** Violet,indigo,blue

3) All colours **4)** All colours except green

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(NUMERICAL VALUE TYPE)

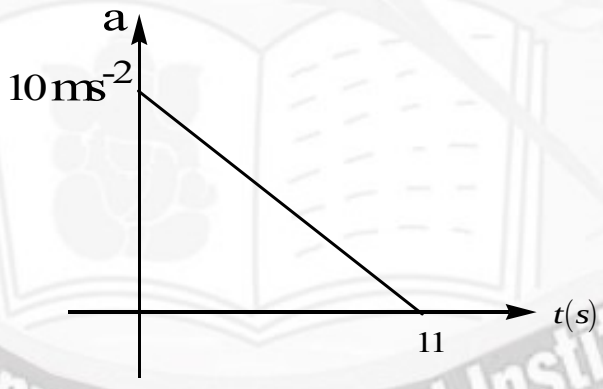
Section-II contains 10 **Numerical Value Type** questions. Attempt any 5 questions only. First 5 attempted questions will be considered if more than 5 questions attempted. The Answer should be within **0 to 9999.** If the Answer is in **Decimal** then round off to the **nearest Integer** value (Example 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. In a Young's double-slit experiment, the slit separation is 0.5 mm and the screen is 0.5 m away from the slit. For a monochromatic light of wavelength 500 nm, the separation of 3rd maxima from the 2nd minima on the other side of central maxima is (in μm)

22. The one division of main scale of Vernier calipers reads 1 mm and 10 divisions of Vernier scale is equal to the 9 divisions on main scale. When the two jaws of the instrument touch each other, the zero of the Vernier lies to the right of zero of the main scale and its fourth Division coincides with a main scale division**.** When a spherical bob is tightly placed between the two jaws, the zero of the Vernier scale lies in between 4.1 cm and 4.2 cm and 6th vernier division coincides with a main scale division. The diameter of the bob will be… $\times 10^{-2} cm$

23. A particle starts from rest. Its acceleration(a) versus time (t) is as shown in the figure. The maximum speed of the particle will be $(in\, m\, s^{-1})$



24. A light inextensible string that goes over a smooth fixed pulley as shown in the figure connects two blocks of masses 0.36 kg and 0.72 kg . Taking $g = 10\, m/s^2$ find the work done (in joules) by the string on the block of mass 0.36 kg during the first second after the system is released from rest

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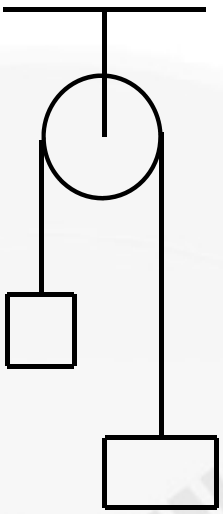
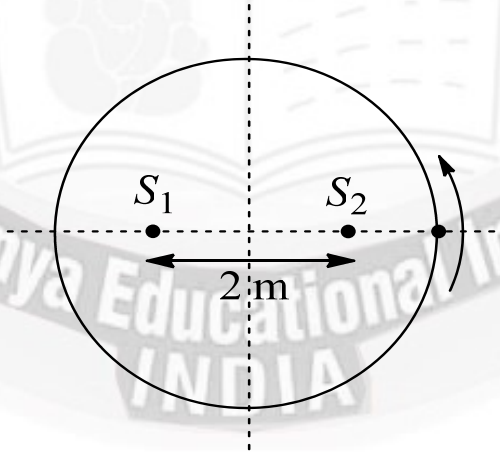


25. A Carnot's engine working between 300 K and 600 K has a work output of 800 J per cycle. How much heat energy is supplied to the engine from the source in each cycle? (in Joule)

26. A ray of light is incident at an angle of 60^0 on one face of a prism which has refracting angle of 30^0.The ray emerging out of the prism makes an angle of 30^0 with the incident ray. If the refractive index of the material of the prism is $\mu = \sqrt{a}$, find the value of a.

27. Two point sources separated by 2.0 m are radiating in phase with $\lambda = 0.50\,\text{m}$. A detector moves in a circular path around the two sources in a plane containing them. How many maxima are detected?



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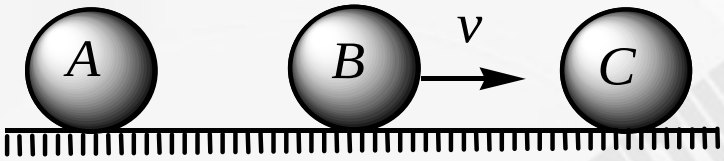
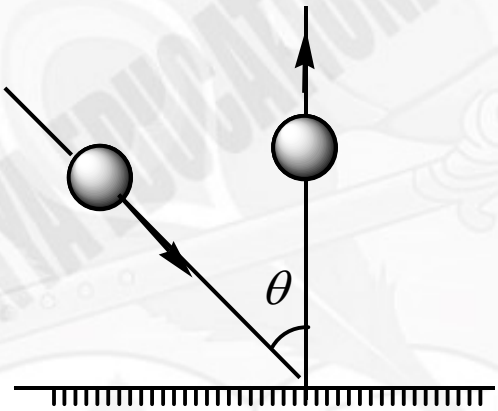
28. Three balls A,B and C $\left(m_A = m_C = 4m_B\right)$ are placed on a smooth horizontal surface. Ball B collides with ball C with an initial velocity *v* as shown in Fig. Find the total number of collisions between the balls (all collisions are elastic)



29. A ball of mass 1 kg moving with a velocity of 5 m/s collides elastically with rough ground at an angle θ with the vertical as shown in Fig. What can be the minimum coefficient of friction if ball rebounds vertically after collision? (given $\tan\theta = 2$)



30. A point object is placed at a distance of 25cm from a convex lens. Its focal length is 22cm. A glass slab of refractive index 1.5 is inserted between the lens and the object, then the image is formed at infinity. Find the thickness of the glass slab (in cm)

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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. A reaction of benzonitrile with one equivalent CH_3MgBr followed by hydrolysis produces a yellow liquid "P". The compound "P" will give positive _____.

1) Schiff's test **2)** Tollen's test **3)** Iodoform test **4)** Ninhydrin's test

32. The increasing order of the reactivity of the following compounds in nucleophilic addition reaction is : Propanal, Benzaldehyde, Propanone, Butanone

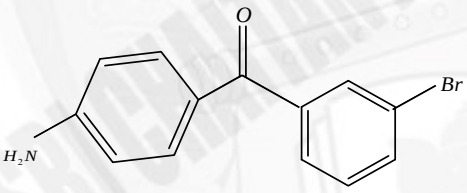
1) Benzaldehyde>Butanone< Propanone < Propanal

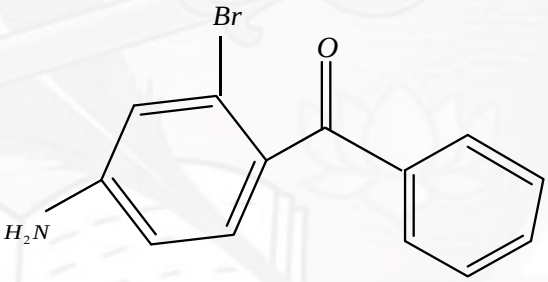
2) Butanone< Propanone < Benzaldehyde < Propanal

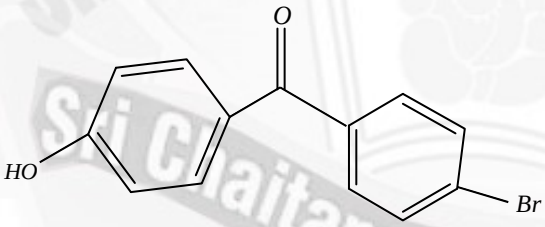
3) Benzaldehyde< Propanal < Propanone < Butanone

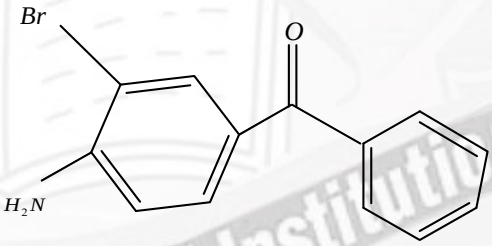
4) Propanal< Propanone < Butanone < Benzaldehyde

33. p-Aminobenzophenone upon reaction with bromine in carbon tetrachloride gives:

1) 

2) 

3) 

4) 

34. Which one of the following reactions will not yield propionic acid?

1) $CH_3CH_2CCl_3 + OH^- / H_3O^+$

2) $CH_3CH_2COCH_3 + IO^- / H_3O^+$

3) $CH_3CH_2CH_2OH + KMnO_4 / H^+$

4) $CH_3CH_2CH_2Br + Mg, CO_2$ dry ether $/ H_3O^+$

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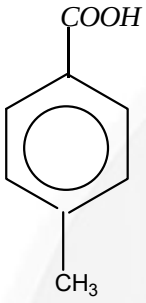
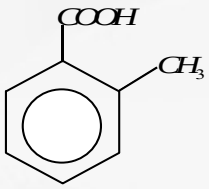
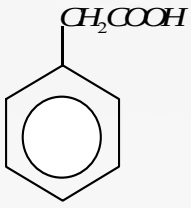
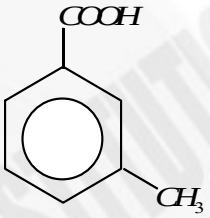
35. [P] on treatment with $Br_2/FeBr_3$ in CCl_4 produced a single isomer $C_8H_7O_2Br$ while heating [P] with sodalime gas gives toluene. The compound [P] is

1) 

2) 

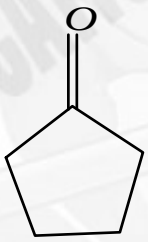
3) 

4) 

36. $CH_2-CH_2-CO_2H \xrightarrow[BaCO_3]{\Delta} A \xrightarrow{NH_2-NH_2} B \xrightarrow[KOH]{heat} (C),\ product(C)\ obtained\ is:$

$CH_2-CH_2-CO_2H$

1) $CH_3-CH=CH-CH_3$

2) 

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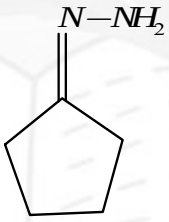
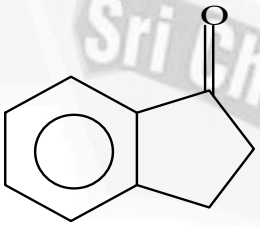
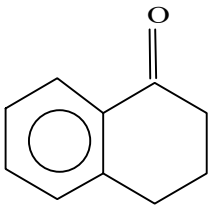
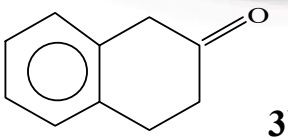
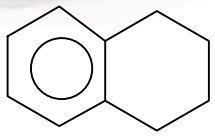
4) 

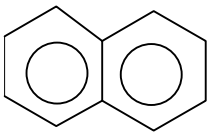
37. 

$\xrightarrow[(3)\ NaNO_2/H^+]{(1)\ HCN,\ (2)\ LiAlH_4} (A)_{major}.\ Product(A)\ is:$

1) 

2) 

3) 

4) 

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38. Given below are two statement:

Statement I: The esterification of carboxylic acid with an alcohol is a nucleophilic substitution

Statement II: Electron withdrawing groups in the carboxylic acid will increase the rate of esterification reaction.

Choose the most appropriate option:

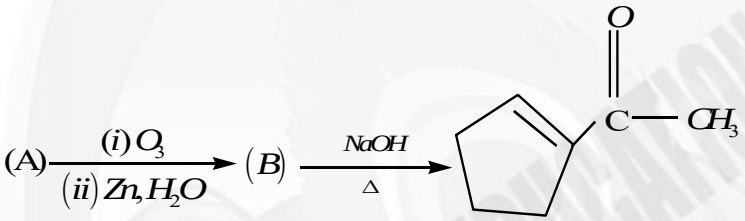
1) Both Statement I and Statement II are correct.

2) Both Statement I and Statement II are incorrect.

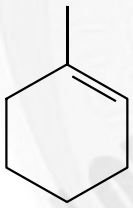
3) Statement I is correct but Statement II is incorrect.

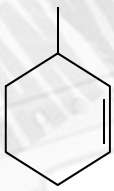
4) Statement I is incorrect but Statement II is correct.

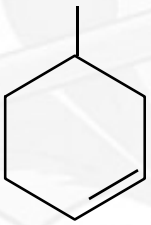
39.

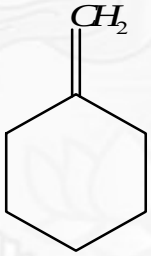


the reactant (A) will be :

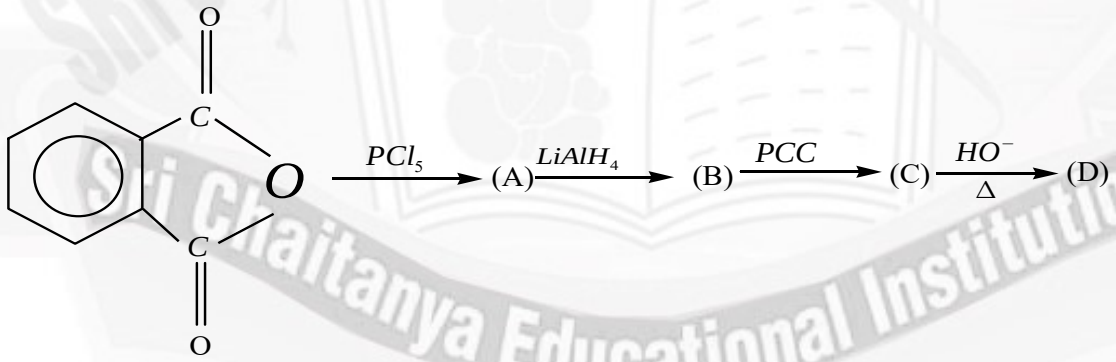
1) 

2) 

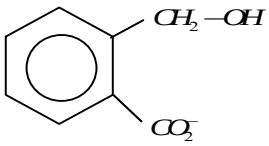
3) 

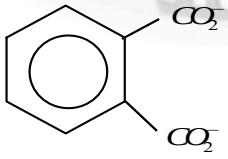
4) 

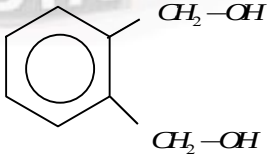
40.

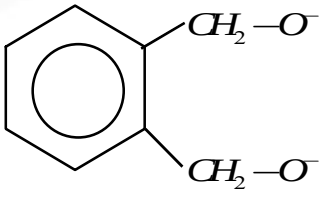


Compound D is :

1) 

2) 

3) 

4) 

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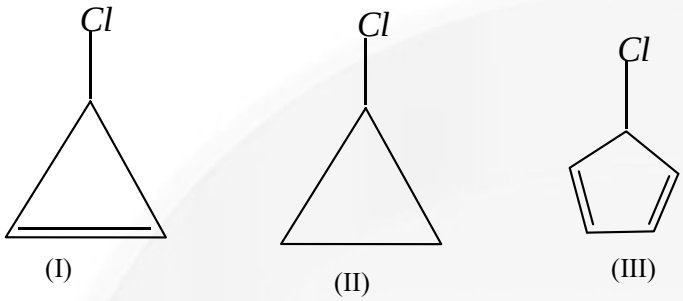
41. Order of rate of reaction with $AgNO_3$ or rate of S_N1



(I) (II) (III)

1) $I > III > II$ **2)** $II > III > I$ **3)** $I > II > III$ **4)** $III > I > II$

42. **Assertion (A):** Aryl Iodides can be prepared by reaction of arenes with iodine in the presence of an oxidizing agent.

Reason: (R) : Oxidising agent oxidizes I_2 into HI.

1) Both A and R are true and R is the correct explanation to A

2) Both A and R are true and R is not the correct explanation to A

3) A is true but R is false

4) A is false but R is true

43. **Assertion (A):** Nitration of chlorobenzene leads to the formation of m-nitrochlorobenzene

Reason: (R) : NO_2 group is a m-directing group.

1) Both A and R are true and R is the correct explanation to A

2) Both A and R are true and R is not the correct explanation to A

3) A is true but R is false

4) A is false but R is true

44. Glycerol $\xrightarrow{KHSO_4} A \xrightarrow{NaBH_4} B$, A and B are;

1) Acrolein, allyl alcohol **2)** Glyceryl sulphate, acrylic acid

3) Allyl alcohol, Acrolein **4)** Only Acrolein (B is not formed)

45. Given below are two statement:

Statement-I: Tropolone is an aromatic compound and has 8π electrons.

Statement-II: π *electrons of* $>C=O$ group in tropolone is involved in aromaticity.

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

1) Both statement I and statement II are true

2) Statement I is true but statement II is false

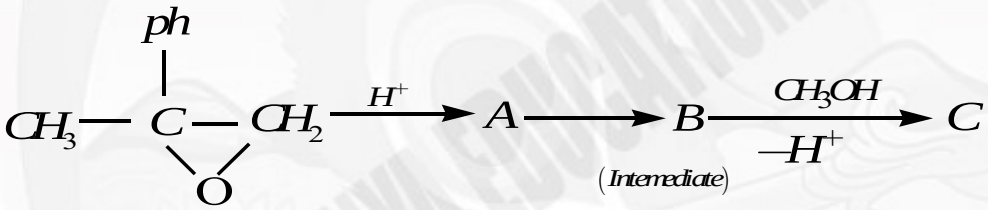
3) Statement I is false but statement II is true

4) Both statement I and statement II are false

46. When benzene sulphonic acid and 2,4- di nitrophenol are treated with $NaHCO_3$ the gases released respectively are

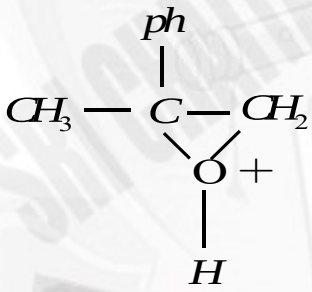
1) SO_2, NO_2 **2)** SO_2, NO **3)** SO_2, CO_2 **4)** CO_2, CO_2

47.



C will be

1)



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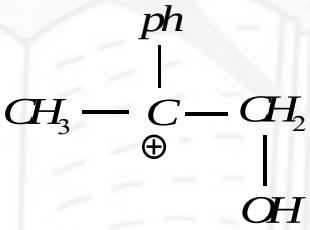

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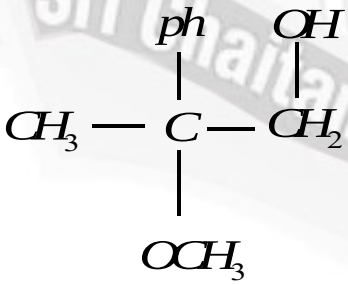

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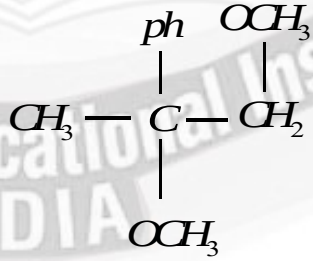

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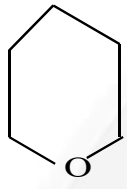
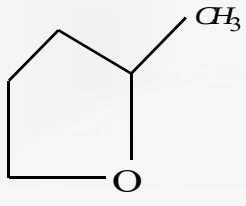
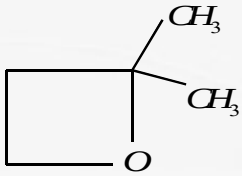
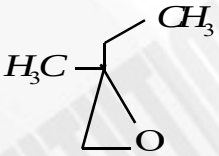
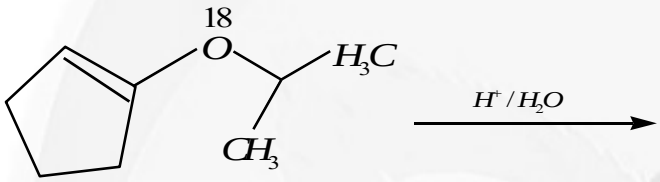
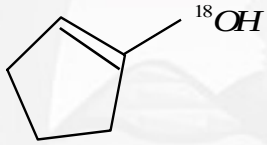
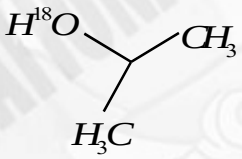
48. A chiral $C_5H_{10}O$ ether reacts with hot HI to give a $C_5H_{10}I_2$ products. Treatment of this with hot KOH in ethanol produces 1,3-pentadiene. What is the structure of the original ether?

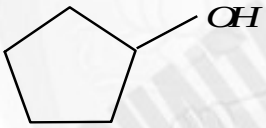
1) 
2) 
3) 
4) 

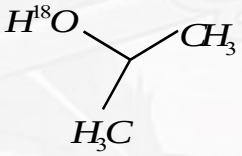
49. 

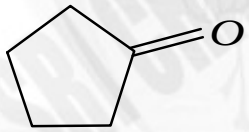
products formed are

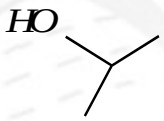
1) 

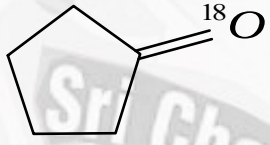
& 

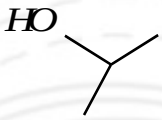
2) 

& 

3) 

& 

4) 

& 

50. S-I : 2-metyl butan-2-ol on heating with H_2SO_4 gives 2- methyl but-2-ene.

S-II: The dehydration of 3^o alcohols occurs through carbocation formation followed by elimination of H^+.

1) S-I & II are correct, S-II is correct explanation of S-I
2) S-I & II are correct, S-II is not correct explanation of S-I
3) S-I is true, but S-II is false
4) S-I is false, but S-II is true

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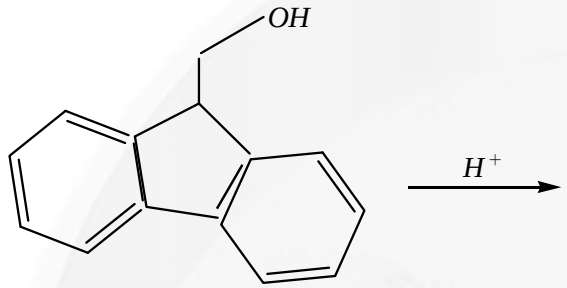
(NUMERICAL VALUE TYPE)

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.

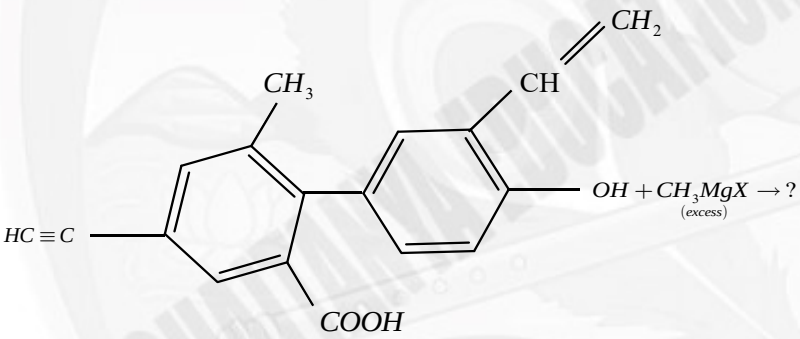
51.



The number of Pi bonds in the final product is

52. A polyhydric alcohol of mol. Wt 92, on benzoylation gives a benzoyl derivative of mol. Wt 404. The number of hydroxyl groups in the alcohol are……

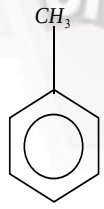
53.

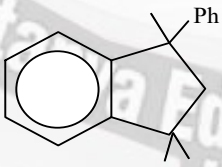


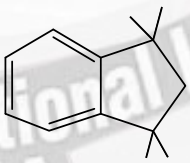
How many moles alkane will be formed?

54. The total number of alkenes possible (including stereo) by dehydro bromination of 3-bromo-3-cyclopentyl hexane using alcoholic KOH is

55. Examine the structural formula shown below and find out how many compounds will show oxidation reaction with acidic $KMnO_4$ to give benzoic acid?

A. 

B. 

C. 

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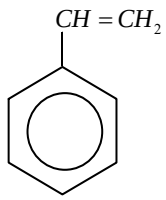
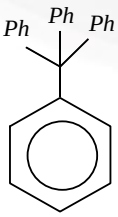
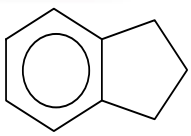
E. 

F. 

G. 

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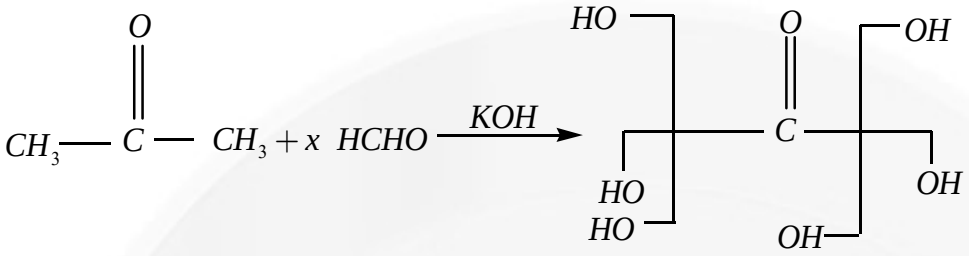
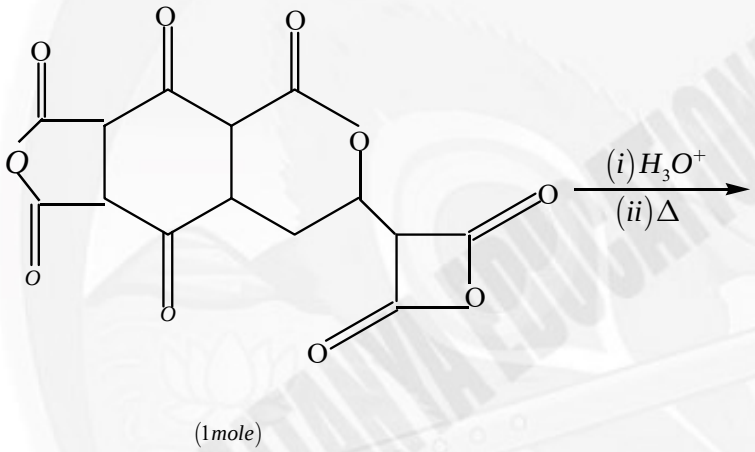
56.



X = moles of HCHO consumed.

Value of (x) will be

57. Total number of moles of $CO_2(\uparrow)$ released in following process.



$(1 mole)$

58. How many of the following compounds will give haloform reaction.

a) CH_3COOCH_3 **b)** CH_3CHO **c)** $CH_3CH(OH)CH_2CH_3$ **d)** CH_3CH_2OH

e) $C_6H_5COCH_3$ **f)** $CH_3CH_2COCH_2CH_3$ **g)**

h) CH_3COOH **i)** $CH_3COCH_2COCH_3$

59. A hydrocarbon 'X' is found to have molar mass of 80. A 10.0 mg of compound 'X' on hydrogenation consumed 8.40 mL of H_2 gas (measured at STP). Ozonolysis compound 'X' yields only formaldehyde and dialdehyde. The total number of fragments/molecules produced from the ozonolysis of compound 'X' is _____

60. How many of the following reagents are required for the following conversion :

$$R-CH_2-CH_2-OH \rightarrow R-CH_2-CH_2-COOH$$

a) PBr_3 **b)** KCN **c)** SeO_2 **d** $KOH(alc)$ **e)** H_3O^+

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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. The area of the region enclosed by the curve $y = x^3$ and its tangent at (1,1), x-axis is ____ sq. units.

1) $\frac{27}{4}$ **2)** $\frac{23}{4}$ **3)** $\frac{1}{12}$ **4)** $\frac{27}{12}$

62. The area bounded by the curve $|y| + \frac{1}{2} = e^{-|x|}$ is ____

1) $2(1-\log_e 2)$ **2)** $2(1+\log_e 2)$ **3)** $4(1+\log_e 2)$ **4)** $\frac{1}{4}(1-\log_e 2)$

63. Area bounded by the curves $y=\left[\frac{x^2}{64}+2\right], x \in (-8,8)$, y=x-1 and x=0 above x-axis is ____ sq. units.[.] $\rightarrow$G.I.F

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

64. Area bounded by the ellipse $3x^2 + 4xy + 3y^2 = 1$ is _____ sq. units.

1) $\frac{\pi}{4\sqrt{5}}$ **2)** $\frac{\pi}{3\sqrt{5}}$ **3)** $\frac{\pi}{2\sqrt{5}}$ **4)** $\frac{\pi}{\sqrt{5}}$

65. Area bounded by the curve $y = \cos^{-1}(\cos x)$ with x-axis in $[0, 2\pi]$ is _____ sq. units.

1) $\frac{\pi^2}{4}$ **2)** $\frac{\pi^2}{8}$ **3)** $\frac{\pi^2}{6}$ **4)** π^2

66. Differential equation with general solution $y = \left(\sin^{-1} x\right)^2 + A\left(\cos^{-1} x\right) + B$ where A, B are arbitrary constants is ____.$(y_1, y_2$ *derivatives of* $y)$

1) $(1+x^2)y_2 - xy_1 = 2$ **2)** $(1-x^2)y_2 - xy_1 = 1$

3) $(1-x^2)y_2 - xy_1 = 2$ **4)** $(1-x^2)y_2 + xy_1 = 2$

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67. Let y=y(x) of the differential equation.

$x\sqrt{x^2-1}\,dy - y\sqrt{y^2-1}\,dx = 0$ *satisty* $y(2)=\frac{2}{\sqrt{3}}$

statement 1: $y(x)=\sec\left(\sec^{-1}x-\frac{\pi}{6}\right)$

statement 2: $y(x)$ *is given by* $\frac{1}{y}=\frac{2\sqrt{3}}{x}-\sqrt{1-\frac{1}{x^2}}$

1) Both statement -1 ,2 are true

2) Neither statement -1 ,2 are true

3) statement-1 is true , statement -2 is False

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

68. Solution of the differential equation $\frac{dy}{dx}=\frac{x+y+7}{2x+2y+3}$ is _____.

1) $6(x+y)+11\log(3x+3y+10)=9x+c$

2) $6(x+y)-11\log(3x+3y+10)=9x+c$

3) $(x+y)-\log\left(x+y+\frac{10}{3}\right)=x+c$

4) $3(x+y)-\log(x+y+10)=9x+c$

69. **Statement I:** Orthogonal trajectories of the family of hyperbolas $xy = c^2$ (where 'c' is a constant) is $y^2 - x^2 =$ constant

Statement II: Orthogonal trajectories of the curve $x^{2/3} + y^{2/3} = a^{2/3}$ (where 'a' is constant) is $x^{4/3} - y^{4/3} =$ constant, then

1) only statement 1 is true **2)** only statement II is true

3) both statement I and II are true **4)** neither statement I,II are true

70. The curve amongst the family of curves given by the differential equation $(x^2 - y^2)dx + 2xydy = 0$ which passes through (1,1) is ____.

1) A circle with centre on the y-axis.

2) A circle with centre on the x-axis.

3) An ellipse with major axis along y-axis.

4) A hyperbola.

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71. Let $f(x)=\text{sgn}(\sin^2 x+2\sin x-3), x\in R$ and $g(x)=x^2+(2m+6)x+(4m+12)$. If $g(x)$ is less than M for at least one real x, where 'M' is maximum value of $f(x)$ then 'm' cannot be (sgn=signum function)

1) -3 **2)** -4 **3)** 2 **4)** 3

72. Let $f(x)=\dfrac{\sin\frac{\pi[x]}{4}}{[x]}$ then which of the following does not hold good,.[.]is G.I.F

1) f is continuous at $x=\dfrac{3}{2}$ **2)** f is discontinuous at x=2

3) f is differential at $x=\dfrac{4}{3}$ **4)** $f(x)$is continuous at every point.

73. Assertion (A) : Let $f:R\to R$ be a function defined by $f(x)=x^3+x-1$ and 'g' is inverse of f,then the value of $\dfrac{g(9)}{g^1(9)}$=26 $\left(g^1 \text{ is the derivative of } g\right)$

Reason (R): g is inverse of f $\Rightarrow g(f(x))=x$

1) Both A and R are true and R is the correct explanation to A

2) Both A and R are true and R is not the correct explanation to A

3) A is true but R is false

4) A is false but R is true

74. **Assertion:** The shortest distance between the line $y=2x$ and $y^2=x-2$ is $\dfrac{31}{8\sqrt{5}}$

Reason: Shortest distance between two curves happens along the common normal

1) Both A and R are true and R is the correct explanation to A

2) Both A and R are true and R is not the correct explanation to A

3) A is true but R is false

4) A is false but R is true

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75. If f(x) and g(x) are continuous functions in [a,b] and differentiable in (a,b) then there exists atleast one $c\in(a,b)$ for which $\begin{vmatrix} f(a) & f(b) \\ g(a) & g(b) \end{vmatrix} =$

1) $\frac{1}{b-a}\begin{vmatrix} f(a) & f^1(c) \\ g(a) & g^1(c) \end{vmatrix}$ **2)** $(b-a)\begin{vmatrix} f(a) & f^1(c) \\ g(a) & g^1(c) \end{vmatrix}$

3) $f(a).g^1(c)-g(a).f^1(c)$ **4)** $\frac{1}{ab}\left(f^1(c).g^1(c)\right)$

76. The value of $\int_{\frac{1}{\sqrt{3}}}^{\sqrt{3}} \frac{1}{1+x^{2024}}.\frac{1}{1+x^2}dx =$

1) $\frac{\pi}{4}$ **2)** $\frac{\pi}{6}$ **3)** $\frac{\pi}{12}$ **4)** $\frac{\pi}{2}$

77. The value of $\int_0^{\frac{1}{2}} \frac{1}{\sqrt{1-x^{2n}}}dx, (n\in N)$ is _____.

1) $\le\frac{\pi}{6}$ **2)** ≥ 1 **3)** $\le\frac{\pi}{12}$ **4)** $\ge\frac{\pi}{6}$

78. If $I_n=\int_0^{\frac{\pi}{2}} \cos^n x.\cos nx dx$ then I_1,I_2,I_3 are in ____.

1) AGP **2)** HP **3)**GP **4)**AP

79. If $\int \frac{2x^7+3x^2}{x^{10}-2x^5+1}dx=\frac{ax^3+bx^8}{x^{10}-2x^5+1}+C$ then

1) a=1,b=-1 **2)** $a=\frac{1}{2},b=\frac{1}{2}$

3) $a=2,b=-2$ **4)** $a=3,b=-3$

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80. If $x.f(x)=3f^2(x)+2$ then $\int \frac{2x^2-12x\ f(x)+f(x)}{(6f(x)-x)\left(x^2-f(x)\right)^2}dx$

1) $\frac{2}{x^2-f(x)}+c$ **2)** $\frac{2}{x^2+f(x)}+c$ **3)** $\frac{1}{x^2+f(x)}+c$ **4)** $\frac{1}{x^2-f(x)}+c$

(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.

81. The area bounded by the curves $y=\log_e x,\ y=\log_e|x|,\ y=|\log_e x|,\ y=|\log_e|x||$ is ____.

82. The value of 'c' for which the area enclosed by $y=\frac{4}{x^2}, x=1$ *and* $y=c^2$ *is* 49 *sq.units is*

83. *If* $x.\phi(x)=\int_5^x\left(3t^2-2\phi^1(t)\right)dt, x>-2$ *and* $\phi(0)=4$, *then* $(\phi(2))^4$

84. If $y=y(x)$ and $\left(\frac{2+\sin x}{y+1}\right)\left(\frac{dy}{dx}\right)=-\cos x, y(0)=1$ then $\left[y\left(\frac{\pi}{2}\right)\right]$=_____. Where([.]→ G.I.F)

85. A normal at P(x,y) on a curve meets the x-axis at Q and N is the foot of ordinate at P .If NQ= $\frac{x\left(1+y^2\right)}{1+x^2}$ then equation of curve passing through the point (3,1) is $x^2-5y^2=k$ then k=

86. The number of integers in the range of the function $f(x)=4\left|\frac{\left(\sqrt{\cos x}-\sqrt{\sin x}\right)\left(\sqrt{\cos x}+\sqrt{\sin x}\right)}{\cos x+\sin x}\right|$ is

87. If $f(x)=\lim_{x\to\infty}\left(\frac{2x^2+2x+1}{x^2+x+2}\right)^{\frac{6x+1}{3x+2}}$ then $(1+f(x))^3$ =____

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88. Let $f(x)$ be a polynomial of degree '4' having extreme values at $x=1$ and $x=2$ and if $\lim_{x\to 0}\left(1+\frac{f(x)}{x^2}\right)=3$ then $f(2)=$_____.

89. *The value of* $\int_0^{\frac{\pi}{2}} \frac{2024\sin^{2023}x-2020\cos^{2023}x}{\sin^{2023}x+\cos^{2023}x}\,dx$ *is* λ *then* $[2\lambda]=$_____(Where [.]Denotes G.I.F)

90. If $f(x)=x^3-\frac{3x^2}{2}+x+\frac{1}{4}$ then the value of $\left(\int_{\frac{1}{4}}^{\frac{3}{4}} f(f(x))dx\right)^{-1}=$

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