# 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) & LIIT _BT** **JEE-MAIN** **Date: 18-01-2023**

**Time: 09.00Am to 12.00Pm** **GTM-08** **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:** _____

**18-01-23_Sr.Super60_(NUCLEUS,STERLING) & LIIT _BT_Jee-Main_GTM-08_Test Syllabus**

**PHYSICS** : TOTAL SYLLABUS

**CHEMISTRY** : TOTAL SYLLABUS

**MATHEMATICS** : TOTAL 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.

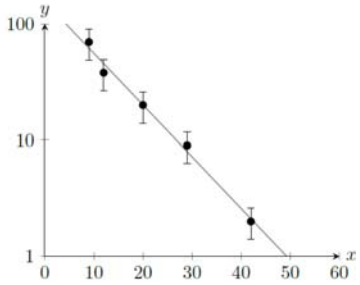
**Marking scheme: +4 for correct answer, 0 if not attempted and –1 in all other cases.**

**1.** A perfectly absorbing, black, solid sphere with constant density and radius R, remains stationary above the sun. This is because the gravitational attraction of the sun is balanced by the pressure due to the sun's light. Assume the sun is far enough away such that it closely approximates a point source of light. The distance from the centre of the sun at which the sphere remains stationary is :

**1)** proportional to R. **2)** proportional to 1/R

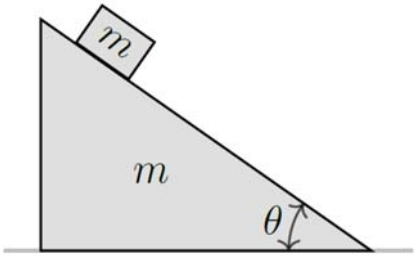
**3)** proportional to $1/R^2$. **4)** independent of R.

**2.** The following graph shows the results of measurements of two physical quantities, y and x. What is the following option best describes the functional dependence of y on x? A and B are positive constants.



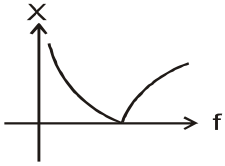

**1)** $y = Ax + B$ **2)** $y = Ax - B$ **3)** $y = Ae^{Bx}$ **4)** $y = Ae^{-Bx}$

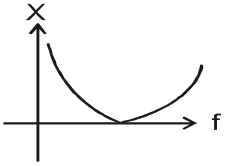
**3.** A block of mass m is placed on a wedge of mass m, inclined at an angle $\theta$, to the horizontal. The coefficients of friction between the block and wedge, and the wedge and ground, are high enough for both the block and the wedge to remain static. What is the magnitude of the friction force of the ground on the wedge?

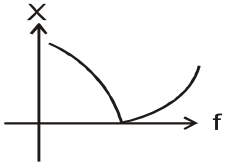


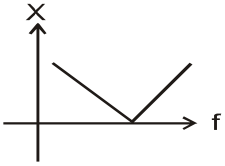

**1)** $mg\sin\theta$ **2)** $mg\cos\theta$ **3)** $mg\tan\theta$ **4)** 0

**4.** In a series L, C circuit, which of the following represents variation of magnitude of reactance (X) with frequency (f)

**1)** 


**2)** 

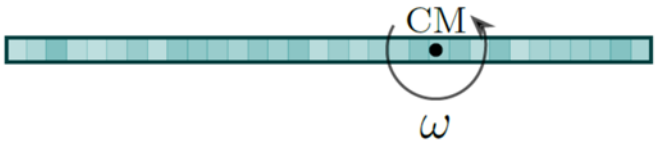

**3)** 


**4)** 

**5.** Two identical spherically symmetric planets, each of mass M, are somehow held at rest with respect to each other. Each planet has radius R, and the distance between the centers of the planets is 4R. If a rocket is launched from the surface of one planet with speed v, what is the minimum speed v so that the rocket can reach the other planet?

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

**6.** A thin rod has a non-uniform density. It is mounted on an axle passing perpendicular to it, through its center of mass, as shown, and is then rotated about the axle.




The axle divides the rod into two parts, one on each side of it. Which of the following must be true, no matter how the mass in the rod is distributed?

**1)** The two parts have the same mass.

**2)** The magnitudes of the momentum of the two parts are equal.

**3)** The magnitudes of the angular momentum of the two parts, about the center of mass, are equal.

**4)** The kinetic energies of the two parts are equal.

**7.** A dip circle is so set that the dip needle moves freely in the magnetic meridian. In this position the angle of dip is 39°. Now the dip circle is rotated so that the plane in which the needle moves makes an angle of 30° with the magnetic meridian. In this position, the needle will dip by an angle :

**1)** exactly 39° **2)** 30° **3)** more than 39° **4)** less than 39°

**8.** **Statement-1 :** Sky wave signals are used for long distance radio communication. These signals are in general, less stable than ground wave signals.

**Statement -2 :** The state of ionosphere varies from hour to hour, day to day and season to season.

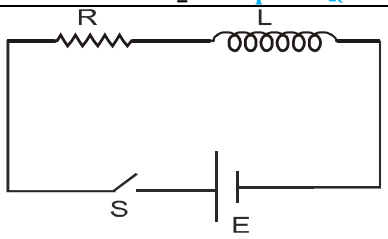
**1)** Statement -1 is true, Statement -2 is true and Statement – 2 is the correct explanation of Statement – 1.

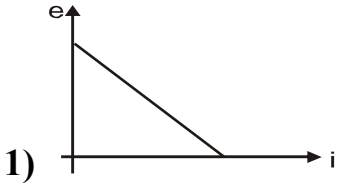
**2)** Statement -1 is true, Statement -2 is true and Statement -2 is not correct explanation of Statement -1.

**3)** Statement -1 is true, Statement -2 is false

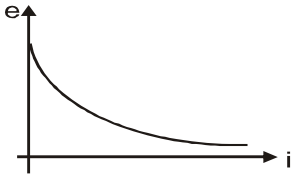
**4)** Statement -1 is false, Statement -2 is true.

**9.** In an L-R circuit connected to a battery of constant e.m.f. E switch S is closed at time t = 0. If e denotes the induced e.m.f. across inductor and i the current in the circuit at any time t. Then which of the following graphs shows the variation of e with i ?

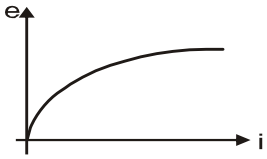


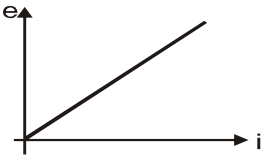

**1)**




**2)**




**3)**




**4)**

10. **STATEMENT–1 :** Two charged particles are released from rest in gravity free space. After some time, one particle will exert a non-zero magnetic force on the other particle in addition to electrostatic force.

**STATEMENT–2:** A moving charge produces magnetic field. Also a magnetic force may act on a charged particle moving in an external magnetic field.

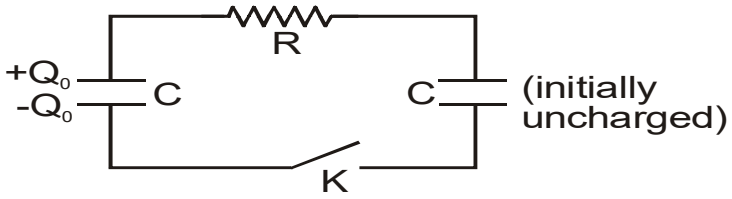
**1)** Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1

**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

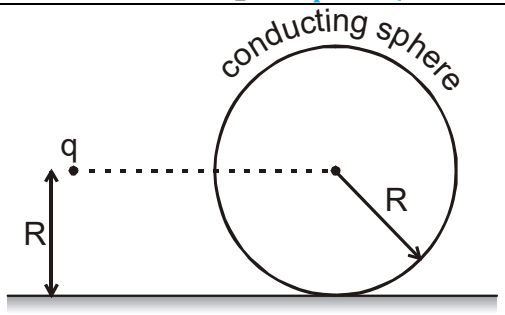
**4)** Statement-1 is False, Statement-2 is True.

**11.** The shown circuit comprises of two identical capacitors of capacitance C Farad and resistor of resistance $R\Omega$. The key K is initially open. At time t = 0 the charge on left capacitor is $Q_0$ Coloumbs and the right capacitor is uncharged as shown. The key K is closed at time t = 0. Then the magnitude of current in amperes through the resistor at any later time t (in sec.) is :



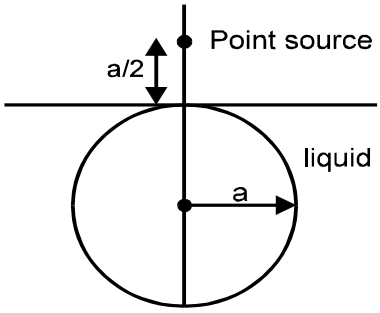

**1)** $\frac{Q_0}{RC}e^{\frac{-t}{RC}}$ **2)** $\frac{Q_0}{RC}e^{\frac{-2t}{RC}}$ **3)** $\frac{Q_0}{2RC}e^{\frac{-2t}{RC}}$ **4)** $\frac{Q_0}{2RC}e^{\frac{-t}{RC}}$

**12.** A point charge +q is fixed at same height as centre of an uncharged conducting sphere placed on a smooth horizontal surface as shown in figure. Neglect the induced charges on horizontal surface. The conducting sphere is released from rest. Then the conducting sphere.



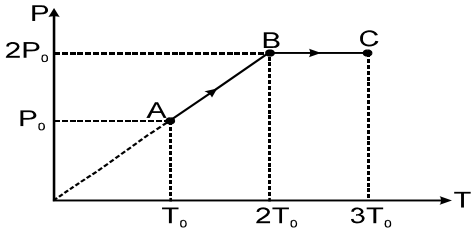

**1)** rolls towards left
**2)** under goes translational motion towards left
**3)** rotates about its centre
**4)** continues to remain at rest

**13.** An opaque sphere of radius a is just immersed in a transparent liquid as shown in figure. A point source is placed on the vertical diameter of the sphere at a distance a/2 from the top of the sphere. One ray originating from the point source after refraction from the air liquid interface forms tangent to the sphere. The angle of refraction for that particular ray is 30º. The refractive index of the liquid is



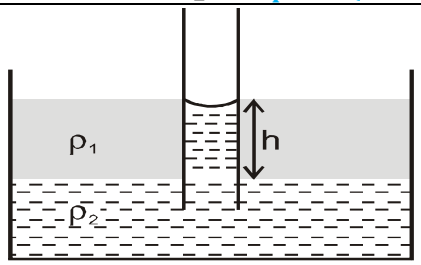

**1)** $\frac{2}{\sqrt{3}}$ **2)** $\frac{3}{\sqrt{5}}$ **3)** $\frac{4}{\sqrt{5}}$ **4)** $\frac{4}{\sqrt{7}}$

**14.** One mole of ideal diatomic gas is taken from state $A \to B \to C$ as shown in P-T diagram. The total heat absorbed by the gas in the complete process is




**1)** $2RT_0$ **2)** $3RT_0$ **3)** $4RT_0$ **4)** $6RT_0$

**15.** A container is partially filled with a liquid of density $\rho_2$. A capillary tube of radius r is vertically inserted in this liquid. Now another liquid of density $\rho_1 (\rho_1 < \rho_2)$ is slowly poured in the container to a height h as shown. There is only denser liquid in the capillary tube. The rise of denser liquid in the capillary tube is also h. Assuming zero contact angle, the surface tension of heavier liquid is

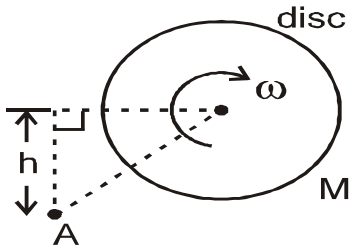



**1)** $r\rho_2 gh$ **2)** $2\pi r\rho_2 gh$ **3)** $\frac{r}{2}(\rho_2-\rho_1)gh$ **4)** $2\pi r(\rho_2-\rho_1)gh$

**16.** Consider a Carnot refrigerator and a Carnot heat pump operating between the same two thermal energy reservoirs. If the COP of the refrigerator is 3.4 then the COP of the heat pump is

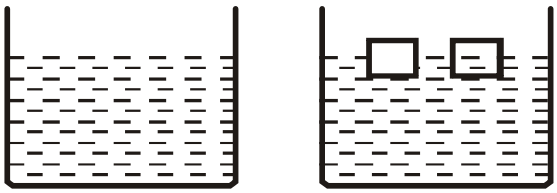
**1)** 1.7 **2)** 2.4 **3)** 3.4 **4)** 4.4

**17.** A uniform disc of mass M and radius R is rotating about its centre of mass (the centre of mass is at rest) with an angular speed $\omega$. The angular momentum of disc about a point A (as shown) will be




**1)** $MR^2\omega + MhR\omega$ **2)** $\frac{1}{2}MR^2\omega$ **3)** $\frac{1}{2}MR^2\omega + MhR\omega$ **4)** None of these

**18.** **Statement-1 :** One of the two identical container is empty and the other contains two ice cubes. Now both the containers are filled with water to same level as shown. Then both the containers shall weigh the same.



**Statement-2 :** The weight of volume of water displaced by ice cube floating in water is equal to the weight of ice cube. Hence both the container in above situation shall weigh the same.

**1)** Statement-1 is 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

**19.** Let the wavelength at which the spectral emissive power of a black body (at a temperature T) is maximum, be denoted by $\lambda_{max}$. As the temperature of the body is increased by 1 K, $\lambda_{max}$ decreases by 1 percent .The temperature T of the black body is

**1)** 100K **2)** 200K **3)** 400K **4)** 288K

**20.** The equation of a wave is given by (all quantity expressed in S.I. units) $Y = 5\sin 10\pi(t - 0.01x)$ along the x-axis. The magnitude of phase difference between the points separated by a distance of 10 m along x- axis is

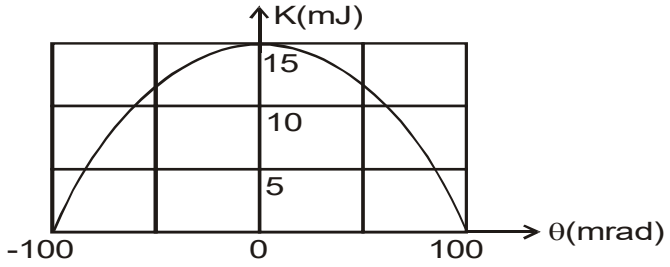
**1)** $\pi/2$ **2)** $\pi$ **3)** $2\pi$ **4)** $\pi/4$

**(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.

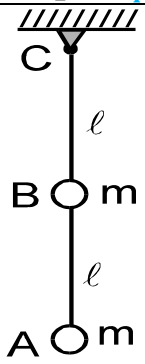
**21.** Figure shows the kinetic energy K of a simple pendulum versus its angle $\theta$ from the vertical. The pendulum bob has mass 0.2 kg. Then the length of the pendulum in centimeters is ____ $\left(g = 10\ m/s^2\right)$.




**22.** In an $\alpha$ -decay the Kinetic energy of $\alpha$ particle is 48 MeV and Q-value of the reaction is 50 MeV. The mass number of the mother nucleus is:_____.(Assume that daughter nucleus is in ground state)

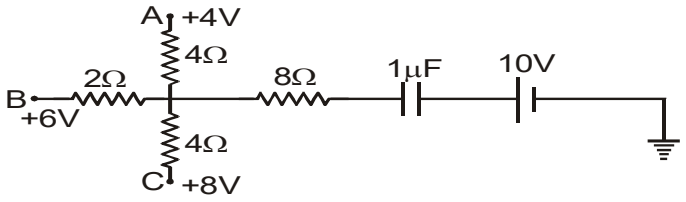
**23.** A thin rod of negligible mass and area of cross-section $2\times10^{-6}\ m^2$, suspended vertically from one end, has a length of 0.5 m at 200°C. The rod is cooled to 0°C, but prevented from contracting by attaching a mass at the lower end. It is given Young's modulus = $10^{11}\ N/m^2$, Coefficient of linear expansion $10^{-5}\ K^{-1}$ and $g = 10\ m/s^2$. Then the value of this mass is _____kg.

**24.** A weightless rod of length $2l$ carries two equal masses 'm', one secured at lower end A and the other at the middle of the rod at B. The rod can rotate in vertical plane about a fixed horizontal axis passing through C. The horizontal velocity must be imparted to the mass at A so that it just completes the vertical circle is $\sqrt{\frac{P}{5}gl}$. Then the value of P is _____ ?




**25.** In YDSE the wavelength used is 600 nm. A transparent slice of thickness 36 micrometer is placed in the path of one wave. The central fringe shifts to 30th bright fringe from the centre then the value of refractive index of the slice is $\frac{x}{2}$, then x= _____.

**26.** Figure shows a part of network of a capacitor and resistors. The potential indicated at A, B and C are with respect to the ground. The charge on the capacitor in steady state is _____ $\mu C$.



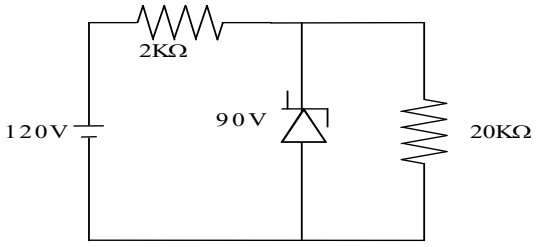

**27.** A uniform magnetic field exists in region given by $\vec{B} = 3\hat{i} + 4\hat{j} + 5\hat{k}$. A rod of length 5 m is placed along y - axis is moved along x - axis with constant speed 1 m/sec. Then induced e.m.f. in the rod is _____ volts.

**28.** A flood light is covered with a filter that transmits red light. The electric field of the emerging beam is represented by a sinusoidal plane wave

$$E_x = 36\sin\left(1.20\times10^7 z - 3.6\times10^{15} t\right) V/m$$

The average intensity of the light will be _____ $W/m^2$. (With nearest integer)

**29.** In the figure shown the potential drop across the series resistor $2K\Omega$ is ___ Volts.




**30.** A band width of 15MHz is available for transmission. If maximum signal frequency used for modulating the carrier is 15kHz, then number of stations which can broadcast without any interference with each other in this band is____.

## 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.** **Statement I:** Magnesium ion is not precipitated in Group – V of salt analysis

**Statement II:** Magnesium ion forms stable complex with ammonia

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

**2)** Statement -1 is true, statement -2 is true; statement -2 is NOT the correct explanation for statement -1.

**3)** Statement -1 is true, statement -2 is false.

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

**32.** **Statement I:** Tin (IV) compounds are more stable than the tin (II) compounds while reverse is true for lead compounds

**Statement II:** Inter pair effect controls the stability of oxidation states of heavier element in group - 14

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

**2)** Statement -1 is true, statement -2 is true; statement -2 is NOT the correct explanation for statement -1.

**3)** Statement -1 is true, statement -2 is false.

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

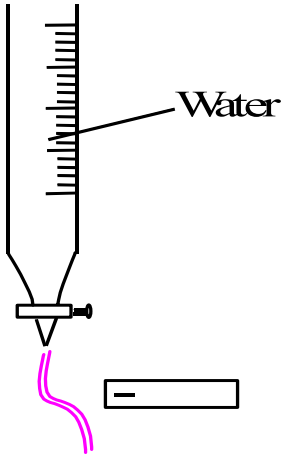
**33.** Consider the following electronic configuration given in column – I match with property given in column – II

| Column – I | Column – II |
|---|---|
| A) $1s^2 2s^2 2p^2 3s^1$ | P) Lowest 2nd IP |
| B) $1s^2 2s^2 2p^2 3s^2$ | Q) Highest electron affinity |
| C) $1s^2 2s^2 2p^2 3s^2 3p^4$ | R) Highest 2nd IP |
| D) $1s^2 2s^2 2p^2 3s^2 3p^5$ | S) Can form di negative ion |

**1)** A – P; B – Q; C – S; D – R **2)** A – R; B – P; C – S; D – Q

**3)** A – R; B – S; C – Q; D – P **4)** A – P; B – Q; C – R; D – S

**34.** A negatively charged rod was brought near a jet of water running out from a burette. The jet of was deflected as shown




Regarding thus observation the correct statement is

**1)** The deflection of jet of water towards negatively charged rod is due to attraction of water molecules by negative charged rod.

**2)** If the negatively charged rod is replaced by a positively charged rod the deflection of jet of water takes place in opposite direction

**3)** Instead of water if hexane and negatively charged rod are brought near, then also the liquid jet deflects away from the negatively charged rod

**4)** The interactions between negatively charged rod and the liquids water & Hexane are same.

**35.** Water sample is reported to be highly polluted if BOD (Biological Oxygen Demand) becomes

**1)** more than 17 ppm **2)** equal to 10 ppm

**3)** equal to 5 ppm **4)** less than 5 ppm

**36.** The inter halogen compound $ICl_3$ can form but $BrCl_3$ cannot form. This is because

**1)** Iodine is large enough to accommodate three chlorine atoms around itself

**2)** Bromine is not electronegative enough to react with chlorine

**3)** Iodine can have positive oxidation state but bromine cannot

**4)** Bromine is too electronegative to react with chlorine.

**37.** What is the oxidation state of iron in $\left[Fe\left(\eta^5-Cp\right)_2\right]\left[BF_4\right]$?

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

**38.** For the reaction,

$2A(g)+B_2(g)\rightleftharpoons 2AB(g);\Delta H=-65.34kJ\ mol^{-1}\ and\ K_c=3.6\times10^{23}\ L\ mol^{-1}$

Which of the following statement(s) is/are **INCORRECT**?

I. The value of equilibrium constant increases as the temperature increases.

II. The addition of $He(g)$ at constant pressure shifts the reaction in the backward direction.

III. The equilibrium shifts in the forward direction if pressure is increased.

IV. The large value of $K_c$ indicates that the reaction is almost going for completion and hence does not require any catalyst.

**1)** I, II, III & IV **2)** II & III **3)** I & IV **4)** III & IV

**39.** Given below are two statements:

**Statement I**: A catalyst is a substance which increases the rate of a reaction without itself undergoing any permanent chemical change.

**Statement II** : The word catalyst should not be used when the added substance reduces the rate of reaction.

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

**1)** Both **Statement I** and **Statement II** are correct.

**2)** 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.

**40.** Bohr's angular momentum of the electron in $Li^{2+}$ when it is present in 2s, 3s, 3p and 3d sub-shells respectively are

**1)** $0,0,\sqrt{2}\frac{h}{2\pi}\ \&\ \sqrt{6}\frac{h}{2\pi}$ **2)** $2\frac{h}{2\pi},3\frac{h}{2\pi},\sqrt{2}\frac{h}{2\pi}\ \&\ \sqrt{6}\frac{h}{2\pi}$

**3)** $2\frac{h}{2\pi},3\frac{h}{2\pi},3\frac{h}{2\pi}\ \&\ 3\frac{h}{2\pi}$ **4)** $0,0,3\frac{h}{2\pi}\ \&\ 3\frac{h}{2\pi}$

**41.** A colloidal solution of silver iodide prepared by adding a dilute aqueous solution of silver nitrate to aqueous potassium iodide solution. Which of the following will be the most effective in coagulating this colloidal solution?

**1)** $Na^+$ **2)** $H^+$ **3)** $Pb^{2+}$ **4)** $PO_4^{3-}$

**42.** Given below are two statements:

**Statement I** : Permanent gases, i.e., gases which show continuous positive deviation in Z value can not be liquefied.

**Statement II** : It is possible to change a gas into liquid or a liquid into gas by a process in which always a single phase is present.

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

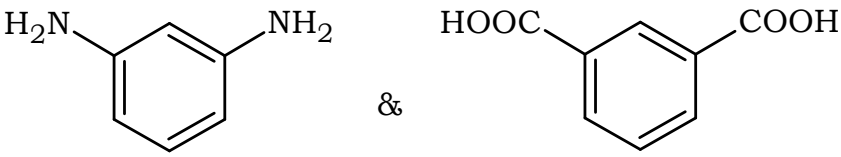
**1)** Both **Statement I** and **Statement II** are correct.

**2)** Both **Statement I** and **Statement II** are incorrect.

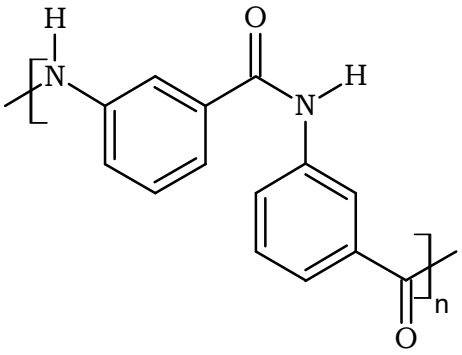
**3) Statement I** is correct, but **Statement II** is incorrect.

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

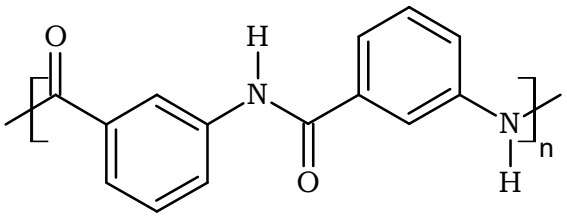
**43.** The structure of polymer produced by the condensation of the following monomers is



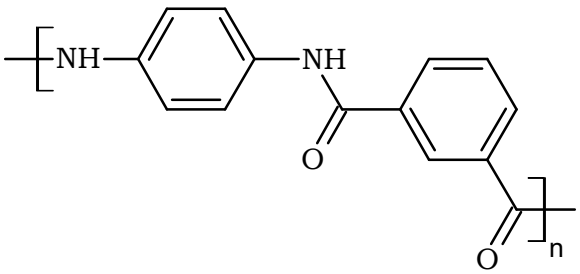

**1)**



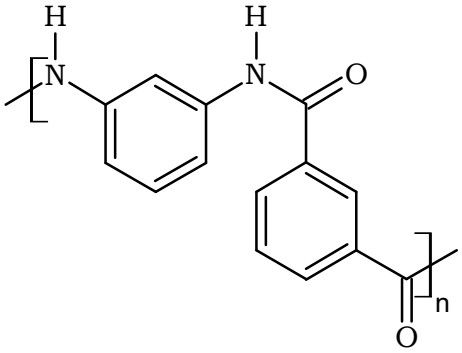

**2)**




**3)**




**4)**

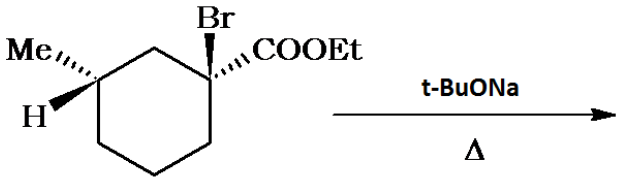


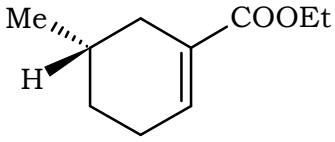
**44.** Correctly matched items match(es) among the following is (are)

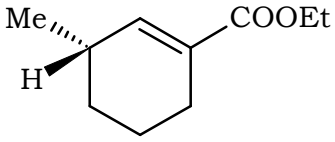
| | **Column I** (Pairs of amino acids) | **Column II** (distinguishing test) |
|---|---|---|
| I | Proline and Histidine | $NaNO_2$ / $Con.HCl$ |
| II | Serine and Glycine | Ceric ammonium nitrate solution |
| III | Tryptophan and Tyrosine | Neutral ferric chloride solution |
| IV | Lysine and Glutamic acid | $NaHCO_3$ |

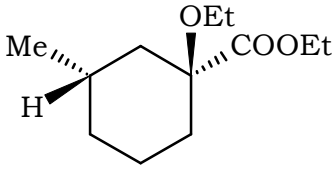
**1)** I, II, III, IV **2)** I, II, III only **3)** II, III, IV only **4)** II only

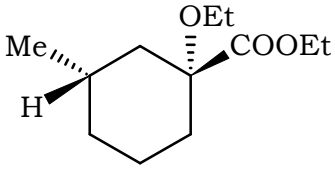
**45.** Chief product of the following reaction is




**1)** 


**2)** 

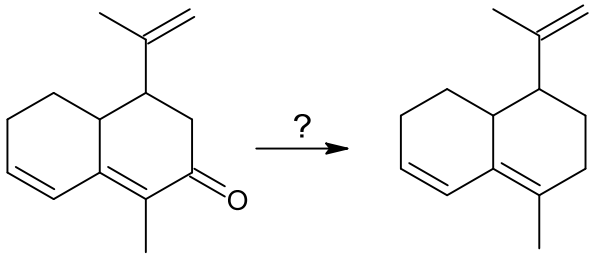

**3)** 


**4)** 


**46.** Tranquilizer among the following is

**1)** Equanil **2)** Ranitidine **3)** Terfanadine **4)** Penicillin

**47.** Consider the reaction given below:




The most appropriate reagent suitable for carrying out the above reaction is

**1)** *1)* $B_2H_6$ / $THF$; *2)* $AcOH$ **2)** $H_2$ / $Pd$

**3)** $NH_2NH_2$/$EtONa$/$EtOH$ **4)** $LiAlH_4$

**48.** Given below are tow statements, one labelled as **Assertion(A)** and the other as **Reason (R)**:
**Assertion (A):**Benzaldehyde is more reactive towards nucleophilic addition reactions than propanal.
**Reason (R):**Ethyl group makes the carbonyl carbon atom in propanal less electrophilic than in benzaldehyde.
In the light of the above statements, choose the correct answer from the options given below:
**1)** **(A)** is incorrect but**(R)** is correct
**2)** Both **(A)** and **(R)** are correct but **(R)** is not the correct explanation of **(A)**.
**3)** Both**(A)** and**(R)** are incorrect.
**4)** Both **(A)** and **(R)** are correct and **(R)** is the correct explanation of **(A)**.

**49.** Given below are tow statements, one labelled as **Assertion(A)** and the other as **Reason (R)**:
**Assertion (A):** Both phenol and benzene diazonium chloride are colourless but the azo dye formed by their coupling is coloured.
**Reason (R):**Azo group between two aromatic rings extends the conjugation of one ring into the other.
In the light of the above statements, choose the correct answer from the options given below:
**1)** **(A)** is incorrect but**(R)** is correct
**2)** Both **(A)** and **(R)** are correct but **(R)** is not the correct explanation of **(A)**.
**3)** **(A)** is correct but**(R)** are incorrect.
**4)** Both **(A)** and **(R)** are correct and **(R)** is the correct explanation of **(A)**.

**50.** Which statement is correct ?
**1)** $NH_2Cl$ is explosive
**2)** $NH_2OH$ is stronger base than $NH_3$
**3)** The most favoured conformer of $N_2H_4$ gausche form
**4)** $H_2$ gas will be liberate when $N_3H$ react with metals

**(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 sum of coordination number of aluminium and the number of bridging hydrogen atoms in $\left[Al\left(BH_4\right)_4\right]^-$ is _____

**52.** What is the %s-character of the hybrid orbitals of chlorine in $ClO_2$ having bond angle 118º $\left(\cos 118^o = -0.47\right)$?

**53.** How many of the following are isostructural $Mn_2O_7, Cr_2O_7^{2-}$, pyrosilicate, pyrophosphate, pyrosulphate, $Cl_2O_7, I_2Cl_6$ ?

**54.** At 0 °C the density of oxygen at 1 atm is 1.43 g/L. The oxygen which occupied 1.5 L at STP was compressed at 0 °C to 600 atm, and the volume was observed to be 4 cc, in violation of Boyle's law. What was the final density (in g/L) of oxygen?

**55.** Potassium crystallizes as BCC. How many second-nearest neighbours does a potassium atom at the body centre have?

**56.** 0.75 g of a sample of pyrolusite ore is treated with 1.89 g of oxalic acid crystals $\left(H_2C_2O_4.2H_2O\right)$ in acidic medium to analyze for its $MnO_2$ content. Following the reaction, the excess oxalic acid is titrated with 0.100 M $KMnO_4$ under acidic conditions, 30.00 mL being required. The percentage of Mn in the ore is_____.

(Atomic weights: Mn = 55 u)

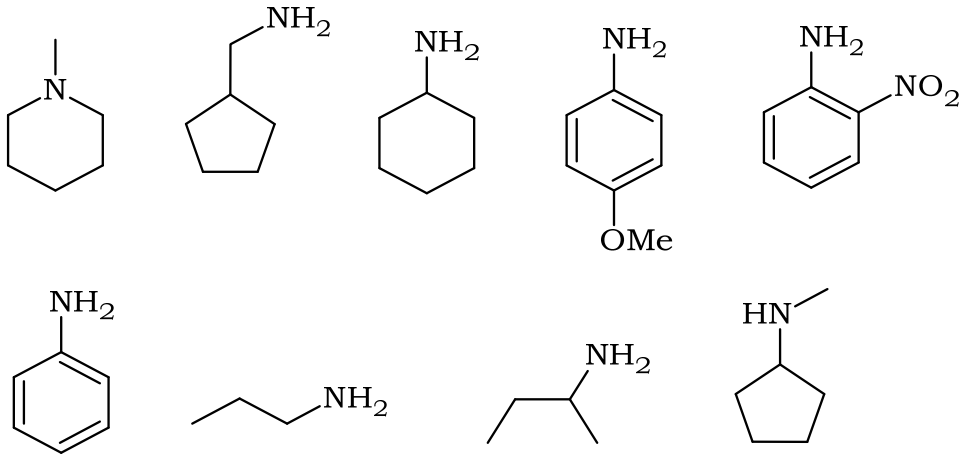
**57.** A fuel cell uses $CH_4(g)$ *and* forms $CO_3^{2-}$ at the anode. It is used to power a car with 80 Amp for 1 hr. How many litres of $CH_4(g)$ would be required?

$\left(molar\ volume\ V_m = 24\ L/mol\ \&\ F = 96500\right)$. Assume 100% efficiency.

**58.** An alkene of the molecular formula $C_6H_{12}$ on reductive ozonolysis give two different aldehydes as products. How many alkenes excluding stereoisomers, satisfy this criterion?

**59.** A dodecapeptide made of molecular weight 980, on complete hydrolysis gives alanine (Molecular weight 89) as one of the products. If the alanine makes up 52.9 % by weight of the hydrolysis products, how many alanine units are there in the dodecapeptide?

**60.** How many of the following compounds give carbylamines on reaction with $CHCl_3$ in presence of alcoholic $KOH$ ?



**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.** $g(n)=\int_0^{n^2+n+1} e^{x/2-[x/2]}\left(\frac{x}{2}-\left[\frac{x}{2}\right]\right)d\left(x-[x]\right);n\in N$ then $g(n)$ ([.] denotes greatest integer function)

**1)** has minimum value as $\frac{1}{4}+\sqrt{e}$ **2)** has minimum value as $3-\sqrt{e}$

**3)** has minimum value as $\frac{3}{4}-\sqrt{\frac{e}{4}}$ **4)** has minimum value is $12-6\sqrt{e}$

**62.** Let $f(t)=\int_0^t e^{x^2}\left(\frac{x^5}{\left(x^4+2x^2+2\right)^2}\right)dx$, then $f(1)+f'(1)$ is equal to

**1)** $\frac{3e}{10}-\frac{1}{4}$ **2)** $\frac{7e}{50}-\frac{1}{4}$ **3)** $\frac{7e}{50}-\frac{1}{2}$ **4)** $\frac{2e}{5}-\frac{1}{2}$

**63.** If $I=\int_0^{\sqrt{2\pi}} \frac{x^3\sin^{2022}x^2}{\cos^{2022}x^2+\sin^{2022}x^2}dx$ is equal to

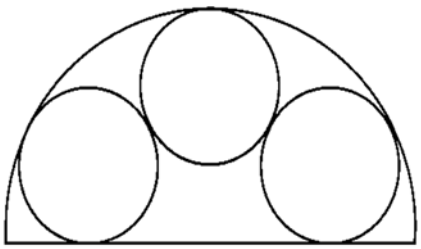
**1)** $\frac{\pi^2}{2}$ **2)** $2\pi^2$ **3)** $\pi^2$ **4)** 0

**64.** If the solution curve of the differential equation $\frac{dy}{dx}=\frac{x+y-4}{x-y}$ passes through the point $(3,2)$ and $(p+2,3)$, $p>0$ then

**1)** $2\tan^{-1}\left(\frac{1}{p}\right)=\log_e(p^2+1)$ **2)** $\tan^{-1}\left(\frac{1}{p}\right)=\log_e(p^2+1)$

**3)** $2\tan^{-1}\left(\frac{1}{p+1}\right)=\log_e(p^2+2p+2)$ **4)** $2\tan^{-1}\left(\frac{1}{p}\right)=\log_e\left(\frac{p^2+1}{p}\right)$

**65.** Three identical circles, each of radius a, are drawn as shown in figure and tangent to a semi circle of radius r, express a in terms of r?



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

**66.** let the line $y=mx$ and the ellipse $4x^2+9y^2=1$ intersect at point P in the first quadrant. If the normal to the ellipse at P meets the coordinate axes at $A(\alpha,0)$ and $B\left(0,-\frac{5}{8\sqrt{3}}\right)$, then area of triangle OAB is equal to (where O is origin)

**1)** $\frac{1}{16\sqrt{3}}$ **2)** $\frac{25}{576\sqrt{3}}$ **3)** $\frac{9}{144\sqrt{3}}$ **4)** $\frac{25}{288\sqrt{3}}$

**67.** For polynomial $P(x)=1-\frac{1}{3}x+\frac{1}{6}x^2$, define $Q(x)=P(x).P(x^3).P(x^5).P(x^7).p(x^9)=\sum_{i=0}^{50}a_ix^i$, then $\sum_{i=0}^{50}|a_i|=$

**1)** $\frac{275}{37}$ **2)** $\frac{243}{32}$ **3)** $\frac{243}{39}$ **4)** $\frac{245}{37}$

**68.** Three Arithmetic mean, three Geometric mean and three Harmonic mean are inserted between 1 and 5. The cubic equation whose roots are 3rd A.M, 2nd G.M, and 1st H.M is

**1)** $x^3-\frac{1}{4}\left(21+4\sqrt{5}\right)x^2+5x-5\sqrt{5}=0$

**2)** $x^3-\frac{1}{4}\left(21+4\sqrt{5}\right)x^2+\left(5+\frac{21}{4}\sqrt{5}\right)x-5\sqrt{5}=0$

**3)** $4x^3-\left(21+4\sqrt{5}\right)x^2+\left(15+21\sqrt{5}\right)x-20\sqrt{5}=0$

**4)** $4x^3-\left(21+4\sqrt{5}\right)x^2+\left(15+21\sqrt{5}\right)x-5\sqrt{5}=0$

**69.** Logical statement $(p\leftrightarrow q)\leftrightarrow(q\leftrightarrow r)$ is equivalent to

**1)** $(p\wedge r)\vee(\sim p\wedge\sim q\wedge\sim r)$

**2)** $(p\wedge r)\vee(\sim p\wedge\sim q)\vee(\sim q\wedge\sim r)$

**3)** $(p\wedge r)\vee(\sim p\wedge q\wedge\sim r)\vee(\sim p\wedge\sim q\wedge\sim r)$

**4)** $(p\wedge r)\vee(\sim p\wedge\sim q\wedge r)\vee(p\wedge\sim r\wedge q)$

**70.** Sum of number of terms in the expansion of

$(a_1+a_2)^{50},(a_1+a_2+a_3)^{50},(a_1+a_2+a_3+a_4)^{50},.....(a_1+a_2+....+a_{50})^{50}$ is equal to

**1)** ${}^{100}C_{50}$ **2)** ${}^{100}C_{51}-1$ **3)** ${}^{100}C_{49}$ **4)** ${}^{100}C_{50}-1$

**71.** Let $f(x)=\begin{vmatrix} f_1(x) & f_2(x) & f_3(x)\\ g_1(x) & g_2(x) & g_3(x)\\ h_1(x) & h_2(x) & h_3(x)\end{vmatrix}$, then

**1)** f is an even function if function of any two rows are all even functions and functions of the remaining row are odd functions

**2)** f is an odd function if functions of any two rows are all odd functions and functions of the remaining row are even functions.

**3)** f is periodic of period T, if $f_1(x), g_2(x)$ and $h_3(x)$ are periodic of period T

**4)** f is an even function if functions of any two rows are all odd functions and functions of the remaining row are even functions.

**72.** The mean of two samples of sizes 200 and 300 were found to be 25 and 10 respectively. Their standard deviations were 3 and 4 respectively. The variance of combined sample of size 500 is

**1)** 64 **2)** 65.2 **3)** 67.2 **4)** 64.2

**73.** Let $a_m$ be the m$^{th}$ term of the sequence $\left(\frac{2^2}{1^2}-\frac{2}{1}\right)^{-1}, \left(\frac{3^3}{2^3}-\frac{3}{2}\right)^{-2}, \left(\frac{4^4}{3^4}-\frac{4}{3}\right)^{-3}$,....., , then the value of $\lim_{m\to\infty}\left(a_m\right)^{\frac{1}{m}}$ is equal to

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

**74.** A tower subtends angles $\alpha, 2\alpha$ and $3\alpha$ respectively at points A, B and C, all lying on a horizontal line through the foot of the tower. Then $\frac{AB}{BC}$ is equal to

**1)** $\frac{\sin 3\alpha}{\sin 2\alpha}$ **2)** $1+2\cos 2\alpha$ **3)** $2\cos 2\alpha$ **4)** $\frac{\sin 2\alpha}{\sin \alpha}$

**75.** Let S be the set of all those 2007-digit integer of the form $2a_1a_2a_3.....a_{2006}$ which contain digit 9 odd number of times in each sequence $a_1, a_2, a_3, ....., a_{2006}$. The cardinal number of S is

**1)** $\frac{1}{2}\left(10^{2006}+8^{2006}\right)$ **2)** $\frac{1}{2}\left(10^{2006}-8^{2006}\right)$ **3)** $10^{2006}+8^{2006}$ **4)** $10^{2006}-8^{2006}$

**76.** Nine balls of the same size and colour, numbered 1, 2,…..9, were put into a packet. Now A draws a ball from packet, noted that it is of number a, and puts it back. Then B also draws a ball from the pocket and noted that it is of number b. Then probability for the inequality $a-2b+10>0$ to hold is

**1)** $\frac{52}{81}$ **2)** $\frac{59}{81}$ **3)** $\frac{60}{81}$ **4)** $\frac{61}{81}$

**77.** Let $R=\{(a,b)\,|\,a-b$ is irrational : a,b are real numbers$\}$, then relation R is

**1)** reflexive and symmetric relation **2)** transitive and symmetric

**3)** symmetric relation **4)** equivalence relation

**78.** STATEMENT-1: $2p^3-(2x+4\sin x-\cos x)p^2-(x\cos x-4x\sin x+\sin 2x)p+\sin 2x=0$ is a differential equation with a possible solution as

$(2y-x^2-c)(y+2\cos x-c)(2y+\sin x-c)=0;\left[p=\frac{dy}{dx}\right]$

STATEMENT-2: Degree of differential equation is the power of the highest order derivative existing in the differential equation.

**1)** Both the statements are true and Statement2 is correct explanation of statement1

**2)** Both the statements are true and Statement2 is not the correct explanation of statement1

**3)** Statement 1 is true and Statement 2 is false

**4)** statemen-1 is false and Statement 2 is true

**79.** If $P(\bar{B})=\{P(A\cup B)\}^2$, then

STATEMENT – 1: $P(A\cup B)$ is at least $\frac{\sqrt{3}-1}{2}$

STATEMENT – 2: For $P(A\cup B)$ to be minimum event A cannot happen given event B has not happend

**1)** Both the statements are true and Statement2 is correct explanation of statement1

**2)** Both the statements are true and Statement2 is not the correct explanation of statement1

**3)** Statement 1 is true and Statement 2 is false

**4)** statemen-1 is false and Statement 2 is true

**80.** Rectangle ABCD has AB=5 and BC=4, point E lies on AB so that EB=1 point G lies on BC so that CG=1 and point F lies on CD so that DF=2, segment AG and AC intersect EF at Q and P respectively then ratio $\frac{PQ}{EF}$ is

**1)** $\frac{\sqrt{13}}{16}$ **2)** $\frac{\sqrt{2}}{13}$ **3)** $\frac{9}{82}$ **4)** $\frac{10}{91}$

**(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.** A relation is chosen randomly from all possible relations defined on a set containing 5 elements. If p be the probability that the selected relation is an anti-symmetric relation, then find the value of $\left[\frac{1}{p}\right]$. ($[.]$denotes Greatest Integer Function)

**82.** If the value of $\lim_{x\to 0}\left(3-2\cos x\sqrt{\cos 2x}\right)^{\left(\frac{x+3}{x^2}\right)}$ is equal to $e^a$ ,then a is equal to

**83.** Let the director circle of the hyperbola $H:\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ be denoted by $C_1$ and let director circle of ellipse $E:\frac{x^2}{a^2}+\frac{y^2}{b^2}=\frac{1}{3}$ be denoted $C_2$. If the circle $C_2$ is also the director circle of $C_1$ and let $e_1$ and $e_2$ be the eccentricities of the ellipse E and hyperbola H, then $\frac{e_2^2}{e_1^2}$ is equal to $(a>b)$

**84.** If the asymptotes of the hyperbola $9x^2-4y^2-18x-24y-63=0$ are tangents to the circle $13x^2+13y^2-26x+k=0$ at point $A(\alpha_1,\beta_1)$ and $B(\alpha_2,\beta_2)$ then $|\alpha_1+\alpha_2+k|$ is equal to

**85.** Kiran is deciding whether to visit Russia or Ukrain for the holidays. She makes her decision by rolling a regular 6-sided die. If she gets 1 or 2 she goes to Ukrain, if she rolls a 3, 4 or 5 she goes to Russia. If she rolls a 6 she rolls again. If the probability that she goes to Ukrain is p, then 5p is

**86.** There are real numbers a, b, c and d such that -20 is a root of $x^3+ax+b=0$ and -21 is a root of $x^3+cx^2+d=0$. These two polynomials share a complex root $m+i\sqrt{n}$, where m, n are positive integers and $i=\sqrt{-1}$ then $\frac{n}{4m}$ is

**87.** If $0\le x<2\pi$, then the number of real values of x, which satisfy the equation $\sin\left(\frac{\pi-2x}{2}\right)+\sin\left(\frac{\pi-4x}{2}\right)+\sin\left(\frac{\pi-6x}{2}\right)+\sin\left(\frac{\pi-8x}{2}\right)=0$ is equal to

**88.** If $\left|\sum_{k=0}^{10}\frac{{}^{10}C_k\,{}^{10+k}C_k}{(-2)^k}\right|=\frac{p}{q}$ where p and q are co-prime, then the value of $p+q$ is

**89.** The polynomial $f(z)=az^{4036}+bz^{4035}-cz^{4034}$ has real coefficients where a, b, c belongs to $(-\infty,4038]$. If $f\left(e^{-\frac{i\pi}{3}}\right)=-4032+4038\sqrt{3}i$, then the value of $|a-b|$ is

**90.** Let $f(x)=\left[\sin x+\left[\cos x+\left[\tan x+\left[\cot x+\left[\operatorname{cosec}x+\left[\sec x\right]\right]\right]\right]\right]\right]$ (where [.] denotes greatest integer function) $A=\left\{y\mid y=f(x);x\in\left(0,\frac{\pi}{4}\right)\right\};B=\left\{y\mid y=f(x);x\in\left(\frac{\pi}{2},\frac{3\pi}{4}\right)\right\}$ and $I$ be set of all integers, then $n\left((I-A)\cap(I-B)\right)$ is equal to