



# Sri Chaitanya IIT Academy.,India.

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

*A right Choice for the Real Aspirant*  
**ICON Central Office - Madhapur - Hyderabad**

**SEC: Sr.Super60\_NUCLEUS & ALL\_BT**

**JEE-MAIN**

**Date: 19-01-2023**

**Time: 09.00Am to 12.00Pm**

**GTM-09**

**Max. Marks: 300**

## IMPORTANT INSTRUCTION:

1. Immediately fill in the Admission number on this page of the Test Booklet with **Blue/Black Ball Point Pen** only.
2. The candidates should not write their Admission Number anywhere (except in the specified space) on the Test Booklet/ Answer Sheet.
3. The test is of **3 hours** duration.
4. The Test Booklet consists of 90 questions. The maximum marks are **300**.
5. There are **three** parts in the question paper 1,2,3 consisting of **Physics, Chemistry and Mathematics** having **30 questions** in each subject and subject having **two sections**.

**(I) Section –I** contains 20 **multiple choice** questions with only one correct option.

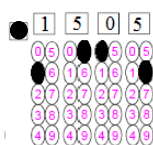
**Marking scheme:** +4 for correct answer, 0 if not attempt and -1 in all other cases.

**(II) Section-II** contains 10 **Numerical Value Type** questions. Attempt any 5 questions only, if more than 5 questions attempted, First 5 attempted questions will be considered.

- The Answer should be within **0 to 9999**. If the Answer is in **Decimal** then round off to the **nearest Integer** value (Example i.e. If answer is above **10** and less than **10.5** round off is **10** and If answer is from **10.5** and less than **11** round off is **11**).

To cancel any attempted question bubble on the question number box.

For example: To cancel attempted question 21. Bubble on 21 as shown below



**Question Answered for Marking**

**Question Cancelled for Marking**

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

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

**Name of the Candidate (in Capital):** \_\_\_\_\_

**Admission Number:**

--	--	--	--	--	--	--	--	--	--

**Candidate's Signature:** \_\_\_\_\_

**Invigilator's Signature:** \_\_\_\_\_

**19-01-23\_Sr.Super60\_NUCLEUS & ALL\_BT\_ Jee-Main\_GTM-09\_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. Suppose force (F), area (A) and time (T) are the fundamental units, then match the following

**Table-1**

(A) Work

(B) Moment of inertia

(C) Velocity

1) A-P B-R C-Q

3) A-R B-P C-Q

**Table-2**(P)  $[A^{1/2}T^{-1}]$ (Q)  $[FA^{1/2}]$ (R)  $[FA^{1/2}T^2]$ 

2) A-Q B-R C-P

4) A-Q B-P C-Q

2. A particle is moving with uniform acceleration, then during an interval of time Which following the statements is/are correct

1) Average velocity of the particle is always less than its final velocity

2) Average velocity of the particle never be greater than its final velocity

3) Average velocity of the particle may be zero

4) Average velocity of the particle is half its final velocity

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

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  $8m/s^2$ 

4. Work done by the conservative forces on a system is equal to

1) The change in kinetic energy of the system

2) The change in potential energy of the system

3) The change in total mechanical energy of the system

4) The negative of change in potential energy of the system

5. Two physicists both of mass 50 kg, climb up identical ropes suspended from the ceiling of a gymnasium. The ropes are 15 m long. Physicist 1 reaches the top twice as quickly as physicist 2 does. After physicist 2 also reaches top, they argue about who did more work against gravity. No one did slip during climb.

**Physicist-1**

“I did more work fighting gravity, because I was overcoming gravity more quickly. Your climb was lazier, and therefore, you did less work.”

**Physicist-2**

“No way. I did more work fighting gravity, because I spend more time climbing the rope. Since we both ended up at the same height, but I spent more time getting there, I had to work harder.”

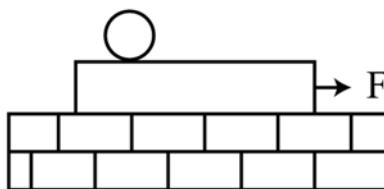
**Q.** The correct statements among the following while climbing from the floor to the ceiling?

- 1) Physicist 1 did more work against friction
- 2) Physicist 2 did more work against gravity
- 3) The work done by friction on both Physicists same and non zero
- 4) The work done by friction on both Physicists is zero

**6.** In an elastic collision between two bodies

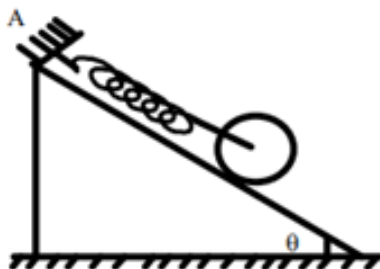
- 1) They will exchange their velocities if their masses are equal
- 2) Both may maintain their same velocities if their masses are equal
- 3) The kinetic energy of the system will be conserved throughout collision
- 4) They may not exchange their velocities even though they have same masses

**7.** A plank with a uniform sphere placed on it is resting on a smooth horizontal plane. Plank is pulled to the right by a constant force  $F$ . If sphere does not slip over the plank. Which of the following is incorrect?



- 1) Acceleration of the centre of sphere is less than that of the plank
- 2) Work done by friction acting on the sphere is equal to its total kinetic energy
- 3) The change in kinetic energy of the system is equal to work done by the force  $F$
- 4) Work done by friction on sphere is zero

**8.** A uniform cylinder of mass  $M$  and radius  $R$  rolls without slipping down a slope of angle  $\theta$  with horizontal. The cylinder is connected to a spring of force constant  $K$  at the centre, the other side of which is connected to a fixed support at A. The cylinder is released when the spring is unstretched. Till it comes to momentary rest for the first time, the force of friction ( $f$ ) on cylinder is





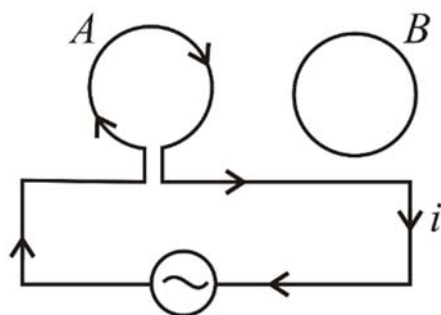
- 1) Always upwards
  - 2) Always downwards
  - 3) Initially upwards and then becomes down wards
  - 4) Initially down wards and then becomes upwards
9. In nuclear reactor fast neutrons can easily be slowed down by
- 1) Using a lead shielding
  - 2) Passing them through heavy water
  - 3) Elastic collisions with heavy nuclei
  - 4) Applying a strong electric field
10. **Assertion:** Earth has an atmosphere but the moon does not.  
**Reason:** Moon is small in comparison to earth
- 1) **Assertion** and **Reason** are true but **Reason** is not correct explanation for **Assertion**
  - 2) **Assertion** and **Reason** are false
  - 3) **Assertion** is true and **Reason** is false
  - 4) Assertion and reason are true but **Reason** is correct explanation for **Assertion**
11. The electric field at a point is
- 1) always continuous
  - 2) continuous if there is no charge at that point
  - 3) discontinuous only if there is a negative charge at that point
  - 4) discontinuous only if there is a positive charge at that point
12. During a negative beta decay
- 1) An atomic electron is ejected
  - 2) An isolated electron which is already present within the nucleus is ejected
  - 3) A neutron in the nucleus decays emitting an electron
  - 4) A part of the binding energy of the nucleus is converted into an electron
13. A n-p-n transistor conducts when,
- 1) Both collector and emitter are positive with respect to the base
  - 2) Collector is positive and emitter is negative with respect to the base
  - 3) Collector is positive and emitter is at same potential as the base
  - 4) Both collector and emitter are negative with respect to the base



14. A vertical capillary is brought in contact with the water surface (surface tension =  $T$ ). The radius of the capillary is  $r$  and the contact angle  $\theta = 0^\circ$ . The increase in potential energy of the water (density =  $\rho$ ) is
- 1) Independent of  $\rho$
  - 2) independent of  $r$
  - 3) Independent of  $T$
  - 4) Zero
15. **Assertion:** The viscosity of liquid increases with rise of temperature.  
**Reason:** Viscosity of liquid is the property of the liquid by virtue of which it opposes the relative motion amongst its different layers.
- 1) **Assertion** and **Reason** are true but **Reason** is not correct explanation for **Assertion**
  - 2) **Assertion** and **Reason** are false
  - 3) **Assertion** is false and **Reason** is true
  - 4) **Assertion** and **Reason** are true but **Reason** is correct explanation for **Assertion**
16. The human circulatory system can be thought of as a closed system of interconnecting pipes through which fluid is continuously circulated by two pumps. The two pumps, the right and left ventricles of the heart, work as simple two-stroke force pumps. The muscles of the heart regulate the force by contracting and relaxing. The contraction (systole) lasts about 0.2 s, and a complete systole/diastole (contraction/relaxation) cycle lasts about 0.8 s. For blood pressure and speeds in the normal range, the volume flow rate of blood through a blood vessel is directly proportional to the pressure difference over a length of the vessel and to the fourth power of the radius of the vessel. The total mechanical energy per unit volume of blood just as it leaves the heart is:
- $$\rho_{\text{blood}} = 1050 \text{ kg / m}^3$$
- $$E / V = \rho gh + P + \frac{1}{2} \rho v^2$$
- Why is diastolic blood pressure much lower than systolic pressure? (**Note:** A typical systole/diastole reading in mm Hg is 120/80)
- 1) Because the heart exerts more force on the blood during diastole
  - 2) Because the heart exerts no force on the blood during diastole
  - 3) Because the radii of the blood vessels increase during diastole, while the forces exerted by the heart on the blood remains the same
  - 4) Because the radii of the blood vessels decrease during diastole, while the forces exerted by the heart on the blood remains the same



17. **Assertion:** Quality of sound produced by an open pipe is better than a closed pipe  
**Reason:** Open pipe produces all harmonics but a closed pipe does not.
- 1) **Assertion** and **Reason** are true but **Reason** is not correct explanation for **Assertion**
  - 2) **Assertion** and **Reason** are false
  - 3) **Assertion** is false and **Reason** is true
  - 4) **Assertion** and **Reason** are true but **Reason** is correct explanation for **Assertion**
18. Choose the wrong statement
- 1) The peak voltage across the inductor can be greater than the voltage of the source in an LCR circuit.
  - 2) In a circuit containing a capacitor and an AC source the current is zero at the instant the source voltage is maximum
  - 3) An AC source is connected to a capacitor. The rms current in the circuit gets increased if a dielectric slab is inserted into the capacitor
  - 4) At resonance of LCR series circuit with AC reading of volt meter across all individual elements will be same
19. A real image is formed by a convex lens, then it is put in contact with a concave lens and again a real image is formed. This image will
- 1) Shift towards the lens system
  - 2) Shift away from the lens system
  - 3) Remain in its original position
  - 4) Shift to infinity
20. Two circular coils A and B are facing each other as shown in figure. The current  $i$  through A can be altered



- 1) There will be repulsion between A and B if  $i$  is increased
- 2) There will be attraction between A and B if  $i$  is increased
- 3) There will be neither attraction nor repulsion when  $i$  is changed
- 4) Attraction or repulsion between A and B depends on the direction of current. It does not depend whether the current is increased or decreased



## (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.

**Note :**

From **Question number's 21 to 30** rules for **Answer marking**

If your answer is options 2,4 Then you have to fill the OMR sheet as '24'

if you answer is options 1,3,4 then you have to fill the OMR sheet as '134'

And if you answer is options 1,2,3,4 then you have to fill the OMR sheet as '1234'

21. The correct statements among the following
- 1) EM waves having wave length 700nm to 1mm relates to magnetron valve
  - 2) EM waves having wave length 1nm to 400nm relates to inner shell electrons in atoms moving one energy to lower energy
  - 3) EM waves having wave length  $< 10^{-3} \text{ nm}$  relates to radio active decay
  - 4) EM waves having wave length 1mm to 0.1m relates to magnetron valve
22. The correct statements among the following
- 1) Long distance communication between two points on earth is achieved by sky wave communication
  - 2) Range of frequencies allotted for mobile to base station communication is 896 to 901 MHz
  - 3) Range of frequencies allotted for commercial FM radio broadcast is 88 to 108 GHz
  - 4) In amplitude modulation power of upper sideband is more than lower sideband.
23. A proton enters in a uniform electric and magnetic fields  $\vec{E}$  and  $\vec{B}$  respectively. Velocity of proton  $\vec{v}$ . All the three vectors are mutually perpendicular. The proton is deflected along positive x-axis when either of the fields or both are switched on simultaneously. Which of the following statement(s) is/are correct?
- 1)  $\vec{v}$  May be along positive y-axis
  - 2)  $\vec{E}$  Is along positive x-axis
  - 3)  $\vec{B}$  May be along positive z-axis
  - 4)  $\vec{B}$  May be along negative y-axis
24. A charged particle is projected in a plane perpendicular to uniform magnetic field. The areal velocity (area swept per unit time) of the particle is
- 1) Directly proportional to kinetic energy of particle
  - 2) Directly proportional to momentum of the particle
  - 3) Inversely proportional to magnetic field strength
  - 4) Inversely proportional to charge on particle





25. Which of the following is/are incorrect statement(s)?
- 1) Electric field is always conservative
  - 2) Magnetic field lines of force are closed loops
  - 3) If electric flux through an imaginary closed surface is zero, then electric field on the surface will be zero
  - 4) Electric field lines are always open curves
26. During the melting of a slab of ice at 273 K at atmospheric pressure
- 1) Positive work is done by the ice-water system
  - 2) negative work is done by the ice-water system
  - 3) The internal energy of the ice water increases
  - 4) The internal energy of the water system remains constant
27. In simple harmonic motion
- 1) Potential energy and kinetic energy may not be equal in mean position
  - 2) Potential energy and kinetic energy may be equal in extreme position
  - 3) Potential energy may be zero at extreme position
  - 4) Kinetic energy plus potential energy oscillates simple harmonically
28. If a circular concentric hole is made on a disc then about an axis passing through the centre of the disc and perpendicular to its plane
- 1) Moment of inertia decreases
  - 2) Moment of inertia increases
  - 3) Radius of gyration increases
  - 4) Radius of gyration decreases
29. The dominant mechanisms for motion of charge carriers in forward and reverse biased silicon p-n junctions are
- 1) Drift in forward bias, diffusion in reverse bias
  - 2) Diffusion in forward bias, drift in reverse bias
  - 3) Diffusion in both forward and reverse bias
  - 4) Drift in both forward and reverse bias
30. A beam of electron is used in an electron YDSE experiment. The slit width is  $d$ . When the velocity of electron is increased, then
- 1) No interference will occur
  - 2) Fringe width increases
  - 3) Fringe width decreases
  - 4) Fringe width remains same



**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.

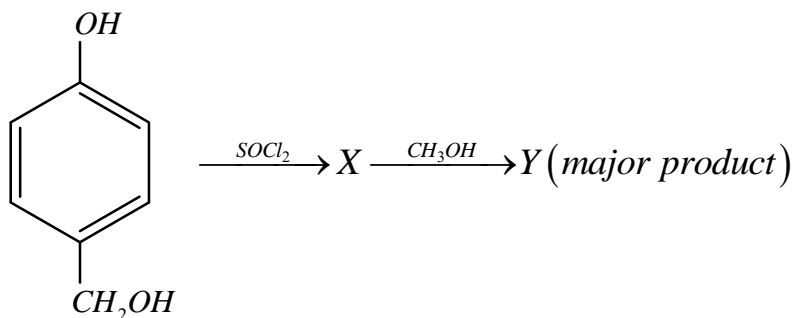
Marking scheme: +4 for correct answer, 0 if not attempted and -1 in all other cases.

31. The disperse phase in colloidal iron (III) hydroxide and colloidal gold are positive and negatively charged respectively. Which of the following statements is not correct?
- 1) Mixing both solutions cause coagulation
  - 2) Coagulation in both sols can be brought about by electrophoresis
  - 3) Barium chloride has more coagulating power towards the iron (III) hydroxide colloidal solution than the gold colloidal solution
  - 4) Addition of  $\text{NaCl}$  cause coagulation in both colloidal solutions.
32. Activated charcoal adsorbs **gas-X** more efficiently than **gas-Y**. This Statement indicates
- 1) Critical temperature ( $T_c$ ) of **gas-X** is less than **gas-Y**
  - 2) van der Waals constant 'a' value is high for **gas-X** than **gas-Y**
  - 3) Under similar conditions **gas-Y** is more compressible than **gas-X**.
  - 4) **Gas-Y** is easily liquefiable than **gas-X**.
33. Consider **Assertion** and **Reason** given below.  
**Assertion (A)** : With increase in atomic number the energies of the orbitals in the same subshell decrease due to increase in effective nuclear charge ( $Z_{eff}$ ).  
**Reason (R)** : In an atom the  $Z_{eff}$  experienced by the electron in different orbitals is in the order  $3d > 3p > 3s$   
 Choose the correct answer form the following :
- 1) Both (A) and (R) are correct but (R) is not the correct explanation of (A)
  - 2) Both (A) and (R) are correct and (R) is the correct explanation of (A)
  - 3) (A) is correct but (R) is wrong
  - 4) (A) is wrong but (R) is correct
34.  $D-(+)$ - Glucose  $\xrightarrow{\text{CH}_3\text{COCl} / \text{pyridine}}$   $D-(+)$ - Glucose pentaacetate?
- Which statement is true about glucose pentaacetate?
- 1) It will react with phenylhydrazine but not with Tollen's reagent
  - 2) It will react with hydroxylamine but not with phenylhydrazine
  - 3) It will react with both hydroxylamine and Fehling's solution.
  - 4) It will react neither with phenylhydrazine nor with hydroxylamine
35. Which indicate correct order for the given property is
- |  |                     |
|--|---------------------|
| 1) $\text{Ba} > \text{Ca} > \text{Be} > \text{Mg}$                 | Density             |
| 2) $\text{Rb} > \text{K} > \text{Na} > \text{Li}$                  | Melting point       |
| 3) $\text{NaF} > \text{NaCl} > \text{NaBr} > \text{NaI}$           | Melting point       |
| 4) $\text{BaCO}_3 > \text{SrCO}_3 > \text{CaCO}_3 > \text{BeCO}_3$ | solubility in water |



36. The correct order of spin only magnetic moment is:

- 1)  $[Fe(CN)_6]^{4-} > [CoCl_4]^{2-} > [MnCl_4]^{2-}$       2)  $[MnCl_4]^{2-} > [Fe(CN)_6]^{4-} > [CoCl_4]^{2-}$   
 3)  $[Fe(CN)_6]^{4-} > [MnCl_4]^{2-} > [CoCl_4]^{2-}$       4)  $[MnCl_4]^{2-} > [CoCl_4]^{2-} > [Fe(CN)_6]^{4-}$



37.

Final major product Y is

- 
- 1)  $CH_2OCH_3$       2)  $CH_2OCH_3$       3)  $CH_2OCH_3$       4)  $CH_2Cl$

38. Match List-I with List-II

List-I

- a) Vapour phase refining  
 b) Froth floatation  
 c) Leaching  
 d) Calcination

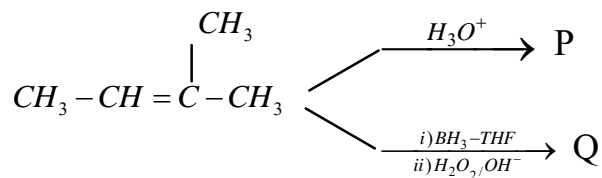
List-II

- i)  $Na[Al(OH)_4]$   
 ii)  $Ni(CO)_4$   
 iii)  $CuCO_3 \cdot Cu(OH)_2$   
 iv)  $ZnS$

Chose the most appropriate answer from the options given below

- 1) a-iv, b-iii, c-ii, d-i      2) a-ii, b-iv, c-iii, d-i  
 3) a-i, b-iv, c-iii, d-ii      4) a-ii, b-iv, c-i, d-iii

39.

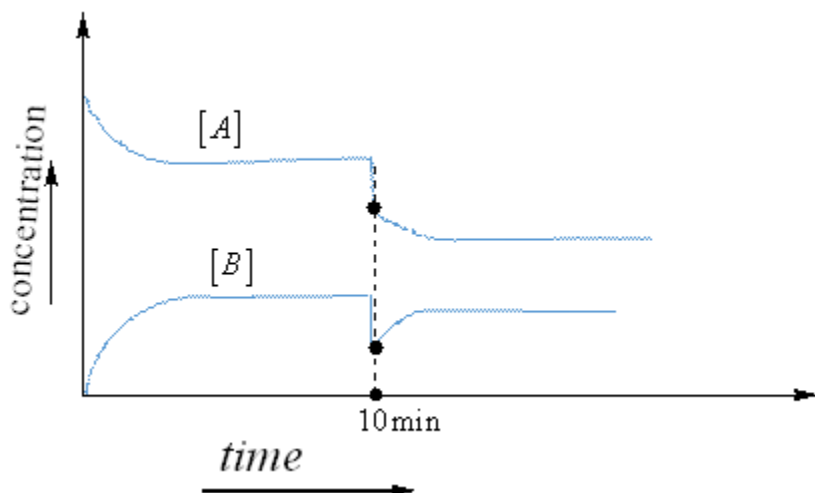


Major products P & Q can be best distinguished by

- 1) Na-metal      2)  $CH_3COOH / H^+$       3)  $CrO_3$       4)  $Conc. H_2SO_4 / \Delta$

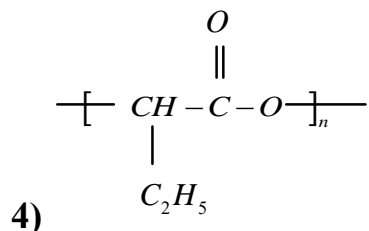
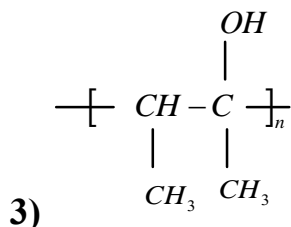
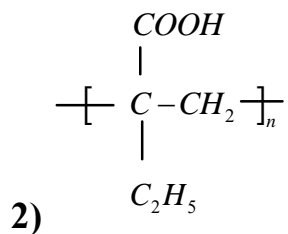
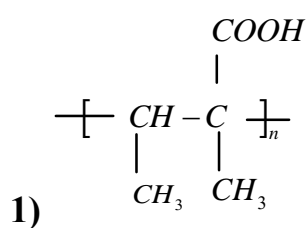
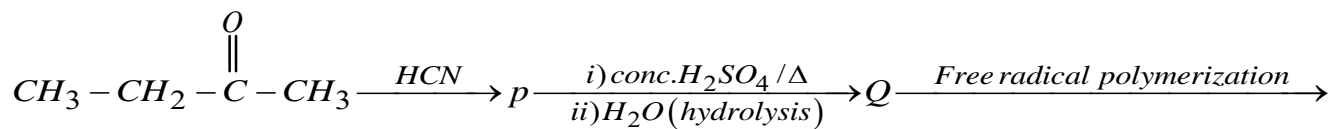


40. For a gaseous reversible reaction  $A_{(g)} \rightleftharpoons 2B_{(g)}$  occurs in a closed vessel with movable piston, following graph was given.



By observing the graph, predict the correct change at 10 Minutes time.

- 1) Additional amount of gas –A was added to the vessel at constant temperature and pressure
  - 2) Additional amount of gas –B was added to the vessel at constant temperature and pressure
  - 3) An inert gas was added to the vessel at constant temperature and pressure.
  - 4) An inert gas was added to the vessel at constant temperature and volume.
41. Major product in the following reaction is



42. Statement-I: Hydrogen peroxide used as antiseptic and bleaching agent.  
Statement-II: Hydrides of group-13 are Lewis acids and group-15 are Lewis base.
- 1) Both Statement-I and statement-II are false
  - 2) Both Statement-I and statement-II are true
  - 3) Statement –I is true but Statement-II is false
  - 4) Statement-I is false but Statement-II is true



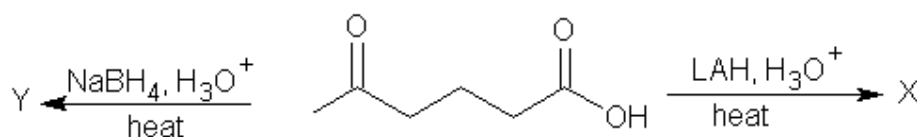
43. The correct order for the wavelength of absorption in the visible region is

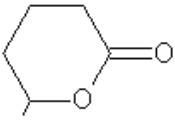
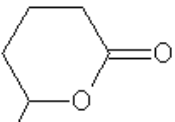
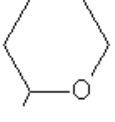
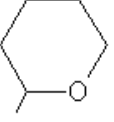
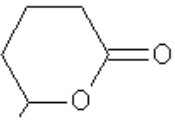
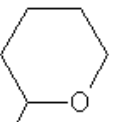
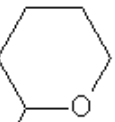
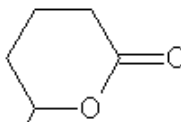
- 1)  $[Ni(NO_2)_6]^{4-} < [Ni(NH_3)_6]^{2+} < [Ni(H_2O)_6]^{2+}$  2)  $[Ni(NO_2)_6]^{4-} < [Ni(H_2O)_6]^{2+} < [Ni(NH_3)_6]^{2+}$   
 3)  $[Ni(H_2O)_6]^{2+} < [Ni(NH_3)_6]^{2+} < [Ni(NO_2)_6]^{4-}$  4)  $[Ni(NH_3)_6]^{2+} < [Ni(H_2O)_6]^{2+} < [Ni(NO_2)_6]^{4-}$

44. Which of the following is correct

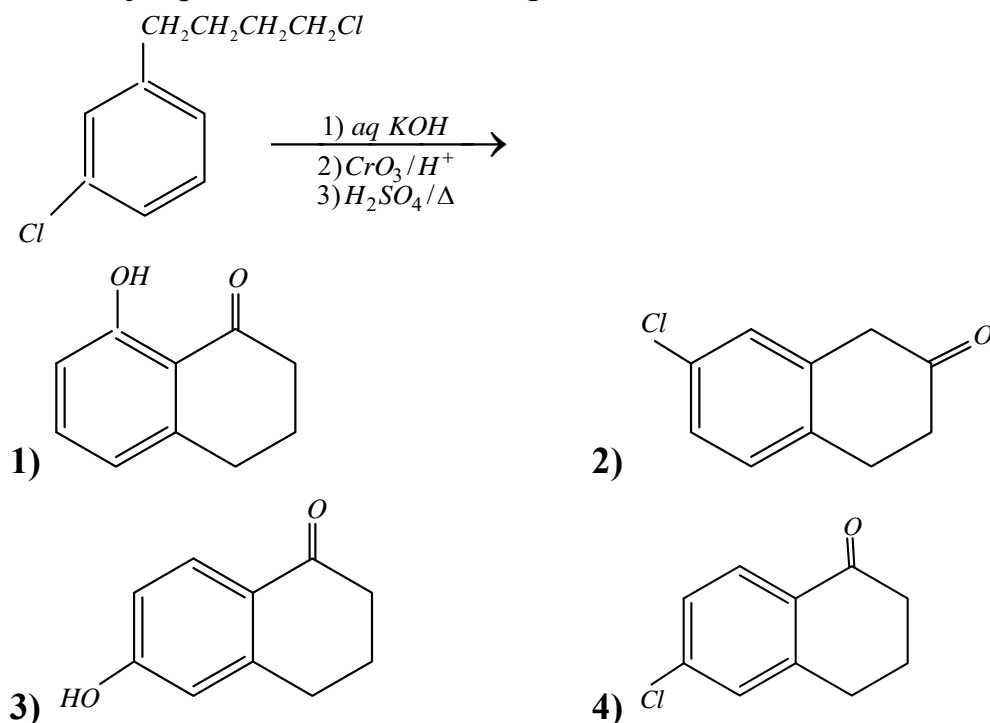
- 1) A liquid with low vapour pressure will have a low surface tension  
 2) A liquid with high vapour pressure will have high intermolecular forces and high boiling point  
 3) A liquid with low vapour pressure will have high surface tension and high boiling point  
 4) A liquid with low vapour pressure will have high surface tension and low boiling point

45. The product X and Y are respectively



- 1)  and  2)  and   
 3)  and  4)  and 


46. The major product of the following reaction is





#### 4) 2-Butanamine

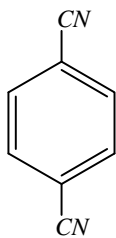
**4)  $Li < Ca < Al < Si$  Valence with respect to hydrogen**

4) 

Page 13



54. Among the following number of molecules which are non-planar and with zero dipole moment are



$CCl_4, BF_3, SF_6, SO_2, BrF_3, XeF_4, SCl_4,$

55. Red phosphorous on reaction with alkaline solution of  $NaClO_2$  produce hypo phosphoric acid. In the structure number of number  $P-H$  bonds are **K**, number of  $P=O$  bonds are **L**, number of  $P-O-P$  bonds are **M** and number of  $P-OH$  bonds are **N**. The value of  $[(K+N)-(L+M)]$  is

56. How many of the following alloys match with given major component metals in them?

German silver	-	$Ni + Zn + Cu$
Magnalium	-	$Mg + Al$
Bronze	-	$Zn + Sn$
Misch metal	-	Lanthanoid + $Fe$
Brass	-	$Cu + Zn$
Coinage alloy	-	$Ni + Cu$

57. The number of alkyl halides which react faster than  $CH_3CH_2Cl$  towards nucleophilic substitution ( $S_N2$ ) is/are

$(CH_3)_2CHCH_2Cl, C_6H_5Cl, CH_2=CHCH_2Cl,$   
 $p-NO_2C_6H_5CH_2Cl, CH_3Cl, (CH_3)_3CCl, CH_2=CHCl, o-CH_3C_6H_4Cl$

58. The number of correct statements in the following are

- I) Among the allotropes of carbon graphite is thermodynamically more stable.
- II) Most abundant inert gas in earth atmosphere is Argon.
- III) Hydrogen peroxide can act as oxidizing agent in both acidic and basic media
- IV) Aqueous solution of borax is acidic in nature due to formation of  $H_3BO_3$
- V) In  $H_2O_2$  structure dihedral angle in gaseous phase is less than in solid phase.

59. How many of the following can be found photochemical smog

$NO, NO_2, O_3, HCHO, CH_3COONO_2, CH_2=CH-CH=O$

60. The number of compounds which are more acidic than ethanoic acid among the given are

$CCl_3COOH, C_6H_5COOH, HCOOH, (COOH)_2, CH_3COOOH, CH_3COCOCH_3, (2,4,6-trinitro\ phenol)$

**MATHEMATICS****Max Marks: 100****(SINGLE CORRECT ANSWER TYPE)**

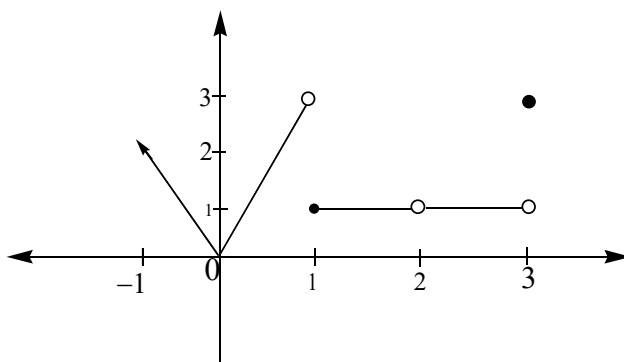
This section contains 20 multiple choice questions. Each question has 4 options (1), (2), (3) and (4) for its answer, out of which ONLY ONE option can be correct.

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

61.  $S_1$ : function  $f : [a, b] \rightarrow R$  defined by  $f(x) = (x-a)^2(x-b)^2 + x$ , takes the value  $\frac{a+b}{2}$  for some  $x \in [a, b]$

$S_2$ : If a function  $y = g(x)$  is defined on  $[a, b]$  and continuous on  $(a, b)$ , then for any  $k \in (g(a), g(b))$  there is some point  $c \in (a, b)$  such that  $g(c) = k$

- 1)  $S_1$  is true and  $S_2$  is true for every function  $g$
  - 2)  $S_1$  is true and  $S_2$  is not true for every function  $g$
  - 3)  $S_1$  is not true and  $S_2$  is true for every function  $g$
  - 4)  $S_1$  is not true and  $S_2$  is not true for every function  $g$
62. The function defined on  $[-1, 3]$  such that  $f(1) = 1$  and  $f(3) = 3$ , Diagram given below



Which of the following statements are true

- 1)  $\lim_{x \rightarrow 1^-} f(x) = 1$
  - 2)  $\lim_{x \rightarrow 2} f(x)$  doesn't exist
  - 3)  $\lim_{x \rightarrow 3} f(x)$  is not defined because  $\lim_{x \rightarrow 3^+} f(x)$  is not defined
  - 4)  $\lim_{x \rightarrow 2} f(x)$  is exist
63. Number of points on hyperbola  $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$  from where mutually perpendicular tangents can be drawn to circle  $x^2 + y^2 = a^2$  are
- 1) 2
  - 2) 3
  - 3) 4
  - 4) infinite
64. Which of the following is always **true**
- 1) One root of the equation  $ax^2 + bx + c = 0$ , ( $a, b, c \in R$  &  $a \neq 0$ ) in the form of  $p + \sqrt{q}$  then other root is  $p - \sqrt{q}$





2) Exactly one of the root of the equation  $ax^2 + bx + c = 0$ , ( $a \neq 0$ ) lies in the given interval  $(k_1, k_2)$  if  $f(k_1) \cdot f(k_2) > 0$

3) If  $a, b, c, d, e, f$  are positive real numbers and  $df - e^2 > 0$ . The equations

$ax^2 + 2bx + c = 0$ , ( $a \neq 0$ ) and  $dx^2 + 2ex + f = 0$  ( $d \neq 0$ ) have a common root, then  $\frac{d}{a} = \frac{e}{b} = \frac{f}{c}$

4) Equation  $(ax^2 + bx + c)(ax^2 - dx - c) = 0$ , ( $ac \neq 0$ ) has no real roots,

65. If  $a, a_1, a_2, a_3, \dots, a_n, b$  are in AP,

$a, g_1, g_2, g_3, \dots, g_n, b$  are in GP

$a, h_1, h_2, h_3, \dots, h_n, b$  are in HP then Which of the following is **incorrect**

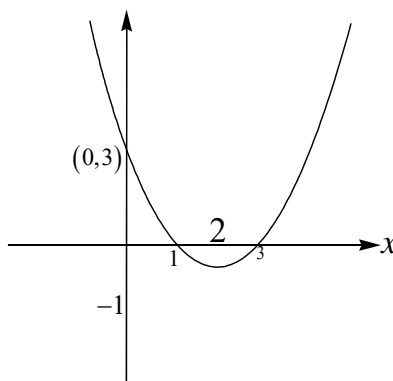
1)  $a_r = \frac{(n-r+1)a + rb}{n+1}$

2)  $g_r = (a^{n-r-1} b^r)^{1/n+1}$

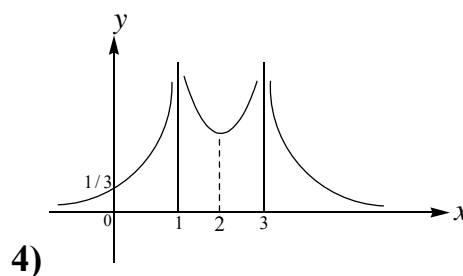
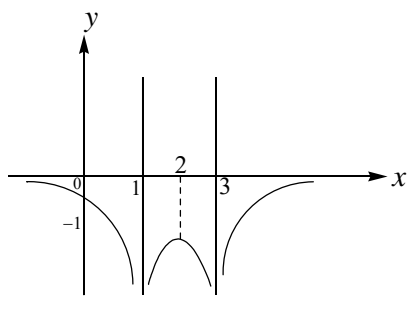
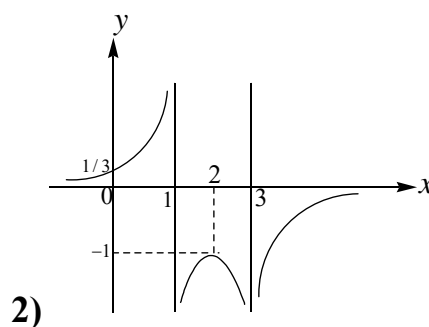
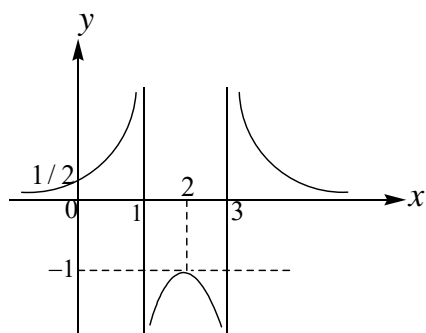
3)  $h_r = \frac{(n+1)ab}{(n-r+1)b + ra}$

4)  $a_r h_{n-r+1} = ab$

66. Graph of  $y = f(x)$  is given below



Then graph of  $y = \frac{1}{f(x)}$  is best represented by

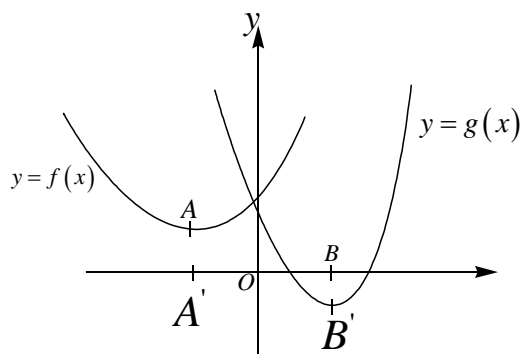




67. Which of the following is **true**

- 1) If  $|f(x)|$  is continuous on  $(a, b)$ , then the function  $f$  must be continuous on  $(a, b)$
- 2) For every continuous functions  $f(x), g(x)$  on  $(0, \infty)$  satisfying  $f(x) < g(x)$  for all  $x > 0$  and both  $\lim_{x \rightarrow \infty} f(x)$  and  $\lim_{x \rightarrow \infty} g(x)$  exist, then  $\lim_{x \rightarrow \infty} f(x) < \lim_{x \rightarrow \infty} g(x)$ .
- 3) If both functions  $f(x)$  and  $g(x)$  are discontinuous at  $x=a$ , then  $f(x)g(x)$  is always discontinuous at  $x=a$
- 4) For every continuous monotonic functions  $f(x), g(x)$  on  $\mathbb{R}$ , Then their sum  $f(x) + g(x)$  is need not be monotonic on  $\mathbb{R}$ .

68. Let  $f(x) = x^2 + 2ax + b, g(x) = cx^2 + 2dx + 1$  be quadratic expressions whose graph is as shown in the figure

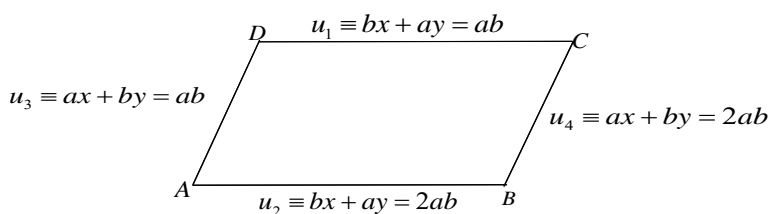


Here it is given that  $|AA'| = |BB'|$  and  $|OA'| = |OB'|$ .

Sum of roots of equations  $f(x) = 0$  and  $g(x) = 0$  is

- 1) 0
- 2)  $2(a + d)$
- 3)  $1 + b$
- 4)  $2a - \frac{2d}{c}$

69. In a parallelogram as shown in the figure ( $a \neq b$ )



equation of the diagonal BD is

- 1)  $u_1 u_4 - u_2 u_3 = 0$
- 2)  $u_1 + u_2 - u_3 - u_4 = 0$
- 3)  $u_1 u_2 - u_3 u_4 = 0$
- 4)  $u_1 u_3 - u_2 u_4 = 0$

70. Image of the point with position vector  $\vec{a}$  in the plane  $\vec{r} \cdot \vec{n} = d$  is

- 1)  $\frac{\vec{a} - 2(d - \vec{a} \cdot \vec{n})}{|\vec{n}|^2} \vec{n}$
- 2)  $\vec{a} + \frac{2(\vec{a} \cdot \vec{n} - d)}{|\vec{n}|^2} \vec{n}$
- 3)  $\vec{a} + \frac{2(d - \vec{a} \cdot \vec{n})}{|\vec{n}|^2} \vec{n}$
- 4)  $\vec{n} + \frac{2(d - \vec{a} \cdot \vec{n})}{|\vec{n}|^2} \vec{n}$



71. The expression in the vector form for the point  $\vec{r}_1$  of intersection of the plane  $\vec{r} \cdot \vec{n} = d$  and the perpendicular line  $\vec{r} = \vec{r}_0 + t\vec{n}$  where  $t$  is a parameter given by

1)  $\vec{r}_1 = \vec{r}_0 + \left( \frac{d - \vec{r}_0 \cdot \vec{n}}{\vec{n} \cdot \vec{n}} \right) \vec{n}$       2)  $\vec{r}_1 = \vec{r}_0 + \left( \frac{\vec{r}_0 \cdot \vec{n}}{\vec{n} \cdot \vec{n}} \right) \vec{n}$

3)  $\vec{r}_1 = \vec{r}_0 + \left( \frac{\vec{r}_0 \cdot \vec{n} - d}{|\vec{n}|^2} \right) \vec{n}$       4)  $\vec{r}_1 = \vec{r}_0 + \left( \frac{\vec{r}_0 \cdot \vec{n}}{|\vec{n}|} \right) \vec{n}$

72. Let  $L_1 = 0$  be a focal chord of the parabola  $P: y^2 = 4ax$ .  $L_1 = 0$  Meets the parabola at “L” and “M”. The tangents at “L” and “M” intersect at “N”.

$S_1$ : Focus is the foot of the perpendicular from “N” to  $L_1 = 0$

$S_2$ :  $\angle NML = 90^\circ$

$S_3$ :  $\frac{1}{SM} + \frac{1}{SL} = \frac{2}{a}$  ( $S$  is focus of the parabola)

$S_4$ : “N” lie on the directrix

The number of correct statements among  $S_1, S_2, S_3, S_4$  is

1) 0      2) 1      3) 2      4) 3

73. If probability of  $n$  heads in  $2n$  tosses of a fair coin is  $P$  then  $P$  can not be

1)  $\frac{\sum_{r=0}^n \binom{n}{r}^2}{\left( \sum_{r=0}^{2n} \binom{2n}{r} \right)}$       2)  $\prod_{r=1}^n \left( \frac{n+r}{2r} \right)$       3)  $\frac{{}^{2n}C_n}{2^{2n}}$       4)  $\prod_{r=1}^n \left( \frac{2r-1}{2r} \right)$

74. Let  $S_1$ : If  $g(a) = 0$ , then the function  $F(x) = \frac{f(x)}{g(x)}$  has a vertical asymptote at the point  $x = a$ .

$S_2$ : If  $g(a) = 0$ , then the rational function  $R(x) = \frac{f(x)}{g(x)}$

(Both  $f(x)$  and  $g(x)$  are polynomials) has a vertical asymptote at the point  $x = a$ .

- 1)  $S_1$  and  $S_2$  are true for every function  $F(x), R(x)$   
 2)  $S_1$  is true for every function  $F(x)$  and  $S_2$  is not true for every function  $R(x)$   
 3)  $S_1$  is not true for every function  $F(x)$  and  $S_2$  is true for every function  $R(x)$   
 4)  $S_1$  is not true for every function  $F(x)$  and  $S_2$  is not true for every function  $R(x)$

75. If  $\vec{a}, \vec{b}, \vec{c}, \vec{d}$  are four vector then  $(\vec{a} \times \vec{b}) \cdot (\vec{c} \times \vec{d})$  is not equal to

- 1)  $\vec{a} \cdot \{\vec{b} \times (\vec{c} \times \vec{d})\}$       2)  $\{(\vec{a} \times \vec{b}) \times \vec{c}\} \cdot \vec{d}$   
 3)  $(\vec{a} \cdot \vec{c})(\vec{b} \cdot \vec{d}) - (\vec{a} \cdot \vec{d})(\vec{b} \cdot \vec{c})$       4)  $(\vec{d} \times \vec{c}) \cdot (\vec{b} \times \vec{a})$



76. Let  $S_1$  : If  $\int_a^b f(x)dx \geq 0$ , Then  $f(x) \geq 0$  for all  $x \in [a, b]$ .  
 $S_2$  : If a function  $g(x)$  is defined for every  $x \in [a, b]$  and  $\int_a^b |g(x)|dx$  exists, then  $\int_a^b g(x)dx$  exists.
- 1)  $S_1$  is true for every function  $f$  and  $S_2$  is true for every function  $g$
  - 2)  $S_1$  is true for every function  $f$  and  $S_2$  is not true for every function  $g$
  - 3)  $S_1$  is not true for every function  $f$  and  $S_2$  is true for every function  $g$
  - 4)  $S_1$  is not true for every function  $f$  and  $S_2$  is not true for every function  $g$
77. **Statement-I**  $\sim (p \leftrightarrow \sim q)$  is equivalent to  $p \leftrightarrow q$ .  
**Statement-II**  $\sim (p \leftrightarrow \sim q)$  is a tautology.
- 1) Statement-I is True, Statement-II is True; Statement-II is a correct explanation for Statement-I
  - 2) Statement-I is True, Statement-II is True; Statement-II is **NOT** a correct explanation for Statement-I
  - 3) Statement-I is True, Statement-II False
  - 4) Statement-I is False, Statement-II True
78. If the equation  $a|z|^2 + \overline{\alpha}z + \alpha\overline{z} + d = 0$  represents a circle where  $a, d$  are real constants, then which of the following condition is correct?
- 1)  $|\alpha|^2 - ad \neq 0$
  - 2)  $\alpha = 0, a, d \in R^+$
  - 3)  $|\alpha|^2 - ad \geq 0$  and  $a \in R$
  - 4)  $|\alpha|^2 - ad > 0$  and  $a \in R - \{0\}$
79. Let  $f(x)$  and  $g(x)$  are two differentiable functions upto any order. If  $f(x)$  and  $g(x)$  are inverse of each other then
- 1)  $g'(f(x)) = \frac{-1}{f'(x)}$
  - 2)  $g''(f(x)) = \frac{f''(x)}{(f'(x))^3}$
  - 3)  $f''(g(x)) = \frac{g''(x)}{(g'(x))^3}$
  - 4)  $g''(f(x)) = -\frac{f''(x)}{(f'(x))^3}$
80. Let  $S_1$  : A function always has a local maximum between any two local minima.  
 $S_2$  : If a function is defined on  $[a, b]$  and continuous on  $(a, b)$ , then it takes its extreme values on  $[a, b]$ .  
 $S_3$  : Every continuous and bounded function on  $(-\infty, \infty)$  takes on its extreme values.  
The number of statements among the  $S_1, S_2, S_3$  which are always true for every function
- 1) 0
  - 2) 1
  - 3) 2
  - 4) 3



## (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. Let  $V_1$  be the variances of 2022 observations which are in A.P With first term 2022 and common difference is 2022 and Let  $V_2$  be the variances of 2022 observations which are in A.P With first term 2023 and common difference 2022 then  $V_1 : V_2 = m : n$  where G.C.D of  $(m, n)$  is 1 then  $m + n$  is
82. Let  $\Delta_1$  be the area of  $\Delta PQR$  inscribed in an ellipse  $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1 (a > b)$  and  $\Delta_2$  be the area of the  $\Delta P'Q'R'$  whose vertices are the points lying on the auxiliary circle corresponding to the points P, Q, R, respectively. If the eccentricity of the ellipse is  $\frac{4\sqrt{3}}{7}$ , then the ratio  $\frac{\Delta_2}{\Delta_1}$  must be \_\_\_\_\_
83. Area of a triangle whose vertices are complex numbers  $z_1, z_2, z_3$  is  $\left| \frac{i}{k} \begin{vmatrix} z_1 & \overline{z_1} & 1 \\ z_2 & \overline{z_2} & 1 \\ z_3 & \overline{z_3} & 1 \end{vmatrix} \right|$  then  $k =$
84. If A is a matrix of order  $n \times n$ ,  $\left| \text{adj}(\text{adj}(\text{adj}(A))) \right| = |A|^{(n-1)^k}$  then  $k =$
85. Let H be the ortho centre of the triangle ABC inscribed in a circle  $(x-h)^2 + (y-k)^2 = 4$ . If image of H with respect to BC is G. Then SG=(where S is the centre of the circle)
86. The co-efficient of  $x^{n-2}$  in the polynomial  $(x-1)(x-2)(x-3).....(x-n)$  is  $\frac{n(n^2-1)(3n+2)}{g}$  then  $g =$
87. Vertices of  $2n$  sided regular polygon, joined to form a triangle then Number of **right angled** triangles, is  $k.n(n-1)$  then  $k =$
88.  $\cos^2 \theta + \cos^2(60^\circ + \theta) + \cos^2(60^\circ - \theta) = k$  then  $4k =$
89. For  $x < -1$ ,  $\sin^{-1} \frac{2x}{1+x^2} = k\pi - 2 \tan^{-1} x$  then  $3 - k =$
90.  $\frac{d^2x}{dy^2} + k \left( \frac{d^2y}{dx^2} \right) \left( \frac{dx}{dy} \right)^3 = 0$  Then  $k =$