



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: 20-01-2023

Time: **02.00Pm to 05.00Pm**

GTM-10

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.

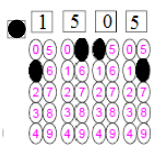
Marking scheme: +4 for correct answer, 0 if not attempt and -1 in all other cases.

(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:

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Candidate's Signature: _____

Invigilator's Signature: _____

20-01-23_Sr.Super60_(NUCLEUS,STERLING) & LIIT_BT_ Jee-Main_GTM-10_Test Syllabus

PHYSICS : TOTAL SYLLABUS

CHEMISTRY : TOTAL SYLLABUS

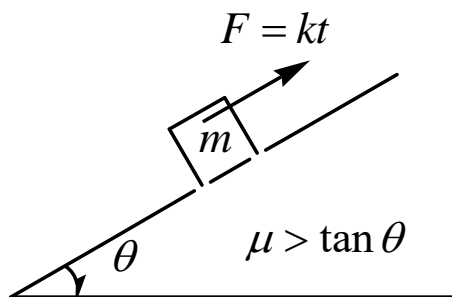
MATHEMATICS : TOTAL SYLLABUS

**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.

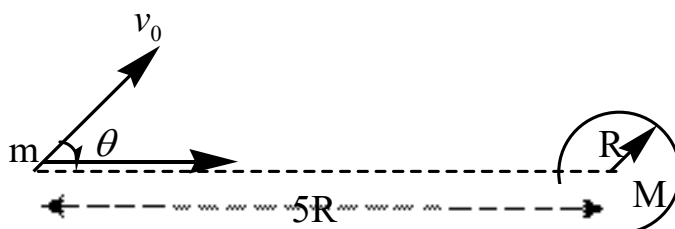
1. If a particle is projected with speed u from the ground at an angle θ with horizontal. Radius of curvature of a point where velocity vector is perpendicular to initial velocity vector is given by
- 1) $\frac{u^2 \cos^2 \theta}{g}$ 2) $\frac{u^2 \cot^2 \theta}{g \sin \theta}$ 3) $\frac{u^2}{g}$ 4) $\frac{u^2 \tan^2 \theta}{g \cos \theta}$
2. A block of mass m is placed on an inclined surface. Coefficient of friction between the plane and block is $\mu > \tan \theta$. A force $F = kt$ is applied on the block at $t = 0$. Then which of the following represents variation of magnitude of frictional force (fr) with time?



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



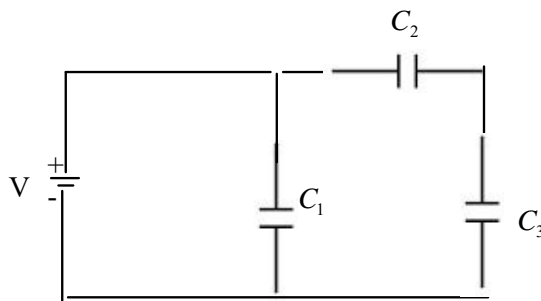
3. Resolving power of reflecting type telescope increases with
- 1) Decrease in wavelength of incident light
 - 2) Increase in wavelength of incident light
 - 3) Increase in diameter of objective mirror
 - 4) both 1 & 3
4. A spaceship is sent to investigate a planet of mass M and radius R , while hanging motionless in space at a distance $5R$ from the center of the planet. It fires a package with speed v_0 as shown in the figure. The package has a mass m , which is much smaller than the mass of the spaceship. The angle θ at which the package will just graze the surface of the planet at the top is



- 1) $\sin^{-1}\left(\frac{1}{2}\sqrt{1+\frac{8GM}{5v_0^2R}}\right)$
 - 2) $\sin^{-1}\left(\frac{1}{5}\sqrt{1+\frac{8GM}{5v_0^2R}}\right)$
 - 3) $\sin^{-1}\left(\frac{1}{5}\sqrt{1+\frac{2GM}{5v_0^2R}}\right)$
 - 4) $\sin^{-1}\left(\frac{1}{5}\sqrt{1+\frac{8GM}{3v_0^2R}}\right)$
5. A large open tank has two holes in the wall. One is a square hole of side L at a depth 'y' from the top and the other is a circular hole of radius R at a depth $4y$ from the top. When the tank is completely filled with water, the quantities of water flowing out per second from both holes are the same. Then $R =$ (Assume R and $L \ll y$)
- 1) $\frac{L}{\sqrt{2\pi}}$
 - 2) $2\pi L$
 - 3) L
 - 4) $\frac{L}{2\pi}$
6. A U- tube whose ends are open and whose limbs are vertical, contains oil of specific gravity 0.8 and surface tension 28 dynes/cm. If one limb has a diameter of 2.2 mm and other of 0.8mm, difference in level of oil in the two limbs is: (contact angle = 0)
- 1) 22.8 mm
 - 2) 6.2 mm
 - 3) 15.2 mm
 - 4) 11.4 mm



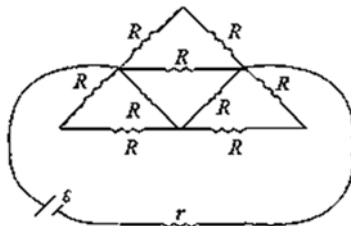
7. Assertion: Resolving power of a telescope is more if the diameter of the objective lens is less
Reason: Objective lens of larger diameter collects more light
- 1) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
 - 2) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
 - 3) If the Assertion is correct but Reason is incorrect.
 - 4) If the Assertion is incorrect and Reason is correct.
8. **Assertion:** Electromagnetic waves interact with matter and set up oscillations.
Reason: Interaction is independent of the wavelength of the electromagnetic waves.
- 1) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
 - 2) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
 - 3) If the Assertion is correct but Reason is incorrect.
 - 4) If the Assertion is incorrect and Reason is correct.
9. Two identical charged spheres suspended from a common point by two massless strings of length l are initially at a distance d ($d \ll l$) apart because of mutual repulsion. The charge begins to leak from both the spheres at constant rate. As a result, the charges approach each other with a velocity ' V ' as a function of the distance (x) between them is:
- 1) $V \propto x^{\frac{-1}{2}}$
 - 2) $V \propto x^{-1}$
 - 3) $V \propto x^{\frac{1}{2}}$
 - 4) $V \propto x$
10. Three capacitors C_1 , C_2 and C_3 are connected to a battery as shown in the figure. The three capacitors have equal capacitances. Which capacitor stores the most energy?





- 1) C_2 or C_3 as they store the same amount of energy
- 2) C_2
- 3) C_1
- 4) All three capacitors store the same amount of energy

11. For maximum power from battery the internal resistance of battery r is

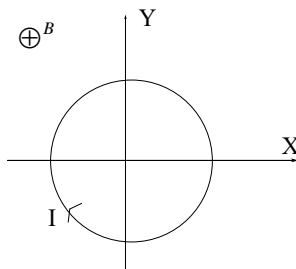


- 1) $10R$
- 2) $\frac{4R}{9}$
- 3) $\frac{R}{8}$
- 4) $\frac{10R}{9}$

12. A long cylindrical wire kept along Z-axis carries a current of density $\vec{J} = J_0 r \hat{k}$ where J_0 is a constant and r is the radial distance from the axis of the cylinder. The magnetic induction B inside the conductor at a distance d from the axis of the cylinder is

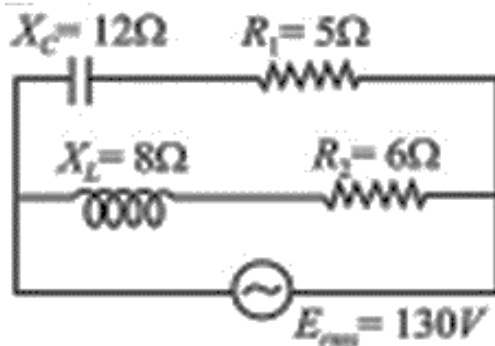
- 1) $\mu_0 J_0$
- 2) $-\frac{\mu_0 J_0 d}{2}$
- 3) $\frac{\mu_0 J_0 d^2}{3}$
- 4) $-\frac{\mu_0 J_0 d^3}{4}$

13. A conducting loop carrying a current I is placed in a uniform magnetic field pointing into the plane of the paper as shown. The loop will have a tendency to



- 1) Contract
- 2) Expand
- 3) Move towards +ve x-axis
- 4) Move towards -ve x-axis

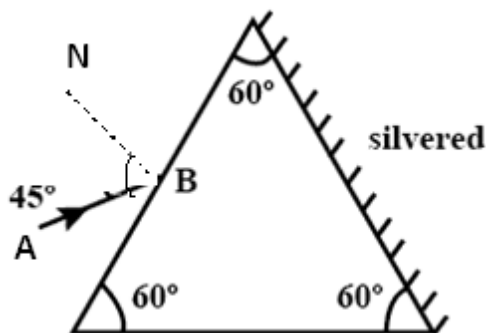
14. Power delivered by the ac source in the circuit shown (in Watts) is:



- 1) 500
- 2) 1014
- 3) 1514
- 4) 2013



15. A equilateral prism is made of a transparent material of refractive index $\sqrt{2}$. A ray of light AB is Incident at angle of incident 45° as shown. The net deviation in the path of ray when it comes out of prism is



- 1) 135° 2) 120° 3) 30° 4) 150°
16. In a Young's double slit experiment 12 fringes are observed to be formed in a certain segment of the screen when light of wavelength 600 nm is used. If the wavelength is changed to 400nm, number of fringes observed in the same segment of the screen is given by
- 1) 12 2) 18 3) 24 4) 30
17. The half life of radioactive Radon is 3.8 days. The time at the end of which $1/20$ th of the radon sample will remain undecayed is (given $\log_e 20 = 3$)
- 1) 3.8 days 2) 16.45 days 3) 33 days 4) 76 days
18. **Assertion:** Ferro-magnetic substances become paramagnetic below Curie temp.
Reason : Domains are destroyed at high temperature
- 1) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
 2) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
 3) If the Assertion is correct but Reason is incorrect.
 4) If the Assertion is incorrect and Reason is correct.
19. The dominant mechanisms for motion of charge carries 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 forward and reverse bias



20. A cylinder rolls up an inclined plane, reaches some height and then rolls down (without slipping throughout these motions). The directions of frictional force acting on the cylinder are:

- 1) Up the incline while ascending and down the incline while descending
- 2) Up the incline while ascending as well as while descending
- 3) Down the incline while ascending and up the incline while descending
- 4) Down the incline while ascending as well as while descending

(NUMERICAL VALUE TYPE)

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

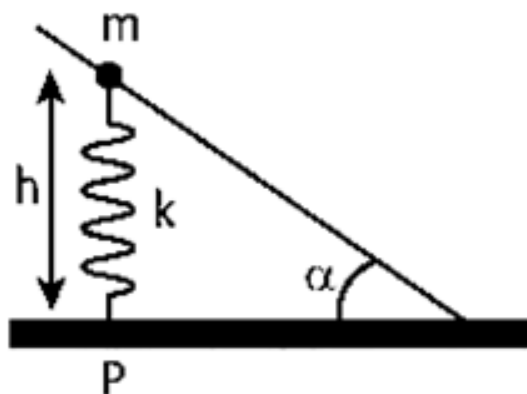
Marking scheme: +4 for correct answer, 0 if **not attempt** and -1 in all other cases.

21. A physical quantity Q is related to four observables x , y , z and t by the relation $Q = \frac{x^{2/5} z^3}{y \sqrt{t}}$.

Percentage errors of measurement in x , y , z and t are 2.5%, 2%, 0.5% and 1% respectively.

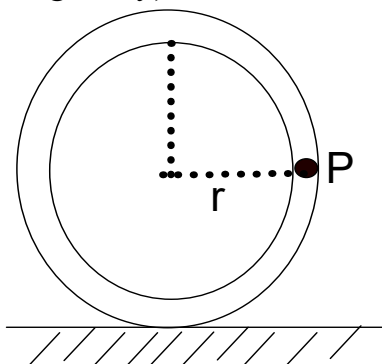
Percentage error in Q will be

22. A bead of mass m is sliding down the fixed inclined of rod of negligible mass without friction. It is connected to a point P on the horizontal surface with a light spring of spring constant k and the other end to the bead. The bead is released from rest and the spring is initially unstretched and vertical. The bead just stops at the bottom of the inclined rod. The angle which the inclined rod makes with the horizontal initially is $\cot^{-1} \left(1 + \sqrt{\frac{pmg}{kh}} \right)$ where $p =$

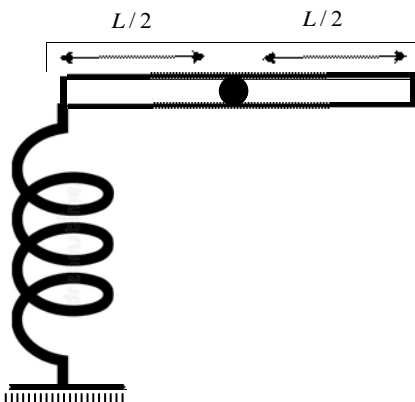




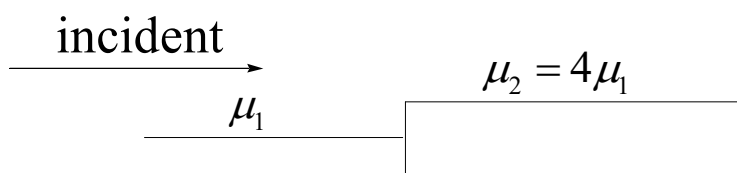
23. A small block of mass 'm' is rigidly attached at point P to a ring of mass '3m' and radius 'r'. System is released from rest when radius vector makes an angle of 90° with the vertical (as shown) and rolls without sliding. Angular acceleration just after its release is g/pr where $p = \underline{\hspace{2cm}}$ (g is acceleration due to gravity)



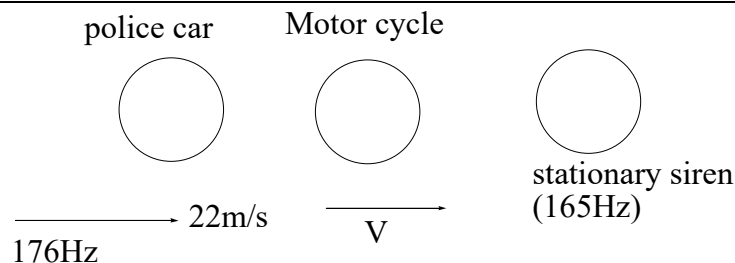
24. A uniform rod of mass m and length L is hinged at its mid - point in such a way that it can rotate in the vertical plane about a horizontal axis passing through the hinge. One of its ends is attached to a spring of spring constant k which is unstretched when the rod is horizontal. If this end is now given a small displacement and released, angular frequency of the resulting motion is $\sqrt{pk/m}$ where $p = \underline{\hspace{2cm}}$



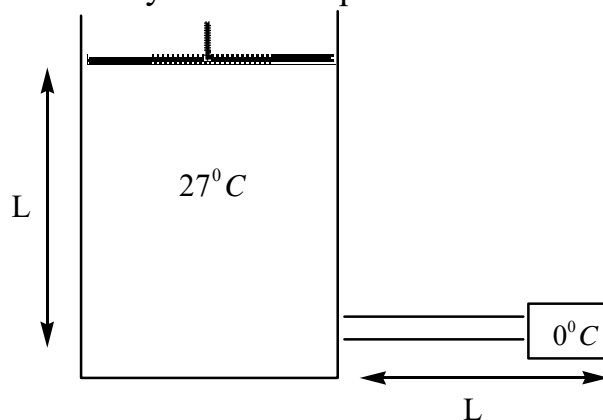
25. String 1 is connected to string 2. Mass/ length in string 1 is μ_1 and that of string 2 is $4\mu_1$. Tension in the strings is T. A travelling wave is coming from left. Fraction of the energy in the incident wave that goes into string 2 is $8/p$ where $p = \underline{\hspace{2cm}}$



26. A police car moving at 22m/s, chases a motorcyclist. The police man sounds his horn at 176Hz while both of them move towards a stationary siren of frequency 165 Hz. Speed of the motorist is $(20+p)$ where $p = \underline{\hspace{2cm}}$ (Given that motorcyclist does not observe any beats and speed of sound is 330m/s)



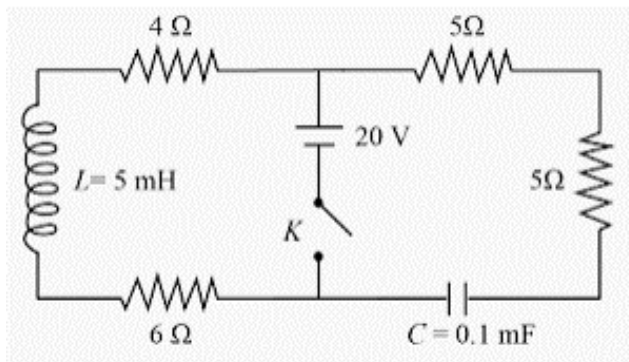
27. 0.5 moles of an ideal gas at constant temperature 27°C Kept inside a cylinder of length of L and cross-section area A closed by a massless piston.



The cylinder is attached with a conducting rod of length L , cross section area $= (1/9)m^2$ and thermal conductivity k , whose other end is maintained at 0°C . If piston is moved such that rate of heat flow through the conducting rod is constant, then velocity of piston when it is at height $L/2$ from the bottom of cylinder is $\left(\frac{k}{pR}\right)m/\text{sec}$. Then $p/20 =$

(R is Universal gas constant and neglect any kind of heat loss from system)

28. Electrical field intensity is given as $\vec{E} = (2x+1)y\hat{i} + x(x+1)\hat{j}$. The magnitude of potential (in Volts) at a point (1,2) if potential at origin is 2 Volts is
29. In the circuit, shown the key (K) is closed at $t=0$. Current through the key at the $t = 10^{-3} \ln 2$ is $p/2$. Then $p =$



30. If the wavelength of the first line of the Balmer series in the hydrogen spectrum is λ then the wavelength of the first line of the Lyman series is $(p/27)\lambda$ where $p =$

**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. Statetment-1: In chromatographic technique retardation factor (R_f) does not depend on the polarity of solvent.

Statement -2: Thin layer chromatography is an example of absorption chromatography.

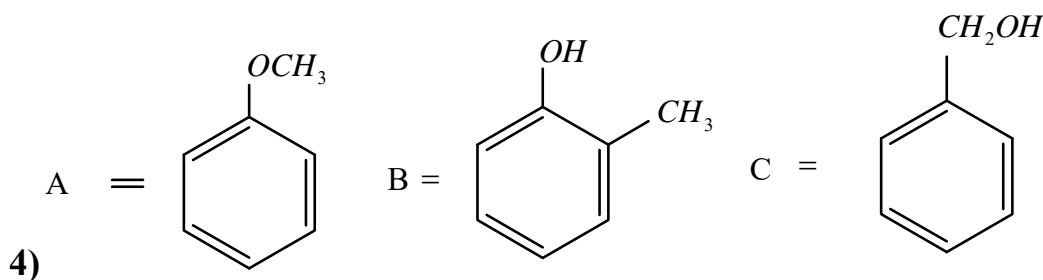
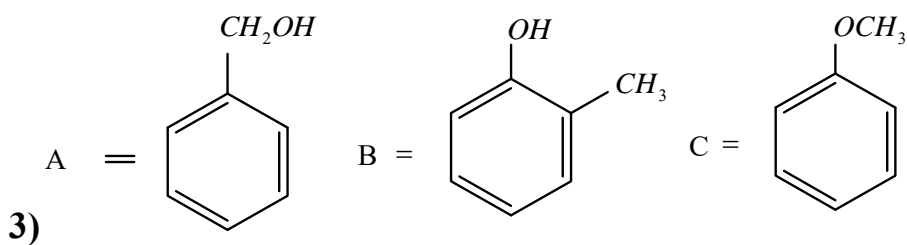
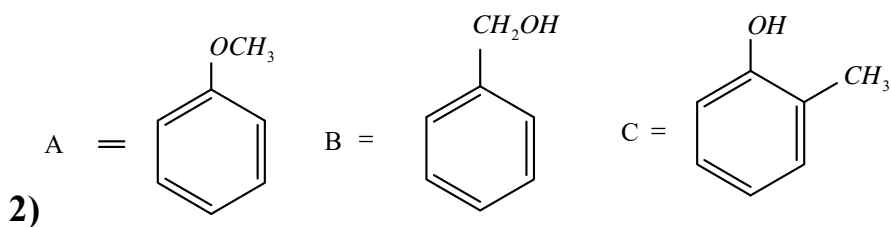
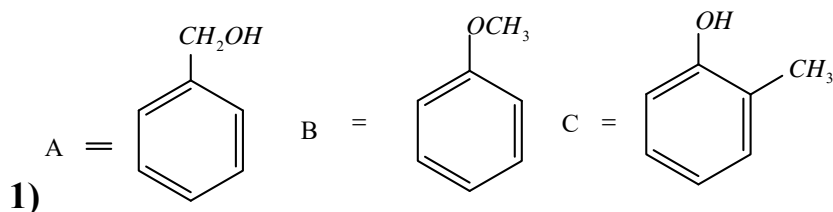
- 1) Both statements are true
- 2) Statement-1 is true but statement -2 is false
- 3) Statement-2 is true but Statement-1 is false
- 4) Both Statements are false

32. Three isomeric compounds **A,B,C** having molecular formula C_7H_8O show following properties.

i) Compound **B** is soluble in aqueous $NaOH$ but **A** and **C** are insoluble,

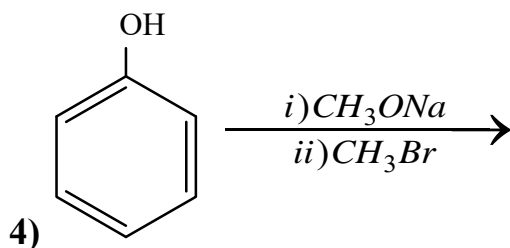
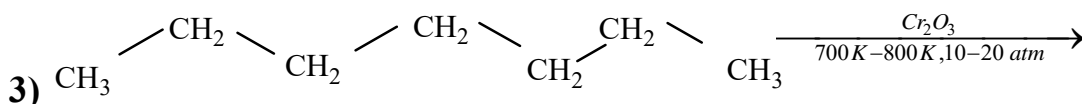
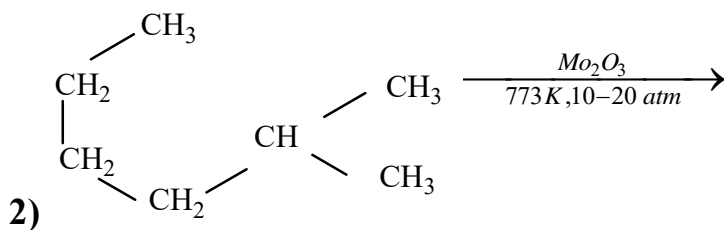
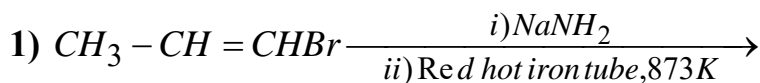
ii) Boiling point order is $A > B > C$

The possible structures of **A,B,C** are





33. Isostructural pairs among the following are
 a) BF_3 and NF_3 b) SO_4^{2-} and CrO_4^{2-} c) CO_3^{2-} and NO_3^- d) SF_4 and CF_4
 1) A and D only 2) A and B only 3) B and C only 4) C and D only
34. The major aromatic product of which of the following reactions give only one type of product on mono chlorination with $Cl_2 / FeCl_3$



35. Statement-1: CsI is less soluble in water compared to $CsCl$
 Statement-2: More amount of heat is liberated during the formation of $CsCl$ than the formation CsI from their elements
 1) Both statements 1 and 2 correct
 2) Statement - 1 is correct and statement -2 is wrong
 3) Statement - 1 is wrong and statement -2 is correct
 4) Both statements 1 and 2 are wrong

36. Match list-I with list II

List-I

(Processes/Reactions)

a) Deacon's Process

b) Ostwald's process

c) Contact process

d) Haber's process

1) a - iv, b - iii, c - ii, d - I

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

List-II

(catalyst)

i) $Pt_{(s)} - Rh_{(s)}$

ii) V_2O_5

iii) $CuCl_2$

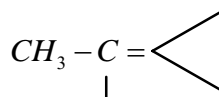
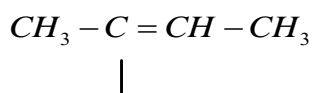
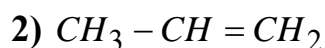
iv) Fe

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

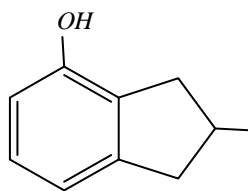
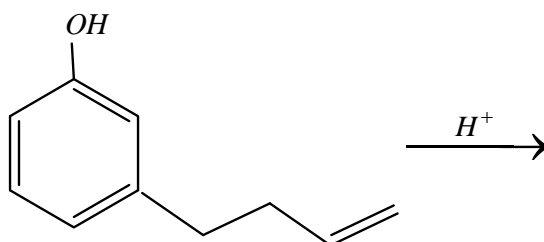
4) a - i, b - iv, c - iii, d - ii



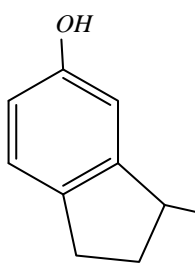
37. An unsaturated hydrocarbon **X** on ozonolysis gives **A**. The compound **A** when warmed with ammonical silver nitrate forms a bright silver mirror along the sides of the test tube. The unsaturated hydrocarbon **X** cannot be



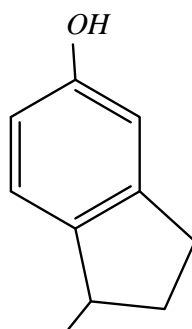
38. The major product of the following reaction is



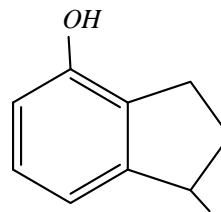
2)



3)



4)



39. Assertion (A): during the process of removing temporary hardness most of magnesium precipitate as $\text{Mg}(\text{OH})_2$ but calcium precipitate as CaCO_3

Reason(R): $\text{Mg}(\text{OH})_2$ is more soluble in water as compared to $\text{Ca}(\text{OH})_2$

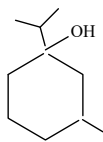
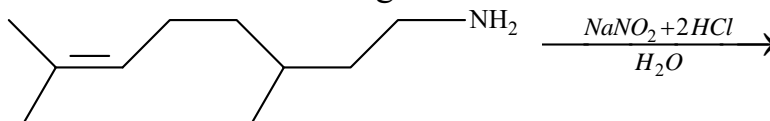
1) Both A and R are true and R is the correct explanation of A

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

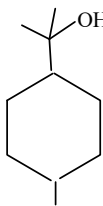
3) A is true but R is false

4) A is false but R is true

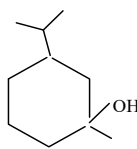
40. The major product formed in the reaction given below will be



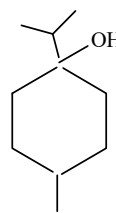
2)



3)



4)





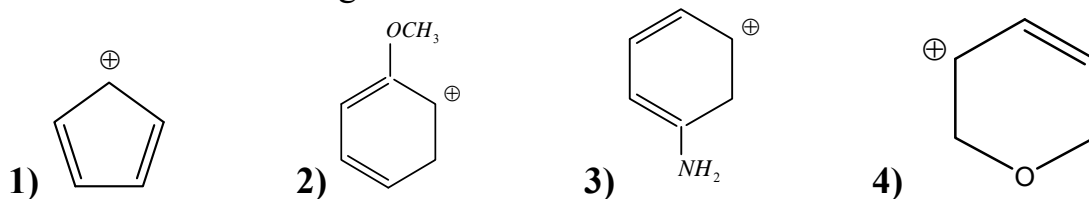
41. A black precipitate is formed when $H_2S(g)$ passed through water extract of an inorganic salt. This precipitate is soluble in dilute HNO_3 . On adding KI to this solution a yellow precipitate is formed. The cation present in inorganic salt is

- 1) Cu^{2+} 2) Pb^{2+} 3) Ba^{2+} 4) Zn^{2+}

42. The correct Statement about B_2H_6 is

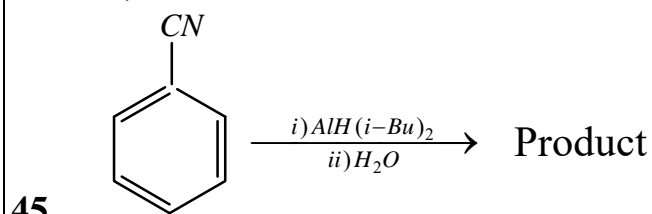
- 1) It behaves as lewis base
 2) It is prepared by hydrolysis of BCl_3
 3) Terminal $B-H$ bonds have relatively more S-character when compared to bridged bonds.
 4) It has two centre- two electron bonds and three centre two electron bonds which are in same plane.

43. Which of the following carbocation's is most stable ?

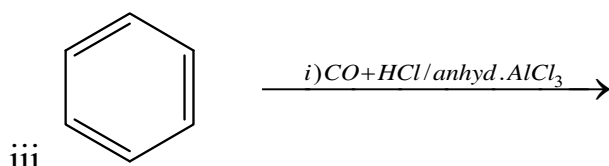
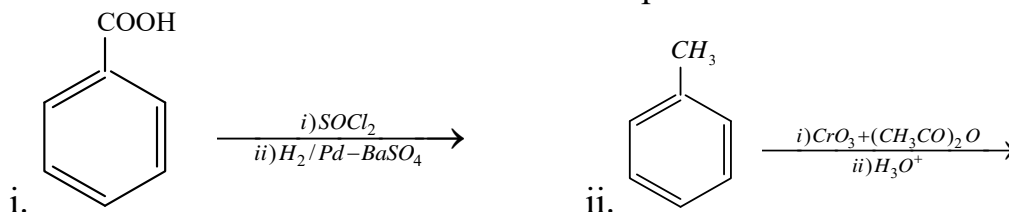


44. When $CH_2 = CH - OCOCH_3$ undergo chain growth polymerization followed by hydrolysis gives a polymer with which of the following repeating unit

- 1) $\text{---}(\text{CH}_2 - \underset{\text{CH}_3}{\text{CH}})\text{---}_n$ 2) $\text{---}(\text{CH}_2 - \underset{\text{COOH}}{\text{CH}})\text{---}_n$
 3) $\text{---}(\text{CH}_2 - \underset{\text{CHO}}{\text{CH}})\text{---}_n$ 4) $\text{---}(\text{CH}_2 - \underset{\text{OH}}{\text{CH}})\text{---}_n$



same product is also obtained in the reaction



- 1) i,ii,only 2) iii only 3) i,ii,iii 4) i,iii only



46. Which among the following species has unequal bond lengths?

- 1) $[XeF_5]^-$ 2) $[BF_4]^-$ 3) SiF_4 4) NF_3

47. Increasing order of reactivity of the following towards nucleophilic substitution (SN_2) is

-
- i) NO_2 ii) Cl iii) CH_2Cl iv) $COCH_2Cl$
- 1) $i < ii < iii < iv$ 2) $ii < i < iv < iii$
 3) $ii < iii < i < iv$ 4) $iv < iii < ii < i$

48. In which of the following reaction paramagnetic gaseous product is obtained?

- 1) $Cu + conc.H_2SO_4 \rightarrow$ 2) $Zn + dilute.HNO_3 \rightarrow$
 3) $Cu + dilute.HNO_3 \rightarrow$ 4) $MnO_2 + conc.HCl \rightarrow$

49. The type of link present in amylose is

- 1) $C_1 - C_6$ α - glycosidic link 2) $C_1 - C_4$ α - glycosidic link
 3) $C_1 - C_6$ β - glycosidic link 4) $C_1 - C_4$ β - glycosidic link

50. Match list-I with list-II

	List-I		List-II
a)	Calamine	i)	Al
b)	Siderite	ii)	Fe
c)	Cryolite	iii)	Zn
d)	Magnetite	iv)	Cu
		v)	Mg

Choose the correct answer from the options given below

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

(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 total number of stereo isomers possible for $[Co(en)_2(Cl)(NH_3)]^{2+}$ is
 (en = ethylene diamine)



52. The emf of the cell $\text{Ag}_{(s)} / \text{Ag}^+ (\text{AgI saturated solution}) // \text{Ag}_{(aq)}^{+1} (0.1M) / \text{Ag}_{(s)}$ is $+0.420V$ at $298K$. The value of solubility product (K_{sp}) of AgI in given saturated solution was calculated as $1.0 \times 10^{-x} M^2$. The value of 'x' is $\left(\frac{2.303RT}{F} = 0.06 \right)$
53. A non-volatile solute **HX** undergo complete (100%) ionization in water at any temperature above boiling point of pure water. The same solute **HX** undergo complete (100%) dimerization in water at any temperature below freezing point of pure water. The sum of values of both colligative properties elevation in boiling point and depression in freezing point for 1.0 molal aqueous solution of **HX** is
(Round off answer to nearest integer)
 $\left[K_b = 0.52, K.kg.mole^{-1}, K_f = 1.86 K.kg.mole^{-1} \right]$
54. A sample of pure $\text{KHC}_2\text{O}_4 \cdot \text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ require 10 litre of 1.5 M NaOH aqueous solution for complete neutralization. In acidic medium MnO_4^{-1} is reduced to Mn^{2+} and oxidize $\text{C}_2\text{O}_4^{2-}$ to CO_2 . The number of moles of MnO_4^{-1} required to completely oxidize given sample in acidic medium is _____
55. The number of electrons in ground state of atomic $\text{Fe}(Z = 26)$ with sum of principal (n) and azimuthal (l) quantum numbers as 4 are
56. For the equilibrium $\text{NiO}_{(s)} + \text{CO}_{(g)} \rightleftharpoons \text{Ni}_{(s)} + \text{CO}_{2(g)}$
 $\Delta G^0 (\text{cal / mole}) = 1400 - 5.6T (\text{kelvin})$. The temperature (in kelven) where the equilibrium gaseous mixture contain 20 mole percent of $\text{CO}_{(g)}$ is _____
 $(\ln 2 = 0.7, R = 2 \text{ cal.k}^{-1}.mole^{-1})$
57. $\text{PCl}_{5(g)}$ decomposes at temperature T K in to $\text{PCl}_{3(g)}$ and $\text{Cl}_{2(g)}$ according to 1st order kinetics. In a closed container initially only $\text{PCl}_{5(g)}$ was taken at 2atm & T K. After 12 seconds the pressure in container found to be 2.4 atm at same temperature. The rate constant (in min^{-1}) for the decomposition of $\text{PCl}_{5(g)}$ at T K is _____
 $(\ln 10 = 2.3, \ln 2 = 0.7)$
58. Among unit cells of 14 types of Bravais lattices, how many unit cells have at least two equal edge lengths?
59. A 2M aqueous solution of solute (180 g/mole) has density 1.10 g/mL. The molality of solution is _____ (round off answer to nearest integer)
60. The bond energies of A_2, B_2 and AB are in the ratio 2:1:2. If the enthalpy of formation of AB from A_2 and B_2 is -150 KJ/mole, then the bond dissociation energy(in KJ/mole) of A_2 is _____

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

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

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

61. Statement-1 : $(p \wedge \sim q) \wedge (\sim p \wedge q)$ is a fallacy
Statement-2 : $(p \Rightarrow q) \Leftrightarrow (\sim q \Rightarrow \sim p)$ is a tautology
1) Both the statements are true and statement-2 is the correct explanation for statement-1
2) Both the statements are true and statement-2 is not the correct explanation for statement-1
3) statement-1 is true but statement-2 is false
4) statement-1 is false but statement-2 is true
62. The solution of the differential equation $(1 - xy - x^5 y^5) dx - x^2(x^4 y^4 + 1) dy = 0$ is given by
1) $x = ce^{xy + \frac{1}{5}x^5 y^5}$ 2) $x = ce^{xy - \frac{1}{5}x^5 y^5}$ 3) $x = ce^{x^2 y^2 + \frac{1}{5}x^5 y^5}$ 4) $x = ce^{x^2 y^2 - \frac{1}{5}x^5 y^5}$
63. If the larger root of equation $x^2 + (2 - a^2)x + (1 - a^2) = 0$ is less than both the roots of the equation $x^2 - (a^2 + 4a + 1)x + a^2 + 4a = 0$, then the range of a, is
1) $\left(-\sqrt{2}, \frac{-1}{4}\right)$ 2) $\left(-\frac{1}{4}, \sqrt{2}\right)$ 3) $(\sqrt{2}, 4)$ 4) $(2, 3)$
64. The number of real solutions of the equation $\tan^{-1} \sqrt{x^2 - 3x + 2} + \cos^{-1} \sqrt{4x - x^2 - 3} = \pi$ is
1) one 2) two 3) zero 4) infinite
65. The value of $\sum_{k=1}^n (n-k) \cos \frac{2k\pi}{n} (n \geq 3)$ is
1) $-\frac{n}{2}$ 2) 0 3) $\frac{n}{2}$ 4) $-n$
66. If $\vec{a}, \vec{b}, \vec{c}$ are unit vectors equally inclined to each other at an angle $\alpha (\neq 0)$, then the angle between $\vec{a} \times \vec{b}$ and the plane containing \vec{b} and \vec{c} is
1) $\sin^{-1} \left(\tan \frac{\alpha}{2} \cdot |\cot \alpha| \right)$ 2) $\cos^{-1} \left(\tan \frac{\alpha}{2} \cdot |\cot \alpha| \right)$
3) $\cos^{-1} \left(\cot \frac{\alpha}{2} \cdot |\tan \alpha| \right)$ 4) $\sin^{-1} \left(\cot \frac{\alpha}{2} \cdot |\tan \alpha| \right)$



67. If the tangent at (x_1, y_1) to the curve $x^3 + y^3 = a^3$ meets the curve again at (x_2, y_2) then
1) $\frac{x_2}{x_1} + \frac{y_2}{y_1} = -1$ 2) $\frac{x_2}{y_1} + \frac{x_1}{y_2} = -1$ 3) $\frac{x_1}{x_2} + \frac{y_1}{y_2} = -1$ 4) $\frac{x_2}{x_1} + \frac{y_2}{y_1} = 1$
68. The circles $x^2 + y^2 = 4$ and $x^2 + y^2 - 4\lambda x + 9 = 0$ have two common tangents if
1) $\lambda \in \left(-\frac{13}{8}, \frac{13}{8}\right)$ 2) $\lambda < \frac{-13}{8}$ or $\lambda > \frac{13}{8}$ 3) $\lambda = \frac{13}{8}$ 4) $\lambda = 0$
69. The number of points of local maxima of the function $f(x) = (x-2)^{2/3}(2x+1)$ is
1) 1 2) 0 3) 2 4) 3
70. In a shop there are five types of ice-creams (each type is available unlimited). A child buys six ice-creams.

Statement-1: The number of different ways the child can buy the six ice-creams is ${}^{10}C_5$.

Statement-2: The number of different ways the child can buy the six ice-creams is equal to the number of different ways of arranging 6 A's and 4 B's in a row.

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

71. $\int \frac{x^2 - 1}{(x^2 + 1)\sqrt{x^4 + 1}} dx =$
1) $\sec^{-1}\left(\frac{x^2 + 1}{\sqrt{2x}}\right) + c$ 2) $\frac{1}{\sqrt{2}} \sec^{-1}\left(\frac{x^2 + 1}{\sqrt{2x}}\right) + c$
3) $\frac{1}{\sqrt{2}} \sec^{-1}\left(\frac{x^2 + 1}{\sqrt{2}}\right) + c$ 4) $\sec^{-1}\left(\frac{x^2 - 1}{\sqrt{2x}}\right) + c$

72. Consider the family of lines $5x + 3y - 2 + \lambda_1(3x - y - 4) = 0$ and $x - y + 1 + \lambda_2(2x - y - 2) = 0$, then the equation of a straight line that belongs to both the families, is
1) $5x - 2y + 6 = 0$ 2) $5x - 2y + 8 = 0$
3) $5x - 2y - 6 = 0$ 4) $5x - 2y - 7 = 0$



73. Let $f(x) = (x+1)(x+2)(x+3)\dots(x+100)$ and $g(x) = f(x) \cdot f''(x) - (f'(x))^2$, then $g(x) = 0$, has
- no solution
 - exactly one solution
 - exactly two solutions
 - minimum three solutions
74. The domain of the function $f(x) = \log_2 \left(-\log_{1/2} \left(1 + \frac{1}{\sqrt[4]{x}} \right) - 1 \right)$ is
- $0 < x < 1$
 - $0 < x \leq 1$
 - $x \geq 1$
 - $x > 1$
75. Chords of the parabola $y^2 = 4x$ touch the hyperbola $x^2 - y^2 = 1$. The locus of the point of intersection of the tangents drawn to the parabola at the extremities of such chords is
- a circle
 - a parabola
 - an ellipse
 - a rectangular hyperbola
76. Let A and B be two matrices such that $A = [a_{ij}]_{2 \times 3} = \begin{bmatrix} x & 1 & 2 \\ 3x & -1 & \frac{1}{4x^2 + 1} \end{bmatrix}$ and
- $$B = [b_{ij}]_{3 \times 2} = \begin{bmatrix} \frac{1}{x^2} & \frac{1}{x} \\ 2x & 2 \\ 3 & x \end{bmatrix} \text{ where } x > 0. \text{ If matrix } C \text{ is defined as } C = [c_{ij}]_{2 \times 2}, \text{ where}$$
- $$c_{ij} = \sum_{r=1}^3 a_{ir} b_{rj}, \forall 1 \leq i, j \leq 2, \text{ then the minimum value of } \Delta(x) = \sum_{1 \leq i \leq j \leq 2} c_{ij} \text{ is}$$
- $\frac{57}{4}$
 - $\frac{57}{2}$
 - $\frac{55}{4}$
 - $\frac{55}{2}$
77. For any two real numbers x and y, we define xRy if and only if $\sin^2 x + \cos^2 y = 1$. The relation R is
- symmetric but not transitive
 - reflexive but not symmetric
 - transitive but not reflexive
 - an equivalence relation
78. Let the function, $f: [-7, 0] \rightarrow \mathbb{R}$ be continuous on $[-7, 0]$ and differentiable on $(-7, 0)$. If $f(-7) = -3$ and $f'(x) \leq 2$, for all $x \in (-7, 0)$, then for all such functions f , $f(-1) + f(0)$ lies in the interval
- $(20, 22)$
 - $(20, \infty)$
 - $(-\infty, 20]$
 - $(20, 21)$



79. If C_r stands for nC_r , then the sum of the series

$$\frac{2\left(\frac{n}{2}\right)!\left(\frac{n}{2}\right)!}{n!} \left[C_0^2 - 2C_1^2 + 3C_2^2 - \dots + (-1)^n (n+1)C_n^2 \right] \text{ where 'n' is an even positive integer is}$$

Equal to

- 1) 0 2) $(-1)^{n/2} (n+1)$ 3) $(-1)^{n/2} (n+2)$ 4) $(-1)^n n$

80. Let 10 vertical poles standing at equal distances on a straight line, subtend the same angle of elevation α at a point O on this line and all the poles are on the same side of O. If the height of the longest pole is 'h' and the distance of the foot of the smallest pole from O is 'a'; then the distance between two consecutive poles is

- 1) $\frac{h \sin \alpha + a \cos \alpha}{9 \sin \alpha}$ 2) $\frac{h \cos \alpha - a \sin \alpha}{9 \cos \alpha}$
 3) $\frac{h \cos \alpha - a \sin \alpha}{9 \sin \alpha}$ 4) $\frac{h \sin \alpha + a \cos \alpha}{9 \cos \alpha}$

(NUMERICAL VALUE TYPE)

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

81. Let $\cos \alpha + \cos \beta = \cos \gamma$ and $\sin \alpha + \sin \beta = \sin \gamma$ then the value of $\frac{\sin(\alpha + \beta)}{\sin 2\gamma}$ is

82. The shortest distance between the lines $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ and $\frac{x-2}{3} = \frac{y-4}{4} = \frac{z-5}{5}$ is K
 then $\sqrt{6}K$ is

83. Area of the region bounded by the curves $y = x \log x$ and $y = 2(x - x^2)$ is:

84. A and B alternately throw a pair of symmetrical dice. A wins if he throws 6 before B throws 7 and B wins if he throws 7 before A throws 6. If A begins the game, the probability of his winning is

85. In an experiment with 15 observations on x, the following results were available
 $\Sigma x^2 = 2830$, $\Sigma x = 170$ one observation that was 20 was found to be wrong and was replaced by the correct value 30. Then the corrected variance is



86. Let $g(x)$ be a non-constant twice differentiable function defined such that $y = g(x)$ is symmetric about the line $x = 2$, $I_1 = \int_{-\pi}^{\pi} g(x+2) \sin x dx$ and $I_2 = \int_0^4 \frac{1}{1+e^{g^1(x)}} dx$, then $I_1 + I_2$ is equal to
87. The integral value of λ for which the vectors $\lambda^3 \hat{i} + \hat{k}$, $\hat{i} - \lambda^3 \hat{j}$ and $\hat{i} + (2\lambda - \sin \lambda) \hat{j} - \lambda \hat{k}$ are coplanar is
88. The solution of the equation $(\sin x + \cos x)^{(1 + \sin 2x)} = 2$, $-\pi \leq x \leq \pi$ is $\frac{\pi}{K}$, then K is equal to
89. Let $f(x) = \frac{4 + e^x}{4} + 2 \frac{\sin x}{|x|}$, then $\lim_{x \rightarrow 0} f(x)$ is equal to
90. The values of x between 0 and 2π which satisfy the equation $\sin x \sqrt{8 \cos^2 x} = 1$ are in A.P. with common difference is K , then the value of $\frac{2\pi}{K}$ is