Sri Chaitanya IIT Academy.,India.

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A right Choice for the Real Aspirant

ICON Central Office - Madhapur - Hyderabad

SEC: Sr.Super60_NUCLEUS & STERLING _BT **JEE-MAIN** **Date:11-01-2023**

Time: 09.00Am to 12.00Pm **GTM-05** **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:** _____

11-01-23_ Sr.Super60_NUCLEUS & STERLING _BT _Jee-Main_GTM-05_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.

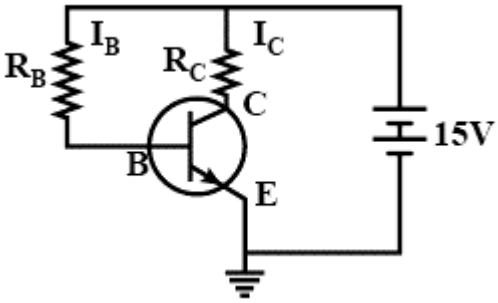
1. A student measures the time period of 20 oscillation of simple pendulum five times. That data set is $53\ s, 52\ s, 55\ s, 54\ s$ and $51\ s$. If the minimum division in the measuring clock is $1\ s$, then the reported time period should be

1) 50 ± 1 sec **2)** 52 ± 2 sec **3)** 53 ± 2 sec **4)** 53 ± 1 sec

2. A sphere of mass m and radius r rolls on a horizontal plane without slipping with the speed u. Now, if it rolls up vertically, the maximum height it would attain will be

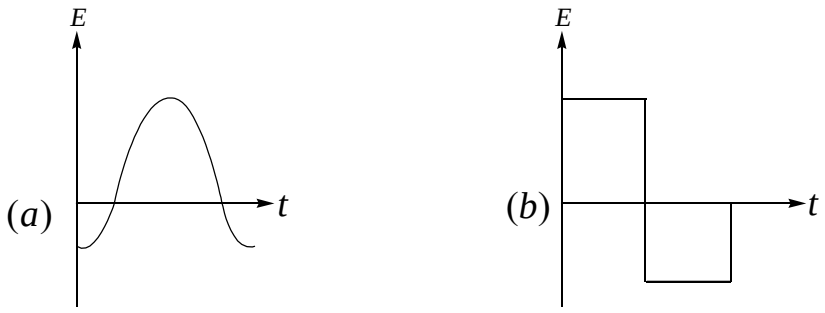
1) $\frac{3u^2}{4g}$ **2)** $\frac{35u^2}{2g}$ **3)** $\frac{7u^2}{10g}$ **4)** $\frac{11u^2}{9g}$

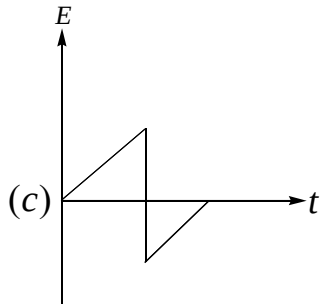
3. In the following common emitter circuit, if $\beta = 100.\ V_{CE} = 7V,\ V_{BE} =$ negligible, $R_C = 2k\Omega,$ then $I_B = ?$

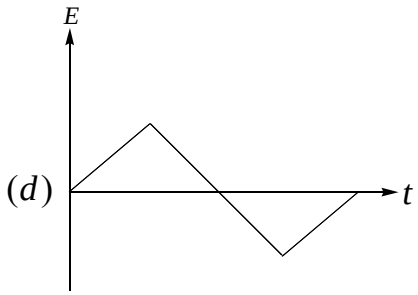


1) 0.01 mA **2)** 0.04 mA **3)** 0.02 mA **4)** 0.03 mA

4. The variation of EMF with time for four types of generators are shown in the figures. Which amongst them can be called AC ?







1) (a) and (d) **2)** (a), (b), (c) and (d)

3) (a) and (b) **4)** Only (a)

5. A small solid ball is dropped from a height above the free surface of a liquid. It strikes the surface of the liquid at $t = 0$. The density of the material of the ball is $500 kg/m^3$ and that of liquid is $1000 kg/m^3$. If the ball comes momentarily at rest at $t = 2\,\text{sec}$ then initial height of the ball from the surface of liquid was (neglect viscosity) $\left(g = 10 m/s^2\right)$

1) 20m **2)** 10m **3)** 15m **4)** 25m

6. The relations amongst the three elements earth's magnetic field, namely horizontal component H, vertical component V and dip δ are, (B_E =total magnetic field)

1) $V = B_E \tan\delta, H = B_E$ **2)** $V = B_E \sin\delta, H = B_E \cos\delta$

3) $V = B_E \cos\delta, H = B_E \sin\delta$ **4)** $V = B_E, H = B_E \tan\delta$

7. A hollow metal sphere or radius R is uniformly charged. The electric field due to the sphere at a distance r from the centre:

1) Increases as r increases for $r < R$ and for $r > R$

2) Zero as r increases for $r < R,$ decreases as r increases for $r > R$

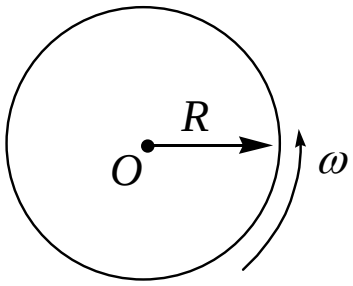
3) Zero as r increases for $r < R,$ increases as r increases for $r > R$

4) Decreases as r increases for $r < R$ and $r > R$

8. The value of numerical aperture of the objective lens of a microscope is 1.25. If light of wavelength $5000\,\text{Å}$ is used then minimum separation between two points, to be seen as distinct is

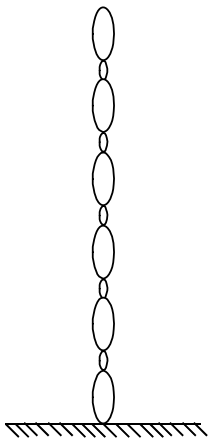
1) 0.24 μm **2)** 0.48 μm **3)** 0.12 μm **4)** 0.38 μm

9. A uniform circular ring of radius 'R' density ρ and young's modulus 'Y' is placed on a smooth horizontal surface. The ring is rotated with a constant angular velocity ω about is own axis is shown. The increase in the radius of the ring is (assume increment in radius is very small as compared to radius)



1) $\frac{\rho\omega^2R^3}{2Y}$ **2)** $\frac{\rho\omega^2R^3}{Y}$ **3)** $\frac{3\rho\omega^2R^3}{2Y}$ **4)** $\frac{2\rho\omega^2R^3}{Y}$

10. A uniform chain of mass m and length ℓ hangs on a thread and touches the surface of a table by its lower end. Find the force exerted by the table on the chain when half of its length has fallen on the table. The fallen part does not from heap and does not bounce



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

11. A body is projected away from the earth's surface with a speed $3v_e$ where v_e is the escape velocity. The speed of the body at infinity will be:

1) 0 **2)** $\sqrt{2}v_e$ **3)** $2v_e$ **4)** $2\sqrt{2}v_e$

12. A cyclic process contains four steps AB, BC, CD and DA. Heat involved in different processes is given as $Q_{AB}=+200J$, $Q_{BC}=+600J$, $Q_{CA}=-300J$ and $Q_{DA}=0$, then efficiency of process is

1) $\frac{5}{8}$ **2)** $\frac{3}{8}$ **3)** $\frac{1}{4}$ **4)** $\frac{1}{2}$

13. The potential energy of a particle under a conservative force is given by $U(x)=(x^2-3x)J$. the equilibrium position of the particle is at

1) $x=1.5m$ **2)** $x=2m$ **3)** $x=2.5m$ **4)** $x=3m$

14. In which of the following devices, the eddy current effect is **not** used?

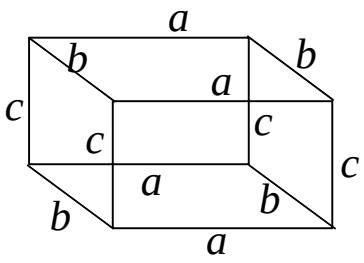
1) Induction furnace **2)** Magnetic braking in train

3) Electromagnet **4)** Electric heater

15. Two identical photons of energy $E(4eV \le E \le 8eV)$ fall on two different metals whose work functions are in the ratio of $1:2$. The ratio of the kinetic energies of the most energetic electrons coming from each metal is $2:1$. Work function of one of the metal is 4 eV. What is the energy of photon in eV.

1) 6 eV. **2)** 8eV **3)** 4 eV **4)** 5 eV

16. A solid conducting cuboid of dimensions $(a\times b\times c)$, having mass 'm' resistivity ρ and density 'd' is connected through ideal battery 'V' volt across the opposite faces for three different situation, produces power P_1, P_2 *and* P_3 respectively. Given that $P_1:P_2:P_3=1:2:8$ choose the correct option. (given $a>b>c$)



1) $c=\sqrt[3]{\frac{3}{4d}}$ **2)** $c=\sqrt[3]{\frac{m}{4\sqrt{2}d}}$ **3)** $c=\sqrt[3]{\frac{m}{4d}}$ **4)** $c=\sqrt[3]{\frac{m}{2d}}$

17. An organ pipe of length L is open at one end and closed at the other end. The air column in the pipe is vibrating in second overtone. The minimum distance from the open end where the pressure amplitude is half of the maximum value is

1) $\frac{L}{4}$ **2)** $\frac{L}{8}$ **3)** $\frac{L}{12}$ **4)** $\frac{L}{15}$

18. A T.V tower has a height 150 m. The population density around the T.V. tower will be, if the population covered is 50 lacs? (Radius of earth $=6.4\times10^6 m$)

1) 708.5 km^{-2} **2)** 828.6 km^{-2} **3)** 856.8 km^{-2} **4)** 454 km^{-2}

19. Given below are two statements: One is labelled as Assertion (A) and the other is labelled as Reason(R).

Assertion(A): In an uniform magnetic field, speed and energy remains constant for a moving charged particle

Reason(R): Moving charged particle experiences magnetic force perpendicular to its direction of motion

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

2) Both (A) and (R) are not 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.

20. **Assertion(A):** C_p is always greater than C_v in gases.

Reason(R): Work done at constant pressure is more than that at constant volume.

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

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

3) (A) is true but (R) is false.

4) (A) and (R) are false.

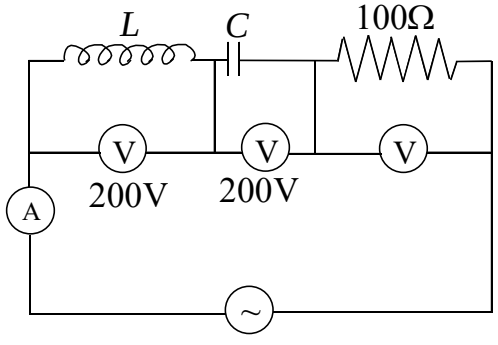
(NUMERICAL VALUE TYPE)

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

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

21. A rope of length 10m and linear density 0.5 kg/m is lying length wise on a smooth horizontal floor. It is pulled by a force of 25N. The tension in the rope at a point 6 m away from the point of application of force is _____ N

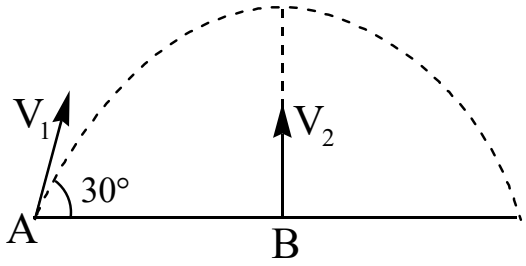
22. The ratio of readings of A.C voltmeter across the resistance and A.C ammeter in the circuit is 'n' volt per ampere then n is equal to



23. Electrons with de Broglie wavelength λ fall on the target in an X-ray tube. The cut-off wavelength of the emitted X-rays is $\frac{nmc\lambda^2}{h}$ then n is [m is mass of electron, c is speed of light and h is plank's constant]

24. In Young's double slit experiment how many maximas can be obtained on the screen (including the central maximum) on both sides of the central fringe. If $\lambda = 2000\,\text{A}^{\circ}$ and $d = 7000\,\text{A}^{\circ}$.

25. A body is projected with a velocity v_1 from the point A as shown in the figure. At the same time, another body is projected vertically upwards from B with velocity v_2. The point B lies vertically below the highest point. For both the bodies to collide, $\frac{v_2}{v_1}$ should be $\frac{1}{x}$ then x = _____.



26. In a system of units if force (F), acceleration (A) and time (T) are taken as fundamental units, then the dimensional formula of energy will become $\left[FAT^{x/3}\right]$. Find value of x?

27. A sample contains two radio active materials A and B with half life of 51 hours and 2 hours respectively. The nucleus A decays into B and B decays into stable nucleus C. At $t = 0$ activities of both samples were equal. The ratio of activity of A to that of B when the activity of B is maximum is

28. 1 kg of diatomic gas is at a pressure of $8\times10^4\,N/m^2$. The density of the gas is $4kg/m^3$. The energy of the gas due to its thermal motion is $N\times10^4\,J$ then value of N

29. In an adiabatic change, the pressure P and temperature T of a diatomic gas are related by the relation $P \propto T^C$, where C equal to $\frac{x}{2}$. Then value of the x

30. Unpolarized light of intensity I passes through an ideal polarizer A. Another identical polarizer B is placed behind A. The intensity of light beyond B is found to be $I/2$. Now another identical polarizer C is placed between A and B. The intensity of light beyond B is now $I/8$. The angle between polarizer A and C is ____ (degrees)

CHEMISTRY

Max Marks: 100

(SINGLE CORRECT ANSWER TYPE)

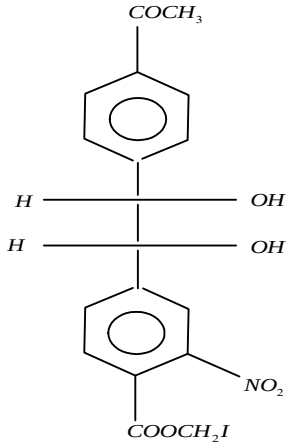
This section contains 20 multiple choice questions. Each question has 4 options (1), (2), (3) and (4) for its answer, out of which ONLY ONE option can be correct.

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

31. An organic compound $C_xH_{2y}O_y$ was burnt with twice the amount of O_2 gas as required for complete combustion into CO_2 *and* H_2O. The hot gases when cooled to 0^0C and 1 atm pressure measured 2.24 litres. The water collected during the cooling weighs 0.9 grams. The vapour pressure of pure water is 17.5 mm of Hg at 20^0C and is lowered by 0.104 mm of Hg when 50 grams of organic compound is dissolved in 1000 grams water.(Assume that organic compound is non volatile and does not dissociate or associate). The molecular formula of the compound is

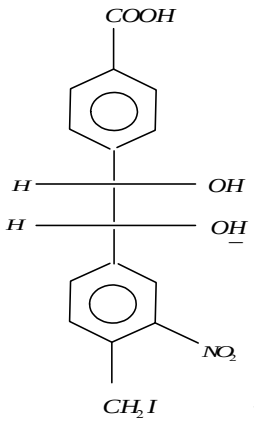
1) $C_5H_{10}O_5$ **2)** $C_{10}H_{10}O_5$ **3)** $C_5H_5O_{10}$ **4)** $C_5H_{10}O_{10}$

32.



One mole of above compound was treated with excess of $NaOH / I_2$ and then acidified. The correct product and the product after acidification has isolated. The least acidic 'H' in the product will be (the least acidic 'H' has been underlined).

1)



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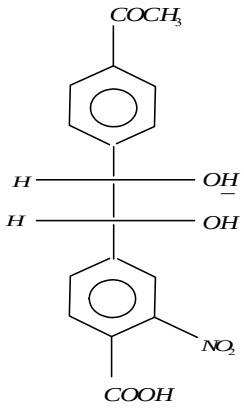
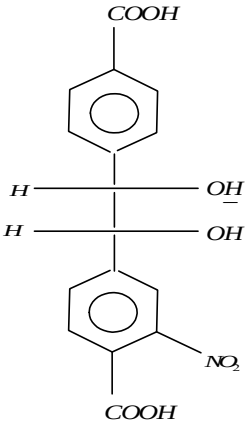


3)



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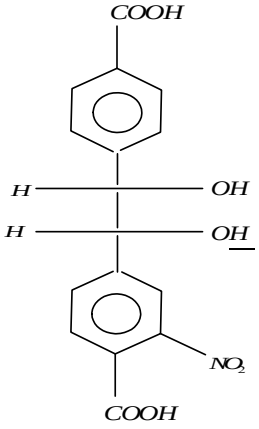
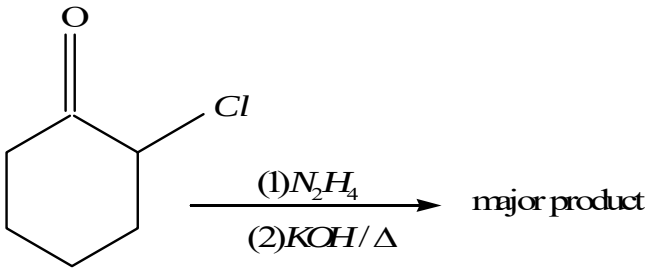
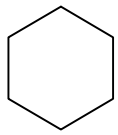
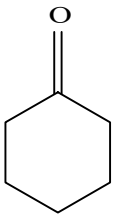
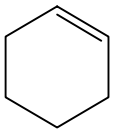
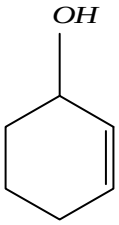


33.



1)  **2)** 

3)  **4)** 

34. Statement -1: Optical diastereomers differ in specific rotation .

Statement-2: Optical diastereomers may have same or opposite signs of rotation or may be inactive.

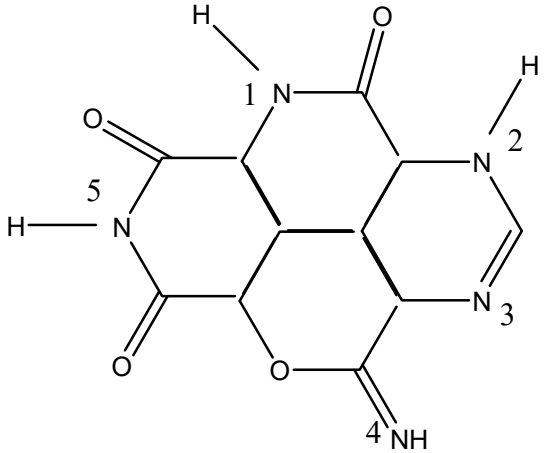
1) Statement -1 is true, Statement -2 true ,Statement-2 is a correct explanation for statement-1.

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.

35. Consider the following compound. The correct decreasing order of pK_a values of conjugate acids of the labeled nitrogen atoms in the below compound is.



1) 3>2>1>4>5 **2)** 4>3>2>1>5 **3)** 3>4>2>1>5 **4)** 5>1>2>4>3

36. Match the items of columns I and II and mark the correct option.

Column I	Column II
(A) Its partial hydrolysis does not Change oxidation state of central atom.	(1) He
(B) It is used in modern diving apparatus.	(2) XeF_6
(C) It is used to provide inert atmosphere for filling electrical bulbs.	(3) XeF_4
(D) Its central atom is in sp^3d^2 hybridization.	(4)Ar

Correct code is:

1)A(1);B(4);C(2);D(3) **2)**A(1);B(2);C(3);D(4)

3)A(2);B(1);C(4);D(3) **4)** A(1);B(3);C(2);D(4)

37. In qualitative analysis when H_2S is passed through an aqueous solution of salt acidified with dil. HCl, a black precipitate is obtained. On boiling the precipitate with dil. HNO_3, it forms a solution of blue colour. Addition of excess of aqueous solution of ammonia to this solution gives _____

1) deep blue precipitate of $Cu(OH)_2$

2) deep blue solution of $[Cu(NH_3)_4]^{2+}$

3) deep blue solution of $Cu(NO_3)_2$

4) deep blue solution of $Cu(OH)_2, Cu(NO_3)_2$

38. Assertion (A) : NaCl reacts with concentrated H_2SO_4 to give colorless fumes with pungent smell. But on adding MnO_2 the fumes become greenish yellow.

Reason(R): MnO_2 oxidizes HCl to chlorine gas which is greenish yellow.

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

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

3) Both A and R are not correct.

4) A is not correct but R is correct.

39. Assertion (A) : Actinoids form relatively less stable complexes as compared to lanthnoids.

Reason(R): Actinoids can utilize their 5f orbitals along with 6d orbitals in bonding but lanthanoids do not use their 4f orbital for bonding

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

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

3) Both A and R are not correct.

4) A is not correct but R is correct

40. Match the complex ions given in column I with the hybridization and number of unpaired electrons given in column II and assign the correct code:

Column I (complex ion)	column II (hybridization, number of unpaired electrons)
A. $[Cr(H_2O)_6]^{3+}$	1. dsp^2,1
B. $[Co(CN)_4]^{2-}$	2. sp^3d^2,5
C. $[Ni(NH_3)_6]^{2+}$	3. d^2sp^3,3
D. $[MnF_6]^{4-}$	4. sp^3,4
	5. sp^3d^2,2

1) A(3);B(1);C(5);D(2) **2)** A(4);B(3);C(2);D(1)
3) A(3);B(2);C(4);D(1) **4)** A(4);B(1);C(2);D(3)

41. Assertion (A): Polyamides are best used as fibres because of high tensile strength.
Reason (R) : Strong intermolecular forces (like hydrogen bonding within polyamides) lead to close packing of chains and increase the crystalline character, hence provide high tensile strength to polymers.
1) Assertion and reason both are correct statement but reason does not expalin assertion.
2) Assertion and reason both are correct statements and reason explains the assertion.
3) Both assertion and reason are wrong statements.
4) Assertion is correct statement and reason is wrong statement.

42. Assertion (A): Competitive inhibitors compete with natural substrate for their attachment on the active sites of enzymes.
Reason(R): In Competitive inhibition, inhibitor binds to the allosteric site of the enzyme.
1) Both A and R are correct and R is the correct explanation of A.
2) Both A and R are correct but R is not the correct explanation of A.
3) Both A and R are not correct.
4) A is correct but R is incorrect.

43. Which of the following options is correct regarding the following statements?
Statement–1: $\Delta S_f{}^0 NH_3(g) \,\&\, \Delta S_f{}^0 PCl_5(g) < 0$
Statement – 2: On heating a metal entropy of metal increases.
Statement – 3: $\Delta S_f{}^0 N_{2(l)} = 0$
Statement–4: number of radial nodes for 3s is two.
1) All the statements are correct **2)** Only statement -3 is incorrect
3) Only statement – 1 is correct **4)** All statements are incorrect

44. Which of the following statement is incorrect?

1) Density and temperature are intensive properties.

2) The value of equilibrium constant is independent on initial concentration of reactants and products.

3) $[CoCl_4]^{-2}_{(aq)}$ when cooled in freezing mixture the colour of the solution turns pink due to formation of $[Co(H_2O)_6]^{+3}$.

4) The basic strength order of OH^-, NH_3, NH_2^- is $OH^- > NH_3 > NH_2^-$

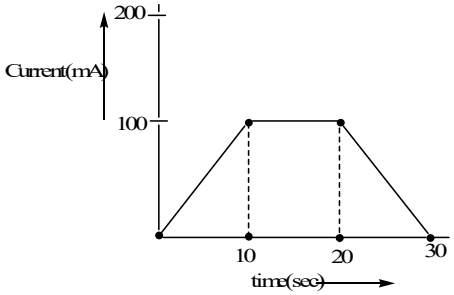
45. A gaseous substance $AB_2(g)$ convert to $AB(g)$ presence of solid $A(s)$ as:

$AB_2(g) + A(s) \rightleftharpoons 2AB(g)$

The initial pressure and equilibrium pressure are 0.7 and 0.95 bar. Now the equilibrium mixture is expanded reversibly and isothermally till the gas pressure falls to 0.4 bar. The volume percentage of $AB_2(g)$ at the final equilibrium is.

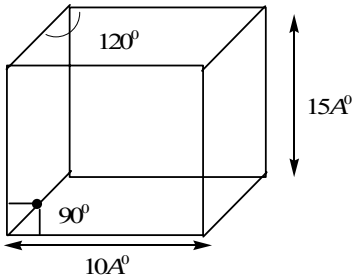
1) 22.5 **2)** 81 **3)** 32.5 **4)** 67.5

46. When copper sulphate solution is electrolyzed in a copper voltameter for 30 seconds, then 'm' gram of copper was deposited. Time current graph for the electrolysis is shown in the figure. The value of electrochemical equivalent (z) of copper using graph will be.



1) z=m **2)** $z = \frac{m}{2}$ **3)** $z = \frac{m}{5}$ **4)** $z = 2m$

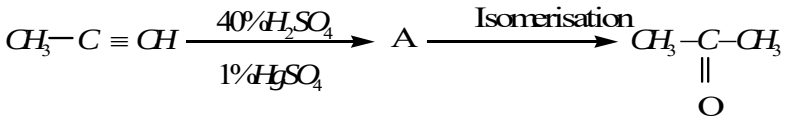
47. A solid crystallises in a hexagonal structures as shown in the figure, if the density of solid is $2\sqrt{3}\ gm/cm^3$.How many molecules are present in the given unit cell.



Take Avogadro's number $=6\times10^{23}$, Atomic mass of solid =450

1) 6 **2)** 18 **3)** 2 **4)** 4

48.



Structure of 'A' and type of isomerism in the above reaction are respectively

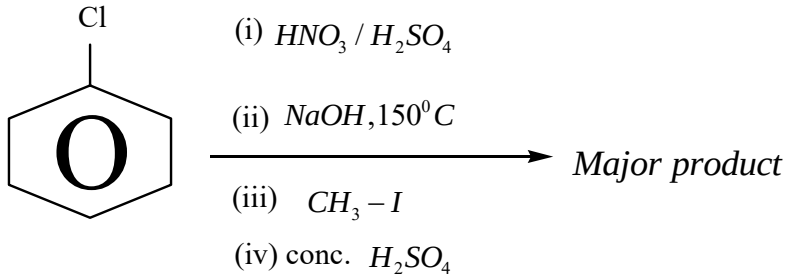
1) Prop – 1 – en – 2-ol,metamerism

2) Prop –1–en–1–ol,tautomerism.

3) Prop –2–en–2–ol, geometrical isomerism.

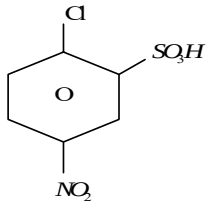
4) Prop –1–en–2–ol,tautomerism

49.

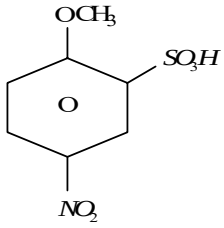


.

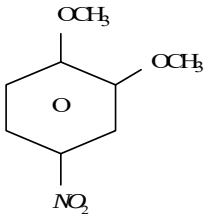
Product is



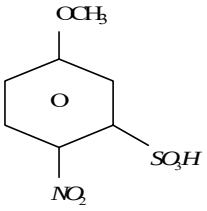
1)



2)

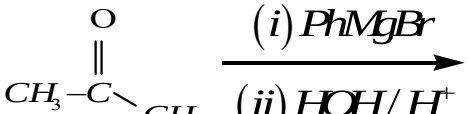


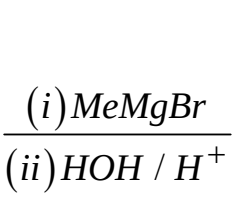
3)

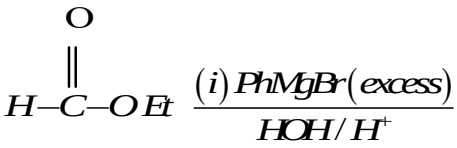


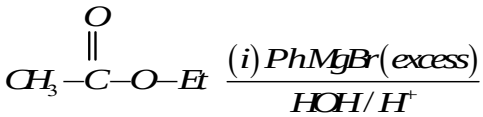
4)

50. In which of the following reactions alcohol is formed as product which gives positive idoform test?

1) 

2) 

3) 

4) 

(NUMERICAL VALUE TYPE)

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

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

51. 21.4 mg of salt XCl is completely dissolved in some amount of water to form 2 litre of a solution. If pH of the following solution is observed to be 5 & the salt in solid state forms rock salt structure with ionic radii of $X^+ = 0.8A^0$ & $Cl^- = 1.7A^0$ then calculate density of the solid crystal in terms of gm/cm^3.

[Data: $N_A = 6\times10^{23}, K_b(XOH) = 10^{-9}$]

52. Number of incorrect statements from the following is/are

i) P^H of acid rain is less than 5.6

ii) Photochemical smog is oxidizing in nature

iii) CO_2 is one of the important green house gases.

iv) Ozone is destroyed by solar radiation in upper stratosphere.

v) Excessive use of chlorinated synthetic pesticides causes soil and water pollution.

vi) BOD is the measure of level of pollution caused by organic biodegradable material.

53. A certain mass of a substance when dissolved in 100g C_6H_6 lowers the freezing point by 1.28^0C. The same mass of solute dissolved in 100 g of water lowers the freezing point by 1.40^0C. If the substance has normal molecular mass in benzene and is completely dissociated in water, into how many ions does it dissociate in water? K_f for H_2O and C_6H_6 are 1.86 and 5.12 K $mol^{-}kg$ respectively.

54. A soap of sodium stearate in solution starts micellisation at $1.2\times10^{-3}M$. A colloidal (micelle) particle, on an average contains 2.4×10^{13} molecules of soap. Total number of micelles in $1mm^3$ at critical micelle concentration is $x\times10^y$. Find the value of x to nearest integer (assume that there are no stearate ions outside the micelles and avagadro number is 6.00×10^{23}.)

55. Assuming there no 2s – 2p mixing, the number of paramagnetic species amongst the following:

$H_2, He_2^+, Li_2, Be_2, B_2, C_2, C_2^{2-}, N_2^+, N_2, O_2, O_2^-, S_2 \ \& \ F_2$

are _____

56.

$$\underset{(x)}{Alkene} + O_3 \xrightarrow[H_2O]{Zn} CH_3CHO + CH_3CH_2CH_2COCH_3 + CH_3COCH_2CHO$$

How many different isomers (inclusive of stereo isomers) of alkene (x) can give the above reaction?

57. The initial concentration of N_2O_5 in the following first order reaction

$N_2O_{5(g)} \rightarrow 2NO_{2(g)} + \frac{1}{2}O_{2(g)}$ was $.1.24 \times 10^{-2} mol/L$. at 318K. The concentration of N_2O_5 after 60 minutes was $0.20 \times 10^{-2} mol/L$. The rate constant of the reaction in $\min^{-1}$ is $x \times 10^{-2}$, value of x is $\{\log 6.2 = 0.792\}$.

58. . The number of reagents listed below which can reduces Fe^{+3} to Fe^{+2}.

A) H_2O_2 in presence of $NaOH$.

B) Na_2O_2 in water.

C) H_2O_2 in presence of H_2SO_4

D) Na_2O_2 in presence of H_2SO_4.

E) Na_2O_2 in presence of limited HCl [in the ratio 2 : 1 respectively]

59. How many of the following compounds produce a product having molecular weight equal to heavy water (D_2O)when dissolved in heavy water.

$CaC_2, Mg_3N_2, Be_2C, Al_4C_3, Ca_3P_2, HCl$

60. How many of the following exist only in solution state.

I) $LiHCO_3$ ii) $NaHCO_3$ iii) $KHCO_3$ iv) $Mg(HCO_3)_2$

v) $Ca(HCO_3)_2$ vi) $Ba(HCO_3)_2$ vii) $RbHCO_3$ viii) $CsHCO_3$

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. Let $f(x)=3x^2-7x+c$, where 'c' is a variable co-efficient and $x>\frac{7}{6}$. The value of 'c' such that $f(x)$ touches $f^{-1}(x)$ is……

1) 6 **2)** 7 **3)** $\frac{16}{3}$ **4)** $\frac{4}{3}$

62. Let $f:R\to R$ be continuous and periodic with period $T>0$. Then

1) $f(x_0+T/2)=f(x_0)$ for some $x_0\in[k,k+T/2],k\in R$

2) $f(x_0+T/2)=f(x_0)$ for some $x_0\in(k,k+T/4),k\in R$

3) $f(x_0+T/2)=f(x_0)$ for some $x_0\in(k,k+T/3),k\in R$

4) $f(x_0+T/2)=f(x_0)$ for some $x_0\in(k,k+T/6),k\in R$

63. The function f(x) = maximum $\left\{\sqrt{x(2-x)},2-x\right\}$ is non-differentiable at x equal to

1) 1 **2)** 0.2 **3)** 0.1 **4)** 0.4

64. Let $f:[0,4]\to R$, be a differentiable function. Then, there exists real numbers $a,b\in(0,4)$ such that, $(f(4))^2-(f(0))^2=Kf^1(a)f(b)$ Where K, is

1) $\frac{1}{4}$ **2)** 8 **3)** $\frac{1}{12}$ **4)** 4

65. If the standard deviation of $x_1,x_2...x_n$ is 3.5, then the standard deviation of $-2x_1-3,-2x_2-3,...,-2x_n-3$ is

1) -7 **2)** -4 **3)** 7 **4)** 1.75

66. The number of positive divisors of $(2008)^8$ that are less than $(2008)^4$ are

1) 28 **2)** 112 **3)** 224 **4)** 56

67. From 50 students taking examinations in mathematics, physics and chemistry. 37 passed mathematics, 24 physics, and 43 in chemistry, At most 19 passed mathematics and physics, at most 29 mathematics and chemistry and at most 20 physics and chemistry. The largest possible number that could have passed all three exams is

1) 10 **2)** 12 **3)** 9 **4)** 14

68. (a, b) is the mid-point of the chord $\overline{AB}$ of the circle $x^2+y^2=r^2$. The tangent at A, B meet at C. then area of $\Delta ABC =$

1) $\frac{\left(a^2+b^2+r^2\right)^{\frac{3}{2}}}{\sqrt{a^2+b^2}}$ **2)** $\frac{\left(r^2-a^2-b^2\right)^{\frac{3}{2}}}{\sqrt{a^2+b^2}}$ **3)** $\frac{\left(a^2-b^2-r^2\right)^{\frac{3}{2}}}{\sqrt{a^2+b^2}}$ **4)** $\frac{\left(a^2-b^2+r^2\right)^{\frac{3}{2}}}{\sqrt{a^2+b^2}}$

69. The number of solutions of the equation $16\left(\sin^5 x+\cos^5 x\right)=11\left(\sin x+\cos x\right)$ in the interval $[0,2\pi]$ is

1) 6 **2)** 7 **3)** 8 **4)** 9

70. If $\frac{z+2i}{z-2i}$ is purely imaginary then $|z|$ is

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

71. If a tangent of slope 2 on the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ is normal to the circle $x^2+y^2+4x+1=0$, then the maximum value of ab is

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

72. Let a variable point P (x, y) is lying on the curve $y^2 = 8x$, then maximum value of $\frac{y-3}{x+2}$ is equal to

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

73. Let p, q, r be three logical statements. Consider the compound statements

$S_1:\left((\sim p)\vee q\right)\vee\left((\sim p)\vee r\right)$ *and*

$S_2: p\rightarrow(q\vee r)$

Then which of the following is NOT TRUE?

1) If S_2 is true, then S_1 is true **2)** If S_2 is false, then S_1 is false

3) If S_2 is false, then S_1 is true **4)** If S_1 is false, then S_2 is false

74. The value of the definite integral $\int_{\frac{-3\pi}{4}}^{\frac{5\pi}{4}} \frac{\cos x+\sin x}{1+e^{x-\frac{\pi}{4}}}dx$ equals

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

75. If $y_1(x)$ is a solution of the differential equation $\frac{dy}{dx}-f(x)y=0$, then a solution of the differential equation $\frac{dy}{dx}+f(x)y=r(x)$ can be $y=$

1) $\frac{1}{y_1(x)}\int r(x)y_1(x)dx$ **2)** $y_1(x)\int\frac{r(x)}{y_1(x)}dx$

3) $\int r(x)y_1(x)dx$ **4)** $\int\left(r(x)+y_1(x)\right)dx$

76. Area of the region defined by $\left||x|+|y|\right|\geq 1$ and $x^2+y^2\leq 1$ is

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

77. Coefficient of x^{2009} in $\left(1+x+x^2+x^3+x^4\right)^{1001}(1-x)^{1002}$ is

1) 0 **2)** 4. $^{1001}C_{501}$ **3)** -2009 **4)** 2009

78. The reflection of the point $P(1,0,0)$ in the line $\frac{x-1}{2}=\frac{y+1}{-3}=\frac{z+10}{8}$ is

1) (3, -4, -2) **2)** (5, -8, -4) **3)** (1, -1, -4) **4)** (2, -3, 8)

79. If $\bar{u},\bar{m},\bar{r}$ be three mutually perpendicular vectors with same magnitude. If $\bar{e}$ satisfies the relation $\bar{u}\times\{(\bar{e}-\bar{m})\times\bar{u}\}+\bar{m}\times\{(\bar{e}-\bar{r})\times\bar{m}\}+\bar{r}\times\{(\bar{e}-\bar{u})\times\bar{r}\}=\bar{0}$ then $\bar{e}=$

1) $\frac{1}{3}(\bar{u}+\bar{m}+\bar{r})$ **2)** $\frac{1}{2}(\bar{u}+\bar{m}+\bar{r})$ **3)** $\frac{1}{4}(\bar{u}+\bar{m}+\bar{r})$ **4)** $\bar{0}$

80. If $p+q+r=0$ and $\begin{vmatrix} pa & qb & rc \\ qc & ra & pb \\ rb & pc & qa \end{vmatrix}=K\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$ then the value of K is

1) $p+q-r$ **2)** $p+q+r$ **3)** pqr **4)** $-pqr$

(NUMERICAL VALUE TYPE)

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

81. Find the number of ways in which four different toys and five indistinguishable marbles can be distributed between Amar, Akbar and Anthony, if each child receives at least one toy and one marble.

82. Three balls are marked 1,2 and 3. They are placed in a bowl and a ball is drawn, its number is recorded and the ball is returned to the bowl. The process is repeated two more times. If the sum of the three numbers is 6 then $P=\frac{a}{b}$ is the probability (express in lowest form) that the ball numbered 2 was drawn all the three times, then find the value of $(a+b)$.

83. The shortest distance between the z-axis and the line of intersection of , $x+y+2z-3=0$ and $2x+3y+4z-4=0$ is:

84. If $A=\begin{bmatrix}1 & -1 & 1\\ 0 & 2 & -3\\ 2 & 1 & 0\end{bmatrix}$ and B = (adj A) and C = 5A, then find the value of $\frac{|adj\ B|}{|C|}$.

85. If L be the length of common tangent to the ellipse $\frac{x^2}{25}+\frac{y^2}{4}=1$ and the circle $x^2+y^2=16$ intercepted by the coordinate axis then $\frac{\sqrt{3}L}{2}$ is

86. ABCD is a square of side length 1 unit. P and Q are points on AB and BC such that $\angle PDQ=45^0$. Find the perimeter of ΔPBQ.

87. The number of normal(s) of a rectangular hyperbola which can touch its conjugate is equal to ___

88. A concrete pillar is 30 feet. high and has a flag staff at its top. The pillar and the flag staff subtend equal angles at a point distant 50 feet from the foot of the tower. Height of the flag staff in feet is

89. Consider a complex number z on the argand plane satisfying

$\arg\left(z^2-\omega^2\right)=\frac{\pi}{2}+\arg\left(z^2-\omega\right)\left(\text{where } \omega=e^{\frac{i2\pi}{3}}\right)$. If minimum value of

$|z-2-2i||z+2+2i|$ is $\left(\frac{\sqrt{a}-\sqrt{b}}{2}\right)(a,b\in N)$ then find the value of $\left(\frac{a+b}{52}\right)$.

90. If R be a relation < from . $A=\{1,2,3,4\}$. to $B=\{1,3,5\}$, i.e. $(a,b)\in R$ iff a < b, then number of elements in RoR^{-1} is (where R^{-1} is inverse relation of R)