



Sri Chaitanya IIT Academy., India.

A.P, TELANGANA, KARNATAKA, TAMILNADU, MAHARASHTRA, DELHI, RANCHI

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

SEC: **Sr.SUPER60**

Time: **09.00Am to 12.00Pm**

JEE-MAIN

GTM-01

Date: **23-03-2022**

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.

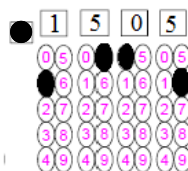
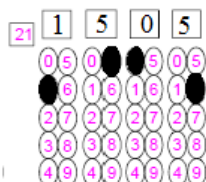
Marking scheme: +4 for correct answer, 0 if not attempt and -1 in all other cases.

(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 or 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: _____



23-03-22_Sr.Super60 _Jee-Main_GTM-01_Test Syllabus

MATHEMATICS: **Total Syllabus (Excluding Extra Syllabus)**

PHYSICS : **Total Syllabus (Excluding Extra Syllabus)**

CHEMISTRY : **Total Syllabus (Excluding Extra Syllabus)**



PHYSICS

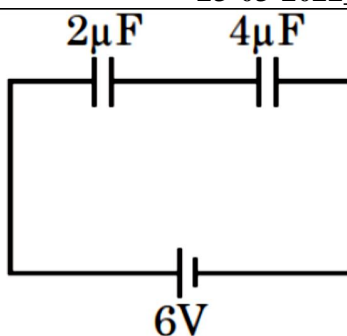
Max Marks: 100

(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. The human body transports heat from the interior tissues, at temperature 37.0°C , to the skin surface, at temperature 27.0°C , at a rate of 100 W. If the skin area is 1.5 m^2 and its thickness is 3.0 mm, what is the effective thermal conductivity, k , of skin ?
1) $4.0 \times 10^{-2} \text{ W / (mK)}$ 2) $2.0 \times 10^{-2} \text{ W / (mK)}$
3) $2.0 \times 10^{-3} \text{ W / (K)}$ 4) $3.0 \times 10^{-2} \text{ W / (mK)}$
2. In a football game, a player wants to throw a ball to his one of teammate, who is running on the field. Taken thrower position as origin and receiver initial position at $2\hat{i} + 3\hat{j}$, where \hat{i} & \hat{j} are in the plane of field. In subsequent run receiver displacement is $5\hat{i}$ then $8\hat{j}$, then $-2\hat{i} + 4\hat{j}$ then $-6\hat{j}$. How far is receiver from thrower? (all displacements are in meter)
1) $\sqrt{106}$ 2) $\sqrt{110}$ 3) $\sqrt{103}$ 4) $\sqrt{112}$
3. A spherical ball of mass m and radius r is allowed to fall in a medium of viscosity η . The time in which the velocity of the body increases from zero to 0.63 times the terminal velocity is called time constant (τ). Dimensionally τ can be represented by
1) $\frac{mr^2}{6\pi\eta}$ 2) $\sqrt{\frac{6\pi mr\eta}{g^2}}$ 3) $\frac{m}{6\pi\eta r}$ 4) None of these
4. In half deflection method, the resistance of resistance box in series with the galvanometer is $10,000 \Omega$. When the galvanometer is shunted with 10Ω resistance, its reading drops to half the initial value. The resistance of galvanometer is :-
1) 5Ω 2) 10Ω 3) 20Ω 4) 25Ω
5. Two air filled capacitors are connected as shown. The left capacitor is suddenly filled with a dielectric of constant K . The work done by battery after that is $24\mu\text{J}$. Dielectric constant K is :-



- 1) 2 2) 3 3) 4 4) 6

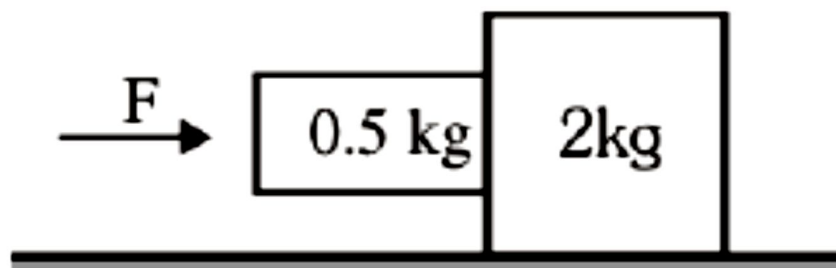
6. Two sources of light that both have wavelengths equal to 700nm are separated by a horizontal distance x . They are 5.00 m from a vertical slit of width 0.500 mm. What is the smallest value of x for which the diffraction pattern of the sources can be resolved by Rayleigh's criterion?

- 1) 7.00 mm 2) 10.00 mm 3) 4.00 mm 4) 12.00 mm

7. The centres of the turns of a toroid form a circle with a radius of 14.0 cm. The cross-sectional area of each turn is 3.00 cm^2 . It is wound with 5278 turns of fine wire, and the wire carries a current of 4.00 A. The core is filled with a paramagnetic material of magnetic susceptibility 2.90×10^{-4} . What would the magnitude of the magnetic field within the substance?

- 1) 12.6 mT 2) 30.16 mT 3) 10.6 mT 4) 16.6 mT

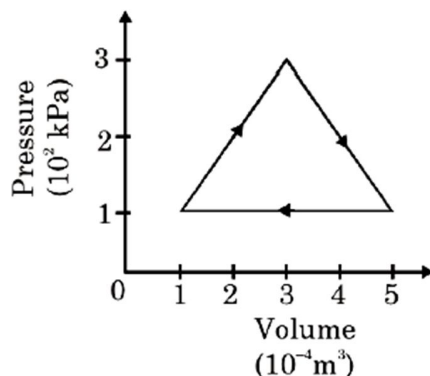
8. Friction coefficients at all surfaces in the given setup is $\mu_s = 0.5$, $\mu_k = 0.20$. Find the minimum acceleration of the block of mass 2 kg so that smaller block of mass 0.5 kg remains at rest w.r.t 2 kg ($g = 10 \text{ m/s}^2$)



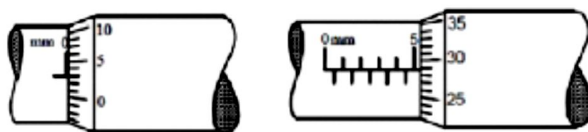
- 1) 1.5 m/s^2 2) 2.0 m/s^2 3) 2.5 m/s^2 4) 3.0 m/s^2



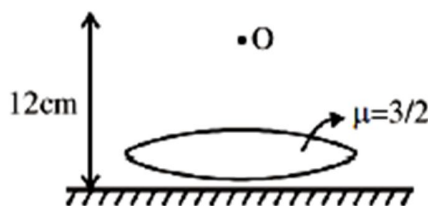
9. How much work is done per cycle by a gas following the path shown on the p V-diagram?



- 1) 10 J 2) 20 J 3) 30 J 4) 40 J
10. Diagrams show readings of a screw gauge. Figure (i) shows the zero error reading when the screw gauge is closed, figure (ii) the reading when the screw gauge is being used to measure the diameter of a ball-bearing. What is the diameter of the ball-bearing? There are 50 divisions on circular scale.



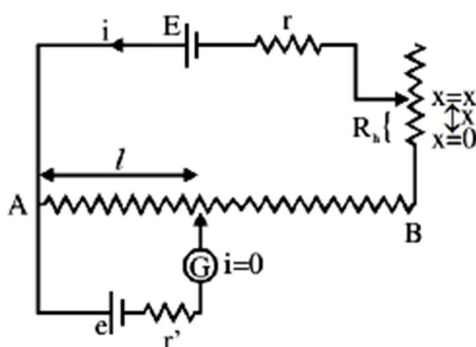
- 1) 5.29 mm 2) 5.26 mm 3) 5.32 m 4) 5.28 mm
11. Let's assume that the car, of mass 1550 kg, can reach a speed of 26.8 m/s in 7.1 s. What is the average power needed to accomplish this? (Given : 1 hp = 746 Watt)
- 1) 105 hp 2) 110 hp 3) 1210 hp 4) 1040 hp
12. An equiconvex lens ($\mu = 3/2$) is placed over a plane mirror as indicated in diagram. An object placed 12 cm from system such that image and object coincide. Now a liquid is poured between mirror and lens and for the same object the image now formed at 24 cm from mirror. The refractive index of the liquid poured will be



- 1) $\frac{5}{4}$ 2) $\frac{4}{3}$ 3) $\frac{3}{2}$ 4) $\frac{5}{3}$



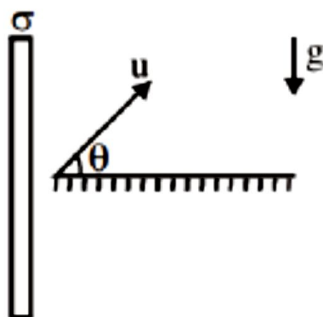
13. A particle starts from rest in circular path of radius $R = 2$ m such that its angular velocity is $\omega = \frac{\pi t}{3}$ rad/s. Find the magnitude of average velocity of particle when it has moved by angle 60° from its initial position.
- 1) $\sqrt{3}$ m/s 2) $2\sqrt{3}$ m/s 3) $2\sqrt{2}$ m/s 4) $\sqrt{2}$ m/s
14. A source of frequency 10kHz when vibrated over the mouth of a closed organ pipe is in unison at 300 K. The beats produced when temperature rises by 1 K is
- 1) 30 Hz 2) 13.33 Hz 3) 16.67 Hz 4) 40 Hz
15. Flash light equipped with a new set of batteries produces bright white light. As the batteries wear out
- 1) The light intensity gets reduced with a no change in its colour
2) Light colour changes first to yellow
3) It stops working suddenly while giving white light
4) Colour changes to red and also intensity gets reduced
16. In given potentiometer, e.m.f of primary cell is 40V and its internal resistance is 2Ω , resistance of wire AB is 4Ω . In primary circuit, there is also a rheostat whose resistance varies as $R_h = (2x + 2)\Omega$. If balance length obtained for $x = 0$ is ℓ_1 and $x = 2$ is ℓ_2 respectively, then find $\frac{\ell_1}{\ell_2}$.



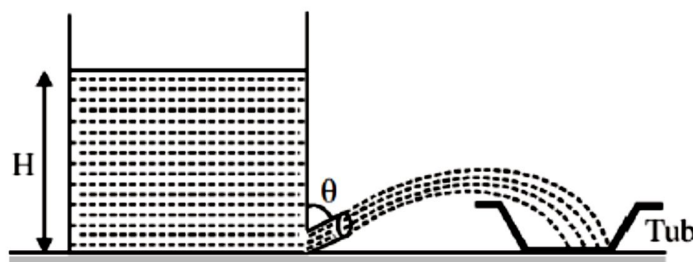
- 1) $\frac{3}{2}$ 2) $\frac{3}{4}$ 3) $\frac{2}{3}$ 4) $\frac{4}{3}$



17. In the set-up shown, there is a large thin non-conducting vertical sheet with charge density σ . In the nearby region a charge q of mass m is projected at an angle θ with initial velocity u . When this charge reaches its maximum height, find its velocity.



- 1) $u \cos \theta \left(1 + \frac{\sigma q \tan \theta}{2m\epsilon_0 g} \right)$ 2) $u \cos \theta \left(1 + \frac{\sigma q \tan \theta}{m\epsilon_0 g} \right)$
 3) $u \sin \theta \left(1 + \frac{\sigma q \tan \theta}{2m\epsilon_0 g} \right)$ 4) $u \sin \theta \left(1 + \frac{\sigma q \tan \theta}{m\epsilon_0 g} \right)$
18. There is a tank of cross-section area A_1 with inclined orifice at its bottom with cross-section area A_2 as shown in the figure. If height of water column in tank is 0.3 m and angle of inclination with vertical $\theta = 30^\circ$ and $\frac{A_1}{A_2} = 2$, then at this instant find the position where tube is to be placed to collect the water coming out from orifice. ($g = 10 \text{ m/s}^2$)



- 1) $\frac{\sqrt{3}}{5} m$ 2) $\frac{3\sqrt{3}}{10} m$ 3) $\frac{2\sqrt{3}}{5} m$ 4) $\frac{2}{5} m$
19. If mass density of earth varies with distance 'r' from centre of earth as $\rho = kr$ and 'R' is radius of earth, then find the orbital velocity of an object revolving around earth at a distance '2R' from its centre.

- 1) $\sqrt{\frac{\pi k R^3 G}{4}}$ 2) $\sqrt{\frac{\pi k R^3 G}{2}}$ 3) $\sqrt{\frac{\pi k R^3 G}{8}}$ 4) $\sqrt{\pi k R^3 G}$



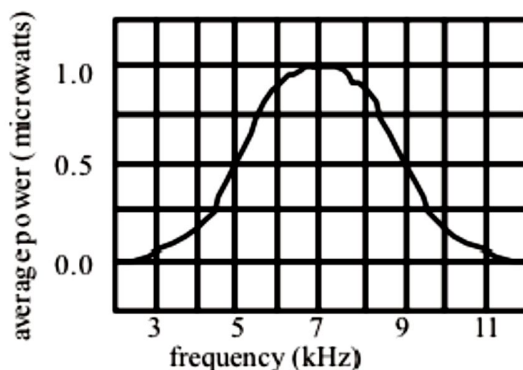
20. A nuclide X, initially at rest, undergoes α -decay according to the equation ${}_{92}X^A \rightarrow {}_Z Y^{228} + \alpha$. The α -particle produced in the above process is found to move in a circular track of radius 0.11 m in a uniform magnetic field of 3T. Find the binding energy per nucleon (in MeV) of the daughter nuclide Y. Given that $m(Y) = 228.03u$; $m({}_2He^4) = 4.003u$; $m({}_0n^1) = 1.009u$; $m({}_1H^1) = 1.008u$
 $u = 1\text{amu} = 931.5\text{MeV}/c^2 = 1.66 \times 10^{-27}\text{kg}$,
 1) 5.89 MeV 2) 6.89 MeV 3) 8.89 MeV 4) 7.89 MeV

(NUMERICAL VALUE TYPE)

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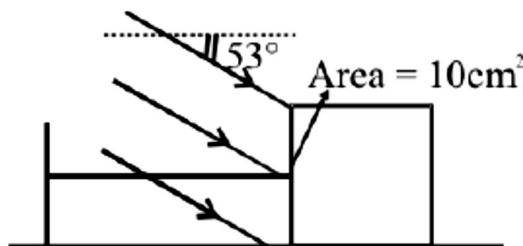
Marking scheme: +4 for correct answer, 0 if not attempt and -1 in all other cases.

21. Electric potential in volt (in region) is given by $V = 6x + 8y + 4z^2$ Calculate the electric force (in N) acting on 2C point charge placed at origin.
22. A rod is moving with velocity 9 m/s perpendicular to external magnetic field of 1T and there is a conducting sphere having charge 30C and radius R. If electric field inside rod is same as electric field on the surface of sphere and radius $R = \sqrt{x} \times 10^5$ m then find x.
23. A neutron collides with a stationary He^+ atom in its ground state, What should be minimum value of energy of neutron (in eV with nearest integer), so that all type of collisions (Elastic, inelastic and perfectly inelastic) can take place? (Consider mass of He^+ atom is 4 times mass of neutron).
24. The plot given below is of the average power delivered to an LRC circuit versus frequency. Resistance of circuit is 100Ω . Capacitive reactance of circuit at resonance (in Ω) is:

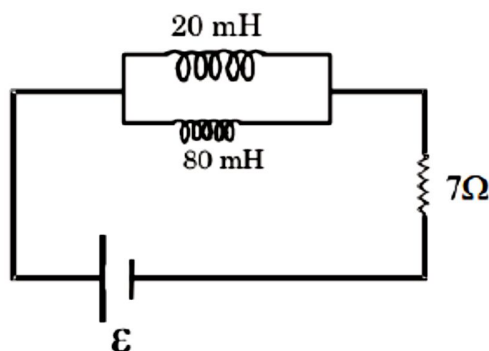




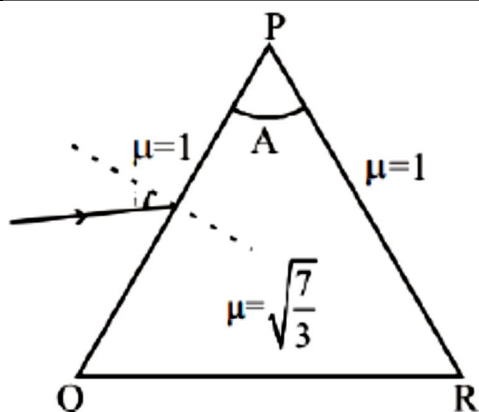
25. A block of mass $1\mu\text{g}$ is connected with an elastic string of stiffness constant $K = 10^{-5} \text{ N/m}$. Now a light pulse of intensity $I = 20 \text{ W/m}^2$ strikes the block at its vertical surface of surface area 10cm^2 at an angle 53° as shown. If surface of block is 100% absorbing the light and the duration of light pulse is 6 ms then the max displacement of block from its mean position is $\frac{N}{100} \mu\text{m}$. Find value of N.



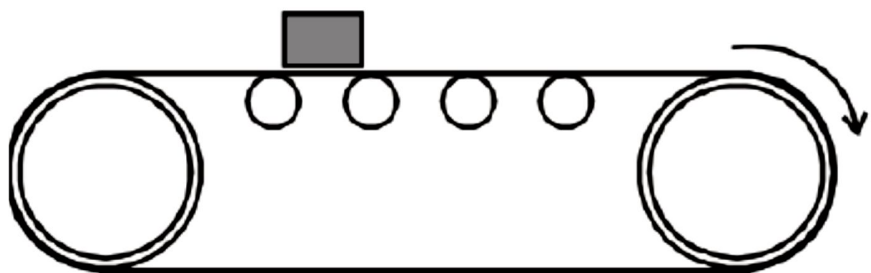
26. A battery of emf 10 V having internal resistance 1Ω connected as shown in figure. The time (in millisecond with nearest integer) elapsed before the current from the battery reaches 99% of its maximum value is



27. In an experiment to measure acceleration due to gravity, we use a simple pendulum having string of length 95.6 cm. It is measured by a meter scale of least count 1mm. The time period for 20 oscillations is measured to be 41 sec. The least count for stopwatch is 1 sec. The percentage error in measurement of g is.
28. A ray of light is incident on surface PQ of an equilateral prism of refractive index $\sqrt{\frac{7}{3}}$. The value of angle (in degree) of incidence for which the emergent ray is parallel to surface PR is



29. The new white belt of a long horizontal conveyor is moving with a constant speed $v = 3.0$ m/s. A small block of carbon is placed on the belt with zero initial velocity relative to the ground. The block will slip a bit before moving with belt, leaving a black mark on the belt (figure). How long is that mark (in m with nearest integer) if the coefficient of kinetic friction between the carbon block and the belt is 0.20 and the coefficient of static friction is 0.30?



30. In gravity free space, a bead of charge $1\mu\text{C}$ and mass 3 mg is threaded on a rough rod of friction coefficient $\mu = 0.3$. A magnetic field of magnitude 0.2 T exists perpendicular to the rod. The bead is projected along the rod with a speed of 4m/s. How much distance (in m) will the bead cover before coming to rest?

**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. Vander Waal's equation of a state is obeyed by a gas **X**. For n moles of **X**, the equation is

$$\left(p + \frac{n^2 a}{V^2}\right)(V - nb) = nRT. \text{ Here } \mathbf{a} \text{ and } \mathbf{b} \text{ are called}$$

- | | |
|------------------------|----------------------------|
| 1) Universal constants | 2) Vander Waal's constants |
| 3) Molar gas constants | 4) All the above |

32. XeF_6 on complete hydrolysis gives :

- | | | | |
|-------------------|--------------------|--------------------|-------------------|
| 1) XeO_4 | 2) XeOF_2 | 3) XeOF_4 | 4) XeO_3 |
|-------------------|--------------------|--------------------|-------------------|

33. Read the following statements and choose the correct option.

- (i) Ethanol undergoes dehydration by heating it with concentrated H_2SO_4 at 443 K to give ethene as main product
- (ii) Ethanol by heating with concentrated H_2SO_4 at 413 K gives diethyl ether as main product
- (iii) Only primary alcohols on dehydration give ethers.
- (iv) Secondary and tertiary alcohols on dehydration give ethers having 2° and 3° carbon attached with O atom.

- | | | | |
|---------|---------|---------|---------|
| 1) TTFF | 2) TFTF | 3) TTTF | 4) FFTF |
|---------|---------|---------|---------|

34. The strongest acid among the following is

- | | |
|--------------------------|--------------------------|
| 1) Salicylic acid | 2) m-hydroxybenzoic acid |
| 3) p-hydroxybenzoic acid | 4) Benzoic acid |



35. Which of the following statement(s) is/are correct?

- (i) The atomic and ionic radii of alkaline earth metals are smaller than those of the corresponding alkali metals in the same periods.
- (ii) Second ionisation enthalpies of the alkaline earth metals are smaller than those of the corresponding alkali metals.
- (iii) Compounds of alkaline earth metals are more extensively hydrated than those of alkali metals

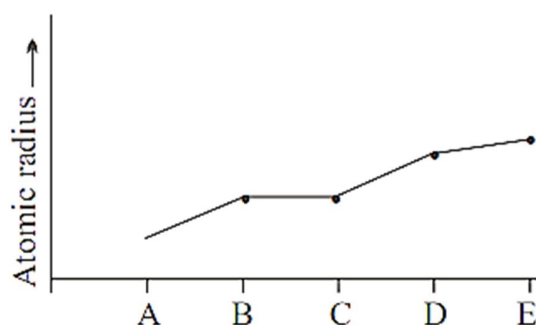
1) (i) and (ii) 2) (ii) and (iii) 3) (i) and (iii) 4) (i), (ii) and (iii)

36. The nature of π - bond in perchlorate ion is

- 1) $O(d\pi)-Cl(p\pi)$ 2) $O(p\pi)-Cl(d\pi)$
- 3) $O(d\pi)-Cl(d\pi)$ 4) $O(p\pi)-Cl(p\pi)$

37. variation of atomic radius of an unknown group in the periodic table is as below

The element B & C respectively are:



1) Cl & Br 2) Be & Mg 3) Si & Ge 4) Al & Ga

38. Match List I with List II and select the correct answer:

List I (ion)	P. ICl_2^-	Q. BrF_2^+	R. ClF_4^-	S. $AlCl_4^-$	
List II (shapes)	1. Linear	2. Pyramidal	3. Tetrahedral	4. Square planar	5. Angular

P Q R S

P Q R S

1) 1 2 4 5

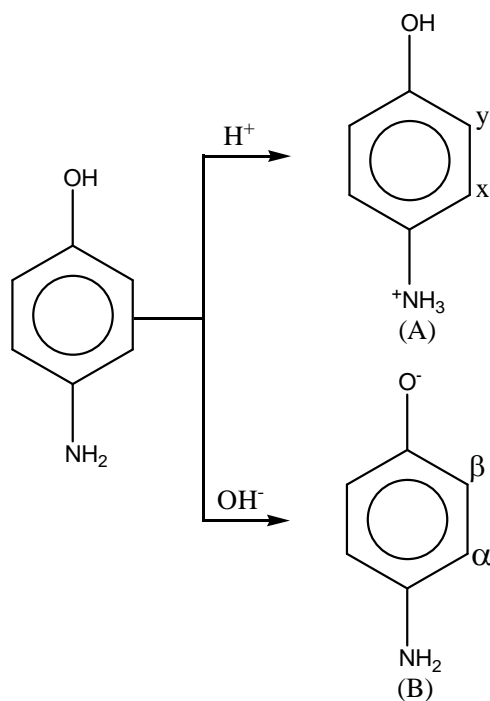
2) 4 5 2 3

3) 1 5 4 3

4) 5 1 3 4

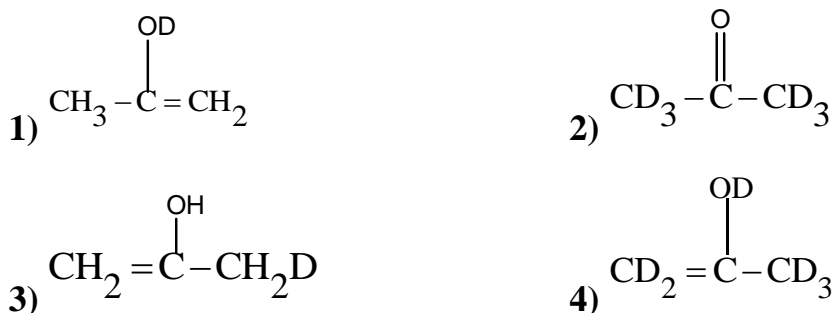


39. Consider the following scheme.



Which positions are activated for coupling reaction in acidic and basic media respectively?

- 1) x in A and β in B 2) x in A and α in B
 3) y in A and α in B 4) y in A and β in B
40. The tautomer of acetone of highest molecular mass obtained after treatment with D_2O for long time, is given by



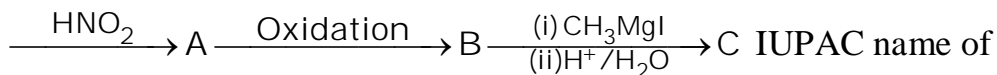
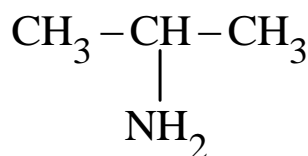
41. Glycerol is obtained from propylene ($\text{CH}_3\text{CH}=\text{CH}_2$) by using the following reagents:

I. Cl_2 (at 773K) II. Na_2CO_3 III. HOCl IV. NaOH

The correct sequence in which these reagents are used is

- 1) II, I, IV, III 2) II, I, III, IV 3) I, II, IV, III 4) I, II, III, IV

42. In the following sequence of reactions,



the compound C formed will be

- 1) Butanol-1**
- 2) Butanol -2**
- 3) 2-Methylpropan-2-ol**
- 4) 1,1-Dimethylethanol**

43. Aluminium reacts with dil. HCl and conc. NaOH solution to liberate the gases respectively

- 1) H_2 and O_2 2) O_2 and H_2 3) H_2 and H_2 4) O_2 and O_2

44. Concentrated HNO_3 oxidises phosphorus to

- 1) H_3PO_4 2) H_3PO_3 3) $\text{H}_4\text{P}_2\text{O}_7$ 4) H_3PO_2

45. Select the correct statements:

- 1) Extent of adsorption of a gas is maximum at its critical temperature
- 2) A low-grade sulphide ore is concentrated by separating it from silica is a chemical adsorption
- 3) Reactants get adsorbed so strongly that they are immobilised on the catalyst's surface
- 4) A mixture of iron oxide, potassium oxide and alumina is used as catalyst in Haber's process

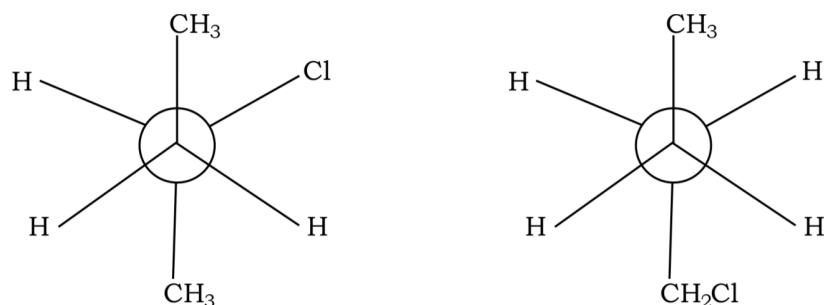
46. An example of double salt is

- 1) Bleaching powder 2) $K_4[Fe(CN)_6]$
3) $CuSO_4.5H_2O$ 4) Mohr's salt

47. Ammonia forms the complex ion $[\text{Cu}(\text{NH}_3)_4]^{2+}$ with copper ions in alkaline solutions but not in acidic solutions. Select correct reason?

- 1) In acidic solutions, protons coordinate with ammonia molecules forming NH_4^+ ions and NH_3 molecules are not available.
- 2) In alkaline solutions insoluble $\text{Cu}(\text{OH})_2$ is precipitated which is soluble in excess of any alkali
- 3) Copper hydroxide is an amphoteric substance
- 4) In acidic solutions hydration protects copper ions

48. The pair of structures given below represent



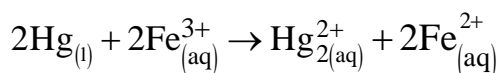
- 1) Enantiomers
2) Diastereomers
3) Structural isomers
4) Two molecules of the same compound
49. When one mole of an ideal gas is compressed to half of its initial volume and simultaneously heated to twice its initial temperature irreversibly, the change in entropy is
(C_p and C_v are molar heat capacities of gas at constant pressure and volume respectively)
- 1) $C_v \ln 2$ 2) $C_p \ln 2$ 3) $R \ln 2$ 4) $(C_v - R) \ln 2$
50. Which of the following is micellar system used to removing oil on hand
- 1) Sodium stearate + water 2) Rubber + benzene
3) Protein + water 4) All the above

(NUMERICAL VALUE TYPE)

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

51. An excess of liquid mercury is added to an acidified solution of $4.0 \times 10^{-3} \text{ M Fe}^{3+}$. It is found that $[\text{Fe}^{+3}] = [\text{Fe}^{+2}]$ at equilibrium for the following reaction



Report magnitude of $E^0(\text{Hg}_2^{2+}/\text{Hg})$ in volts to nearest integer

Given that $E^0(\text{Fe}^{3+}/\text{Fe}^{+2}) = 0.77\text{V}$, $2.303RT/F = 0.06$

Report the value after rounding off to first decimal

52. If 2, 4–dichloropentane is treated with one equivalent of $\text{C}_2\text{H}_5\text{ONa}$ in ethanol, only one HCl is eliminated to give chloro pentene. How many different chloro pentenes (including stereoisomers) would be formed?



53. A hydrocarbon (**X**) contains 91.3% carbon and 8.8% hydrogen. **X** on chlorination using $\text{Cl}_2/h\nu$ gives compound **Y** and with $\text{Cl}_2/\text{AlCl}_3$ gives three isomeric monochloro substituted products of **Y** (considering major as well as minor products). Total maximum number of atoms present on one of possible planes of **X** is **ab**. (**a+b**) is.....(Here **a** and **b** are integers and **a** can be zero)
54. Atomic number of Cr is 24. One of the ions of the metal in aqueous solution has a magnetic moment 4.9 BM. What is the difference in the number of electrons of the ion with clockwise and anticlockwise self-spins in ground state of aqueous ion?
55. Oxidation state of nickel in the compound formed during purification of nickel in vapour phase refining is....
56. $\text{RCONH}_2 + x\text{NaOH} + \text{Br}_2 \rightarrow \text{RNH}_2 + 2\text{NaBr} + \text{Na}_2\text{CO}_3 + \text{H}_2\text{O}$
Number of moles of NaOH used in above Hoffman's bromamide reaction per mole of the amide is.....
57. A metal M of molar mass 96 gm/mole reacts with fluorine to form a salt that can be represented by empirical formula MF_x . In order to determine **x**, a 41.20gm of the sample of the salt is dissolved in 100gm of water and its boiling point was determined to be 374.38K. If degree of dissociation of salt is 10^{-4} , what is value of **x**? Given $K_b(\text{water}) = 0.512 \text{ K kg/mole}$.
58. For a triprotic acid H_3A , K_{a_1} is 10^{-2} , K_{a_2} is 10^{-5} and K_{a_3} is 10^{-11} . Requisite moles of NaOH are added to 0.1 molar H_3A to form maximum $[\text{HA}^{2-}]$. At what pH (to nearest integer), this would occur ?
59. M^+X^- crystallizes as fcc structure. Edge length is 3.2 \AA . Radius of anion is 1.4 \AA . Assuming $\text{M}^+ - \text{X}^-$ contact along the cell edge, radius of M^+ ion is $x \times 10^{-1} \text{ \AA}$. The value of 'x' is.....
60. A tiny spherical ball of water-soluble solute is dropped in 1 litre of water. Mass of ball is $\frac{1}{7}$ gm and molecular mass of solute is 125u. Decrease in surface area due to dissolution follows 1st order of half-life period 1 sec. and after 2 sec. molarity of solution is 10^{-x} . Find the value of **x**.

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

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

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

- 61.** The equation of pair of angular bisector of the pair of lines $xy + x + y + 1 = 0$ is
- 1) $x^2 - y^2 + 2x + 2y = 0$ 2) $x^2 - y^2 - 2x + 2y = 0$
- 3) $x^2 - y^2 + 2x - 2y = 0$ 4) $x^2 - y^2 - 2x - 2y = 0$
- 62.** The maximum value of $f(x) = \begin{vmatrix} \sin^2 x & 1 + \cos^2 x & \cos 2x \\ 1 + \sin^2 x & \cos^2 x & \cos 2x \\ \sin^2 x & \cos^2 x & \sin 2x \end{vmatrix}, x \in \mathbb{R}$ is
- 1) $\sqrt{7}$ 2) $\frac{3}{4}$ 3) $\sqrt{5}$ 4) 5
- 63.** A curve $y = f(x)$ passing through (1, 1) satisfies $x^2 \frac{dy}{dx} = x^2 + xy + y^2$, then the curve is
- 1) $y = x \tan(\ln x)$ 2) $x = y \tan(\ln x)$
- 3) $y = x \tan\left(\ln x + \frac{\pi}{4}\right)$ 4) $x = y \tan\left(\ln x + \frac{\pi}{4}\right)$
- 64.** If Z_1 and Z_2 are 2 complex numbers such that $|Z_1| = 2$ and $|Z_2| = 3$ and $\arg\left(\frac{Z_1}{Z_2}\right) = \frac{\pi}{3}$.
Then $|Z_1 + Z_2|$ is
- 1) $\sqrt{21}$ 2) $\sqrt{7}$ 3) $\sqrt{19}$ 4) 5
- 65.** If the tangent at a point $\left(4\cos\phi, \frac{16}{\sqrt{11}}\sin\phi\right)$ to the ellipse $16x^2 + 11y^2 = 256$ is also a tangent to $x^2 + y^2 - 2x = 15$ then the possible value of ϕ equals
- 1) $\frac{\pi}{3}$ 2) $\frac{\pi}{6}$ 3) $-\frac{\pi}{6}$ 4) $\frac{\pi}{4}$



66. If (x, y, z) be an arbitrary point lying on a plane P which passes through the point $(42, 0, 0)$, $(0, 42, 0)$ and $(0, 0, 42)$, then the value of expression

$$3 + \frac{x-11}{(y-19)^2(z-12)^2} + \frac{y-19}{(x-11)^2(z-12)^2} + \frac{z-12}{(x-11)^2(y-19)^2} - \frac{x+y+z}{14(x-11)(y-19)(z-12)}$$

- 1) 0 2) 3 3) 39 4) -45
67. The value of the integral $\int_0^{\infty} \frac{\tan^{-1} x}{x^2 + 1 + 2x} dx$ is
- 1) $\frac{\pi}{2}$ 2) $\frac{\pi}{8}$ 3) $\frac{\pi}{4}$ 4) $\frac{3\pi}{4}$
68. A class has 20 students. A teacher makes certain visit to the zoo along with 2 students from the class. The teacher visits zoo with all possible selections of 2 students exactly once. Find the number of takes teacher makes visit to the zoo more than any particular student.
- 1) ${}^{20}C_2$ 2) ${}^{19}C_1$ 3) ${}^{19}C_2$ 4) ${}^{18}C_2$
69. If the equation of plane through straight line $\frac{x-1}{2} = \frac{y+2}{-3} = \frac{z}{5}$ and perpendicular to the plane $x - y + z - 2 = 0$ is $ax - by + cz + 4 = 0$, then the value of $\frac{b^2}{a+c}$ is
- 1) a 2) b 3) c 4) -b
70. Let $f^2(x) = \int_0^x \frac{tf(t)}{1+t^2} dt \forall x \in \mathbb{R}$ where f is a continuous function on \mathbb{R} , not identically zero and satisfying $f(0) = 0$, then the value of $f\left(\sqrt{e^4 - 1}\right)$ is
- 1) 1 2) 2 3) 3 4) 4



71. Consider the integral $I = \int_0^{10} \frac{[x]e^{[x]}}{e^{x-1}} dx$, Where $[x]$ denotes the greatest integer less than or equal to x . Then the value of I is equal to :
- 1) $9(e - 1)$ 2) $45(e + 1)$ 3) $45(e - 1)$ 4) $9(e + 1)$
72. The ordinate of all points on $y = \frac{1}{2\sin^2 x + 3\cos^2 x}$ where the tangent is horizontal is
- 1) $\frac{1}{2}$ only 2) $\frac{1}{3}$ only 3) $\frac{1}{2}$ or $\frac{1}{3}$ 4) $\frac{2}{5}$ only
73. The area of the triangle formed by co-ordinate axes and tangent at vertex to the parabola, whose focus is $(3, 4)$ and tangents are $x = 0, y = 0$ is sq. units
- 1) 12 2) 3 3) 6 4) 4
74. If the curve $y = ax^3 + bx^2 + cx + 5$ touches x axis at $P(-2, 0)$ and cuts y axis at point Q where its gradient is 3. Find $c + 2b + a$.
- 1) 1 2) 0 3) 2 4) -1
75. Let the lengths of intercepts on x -axis and y -axis made by the circle $x^2 + y^2 + ax + 2ay + c = 0$, ($a < 0$) be $2\sqrt{2}$ and $2\sqrt{5}$, respectively. Then the shortest distance from origin to a tangent to this circle which is perpendicular to the line $x + 2y = 0$, is equal to :
- 1) $\sqrt{11}$ 2) $\sqrt{7}$ 3) $\sqrt{6}$ 4) $\sqrt{10}$
76. Area bounded by the lines $7x + 5y + 3 = 0$, $16x + y = 14$, $13x = 2y + 17$ is
- 1) $\frac{\sqrt{3}}{2}$ 2) $\frac{2}{\sqrt{3}}$ 3) $\sqrt{3}$ 4) 0



77. Given $f(x) = \sum_{n=1}^{\infty} \sin \frac{2x}{3^n} \cdot \sin \frac{x}{3^n}$ (independent of n). Then the sum of all possible values of x in $(0, 628)$ such that $f(x) = 0$.
- 1) 5050π 2) 10100π 3) 9900π 4) 99000π
78. The function $f(x) = (e^x - 1) \sin \frac{\pi x}{2} |x(x-1)(x-2)(x-3)|$ is not differentiable at x
- 1) $\{0, 1, 2, 3\}$ 2) $\{1, 2, 3\}$ 3) $\{0, 2, 3\}$ 4) $\{1, 3\}$
79. Consider a rectangle ABCD having 5, 7, 6, 9 points in the interior of the line segments AB, CD, BC, DA respectively. Let α be the number of triangles having these points from different sides as vertices and β be the number of quadrilaterals having these points from different sides as vertices. Then $(\beta - \alpha)$ is equal to :
- 1) 795 2) 1173 3) 1890 4) 717
80. The minimum distance of the curve $\frac{a^2}{x^2} + \frac{b^2}{y^2} = 1$ from origin is ($a, b > 0$)
- 1) $|a - b|$ 2) $|a + b|$ 3) ab 4) $a^2 + b^2$

(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. If the sum $\sqrt{1 + \frac{1}{1^2} + \frac{1}{2^2}} + \sqrt{1 + \frac{1}{2^2} + \frac{1}{3^2}} + \sqrt{1 + \frac{1}{3^2} + \frac{1}{4^2}} + \dots + \sqrt{1 + \frac{1}{19^2} + \frac{1}{20^2}}$ is in the form $\left(n - \frac{1}{n}\right) \left(n \in \mathbb{Z}^+\right)$ and $\frac{x}{n} = \frac{25 - \left(\frac{1}{2} + \frac{2}{3} + \frac{3}{4} + \dots + \frac{24}{25}\right)}{1 + \frac{1}{2} + \frac{1}{3} + \dots + \frac{1}{25}}$. Then x is



82. If $|z_1| = 2, (1-i)z_2 + (1+i)\overline{z_2} = 8\sqrt{2}$, (z_1, z_2 are complex variables) then the minimum value of $|z_1 - z_2|$ is
83. If \vec{a} and \vec{b} are any two unit vectors, then the minimum value of $\frac{1}{|\vec{a} + \vec{b}|^2} + \frac{1}{|\vec{a} - \vec{b}|^2}$ is
84. Let $\int e^{x^2+x} (4x^3 + 4x^2 + 5x + 1) dx = e^{x^2+x} f(x) + c$. Then $f'(1)$ is
85. A bag contain 5 balls of unknown colors. A ball is drawn at random from it and is found to be white. The probability that bag contains only white balls is
86. The coefficient of x^{210} in the expression $(x-1)(x^2-2)(x^3-3)\dots(x^{20}-20)$ is
87. If α, β are roots of the quadratic equation $x^2 - bx + c = 0$ ($b, c \in \mathbb{R}$) such that $\{\alpha, \beta\} = \{\alpha^2, \beta^2\}$. Then sum of all possible values of b is
88. If the least area bounded by the curves $y = x^2 - 4$ and $y = \lambda x + 12$ is equal to $\frac{\alpha}{\beta}$ ($\alpha, \beta \in \mathbb{N}$ and $\text{GCD}(\alpha, \beta) = 1$). Then $\alpha + 3\beta$ represents a three digit integer whose digit at ten's place is
89. Consider the function $f(x) = \lim_{m \rightarrow \infty} \left(\cos \frac{x}{m} \right)^{m^2}$ then the number of solution of equation $f(x) = x^2$ are
90. The absolute value of sum of the first 25 terms of an A.P. whose first four terms are 1, $\log_y x, \log_z y$ and $-15 \log_x z$ is ($x, y, z > 0, x, y, z \neq 1$)