FIITJEE

ALL INDIA TEST SERIES

FULL TEST – III

JEE (Main)-2019

TEST DATE: 30-12-2018

Time Allotted: 3 Hours **Maximum Marks: 360**

General Instructions:

- The test consists of total 90 questions.
- Each subject (PCM) has 30 questions.
- This question paper contains **Three Parts.**
- **Part-I** is Physics, **Part-II** is Chemistry and **Part-III** is Mathematics.
- Each part has only one section: **Section-A**.

  Section-A (01 – 30, 31 – 60, 61 – 90) *contains 90 multiple choice questions which have* ***only one correct answer****. Each question carries* ***+4 marks*** *for correct answer and* ***–1 mark*** *for wrong answer.*

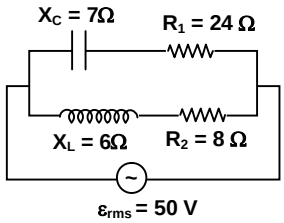
Physics

PART – I

SECTION – A
(One Options Correct Type)

This section contains **30 multiple choice questions**. Each question has **four choices** (A), (B), (C) and (D), out of which **ONLY ONE** option is correct.

1. What amount of I_{rms} is flowing through the a.c. source in the circuit shown in figure. (given $X_C = 7\Omega$, $X_L = 6\ \Omega$, $R_1 = 24\ \Omega$ and $R_2 = 8\ \Omega$)



(A) $\sqrt{82}$A

(B) $\frac{1125}{217}$A

(C) $\sqrt{41}$A

(D) $\sqrt{\frac{41}{2}}$A

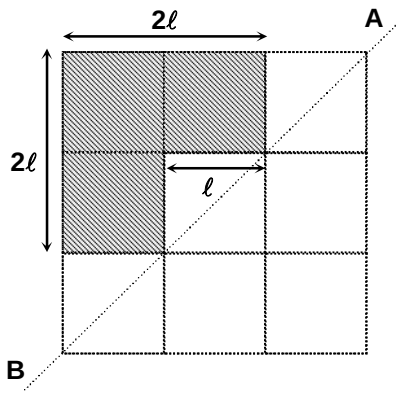
2. The main scale of vernier calipers reads in millimeter and its one division is equal to one millimeter. Its vernier is divided into 10 divisions, which coincide with 7 divisions of main scale. Further more when a cylinder is tightly placed along its length between two jaws, it is observed that the zero vernier scale lies just right to 37^{th} division of main scale and seventh division of vernier scale coincide with the main scale. Then the measured value is
(A) 3.71 cm
(B) 3.77 cm
(C) 3.91 cm
(D) 3.67 cm

3. A transistor is used in a common emitter mode in an amplifier circuit. When a voltage of 20 mV is added to the base emitter voltage, the base current changes by 20 μA and collector current changes by 2mA. The load resistor is 5 kΩ. The input resistance is
(A) 1 kΩ
(B) 2 kΩ
(C) 4 kΩ
(D) 1/2 kΩ

4. In a YDSE, slits are separated by 1 mm, and the screen is place 150 cm away. A beam of light consisting of two wavelengths 560 nm and 980 nm is used to obtain interference fringes on the screen. Then the distance from the common central maxima to the point where bright fringe due to both the wavelength coincide is
(A) 11.70 mm
(B) 5.08 mm
(C) 17.64 mm
(D) 23.02 mm

5. Assume that an electric field $\vec{E} = 40x^3\hat{i}$ N/C exists in space. The charge density at x = 2m is
(A) $360\varepsilon_0$ Coulmb/m^3
(B) $120\varepsilon_0$ Coulmb/m^3
(C) $240\varepsilon_0$ Coulmb/m^3
(D) $480\varepsilon_0$ Coulmb/m^3

6. The moment of inertia of a square plate of side 'ℓ' about an axis passing through its centre of mass and perpendicular to the plane of plate is I_0. Then find the moment of inertia of the shaded portion of the given lamina about AB as shown in figure. (mass per unit area of square plate and lamina is same)



(A) $39I_0$

(B) $\frac{39}{2}I_0$

(C) $\frac{81}{2}I_0$

(D) $\frac{75}{2}I_0$

7. When 0.98 meter long metallic wire is stressed, an extension of 0.02 meter is produced. An organ pipe 0.5 meter long and open at both ends, when sounded with this stressed metallic wire produces 8 beats in their fundamental mode. By decreasing the stress in the wire, the numbers of beats are found to decrease. The young's modulus of the wire is (The density of wire is 10^4 kg/m^3 and sound velocity in air is 292 m/sec).

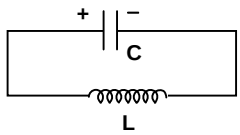
(A) 26.46×10^{10} N/m^2

(B) 8.82×10^{10} N/m^2

(C) 4.41×10^{10} N/m^2

(D) 17.64×10^{10} N/m^2

8. In an LC circuit shown in figure, C = 2F and L = 2H. At time t = 0, charge on the capacitor is 3 coulomb and it is decreasing with rate of $\sqrt{4}$ coulomb/sec. Then choose the correct statement.



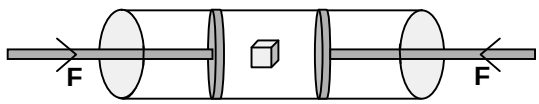
(A) maximum charge on the capacitor can be 6C.

(B) maximum charge on the capacitor can be 4C.

(C) charge on the capacitor will be maximum after time $\frac{127\pi}{90}$sec

(D) charge on the capacitor will be maximum after time $\frac{153\pi}{90}$sec

9. A solid cube of side 'ℓ' made of a soft material of bulk modulus 'K' is surrounded by liquid and piston in a cylindrical container and kept in gravity free space as shown in the figure. Both piston of area 'A' covers entire cross section of the cylindrical container. When a force 'F' is applied from the both side of the piston to compress the liquid, the fractional decrement in side of the cube $\left(\frac{d\ell}{\ell}\right)$, is:



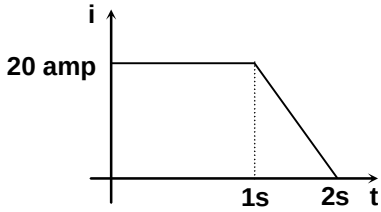
(A) $\frac{2F}{3KA}$

(B) $\frac{2}{3}\frac{F}{K\ell^2}$

(C) $\frac{F}{3KA}$

(D) $\frac{F}{3K\ell^2}$

10. In a coil of resistance 200 Ω, a current is induced by changing the magnitude of magnetic flux through it, is shown in figure. The magnitude of average induced emf in the coil is



(A) 4000 V
(B) 3000 V
(C) 6000 V
(D) 2000 V

11. A piece of metal weighs 40 gm in air. When it is immersed in the liquid of specific gravity 2.0 at 28°C it weighs 32 gm, when the temperature of liquid is raised to 32°C the metal piece weighs 28 gm. If the specific gravity of the liquid at 32°C is 1.5, then the linear expansion of the metal will be

(A) $\frac{1}{48}$ / °C

(B) $\frac{1}{12}$ / °C

(C) $\frac{1}{32}$ / °C

(D) $\frac{1}{16}$ / °C

12. An optical fiber communication system work on a wavelength 1.5 μm. The number of subscribers it can feed if a channel requires 25 kHz are

(A) 8×10^9
(B) 8×10^7
(C) 8×10^{10}
(D) 4×10^9

13. A time dependent force $F = 3t^2 + 6t$ acts on a particle of mass 18 kg. If particle starts from rest, the work done by the force during the first 3 second, will be:

(A) 40.5 Joule
(B) 324 Joule
(C) 81 Joule
(D) 262 Joule

14. In YDSE double slit experiment, one of the slit wider than other, so that the amplitude of the light from one slit is thrice of that from the other slit. If I_0 be the maximum intensity. Then find the resultant intensity I when the interference at a phase difference 120°.

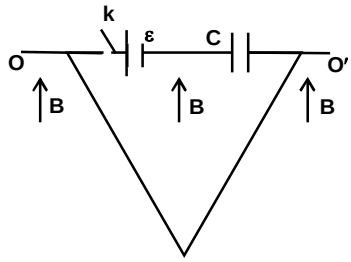
(A) $\frac{13}{16}I_0$

(B) $\frac{7}{8}I_0$

(C) $\frac{13}{8}I_0$

(D) $\frac{7}{16}I_0$

15. A triangular loop which is free to rotate about the axis OO′ is suspended in space in which a vertical magnetic field B is present as shown in the figure. The mass and length of each side of the wire are m and ℓ, respectively. A cell of emf ε and an uncharged capacitor C are connected in the wire frame. The angular velocity of the wire loop just after closing the key K is



(A) $\frac{\sqrt{3}BC\varepsilon}{m}$

(B) $\frac{\sqrt{3}BC\varepsilon}{4m}$

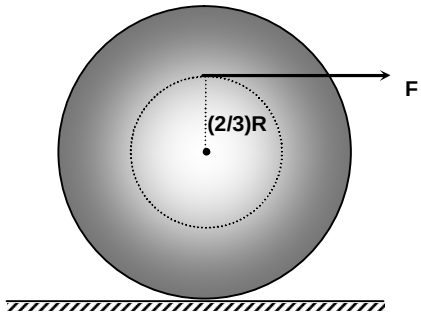
(C) $\frac{\sqrt{3}BC\varepsilon}{2m}$

(D) $\frac{2\sqrt{3}BC\varepsilon}{m}$

16. In a collinear collision, a block of mass 4 kg moving with initial speed 4 m/sec strikes a stationary particle of the same mass. If the final kinetic energy is 50% of the initial kinetic energy, then the coefficient of restitution is

(A) 1/2
(B) 1/3
(C) 1/4
(D) zero

17. A force F = 12 μmg acts tangentially at the given point of the disc which is at a distance of $\frac{2}{3}$R from centre of disc as shown in figure. Disc is kept on a rough horizontal plane of coefficient of friction μ. The angular acceleration of the disc is (mass of the disc is m and its radius is R)



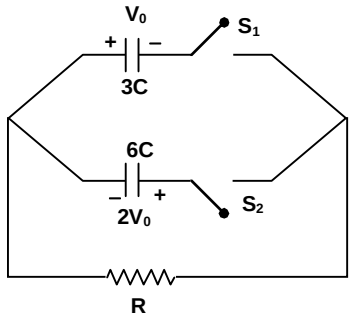
(A) $\frac{40\mu g}{3R}$

(B) $\frac{18\mu g}{R}$

(C) $\frac{20\mu g}{3R}$

(D) $\frac{14\mu g}{R}$

18. Two capacitor of capacitance 3C and 6C are charged to potential V_0 and $2V_0$ respectively and connected to a resistor of resistance R as shown in fig. Now the both switch S_1 and S_2 are closed. Find the charge flown in the resistor as a function of time 't'



(A) $CV_0(1-e^{-t/9RC})$

(B) $9CV_0\, e^{-t/2RC}$

(C) $9CV_0\, e^{-t/9RC}$

(D) $9CV_0(1-e^{-t/9RC})$

19. When photons of wavelength λ are incident on an isolated sphere suspended by an isolated thread, the corresponding stopping potential is found to be V. When photons of wavelength $\lambda/2$ are used the corresponding stopping potential was thrice the above value. If the light of wavelength $\lambda/3$ is used, then calculate the stopping potential for this case.

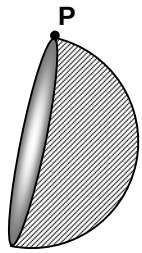
(A) $\frac{5}{4}\frac{hC}{\lambda}$

(B) $\frac{5}{4}\frac{hC}{e\lambda}$

(C) $\frac{5}{2}\frac{hC}{e\lambda}$

(D) $\frac{hC}{2e\lambda}$

20. A uniform hollow hemisphere having mass m is closed with a circular disc of same mass and radius R is hanging at one of its ends freely as shown in figure. the system is slightly disturbed so that it oscillates perpendicular to the plane of the disc. The time period of oscillation is



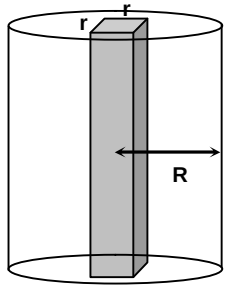
(A) $2\pi\sqrt{\frac{35R}{6\sqrt{17}g}}$

(B) $2\pi\sqrt{\frac{35R}{12\sqrt{5}g}}$

(C) $2\pi\sqrt{\frac{35R}{3\sqrt{17}g}}$

(D) $2\pi\sqrt{\frac{35R}{6\sqrt{5}g}}$

21. A glass rod of side 'r' is inserted into a vertical capillary tube of radius 'R' such that their lower ends are at the same level as shown in figure. The arrangement is now dipped in water. The height to which water will rise into the tube, will be (T = surface tension of water, ρ = density of water and the contact angle between the glass and water is 0°)



(A) $\frac{T(\pi R+2r)}{(\pi R^2-r^2)\rho g}$

(B) $\frac{2T(\pi R+2r)}{(\pi R^2-r^2)\rho g}$

(C) $\frac{T(\pi R+2r)}{2(\pi R^2-r^2)\rho g}$

(D) $\frac{2T(\pi R+2r)}{3(\pi R^2-r^2)\rho g}$

22. An unknown magnitude of charged particle is placed at some distance along the axis of a uniformly charged disc of surface charge density σ. The flux due to the charge particle through the disc is ϕ. The electric force exerted by the disc on the charged particle is

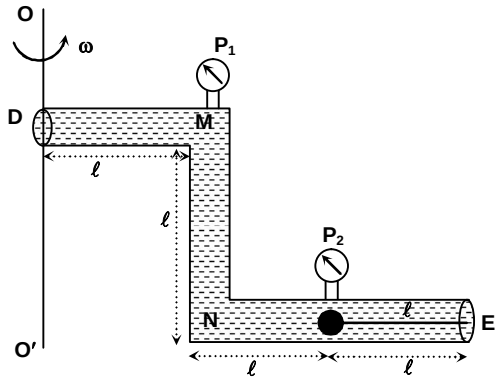
(A) $\frac{\sigma\phi}{\pi}$

(B) $\sigma\phi$

(C) $\frac{\sigma\phi}{2\pi}$

(D) $\frac{\sigma\phi}{2}$

23. A tube filled with water (density ρ) and closed at both ends uniformly rotates in a horizontal plane about a vertical axis OO′-axis and tube MN is parallel to OO′. The manometers fixed in the tube wall at distance ℓ and 2ℓ from the rotational axis indicate pressure P_1 and P_2 respectively as shown in the figure. A spherical ball of mass m and density $\rho/2$ is tied with a massless string which is joined to the end E of the tube and the diameter of sphere is just less than the diameter of tube. The tension in the string is [take $(P_2 - P_1) = 2\rho\ell g$].

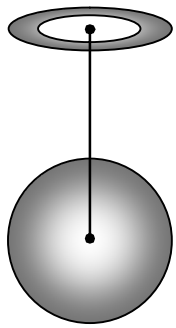


(A) (2/3)mg
(B) (4/3)mg
(C) (8/3)mg
(D) zero

24. A non-conducting disc of radius 6m is rotated about its axis of symmetry perpendicular to the plane of the disc with uniform angular speed 10 rad/sec. The disc carries a charge whose charge density is given as $\sigma = (Ar - Br^2)$, where A and B are positive constant and r is distance from the centre of the disc. The value of A/B for which magnetic field at the centre of the disc will be zero, is
(A) 4
(B) 3
(C) 2
(D) 1

25. Wire has a mass (0.3 ± 0.003) gram radius (0.5 ± 0.005) millimeter and length (0.6 ± 0.006) centimeter. The maximum percentage error in the measurement of its density is
(A) 2
(B) 4
(C) 6
(D) 8

26. Uniform annular disc of inner radius 3R and outer radius $4\sqrt{3}R$ and mass m, is placed directly above a uniform hollow sphere of same mass and radius 2R. The centre of disc directly above the centre of the hollow sphere at a distance 4R as shown in figure. The gravitational force exerted by the hollow sphere on the disc will be



(A) $\frac{2Gmm}{65R^2}$

(B) $\frac{3Gmm}{65R^2}$

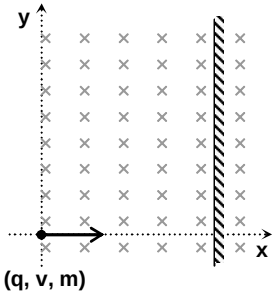
(C) $\frac{Gmm}{65R^2}$

(D) $\frac{Gmm}{130R^2}$

27. Two waves of wavelength λ and ($\lambda + \Delta\lambda$) produce 5 beats per second. If $\frac{\Delta\lambda}{\lambda} = \frac{\lambda + \Delta\lambda}{65}$, find the speed of sound waves in gas in which these waves produced beats.

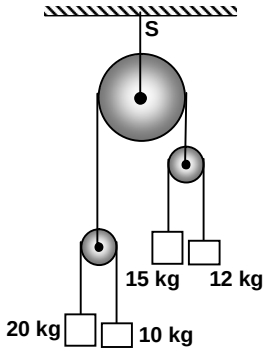
(A) 325 m/s
(B) 324 m/s
(C) 334 m/s
(D) 335 m/s

28. A charged particle 'q' moving with a speed v along x-axis. At y = 0, enters a region of uniform magnetic field $\vec{B} = -B_0\hat{k}$ which exist to the right of y-axis. There is a vertical wall which is parallel to y-z plane as shown in figure at a distance $\frac{4mv}{5qB_0}$ from the y-axis. The charged particle may collide with the wall and collision is perfectly elastic and come back. The charged particle exit from the magnetic region after some time, then the y-coordinate from which charged particle exit the magnetic region, is



(A) $\frac{2mv}{qB_0}$
(B) $\frac{4mv}{5qB_0}$
(C) $\frac{2mv}{5qB_0}$
(D) $\frac{mv}{5qB_0}$

29. The three pulley arrangement shown in the figure are identical and four blocks are attached with the rope. The mass of rope is negligible. At t = 0, all the blocks are released from rest. The tension in the string 'S' is



(A) $\frac{800}{3}$N
(B) $\frac{400}{3}$N
(C) $\frac{1600}{3}$N
(D) 700 N

30. A particle moves in the xy plane. The position vector of the particle at any time 't' is $\vec{r} = (2t^2\hat{i} + 3t^3\hat{j})$ m. The rate of change of θ at time t = 4 sec. (where θ is the angle which its velocity vector makes with positive x-axis) is

(A) $\frac{9}{656}$ rad/s
(B) $\frac{9}{164}$ rad/s
(C) $\frac{9}{328}$ rad/s
(D) $\frac{9}{82}$ rad/s

Chemistry

PART – II

SECTION – A
(One Options Correct Type)

This section contains **30 multiple choice questions**. Each question has **four choices** (A), (B), (C) and (D), out of which **ONLY ONE** option is correct.

31. What is the oxidation state of iodine when it is oxidized in the form of I^- in neutral medium by permanganate ion
    (A) +5
    (B) +7
    (C) +3
    (D) +1

32. Which of the following statement is correct?
    (A) Diborane hydrolyses to give metaboric acid
    (B) SnO_2 is acidic in nature
    (C) Ionisation enthalpy of Al > Ga
    (D) Borax has 5 B – O – B linkage in it's structure

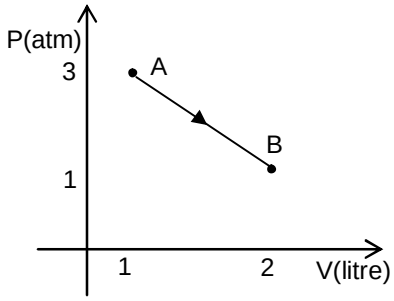
33. Which one is not a synthetic rubber?
    (A) Buna – S
    (B) Homopolymers of 1, 3-butadiene derivative
    (C) PVC
    (D) Copolymer of 1,3-butadiene

34. Which of the following is only known example of a non-transition element using three d-orbitals for bonding?
    (A) XeF_4
    (B) IF_7
    (C) SF_6
    (D) $XeOF_4$

35. 8 gm of H_2 and 32 gm of SO_2 are present in a gaseous mixture at NTP. The partial pressure of H_2 is
    (A) Equal to that of SO_2
    (B) Four times to that of SO_2
    (C) Eight times to that of SO_2
    (D) Two times to that of SO_2

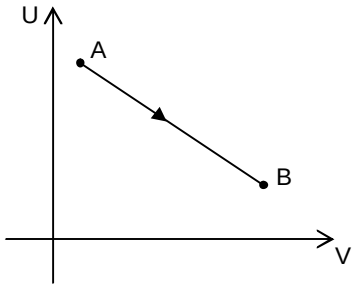
36. What kind of glycosidic linkage is present in maltose?
    (A) C1 of glucose (I) and C4 of glucose (II)
    (B) C2 of glucose (I) and C1 of glucose (II)
    (C) C2 of glucose (I) and C2 of glucose (II)
    (D) C1 of glucose (I) and C2 of glucose (II)

37. A diatomic ideal gas changes its state from A to B as shown in the figure.

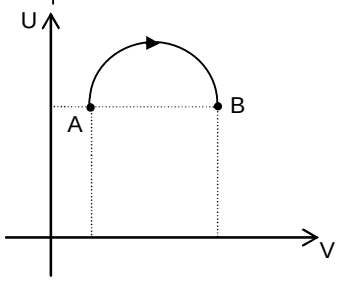


Choose the correct U versus V graph: (where U is internal energy of the gas)

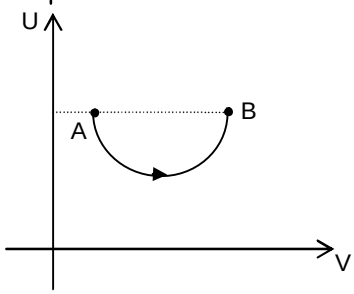
(A)



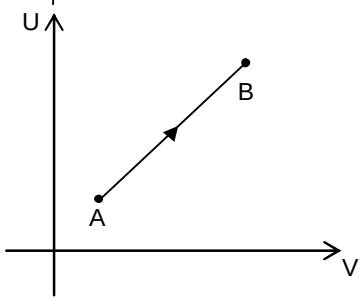
(B)



(C)



(D)



38. Which one of the following shows $d\pi$ - $d\pi$ bond?
(A) XeO_4
(B) $P(C_2H_5)_3$ with transition metals acting as ligand
(C) $N(SiH)_3$
(D) $R_3P = 0$

39. H_3A is a weak tripotic acid

$\left(K_{a_1} = 10^{-6};\ K_{a_2} = 10^{-10};\ K_{a_3} = 10^{-14}\right)$

Calculate the value of (pY – pX) of 1 M H_3A (aq) solution where $X = \frac{\left[HA^{2-}\right]}{\left[H_2A^{-}\right]}$ $Y = \frac{\left[A^{3-}\right]}{\left[HA^{2-}\right]}$

(A) 10
(B) 3
(C) 7
(D) 4

40. What is the ppm range of chlorine in aqueous solution which will act as disinfectanct?
(A) 0.2 – 0.4 ppm
(B) 2 – 4 ppm
(C) 0.4 – 0.8 ppm
(D) 4 – 8 ppm

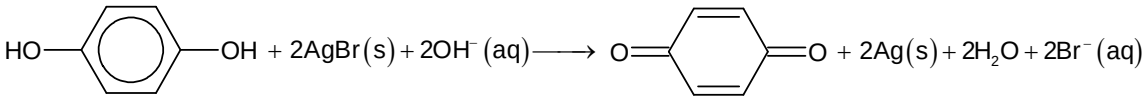
41. In a sample of H atom all electrons are present in 4^{th} excited state. If e^- deexcite then a radiation is observed. How many minimum number atoms are required to observe all spectral lines except lines of Balmer series?
(A) 3
(B) 2
(C) 1
(D) 4

42. Which of the following is correct order regarding ionic size?
(A) $H^- > I^- > Br^- > Cl^- > F^-$
(B) $I^- > Br^- > Cl^- > F^- > H^-$
(C) $I^- > H^- > Br^- > Cl^- > F^-$
(D) $I^- > Br^- > Cl^- > H^- > F^-$

43. How many d-orbitals are used in hybridization of the following molecules in total?

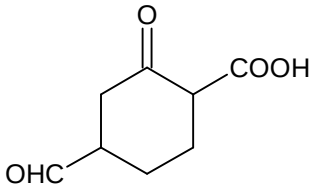
$\left[Ni(CN)_4\right]^{2-}, [NiCl_4]^{2-}, \left[Fe(CO)_5\right], \left[Ag(NH_3)_2\right]^{+}, \left[Co(H_2O)_6\right]^{3+}, CrO_4^{2-}$

(A) 6
(B) 4
(C) 7
(D) 5

44. 

What is the number of moles of electrons exchanged in this balanced redox reaction?
(A) 1
(B) 4
(C) 3
(D) 2

45. The correct IUPAC name of the compound is:

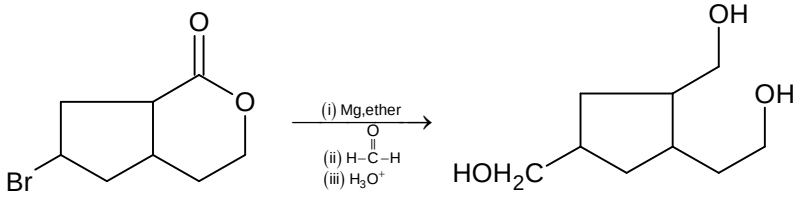


(A) 5-carboxy-3-oxocyclohexane carbaldehyde
(B) 2-carboxy – 5-formyl cyclohexanone
(C) 4-formyl-2-oxocyclohexane carboxylic acid
(D) 4-carboxy-3-oxocyclohexane

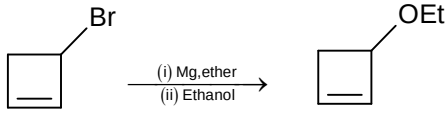
46. Which of the following will give Lassaignes test for nitrogen?
(A) NH_3
(B) $NH_2 – CH_2 – COOH$
(C) $Ph – N_2Cl$
(D) NH_2OH

47. Which of the following is a correct conversion?

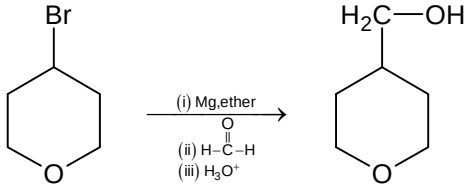
(A)



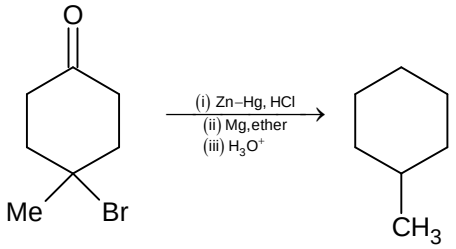
(B)



(C)



(D)



48. 3-methylpentane is subjected to chlorination in presence of sunlight. What is the maximum number of monochloro derivatives possible?
(A) 4 only
(B) 5 only
(C) 6 only
(D) 8 only

49. A water heater, operating on a hydrocarbon fuel heats water flowing at the rate of 5 kg per minute, from 27^oC to 77^oC. If the heat of combustion of hydrocarbon is 20,000 J/g, how much fuel in g is consumed per minute? (Specific heat of water is 4200 J/Kg – K)
(A) 52

(B) 52.7
(C) 53
(D) 52.5

50. Select the correct option if it is known that K_{sp} (AgCl) > K_{sp} (AgBr) > K_{sp} (AgI)
(A) $E^{o}_{I^-/AgI/Ag} > E^{o}_{Br^-/AgBr/Ag} > E^{o}_{Cl^-/AgCl/Ag}$
(B) $E^{o}_{I^-/AgI/Ag} < E^{o}_{Br^-/AgBr/Ag} < E^{o}_{Cl^-/AgCl/Ag}$
(C) $E^{o}_{I^-/AgI/Ag} < E^{o}_{Cl^-/AgCl/Ag} < E^{o}_{Br^-/AgBr/Ag}$
(D) $E^{o}_{I^-/AgI/Ag} = E^{o}_{Br^-/AgBr/Ag} = E^{o}_{Cl^-/AgCl/Ag}$

51. An excited H atom emits a photon of wavelength λ in returning to the ground state. If R is the Rydberg constant, then the quantum number n of the excited state is
(A) $\sqrt{\lambda R - 1}$
(B) $\sqrt{\lambda R}$
(C) $\sqrt{\frac{\lambda R}{\lambda R - 1}}$
(D) $\sqrt{\lambda R(\lambda R - 1)}$

52. Graph between log(x/m) vs log P is a straight line at an angle 30^o with intercept on y – axis, 0.477. The amount (in g) of the gas adsorbed per g of the adsorbent when pressure is 1 atm, is
(A) 1
(B) 2
(C) 3
(D) 4

53. If the values of enthalpies of reactants and products are p and q J/mol respectively. If the activation energy for the backward reaction is r J/mol, then the activation energy for forward reaction will be in (J/mol) (take only magnitudes)
(A) p – q - r
(B) p – q + r
(C) q – p – r
(D) q – p + r

54. Which element is present as an impurity, in principal ores of aluminium and iron, obtained from blast furnace?
(A) P
(B) Mn
(C) C
(D) Si

55. What is the correct order of SN^1 reactivity of the following alkyl halide?
$\underset{(1)}{C_6H_5CH_2Br}$, $\underset{(2)}{C_6H_5CH(C_6H_5)Br}$, $\underset{(3)}{C_6H_5CH(CH_3)Br}$, $\underset{(4)}{C_6H_5C(CH_3)(C_6H_5)Br}$
(A) 4 > 2 > 3 > 1
(B) 4 > 3 > 2 > 1
(C) 4 > 2 > 1 > 3
(D) 2 > 3 > 4 > 1

56. Which one of the following statements is correct regarding s-block element?
(A) Superoxides of alkali metals are black in colour.
(B) CsI (Cesium iodide) is less soluble in water due to high covalent character.

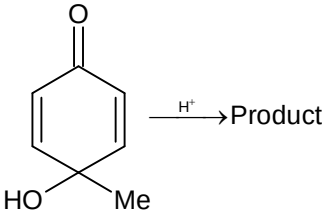
(C) On heating $LiNO_3$ gives a brown gas.
(D) Oxide and hydroxide of Be are acidic in nature.

57. α form of S exists in FCC and β form exists in BCC structure. Assuming that distance between the nearest neighbours is the same in the two forms, the ratio of the density of α form to that of β form is?
(A) $4\sqrt{2} : 3\sqrt{3}$
(B) $4\sqrt{3} : 3\sqrt{2}$
(C) $\sqrt{2} : \sqrt{3}$
(D) $2\sqrt{2} : 3\sqrt{3}$

58. The correct order of acidity of following carboxylic acids is
$\underset{(P)}{CCl_3COOH}$ $\underset{(Q)}{NC-CH_2COOH}$ $\underset{(R)}{HCOOH}$ $\underset{(S)}{Ph-COOH}$
(A) Q > P > R > S
(B) P > R > S > Q
(C) S > R > P > Q
(D) P > Q > R > S

59. Which of the following statement is incorrect?
(A) Ammonia reacts with diborane gives $B_2H_6.2NH_3$ and it is formulated as $\left[BH_2(NH_3)_2\right]^+\left[BH_4\right]^-$
(B) The hybridization of $\left[Sn(OH)_6\right]^{2-}$ contain two d-orbitals.
(C) H_2CO_3 / HCO_3^- buffer system helps to maintain pH of blood below 7.
(D) SiO_2 reacts with HF to form a compound containing 4 mole F atoms per mole of compound.

60. The number of hydroxyl groups present in the product of the following reactions is:



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

Mathematics

PART – III

SECTION – A
(One Options Correct Type)

This section contains **30 multiple choice questions**. Each question has **four choices** (A), (B), (C) and (D), out of which **ONLY ONE** option is correct.

61. If M is the number of words that can be formed using letters of word "EXCELLENCE" and N is the number of such words in which no two vowels are together, then $\frac{M}{N}$ is equal to

(A) $\frac{1}{4}$
(B) 6
(C) 4
(D) none of these

62. The value of $\int \frac{x\left(x^4-1\right)}{\left(x^8+3x^4+1\right)\tan^{-1}\left(x^2+\frac{1}{x^2}\right)}dx$ is equal to

(A) $\ln\tan^{-1}\left(x^2+\frac{1}{x^2}\right)+c$
(B) $\frac{1}{2}\ln\tan^{-1}\left(x^2+\frac{1}{x^2}\right)+c$
(C) $2\ln\tan^{-1}\left(x^2+\frac{1}{x^2}\right)+c$
(D) none of these

63. Let image of point A(3, 1) about line x + y + 7 = 0 be B(α, β) and image of B(α, β) about line x – 2y + 4 = 0 be C(γ, δ), then circumcentre of ΔABC is
(A) (–6, 2)
(B) (–6, –1)
(C) (6, –1)
(D) (6, 1)

64. The value of $\int_0^1 \frac{\log_e(x+1)}{1+x^2}dx = \frac{\pi\ln a}{b}$, then $a^2 + b^2$ equal to
(A) 20
(B) 68
(C) 40
(D) none of these

65. The equation of line through (1, 2, –1) and perpendicular to the lines $\vec{r}=\left(\hat{i}+\hat{j}\right)+\lambda\left(\hat{i}-\hat{j}+\hat{k}\right)$ and $\vec{r}=\left(-\hat{i}+2\hat{j}\right)+\mu\left(\hat{j}-3\hat{k}\right)$ is

(A) $\vec{r}=\left(\hat{i}+2\hat{j}-k\right)+\lambda\left(2\hat{i}+3\hat{j}+\hat{k}\right)$
(B) $\vec{r}=\left(\hat{i}+2\hat{j}-k\right)+\lambda\left(\hat{i}-\hat{j}+\hat{k}\right)$
(C) $\vec{r}=\left(\hat{i}+2\hat{j}-k\right)+\lambda\left(\hat{j}-3\hat{k}\right)$
(D) none of these

66. Number of ways to seat 8 men and 8 women around a round table where one particular man and one particular woman always sit together, and men and women alternate is equal to
(A) $2 \times (7!)^2$
(B) $2(6!)^2$
(C) $16! - 2! \times 14!$
(D) none of these

67. If $\alpha_1, \alpha_2, \alpha_3, ..., \alpha_n$ are n real roots of equation f(x) = 0 and f(x) satisfies the condition f(k – x) = f(x + k), then the value of $\sum_{i=1}^{n} \alpha_i$ is equal to
(A) 2nk, $\forall$ n $\in$ N
(B) nk, $\forall$ n $\in$ N
(C) nk, if n is odd
(D) nk, if n is even

68. The number of skew-symmetric matrices of order 4×4, whose entries belong to the set $\{\pm 4, \pm 3, \pm 2, \pm 1, 0\}$ is
(A) 9^6
(B) 6^9
(C) 9^9
(D) 8^6

69. For $f(x) = \tan\frac{\pi x}{2}$ and $g(x) = \frac{e^x - e^{-x}}{e^x + e^{-x}}$, which of the following is not correct?
(A) f(g(x)) is one-one
(B) f(g(x)) is onto
(C) f(g(x)) is not differentiable
(D) none of these

70. Number of solution(s) of $\frac{3\cos 2x + \cos^3 2x}{\cos^6 x - \sin^6 x} = x^2 + 3$ in $[0, 4\pi]$ is
(A) 0
(B) 1
(C) 2
(D) infinite

71. If $a = \left({}^{100}C_0 + {}^{100}C_3 + {}^{100}C_6 + ... + {}^{100}C_{99}\right)$, $b = \left({}^{100}C_1 + {}^{100}C_2 + {}^{100}C_3 + ...\right)$ and $c = \left({}^{100}C_1 - {}^{100}C_2 + {}^{100}C_4 - {}^{100}C_5 + ...\right)$, then value of $\left(a - \frac{b}{2}\right)^2 + \frac{3}{4}c^2$ is equal to
(A) 4
(B) 7
(C) 1
(D) 2

72. $\text{Min}\left[\left(x_1 - x_2\right)^2 + \left(7 + \sqrt{4 - \left(x_1 + 4\right)^2} - \sqrt{4x_2}\right)^2\right]$, $\forall$ $x_1x_2 \in$ R is
(A) $5\sqrt{2} - 2$
(B) 5
(C) $5\sqrt{3} - 2$
(D) 10

73. If the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ is inscribed in a rectangle whose length to breadth ratio is 3 : 2, then the area of rectangle is

(A) $\frac{2}{13}\left(a^2+b^2\right)$

(B) $\frac{24}{13}\left(a^2+b^2\right)$

(C) $\frac{9}{13}\left(a^2+b^2\right)$

(D) $\frac{8}{9}\left(a^2+b^2\right)$

74. $\sim (p \leftrightarrow q) \wedge p$ is equal to

(A) p

(B) q

(C) $p \wedge \sim p$

(D) $\sim P \wedge q$

75. $x_1, x_2, ..., x_{10}$ are ten observations x such that $\Sigma x_i = 50$ and $\Sigma x_i x_j = 1100\ \forall\ i \neq j$, then standard deviation of $x_1, x_2, ..., x_{10}$ is equal to

(A) 5

(B) 10

(C) $\sqrt{5}$

(D) $\sqrt{10}$

76. The combined equation of the pair of asymptotes of the hyperbola $5x^2 + 23xy – 10y^2 + 33x + 3y = 0$ is

(A) $5x^2 + 23xy – 10y^2 + 33x + 3y + 7 = 0$

(B) $5x^2 + 23xy – 10y^2 + 33x + 3y + 18 = 0$

(C) $5x^2 – 23xy + 7x^2 + 33x + 18 = 0$

(D) none of these

77. Let $\vec{a}, \vec{b}, \vec{c}$ be 3 mutually perpendicular unit vectors. If an unknown vector $\vec{x}$ satisfies the equation $\vec{a}\times\left(\left(\vec{x}-\vec{b}\right)\times\vec{a}\right)+\vec{b}\times\left(\left(\vec{x}-\vec{c}\right)\times\vec{b}\right)+\vec{c}\times\left(\left(\vec{x}-\vec{a}\right)\times\vec{c}\right)=0$, then $\vec{x}$ is equal to

(A) $\vec{a}+\vec{b}+\vec{c}$

(B) $\frac{\vec{a}+\vec{b}+\vec{c}}{2}$

(C) $\frac{\vec{a}+\vec{b}+\vec{c}}{3}$

(D) $\frac{\vec{a}+\vec{b}+\vec{c}}{4}$

78. A plane passes through (1, 2, –2) and is perpendicular to two planes $x – 2y + 3z + 4 = 0$ and $2x – y – z + 7 = 0$. The distance of this plane from the point (1, 1, 3) is equal to

(A) $\frac{8}{83}$

(B) $\frac{16}{83}$

(C) $\frac{64}{\sqrt{83}}$

(D) $\frac{8}{\sqrt{83}}$

79. From all the functions that can be defined from the set A to set B, where A = {1, 2, 3, 4, 5, 6}; and B = {7, 8, 9, 10, 11, 12, 13, 14}, a mapping is randomly selected. The chance that the selected mapping is strictly monotonic is

(A) $\frac{7}{2^{14}}$

(B) $\frac{7}{2^{16}}$

(C) $\frac{7}{8^5}$

(D) none of these

80. The locus of centre of circles which bisect the circumference of circles $x^2 + y^2 = 9$ and $x^2 + y^2 – 2x – 4y + 2 = 0$ is

(A) $2x – 2y + 3 = 0$

(B) $2x + 2y – 1 = 0$

(C) $2x – 2y + 1 = 0$

(D) $2x + 2y + 3 = 0$

81. If $\lim\limits_{x\to\infty}\left(\sqrt{x^2+x+2}-ax-b\right)=2$, then equation of circle whose centre is (a, 2b) and radius 1 units is

(A) $x^2 + y^2 + 2x + 6y + 9 = 0$

(B) $x^2 + y^2 – 2x + 6y + 1 = 0$

(C) $x^2 + y^2 – 2x + 6y + 9 = 0$

(D) none of these

82. The point on curve $x^2 + 4y^2 = 4$ nearest to the line $x + 2y + 12 = 0$ is

(A) $\left(-\sqrt{2}, \frac{1}{\sqrt{2}}\right)$

(B) (–2, 0)

(C) (0, –1)

(D) $\left(-\sqrt{2}, \frac{-1}{\sqrt{2}}\right)$

83. The equation of normal to the curve $y = 2x^3 + 6x + 5$, which is parallel to $x + 12y + 15 = 0$ is

(A) $x + 12y + 107 = 0$

(B) $x + 12y – 157 = 0$

(C) $x + 12y – 108 = 0$

(D) $x + 12y + 13 = 0$

84. Remainder when $\sum\limits_{r=0}^{n}\left((r!)^3+(r!)^2+(r!)\right)$ is divided by 36 ($n \geq 4$) is equal to

(A) 2

(B) 8

(C) 26

(D) none of these

85. If $I_1=\int\limits_{-5}^{6}\frac{dx}{\left(6+2x-2x^2\right)\left(1+e^{3-6x}\right)}$ and $I_2=\int\limits_{-5}^{6}\frac{dx}{6+2x-2x^2}$, then $\frac{I_1}{I_2}$ is equal to

(A) 1

(B) $\frac{1}{2}$
(C) 2
(D) none of these

86. Number of real root(s) of equation $x^2 \tan x = 1$ between $-\frac{3\pi}{2}$ and $\frac{3\pi}{2}$ is
(A) 1
(B) 2
(C) 3
(D) 4

87. Let $f(x) = \begin{cases} 1+|x-2| & x \neq 2 \\ 2 & x = 2 \end{cases}$ then at x = 2, f(x) has
(A) a local minimum
(B) a local maximum
(C) no extremities
(D) none of these

88. The area of the region of plane bounded by $\max(|x|, |y|) \leq 2$ and xy = 1 is equal to
(A) 3 – 2 ln 2
(B) 3 + 2 l n 2
(C) 6 – 4 ln 2
(D) 6 + 4 ln 2

89. A function y = f(x) satisfies the differential equation
$f(x)\sin 2x + \sin x - (1 + \cos^2 x)f'(x) = 0$ with initial condition y(0) = 0, then the value of $f\left(\frac{\pi}{4}\right)$ is equal to
(A) $\frac{\sqrt{2}\left(\sqrt{3}-1\right)}{3}$
(B) $\frac{\sqrt{2}\left(\sqrt{3}-\sqrt{2}\right)}{3}$
(C) $\frac{\sqrt{2}\left(\sqrt{2}-1\right)}{3}$
(D) $\frac{\sqrt{3}\left(\sqrt{2}+1\right)}{3}$

90. Let f(x) be a polynomial, with positive leading coefficient, satisfying f(0) = 0 and $f(f(x)) = x\int_0^x f(t)dt \ \ \forall\, x \in R$. Then f(2) is equal to
(A) $\frac{2}{\sqrt{3}}$
(B) $\frac{1}{\sqrt{6}}$
(C) $\sqrt{\frac{2}{3}}$
(D) $\frac{4}{\sqrt{3}}$