

FIITJEE

ALL INDIA TEST SERIES

FULL TEST – IX

JEE (Main)-2025

TEST DATE: 26-03-2025

Time Allotted: 3 Hours

Maximum Marks: 300

General Instructions:

- The test consists of total 75 questions.
- Each subject (PCM) has 25 questions.
- This question paper contains **Three Parts**.
- **Part-A** is Physics, **Part-B** is Chemistry and **Part-C** is Mathematics.
- Each part has only two sections: **Section-A** and **Section-B**.

Section-A (01 – 20, 26 – 45, 51 – 70) contains 60 multiple choice questions which have **only one correct answer**. Each question carries **+4 marks** for correct answer and **–1 mark** for wrong answer.

Section-B (21 – 25, 46 – 50, 71 – 75) contains 15 Numerical based questions. The answer to each question is rounded off to the nearest integer value. Each question carries **+4 marks** for correct answer and **–1 mark** for wrong answer.

Physics

PART – A

SECTION – A

(Single Choice Answer Type)

This section contains **20 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

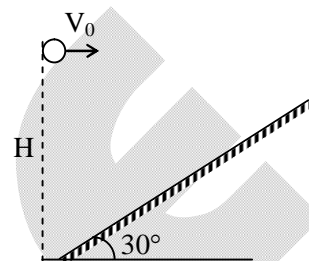
1. In the given figure, the angle of inclination of the inclined plane is 30° . A particle is projected horizontally from a height H above the foot of the inclined plane. Find the horizontal velocity V_0 so that the particle will retrace the path after hitting the inclined plane. Collision is perfectly elastic.

(A) $v_0 = \sqrt{\frac{2gH}{5}}$

(B) $v_0 = \sqrt{\frac{2gH}{7}}$

(C) $v_0 = \sqrt{\frac{gH}{5}}$

(D) $v_0 = \sqrt{\frac{gH}{7}}$



2. A signal of frequency 25 KHz and peak voltage 20 V is used to modulate a carrier wave of frequency 1.5 MHz and peak voltage 50 V. Choose the correct statement.

(A) Modulation index is 0.4, side frequency bands are 1475 KHz and 1525 KHz

(B) Modulation index is 0.4, side frequency bands are 2950 KHz and 3150 KHz

(C) Modulation index is 2.5, side frequency bands are 1475 KHz and 1575 KHz

(D) Modulation index is 2.5, side frequency bands are 2950 KHz and 3150 KHz

3. A ball of mass m falls vertically from a height $h = \frac{20}{3}m$ and

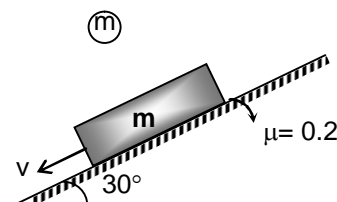
collides with a block of equal mass m moving down an inclined plane with a velocity v as shown in the figure. The coefficient of kinetic friction between the block and the surface is 0.2, while the coefficient of restitution (e) between the ball and the block is 0.5. There is no friction acting between the ball and the block. The velocity of the block decreases by

(A) 5 m/s

(B) 0

(C) 1 m/s

(D) 3 m/s



4. Air column in an open organ pipe of length $\ell = 30$ cm resonates with a sonic source emitting wave of frequency $f = 1100\text{Hz}$. If maximum pressure variation in the pipe over the atmospheric pressure due to standing wave is $0.1 P_0$, where P_0 is the atmospheric pressure. Find the difference of the maximum and minimum pressure in the tube at a distance 5 cm from the open end. Take speed of sound in air equal to 330 m/s and ignore the end correction.

(A) $\frac{\sqrt{3}}{20} P_0$

(B) $\frac{\sqrt{3}}{10} P_0$

(C) $\sqrt{3} P_0$

(D) $2 P_0$

5. At time $t = 0$, a horizontal disc starts rotating with angular acceleration 1 rad/sec^2 about an axis perpendicular to its plane and passing through its center. A small block is lying on this disc at a distance 0.5 m from center, coefficient of friction between surface of block and disc is 0.255. The block will start slipping on the disc at time t , is approximately equal to

(A) $2\sqrt{3} \text{ s}$

(B) $2\sqrt{2} \text{ s}$

(C) 6 s

(D) $\sqrt{5} \text{ s}$

6. A thin spherical conducting shell of radius R has a charge q . Another charge Q is placed at the centre of the shell. Calculate electrostatic potential at a point P a distance $R/2$ from the centre of the shell.

(A) $\frac{2Q}{2\pi\epsilon_0 R} - \frac{2q}{4\pi\epsilon_0 R}$

(B) $\frac{Q}{2\pi\epsilon_0 R} + \frac{q}{4\pi\epsilon_0 R}$

(C) $\frac{(q+Q)}{2\pi\epsilon_0} \frac{2}{R}$

(D) $\frac{2Q}{2\pi\epsilon_0 R}$

7. An ammeter reads upto 1 ampere. Its internal resistance is 0.81 ohm . To increase the range to 10A the value of the required shunt is –

(A) 0.3Ω

(B) 0.9Ω

(C) 0.09Ω

(D) 0.30Ω

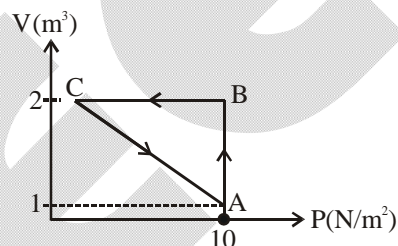
8. An ideal gas is taken through a cycle $A \rightarrow B \rightarrow C \rightarrow A$ as shown in figure. If the heat supplied in the cycle is 5J , then work done on the gas in the process $C \rightarrow A$ is in joules is

(A) -5J

(B) -10J

(C) -15J

(D) -20J



9. A space vehicle approaching a planet has a speed v , when it is very far from the planet. At that moment tangent of its trajectory would miss the centre of the planet by distance R . If the planet has mass M and radius r , what is the value of R in order that the resulting orbit of the space vehicle will just miss the surface of the planet ?

(A) $R = \frac{r}{v} \left[v^2 + \frac{2GM}{r} \right]^{1/2}$

(B) $R = vr \left[1 + \frac{2GM}{r} \right]$

(C) $R = \frac{r}{v} \left[v^2 + \frac{2GM}{r} \right]$

(D) $R = \frac{2GMv}{r}$

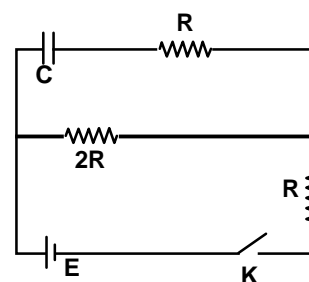
10. In the given circuit, the capacitor of capacitance C is charged by closing key K at $t = 0$. Find the time required to charge the capacitor up to maximum charge for the given circuit, if it were to be charged with the constant initial charging rate at $t = 0$ in the given circuit.

(A) $RC/3$

(B) $2RC/3$

(C) $2RC/3$

(D) $5RC/3$



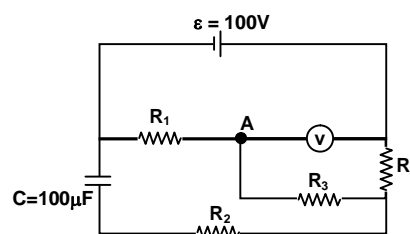
11. In the circuit shown in figure E is a battery of emf 100 V . Resistance $R_1 = 100\Omega$, $R_2 = 200\Omega$, $R_3 = 200\Omega$. The voltmeter resistance is 200Ω . What reading will the voltmeter show in steady state ?

(A) $50/3 \text{ V}$

(B) $400/7 \text{ V}$

(C) $100/3 \text{ V}$

(D) 50 V



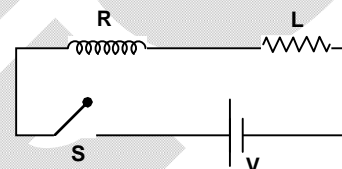
12. A ray of light travelling in a medium of refractive index μ is incident at an angle θ on a composite transparent plate consisting of 50 plates of refractive indices $1.01\mu, 1.02\mu, 1.03\mu, \dots, 1.50\mu$. The ray emerges from the composite plate into a medium of refractive index 1.6μ at angle x . Then

(A) $\sin x = \left(\frac{1.01}{1.5}\right)^{50} \sin \theta$ (B) $\sin x = \frac{5}{8} \sin \theta$
 (C) $\sin x = \frac{8}{5} \sin \theta$ (D) $\sin x = \left(\frac{1.5}{1.01}\right)^{50} \sin \theta$

13. The binding energy per nucleon of deuteron (${}^2_1\text{H}$) and helium nucleus (${}^4_2\text{He}$) is 1.1 MeV and 7 MeV respectively. If two deuteron nuclei react to form a single helium nucleus, then the energy released is—

(A) 23.6 MeV (B) 26.9 MeV
 (C) 13.9 MeV (D) 19.2 MeV

14. An inductor of inductance $L = \frac{\tau R}{2}$ and a resistor of resistance R is connected to a battery of emf V as shown in the figure. The potential difference across the resistance at a time, $t = \tau \ln 2$ after the switch S is closed is (τ is constant)



(A) $\frac{V}{4}$ (B) $\frac{3V}{4}$
 (C) $\frac{V}{2}$ (D) $\frac{2V}{3}$

15. A resistance R draws P power when connected to an AC source. If an inductance is now placed in series with the resistance, such that the impedance of the circuit becomes Z , the power drawn will be

(A) $P \left(\frac{R}{Z}\right)^2$ (B) $P \left(\frac{R}{Z}\right)$
 (C) $P \sqrt{\frac{R}{Z}}$ (D) P

16. At STP 44.8 liter of helium gas is confined in a cylindrical vessel by a movable piston. The gas is thermally insulated from surrounding, however, heat is supplied to the gas very slowly by an electric heater consequently piston moves slowly. In this process find the heat supplied to the gas by the heater to increase its temperature by 20°C . Ignore any dissipative force on the piston. (R is universal gas constant)

(A) $200 R$ (B) $100 R$
 (C) $60 R$ (D) $140 R$

17. Wavelength of K_α X-ray of an element A is λ_1 and wavelength of K_α X-ray element B is λ_2 . $\frac{\lambda_1}{\lambda_2}$ is

equal to $\frac{1}{4}$ and Z_1 and Z_2 are the atomic numbers of element A and B respectively. Then relation between Z_1 and Z_2 are given by

(A) $2Z_2 - Z_1 = 1$ (B) $Z_2 - 2Z_1 = 1$
 (C) $\frac{Z_2}{Z_1} = 4$ (D) $\frac{Z_1}{Z_2} = 4$

18. A radioactive element undergoes two different types of radioactive disintegration, one with disintegration constant λ_1 and the other with λ_2 . The half-life of the element is
- (A) $\frac{0.693}{\lambda_1 + \lambda_2}$ (B) $\frac{0.693}{(\lambda_1 + \lambda_2)/2}$
- (C) $0.693 \frac{\lambda_1 \lambda_2}{\lambda_1 + \lambda_2}$ (D) $\frac{0.693}{2} \frac{\lambda_1 \lambda_2}{\lambda_1 + \lambda_2}$
19. A photon collides with a stationary hydrogen atom in ground state inelastically. Energy of the colliding photon is 10.2 eV. Almost instantaneously, another photon collides with same hydrogen atom inelastically with an energy of 15 eV. What will be observed by the detector ?
- (A) two photons of energy 10.2 eV
(B) two photons of energy 1.4 eV
(C) one photon of energy 10.2 eV and an electron of energy 1.4 eV
(D) one electron having kinetic energy nearly 11.6 eV
20. A uniform string of mass $m = 200$ g and lengths $l = 5$ m is stretched along x-axis. One end at $x = 0$ is attached to a harmonic oscillator and the other end is fixed to a rigid support. Tension in the string is $T = 1600$ N. At the time $t = 0$, the oscillator starts producing transverse harmonic waves in the string. The y-coordinate of a particle in the string near the source varies with time as $y = 0.5 \text{ cm} \sin(100\pi t)$, where t is the time in second. Find the y-co-ordinate of the mid point on the string at the instant when first disturbance emitted by the source reaches the fixed end.
- (A) $\frac{1}{2\sqrt{2}} \text{ cm}$ (B) $-\frac{1}{2\sqrt{2}} \text{ cm}$
- (C) $\frac{1}{\sqrt{2}} \text{ cm}$ (D) $\frac{1}{2} \text{ cm}$

SECTION – B
(Numerical Answer Type)

This section contains 5 Numerical based questions. The answer to each question is rounded off to the nearest integer value.

21. An electric lamp designed for operation on 110V AC is connected to a 220 V AC supply, through a choke coil of inductance 2H, for proper operation. The angular frequency of the AC is $100\sqrt{10}$ rad/s. If a capacitor is to be used in place of the choke coil, its capacitance must be (in μF)
22. A cylindrical block of mass $m = 200$ gm is suspended from a fixed support by a light spring of stiffness $k = 90$ N/m. The block is slightly pulled down from its equilibrium and then the pulling force is removed. Consequently, the block performs oscillatory motion. If damping constant of air is 40 g/s, the time (in sec) after which displacement amplitude reduces to the half of the initial value is nearly
23. An object is projected with a speed 10 m/s at an angle of 30° with the horizontal. The object breaks down into n equal fragments during its motion. One fragment is found to strike the ground at a distance of $\sqrt{3}$ m from the point of projection in the same azimuthal plane, in which the object is projected. If the centre of mass of the remaining fragments strikes the ground at distance of $7\sqrt{3}$ m from the point of projection, then the value of n is
24. A beam of light converges at a point P. A converging lens of focal length 25 cm is placed in the path of the beam before converging it at P at a distance of 20 cm from the point P. Now locate the point where beam will converge. Find the distance from the position of the lens.
25. All atoms in a sample of helium gas are in the first excited state. Photons emitted from these atoms due to de-excitation are incident on the surface of a metal having work function $\phi = 2.8$ eV. Find the stopping potential of the photoelectrons ejected from metal surface. The ionization energy of hydrogen atom is 13.6 eV.

Chemistry

PART – B

SECTION – A

(Single Choice Answer Type)

This section contains **20 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

26. Substance which tends to decompose at their sublimation temperature can preferably purified by sublimation under the following pressure condition
 (A) increased pressure
 (B) reduced pressure
 (C) pressure has no effect on the sublimation temperature of a substance
 (D) at atmospheric pressure
27. Liquid A and liquid B form ideal solution. The ratio of the pure vapour pressure of A and B, respectively at 298 K is 1 : 4. Also, the ratio of their masses in liquid phase is 2 : 1. What will be the ratio of their masses in vapour phase?
 (A) 1 : 2
 (B) 1 : 8
 (C) 8 : 1
 (D) 2 : 1
28. In which of the following conditions, the electrical conductivity decreases?
 (A) ZnO is heated in Zn vapour
 (B) NaCl is heated in Na vapour
 (C) Silicon is doped with arsenic
 (D) Heating metallic conductor
29. Which of the following order is INCORRECT?
 (A) $\text{Li} < \text{Be} < \text{B} < \text{C}$ (magnitude of effective nuclear charge)
 (B) $\text{Li}^+ > \text{Na}^+ < \text{K}^+ < \text{Rb}^+$ (ionic radius in aqueous medium)
 (C) $\text{N}^{3-} > \text{Ne} > \text{Mg}^{2+} > \text{Al}^{3+}$ (ionic radius)
 (D) $\text{B} > \text{Al} < \text{Ga} > \text{In}$ (first ionization energy)
30. Which of the following orders of given character in the following oxides is CORRECT?
 (A) $\text{V}_2\text{O}_3 < \text{V}_2\text{O}_4 < \text{V}_2\text{O}_5$ (basic character)
 (B) $\text{CrO} < \text{Cr}_2\text{O}_3 < \text{CrO}_3$ (acidic character)
 (C) $\text{CO}_2 > \text{SO}_3 > \text{Cl}_2\text{O}_7$ (acidic character)
 (D) $\text{MgO} < \text{CaO} > \text{BaO}$ (basic character)
31. Which of the following statement about hydrogen peroxide is INCORRECT?
 (A) The gas phase bond angles in H_2O_2 is less than that in crystalline phase.
 (B) H_2O_2 can be prepared by adding ice-cold dilute H_2SO_4 (20%) on Na_2O_2 .
 (C) The gas phase O – H bond length is greater than that of in crystalline phase.
 (D) The dihedral angle in H_2O_2 in its gas phase is larger than that of bond angle.
32. Electrons in a group of degenerate orbitals can have five Z-components of angular momentum. Which sub-shell does this group of orbitals belong to:
 (A) s
 (B) p
 (C) d
 (D) s + d

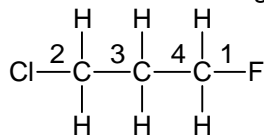
33. Two containers containing N_2 and O_2 gases respectively, are present in the same compartment of a train which is moving with 120 km/hr. The volume of first container is twice the size of second one. Find the ratio of the mean square speeds of N_2 gas and O_2 gas, respectively

(A) $\frac{8}{7}$ (B) $\frac{7}{8}$
(C) $\frac{1}{2}$ (D) $\frac{2}{1}$


34. He gas and N_2 gas both initially at the same temperature and pressure are compressed adiabatically and reversibly from a volume of V to $\frac{V}{3}$ (Assuming ideal behaviour of both the gases). Which gas will be at higher temperature?

(A) He
(B) N_2
(C) Both remain at same temperature
(D) None of these

35. Which of the following highlighted bond most likely break through homolytic bond cleavage?




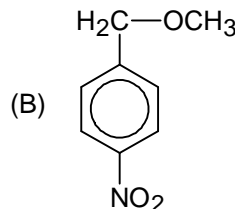
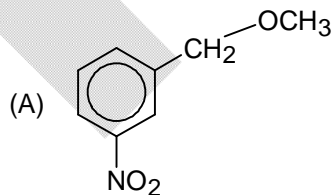
(A) 1 (B) 2
(C) 3 (D) 4

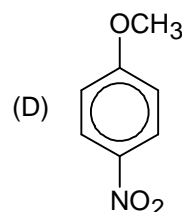
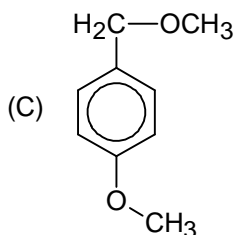
36.  $\xrightarrow{\text{Reagent}}$ Product

With which reagent, the major product will not be syn addition product?

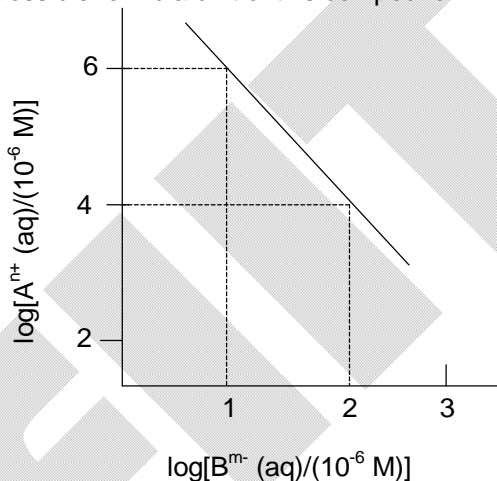
(A) (1) OsO_4 , (2) Na_2SO_3 , H_2O
(B) (1) $KMnO_4$, H_2O / OH^- (cold)
(C) (1) HBr , $(C_6H_5COO)_2$
(D) (1) B_2H_6 / THF, (2) H_2O_2 / $NaOH$

37.  $\xrightarrow{CH_3OH}$ (Major product A)





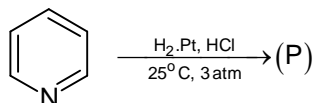
38. Which of the following is CORRECT?
- (A) In case of association, value of van't Hoff factor is more than unity while for dissociation it is less than unity.
- (B) Solid CO_2 directly sublimates upon heating at atmospheric pressure but it will first liquefy if this heating is done at sufficiently higher pressure.
- (C) Even at high pressure solid CO_2 always sublimates upon heating.
- (D) When placed in saline water (concentration $< 0.9\%$ m/V) blood cells (internal concentration = 0.9% m/V) shrink.
39. In which of the following reactions, the catalyst has been incorrectly marked?
- (A) $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \xrightarrow{\text{Fe}(\text{s})} 2\text{NH}_3(\text{g})$ (Haber's process)
- (B) $4\text{NH}_3(\text{g}) + 5\text{O}_2(\text{g}) \xrightarrow{\text{Pt}(\text{s})} 4\text{NO}(\text{g}) + 6\text{H}_2\text{O}(\text{g})$ (Ostwald's process)
- (C) $2\text{KClO}_3 \xrightarrow{\text{MnO}_2(\text{s})} 2\text{KCl} + 3\text{O}_2$
- (D) $\text{CH}_3\text{COOCH}_3(\text{aq}) + \text{H}_2\text{O}(\ell) \xrightarrow{\text{NaOH}} \text{CH}_3\text{COOH}(\text{aq}) + \text{CH}_3\text{OH}(\text{aq})$
40. A sparingly soluble salt A_mB_n shows following relation in its saturated aqueous solution. Find the possible formula unit of this compound



- (A) AB
(C) A_2B

- (B) AB_2
(D) A_3B

41.

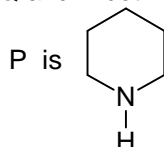


Pyridine [Q]

Which of the following statement is correct?

(A) Q and P both are aromatic

(B)

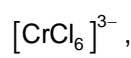


(C) P is acyclic amine compound

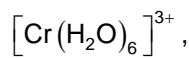
(D) Q is more basic than P

42.

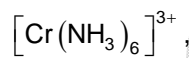
Arrange the following coordination compounds in increasing order of wavelength of light that they absorbed



(I)



(II)



(III)



(IV)

(A) I > II > III > IV

(B) IV > II > III > I

(C) I > III > II > IV

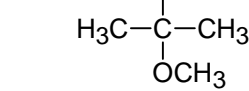
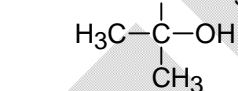
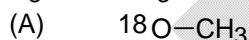
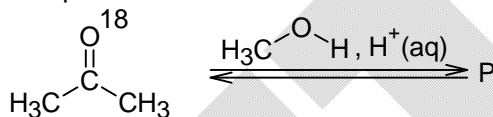
(D) IV > III > II > I

43.

Order of octahedral ionic radii of M^{2+} for the first row transition elements(A) $\text{Ca} < \text{V} < \text{Mn} > \text{Zn}$ (B) $\text{V} < \text{Mn} > \text{Ni} < \text{Zn}$ (C) $\text{V} < \text{Mn} < \text{Ni} > \text{Zn}$ (D) $\text{Fe} < \text{Co} < \text{Ni} > \text{Zn}$

44.

The product or intermediate which can not be synthesized from the given reaction



45.

Compound A upon strong heating produces a salt B and a colourless gas C. The gas C is also produced by heating hydrogen peroxide. Aqueous solution of salt B produces white precipitate when aqueous AgNO_3 solution is mixed into it. When gas D is passed through hot and concentrated solution of potassium hydroxide, then compound A is formed. In presence of moisture, gas D acts as an oxidizing agent.

Correct option is:

(A) $\text{A} = \text{KNO}_3$ (B) $\text{A} = \text{KClO}_3$ (C) $\text{D} = \text{O}_2$ (D) $\text{B} = \text{NaI}$

SECTION – B

(Numerical Answer Type)

This section contains 5 Numerical based questions. The answer to each question is rounded off to the nearest integer value.

46. Find the total number of bonds in which there is involvement of hybridized orbitals in the following molecules/ions.
 CH_4 , ClF_3 , C_2H_4 , C_2H_2 , NO_2^+
47. 20 mL of '10 volume' hydrogen peroxide solution upon heating releases that much amount of oxygen at STP which is just sufficient to completely burn 'x mg' of ethene. Find the value of x (to the nearest integer).
48. The total loss in mass (in g) when mixture of 1 mole Li_2CO_3 and 2 moles $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ is heated.
49.
$$\begin{array}{c} \text{H} \quad \text{H} \\ | \quad | \\ \text{Cl}-\text{C}-\text{C}-\text{Cl} \\ | \quad | \\ \text{T} \quad \text{H} \end{array} \xrightarrow[\text{Ether}]{\text{Na}} \text{Product(s)}$$

 (Product should not have more than 4 carbons)
 From all the possible products, how many of them will be chiral?
50. During rusting of iron, iron converted to ferric oxide it has been found that 3.2 kg of iron rust has been formed. How many mole(s) of electrons does iron has given up to form this much rust? (Atomic mass : Fe = 56 u, O = 16 u)

Mathematics**PART – C****SECTION – A****(Single Choice Answer Type)**

This section contains **20 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

51. For a data set having 100 observations, mean, median, mode are 50, 60, 70 respectively. If the largest 50 observations are increased by 10, then sum of new mean, median, mode equals
 (A) 180 (B) 190
 (C) 200 (D) 210
52. Maximum number of compound propositions out of
 $p \wedge q \wedge r$, $p \wedge \sim q \wedge r$, $p \wedge q \wedge \sim r$
 $\sim p \wedge q \wedge s$, $\sim p \wedge \sim q \wedge s$, $\sim p \wedge q \wedge \sim s$
 $q \wedge r \wedge s$, $q \wedge \sim r \wedge s$, $\sim q \wedge \sim r \wedge \sim s$
 that can be made simultaneously false by an assignment of the truth values to p, q, r and s, is equal to
 (A) 6 (B) 7
 (C) 8 (D) 9
53. Let $f(x) = \begin{vmatrix} \cos x & \cos^2 x & \cos^4 x \\ \cos 3x & \cos^2 3x & \cos^4 3x \\ \cos 5x & \cos^2 5x & \cos^4 5x \end{vmatrix}$, then $\int_0^\pi f(x) dx$ equals
 (A) 9 (B) 18
 (C) 27 (D) none of these
54. Let R be a relation defined on first twenty natural numbers such that $R = \{(a, b) : \frac{a}{b} \text{ is a prime number}\}$. Consider the following statements :
 (I) R is reflexive and symmetric but not transitive
 (II) Range of R^{-1} has 20 elements
 (III) Domain of R^{-1} has 10 elements
 which of the statements are true ?
 (A) I, II, III (B) II, III
 (C) II (D) III
55. Value of $\sin 32^\circ \sin 88^\circ \sin 152^\circ$ equals
 (A) $\sin 6^\circ$ (B) $\frac{\sin 6^\circ}{4}$
 (C) $\cos 6^\circ$ (D) $\frac{\cos 6^\circ}{4}$
56. Let α, β be roots of the equation $x^2 - 3x - \sqrt{7} = 0$ and $\alpha^2 + \frac{1}{\beta}, \beta^2 + \frac{1}{\alpha}$ be the roots of the equation $x^2 + px + q = 0$, then for the equation $x^2 + p^2q^2x - (11q + p) = 0$, roots are
 (A) positive (B) negative
 (C) one positive and other negative (D) none of these

57. Let $A = \sum_{i=0}^{2023} \sum_{j=0}^{2023} \min\{ {}^{2023}C_i, {}^{2023}C_j \}$, $B = \sum_{i=0}^{2023} \sum_{j=0}^{2023} \max\{ {}^{2023}C_i, {}^{2023}C_j \}$, then $A + B$ equal
 (A) $2024 \cdot 2^{2023}$ (B) $2023 \cdot 2^{2023}$
 (C) $2024(2^{2023} - 1)$ (D) $2023(2^{2023} - 1)$
58. Let H_L and H_R be two branches of a hyperbola having A, B as endpoints of latus-rectum on H_L . If C be any point on H_R such that $\angle ACB$ is never obtuse, then maximum possible eccentricity of hyperbola is
 (A) $\sqrt{2}$ (B) $\sqrt{3}$
 (C) 2 (D) 3
59. If chord of contact of pair of tangents from points P and Q on $\frac{x^2}{9} + \frac{y^2}{16} = 1$ to the ellipse $\frac{x^2}{3} + \frac{y^2}{4} = 1$ is normal to the curve $2x^2 + 2y^2 - 4x - 4y + 1 = 0$, then sum of eccentric angles of P and Q is
 (A) $\frac{\pi}{2}$ (B) π
 (C) 2π (D) none of these
60. A rectangular hyperbola and ellipse have coincident end points of latus-rectum, then eccentricity of ellipse equals
 (A) $\frac{1}{2\sqrt{2}}$ (B) $\frac{1}{\sqrt{2}}$
 (C) $\frac{1}{2}$ (D) none of these
61. If $\lim_{x \rightarrow 0} \frac{\sin x \sin 2x \sin 3x \dots \sin nx - x^n}{x \tan((1+x)(1+2x)(1+3x) \dots (1+2023x))}$ exists and is non-zero, then 'n' equals
 (A) 2022 (B) 2023
 (C) 2024 (D) no such value of n exists
62. Let $A_k = [a_{ij}]$ be square matrix of order 3 such that $a_{ij} = (i - j)^k$ for all $i, j = 1, 2, 3$. Then determinant value of $|A_1 + A_3 + A_5 + \dots + A_{2023}|$ equals
 (A) 3^{4046} (B) 3^{6069}
 (C) $3^{6069} - 3^{4046}$ (D) none of these
63. Which of the following functions is differentiable at $x = 0$?
 (A) $|\tan|x| - \cos|x||$ (B) $|\sin|x| - \tan|x||$
 (C) $|\cos|x| - \sin|x||$ (D) all of these
64. Water is being filled at rate of $\pi \text{ cm}^3/\text{s}$ in right circular conical vessel (vertex upwards) of height 5cm and diameter 8cm. When the height of water level is 3cm, the rate (in cm^2/s) at which the wet conical surface area of the vessel increases is
 (A) $\frac{2\pi}{3}$ (B) $\frac{\sqrt{41}}{12} \pi$
 (C) $\frac{\sqrt{41}}{18} \pi$ (D) none of these

65. Let $f(x) = x^7(x^3 + 2x^2 - x - 2) + (x^3 - x)(x + 3) + 2(x^2 - 1)$, then which of the following is **NOT** true?
 (A) $y = f(x)$ has 7 critical points
 (B) there are exactly 2 points in $(-1, 1)$ where $f'(x) = 0$
 (C) $y = f(x)$ does not have an extrema at $x \in I$
 (D) $y = f(x)$ has exactly 2 stationary point in $(-2, 1)$
66. Value of $\int_0^1 x^6 (x^3 - 1)^{2022} dx$ is
 (A) $\frac{3^{2022} (2022)!}{10.13.16.....6073}$
 (B) $\frac{3^{2022} (2022)!}{7.10.13.....6073}$
 (C) $\frac{3^{2022} (2022)!}{4.7.10.....6073}$
 (D) none of these
67. If area bounded by an ellipse with its auxiliary circle equals area bounded by its auxiliary circle and director circle, then eccentricity of ellipse equals
 (A) $\sqrt{2}\sin 18^\circ$
 (B) $\sqrt{2}\cos 18^\circ$
 (C) $\sqrt{2}\sin 36^\circ$
 (D) $\sqrt{2}\cos 36^\circ$
68. Ajay has to take medicine having 100 mg paracetamol at a gap of every 12 hours. The amount of paracetamol (salt) in Ajay's bloodstream decreases at a rate that is proportional at any time to the amount of salt in bloodstream at that time. If the amount of salt in bloodstream is halved in every 5 hours, then amount of salt in Ajay's bloodstream 15 hours after taking the medicine first time is (in mg)
 (A) $100\left(\frac{1}{2}\right)^3$
 (B) $100\left[\left(\frac{1}{2}\right)^3 + 1\right]$
 (C) $100\left[\left(\frac{1}{2}\right)^3 + \left(\frac{1}{2}\right)^{12/5}\right]$
 (D) $100\left[\left(\frac{1}{2}\right)^3 + \left(\frac{1}{2}\right)^{3/5}\right]$
69. Equation of plane passing through the line $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ at minimum possible distance from the point $(-1, -3, 1)$ is
 (A) $7x - 2y - 2z + 3 = 0$
 (B) $x + 3y + 10 = 0$
 (C) $3x + y - z = 2$
 (D) none of these
70. $[(\vec{a} \times \vec{b}) \times (\vec{b} \times \vec{c})] \times (\vec{c} \times \vec{a}) \cdot \vec{b}$ equal (where $\vec{a}, \vec{b}, \vec{c}$ are non-coplanar vectors)
 (A) $[\vec{a} \vec{b} \vec{c}]^2 |\vec{b}|^2$
 (B) $[\vec{a} \vec{b} \vec{c}]^2 (\vec{b} \cdot \vec{c})$
 (C) $[\vec{a} \vec{b} \vec{c}]^2 (\vec{b} \cdot \vec{a})(\vec{c} \cdot \vec{b})$
 (D) none of these

SECTION – B

(Numerical Answer Type)

This section contains 5 Numerical based questions. The answer to each question is rounded off to the nearest integer value.

71. Let z_1, z_2, z_3 be represented by A, B, C on Argand plane such that $z_1 = 3 + 3i$, $z_2 = 9 - 6\sqrt{2} + (6\sqrt{2} - 3)i$ and $\triangle ABC$ is right angled at C. If minimum and maximum possible value of Argument of z_3 is a, b respectively (Argument of $z_3 \in (-\pi, \pi]$, then $b - a$ is $\frac{\pi}{k}$ where k equals
72. Number of ordered pairs (x, y) satisfying $\frac{4^{\sin x} 16^{\sin y}}{(1 + 16^{\sin x})(1 + 256^{\sin y})} = \frac{1}{4}$, $3^{1 + \sqrt{\cos^2 x}} + 3^{1 + \cos y} = 10$; x, y $\in [0, 2\pi]$ is
73. Two families each having 4 members are to be seated around a circular table having alternate red and blue chairs. If probability that members of same family are seated together is p, then $35p$ equals
74. Number of 5-digit natural numbers such that the product of their digits equals number of ways to create a necklace out of 6 beads from 10 distinct beads is
75. Remainder when $(2022)^{2023}$ is divided by 11 is