3S INSTITUTE
JEE ADVANCED | JEE MAIN | NEET | OLYMPIADS | MHT-CET | FOUNDATION

24-January-2023 (Morning Batch) : JEE Main Paper

PHYSICS **Section - A (Single Correct Answer)**

1. Two long straight wires P and Q carrying equal current 10A each were kept parallel to each other at 5 cm distance. Magnitude of magnetic force experienced by 10 cm length of wire P is F_1. If distance between wires is halved and currents on them are doubled, force F_2 on 10 cm length of wire P will be :
(A) $8\ F_1$ (B) $10\ F_1$ (C) $F_1/8$ (D) $F_1/10$

2. Given below are two statements :
Statement-I : An elevator can go up or down with uniform speed when its weight is balanced with the tension of its cable.
Statement-II : Force exerted by the floor of an elevator on the foot of a person standing on it is more than his/her weight when the elevator goes down with increasing speed.
In the light of the above statements, choose the correct answer from the options given below :
(A) Both statement I and statement II are false (B) Statement I is true but Statement II is false
(C) Both Statement I and Statement II are true (D) Statement I is false but Statement II is true

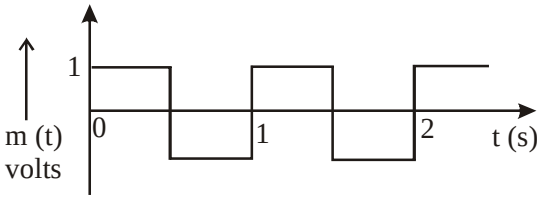
3. From the photoelectric effect experiment, following observations are made. Identify which of these are correct
1. The stopping potential depends only on the work function of the metal.
2. The saturation current increases as the intensity of incident light increases.
3. The maximum kinetic energy of a photo electron depends on the intensity of the incident light.
4. Photoelectric effect can be explained using wave theory of light.
Choose the correct answer from the options given below:
(A) 2, 3 only (B) 1, 3, 4 only (C) 2 only (D) 1, 2, 4 only

4. The weight of a body at the surface of earth is 18 N. The weight of the body at an altitude of 3200 km above the earth's surface is (given, radius of earth R_e = 6400 km)
(A) 9.8 N (B) 4.9 N (C) 19.6 N (D) 8 N

5. A 100 m long wire having cross-sectional area $6.25 \times 10^{-4}\ m^2$ and Young's modulus is $10^{10}\ Nm^{-2}$ is subjected to a load of 250 N, then the elongation in the wire will be :
(A) 6.25×10^{-3} m (B) 4×10^{-4} m (C) 6.25×10^{-6} m (D) 4×10^{-3} m

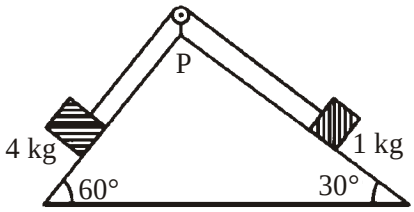
6. 1g of a liquid is converted to vapour at 3×10^5 Pa pressure. If 10% of the heat supplied is used for increasing the volume by 1600 cm^3 during this phase change, then the increase in internal energy in the process will be :
(A) 4320 J (B) 432000 J (C) 4800 J (D) 4.32×10^8 J

7. A modulating signal is a square wave, as shown in the figure.



If the carrier wave is given as c(t) = 2 sin (8πt) volts, the modulation index is :
(A) 1/4 (B) 1 (C) 1/3 (D) 1/2

8. As per given figure, a weightless pulley P is attached on a double inclined frictionless surface. The tension in the string (massless) will be (if g = 10 m/s^2)



(A) $\left(4\sqrt{3}+1\right)$N (B) $4\left(\sqrt{3}+1\right)$N (C) $4\left(\sqrt{3}-1\right)$N (D) $\left(4\sqrt{3}-1\right)$N

9. Given below are two statements : one is labelled as
Assertion A and the other is labelled as **Reason R**
Assertion A : Photodiodes are preferably operated in reverse bias condition for light intensity measurement.
Reason R : The current in the forward bias is more than the current in the reverse bias for a p – n junction diode.
In the light of the above statement, choose the correct answer from the options given below :
(A) **A** is false but **R** is true
(B) Both **A** and **R** are true but **R** is **NOT** the correct explanation of **A**
(C) **A** is true but **R** is false
(D) Both **A** and **R** are true and **R** is the correct explanation of **A**

10. If $\vec{E}$ and $\vec{K}$ represent electric field and propagation vectors of the EM waves in vacuum, then magnetic field vector is given by : (ω - angular frequency) :

(A) $\frac{1}{\omega}\left(\vec{K}\times\vec{E}\right)$ (B) $\omega\left(\vec{E}\times\vec{K}\right)$ (C) $\omega\left(\vec{K}\times\vec{E}\right)$ (D) $\vec{K}\times\vec{E}$

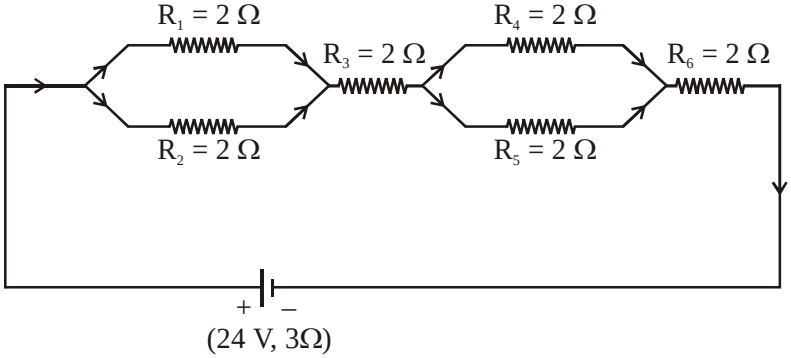
11. A circular loop of radius r is carrying current I A. The ratio of magnetic field at the centre of circular loop and at a distance r from the center of the loop on its axis is :

(A) $1:3\sqrt{2}$ (B) $3\sqrt{2}:2$ (C) $2\sqrt{2}:1$ (D) $1:\sqrt{2}$

12. A travelling wave is described by the equation y(x, t) = [0.05 sin (8x – 4t] m. The velocity of the wave is [all the quantities are in SI unit]

(A) 4 ms^{-1} (B) 2 ms^{-1} (C) 0.5 ms^{-1} (D) 8 ms^{-1}

13. As shown in the figure, a network of resistors is connected to a battery of 24 V with an internal resistance of 3Ω. The currents through the resistors R_4 and R_5 are I_4 and I_5 respectively. The values of I_4 and I_5 are



(A) $I_4=\frac{8}{5}$A and $I_5=\frac{2}{5}$A (B) $I_4=\frac{24}{5}$A and $I_5=\frac{6}{5}$A

(C) $I_4=\frac{6}{5}$A and $I_5=\frac{24}{5}$A (D) $I_4=\frac{2}{5}$A and $I_5=\frac{8}{5}$A

14. Given below are two statements :

Statement I : If the Brewster's angle for the light propagating from air to glass is θ_B, then Brewster's angle for the light propagating from glass to air is $\frac{\pi}{2}-\theta_B$.

Statement II : The Brewster's angle for the light propagating from glass to air is $\tan^{-1}(\mu_g)$ where μ_g is the refractive index of glass.

In the light of the above statements, choose the **correct** answer from the options given below :

(A) Both Statements I and Statement II are true. (B) Statement I is true but Statement II is false.

(C) Both Statement I and Statement II are false. (D) Statement I is false but Statement II is true.

15. If two charges q_1 and q_2 are separated with distance 'd' and placed in a medium of dielectric constant K. What will be the equivalent distance between charges in air for the same electrostatic force ?

(A) $d\sqrt{k}$ (B) $k\sqrt{d}$ (C) $1.5d\sqrt{k}$ (D) $2d\sqrt{k}$

16. Consider the following radioactive decay process

$$^{218}_{84}A \xrightarrow{\alpha} A_1 \xrightarrow{\beta^-} A_2 \xrightarrow{\gamma} A_3 \xrightarrow{\alpha} A_4 \xrightarrow{\beta^+} A_5 \xrightarrow{\gamma} A_6$$

The mass number and the atomic number A_6 are given by :

(A) 210 and 82 (B) 210 and 84 (C) 210 and 80 (D) 211 and 80

17. Given below are two statements :

Statements I : The temperature of a gas is – 73°C. When the gas is heated to 527°C, the root mean square speed of the molecules is doubled.

Statement II : The product of pressure and volume of an ideal gas will be equal to translational kinetic energy of the molecules.

In the light of the above statements, choose the correct answer from the options given below :

(A) Both statement I and Statement II are true (B) Statement I is true but Statement II is false

(C) Both Statement I and Statement II are false (D) Statement I is false but Statement II is true

18. The maximum vertical height to which a man can throw a ball is 136 m. The maximum horizontal distance upto which he can throw the same ball is

(A) 192 m (B) 136 m (C) 272 m (D) 68 m

19. A conducting loop of radius $\frac{10}{\sqrt{\pi}}$cm is placed perpendicular to a uniform magnetic field of 0.5T. The magnetic field is decreased to zero in 0.5 s at a steady rate. The induced emf in the circular loop at 0.25 s is:

(A) emf = 1 mV (B) emf = 10 mV (C) emf = 100 mV (D) emf = 5 mV

20. Match List I with List II

	List - I		List - II
A.	Planck's constant (h)	I.	$[M^1L^2T^2]$
B.	Stopping potential (Vs)	II.	$[M^1L^1T^{-1}]$
C.	Work function $(\varnothing)$	III.	$[M^1L^2T^{-1}]$
D.	Momentum (p)	IV.	$[M^1L^2T^{-3}A^{-1}]$

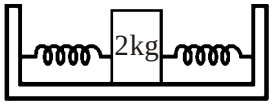
(A) A-III, B-I, C-II, D-IV (B) A-III, B-IV, C-I, D-II

(C) A-II, B-IV, C-III, D-I (D) A-I, B-III, C-IV, D-II

SECTION - B

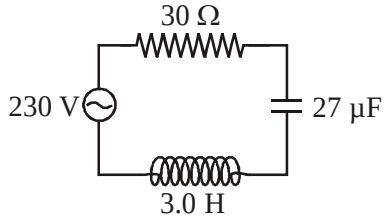
21. A spherical body of mass 2 kg starting from rest acquires a kinetic energy of 10000 J at the end of 5th second. The force acted on the body is ____ N.

22. A block of mass 2 kg is attached with two identical springs of spring constant 20 N/m each. The block is placed on a frictionless surface and the ends of the springs are attached to rigid supports (see figure). When the mass is displaced from its equilibrium position, it executes a simple harmonic motion. The time period of oscillation is $\frac{\pi}{\sqrt{x}}$ in SI unit. The value of x is _____ .



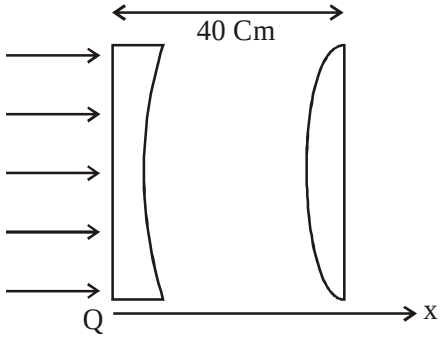
23. A hole is drilled in a metal sheet. At 27°C, the diameter of hole is 5 cm. When the sheet is heated to 177°C, the change in the diameter of hole is $d \times 10^{-3}$ cm. The value of d will be _____ if coefficient of linear expansion of the metal is 1.6×10^{-5}/°C.

24. In the circuit shown in the figure, the ratio of the quality factor and the band width is _____ s.

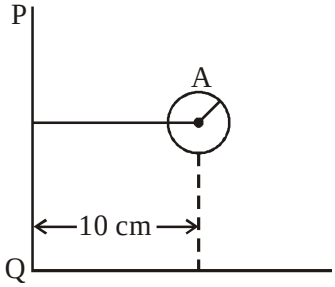


25. A hollow cylindrical conductor has length of 3.14m, while its inner and outer diameters are 4 mm and 8 mm respectively. The resistance of the conductor is $n \times 10^{-3}\ \Omega$. If the resistivity of the material is $2.4 \times 10^{-8}\ \Omega$m. The value of n is _____ .

26. As shown in the figure, a combination of a thin plano concave lens and a thin plano convex lens is used to image an object placed at infinity. The radius of curvature of both the lenses is 30 cm and refraction index of the material for both the lenses is 1.75. Both the lenses are placed at distance of 40 cm from each other. Due to the combination , the image of the object is formed at distance x = _____ cm, from concave lens.



27. Solid sphere A is rotating about an axis PQ. If the radius of the sphere is 5 cm then its radius of gyration about PQ will be $\sqrt{x}$ cm . The value of x is _____ .



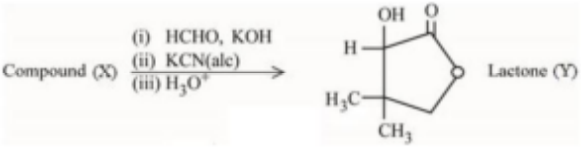
28. Vectors are $a\hat{i}+b\hat{j}+\hat{k}$ and $2\hat{i}-3\hat{j}+4\hat{k}$ perpendicular to each other when 3a + 2b = 7, the ratio of a to b is $\frac{x}{2}$. The value of x is _____ .

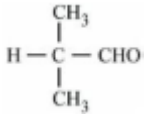
29. Assume that protons and neutrons have equal masses. Mass of a nucleon is 1.6×10^{-27} kg and radius of nucleus is $1.5 \times 10^{-15} A^{1/3}$ m. The approximate ratio of the nuclear density and water density is $n \times 10^{13}$. The value of n is _____ .

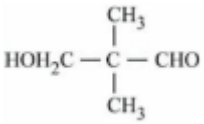
30. A stream of a positively charged particles having $\frac{q}{m}=2\times10^{11}\frac{C}{kg}$ and velocity $\vec{v}_0=3\times10^7\hat{i}$ m/s is deflected by an electric field $1.8\hat{j}k$ V/m. The electric field exists in a region of 10 cm along x direction. Due to the electric field, the deflection of the charge particles in the y direction is _____ mm.

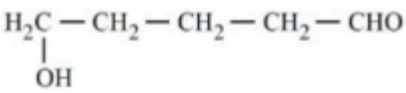
CHEMISTRY Section - A (Single Correct Answer)

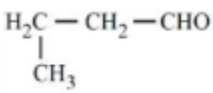
31. Compound (X) undergoes following sequence of reactions to give the Lactone (Y).



(A) 

(B) 

(C) 

(D) 

32. **Assertion A :** Hydrolysis of an alkyl chloride is a slow reaction but in the presence of NaI, the rate of the hydrolysis increases.

Reason R : I^- is a good nucleophile as well as a good leaving group.

In the light of the above statements, choose the correct answer from the options given below.

(A) A is false but R is true

(B) A is true but R is false

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

(D) Both A and R are true but R is NOT the correct explanation of A

33. Order of Covalent bond ;

A. KF > KI ; LiF > KF

B. KF < KI ; LiF > KF

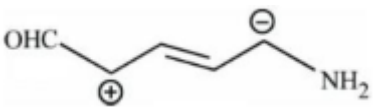
C. $SnCl_4 > SnCl_2$; CuCl > NaCl

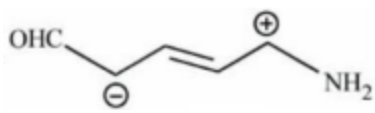
D. LiF > KF ; CuCl < NaCl

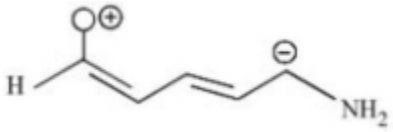
E. KF < KI ; CuCl > NaCl

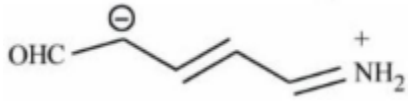
(A) C, E only (B) B, C only (C) B, C, E only (D) A, B only

34. Increasing order of stability of the resonance structure is :

A. 

B. 

C. 

D. 

(A) C, D, B, A (B) C, D, A, B (C) D, C, A, B (D) D, C, B, A

35. The magnetic moment of a transition metal compound has been calculated to be 3.87 B.M. The metal ion is

(A) Cr^{2+} (B) Mn^{2+} (C) V^{2+} (D) Ti^{2+}

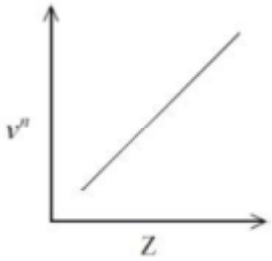
36. Match List I with List II.

	List-I		List-II
A.	Reverberatory furnace	I.	Pig iron
B.	Electrolytic cell	II.	Aluminium
C.	Blast furnace	III.	Silicon
D.	Zone refining furnace	IV.	Copper

(A) A – IV, B – II, C – I, D – III (B) A – I, B – IV, C – II, D – III

(C) A – I, B – III, C – II, D – IV (D) A – III, B – IV, C – I, D – II

37. It is observed that characteristic X-ray spectra of elements show regularity. When frequency to the power 'n' i.e. ν^n of X-rays emitted is plotted against atomic number 'Z', following graph is obtained.



The value of 'n' is

(A) 1 (B) 2 (C) $\frac{1}{2}$ (D) 3

38. Which of the Phosphorus oxoacid can create silver mirror from $AgNO_3$ solution ?

(A) $(HPO_3)_n$ (B) $H_4P_2O_5$ (C) $H_4P_2O_6$ (D) $H_4P_2O_7$

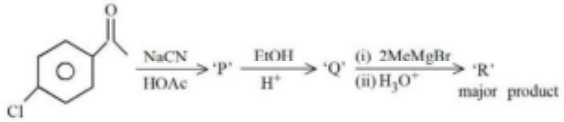
39. The primary and secondary valencies of cobalt respectively in $[Co(NH_3)_5Cl]Cl_2$ are :

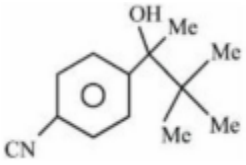
(A) 3 and 5 (B) 2 and 6 (C) 2 and 8 (D) 3 and 6

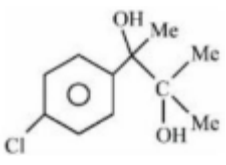
40. An ammoniacal metal salt solution gives a brilliant red precipitate on addition of dimethylglyoxime. The metal ion is :

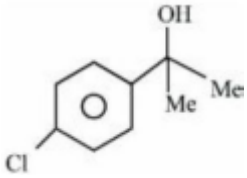
(A) Cu^{2+} (B) Co^{2+} (C) Fe^{2+} (D) Ni^{2+}

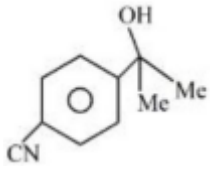
41. 'R' formed in the following sequence of reaction is :



(A) 

(B) 

(C) 

(D) 

42. Match List I with List II.

	List-I		List-II
A.	Chlorophyll	I.	Na_2CO_3
B.	Soda ash	II.	$CaSO_4$
C.	Dentistry,Ornamental work	III.	Mg^{2+}
D.	Used in white washing	IV.	$Ca(OH)_2$

Choose the correct answer from the options given below.

(A) A – III, B – I, C – II, D – IV (B) A – II, B – I, C – III, D – IV

(C) A – III, B – IV, C – I, D – II (D) A – II, B – III, C – IV, D – I

43. **Statement I :** For colloidal particles, the values of colligative properties are of small order as compared to values shown by true solutions at same concentration.

Statement II : For colloidal particles, the potential difference between the fixed layer and the diffused layer of same charges is called the electrokinetic potential or zeta potential.

In the light of the above statements, choose the **correct** answer from the options given below.

(A) Statement I is true but Statement II is false

(B) Statement I is false but Statement II is true

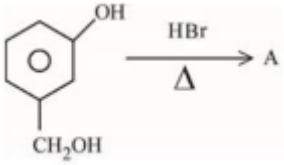
(C) Both Statement I and Statement II are true

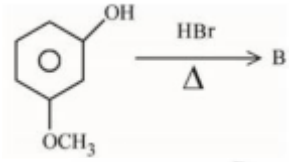
(D) Both Statement I and Statement II are false

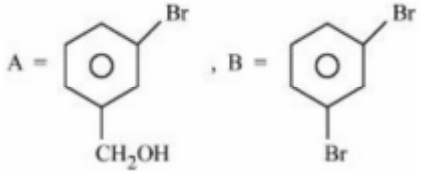
44. Reaction of BeO with ammonia and hydrogen fluoride gives 'A' which on thermal decomposition gives BeF_2 and NH_4F. What is 'A' ?

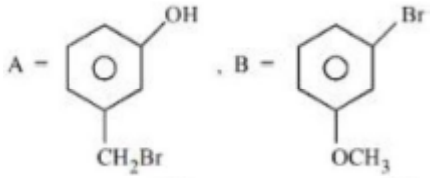
(A) $(NH_4)_2BeF_4$ (B) H_3NBeF_3 (C) $(NH_4)BeF_3$ (D) $(NH_4)Be_2F_5$

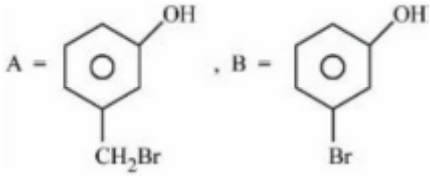
45. 'A' and 'B' formed in the following set of reactions are :

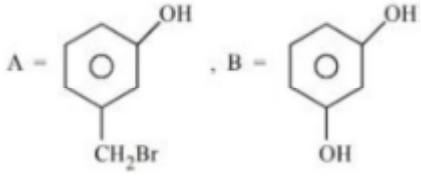




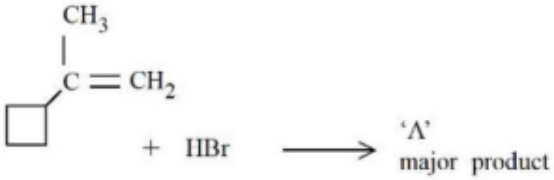
(A) 

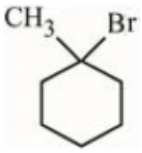
(B) 

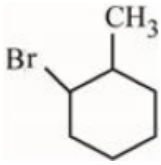
(C) 

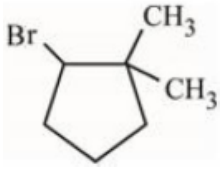
(D) 

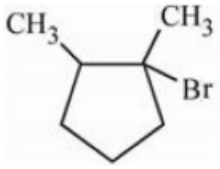
46. In the following given reaction 'A' is



(A) 

(B) 

(C) 

(D) 

47. Decreasing order of the hydrogen bonding in following forms of water is correctly represented by

A. Liquid water **B.** Ice **C.** Impure water

(A) A = B > C (B) B > A > C (C) C > B > A (D) A > B > C

48. Given below are two statements :

Statement I : Noradrenaline is a neurotransmitter.

Statement II : Low level of noradrenaline is not the cause of depression in human.

In the light of the above statements, choose the correct answer from the options given below.

(A) Statement I is correct but Statement II is incorrect

(B) Statement I is incorrect but Statement II is correct

(C) Both Statement I and Statement II are correct

(D) Both Statement I and Statement II are incorrect

49. In the depression of freezing point experiment

A. Vapour pressure of the solution is less than that of pure solvent

B. Vapour pressure of the solution is more than that of pure solvent

C. Only solute molecules solidify at the freezing point

D. Only solvent molecules solidify at the freezing point

(A) A and D only (B) B and C only (C) A and C only (D) A only

50. Which of the following is true about freons ?

(A) These are chlorofluorocarbon compounds

(B) These are chemicals causing skin cancer

(C) These are radicals of chlorine and chlorine monoxide

(D) All radicals are called freons

SECTION - B

51. The dissociation constant of acetic is $x \times 10^{-5}$. When 25 mL of 0.2 M CH_3COONa solution is mixed with 25 mL of 0.02 M CH_3COOH solution, the pH of the resultant solution is found to be equal to 5. The value of x is _____.

52. 5 g of NaOH was dissolved in deionized water to prepare a 450 mL stock solution. What volume (in mL) of this solution would be required to prepare 500 mL of 0.1 M solution ?

Given : Molar Mass of Na, O and H is 23, 16 and 1 g mol^{-1} respectively

53. If wavelength of the first line of the Paschen series of hydrogen atom is 720 nm, then the wavelength of the second line of this series is _____ nm.

(Nearest integer)

54. The number of correct statement/s from the following is _____.

A. Larger the activation energy, smaller is the value of the rate constant.

B. The higher is the activation energy, higher is the value of the temperature coefficient.

C. At lower temperatures, increase in tempe-rature causes more change in the value of k than at higher temperature.

D. A plot of ln k *vs* $\frac{1}{2}$ is a straight line with slope equal to $-\frac{Ea}{R}$.

55. At 298 K, a 1 litre solution containing 10 m mol of $Cr_2O_7^{2-}$ and 100 m mol of Cr^{3+} shows a pH of 3.0.

Given : $Cr_2O_7^{2-} \rightarrow Cr^{3+}$; E^o = 1.330 V and $\frac{2.303\ RT}{F}$ = 0.059 V

The potential for the half cell reaction is x × 10^{-3} V. The value of x is _____.

56. When $Fe_{0.93}O$ is heated in presence of oxygen, it converts to Fe_2O_3. The number of correct statement/s from the following is _____.

A. The equivalent weight of $Fe_{0.93}O$ is

$$\frac{\text{Molecular weight}}{0.79}.$$

B. The number of moles of Fe^{2+} and Fe^{3+} in 1 mole of $Fe_{0.93}O$ is 0.79 & 0.14 respectively.

C. $Fe_{0.93}O$ is metal deficient with lattice com-prising of cubic closed packed arrangement of O^{2-} ions.

D. The % composition of Fe^{2+} and Fe^{3+} in $Fe_{0.93}O$ is 85% and 15% respectively.

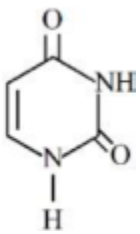
57. The d-electronic configuration of $[CoCl_4]^{2-}$ in tetrahedral crystal field is $e^m t_2^n$. Sum of 'm' and number of unpaired electrons is _____.

58. For independent process at 300 K.

Process	ΔH / kJ mol^{-1}	ΔS / J K^{-1}
A	–25	–80
B	–22	40
C	25	–50
D	22	20

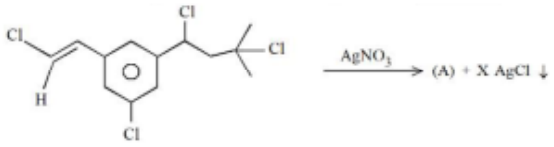
The number of non-spontaneous process from the following is _____.

59. Uracil is base present in RNA with the following structure. % of N in uracil is _____.



Given : Molar mass N = 14 g mol^{-1} ; O = 16 g mol^{-1} ; C = 12 g mol^{-1} ; H = 1 g mol^{-1}.

60. Number of moles of AgCl formed in the following reaction is _____.



MATHEMATICS Section - A (Single Correct Answer)

61. The distance of the point (7, –3, –4) from the plane passing through the points (2, –3, 1), (–1, 1, –2) and (3, –4, 2) is :

(A) 4 (B) 5 (C) $5\sqrt{2}$ (D) $4\sqrt{2}$

62. $\lim\limits_{t\to 0}\left(1^{\frac{1}{\sin^2 t}}+2^{\frac{1}{\sin^2 t}}+.....+n^{\frac{1}{\sin^2 t}}\right)^{\sin^2 t}$ is equal to

(A) $n^2 + n$ (B) n (C) $\frac{n(n+1)}{2}$ (D) n^2

63. Let $\vec{u}=\hat{i}-\hat{j}-2\hat{k}$, $\vec{v}=2\hat{i}+\hat{j}-\hat{k}$, $\vec{v}\cdot\vec{w}=2$ and $\vec{v}\times\vec{w}=\vec{u}+\lambda\vec{v}$. Then $\vec{u}\cdot\vec{w}$ is equal to

(A) 1 (B) $\frac{3}{2}$ (C) 2 (D) $-\frac{2}{3}$

64. The value $\sum\limits_{r=0}^{22} {}^{22}C_r\ {}^{23}C_r$ is

(A) ${}^{45}C_{23}$ (B) ${}^{44}C_{23}$ (C) ${}^{45}C_{24}$ (D) ${}^{44}C_{22}$

65. Let a tangent to the curve $y^2 = 24x$ meet the curve $xy = 2$ at the points A and B. Then the mid points of such line segments AB lie on a parabola with the

(A) directrix $4x = 3$ (B) directrix $4x = -3$

(C) Length of latus rectum $\frac{3}{2}$ (D) Length of latus rectum 2

66. Let N denote the number that turns up when a fair die is rolled. If the probability that the system of equations

$x + y + z = 1$

$2x + Ny + 2z = 2$

$3x + 3y + Nz = 3$

has unique solution is $\frac{k}{6}$, then the sum of value of k and all possible values of N is

(A) 18 (B) 19 (C) 20 (D) 21

67. $\tan^{-1}\left(\frac{1+\sqrt{3}}{3+\sqrt{3}}\right)+\sec^{-1}\left(\sqrt{\frac{8+4\sqrt{3}}{6+3\sqrt{3}}}\right)$ is equal to

(A) $\frac{\pi}{4}$ (B) $\frac{\pi}{2}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{6}$

68. Let PQR be a triangle. The points A, B and C are on the sides QR, RP and PQ respectively such that $\frac{QA}{AR}=\frac{RB}{BP}=\frac{PC}{CQ}=\frac{1}{2}$. Then $\frac{\text{Area }(\Delta PQR)}{\text{Area }(\Delta ABC)}$ is equal to

(A) 4 (B) 3 (C) 2 (D) $\frac{5}{2}$

69. If A and B are two non-zero n x n matrics such that $A^2 + B = A^2 B$, then

(A) AB = I (B) $A^2B = I$ (C) $A^2 = I$ or B = I (D) $A^2B = BA^2$

70. Let y = y(x) be the solution of the differential equation $x^3\,dy + (xy - 1)\,dx = 0$, $x > 0$, $y\left(\frac{1}{2}\right)=3-e$. Then y(1) is equal to

(A) 1 (B) e (C) 2 – e (D) 3

71. The area enclosed by the curves $y^2 + 4x = 4$ and $y - 2x = 2$ is :

(A) $\frac{25}{3}$ (B) $\frac{22}{3}$ (C) 9 (D) $\frac{23}{3}$

72. Let α be a root of the equation $(a - c)x^2 + (b - a)x + (c - b) = 0$ where a, b, c are distinct real numbers such that the matrix $\begin{bmatrix}\alpha^2 & \alpha & 1\\ 1 & 1 & 1\\ a & b & c\end{bmatrix}$ is singular. Then the value of

$$\frac{(a-c)^2}{(b-a)(c-b)}+\frac{(b-a)^2}{(a-c)(c-b)}+\frac{(c-b)^2}{(a-c)(b-a)}$$ is

(A) 6 (B) 3 (C) 9 (D) 12

73. The distance of the point (–1, 9, –16) from the plane 2x + 3y – z = 5 measured parallel to the line $\frac{x+4}{3}=\frac{2-y}{4}=\frac{z-3}{12}$ is

(A) $13\sqrt{2}$ (B) 31 (C) 26 (D) $20\sqrt{2}$

74. For three positive integers p, q, r, $x^{pq^2} = y^{qr} = z^{p^2r}$ and r = pq + 1 such that 3, 3 $\log_y x$, 3 $\log_z y$, 7 $\log_x z$ are in A.P. with common difference $\frac{1}{2}$. Then r – p – q is equal to

(A) 2 (B) 6 (C) 12 (D) –6

75. Let $p, q \in \mathbb{R}$ and $\left(1-\sqrt{3}i\right)^{200} = 2^{199}(p+iq)$, $i=\sqrt{-1}$. Then $p + q + q^2$ and $p - q + q^2$ are roots of the equation.

(A) $x^2 + 4x - 1 = 0$ (B) $x^2 - 4x + 1 = 0$

(C) $x^2 + 4x + 1 = 0$ (D) $x^2 - 4x - 1 = 0$

76. The relation $R=\{(a, b): \gcd(a, b)=1,\ 2a \neq b,\ a, b \in \mathbb{Z}\}$ is :

(A) transitive but not reflexive (B) symmetric but not transitive

(C) reflexive but not symmetric (D) neither symmetric nor transitive

77. The compound statement $(\sim(P \wedge Q)) \vee ((\sim P) \wedge Q) \Rightarrow ((\sim P) \wedge (\sim Q))$ is equivalent to

(A) $((\sim P) \vee Q) \wedge ((\sim Q) \vee P)$ (B) $(\sim Q) \vee P$

(C) $((\sim P) \vee Q) \wedge (\sim Q)$ (D) $(\sim P) \vee Q$

78. Let $f(x) = \begin{cases} x^2 \sin\left(\frac{1}{x}\right), & x \neq 0 \\ 0, & x = 0 \end{cases}$; Then at x = 0

(A) f is continuous but not differentiable (B) f is continuous but f ' is not continuous

(C) f and f ' both are continuous (D) f ' is continuous but not differentiable

79. The equation $x^2 - 4x + [x] + 3 = x[x]$, where [x] denotes the greatest integer function, has :

(A) exactly two solutions in $(-\infty, \infty)$ (B) no solution

(C) a unique solution in $(-\infty, 1)$ (D) a unique solution in $(-\infty, \infty)$

80. Let Ω be the sample space and $A \subseteq \Omega$ be an event. Given below are two statements :

(S1) : If P (A) = 0, then A = ϕ

(S2) : If P (A) = 1, then A = Ω Then

(A) only (S1) is true (B) only (S2) is true

(C) both (S1) and (S2) are true (D) both (S1) and (S2) are false

SECTION - B

81. Let C be the largest circle centred at (2, 0) and inscribed in the ellipse $\frac{x^2}{36} + \frac{y^2}{16} = 1$.

If $(1, \alpha)$ lies on C, then $10\alpha^2$ is equal to _____

82. Suppose $\sum_{r=0}^{2023} r^2 \, {}^{2023}C_r = 2023 \times \alpha \times 2^{2022}$. Then the value of α is _____

83. The value of $12\int_0^3 |x^2 - 3x + 2| dx$ is _____

84. The number of 9 digit numbers, that can be formed using all the digits of the number 123412341 so that the even digits occupy only even places, is_____

85. Let $\lambda \in \mathbb{R}$ and let the equation E be $|x|^2 - 2|x| + |\lambda - 3| = 0$. Then the largest element in the set S = $\{x + \lambda$: x is an integer solution of E$\}$ is_____

86. A boy needs to select five courses from 12 available courses, out of which 5 courses are language courses. If he can choose at most two language courses, then the number of ways he can choose five courses is

87. Let a tangent to the Curve $9x^2 + 16y^2 = 144$ intersect the coordinate axes at the points A and B. Then, the minimum length of the line segment AB is_____

88. The value of $\frac{8}{\pi}\int_0^{\frac{\pi}{2}} \frac{(\cos x)^{2023}}{(\sin x)^{2023} + (\cos x)^{2023}} dx$ is _____

89. The shortest distance between the lines $\frac{x-2}{3}=\frac{y+1}{2}=\frac{z-6}{2}$ and $\frac{x-6}{3}=\frac{1-y}{2}=\frac{z+8}{0}$ is equal to ___

90. The 4^{th} term of GP is 500 and its common ratio is $\frac{1}{m}$, $m \in N$. Let S_n denote the sum of the first n terms of this GP. If $S_6 > S_5 + 1$ and $S_7 < S_6 + \frac{1}{2}$, then the number of possible values of m is _____

❒ ❒ ❒

24-January-2023 (Morning Batch) : JEE Main Paper

ANSWER KEY

Physics

Single Choice Correct

1.	A	2.	B	3.	C	4.	D	5.	D
6.	A	7.	D	8.	B	9.	B	10.	A
11.	C	12.	C	13.	D	14.	B	15.	A
16.	C	17.	B	18.	C	19.	B	20.	B

Numerical Value

21.	40	22.	5	23.	12	24.	10	25.	2
26.	120	27.	110	28.	1	29.	11	30.	2

Chemistry

Single Choice Correct

31.	A	32.	C	33.	C	34.	B	35.	C
36.	A	37.	C	38.	B	39.	D	40.	D
41.	B	42.	A	43.	C	44.	A	45.	D
46.	D	47.	B	48.	A	49.	A	50.	A

Numerical Value

51.	10	52.	180	53.	492	54.	3	55.	917
56.	4	57.	7	58.	2	59.	25	60.	2

Mathematics

Single Choice Correct

61.	C	62.	B	63.	A	64.	A	65.	A
66.	C	67.	C	68.	B	69.	D	70.	A
71.	C	72.	B	73.	C	74.	A	75.	B
76.	D	77.	A	78.	B	79.	D	80.	C

Numerical Value

81.	118	82.	1012	83.	22	84.	60	85.	5
86.	546	87.	7	88.	2	89.	14	90.	12