3S INSTITUTE
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01-February-2023 (Morning Batch) : JEE Main Paper

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

1. Match the List I with List II

	List-I		List-II
A.	Intrinsic Semiconductor	I.	Fermi-level near conduction band
B.	n-type semiconductor	II.	Fermi-level at middle
C.	p-type semiconductor	III.	Fermi-level near valence band
D.	Metals	IV.	Fermi-level inside conduction band

Choose the correct answer from the options given below:

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

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

2. An object moves with speed v_1, v_2, and v_3 along a line segment AB, BC and CD respectively as shown in figure. Where AB = BC and AD = 3 AB, then average speed of the object will be :

(A) $\frac{(v_1+v_2+v_3)}{3}$ (B) $\frac{v_1v_2v_3}{3(v_1v_2+v_2v_3+v_3v_1)}$

(C) $\frac{3v_1v_2v_3}{v_1v_2+v_2v_3+v_3v_1}$ (D) $\frac{(v_1+v_2+v_3)}{3v_1v_2v_3}$

3. Given below are two statements :

Statement-I: Acceleration due to gravity is different at different places on the surface of earth.

Statement-II: Acceleration due to gravity increases as we go down below the earth's surface.

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) Both Statement I and Statement II are false

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

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

4. Match the List-I with List-II.

	List-I		List-II
A.	AC generator	I.	Presence of both L and C
B.	Transformer	II.	Electromagnetic Induction
C.	Resonance phenomenon to occur	III.	Quality factor
D.	Sharpness of resonance	IV.	Mutual Inductance

Choose the correct answer from the options given below:

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

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

5. Match the List-I with List-II:

	List-I		List-II
A.	Microwaves	I.	Radio active decay of the nucleus
B.	Gamma rays	II.	Rapid acceleration and deceleration of electron in aerials
C.	Radio waves	III.	Inner shell electrons
D.	X-rays	IV.	Klystron valve

Choose the correct answer from the options given below:

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

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

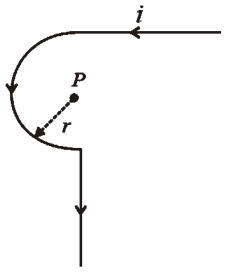
6. If earth has a mass nine times and radius twice to the of a planet P. Then $\frac{v_e}{3}\sqrt{x}$ ms^{-1} will be the minimum velocity required by a rocket to pull out of gravitational force of P, where ve is escape velocity on earth. The value of x is

(A) 2 (B) 3 (C) 18 (D) 1

7. 'n' polarizing sheets are arranged such that each makes an angle 45° with the proceeding sheet. An unpolarized light of intensity I is incident into this arrangement. The output intensity is found to be I/64. The value of n will be:

(A) 3 (B) 6 (C) 5 (D) 4

8. Find the magnetic field at the point P in figure. The curved portion is a semicircle connected to two long straight wires.



(A) $\frac{\mu_0 i}{2r}\left(1+\frac{2}{\pi}\right)$ (B) $\frac{\mu_0 i}{2r}\left(1+\frac{1}{\pi}\right)$ (C) $\frac{\mu_0 i}{2r}\left(\frac{1}{2}+\frac{1}{2\pi}\right)$ (D) $\frac{\mu_0 i}{2r}\left(\frac{1}{2}+\frac{1}{\pi}\right)$

9. Which of the following frequencies does not belong to FM broadcast.

(A) 106 MHz (B) 64 MHz (C) 99 MHz (D) 89 MHz

10. A steel wire with mass per unit length 7.0×10^{-3} kg m^{-1} is under tension of 70 N. The speed of transverse waves in the wire will be:

(A) 200 π m/s (B) 100 m/s (C) 10 m/s (D) 50 m/s

11. A child stands on the edge of the cliff 10 m above the ground and throws a stone horizontally with an initial speed of 5 ms^{-1}. Neglecting the air resistance, the speed with which the stone hits the ground will be _____ ms^{-1} (given, g = 10 ms^{-2}).

(A) 20 (B) 15 (C) 30 (D) 25

12. A proton moving with one tenth of velocity of light has a certain de Broglie wavelength of λ. An alpha particle having certain kinetic energy has the same de-Brogle wavelength λ. The ratio of kinetic energy of proton and that of alpha particle is:

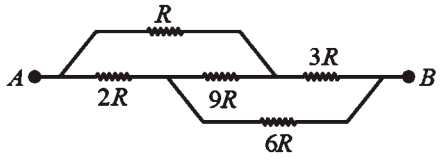
(A) 2 : 1 (B) 4 : 1 (C) 1 : 2 (D) 1 : 4

13. A sample of gas at temperature T is adiabatically expanded to double its volume. The work done by the gas in the process is $\left(\text{given}, \gamma = \frac{3}{2}\right)$

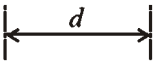
(A) $W = TR\left[\sqrt{2} - 2\right]$ (B) $W = \frac{T}{R}\left[\sqrt{2} - 2\right]$

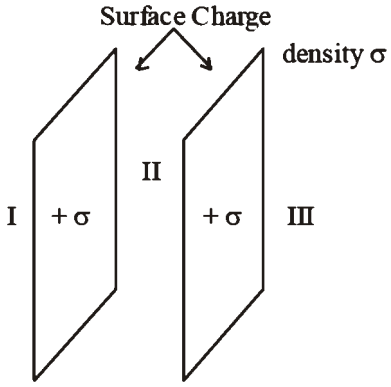
(C) $W = \frac{R}{T}\left[2 - \sqrt{2}\right]$ (D) $W = RT\left[2 - \sqrt{2}\right]$

14. The equivalent resistance between A and B of the network shown in figure:



(A) $11\frac{2R}{3}$ (B) 14R (C) 21 R (D) $\frac{8}{3}R$

15. Let σ be the uniform surface charge density of two infinite thin plane sheets shown in figure. Then the electric fields in three different region E_I, E_{II} and E_{III} are: 



(A) $\vec{E}_I = \frac{2\sigma}{\epsilon_0}\hat{n}, \vec{E}_{II} = 0, \vec{E}_{III} = \frac{2\sigma}{\epsilon_0}\hat{n}$

(B) $\vec{E}_I = 0, \vec{E}_{II} = \frac{\sigma}{\epsilon_0}\hat{n}, \vec{E}_{III} = 0$

(C) $\vec{E}_I = \frac{\sigma}{2\epsilon_0}\hat{n}, \vec{E}_{II} = 0, \vec{E}_{III} = \frac{\sigma}{2\epsilon_0}\hat{n}$

(D) $\vec{E}_I = -\frac{\sigma}{\epsilon_0}\hat{n}, \vec{E}_{II} = 0, \vec{E}_{III} = \frac{\sigma}{\epsilon_0}\hat{n}$

16. A mercury drop of radius 10^{-3} m is broken into 125 equal size droplets. Surface tension of mercury is 0.45 Nm^{-1}. The gain in surface energy is:

(A) 2.26×10^{-5} J (B) 28×10^{-5} J (C) 17.5×10^{-5} J (D) 5×10^{-5} J

17. The mass of proton, neutron and helium nucleus are respectively 1.0073 u, 1.0087 u and 4.0015u. The binding energy of helium nucleus is:

(A) 14.2 MeV (B) 28.4 MeV (C) 56.8 MeV (D) 7.1 MeV

18. $\left(P + \frac{a}{V^2}\right)(V - b) = RT$ represents the equation of state of some gases. Where P is the pressure, V is the volume, T is the temperature and a, b, R are the constants. The physical quantity, which has dimensional formula as that of $\frac{b^2}{a}$, will be :

(A) Bulk modulus (B) Modulus of rigidity (C) Compressibility (D) Energy density

19. The average kinetic energy of a molecule of the gas is
(A) proportional to absolute temperature (B) proportional to volume
(C) proportional to pressure (D) dependent on the nature of the gas

20. A block of mass 5 kg is placed at rest on a table of rough surface. Now, if a force of 30N is applied in the direction parallel to surface of the table, the block slides through a distance of 50 m in an interval of time 10s. Coefficient of kinetic friction is (given, g = 10 ms^{-2}):
(A) 0.60 (B) 0.75 (C) 0.50 (D) 0.25

SECTION - B

21. A charge particle of 2 μC accelerated by a potential difference of 100V enters a region of uniform magnetic field of magnitude 4 mT at right angle to the direction of field. The charge particle completes semicircle of radius 3 cm inside magnetic field. The mass of the charge particle is_____ × 10^{-18} kg.

22. In an experiment to find emf of a cell using potentiometer, the length of null point for a cell of emf 1.5 V is found to be 60 cm. If this cell is replaced by another cell of emf E. the length-of null point increases by 40 cm. The value of E is $\frac{x}{10}$V. The value of x is _____.

23. A small particle moves to position $5\hat{i}-2\hat{j}+\hat{k}$ from its initial position $2\hat{i}+3\hat{j}-4\hat{k}$ under the action of force $5\hat{i}+2\hat{j}+7\hat{k}$ N. The value of work done will be _____ J.

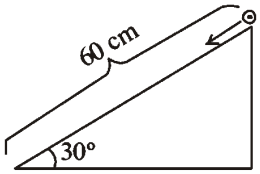
24. A light of energy 12.75 eV is incident on a hydrogen atom in its ground state. The atom absorbs the radiation and reaches to one of its excited states. The angular momentum of the atom in the excited state is $\frac{x}{\pi}\times10^{-17}$ eVs. The value of x is _____ (use h = 4.14 × 10^{-15} eVs, c = 3 × 10^{8} ms^{-1}).

25. A certain pressure 'P' is applied to 1 litre of water and 2 litre of a liquid separately. Water gets compressed to 0.01% whereas the liquid gets compressed to 0.03%. The ratio of Bulk modulus of water to that of the liquid is 3/x. The value of x is _____.

26. Two equal positive point charges are separated by a distance 2a. The distance of a point from the centre of the line joining two charges on the equatorial line (perpendicular bisector) at which force experienced by a test charge q_0 becomes maximum is $\frac{a}{\sqrt{x}}$. The value of x is _____.

27. A thin cylindrical rod of length 10 cm is placed horizontally on the principle axis of a concave mirror of focal length 20 cm. The rod is placed in a such a way that mid point of the rod is at 40 cm from the pole of mirror. The length of the image formed by the mirror will be x/3 cm. The value of x is _____.

28. A solid cylinder is released from rest from the top of an inclined plane of inclination 30° and length 60 cm. If the cylinder rolls without slipping, its speed upon reaching the bottom of the inclined plane is ___ ms^{-1}. (Given g = 10 ms^{-2})



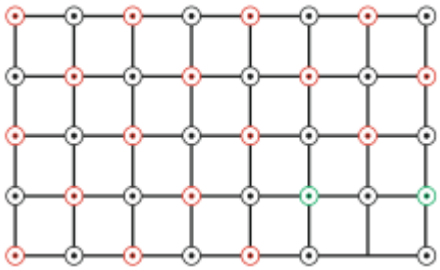
29. The amplitude of a particle executing SHM is 3 cm. The displacement at which its kinetic energy will be 25% more than the potential energy is: _____ cm.

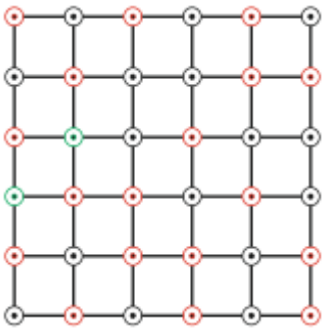
30. A series LCR circuit is connected to an ac source of 220V, 50Hz. The circuit contain a resistance R = 100Ω and an inductor of inductive reactance X_L = 79.6 Ω. The capacitance of the capacitor needed to maximize the average rate at which energy is supplied will be _____ μF.

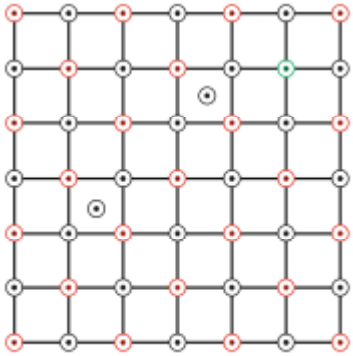
CHEMISTRY **Section - A (Single Correct Answer)**

31. Which of the following represents the lattice structure of $A_{0.95}O$ containing A^{2+}, A^{3+} and O^{2-} ions ?

$\odot A^{2+}$ $\odot A^{3+}$ $\odot O^{2-}$

A. 

B. 

C. 

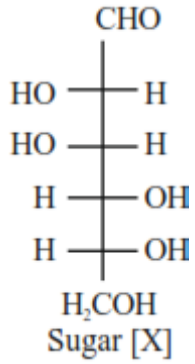
(A) B and C only

(B) B only

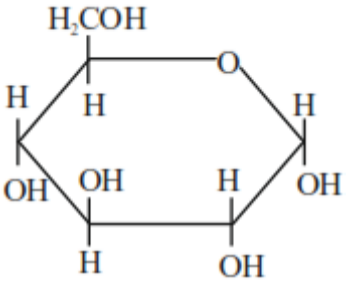
(C) A and B only

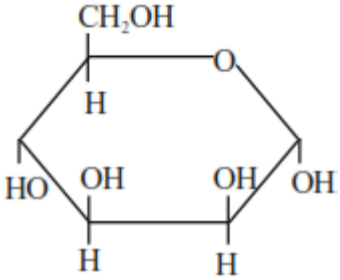
(D) A only

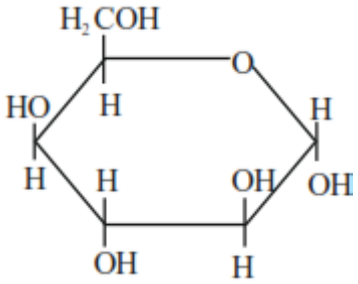
32. The **correct** representation in six membered pyranose form for the following sugar [X] is

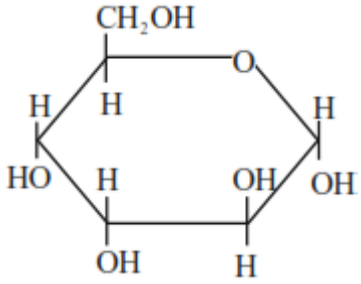


Sugar [X]

(A) 

(B) 

(C) 

(D) 

33. Highest oxidation state of Mn is exhibited in Mn_2O_7. The correct statements about Mn_2O_7 are

(A) Mn is tetrahedrally surrounded by oxygen atoms

(B) Mn is octahedrally surrounded by oxygen atoms

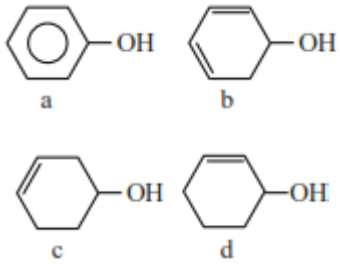
(C) Contains Mn-O-Mn bridge

(D) Contains Mn-Mn bond

Choose the correct answer from the options given below

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

34. Decreasing order of dehydration of the following alcohols is



(A) a > d > b > c (B) b > d > c > a

(C) b > a > d > c (D) d > b > c > a

35. Given below are two statements :

One is labelled as Assertion A and the other is labelled as Reason R.

Assertion A : Amongst He, Ne, Ar and Kr ; 1 g of activated charcoal adsorbs more of Kr.

Reason R : The critical volume V_c ($cm^3\ mol^{-1}$) and critical pressure P_c (atm) is highest for Krypton but the compressibility factor at critical point Z_c is lowest for Krypton.

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

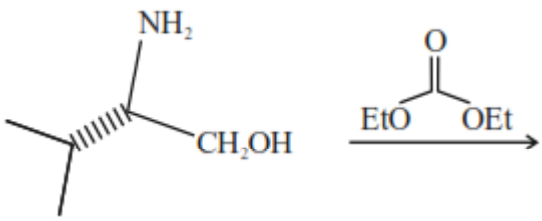
(A) A is true but R is false

(B) A is false but R is true

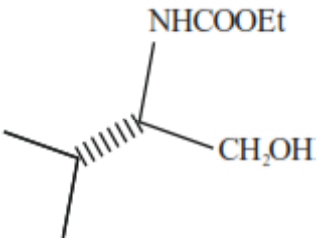
(C) Both A and R are true but R is NOT the correct explanation of A

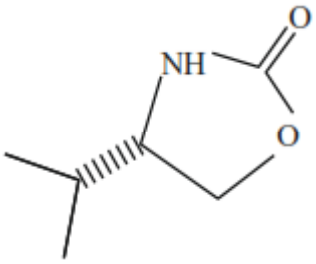
(D) Both A and R are true and R is the correct explanation A

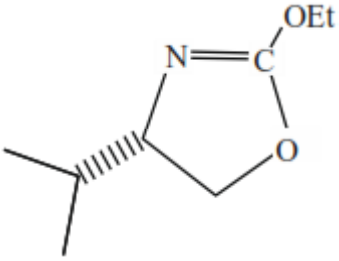
36. In the following reaction, 'A' is

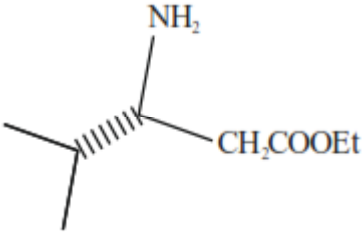


'A' Major product.

(A) 

(B) 

(C) 

(D) 

37. Match List I with List II

	List-I		List-II
A.	Tranquilizers	I.	Anti blood clotting
B.	Aspirin	II.	Salvarsan
C.	Antibiotic	III.	Antidepressant drugs
D.	Antiseptic	IV.	Soframicine

Choose the correct answer from the options given below.

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

38. Given below are two statements :

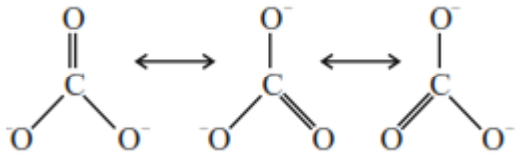
Statement I: Chlorine can easily combine with oxygen to from oxides: and the product has a tendency to explode.

Statement II: Chemical reactivity of an element can be determined by its reaction with oxygen and halogens.

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

(A) Both the statements I and II are true
(B) Statement I is true but Statement II is false
(C) Statement I is false but Statement II is true
(D) Both the Statements I and II are false

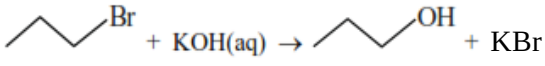
39. Resonance in carbonate ion (CO_3^{2-}) is

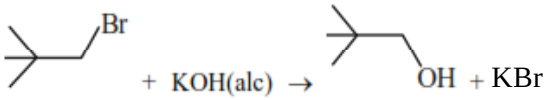


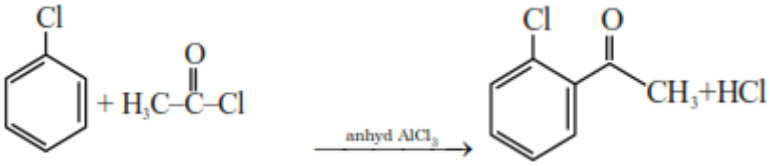
Which of the following is **true** ?

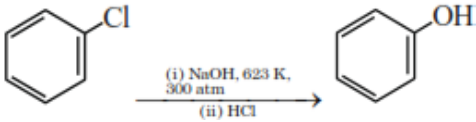
(A) It is possible to identify each structure individually by some physical or chemical method.
(B) All these structures are in dynamic equili-brium with each other.
(C) Each structure exists for equal amount of time.
(D) CO_3^{2-} has a single structure i.e., resonance hybrid of the above three structures.

40. Identify the incorrect option from the following.

(A) 

(B) 

(C) 

(D) 

41. A solution of $FeCl_3$ when treated with $K_4[Fe(CN)_6]$ gives a prussiun blue precipitate due to the formation of

(A) $K[Fe_2(CN)_6]$ (B) $Fe[Fe(CN)_6]$ (C) $Fe_3[Fe(CN)_6]_2$ (D) $Fe_4[Fe(CN)_6]_3$

42. Which of the following are the example of double salt ?

A. $FeSO_4 \cdot (NH_4)_2SO_4 \cdot 6H_2O$

B. $CuSO_4 \cdot 4NH_3 \cdot H_2O$

C. $K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$

D. $Fe(CN)_2 \cdot 4KCN$

Choose the **correct** answer.

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

43. Which of the following complex will show largest splitting of d-orbitals ?

(A) $[Fe(C_2O_4)_3]^{3-}$ (B) $[FeF_6]^{3-}$ (C) $[Fe(CN)_6]^{3-}$ (D) $[Fe(NH_3)_6]^{3+}$

44. How can photochemical smog be controlled ?

(A) By using tall chimneys

(B) By complete combustion of fuel

(C) By using catalytic converters in the auto-mobiles/industry

(D) By using catalyst

45. Match List I with List II

	List I		List II
A.	Slaked lime	I.	NaOH
B.	Dead burnt plaster	II.	$Ca(OH)_2$
C.	Caustic soda	III.	$Na_2CO_3 \cdot 10H_2O$
D.	Washing soda	IV.	$CaSO_4$

Choose the correct answer form the options given below.

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

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

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

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

46. Choose the **correct** statement(s) :

A. Beryllium oxide is purely acidic in nature.

B. Beryllium carbonate is kept in the atmos-phere of CO_2.

C. Beryllium sulphate is readily soluble in water.

D. Beryllium shows anomalous behavior.

Choose the correct answer from the options given below :

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

47. Given below are two statements : one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A : In an Ellingham diagram, the oxidation of carbon to carbon monoxide shows a negative slope with respect to temperature.

Reason R : CO tends to get decomposed at higher temperature.

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

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

(B) A is not correct but R is correct

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

(D) A is correct but R is not correct

48. But-2-yne is reacted separately with one mole of Hydrogen as shown below.

$$\underline{B} \xleftarrow[\text{liq. } NH_3]{Na} CH_3 - C \underset{+H_2}{\equiv} C - CH_3 \xrightarrow[\Delta]{Pd/C} \underline{A}$$

Identify the incorrect statements from the options given below.

A. A is more soluble than B.

B. The boiling point and melting point of A are higher and lower than B respectively.

C. A is more polar than B because dipole moment of A is zero.

D. Br_2 adds easily to B than A.

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

49. Given below are two statements : one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A : Hydrogen is an environment friendly fuel.

Reason R : Atomic number of hydrogen is 1 and it is a very light element.

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

(A) A is true but R is false

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

(C) A is false but R is true

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

50. Match List I and List II

	List I		**List II**
	Test		**Functional group / Class of Compound**
A.	Molisch's Test	I.	Peptide
B.	Biuret Test	II.	Carbohydrate
C.	Carbylamine Test	III.	Primary amine
D.	Schiff s Test	IV.	Aldehyde

Choose the correct answer from the options given below.

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

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

SECTION - B

51. The density of 3 M solution of NaCl is 1.0 g mL^{-1}.
Molality of the solution is _____ × 10^{-2} m. (Nearest integer).
Given : Molar mass of Na & Cl is 23 and 35.5 g mol^{-1} respectively.

52. Electrons in a cathode ray tube have been emitted with a velocity of 1000 ms^{-1}. The number of following statements which is/are true about the emitted radiation is _____.
Given : h = 6 × 10^{-34} Js, m_e = 9 × 10^{-31} kg.
(A) The de-Broglie wavelength of the electron emitted is 666.67 nm.
(B) The characteristic of electrons emitted depend upon the material of the electrodes of the cathode ray tube.
(C) The cathode rays start from cathode and move towards anode.
(D) The nature of the emitted electrons depends on the nature of the gas present in cathode ray tube.

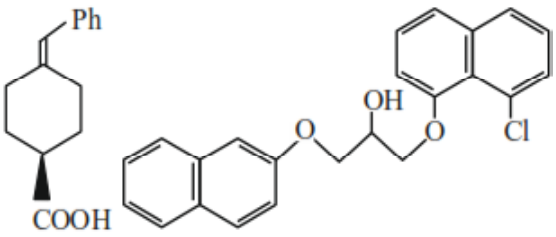
53. Sum of oxidation states of bromine in bromic acid and perbromic acid is _____.

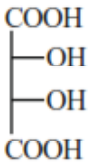
54. At what pH, given half cell
MnO_4^- (0.1 M) | Mn^{2+} (0.001 M) will have electrode potential of 1.282 V ? _____. (Nearest Integer)
Given : $E^{o}_{MnO_4^-/Mn^{2+}} = 1.54$ V, $\frac{2.303}{F} = 0.059$ V

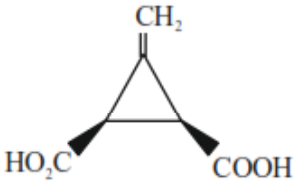
55. Number of isomeric compounds with molecular formula $C_9H_{10}O$ which (i) do not dissolve in NaOH (ii) do not dissolve in HCl. (iii) do not give orange precipitate with 2, 4–DNP (iv) on hydro-genation give identical compound with molecular formula $C_9H_{12}O$ is _____.

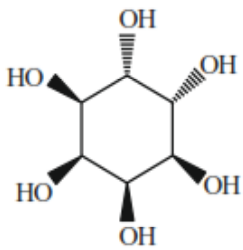
56. (i) $X(g) \rightleftharpoons Y(g) + Z(g)$; $K_{p1} = 3$ (ii) $A(g) \rightleftharpoons 2B(g)$; $K_{p2} = 1$
If the degree of dissociation and initial concen-tration of both the reactants X(g) and A(g) are equal, then the ratio of the total pressure at equilibrium $\left(\frac{p_1}{p_2}\right)$ is equal to x : 1. The value of 'x' is _____.
(Nearest integer)

57. The total number of chiral compound/s from the following is _____.









58. A & B are two substances undergoing radioactive decay in a container. The half-life of A is 15 min and that of B is 5 min. If the initial concentration of B is 4 times that of A and they both start decaying at the same time, how much time will it take for the concentration of both of them to be same ? _____ min.

59. At 25°C, the enthalpy of the following processes are given :

$H_2(g) + O_2(g) \rightarrow 2OH(g)$; $\Delta H^o = 78 kJ\ mol^{-1}$

$H_2(g) + \frac{1}{2} O_2(g) \rightarrow H_2O(g)$; $\Delta H^o = -242\ kJ\ mol^{-1}$

$H_2(g) \rightarrow 2H(g)$; $\Delta H^o = 436\ kJ\ mol^{-1}$

$\frac{1}{2} O_2(g) \rightarrow O(g)$; $\Delta H^o = 249\ kJ\ mol^{-1}$

What would be the value of X for the following reaction ? _____

(Nearest integer)

$H_2O(g) \rightarrow H(g) + OH(g)$; $\Delta H^o = X\ kJ\ mol^{-1}$

60. 25 mL of an aqueous solution of KCl was found to require 20 mL of 1 M $AgNO_3$ solution when titrated using K_2CrO_4 as an indicator. What is the depression in freezing point of KCl solution of the given concentration ? _____

(Nearest integer)

(Given : $K_f = 2.0\ K\ kg\ mol^{-1}$)

Assume –

1. 100% ionization and
2. density of the aqueous solution as $1\ g\ mL^{-1}$

MATHEMATICS Section - A (Single Correct Answer)

61. $\lim\limits_{n\to\infty}\left(\frac{1}{1+n}+\frac{1}{2+n}+\frac{1}{3+n}+....+\frac{1}{2n}\right)$ is equal to :

(A) 0 (B) $\log_e 2$ (C) $\log_e\left(\frac{3}{2}\right)$ (D) $\log_e\left(\frac{2}{3}\right)$

62. The negation of the expression $q \vee ((\sim q) \wedge p)$ is equivalent to

(A) $(\sim p) \wedge (\sim q)$ (B) $p \wedge (\sim q)$ (C) $(\sim p) \vee (\sim q)$ (D) $(\sim p) \vee q$

63. In a binomial distribution B(n, p), the sum and product of the mean & variance are 5 and 6 respectively, then find 6(n + p – q) is equal to :

(A) 51 (B) 52 (C) 53 (D) 50

64. The sum to 10 terms of the series $\frac{1}{1+1^2+1^4}+\frac{2}{1+2^2+2^4}+\frac{3}{1+3^2+3^4}+....$ is :

(A) $\frac{59}{111}$ (B) $\frac{55}{111}$ (C) $\frac{56}{111}$ (D) $\frac{58}{111}$

65. The value of $\frac{1}{1!50!}+\frac{1}{3!48!}+\frac{1}{5!46!}+.....+\frac{1}{49!2!}+\frac{1}{51!1!}$ is :

(A) $\frac{2^{50}}{50!}$ (B) $\frac{2^{50}}{51!}$ (C) $\frac{2^{51}}{51!}$ (D) $\frac{2^{51}}{50!}$

66. If the orthocentre of the triangle, whose vertices are (1, 2), (2, 3) and (3, 1) is (α, β), then the quadratic equation whose roots are $\alpha + 4\beta$ and $4\alpha + \beta$, is

(A) $x^2 - 19x + 90 = 0$ (B) $x^2 - 18x + 80 = 0$

(C) $x^2 - 22x + 120 = 0$ (D) $x^2 - 20x + 99 = 0$

67. For a triangle ABC, the value of cos 2A + cos 2B + cos 2C is least. If its inradius is 3 and incentre is M, then which of the following is NOT correct ?

(A) Perimeter of ΔABC is $18\sqrt{3}$ (B) $\sin 2A + \sin 2B + \sin 2C = \sin A + \sin B + \sin C$

(C) $\overrightarrow{MA} \cdot \overrightarrow{MB} = -18$ (D) are of ΔABC is $\frac{27\sqrt{3}}{2}$

68. The combined equation of the two lines ax + by + c = 0 and a'x + b'y + c' = 0 can be written as (ax + by + c) (a'x + b'y + c') = 0

The equation of the angle bisectors of the lines represented by the equation $2x^2 + xy - 3y^2 = 0$ is

(A) $3x^2 + 5xy + 2y^2 = 0$ (B) $x^2 - y^2 + 10xy = 0$

(C) $3x^2 + xy - 2y^2 = 0$ (D) $x^2 - y^2 - 10xy = 0$

69. The shortest distance between the lines $\frac{x-5}{1} = \frac{y-2}{2} = \frac{z-4}{-3}$ and $\frac{x+3}{1} = \frac{y+5}{4} = \frac{z-1}{-5}$ is :

(A) $7\sqrt{3}$ (B) $5\sqrt{3}$

(C) $6\sqrt{3}$ (D) $4\sqrt{3}$

70. Let S denote the set of all real values of λ such that the system of equations

$\lambda x + y + z = 1$

$x + \lambda y + z =$

$x + y + \lambda z = 1$

is inconsistent, then $\sum_{\lambda \in S} (|\lambda|^2 + |\lambda|)$ is equal to :

(A) 2 (B) 12 (C) 4 (D) 6

71. Let $S = \{x : x \in \mathbb{R} \text{ and } (\sqrt{3}+\sqrt{2})^{x^2-4} + (\sqrt{3}-\sqrt{2})^{x^2-4} = 10\}$. Then n (S) is equal to :

(A) 2 (B) 4 (C) 6 (D) 0

72. Let S be the set of all solutions of the equation $\cos^{-1}(2x) - 2\cos^{-1}(\sqrt{1-x^2}) = \pi$, $x \in \left[-\frac{1}{2}, \frac{1}{2}\right]$. Then $\sum_{x \in S} 2\sin^{-1}(x^2 - 1)$ is equal to :

(A) 0 (B) $\frac{-2\pi}{3}$

(C) $\pi - \sin^{-1}\left(\frac{\sqrt{3}}{4}\right)$ (D) $\pi - 2\sin^{-1}\left(\frac{\sqrt{3}}{4}\right)$

73. If the center and radius of the circle $\left|\frac{z-2}{z-3}\right| = 2$ are respectively (α, β) and γ, then $3(\alpha + \beta + \gamma)$ is equal to

(A) 11 (B) 9

(C) 10 (D) 12

74. If y = y(x) is the solution curve of the differential equation $\frac{dy}{dx} + y\tan x = x\sec x,\ 0 \le x \le \frac{\pi}{3},\ y(0) = 1,$ then $y\left(\frac{\pi}{6}\right)$ is equal to :

(A) $\frac{\pi}{12} - \frac{\sqrt{3}}{2}\log_e\left(\frac{2}{e\sqrt{3}}\right)$ (B) $\frac{\pi}{12} + \frac{\sqrt{3}}{2}\log_e\left(\frac{2\sqrt{3}}{e}\right)$

(C) $\frac{\pi}{12} - \frac{\sqrt{3}}{2}\log_e\left(\frac{2\sqrt{3}}{e}\right)$ (D) $\frac{\pi}{12} + \frac{\sqrt{3}}{2}\log_e\left(\frac{2}{e\sqrt{3}}\right)$

75. Let R be a relation on $\mathbb{R}$, given by R = {(a, b) : 3a – 3b + $\sqrt{7}$ is an irrational number}. Then R is

(A) Reflexive but neither symmetric nor transitive (B) Reflexive and transitive but not symmetric

(C) Reflexive and symmetric but not transitive (D) An equivalence relation

76. Let the image of the point P(2, –1, 3) in the plane x + 2y – z = 0 be Q. Then the distance of the plane 3x + 2y + z + 29 = 0 from the point Q is :

(A) $\frac{22\sqrt{2}}{7}$ (B) $\frac{24\sqrt{2}}{7}$ (C) $2\sqrt{14}$ (D) $3\sqrt{14}$

77. Let $f(x) = \begin{vmatrix} 1+\sin^2 x & \cos^2 x & \sin 2x \\ \sin^2 x & 1+\cos^2 x & \sin 2x \\ \sin^2 x & \cos^2 x & 1+\sin 2x \end{vmatrix},\ x \in \left[\frac{\pi}{6}, \frac{\pi}{3}\right]$. If α and β respectively are the maximum and the minimum values of f, then

(A) $\beta^2 - 2\sqrt{\alpha} = \frac{19}{4}$ (B) $\beta^2 + 2\sqrt{\alpha} = \frac{19}{4}$ (C) $\alpha^2 - \beta^2 = 4\sqrt{3}$ (D) $\alpha^2 + \beta^2 = \frac{9}{2}$

78. Let $f(x)=2x + \tan^{-1}x$ and $g(x) = \log_e(\sqrt{1+x^2} + x),\ x \in [0,\ 3]$. Then

(A) There exists $\hat{x} \in [0,\ 3]$ such that $f'(\hat{x}) < g'(\hat{x})$

(B) max f(x) > max g(x)

(C) There exist $0 < x_1 < x_2 < 3$ such that $f(x) < g(x),\ \forall x \in (x_1,\ x_2)$

(D) min f '(x) = 1 + max g '(x)

79. The mean and variance of 5 observations are 5 and 8 respectively. If 3 observations are 1, 3, 5, then the sum of cubes of the remaining two observations is

(A) 1072 (B) 1792 (C) 1216 (D) 1456

80. The area enclosed by the closed curve C given by the differential equation $\frac{dy}{dx} + \frac{x+a}{y-2} = 0,\ y(1) = 0$, is 4π.

Let P and Q be the points of intersection of the curve C and the y-axis. If normals at P and Q on the curve C intersect x-axis at points R and S respectively, then the length of the line segment RS is

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

SECTION - B

81. Let $a_1 = 8, a_2, a_3, ... a_n$ be an A.P. If the sum of its first four terms is 50 and the sum of its last four terms is 170, then the product of its middle two terms is _____.

82. A(2, 6, 2), B(–4, 0, λ), C(2, 3, –1) and D(4, 5, 0), $|\lambda| \leq 5$, are the vertices of a quadrilateral ABCD. If its area is 18 square units, then $5 - 6\lambda$ is equal to ____.

83. The number of 3-digit numbers, that are divisible by either 2 or 3 but not divisible by 7 is____.

84. The remainder when $19^{200} + 23^{200}$ is divided by 49, is____.

85. If $\int_0^1 (x^{21} + x^{14} + x^7)(2x^{14} + 3x^7 + 6)^{1/7} dx = \frac{1}{l}(11)^{m/n}$ where l, m, n $\in \mathbb{N}$, m and n are coprime then l + m + n is equal to _____.

86. If $f(x) = x^2 + g'(1)x + g''(2)$ and $g(x) = f(1)x^2 + xf'(x) + f''(x)$, then the value of f(4) – g(4) is equal to _____.

87. Let $\vec{v} = \alpha\hat{i} + 2\hat{j} - 3\hat{k}$, $\vec{w} = 2\alpha\hat{i} + \hat{j} - \hat{k}$, and $\vec{u}$ be a vector such that $|\vec{u}| = \alpha > 0$. If the minimum value of the scalar triple product $[\vec{u}\vec{v}\vec{w}]$ is $-\alpha\sqrt{3401}$, and $|\vec{u} \cdot \hat{i}|^2 = \frac{m}{n}$, where m and n are coprime natural numbers, then m + n is equal to_____.

88. The number of words, with or without meaning, that can be formed using all the letters of the word ASSASSINATION so that the vowels occur together, is_____.

89. Let A be the area bounded by the curve y = x |x – 3|, the x-axis and the ordinates x = –1 and x = 2. Then 12A is equal to_____.

90. Let $f : \mathbb{R} \to \mathbb{R}$ be a differentiable function such that $f'(x) + f(x) = \int_0^2 f(t)dt$. If $f(0) = e^{-2}$, then 2f(0) – f(2) is equal to_____.

❐ ❐ ❐

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01-February-2023 (Morning Batch) : JEE Main Paper

ANSWER KEY

Physics

Single Choice Correct									
1.	C	2.	C	3.	C	4.	C	5.	B
6.	A	7.	B	8.	C	9.	B	10.	B
11.	B	12.	B	13.	D	14.	D	15.	D
16.	A	17.	B	18.	C	19.	A	20.	C
Numerical Value									
21.	144	22.	25	23.	40	24.	828	25.	1
26.	2	27.	32	28.	2	29.	2	30.	40

Chemistry

Single Choice Correct									
31.	D	32.	B	33.	A	34.	B	35.	A
36.	B	37.	C	38.	A	39.	D	40.	B
41.	D	42.	A	43.	C	44.	C	45.	C
46.	B	47.	D	48.	B	49.	B	50.	C
Numerical Value									
51.	364	52.	2	53.	12	54.	3	55.	2
56.	12	57.	2	58.	15	59.	499	60.	3

Mathematics

Single Choice Correct									
61.	B	62.	A	63.	B	64.	B	65.	B
66.	D	67.	D	68.	D	69.	C	70.	D
71.	B	72.	B	73.	D	74.	A	75.	A
76.	D	77.	A	78.	B	79.	A	80.	D
Numerical Value									
81.	754	82.	11	83.	514	84.	29	85.	63
86.	14	87.	3501	88.	50400	89.	62	90.	1