FIITJEE
ALL INDIA TEST SERIES
JEE (Advanced)-2023
FULL TEST – VII
PAPER –1
TEST DATE: 23-04-2023

Time Allotted: 3 Hours **Maximum Marks: 180**

General Instructions:

- The test consists of total 54 questions.
- Each subject (PCM) has 18 questions.
- This question paper contains **Three Parts.**
- **Part-I** is Physics, **Part-II** is Chemistry and **Part-III** is Mathematics.
- Each **Part** is further divided into **Two Sections**: **Section-A & Section-B**.

Section – A *(01 –06, 19 – 24, 37 – 42):* This section contains **EIGHTEEN (18)** questions. Each question has **FOUR** options. **ONE OR MORE THAN ONE** of these four option(s) is(are) correct answer(s).

Section – A *(07 – 10, 25 – 28, 43 – 46):* This section contains **TWELVE (12)** Matching List Type Questions. Each question has **FOUR** statements in **List-I** entries (I), (II), (III) and (IV) and **FIVE** statements in **List-II** entries (P), (Q), (R), (S) and (T). The codes for lists have choices (A), (B), (C), (D) out of which, **ONLY ONE** of these four options is correct answer.

Section – B *(11 – 18, 29 – 36, 47 – 54):* This section contains **TWENTY FOUR (24)** numerical based questions. The answer to each question is a **NUMERICAL VALUE.** If the numerical value has more than two decimal places, truncate/round-off the value to **TWO** decimal places.

MARKING SCHEME

Section – A (One or More than One Correct): Answer to each question will be evaluated according to the following marking scheme:

Full Marks	:	+4	If only (all) the correct option(s) is (are) chosen;
Partial Marks	:	+3	If all the four options are correct but ONLY three options are chosen;
Partial marks	:	+2	if three or more options are correct but ONLY two options are chosen and both of which are correct;
Partial Marks	:	+1	If two or more options are correct but ONLY one option is chosen and it is a correct option;
Zero Marks	:	0	If none of the options is chosen (i.e. the question is unanswered);
Negative Marks	:	–2	In all other cases.

Section – A (Single Correct): Answer to each question will be evaluated according to the following marking scheme:

Full Marks	:	+3	If ONLY the correct option is chosen.
Zero Marks	:	0	If none of the options is chosen (i.e. the question is unanswered);
Negative Marks	:	–1	In all other cases.

Section – B: Answer to each question will be evaluated according to the following marking scheme:

Full Marks	:	+3	If ONLY the correct numerical value is entered at the designated place;
Zero Marks	:	0	In all other cases.

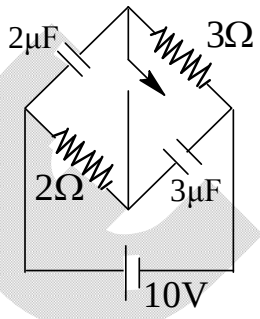
Physics

PART – I

Section – A (Maximum Marks: 24)

*This section contains **SIX (06)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).*

1. In the show circuit initially, the switch is open, and the circuit is in steady state. Then:



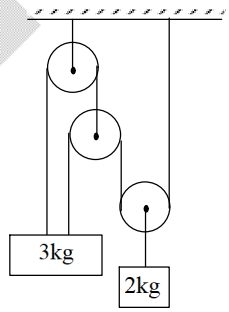
(A) The charge on $3\mu F$ capacitor in steady state before closing the switch is $20\mu C$

(B) The current through the battery in steady state before closing the switch is zero.

(C) The charge on $2\mu F$ in steady state after closing the switch is $8\mu C$

(D) The current through the battery in steady state after closing the switch is 2 ampere.

2. In the shown figure pulleys are ideal and thread is massless. Block are released from rest, then:



(A) The acceleration of 2kg block is 5 m/s^2

(B) The acceleration of 3kg block is zero

(C) Tension in string connected with 2kg block is 20N

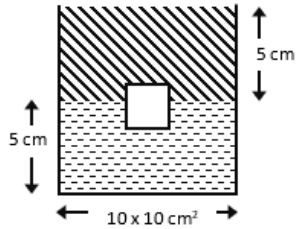
(D) Tension in string connected with 2kg block is 10N

3. Two pendulums perform S.H.M. with time periods of 9 sec and 11 sec respectively. At t = 0 they are in phase. The non-zero time at which they will be in phase again is/are

(A) 99 sec (B) 200 sec

(C) 297 sec (D) 49.5 sec

4. An ice cube of side 4 cm floats on the boundary of water and Kerosine oil in a vessel of dimension shown in figure. When the ice melts completely then



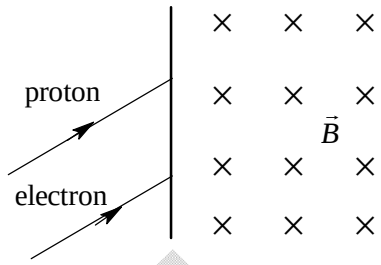
(A) Surface of oil will fall by 0.64 cm

(B) Boundary of oil and water will rise by 2.56 cm

(C) Ratio of volume of ice and water before it starts melting is 1

(D) Final volume of water is 6.25 cm^3

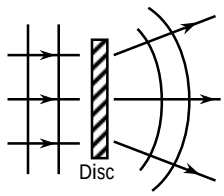
5. An electron and a proton are moving on straight parallel paths with same velocity. They enter a semi-infinite region of uniform magnetic field which is perpendicular to the velocity as shown in the figure. Which of the following statement(s) is/are true? (Consider no interaction between electron and proton)



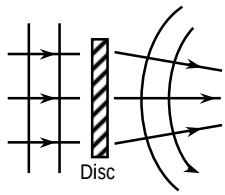
(A) they will never come out of the magnetic field region.
(B) they will come out travelling along parallel paths.
(C) they will come out at the same time.
(D) they will come out at different times.

6. A plane wavefront enters a disc having variable refractive index which changes linearly radially from centre of disc. Then the shape of wavefront after coming out of the disc

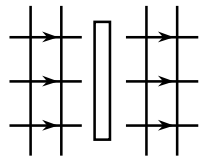
(A) if refractive index increases from centre.



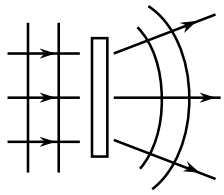
(B) if refractive index increases from centre.



(C) if refractive index decreases from centre.



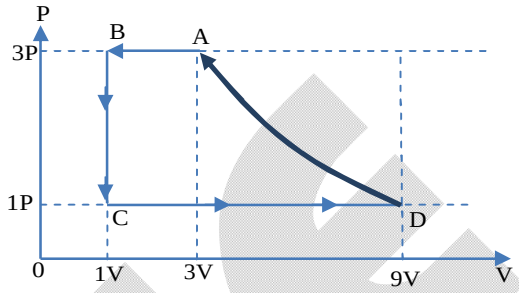
(D) if refractive index decreases from centre.



Section – A (Maximum Marks: 12)

*This section contains **FOUR (04)** Matching List Type Questions. Each question has FOUR statements in **List-I** entries (I), (II), (III) and (IV) and FIVE statements in **List-II** entries (P), (Q), (R), (S) and (T). The codes for lists have choices (A), (B), (C), (D) out of which **ONLY ONE** of these four options is correct answer.*

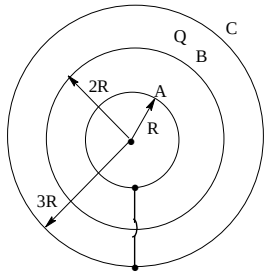
7. One mole of a monatomic gas is taken through a cycle ABCDA as shown in the P-V diagram. List–II give the characteristics involved in the cycle. Match them with each of the process given in list– I.



List– I		List– II	
(I)	Process A → B	(P)	Internal energy decreases
(II)	Process B → C	(Q)	Internal energy increases
(III)	Process C → D	(R)	Heat is lost
(IV)	Process D → A	(S)	Heat is gained
		(T)	Work is done on the gas

(A) (I) → (P),(Q),(T); (II) → (P),(R), (III) → (Q) (IV) → (R), (T)
(B) (I) → (R),(T); (II) → (P),(R) (III) → (S) (IV) → (R), (T)
(C) (I) → (R) (II) → (P), (R), (T) (III) → (S) (IV) → (R),(T)
(D) (I) → (P) (II) → (Q), (R), (T) (III) → (R) (IV) → (R), (S)

8. Figure shows three concentric spherical conducting shells A, B and C of radii R. 2R and 4R respectively. A and C are connected by a conducting wire and B is given charge Q. Match the following list: $\left[\frac{1}{4\pi\varepsilon_0}=K\right]$



List– I		List- II	
(I)	Charge on shell A	(P)	Q/3
(II)	Charge on shell C	(Q)	-Q/3
(III)	Potential of A	(R)	Q
(IV)	Potential of C	(S)	KQ/4R
		(T)	None

(A) (I) → (R); (II) → (P); (III) → (Q); (IV) → (T)
(B) (I) → (P); (II) → (Q); (III) → (R); (IV) → (T)
(C) (I) → (R); (II) → (P); (III) → (S); (IV) → (T)
(D) (I) → (P); (II) → (Q); (III) → (S); (IV) → (T)

9. A particle of unit mass is moving along the x-axis under the influence of a force and its total energy is conserved. Four possible forms of the potential energy of the particle are given in list– I (a and U_0 constants). Match the potential energies in list– I to the corresponding statement(s) in list– II.

List – I		List– II	
(I)	$U_1(x)=\frac{U_0}{2}\left[1-\left(\frac{x}{2}\right)^2\right]^2$	(P)	The force acting on the particle is zero at $x=a$
(II)	$U_2(x)=\frac{U_0}{2}\left(\frac{x}{a}\right)^2$	(Q)	The force acting on the particle is zero at $x=0$
(III)	$U_3(x)=\frac{U_0}{2}\left(\frac{x}{a}\right)^2\exp\left[-\left(\frac{x}{a}\right)^2\right]$	(R)	The force acting on the particle is zero at $x=-a$
(IV)	$U_4(x)=\frac{U_0}{2}\left[\frac{x}{a}-\frac{1}{3}\left(\frac{x}{a}\right)^3\right]$	(S)	The particle experiences an attractive force towards x = 0 in the region $\lvert x\rvert < a$
		(T)	The particle with total energy $U_0/4$ can oscillate about the point $x=-a$

(A) (I) → (P),(Q),(R); (II) → (P),(Q),(T) (III) → (Q),(R),(S) (IV) → (T)
(B) (I) → (P),(Q),(R); (II) → (Q),(R),(S) (III) → (R), (S) (IV) → (R), (T)
(C) (I) → (Q)(P) (II) → (Q), (S) (III) → (R), (S) (IV) → (R),(T)
(D) (I) → (P),(P),(R),(T) (II) → (Q), (S) (III) → (P),(Q),(R),(S) (IV) → (P),(R), (T)

10. Match the following list-I & list-II:

List– I		List- II	
(I)	Radiation pressure	(P)	Particle nature of radiation
(II)	Threshold wavelength	(Q)	Stopping potential
(III)	Maximum kinetic energy of photoelectron	(R)	Maximum wavelength of incident photos for photoelectric effect
(IV)	Quantization of angular momentum of electron	(S)	de Broglie hypothesis
		(T)	Principal quantum number

(A) (I) → (P) (II) → (R) (III) → (Q) (IV) → (S), (T)
(B) (I) → (S), (T) (II) → (R) (III) → (S) (IV) → (P)
(C) (I) → (P) (II) → (Q) (III) → (P) (IV) → (S), (T)
(D) (I) → (P) (II) → (S) (III) → (Q) (IV) → (R), (T)

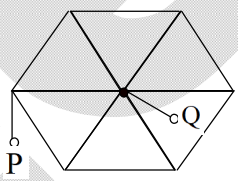
Section – B (Maximum Marks: 24)

*This section contains **EIGHT (08)** numerical based questions. The answer to each question is a **NUMERICAL VALUE.** If the numerical value has more than two decimal places, truncate/round-off the value to **TWO** decimal places.*

11. A square plate of side $8\sqrt{6}$cm executes simple harmonic motion like a physical pendulum. Find its minimum time period (in second). (take g = π^2)

12. In YDSE if the two sources are incoherent then the intensity on the screen is $11I_0$. When these two sources are coherent then the minimum intensity is I_0 and maximum intensity is mI_0. Find the value of m.

13. An electrical circuit is made as shown in the figure and all side have resistance of 1Ω. Find its equivalent resistance (in ohm) between point P and Q.

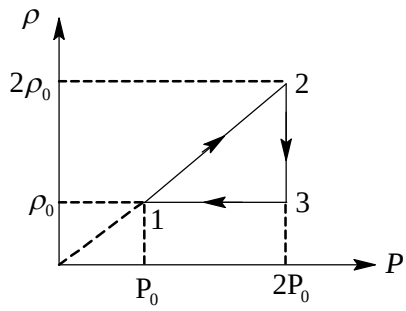


14. A source of sound of frequency 1000Hz is moving towards a stationary observer with velocity 40 m/s if speed of sound in still air is 260 m/s and air blows with speed 100 m/s in a direction perpendicular to line joining source and observer then find the frequency (in Hz) detected by the observer.

15. A string PQ of length 14 meter and linear mass density 10 gm/m is clamped at both ends with a tension of 196N. Find the minimum frequency (in Hz) of transverse standing wave in string so that a node appears at a distance of 10 m from end P.

16. A radioactive source in the form of a metal sphere of diameter 10^{-3} m emits β (in μS) particles at a constant rate of 6.25×10^{10} particles per second. If the source is electrically insulated, how long (in seconds) will it take for its potential to rise by 1.0 volt, assuming that 80% of emitted β particles escape from the surface. (write your answer in nearest integer).

17. One mole of a mono atomic gas of molar mass M undergoes a cyclic process as shown in the figure. Here ρ is density and P is pressure of the gas. Find the efficiency of the cycle. (Take: ln2 = 0.7)



18. Three conducting concentric spherical shells of radii R, 2R and 3R carry some charge on them. The potential at the centre is 50 V and that of middle and outer shell is 20V and 10V respectively. Find the potential of the inner shell (in volt).

Chemistry

PART – II

Section – A (Maximum Marks: 24)

*This section contains **SIX (06)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).*

19. Which compounds shows partial hydrolysis:

(A) BF_3 (B) $AlCl_3$

(C) SiF_4 (D) $SiCl_4$

20. $HClO_3$ on reaction with SO_2 gives a paramagnetic gas 'X' and gas 'X' on reaction with O_3 gives Y, X on reaction with H_2O_2 in presence of NaOH gives a compound 'Z' containing halogen :

$X \Rightarrow ClO_2$ $Y = Cl_2O_6$ $Z = NaClO_2$

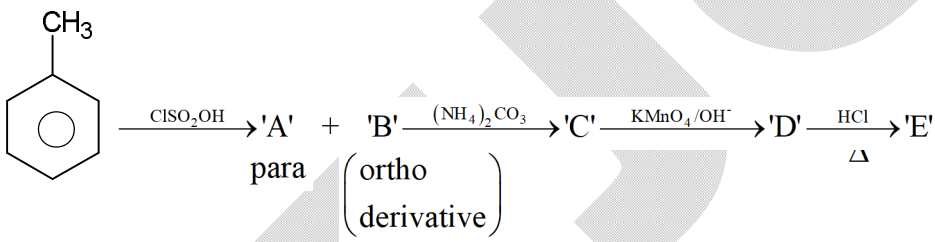
(A) The oxidation number of halogen in X = 4

(B) The oxidation number of halogen in Y = 6

(C) The oxidation number of halogen in Z = 3

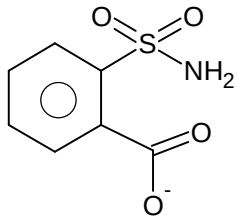
(D) The oxidation number of halogen in X = 5

21.



(A) 'E' is a non-fattening sweetener (B) 'E' is saccharin

(C) 'A'is 

(D) 'D'is 

22. Select Correct statement/s

(A) Frenkel defects is a non-stoichiometric defect.

(B) Conductivities of metallic conductor varies between 1 Sm^{-1} to 10 Sm^{-1}.

(C) Si & Ge are intrinsic semiconductor.

(D) diamagnetic substance has no unpaired electron.

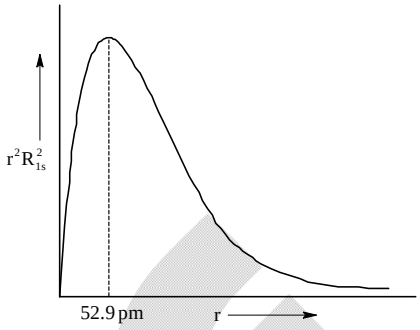
23. Which of the following option is/are correct?

(A) Atomic orbitals are completely described as the regions where the probability of finding the electron is maximum.

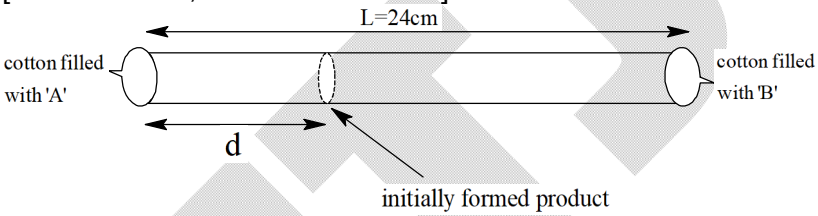
(B) The weighted average of large number of observations for measuring the radius of 1s orbital is greater than $52.9\,pm$ (r^2R^2 dr represents the total probability of finding the electron between r and r+dr).

(C) The energy of 4s is always lower than 3d for multi electronic atom/ ion.

(D) Energy needed to excite an electron from $n=2$ to $n=4$ state is 25/28 times the energy needed to excite an electron from n=2 to n=5 for a single electron atom / ion.



24. A and B are two volatile liquids, two cotton plugs, one soaked with 'A' and the other is soaked with 'B' , are simultaneously placed at the ends of the tube of length 24cm, as shown in the figure. The tube is filled with inert gas at 1 atm pressure at 300K. Vapours of A & B react to form a product which is first observed at a distance 'd' cm from the plug soaked with 'A'. The experimental value of 'd' is found to be 20 cm. This 'd' is different from the distance found by Grahm's Law. This difference is due to
(Assume 'A' & 'B' have equal molecular diameter & assume A, B & inert gas are ideal.
[MW of A = 10, and MW of B = 40]



(A) Larger mean for path for 'A' as compared to 'B'

(B) Larger mean for path for 'B' as compared to 'A'

(C) Increased collision frequency of B with inert gas as compared to that of A with inert gas.

(D) increased collision frequency of A with inert gas as compared to that of B with inert gas.

Section – A (Maximum Marks: 12)

*This section contains **FOUR (04)** Matching List Type Questions. Each question has FOUR statements in **List-I** entries (I), (II), (III) and (IV) and FIVE statements in **List-II** entries (P), (Q), (R), (S) and (T). The codes for lists have choices (A), (B), (C), (D) out of which **ONLY ONE** of these four options is correct answer.*

25. Match the particulars given in list (I) with the appropriate chemical reagents given in list (II).

List– I		List- II	
(I)	Fe^{3+} & Zn^{2+} can be separated by	(P)	KI Solution
(II)	PbS, CuS and CdS dissolve in	(Q)	Alkaline Na_2SnO_2 solution
(III)	Pb^{2+} gives yellow precipitate with	(R)	50% HNO_3
(IV)	$\left[Ag(NH_3)_2\right]Cl$ gives precipitate.	(S)	K_2CrO_4 solution
		(T)	Aqueous NH_3

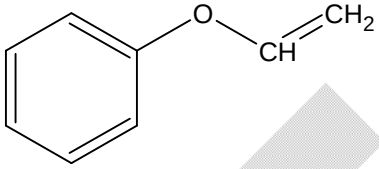
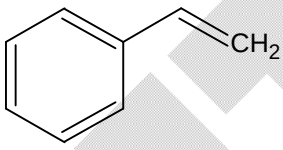
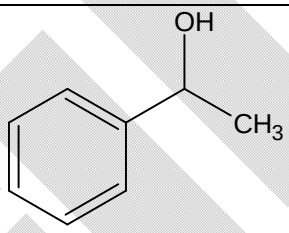
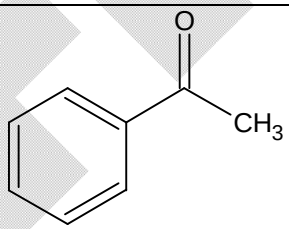
(A) (I) → (T) (II)→ (R) (III) → (P) (IV) → (T)
(B) (I)→ (T) (II)→(R) (III) → (S) (IV) → (P)
(C) (I) → (P) (II)→ (Q) (III) → (P) (IV) → (S)
(D) (I) → (S) (II)→ (S) (III) → (Q) (IV) → (R)

26. Match the particulars given in list (I) with the appropriate chemical reagents given in list (II).

List– I		List- II	
(I)	Perfectly Crystalline solid.	(P)	$\Delta H_{sys}=0$
(II)	Reversible Cyclic process	(Q)	$\lim_{T\to 0} S \to 0$
(III)	Irreversible Cyclic process	(R)	$\Delta S_{(Surrounding)} = 0$
(IV)	Any adiabatic process	(S)	$\Delta U_{sys} = 0$
		(T)	Net heat change is zero

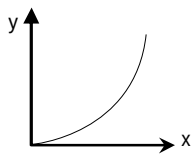
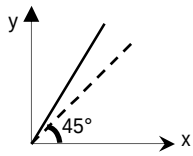
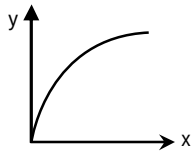
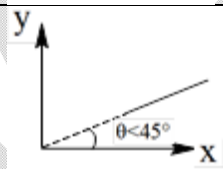
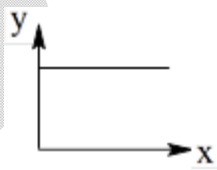
(A) (I) → (Q) (II)→ (P), (III) → (S) (IV) → (P)
(B) (I)→ (Q) (II) → (S), (III) → (P) (IV) → (R)
(C) (I) → (P) (II)→ (Q), (III) → (P) (IV) → (S)
(D) (I) → (S) (II)→ (S), (III) → (Q) (IV)→ (R)

27. Match the correct properties of compounds of list (I) with list (II).

List– I		List– II	
(I)		(P)	Gives Benzoic Acid with hot Alkaline $KMnO_4$
(II)		(Q)	O/P directing and activating for $E^{\oplus}$
(III)		(R)	Decolorises Br_2 water
(IV)		(S)	Gives an ester on reductive ozonolysis
		(T)	m- directing and deactivating for $E^{\oplus}$

(A) (I) → (Q) (II)→ (P) (III) → (Q) (IV) → (T)
(B) (I)→ (R) (II)→ (P) (III) → (T) (IV) → (Q)
(C) (I) → (S) (II)→ (P) (III) → (Q) (IV) → (T)
(D) (I) → (P) (II)→ (Q) (III) → (S), (IV)→ (T)

28. Match the correct properties of compounds of list (I) with list (II). [Take Pressure in bar; Volume in Litre: R=0.08Latm/mol/K

List – I		List – II	
(I)	PV vs T^2 [n & V constant] [PV is taken on Y axis]	(P)	
(II)	PV vs T = (n = 0.1 mol)	(Q)	
(III)	$\frac{P}{V}$ vs $\frac{1}{V^2}$ [n = 1 mol, T = 298 K]	(R)	
(IV)	V vs $\sqrt{T}$ [n & P constant]	(S)	
		(T)	

(A) (I) → (R) :(II) → (S) (III) → (Q) (IV) → (P)
(B) (I)→ (P) :(II) →(S) (III) → (Q) (IV) → (R)
(C) (I) → (S) : (II) → (Q) (III) → (R) (IV) →(T)
(D) (I) → (P) :(II) → (S) (III) → (R) (IV)→ (Q)

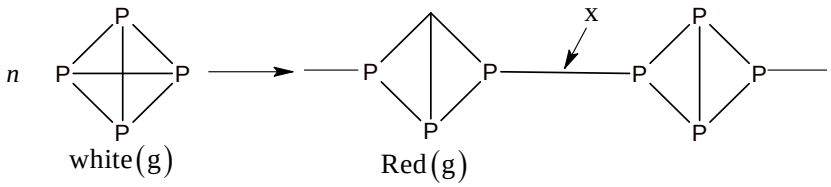
Section – B (Maximum Marks: 24)

*This section contains **EIGHT (08)** numerical based questions. The answer to each question is a **NUMERICAL VALUE.** If the numerical value has more than two decimal places, truncate/round-off the value to **TWO** decimal places.*

29. The std reduction potential of $MnO_4^-(aq.)/Mn(s)$ is _____.

$E^\circ_{MnO_4^-/MnO_2(s)} = 1.68V$ $E^\circ_{MnO_2/Mn^{2+}(aq)} = 1.21V$ $E^\circ_{Mn^{2+}(aq)/Mn(s)} = -1.035V$

30. White phosphorous $P_4(s)$ is polymerised in to red phosphorous as:



$\Delta H = -101 \frac{kJ}{\text{mole of } P_4}$

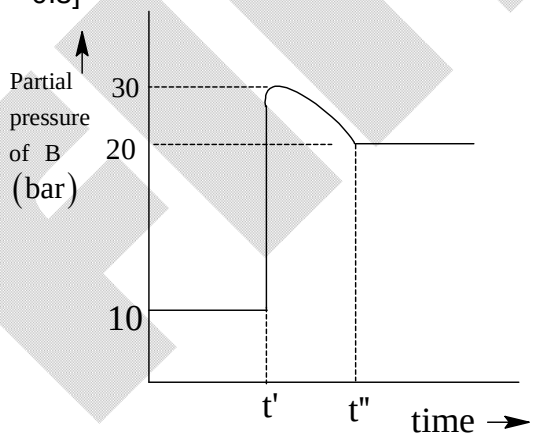
$(n \text{ is a large number})$

The enthalpy of sublimation of $P_4(s) \underset{\text{white}}{\longrightarrow} P_4(g)_{\text{white}}$ is 59 kJ/mol & enthalpy of atomization of $P_4(s)$ is 1265 kJ/mole. The P – P bond enthalpy in red phosphorus joining two tetrahedral $\left(\frac{kJ}{mol}\right)$ is:

31. A compound 'X' and calcium phosphide formed by reaction of calcium orthophosphate with Mg was hydrolysed with water. The evolved PH_3 was burnt in air to yield phosphorous pentoxide how many grams of magnesium meta phosphate would be obtained by using phosphorous pentoxide and 'X'. If 19.2 g of Mg were used for reducing calcium phosphide (Mg = 24, P = 31)

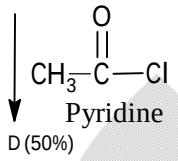
32. The solubility of salt of weak acid (AB) at pH = 3 is $Y \times 10^{-3} M$. The value of 'Y' is____.
$K_{sp,AB} = 2 \times 10^{-10}$, $K_{a,HB} = 10^{-9}$

33. $A_{(g)} \rightleftharpoons B_{(g)} + C_{(s)}$ at time t' temperature of the system is increased from 100K to 200K. The variation of partial pressure of B with time is shown in the following figure. At temperature 200K again equilibrium is established. The partial pressure of "A" is maintained at 2 bar throughout the experiment. The ratio of $\frac{\Delta G°_{100K}}{\Delta G°_{200K}}$ will be _____. [log 2 = 0.3]



34. $HC\equiv CH \xrightarrow[Fe]{\text{Red Hot tube}} \underset{(70\%)}{A} \xrightarrow{CH_3CH=CH_2, H^+} \underset{(50\%)}{B} \xrightarrow[(ii)\ H_3O^+,\ \Delta]{(i)\ O_2} \underset{(40\%)}{C}$

Gives $FeCl_3$ Test



D (50%)

12 moles of Acetylene is taken the amount of Product D formed (in gm) will be _____. The yield of product is given in bracket.

35. 4 mole of As(black) is combusted in a fixed volume bomb Calorimeter with excess of O_2 at 298 K & 1 atm to form As_2O_3 (s). During the reaction, temperature is increase from 298 K to 310 K. If heat capacity of bomb calorimeter & standard enthalpy of formation of As (black) are $\frac{50}{3}$ kJ/K & 60 KJ/mole at 298 K respectively.

standard enthalpy of formation of As_2O_3 (s) at 298 K is 'X' KJ/mole. Determine |X| [R = 8.3 J/mol/K]

36. 0.25 mol of propane is used in fuel cell. The number of electron transferred will be

Mathematics

PART – III

Section – A (Maximum Marks: 24)

*This section contains **SIX (06)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).*

37. A parabola S = 0 has its vertex at(–9, 3) and it touches the x-axis at the origin then equation of axis of symmetry of the aforesaid parabola can be.
(A) $x - y + 12 = 0$ (B) $x - 2y + 15 = 0$
(C) $2x - y + 21 = 0$ (D) $x + y + 6 = 0$

38. In an ellipse with focii F_1 and F_2. Suppose P, Q are 2 vertices of the ellipse such that $F_1P = 3$ units and $F_2P = 2$ units then length PQ can be
(A) 5 (B) $\sqrt{7}$
(C) $\sqrt{17}$ (D) $\sqrt{27}$

39. The function f satisfies $f(x)(f(y))^{-1} \le 2^{(x-y)^2} \forall x, y \in D_f$, where D_f is Domain set of f(x) will be
(A) $\left(\sqrt{x} + x^3\right)$ (B) $\int_0^x 2t^3 dt$
(C) $\int_0^{\sin^2 x} \sin^{-1}\sqrt{t}\,dt + \int_0^{\cos^2 x} \cos^{-1}\sqrt{t}\,dt$ (D) $\sqrt{-|x|}$

40. Akhil tosses a coin and scores one point for every head and 2 points for every tail that turns up. He plays on until his score reaches or passes n; Denoting $\mathbf{P_n}$ as his probability of getting score of exactly n, then which of the following statements is/are incorrect.
(A) $P_{1000} > \frac{2}{3}$ (B) $P_{2023} > \frac{2}{3}$
(C) $P_{10} = \frac{683}{1024}$ (D) $P_9 = \frac{483}{875}$

41. A parallelopiped is formed, using three non-zero non-coplanar vectors $\vec{a}, \vec{b}$ & $\vec{c}$ with fixed magnitudes. Angles between any of the vector with normal of the plane determined by the other two is α and the volume of parallelopiped is T and its surface area is Y. If $\left(\frac{Y}{T}\right) = 4\left(\frac{1}{|\vec{a}|} + \frac{1}{|\vec{b}|} + \frac{1}{|\vec{c}|}\right)$ then:
(A) $\cos^2\alpha + \cos\alpha = \frac{3}{4}$ (B) $\sin^2\alpha + \sin^4\alpha = \frac{21}{16}$
(C) $\cos^2\alpha + \cos\alpha = \frac{3+2\sqrt{3}}{4}$ (D) $\sin^2\alpha + \sin^4\alpha = \frac{5}{16}$

42. z_1, z_2, z_3 are three non-zero distinct points satisfying $|z-1|=1$ & $z_2^2 = z_1 z_3$ then

(A) $\frac{z_3 - z_2}{z_2 + z_3 - 2}$ is purely imaginary

(B) $\text{Arg}\left(\frac{z_2 - 1}{z_1 - 1}\right) = 2\text{Arg}\left(\frac{z_3}{z_2}\right)$

(C) $\text{Arg}\left(\frac{z_2 - 1}{z_1 - 1}\right) = 2\text{Arg}\left(\frac{z_3}{z_1}\right)$

(D) $\left|\frac{1}{z_2} - \frac{1}{z_3}\right| + \left|\frac{1}{z_1} - \frac{1}{z_2}\right| = \left|\frac{1}{z_1} - \frac{1}{z_3}\right|$

Section – A (Maximum Marks: 12)

*This section contains **FOUR (04)** Matching List Type Questions. Each question has FOUR statements in **List-I** entries (I), (II), (III) and (IV) and FIVE statements in **List-II** entries (P), (Q), (R), (S) and (T). The codes for lists have choices (A), (B), (C), (D) out of which **ONLY ONE** of these four options is correct answer.*

43. Match functions in List – I with their number of distinct solutions in List – II

List – I		List – II	
(I)	$6^x + 1 = 8^x - 27^{x-1}$	(P)	1
(II)	$2^x + 3^x - 4^x + 6^x - 9^x = 1$	(Q)	2
(III)	$5^{(1+\cos(\pi x))} + 2^{\left(x^2-1\right)} + 4^{1-\lvert x\rvert} = 3$	(R)	0
(IV)	$\ln(x^{2014}+1) + \ln(1 + x^2 + x^4 + \ldots + x^{2012}) = \ln(2014) + 2013\ln(x)$	(S)	3
		(T)	∞

(A) (I) → (S) (II) → (R) (III) → (Q) (IV) → (T)
(B) (I) → (T) (II) → (Q) (III) → (P) (IV) → (R)
(C) (I)→ (Q), (II) → (P), (III) → (R), (IV) → (P)
(D) (I) → (P) (II) → (T) (III) → (R) (IV) → (S)

44. Suppose $A \in \{a_1, a_2, a_3, a_4, a_5\}$ where $a_1 < a_2 < a_3 < a_4 < a_5$ and $B \in \{1, 2, 3, 4, \ldots k\}$ then, match
List – I with List – II

List – I		List – II	
(I)	No. of injective functions in f: A→ B such that $f(a_i) \neq i$ for k = 6	(P)	44
(II)	No. of Non-decreasing functions in f: A→ B for k = 11	(Q)	309
(III)	No. of increasing functions in f: A→ B such that $f(a_i) \neq i$ for k = 9	(R)	3003
(IV)	No. of Non-increasing functions in f: A→ B for k = 10	(S)	56
		(T)	2002

(A) (I) → (R) (II) → (T) (III) → (Q) (IV) → (R)
(B) (I)→ (Q), (II) → (R), (III) → (S), (IV) → (T)
(C) (I) → (R) (II) → (S) (III) → (T) (IV) → (P)
(D) (I) → (P) (II) → (T) (III) → (R) (IV) → (S)

45. Consider $I_1 = \int_0^1 \frac{e^{\tan^{-1}x}}{\sqrt{1+x^2}}dx$, $I_2 = \int_0^1 \frac{xe^{\tan^{-1}x}}{\sqrt{1+x^2}}dx$, $I_3 = \int_0^1 \frac{x^2e^{\tan^{-1}x}}{\sqrt{1+x^2}}dx$, then

List– I		List– II	
(I)	$I_1 + I_2$	(P)	3/2
(II)	$I_1 + I_2 - 4I_3$	(Q)	1
(III)	$\frac{I_1 + I_2 + 1}{I_1 + I_2 + 2I_3}$	(R)	$\sqrt{2}e^{\pi/4} - 1$
(IV)	$\frac{2(I_1 + I_2)}{2I_3 + 1}$	(S)	$\sqrt{2}e^{\pi/4}$
		(T)	$\sqrt{2}e^{\pi/4} - 3$

(A) (I) → (R) (II) → (T) (III) → (Q) (IV) → (R)
(B) (I) → (S) (II) → (T) (III) → (P) (IV) → (R)
(C) (I) → (R) (II) → (S) (III) → (T) (IV) → (P)
(D) (I) → (P) (II) → (T) (III) → (R) (IV) → (S)

46. Match the following list-I & list-II:

List – I		List – II	
(I)	If A and B are non-singular real matrices such that det(A) = 3 and $A^{-1} + B^{-1} = (A + B)^{-1}$, det (B) =	(P)	190
(II)	Let $A = \begin{bmatrix} a & x & p \\ y & q & b \\ r & c & z \end{bmatrix}$ and $B = \begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix}$ (a, b, c, x, y, z, p, q, r $\in$ N). If $tr(AB + AB^3 + AB^5 + \ldots + AB^{19}) = 210$, then the number of ordered triplets (p, q, r) is _____ (tr(A) denotes sum of principal diagonal elements of A).	(Q)	44
(III)	Consider $A = \begin{bmatrix} 1 & 2 & 4 \\ 0 & 1 & 3 \\ 0 & 1 & 1 \end{bmatrix}$ $B = \begin{bmatrix} 2 & 4 & 5 \\ 4 & 0 & 0 \\ 5 & 0 & 0 \end{bmatrix}$. If $C = [c_{ij}]_{3\times3} = A^{20} +$ B and $c_{22}c_{33} - c_{23}c_{32} = 2^m$, then m = _____	(R)	5
(IV)	Consider three matrices $A = [a_{ij}]_{3\times5}$, $B = [b_{ij}]_{5\times9}$, and $C = A \times B = [c_{ij}]_{3\times9}$. It is given that $a_{ij} = \frac{i}{3j-2}$ & $b_{ij} = \frac{j}{3i+1}$, then value of the element c_{28} is _____	(S)	11
		(T)	20

(A) (I) → (R) (II) → (S) (III) → (Q) (IV) → (R)
(B) (I) → (Q) (II) → (P) (III) → (T) (IV) → (R)
(C) (I) → (R) (II) → (Q) (III) → (T) (IV) → (P)
(D) (I) → (P) (II) → (T) (III) → (R) (IV) → (S)

Section – B (Maximum Marks: 24)

*This section contains **EIGHT (08)** numerical based questions. The answer to each question is a **NUMERICAL VALUE.** If the numerical value has more than two decimal places, truncate/round-off the value to **TWO** decimal places.*

47. Suppose integers $a_1, a_2, a_3, \_\_\_\_\_, a_{2019}$ satisfy $a_1 = 1 \le a_2 \le a_3 \ldots \le a_{2019} = 99$
Suppose $f = \left(a_1^2 + a_2^2 + a_3^2 + \ldots.. + a_{2019}^2\right) - (a_1a_3 + a_2a_4 + a_3a_5 + \ldots\ldots + a_{2017}a_{2019})$
Then find the minimum value of f.

48. The value of $\dfrac{\sum_{i=0}^{2024}\sum_{r=0}^{2024}(-1)^r\ {}^{2024}C_r\left(2024-r\right)^i \times 10^4}{\sum_{r=0}^{2025}(-1)^r\ {}^{2025}C_r\left(2025-r\right)^{2025}}$

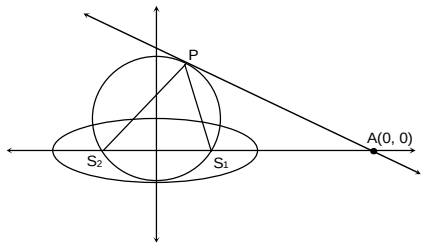
49. Find number of 8-digits permutations of 2, 0, 3, 4, 20, 34 with first digit being non-zero_____.

50. A variable line $y = mx + \frac{1}{2}(1-m)\ \forall\ m \in R$ either intersects or touches curves $y = \frac{3}{2} + \left(x + \frac{1}{2}\right)^2$ and $(2y-3)^2 = 4\left[(2x+1)^2 - 4\right]$ in total 3 points then Find absolute sum of all possible real values of m.

51. A circle S = 0 and a parabola $Q \equiv y^2 - 4x = 0$ have just a singleton point in common and S = 0 is tangent to the abscissa axis at the focus of curve Q then radius of S = 0 is_____

52. Find the greatest value of ln(x) ln(z) provides that $\ln(x) + \log_y(z) = 3$ and $\ln(y) + \log_x(z) = 4$ where x, y, z > 1.

53. Consider the curve = $\left\{x = \sqrt{13}\cos\theta,\ y = -12 + 2\sin\theta\right\}$
having focii S_1 and S_2 and a variable point P (ϕ, -2ϕ) in such a way that $\angle S_1PS_2$ is maximum then the value of $\frac{S_1P}{S_2P}$.



54. If f is a continuous and differentiable function in $x \in (0, 1)$ function such that $\sum_{r=0}^{10}\left(f(x+r) - \left|e^x - r - 1\right|\right) = 0$, then $\int_0^{11} f(x)dx$ is _____ where e =2.78 and ln2 = 0.693, ln(3) = 1.098