Test Date: 29/07/2020

B
CODE

Aakash
Medical | IIT-JEE | Foundations
(Divisions of Aakash Educational Services Limited)

***Regd. Office*:** Aakash Tower, 8, Pusa Road, New Delhi-110005, Ph.011-47623456

Time: 3 hrs **MM : 180**

Mock Test
for JEE (Advanced) - 2020
Test – 3A (Paper – II)_Actual Pattern-2018

Topics covered:

PHYSICS : **MOCK TEST on Complete Syllabus**

CHEMISTRY : **MOCK TEST on Complete Syllabus**

MATHEMATICS : **MOCK TEST on Complete Syllabus**

General Instructions:

1. Read each question carefully.
2. It is mandatory to use blue/black ballpoint pen to darken the appropriate circle in the answer sheet.
3. Mark should be dark and should completely fill the circle.
4. Rough work must not be done on the answer sheet.
5. Do not use white-fluid or any other rubbing material on answer sheet.
6. Student cannot use log table and calculator or any other material in the examination hall.
7. Before attempting the question paper, student should ensure that the test paper contains all pages and no page is missing.
8. Before handing over the answer sheet to the invigilator, candidate should check that Roll No., Centre Code and Date of Birth have been filled and marked correctly.
9. Immediately after the prescribed examination time is over, the answer sheet is to be returned to the invigilator.
10. **Pattern of the questions are as under :**
    (i) The question paper consists of 3 parts (Physics, Chemistry and Mathematics). Each part has 3 sections.
    (ii) **Section-1:** This section contains **6** multiple choice questions which have one or more correct answer(s). Each question carries **+4 marks** for correct answer and **–2 marks** for wrong answer. Partial **+1 mark** is given for darkening a bubble corresponding to each correct option, provided NO incorrect option is darkened
    (iii) **Section-2:** This section contains **8** questions. The answer to each of the question is a **double-digit integer**, ranging from 00 to 99 (both inclusive) without being given any option. Each question carries **+3 marks** for correct answer and there is **no negative mark** for wrong answer.
    (iv) **Section-3:**This section contains **4** multiple choice questions. Each question has two matching lists : (**List-I** and **List-II**). In general, four options are given representing matching of elements from **List-I** and **List-II**. **Only ONE** of these four options corresponds to a correct matching. For each question, choose the option corresponding to the correct matching. Each question has **only one** answer is correct and carries **+3 marks** for correct answer and **–1 mark** for wrong answer

PART – I: PHYSICS

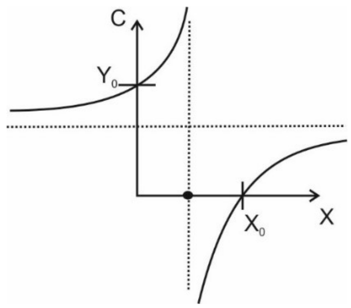
SECTION - 1

One or More than One Option Correct Type

This section contains **6** questions. Each question has **FOUR** options for correct answer(s). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct option(s).

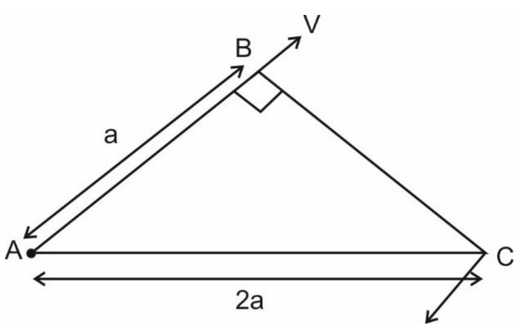
1. When a sound wave propagates
   (A) The wave intensity remains constant for a plane wave
   (B) The wave intensity decreases as the inverse of the distance from the source for a spherical wave
   (C) The wave intensity decreases as the inverse square of distance from the source for a spherical wave
   (D) Wave front is cylindrical for line source

2. One moles of an ideal gas is taken along the process in which PV^x = constant, The graph shows variation of molar heat capacity C of a gas with respect to x. If gas is monoatomic, then



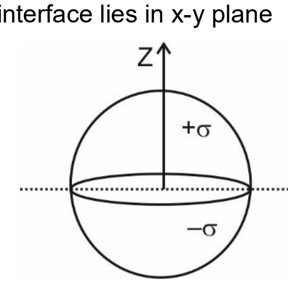
   (A) $X_0 = \frac{5}{3}$ (B) $Y_0 = \frac{5R}{2}$
   (C) $X_0 = \frac{7}{5}$ (D) $Y_0 = \frac{3R}{2}$

3. A triangular block ABC is moving in a plane such that point B and C are moving with speed V as shown in the diagram



   (A) Speed of point A is $\sqrt{\frac{7}{3}}V$ (B) Speed of point A is $\frac{2}{\sqrt{3}}V$
   (C) Angular velocity of block is $\frac{2V}{\sqrt{3}a}$ (D) Angular velocity of block is $\frac{V}{a}$

4. A hollow insulating spherical shell has surface charge density σ on upper half and surface charge density, – σ on the lower half. Their interface lies in x-y plane



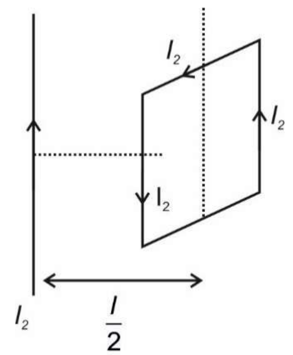
(A) *x-y* plane is equipotential surface

(B) Inside the sphere at points on *z*-axis field is along +ve Z-direction

(C) Inside the sphere at all point on *z*-axis field is along negative Z-direction

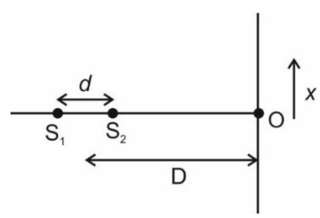
(D) At all points on *z*-axis outside the sphere field is along negative Z-direction

5. A square loop of side length l carrying current, I_2 is placed near an infinitely long wire as shown in the figure. The straight wire carries current I_0. The plane of the square loop is perpendicular to the plane of paper containing straight wire



(A) Torque on the loop is zero
(B) Torque on the loop is non zero
(C) Force acting on the loop is zero
(D) Force acting on the loop is non zero

6. Two coherent point sources S_1 and S_2 are placed on a line perpendicular to the screen as shown in the figure. The wavelength of the light emitted by the source is λ. The distance between two source is d = 3λ. The distance of sources from screen is D(>>λ). If source S_1 leads S_2 in phase by $\frac{2\pi}{3}$, then

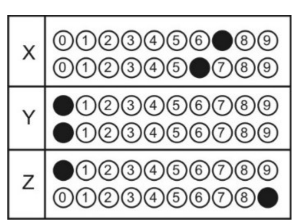


(A) Value of x for nearest maxima to O is $\frac{4\sqrt{2}D}{7}$
(B) Value of x for nearest maxima to O is $\frac{4D}{9}$
(C) The number of visible bright fringes on screen is 3
(D) The number of bright fringes on screen is 2

SECTION - 2

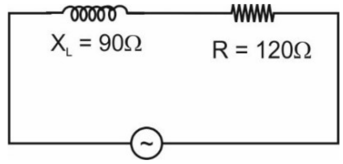
Integer Value Type

This section contains **8** questions. The answer to each of the question is a **Double-digit integer,** ranging from 00 to 99. The answer will have to be appropriately bubbled in the OMR as per the instructions as follows. **Examples-** If the correct answer to question numbers X, Y and Z (say) are 76, 0 and 9 respectively, then mark 76, 00 and 09 in OMR respectively

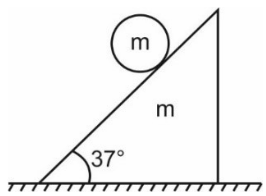


7. The distance between object and eye is kept fixed equal to 30 cm. A convex lens of focal length 20 cm is to be placed in between object and eye. If the object is to kept within the focal plane of length and has to be kept in such a way that angular magnification is maximum then distance of object (in cm) from lens for such a configuration is ___

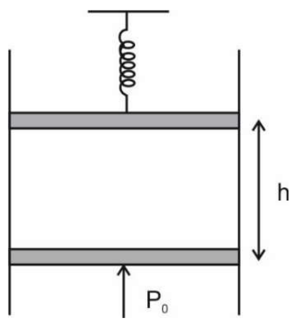
8. In a L-R circuit, X_L = 90 Ω, R = 120Ω. At a given instant voltage across inductor is 72 V and voltage across resistor is 72 V. RMS value of applied voltage (in V) is $n\sqrt{2}$. Value of n is



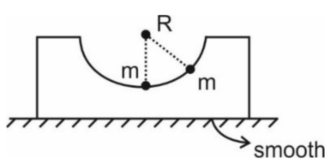
9. A wedge of mass m is placed on a smooth horizontal plane and a disc of mass m is placed on the wedge as shown in the figure. The contact surface between disc and wedge is rough. Acceleration of the wedge when the disc begins to roll down is a_0. If in the given situation acceleration of center of mass of disc w.r.t wedge is $\frac{30a_0}{n}$, then value of n,



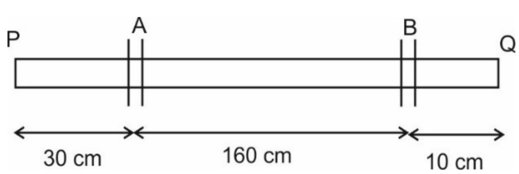
10. A cylindrical container of cross sectional area A contain ideal gas at atmospheric pressure P_0 and temperature T_0. Both the piston used are massless. Initially the spring is relaxed and separation between the piston is h as shown in figure. When lower piston is moved isothermally by $\frac{h}{2}$, the upper piston moves by $\frac{h}{3}$. The value of spring constant is $\frac{9P_0A}{nh}$. Value of n is



11. A symmetrical block of mass m, having groove of hemispherical shape of radius R is placed on a smooth horizontal surface. A small particle of mass m is placed inside the hemisphere and can move without friction. Time period of small oscillation of block and particle is $2\pi\sqrt{\frac{R}{ng}}$. Value of n is



12. A metal rod PQ of length 2 m is clamped at two points A and B as shown in the figure. If speed of wave in the rod is 100 m/s, then fundamental frequency for natural longitudinal oscillation of rod is 5 n Hz. Value of n is __



13. A moving hydrogen atom makes an inelastic collision with a stationary hydrogen atom. After collision both of them move at an angle of 60° to each other with equal speed. If one of the hydrogen atom gets excited to 1st excited state, then kinetic energy of colliding hydrogen atom is $5.1n\,eV$. Value of n is ___

14. The density, ρ inside a solid sphere of radius R and mass M varies as $\rho = \rho_0\left(1 - \frac{r}{R}\right)$ where ρ_0 is positive constant. If gravitation field at distance $\frac{R}{2}$ from centre is $\frac{20GM}{nR^2}$, then value of n is ___

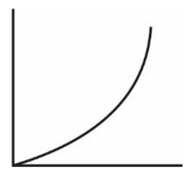
SECTION - 3

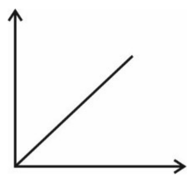
Matrix Match Type

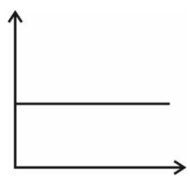
This section contains Four **4** question. Each question has TWO (02) matching lists. LIST-I and LIST-II. Each question has Four options. **ONLY ONE** of these four options corresponds to the correct answer. For each question, choose the option corresponding to the correct answer.

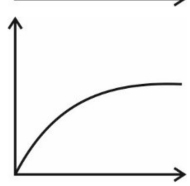
15. A particle is moving along a straight line with velocity varying with position S as $v = k\sqrt{S}$ where k is constant. Match the entries in Column II with entries in Column I

List-I | **List-II**

(P) Velocity vs time curve | (1) 

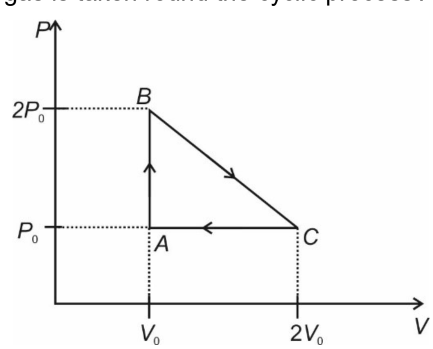
(Q) Acceleration vs time curve | (2) 

(R) Acceleration vs displacement curve | (3) 

(S) Displacement vs time curve | (4) 

(A) (P) → (2), (Q) → (3), (R) → (3), (S) → (1)
(B) (P) → (2), (Q) → (3), (R) → (4), (S) → (4)
(C) (P) → (2), (Q) → (2), (R) → (3), (S) → (1)
(D) (P) → (2), (Q) → (3), (R) → (4), (S) → (3)

16. One mole of an ideal diatomic gas is taken round the cyclic process ABCA as shown is figure



List-I | **List-II**

(P) Work done by the gas in complete cycle | (1) $\frac{27}{100}P_0V_0$

(Q) Magnitude of heat exchange in process BC (2) $\frac{P_0V_0}{2}$

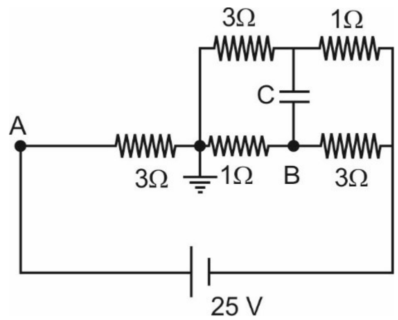
(R) Magnitude of heat exchange in CA (3) $\frac{7}{2}P_0V_0$

(S) Maximum temperature attained during the cycle (4) $\frac{3P_0V_0}{2}$

$\left[R = \frac{25}{3} \text{ in S.I. units}\right]$

(A) (P) → (2), (Q) → (3), (R) → (4), (S) → (1)
(B) (P) → (2), (Q) → (4), (R) → (3), (S) → (1)
(C) (P) → (2), (Q) → (3), (R) → (1), (S) → (4)
(D) (P) → (1), (Q) → (2), (R) → (4), (S) → (3)

17. For the circuit shown in figure match the entries in List I with entries in List II

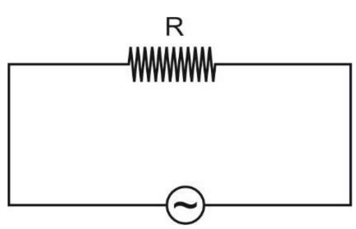


List-I	List-II
(P) Current through battery (in A)	(1) $-\frac{5}{2}$
(Q) Potential difference across capacitor (in V)	(2) 5
(R) Potential of point A (in V)	(3) 15
(S) Potential of point B (in V)	(4) $-\frac{15}{2}$

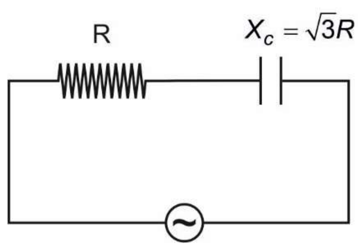
(A) (P) → (2), (Q) → (2), (R) → (4), (S) → (1)
(B) (P) → (2), (Q) → (2), (R) → (3), (S) → (1)
(C) (P) → (2), (Q) → (2), (R) → (3), (S) → (4)
(D) (P) → (2), (Q) → (4), (R) → (3), (S) → (2)

18. For AC circuits listed in List-I applied voltage is V = $V_0\sin(\omega t)$. List II gives the current in circuit listed in List I. Match the entries in List I with List II

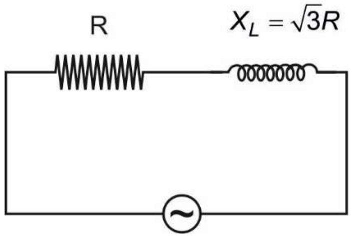
List-I **List-II**

(P)


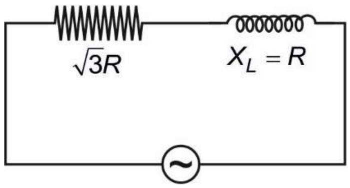
(1) $\frac{V_0}{2R}\sin\left(\omega t + \frac{\pi}{3}\right)$

(Q)


(2) $\frac{V_0}{R}\sin(\omega t)$

(R) 

(3) $\frac{V_0}{2R}\sin\left(\omega t - \frac{\pi}{6}\right)$

(S) 

(4) $\frac{V_0}{2R}\sin\left(\omega t - \frac{\pi}{3}\right)$

(A) (P) $\rightarrow$ (2), (Q) $\rightarrow$ (1), (R) $\rightarrow$ (4), (S) $\rightarrow$ (3)
(B) (P) $\rightarrow$ (2), (Q) $\rightarrow$ (1), (R) $\rightarrow$ (3), (S) $\rightarrow$ (4)
(C) (P) $\rightarrow$ (2), (Q) $\rightarrow$ (1), (R) $\rightarrow$ (4), (S) $\rightarrow$ (4)
(D) (P) $\rightarrow$ (2), (Q) $\rightarrow$ (4), (R) $\rightarrow$ (3), (S) $\rightarrow$ (1)

PART – II: CHEMISTRY

SECTION - 1

One or More than One Option Correct Type

This section contains **6** questions. Each question has **FOUR** options for correct answer(s). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct option(s).

19. Consider the following thermodynamic relations and identify the correct one(s).
(A) dU = TdS + PdV
(B) dH = TdS + VdP
(C) dG = VdP – TdS
(D) dH = dU + PdV + VdP

20. Consider the following reaction

$N_2 + 3H_2 \rightleftharpoons 2NH_3$

Iron can be used as catalyst. Which of the following parameter does not get any change on addition of iron into it?
(A) Maximum energy required to carry out the reaction
(B) ΔH
(C) ΔS
(D) ΔG for the formation of the activated complex

21. Consider the quantum mechanical model for unielectronic species like H, He^+, Li^{2+} etc. and identify the correct statements
(A) For all unielectronic species probability of finding an electron is maximum at 0.529 Å away from the nucleus
(B) It is possible that e^- of 1s orbital is present at 2.116 Å away from the nucleus in both H and He^+
(C) It is possible that e^- of 2s orbital may spend some time in space of 1 orbital
(D) An orbital with wave function $\psi = \frac{\pi}{\sqrt{2}} e^{-r/a_0}$ has no angular node as well as no radial node

22. Consider the following statements and identify the correct one(s)
(A) $(NH_4)_2Cr_2O_7$ on heating gives a diatomic, colourless and diamagnetic gas as one of the products
(B) Heating of NH_4NO_3 will liberate a brown coloured gas along with other product
(C) When $Pb(NO_3)_2$ is heated at around 680 K a brown coloured gas is produced which is less acidic than N_2O_5 plus other products
(D) $(NH_4)NO_3$ on heating will liberate a neutral gas as one of the products

23. Identify the complexes which are paramagnetic but their CFSE is not equal to zero?

(A) $Na_3\left[\underset{(iii)}{Fe}(CN)_5O_2\right]$

(B) $[Co(C_2O_4)_3]^{3-}$

(C) $[Mn(H_2O)_6]^{2+}$

(D) $[Fe(H_2O)_6]^{2+}$

24. Consider a hydrocarbon (X) of molecular formula C_5H_{10}. Reductive ozonolysis of (X) gives two compounds (Y) and (Z). Compound (Y) is the smallest carbonyl compound which gives positive Tollen's test as well as Iodoform test. Compound (Z) is the smallest carbonyl compound which gives negative Tollen's test but positive iodoform test. When compounds (Y) and (Z) are heated in presence of small amount of aq NaOH, then Pent-3-en-2one is produced as major product. Identify the correct statement(s)

(A) Compound (X) does not show geometrical isomerism

(B) Compound A has 6 α hydrogens

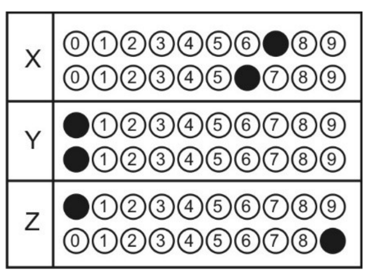
(C) All the products formed when A and B heated with NaOH can show geometrical isomerism

(D) Compound (X) on treatment with MCPBA gives a compound which is resistant to oxidation

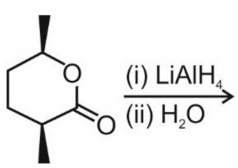
SECTION - 2

Integer Value Type

This section contains **8** questions. The answer to each of the question is a **Double-digit integer,** ranging from 00 to 99. The answer will have to be appropriately bubbled in the OMR as per the instructions as follows. **Examples-** If the correct answer to question numbers X, Y and Z (say) are 76, 0 and 9 respectively, then mark 76, 00 and 09 in OMR respectively



25. Consider the following reaction



How many different compounds are formed in the above reaction (including stereoisomers)?

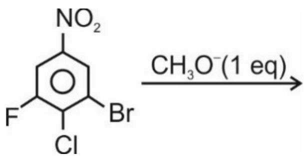
26. During electrolysis 96.5 mA current is passed through 150 ml of 0.2 M $Fe_2(SO_4)_3$ solution for 1 hr reduction occurs only to the formation of Fe^{2+}. The volume (in ml) of 0.01 M $KMnO_4$ required to oxidise Fe^{2+} is X ml. The value of X is

27. Assuming 2s – 2p mixing does not occur then the sum of number of antibonding e^- present in N_2^+, N_2^- and O_2^+ is

28. Among the alkali metals the atomic number of the element which has second lowest density, is

29. The moles of Cl^- ions to be added to decrease the concentration of Ag^+ from 5×10^{-5} M to 2×10^{-5} M in 1 L solution is $P \times 10^{-q}$ (in scientific notation). The value of $\frac{P}{0.1} + q$ is. [Ksp of AgCl = 10^{-10} M^2]

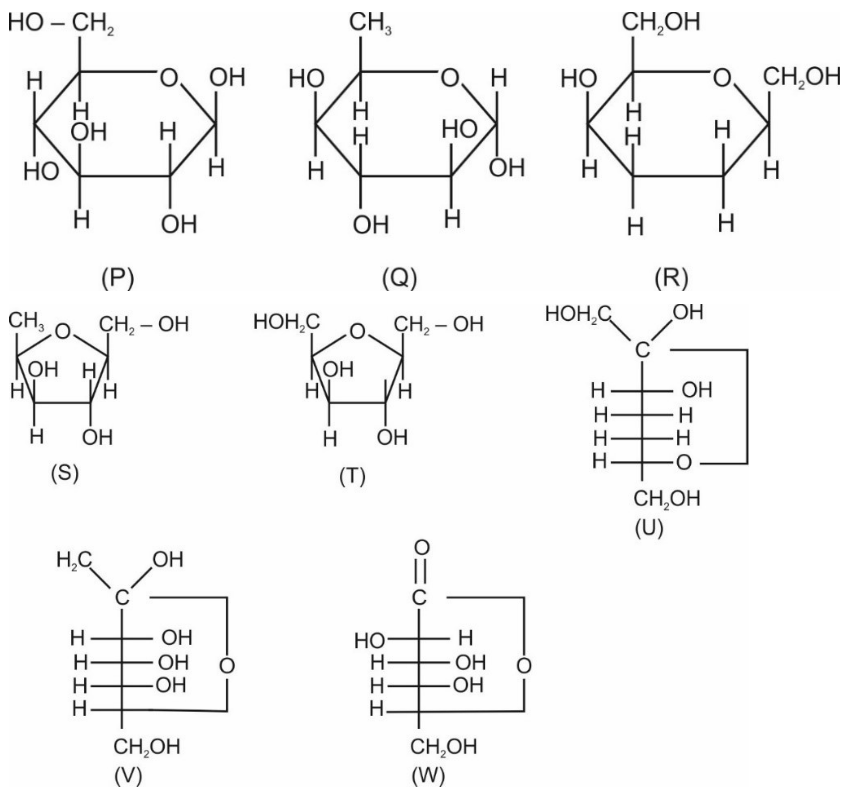
30. Consider the following reaction



An aromatic nucleophilic substitution reaction takes place.

The difference in the molar mass of reactant and product is [F = 19, Cl = 36, Br = 80 g/mol]

31. How many of the following are reducing sugar?



32. Two radioactive nuclides P and Q have half life of 200 mins and 50 mins respectively. A fresh sample contains nuclides of Q to be 64 times that of P. The time it will take to make ratio number of nuclides of P and Q equal to 4 : 1 is t min. Find the value of $\frac{9t}{200}$.

Section - 3

Matrix Match Type

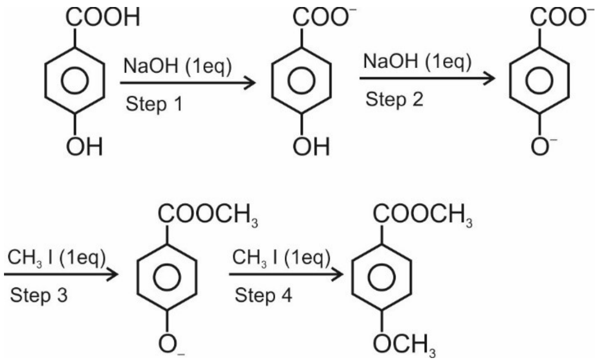
This section contains Four **4** question. Each question has TWO (02) matching lists. LIST-I and LIST-II. Each question has Four options. **ONLY ONE** of these four options corresponds to the correct answer. For each question, choose the option corresponding to the correct answer.

33. List I contains some reactions in which some step(s) are wrong (each step is labelled with number) and List II contains the number of that step which may be given in List I

Match the wrong numbered step(s) from List I to list II

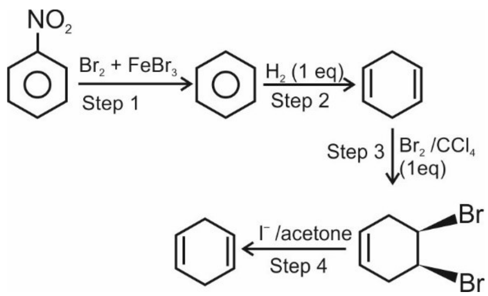
List-I **List-II**

(P)



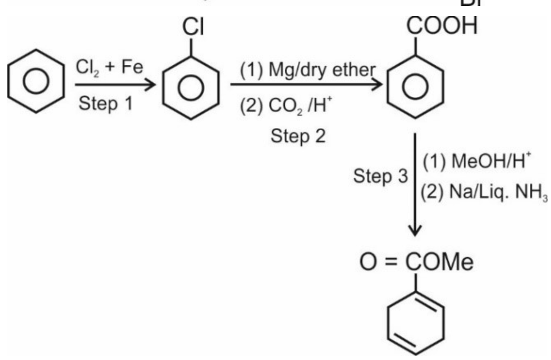
(1) 1

(Q)



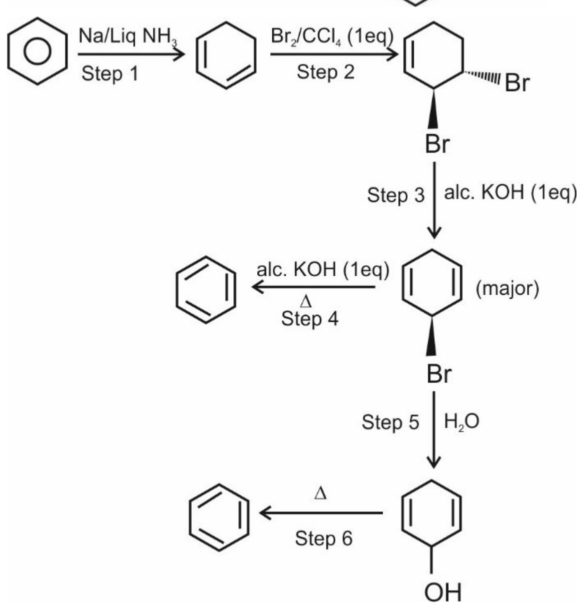
(2) 2

(R)



(3) 3

(S)



(4) 4

(5) 5

(6) 6

The correct option is

(A) (P) → (1, 2), (Q) → (1, 2), (R) → (1), (S) → (6)

(B) (P) → (3), (Q) → (1, 2, 3, 4), (R) → (3), (S) → (1, 3)

(C) (P) → (1), (Q) → (2, 3, 4), (R) → (2), (S) → (5, 6)

(D) (P) → (3), (Q) → (1, 2, 3, 4), (R) → (1), (S) → (1, 4)

34. Match List-I with List-II

List-I	**List-II**
(Processes)	(Metals that can be extracted by commercial processes given in List I)
(P) Self reduction	(1) Cu
(Q) Carbon reduction	(2) Au
(R) Complex formation then heated to higher temperature	(3) Ag
(S) Complex formation then reduced by zinc	(4) Pb
	(5) Zr
	(6) Fe

Identify the correct option

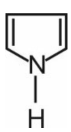
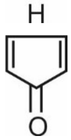
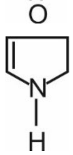
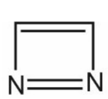
(A) (P) → (1), (Q) → (4), (R) → (4), (S) → (2, 3)

(B) (P) → (2), (Q) → (4, 5), (R) → (4), (S) → (1)

(C) (P) → (1, 4), (Q) → (6), (R) → (5), (S) → (2, 3)

(D) (P) → (1), (Q) → (5, 6), (R) → (5, 6), (S) → (2, 3)

35. Match List-I with List-II

List-I	**List-II**
(Contains some compounds)	(Characteristics of compounds given in List I)
(P) 	(1) Aromatic
(Q) 	(2) Unstable at room temperature
(R) 	(3) More basic than aniline
(S) 	(4) less basic than aniline
	(5) can give ppt with $PhSO_2Cl$

Identify the correct option

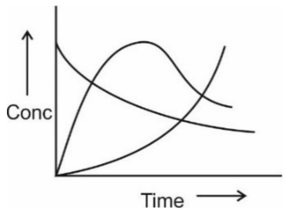
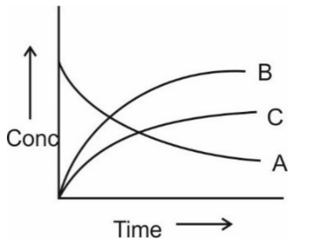
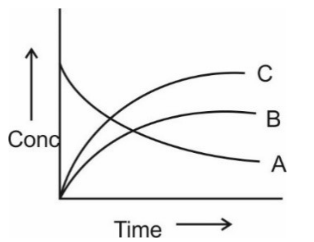
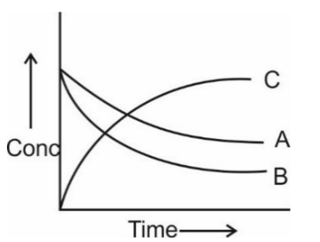
(A) (P) → (1, 4), (Q) → (2), (R) → (3, 5), (S) → (2)

(B) (P) → (4, 5), (Q) → (2), (R) → (4, 5), (S) → (1)

(C) (P) → (4, 5), (Q) → (1), (R) → (4, 5), (S) → (1)

(D) (P) → (1, 4, 5), (Q) → (2), (R) → (3, 5), (S) → (1)

36. Match List-I with List-II

List-I (Contains graph of kinetics of reactions)	**List-II** (Contains reaction)
(P) 	(1) $A \rightarrow 2B.\ A \rightarrow C$
(Q) 	(2) $A \rightarrow B \rightarrow C$
(R) 	(3) $A + 2B \rightarrow C$
(S) 	(4) $A \rightarrow B,\ A \rightarrow 2C$
	(5) $A \rightarrow B \rightarrow 2C$

Identify the correct option

(A) (P) $\rightarrow$ (2, 5), (Q) $\rightarrow$ (1), (R) $\rightarrow$ (4), (S) $\rightarrow$ (3)

(B) (P) $\rightarrow$ (1), (Q) $\rightarrow$ (2, 5), (R) $\rightarrow$ (4), (S) $\rightarrow$ (3)

(C) (P) $\rightarrow$ (1), (Q) $\rightarrow$ (1), (R) $\rightarrow$ (4), (S) $\rightarrow$ (2, 5)

(D) (P) $\rightarrow$ (2, 5), (Q) $\rightarrow$ (1), (R) $\rightarrow$ (3, 4), (S) $\rightarrow$ (3, 4)

PART – III: MATHEMATICS

SECTION - 1

One or More than One Option Correct Type

This section contains **6** questions. Each question has **FOUR** options for correct answer(s). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct option(s).

37. If the inequality $-3 < \dfrac{x^2 - kx - 2}{x^2 - x + 1} < 2$ is satisfied for every $x \in R$, then k may assume which of the following values?

(A) $-\left(\dfrac{\sqrt{3}+1}{\sqrt{2}}\right)$

(B) $\dfrac{\sqrt{2+\sqrt{2}}}{2}$

(C) $\log_{\frac{1}{2}} 3$

(D) $\sqrt{2}$

38. Let S be the sum of all the positive integral values of n for which $2^{103} + 2^{100} + 2^n$ is a perfect square, then which of the following is/are true?

(A) Total number of divisors of S is 8

(B) S is divisible by 13

(C) S is a perfect square

(D) The remainder when S is divide by 100 is 4

39. If $I = \int \dfrac{x^{10}\left(5x^2-2\right)dx}{\left[\left((x-1)(2x-1)\right)^3-\left((x+1)(2x+1)\right)^3+\left(216x^3\right)\right]^3} = \dfrac{x^8}{p\left(\left(ax^2-1\right)\left(bx^2-1\right)\right)^2}+k$, then (where a < b and k is constant of integration)

(A) ab is a perfect square

(B) ab is a perfect cube

(C) bp is a perfect square

(D) bp is perfect cube

40. Let $I = \int\limits_0^{1/2} \dfrac{dx}{\sqrt{1-x^{2n}}}$ for $n \geq 1$, then I is

(A) More than $\dfrac{2}{5}$

(B) More than $\dfrac{1}{2}$

(C) Less than $\dfrac{3}{5}$

(D) Less than $\dfrac{1}{2}$

41. Let z_1, z_2, z_3 be vertices of ΔABC, respectively such that $\dfrac{z_3-z_2}{z_1-z_2}$ is purely imaginary number. A square on side AC is drawn outwardly and P(z_4) is the centre of square, then

(A) $|z_1-z_2| = |z_2-z_3|$ must necessarily hold

(B) $\arg\left(\dfrac{z_1-z_2}{z_4-z_2}\right)+\arg\left(\dfrac{z_3-z_2}{z_4-z_2}\right)=+\dfrac{\pi}{2}$

(C) $\arg\left(\dfrac{z_1-z_2}{z_4-z_2}\right)+\arg\left(\dfrac{z_3-z_2}{z_4-z_2}\right)=0$

(D) z_1, z_2, z_3 and z_4 lie on a circle

42. If $A = \begin{pmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{pmatrix}$ then which of the following is/are true?

(A) adj (adj (A)) = A

(B) |adj (adj(A))| = 1

(C) |adj (A)| = 1

(D) adj(adj(adj(adjA))) = A

SECTION - 2

Integer Value Type

This section contains **8** questions. The answer to each of the question is a **Double-digit integer,** ranging from 00 to 99. The answer will have to be appropriately bubbled in the OMR as per the instructions as follows. **Examples-** If the correct answer to question numbers X, Y and Z (say) are 76, 0 and 9 respectively, then mark 76, 00 and 09 in OMR respectively

X	⓪①②③④⑤⑥●⑧⑨ ⓪①②③④⑤●⑦⑧⑨
Y	●①②③④⑤⑥⑦⑧⑨ ●①②③④⑤⑥⑦⑧⑨
Z	●①②③④⑤⑥⑦⑧⑨ ⓪①②③④⑤⑥⑦⑧●

43. Let G_1, G_2 & G_3 be the centroids of the triangular faces OBA, OCA and OAB respectively of a tetrahedron OABC. If V_1 denotes the volume of the tetrahedron OABC and V_2 that of the parallelepiped with OG_1, OG_2 and OG_3 as three concurrent edges then $12\left(\frac{V_1}{V_2}\right)$ is equal to

44. Number of order pairs (*x*, *y*) which satisfy the equation $x^2 + 2x\sin(xy) + 1 = 0$, where $y \in [0, 2\pi]$ is

45. If $U_n = \int_0^1 x^n (2-x)^n\,dx$ and $V_n = \int_0^1 x^n (1-x)^n\,dx$, n ∈ N and if $\frac{U_n}{V_n} = 1024$, then n equals

46. If $f(x) = (x-\alpha)^{k_1}(x-\beta)^{k_2}(x-\gamma)^{k_3}(x-\delta)^{k_4}$, where $\alpha < \beta < \gamma < \delta$ and $k_i = \sum_{r=1}^{n}(i!)\left(r^{i-1}\right)$, n ∈ N and i = 1, 2, 3, 4 then the minimum number of points of extrema of *f*(x) is

47. A particle is moving along the parabola $y^2 = 12x$ at the uniform rate of 10 cm/sec, then the square of the component velocity parallel to x-axis when the particle is at the point (3, 6) is

48. Let A(3, 2) and B(4, 7) be the foci of an ellipse and the line x + y – 2 = 0 is a tangent to the ellipse if the point of contact is (α, β) then $\sqrt{\alpha^2 + 3\beta^2}$ =

49. Let $P(x) = x^6 - x^5 - x^3 - x^2 - x$ and $\alpha, \beta, \gamma, \delta$ are the roots of the equation $x^4 - x^3 - x^2 - 1 = 0$, then $P(\alpha) + P(\beta) + P(\gamma) + P(\delta) =$

50. Let *f*(*x*) = [*x*] [sin*x*] + [–*x*] [–sin*x*] + *x* + [–*x*] [sin*x*] + [*x*] [–sin*x*], where [.] is the greatest integer function then the number of points of discontinuity of *f*(*x*) in (0, π) is

Section - 3

Matrix Match Type

This section contains Four **4** question. Each question has TWO (02) matching lists. LIST-I and LIST-II. Each question has Four options. **ONLY ONE** of these four options corresponds to the correct answer. For each question, choose the option corresponding to the correct answer.

51. Match the List I with List II

List-I	**List-II**
(P) If roots of the equation ax^4 $bx^3 + cx^2 + dx + e = 0$ are all positive and a = 1, b = –8, c, d ∈ R and e = 16, then absolute value of c is	(1) 3
(Q) If $\left(\frac{\sin\theta}{\sin\phi}\right)^2 = \frac{\tan\theta}{\tan\phi} = 3$ then $\tan^2\theta =$	(2) 4
(R) The nearest integer to the maximum value of $\frac{\tan x}{\tan 3x}$ for $x \in \left(0, \frac{\pi}{2}\right) - \left\{\frac{\pi}{6}, \frac{\pi}{3}\right\}$ is	(3) 24
(S) The area bounded by $y = a^2x^2 + ax + 1$ coordinate axes and the line x = 1 attains its least value then $a + \frac{3}{4} =$	(4) 0

Which of the following match is correct?

(A) (P) → (1), (Q) → (2), (R) → (3), (S) → (4)
(B) (P) → (3), (Q) → (1), (R) → (2), (S) → (1)
(C) (P) → (3), (Q) → (2), (R) → (1), (S) → (1)
(D) (P) → (1), (Q) → (3), (R) → (4), (S) → (2)

52. Match List-I with List-II

List-I	**List-II**
(P) Number of solution the equation $\frac{2+\cos^4 x}{1+\sin^6 x} = \sin^{10} x + \cos^{10} x$, where $x \in \left[-\frac{5\pi}{2}, \frac{5\pi}{2}\right]$ is	(1) 2
(Q) If the tangent to the curve $x = 1 - 3t^2$, $y = t - 3t^3$ at the Point P(–2, 2) meets the curve again at Q then the angle between the tangents at P and Q is $\frac{\pi}{k}$, then $k =$	(2) 1
(R) $\lim_{h \to 0} \frac{2\log(1+h) - \log(1+2h)}{h^2} =$	(3) 12
(S) If the average value of $f(x) = \frac{\cos^2 x}{\sin^2 x + 4\cos^2 x}$ in $\left[0, \frac{\pi}{2}\right]$ is M then $\frac{1}{M}$ equals	(4) 6

Which of the following match is correct?

(A) (P) → (4), (Q) → (1), (R) → (2), (S) → (4)
(B) (P) → (4), (Q) → (2), (R) → (1), (S) → (3)
(C) (P) → (3), (Q) → (2), (R) → (1), (S) → (4)
(D) (P) → (3), (Q) → (1), (R) → (2), (S) → (3)

53. Any differential equation of form $\frac{dy}{dx} + P(x)y = Q(x)$, where $P(x)$ and $Q(x)$ are functions of x only, is called Linear Differential equation of first order and first degree

Match entries in List I to entries in List II

List-I	**List-II**
(P) If $\frac{xdx + ydy}{xdy - ydx} = \sqrt{\frac{a^2 - x^2 - y^2}{x^2 + y^2}}$, then	(1) $y = \frac{c}{x^3} e^{-1/x}$
(Q) Solution of $\cos^2 x \frac{dy}{dx} - y \tan 2x = \cos^4 x$ Where $\lvert x \rvert < \frac{\pi}{4}$ and $y\left(\frac{\pi}{6}\right) = \frac{3\sqrt{3}}{8}$ is	(2) $\sqrt{x^2 + y^2} = a \sin\left[c + \tan^{-1}\left(\frac{y}{x}\right)\right]$
(R) The equation of all possible curves that will cut each member of the family of circles $x^2 + y^2 - 2cx = 0$ at right angles is given by	(3) $x^2 + y^2 + cy = 0$
(S) Solution of the equation $x\int_0^x y(t)\,dt = (x+1)\int_0^x ty(dt)$ $x > 0$ is	(4) $y = \frac{\sin 2x}{2(1 - \tan^2 x)}$

Which one of the following mapping is correct?

(A) (P) → (2), (Q) → (1), (R) → (3), (S) → (4)
(B) (P) → (2), (Q) → (4), (R) → (1), (S) → (3)
(C) (P) → (2), (Q) → (4), (R) → (3), (S) → (1)
(D) (P) → (2), (Q) → (3), (R) → (1), (S) → (4)

54. If e_1 and e_2 are the roots of the equation $x^2 - ax + 2 = 0$, then match the following and choose the correct option given below

List-I	**List-II**
(P) If e_1 and e_2 are the eccentricities of ellipse and hyperbola, respectively then least integral value of n is	(1) 6

(Q) If e_1 and e_2 both are eccentricities of the hyperbolas then a rational value of a is	(2) $2\sqrt{2}$
(R) If e_1 and e_2 both are eccentricities of the hyperbola and conjugate hyperbola then a is	(3) $\frac{29}{10}$
(S) If e_1 is the eccentricity of the hyperbola for which there exist infinite points from which perpendicular tangents can be drawn and e_2 is the eccentricity of the hyperbola in which no such point exist then which cannot be the possible value of *a*	(4) 4

(A) (P) → (4), (Q) → (3), (R) → (2), (S) → (2)

(B) (P) → (4), (Q) → (2), (R) → (3), (S) → (2)

(C) (P) → (1), (Q) → (2), (R) → (3), (S) → (4)

(D) (P) → (1), (Q) → (3), (R) → (2), (S) → (4)

❒ ❒ ❒