Test Date: 12/07/2020

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CODE

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

Mock Test_CoE_XII
for JEE (Advanced) - 2020

MM : 264

Test – 2A (Paper – I)_Actual Pattern-2015

Topics covered:

PHYSICS : **MOCK TEST on Complete Syllabus**

CHEMISTRY : **MOCK TEST on Complete Syllabus**

MATHEMATICS : **MOCK TEST on Complete Syllabus**

General Instructions:

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 **8** questions. The answer to each of the questions is a **single-digit integer**, ranging from 0 to 9. Each question carries **+4 marks** for correct answer. There is no negative mark for wrong answer.

(iii) **Section-2:** This section contains **10** multiple choice questions. Each question has 4 choices (A), (B), (C) and (D), for its answer, out of which **one or more than one is/are correct.** Each question carries **+4 marks** for correct answer, **0 mark** if not attempted and **–2 marks** for wrong answer.

(iv) **Section-3:** This section contains **2** questions. Each question contains two Columns (Column I and Column II). Column I has four entries (A), (B), (C) and (D), Column II has five entries (P), (Q), (R), (S) and (T). Match the entries in Column I with the entries in Column II. Each entry in Column I may match with one or more entries in Column II. Each entry in Column I carries **+2 marks** for correct answer, **0 mark** if not attempted and **–1 mark** for wrong answer.

PART – I: PHYSICS

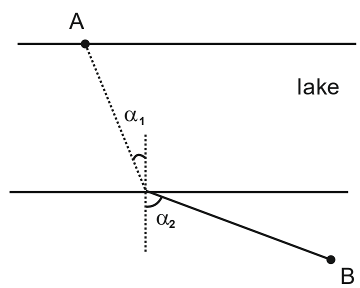
SECTION - 1

Integer Value Type

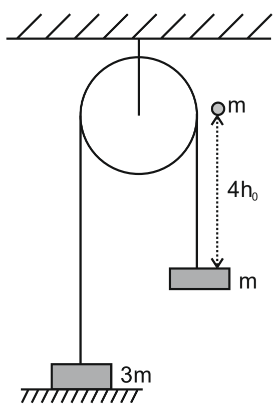
This section contains **8** questions. The answer to each of the questions is a **single-digit integer,** ranging from 0 to 9. The answer will have to be appropriately bubbled in the OMR as per the instructions as follows. **Examples-** If the correct answer to question numbers X, Y and Z (say) are 6, 0 and 9 respectively, then mark 6, 0 and 9 in OMR respectively

X	0	1	2	3	4	5	6	7	8	9
Y	0	1	2	3	4	5	6	7	8	9
Z	0	1	2	3	4	5	6	7	8	9

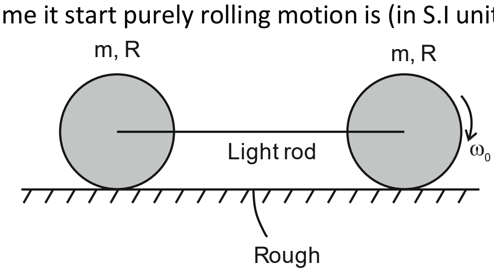
1. From a point A on the bank of a lake with still water a man must get to a point B on the opposite side of the lake. The man uses a boat to travel across the lake and then walk on the land to reach point B. His rowing and walking speeds are V_1 = 6 m/s and V_2 = 2 m/s respectively. If man moves from Point A to B in minimum possible time then value of $\frac{\sin\alpha_1}{\sin\alpha_2}$ is equal to



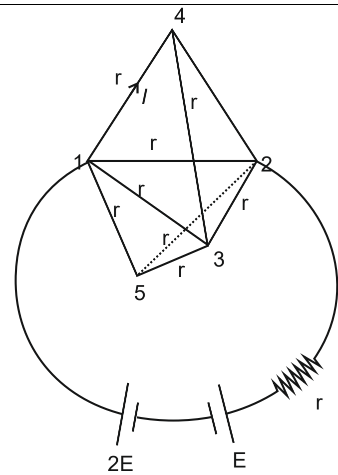
2. In the pulley system arrangement shown in figure a particle of mass m falls from a height $4h_0$ on the mass *m* and gets stick to it. Calculate the maximum height (in cm) to which the heavy mass rises above the ground. (Given h_0 = 10 cm)



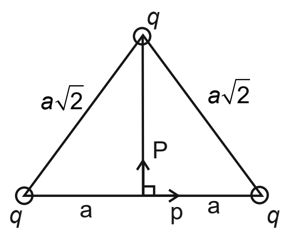
3. The assembly of two identical disc connected by light rigid rod is kept on a sufficient rough horizontal surface. Front disc is given an initial angular velocity ω_0 = 12 rad/s. Total impulse provided by all the forces to rear disc till the time it start purely rolling motion is (in S.I unit). (Given *m* = 2 kg, *R* = 1 m)



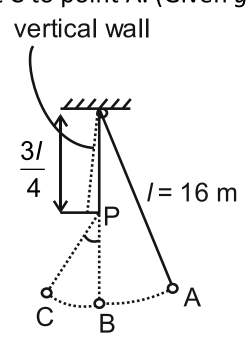
4. Points 1 and 2 of triangular bipyramid are connected by two ideal batteries and resistance *r* as shown. Resistance of each branch of bipyramid is also *r*. Find current I (in A) for E = 14 volt and *r* = 1 Ω



5. For the electrostatic system of three identical charges q and two mutually perpendicular dipoles (P). Centers of the dipoles are at midpoint of the side of the triangle shown. If net force acting on the dipole system due to charges is $\frac{NPq}{8\pi \in_0 a^3}$, then value of N is

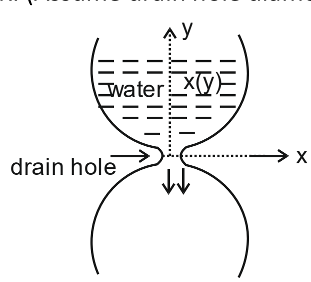


6. A pendulum of length l = 16 m is released from position A. Due to obstacle at P bob moves in the circular path of radius $\frac{l}{4}$ after point B and reaches till the point C shown in figure. Find minimum time (in sec) in which bob return from point C to point A. (Given $g = \pi^2$ m/s^2)



7. Equation of a standing wave in a string ($\mu = 10^{-3}$ gm/m) is given as y = (10 mm) sin($2\pi x$) cos(100t), here x is in meter and t is in sec. If energy associated with this standing wave from $x = \frac{1}{2}m$ to x = 3m is $\frac{5}{K}\mu J$, then value of K is

8. The ancient water clock clepsydra shown in figure has such a shape that the water level descended at a constant rate at all times. If shape of the jar (i.e. specify x as a function of y) comes out in the form of X = (constant) $Y^{1/k}$, then find value of K. (Assume drain hole diameter is very small)

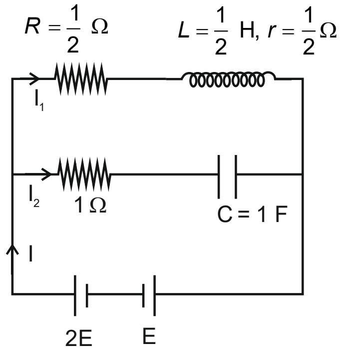


SECTION - 2

One or More Options Correct Type

This section contains **10** multiple choice questions. Each question has 4 choices (A), (B), (C) and (D), for its answer, out of which **one or more than one is/are correct.**

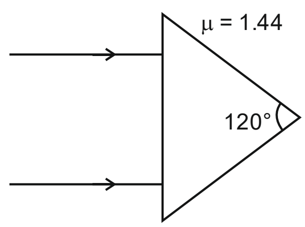
9. In the shown circuit inductor has inductance $\frac{1}{2}$ H and resistance $\frac{1}{2}\ \Omega$. Current I, I_1 and I_2 are shown in figure. Choose correct options.(E = 1 volt)



(A) $I^{max} = 2A$ (B) $I_2^{max} = 1A$

(C) $I_1^{max} = 0.5A$ (D) $I_1^{max} = 1A$

10. A parallel beam of light (monochromatic) enters into an isosceles prism of angle 120° as shown. The rays emerging from the opposite faces



(A) Are parallel to each other

(B) Are conversing

(C) Make an angle of $2[\sin^{-1}(0.72) - 30°]$ with each other

(D) Makes an angle of $[90° - \sin^{-1}(0.72)]$ from horizontal

11. An electromagnetic radiation whose electric component varies with time as $E = a(1 + \cos\omega t)\cos\omega_0 t$, falls on a metal surface (work function ϕ = 2.39 eV). If stopping potential is V and lowest angular frequency of falling radiation is ω_l then (given $\omega = 6 \times 10^{14}$ rad/s, $\omega_0 = 3.6 \times 10^{15}$ rads)

(A) V = 0.37 Volt (B) $\omega_l = |\omega - \omega_0|$

(C) V = 0.50 Volt (D) $\omega_l = |2\omega - \omega_0|$

12. In the shown radioactive decay

$$A \xrightarrow{t_{half} = 30 \text{ days}} B \xrightarrow{t_{1/2} = 45 \text{ days}} C$$

Initially (t = 0) nuclei A and B $\left(N_A^{\circ}, N_B^{\circ}\right)$ was in the ratio 3 : 1. If at $t = t_0$ ratio of activity of A and that of B are in the ratio 9 : 22 then

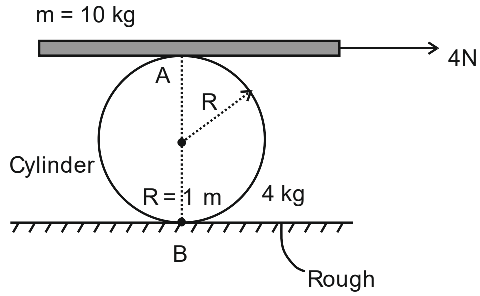
(A) t_0 = 75 days

(B) t_0 = 60 days

(C) At $t = 0$, $\frac{dN_A}{dt} = \frac{9}{2}\frac{dN_B}{dt}$

(D) At $t \to \infty$ $N_c = N_A^{\circ} + N_B^{\circ}$

13. Force of magnitude 4 N is applied on plank placed over rough solid cylinder of mass 4 kg and radius 1 m as shown in figure. Assuming there is no slipping at any point of contact and plank always remains horizontal. Choose the correct options



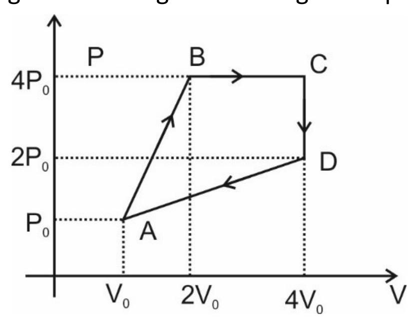
(A) Acceleration of plank will be $\frac{8}{23}$ m/s^2

(B) Acceleration of plank will be $\frac{5}{23}$ m/s^2

(C) Direction of frictional force at B will be towards right

(D) Direction of frictional force at B will be towards left

14. An ideal monoatomic gas is taken through cyclic process ABCDA temperature of gas at point B is 8 T_0. If W_{ij}. Q_{ij} represent work done by gas and heat given to the gas sample in the process i $\rightarrow$ j, then



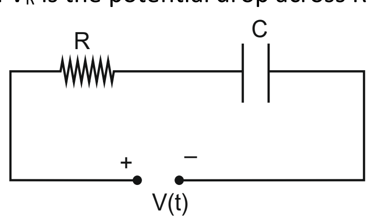
(A) $\frac{Q_{DA}}{15} = -\frac{Q_{AB}}{13}$

(B) $\frac{Q_{AB}}{13} = \frac{Q_{BC}}{20}$

(C) $\frac{2W_{AB}}{5} = \frac{W_{BC}}{8}$

(D) $\frac{W_{AB}}{5} = \frac{W_{BC}}{8}$

15. A time varying voltage V = αt, where α is constant is applied at t = 0, to shown R-C circuit. If q(t) is charge on capacitor at time t and V_R is the potential drop across R at time t , then



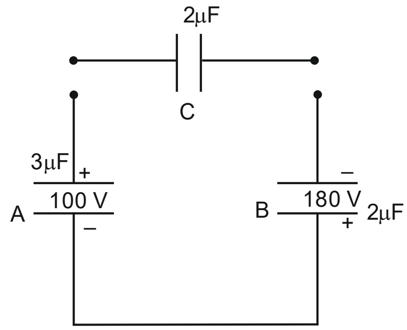
(A) $q_t = \alpha C[t - RC] + \alpha RC^2 e^{-t/RC}$

(B) V_R = RαCt

(C) $q_t = 2\alpha C[t - RC] + 2\alpha RC^2 e^{-t/RC}$

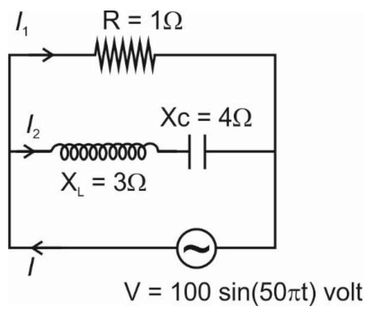
(D) $V_R = 2\alpha C[t - RC]R$

16. Two capacitors A and B with capacitance 3μF and 2μF are charged to potential difference of 100 V and 180 V respectively and connected with each other as shown. An uncharged capacitor C of 2μF with lead wires on the free end are joined to circuit. If q_A, q_B and q_C are final charge on capacitor A and B and C respectively, then



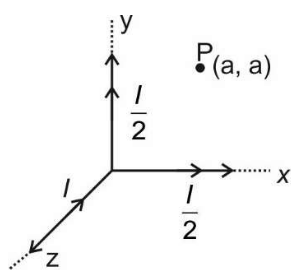
(A) $q_A = 90\ \mu C$
(B) $q_B = 150\ \mu C$
(C) $q_C = 210\ \mu C$
(D) $q_B = 100\ \mu C$

17. In the shown AC circuit



(A) $I_1 = 100\sin(50\pi t)$ Amp (B) $I_2 = 100\cos(50\pi t)$ Amp
(C) $I_{RMS} = 100$ Amp (D) $I_{RMS} = 100\sqrt{\frac{26}{25}}$ Amp

18. Three semi-infinitely long wire along *x*, *y* and *z*-axis are joined at origin as shown. Current in each wire is shown in figure. If $\overrightarrow{B_x^P}, \overrightarrow{B_y^P}$ and $\overrightarrow{B_z^P}$ are magnetic field due to wires placed along x, y and z-axis respectively, then



(A) $\overrightarrow{B_x^P} = -\overrightarrow{B_y^P}$
(B) $\overrightarrow{B_x^P} = \overrightarrow{B_y^P}$
(C) $\overrightarrow{B_z^P} = \frac{\mu_0 I}{4\pi a\sqrt{2}}\left(\frac{\hat{i}}{\sqrt{2}} - \frac{\hat{j}}{\sqrt{2}}\right)$
(D) $\overrightarrow{B_z^P} = \frac{\mu_0 I}{4\pi a\sqrt{2}}(\hat{i} - \hat{j})$

SECTION - 3

Matching Column Type

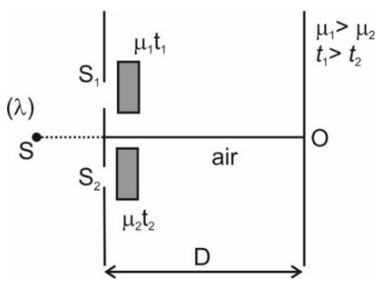
This section contains two questions. Each question contains two Columns (Column I and Column II). Column I has four entries (A), (B), (C) and (D), Column II has five entries (P), (Q), (R), (S) and (T). Match the entries in Column I with the entries in Column II. Each entry in Column I may match with one or more entries in Column II. The OMR contains a 4 × 5 matrix whose layout will be similar to the one shown below :

For each entry in Column I, darken the bubbles of all the matching entries. For example, if entry (A) in Column I matches with entries (Q), (R) and (T), then darken these three bubbles in the OMR. Similarly, for entries (B), (C) and (D)

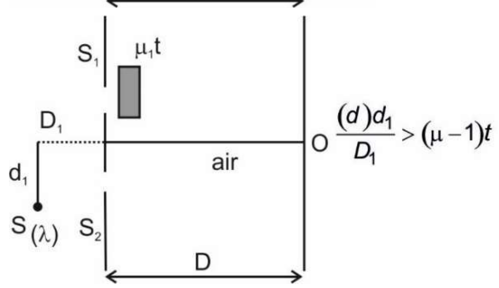
(A)	(P)	(Q)	(R)	(S)	(T)
(B)	(P)	(Q)	(R)	(S)	(T)
(C)	(P)	(Q)	(R)	(S)	(T)
(D)	(P)	(Q)	(R)	(S)	(T)

19. Column (I) contain YDSE arrangement with some modification (insertion of glass plate infront of slits, position of point source of light and placing liquid between slits and screen) and Column II contain related information. Match the correct options (D >> d, d_1)

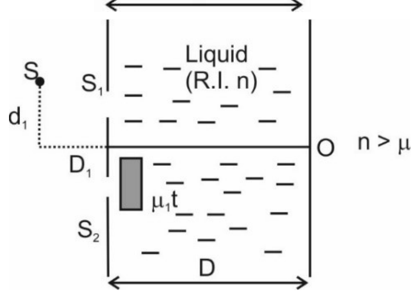
Column-I **Column-II**

(A) 

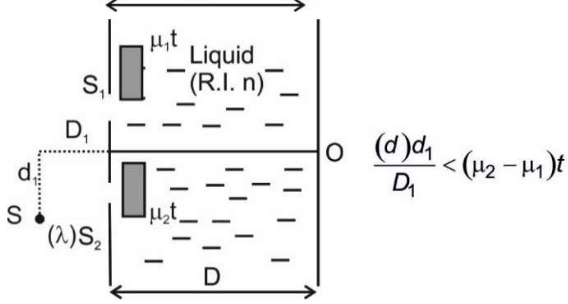
(P) Central Maxima must be above point O

(B) 

(Q) Central Maxima must be below point O

(C) 

(R) Central Maxima may be above or below point O

(D) 

(S) Frindge width $(\beta) = \frac{\lambda D}{d}$

(T) Frindge with $\beta = \frac{\lambda D}{nd}$

20. Match the correct one for variation of A gravitational potential (V) and gravitational field intensity (E) vs distance r from centre

Column-I

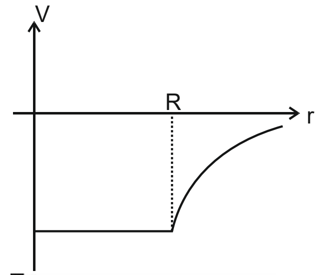
(A) Uniform Spherical Shell

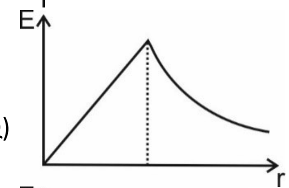
(B) Uniform Solid sphere

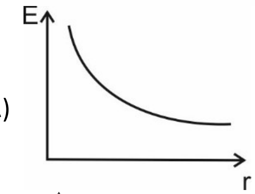
(C) Uniform Ring

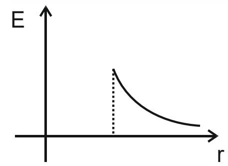
(D) Point mass

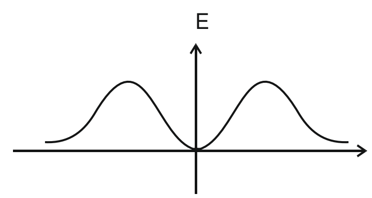
Column-II

(P) 

(Q) 

(R) 

(S) 

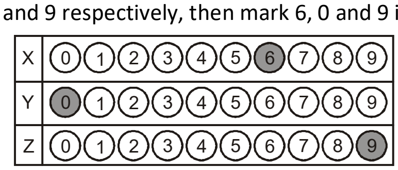
(T) 

PART – II: CHEMISTRY

SECTION - 1

Integer Value Type

This section contains **8** questions. The answer to each of the questions is a **single-digit integer,** ranging from 0 to 9. 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 6, 0 and 9 respectively, then mark 6, 0 and 9 in OMR respectively



21. Epimers are diastereomers with more than one stereo centre that differ in the configuration about only one stereocentre. Number of correct statement(s) regarding stereoisomers of aldohexoses

(I) D-glucose and D-Mannose are C2 epimers

(II) D-glucose and D-Allose are C3 epimers

(III) D-glucose and D-galactose are C4 epimers

(IV) D-galactose and D-Talose are C2 epimers

(V) D-Mannose and D-Talose are C4 epimers

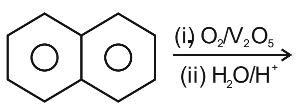
(VI) D-Allose and D-Altrose are C2 epimers

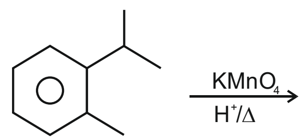
(VII) D-iodose and D-Talose are C3 epimers

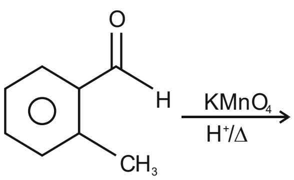
22. How many of the following compounds, when treated with acetylene give aromatic compounds?
   (I) $NH_4Cl + Cu_2Cl_2$
   (II) $Ni(CN)_2$
   (III) NH_3
   (IV) Red hot Fe tube at 773 K
   (V) HCN through Red hot tube
   (VI) $[Ag(NH3)]^{2+}$

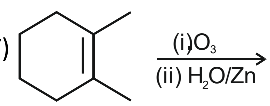
23. Wave number is the special frequency of a wave. The ratio of wave number of first line of Lyman series of Be^{+3} ion to limiting line of Lyman series of He^{+} ion is X : 1. The value of X is

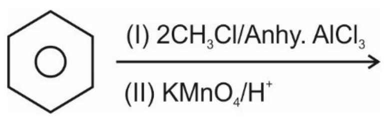
24. Phthalic acid is an aromatic dicarboxylic acid with molecular formula $C_6H_4(CO_2H)_2$. Although it is of modest commercial importance and prepared by different methods. Identify the number of correct chemical reactions from the following by which phthalic acid can be synthesised

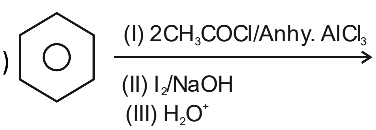
(I) 

(II) 

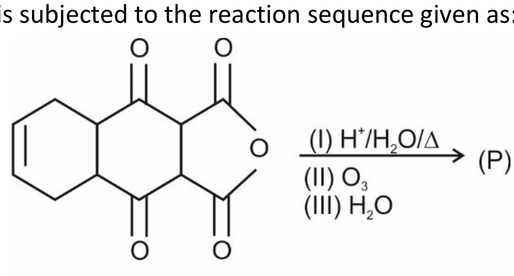
(III) 

(IV) 

(V) 

(VI) 

25. An organic compound (R) is subjected to the reaction sequence given as:



(R)

Number of Ketonic and carboxylic groups in (P) are A and B respectively. The value of A + B is

26. In the Crystalline Solids, atoms or ions are arranged in a fixed lattice arrangement. In how many of the following solids, Stoichiometry will be affected if cations and anions of the solid are interchanged ?

KCl, ZnS, CsCl, CaF_2, Na_2O, BeS, CUI, AgBr, CsCN

27. For a chemical reaction $P + Q \longrightarrow 2R$, the rate of reaction becomes doubled when conc. of P is doubled Keeping the concentration of Q same. However it becomes 5.6 times when the concentration of Q is doubled keeping the concentration of P same. If 'n' is the overall order of the reactions. Find the value of $50 - (2n)^2$. [log56 = 1.75]

28. A solution containing Cu^{+2} and $C_2O_4^{-2}$ ions on titration with 0.02 M $KMnO_4$ in presence of H_2SO_4 consumes 22.6 ml of the oxidant the resultant solution is neutralised with Na_2CO_3, acidified with dil acetic acid and treated with excess KI. The liberated iodine requires 11.3 ml of 0.05 M $Na_2S_2O_3$ solution for complete reduction. Calculate the Molar ratio of $C_2O_4^{-2}$ to Cu^{+2}

SECTION - 2

One or More Options Correct Type

This section contains **10** multiple choice questions. Each question has 4 choices (A), (B), (C) and (D), for its answer, out of which **one or more than one is/are correct.**

29. A 250 gm sample of water at 20°C is placed in a freezer that is held at a constant temperature of –20°C. Considering the water as the 'system' choose the correct statements

(A) After the water is placed into the freezer q_{system} is negative

(B) After the water is placed into the freezer, q_{system} is positive

(C) The initial enthalpy (of the water) is higher than the final enthalpy (of the ice)

(D) After several hours, the temperature of the water will be –20°C

30. Which is/are correct statement(s) about the solubility of AgCl(S)? Given: $K_{SP}(AgCl) = 10^{-10}$; $Kf\left[Ag(NH_3)_2^+\right] = 10^8$

(A) Solubility of AgCl in pure water is 10^{-5} g/L

(B) Solubility of AgCl in 2M KNO_3 is 10^{-5} mol/L

(C) Solubility of AgCl in 2M $AgNO_3$ is 5×10^{-11} M

(D) Solubility of AgCl in 2M NH_3 is 0.166 M

31. Select the false statement(s).

(A) Brownian motion and Tyndall effect are shown by true solution

(B) Sorption process is combinations of adsorption and absorption process

(C) Law Hardy-Schulze is related with coagulation of a Sol.

(D) Higher is the Gold number greater will be the protective power of a Colloid

32. Which of the following statement(s) is/are false?

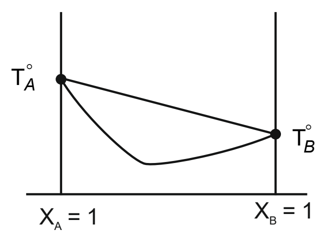
(A) In $[PtCl_2(NH_3)_4]^{+2}$ complex ion, the cis-form is optically active while trans form is optically Inactive

(B) In $[Fe(C_2O_4)_3]^{-3}$, geometrical isomerism does not exist while optical isomerism exists

(C) In $[Mabcd]^{\pm n}$ tetrahedral complexes, optical isomerism cannot be seen

(D) In $[Mabcd]^{\pm n}$ square planar complexes, generally optical isomerism can't be observed

33. A binary solution is prepared by mixing two volatile liquids (liquid A & liquid B) and the Boiling point curve is given as:



Then identify the correct statement(s)

(A) The vapour pressure of pure liquid B is more than A

(B) Liquid A is more volatile than B

(C) If it is non-ideal solution then it has –ve deviation

(D) If it is non-ideal solution then intermolecular attraction force between A & B in the mixture is less than the individual attraction between A – A and B – B

34. Consider the statements about interhalogen compounds of the elements of group-17 and select the correct statement(s)

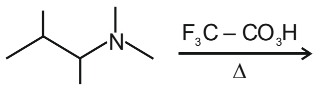
(A) ICl is stable compound but IF is not

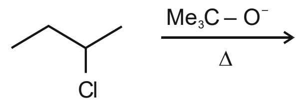
(B) ClF_3 is a Toxic hypergolic gas

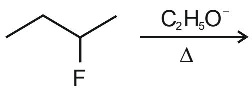
(C) BrF_3 is yellow liquid which conduct electric current

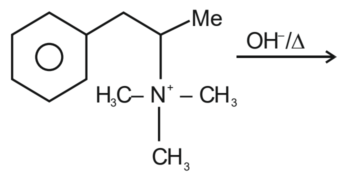
(D) ICl_3 is solid at room temperature and exists as dimer

35. Which of the following chemical reaction(s) will gives Hofmann (less substituted) alkene?

(A) 

(B) 

(C) 

(D) 

36. Select the correct statement(s) regarding extraction process

(A) When the lead-silver alloy is rich in silver, lead is removed by the cupellation process

(B) When the lead-Silver alloy is rich in lead, Ag is removed by Parke's or Pattinson's process

(C) Lead is extracted from galena by self-reduction

(D) Pb form alloy with Ag, from which Pb is separated by distillation

37. The pair(s) of reagents that yield paramagnetic species is/are

(A) Na and excess of liquid NH_3

(B) K and excess of O_2

(C) Cu and dilute HNO_3

(D) O_2 and 2-ethylanthraquinol

38. Nitrogen (I) oxide is produced by:

(A) Thermal decomposition of NH_4NO_3

(B) Disproportionation of N_2O_4

(C) Thermal decomposition of NH_4NO_2

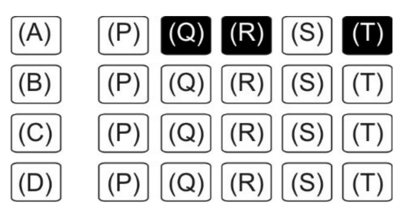
(D) Interaction of hydroxylamine and nitrous acid

SECTION - 3

Matching Column Type

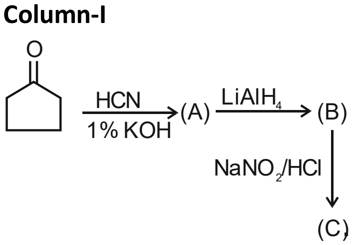
This section contains two questions. Each question contains two Columns (Column I and Column II). Column I has four entries (A), (B), (C) and (D), Column II has five entries (P), (Q), (R), (S) and (T). Match the entries in Column I with the entries in Column II. Each entry in Column I may match with one or more entries in Column II. The OMR contains a 4 × 5 matrix whose layout will be similar to the one shown below :

For each entry in Column I, darken the bubbles of all the matching entries. For example, if entry (A) in Column I matches with entries (Q), (R) and (T), then darken these three bubbles in the OMR. Similarly, for entries (B), (C) and (D)

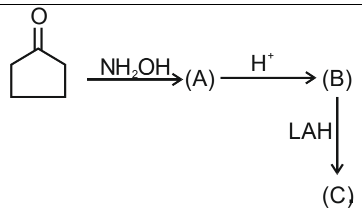


39. Match the Column (I) and Column(II)

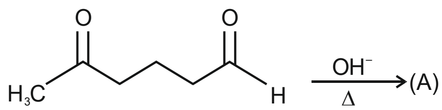
Column-I **Column-II**

(A) 

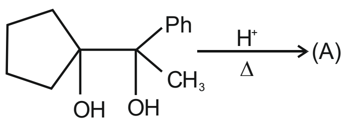
(P) 6 membered ring formation

(B) 

(Q) Final product is a Ketone

(C) 

(R) Carbanion intermediate is involved

(D) 

(S) Final Product will react with 2,4 DNP

(T) Final product is 2° cyclic amine

40. Column-I and Column-II contains four entries each. Entries of Column I are to be matched with some entries of Column II one or more than one entries of Column I may have the matching with the same entries of Column II.

Column-I

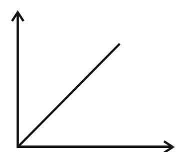
(A) $\frac{1}{V^2}$ v/s P (For ideal gas; T & n are constant)

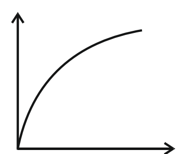
(B) V v/s $\frac{1}{T}$ (For ideal gas P & n are constant)

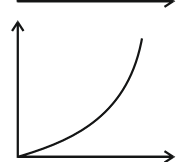
(C) PT v/s T^2 (For ideal gas ; V & n are constant)

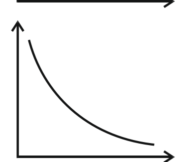
(D) V v/s $\frac{1}{P^2}$ (For ideal gas ; T & n are constant)

Column-II

(P) 

(Q) 

(R) 

(S) 

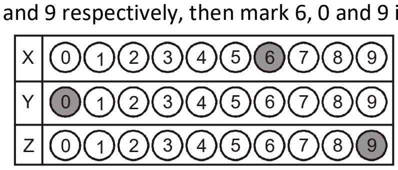
(T) Charles law holds good

PART – III: MATHEMATICS

SECTION - 1

Integer Value Type

This section contains **8** questions. The answer to each of the questions is a **single-digit integer,** ranging from 0 to 9. 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 6, 0 and 9 respectively, then mark 6, 0 and 9 in OMR respectively



41. If $P = \lim_{x\to\infty} \frac{\sum_{i=0}^{2020}\left[x^i\right]}{\sum_{i=0}^{2020} x^i}$, where [.] denotes the greatest integer function. Then the value of $\frac{12}{\pi}\sin^{-1}P$ is

42. If $S_n(\theta)=\sum_{r=1}^{n}\frac{\cos(r-1)\theta}{(\cos\theta)^{r-1}}$, then sum of the series $\left[S_3\left(\frac{\pi}{3}\right)\right]+\left[S_9\left(\frac{\pi}{3}\right)\right]+\left[S_{15}\left(\frac{\pi}{3}\right)\right]+....+\left[S_{2025}\left(\frac{\pi}{3}\right)\right]$ is where [.] denotes the greatest integer function)

43. If $2\cos^4 x+\sqrt{5}\left(\sqrt{5}-1\right)=\cos^2 x\left(\sqrt{5}+1+2\sin x\right)+\left(\sqrt{5}-1\right)\sin x$, then

$\sin^{10}x+4\sin^9 x+6\sin^8 x+4\sin^7 x+\sin^6 x+\sin x+1$ equals

44. Focus of parabola $y^2 = 4ax$ (a > 0) and one of the Focii of $3x^2 + 4y^2 = 12$ coincide. The ray of light coming out of their common focus strikes at their point of intersection. If the angle between the reflected rays by parabola and Ellipse is θ, such that $\tan\theta=\frac{-P\sqrt{6}}{5}$, then P equals

45. If three Ellipses

$$E_1 = x^2+\frac{y^2}{2}=1$$

$$E_2=\frac{x^2}{2}+\frac{y^2}{P^2}=1$$

$$E_3=\frac{x^2}{3}+\frac{y^2}{2P}=1$$

has a common tangent, then the value of 12Psin54° is

46. A man has four coins A, B, C and D. The probability of head appearing when tossed are $\frac{1}{2},\frac{1}{3},\frac{2}{3}$ and $\frac{3}{4}$ for A, B, C and D respectively. If one of the coins chosen at random, is tossed three times giving one head and two tails, then the probability that the chosen coin was D is P. The value of $\left(\frac{454P}{9}\right)$ is

47. If $S_x=\frac{1}{(x+1)^2}\begin{vmatrix}3x^2+1 & 2x^3+2x & 2x+1\\ 4x^2+x+2 & 4x^3+2x+1 & 2x+3\\ x^2+3x & 3x^2+x & 2x+1\end{vmatrix}$ for $x\in N$ and $Ep=\sqrt{S_{p+1}}-\sqrt{S_p}$, then $\left[\frac{\sum_{p=1}^{2020}E_p}{(2020)^2}\right]$ is equal to

([ ] denotes the greatest integer function)

48. If *abcde* is a five digit number formed by using digits 1 to 9 such that $b^2 = d$ and a < b < c < d < e, then the total such numbers will be

SECTION - 2

One or More Options Correct Type

This section contains **10** multiple choice questions. Each question has 4 choices (A), (B), (C) and (D), for its answer, out of which **one or more than one is/are correct.**

49. If $f(y)=\int_{\frac{\pi}{4}}^{y}\left((\tan x)^x-(\cot x)^x\right)(2x\operatorname{cosec}2x+\ln\tan x)\,dx$, where $y\in\left(\frac{\pi}{4},\frac{\pi}{2}\right)$. Then

(A) $f\left(\frac{\pi}{3}\right)=3^{\frac{\pi}{6}}-3^{-\frac{\pi}{6}}$

(B) $f\left(\frac{\pi}{3}\right)=3^{\frac{\pi}{6}}+3^{-\frac{\pi}{6}}-2$

(C) $f\left(\frac{2\pi}{5}\right)<f\left(\frac{\pi}{3}\right)$

(D) $f\left(\frac{2\pi}{5}\right)<f\left(\frac{3\pi}{7}\right)$

50. If P is the root of the equation $2^{2x+1}+2.3^{2x}+6^{2x}-2^{x+1}.3^{x}-2^{x+2}-4.3^{x}+5=0$ and $A=\begin{bmatrix}1 & P & 1\\ P^2 & 0 & 1\\ 1 & 1 & 2P\end{bmatrix}$ satisfies $A^3+\alpha A^2+\beta A+\gamma I_3=0$, then

(A) $\beta^2+4\alpha\gamma=0$ (B) $\beta^2-4\alpha\gamma=0$

(C) $\alpha=\beta+\gamma$ (D) $|\alpha|+|\gamma|=|\beta|$

51. Let $\vec{b}$ and $\vec{c}$ be two non-collinear vectors and $\vec{a}$ is a vector such that $\vec{a}.(\vec{b}+\vec{c})=6$ and $\vec{a}\times(\vec{b}\times\vec{c})=(-x^2-4x+1)\vec{b}+\cos y\vec{c}$. Then which of the following equation(s) are satisfied by atleast one ordered pair (x, y)

(A) $2x+y-\pi+4=0$ (B) $x-y+2\pi+2=0$

(C) $x=-2$ (D) $7x-y+15\pi+14=0$

52. If α,β are two distict positive numbers satisfying $x^3-2020x^2+2021=0$ and $a_n=\alpha^n+\beta^n$ for $n\in N$. Then

(A) $a_n\in N$ for all $n\in N$ (B) $2020\,a_{2020}=2021a_{2018}+a_{2021}$

(C) $\dfrac{a_7+a_4}{a_6-a_4}=1010$ (D) $\dfrac{a_7+a_4}{a_6-a_4}=\alpha\beta-1$

53. If $\lim\limits_{n\to\infty}\prod\limits_{r=0}^{n}\left(\sqrt{\frac{r}{n}}+\tan^{-1}\sqrt{\frac{r}{n}}\right)^{\frac{r+2n}{\sqrt{r.n}(r+n)}}=\left(\frac{a\pi+4}{b.e}\right)^{\frac{p\pi+4}{q}}$ then,

(A) $b=q$ (B) $p+q=5$

(C) $a+b=5$ (D) $q-p=1$

54. Which of the following cannot be the length of normal chord to the parabola $y^2=16x$?

(A) 12 (B) $12\sqrt{3}$

(C) 24 (D) $24\sqrt{3}$

55. Let $|Z|=N$, $N\in\{1,2,3....\}$ are concentric circles. A ray of light emerges from point (1,0) in the direction $-\sqrt{3}\hat{i}+\hat{j}$ and strikes the circle $|Z|=1$ at Z_1 and after reflection again strikes the circle $|Z|=1$ at Z_2. Similarly this is repeated for $|Z|=2$ & $|Z|=3$ & .$|Z|=n$ ray emerges from the points (2, 0) (3, 0) .... (n, 0) in the direction of $-\sqrt{3}\hat{i}+\hat{j}$ and strikes each circle at two points by reflection. So (Z_1, Z_2) for $|Z|=1$; (Z_3, Z_4) for $|Z|=2$; (Z_5, Z_6) for $|Z|=3$ and so on (Z_{2n-1}, Z_{2n}) for $|Z|=n$. Then

(A) Z_1, Z_3, Z_5, Z_7.....are in a straight line (B) $\arg(Z_3-Z_1)-\arg(Z_4-Z_2)=-\dfrac{2\pi}{3}$

(C) $\sum\limits_{r=1}^{n}Z_{2r-1}^2+\sum\limits_{r=1}^{n}Z_{2r}^2=-\dfrac{n(n+1)(2n+1)}{6}$ (D) $|Z_2|,|Z_4||Z_6|.......|Z_{2n}|$ are in A.P

56. Sides of a triangle ABC are in A.P. If a < minimum {b, c} then cos A may be equal to

(A) $\dfrac{4b-3c}{2b}$ (B) $\dfrac{3c-4b}{2c}$

(C) $\dfrac{4c-3b}{2b}$ (D) $\dfrac{4c-3b}{2c}$

57. If x and y are two real numbers connected by the equation $9x^2+2xy+y^2-92x-20y+244=0$ then

(A) The number of integral values of x which satisfy this equation is 4

(B) The number of integral values of y, which satisfy this equation is 10

(C) The given equation represents ellipse

(D) Area of given ellipse is $\dfrac{9\pi}{\sqrt{2}}$ units

58. Two lines $L_1 \equiv \left(2\hat{i}+3\hat{j}+\hat{k}\right)+\lambda\vec{a}$ and $L_2 \equiv \left(\hat{i}+9\hat{j}+11\hat{k}\right)+\mu\left(\hat{i}-\hat{j}+\hat{k}\right)$ are such that $L_1 \perp L_2.\vec{a}$ is coplanar with $\vec{b}=2\hat{i}+\hat{j}+\hat{k}$ and $\vec{c}=-\hat{i}+4\hat{j}+\hat{k}$ and $\vec{a}.\vec{b}=5$. Then

(A) $\left|\vec{a}\right|=\sqrt{6}$

(B) $\vec{a}.\vec{c}=8$

(C) $\left|\vec{a}\times\left(\vec{b}\times\vec{c}\right)\right|=3\sqrt{66}$

(D) $\vec{b}.\vec{c}=2$

SECTION - 3

Matching Column Type

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(A)	(P)	**(Q)**	**(R)**	(S)	**(T)**
(B)	(P)	(Q)	(R)	(S)	(T)
(C)	(P)	(Q)	(R)	(S)	(T)
(D)	(P)	(Q)	(R)	(S)	(T)

59. Match the following:

Column-I	Column-II
(A) $L=\lim\limits_{x\to 0}\dfrac{\sin^{-1}x-\sin x}{\tan^{-1}x-\tan x}$, then 2|L| equals	(P) 0
(B) Number of points of discontinuity for $f(x)=\text{sgn}\left(\{x\}^{2020}-\{x\}^{2022}+1\right)$ (Where {.} denotes fractional part function	(Q) 1
(C) Number of values of x for which $\sqrt{1+2x}+\sqrt{2+x}=\sqrt{1-2x}+\sqrt{2-x}$	(R) $-\dfrac{1}{2}$
(D) Numbers of solution of $\{x\}+2[x^2]=3[2^x]+4[\ln x]$ $x\in R^+-Z$ (Where [.] and {.} denotes the greatest integer function and fractional part function)	(S) $\dfrac{1}{2}$
	(T) 2

60. Match the following:

Column-I	Column-II
(A) If lines L_1 and L_2 have direction cosines as l_1, m_1, n_1 and l_2, m_2, n_2 respectively then maximum value of $l_1m_2 + m_1n_2 + n_1l_2$ is	(P) 2
(B) If the vectors $\vec{P}=\lambda\hat{i}+\hat{j}+2\lambda\hat{k}$ $\vec{Q}=\hat{i}+\lambda\hat{j}+\hat{k}$ and $\vec{R}=\hat{i}+\hat{j}+2\lambda\hat{k}$ are coplanar then number of values of [|λ|] is (Where [.] denotes the greatest integer function)	(Q) 1

(C) If the minimum value of $\frac{5\sin^4\theta}{9}+\frac{5\cos^4\theta}{16}$ is $\frac{1}{P}$ then P is	(R) 4
(D) In a polygon of n sides if number of triangles with no side common to that of polygon is 0, then maximum value of n is	(S) 5
	(T) 3

❒❒❒