Test Date: 05/07/2020

Aakash

Medical | IIT-JEE | Foundations

(Divisions of Aakash Educational Services Limited)

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CODE

Time : 3 hrs

Mock Test_CoE_XII

for JEE (Advanced) - 2020

MM : 264

Test – 1A (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.

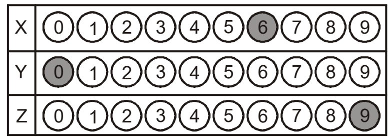
(iv) **Section-3:** This section contains **2** questions. Each question contains two Columns (Column I and Column II). Column I has four entries (A), (B), (C) and (D), Column II has five entries (P), (Q), (R), (S) and (T). Match the entries in Column I with the entries in Column II. Each entry in Column 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

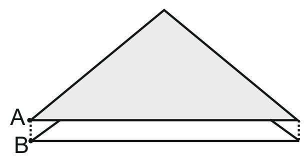
SECTION - 1

Integer Value Type

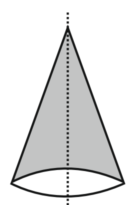
This section contains **8** questions. The answer to each of the questions is a **single-digit integer,** ranging from 0 to 9. The answer will have to be appropriately bubbled in the OMR as per the instructions as follows. **Examples-** If the correct answer to question numbers X, Y and Z (say) are 6,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



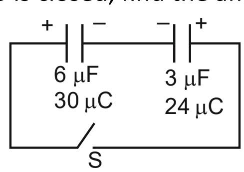
1. Two parallel equilateral plates are placed overlapping each other very close to each other as shown in figure. The plates carry uniformly distributed charge of density σ and $-\sigma$. If electric field at mid-point of the line joining the centres of two plates is E_0, then it is at mid-point of AB is $\frac{E_0}{n}$. Find n



2. The moment of inertia of a right circular solid cone of mass 10 kg, radius 1 m and height 3 m about its axis in S.I. unit is ____

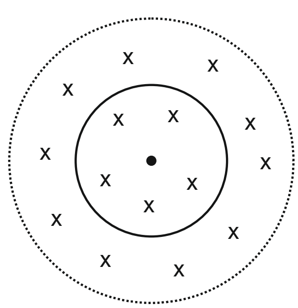


3. In the circuit shown, when the switch S is closed, find the amount of heat generated in mJ



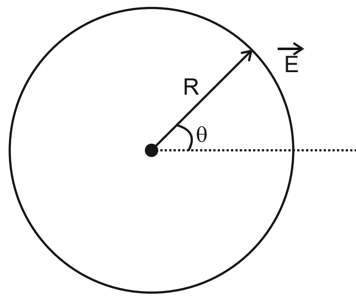
4. A uniform sphere has mass M and radius R. If the pressure at centre due to gravitational compression is $\frac{3GM^2}{k \times \pi R^4}$, then find k.

5. A non-conducting ring of mass m radius R and uniformly distributed charge Q is placed on rough horizontal surface. A time varying magnetic field $B = 4t^2$ is switched on at $t = 0$ which is directed normal to ring. If the ring starts rotating at $t = 2$s, then coefficient of friction is given by $k \times \frac{QR}{mg}$. Find k.



6. A circular wire of mass M, radius R, cross sectional area A and Young's modulus Y is rotated about its axis with constant angular speed ω. If elastic energy stored in wire is given by $U = \frac{M^2\omega^4R^3}{\lambda\pi YA}$, then find λ

7. A conducting sphere of radius R is placed in uniform electric field. The induced charge density on sphere is $\sigma_0\cos\theta$, where θ is polar angle. If the electric force on the charges of same sign is $\frac{\pi R^2\sigma_0^2}{n \in_0}$, then value of n is ___



8. One mole of an ideal gas undergoes a processes in which temperature varies with volume as $T = T_0 + 16\ V^2$. If the minimum pressure attained is $\lambda R\sqrt{T_0}$, then value of λ is ___

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. A long capillary tube of radius r is dipped vertically in a liquid of density ρ. The angle of contact is zero and surface tension is S. If viscosity of liquid is very low, then maximum rise of liquid in the tube h is related as

(A) $h < \frac{2S}{\rho gr}$

(B) $h > \frac{2S}{\rho gr}$

(C) $h < \frac{4S}{\rho gr}$

(D) $h > \frac{4S}{\rho gr}$

10. The potential energy of a particle of mass m which can move along x-axis is given as U = α |x|, where α is a positive constant. If the particle is projected from origin with velocity V_0, then

(A) Motion of particle is SHM

(B) Motion of particle is not SHM

(C) Time period of motion is $\frac{2mV_0}{\alpha}$

(D) Time period of motion is $\frac{4mV_0}{\alpha}$

11. In a displacement method experiment, distance between screen and object is 120 cm. The ratio of sizes of images formed is 1 : 9, then

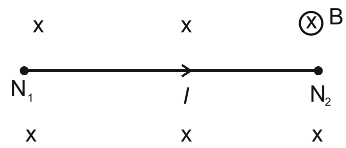
(A) Focal length of lens is 15 cm

(B) Focal length of lens is 22.5 cm

(C) Distance between two positions of lens is 60 cm

(D) The smaller image is more brighter than larger image

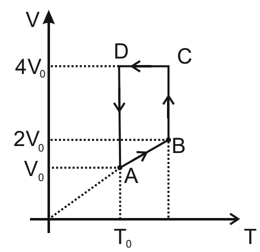
12. An elastic conducting cord of length l_0 and force constant k is fastened to the nails N_1 and N_2 as shown. Uniform magnetic field B is present as shown. If constant current I is passed through cord, then in steady state



(A) Shape of cord would be circular arc
(B) Shape of cord would be parabolic arc
(C) Shape of cord would be elliptical arc
(D) Magnetic force of cord is $I\,l_0\,B$

13. A non-conducting long hollow cylinder of radius R having uniform surface charge density σ is rotated with varying angular speed given as $\omega = kt$, where k is small positive constant, then
(A) Magnetic field inside cylinder is uniform (in space)
(B) Electric field inside cylinder is uniform (in space)
(C) Magnetic field strength is constant
(D) Electric field strength is constant

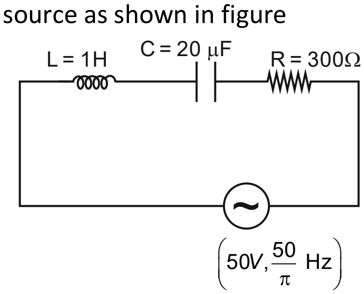
14. One mole of an ideal monoatomic gas is taken through a cyclic process as shown in figure. If T_0 = 27°C, then



(A) Temperature at C is 327°C
(B) Heat supplied to gas in process A $\rightarrow$ B is 750 R
(C) Total work done by gas in cyclic process is 300R
(D) Total heat absorbed by the gas is 450 R

15. A white light beam is incident normally on a glass plate of thickness 5×10^{-7} m. The refractive index of glass is 1.50. The wavelength of light which is/are strongly reflected by plate is/are (approximately)
(A) 460 nm
(B) 430 nm
(C) 530 nm
(D) 600 nm

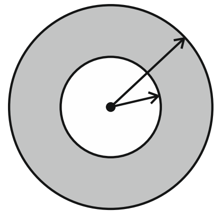
16. In a series LCR circuit with an AC source as shown in figure



(A) rms current in circuit is 0.2 A
(B) Circuit is in resonance
(C) rms voltage across capacitor is 50 V
(D) Power factor of circuit is 0.6

17. A beam of photons of energy $\frac{144\,E_0}{225}$ is incident on identically excited hydrogen like ions, where E_0 is ionization energy of hydrogen atom in ground state. Ten distinct lines are observed in emission spectrum. Then
(A) Initially ions were in second excited state
(B) Ions get excited to fourth excited state
(C) Ions are of lithium
(D) Ions are of helium

18. The space between two concentric spherical shells of radii 30 cm and 90 cm is filled with a material of conductivity k. If inner cell is maintained at 100°C and the outer shell is **maintained** at 0°C, then



(A) Temperature at 60 cm from centre is 40°C
(B) Temperature at 60 cm from centre is 25°C
(C) Temperature of 50°C is at distance 50 cm from centre
(D) Temperature of 50° C is at distance 45 cm from centre

SECTION - 3

Matching Column Type

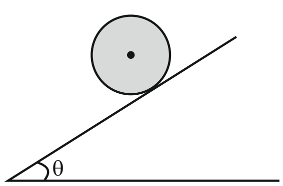
This section contains two questions. Each question contains two Columns (Column I and Column II). Column I has four entries (A), (B), (C) and (D), Column II has five entries (P), (Q), (R), (S) and (T). Match the entries in Column I with the entries in Column II. Each entry in Column I may match with 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)

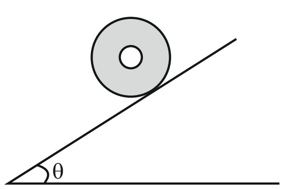
(A)	(P)	**(Q)**	**(R)**	(S)	**(T)**
(B)	(P)	(Q)	(R)	(S)	(T)
(C)	(P)	(Q)	(R)	(S)	(T)
(D)	(P)	(Q)	(R)	(S)	(T)

19. Column-I contains four object rolling without slipping on an inclined plane as shown. Column-II contains related quantities for rolling objects in Column I. Match the entries of two columns

Column-I **Column-II**

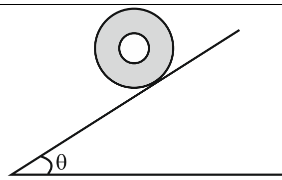


(A) (P) Minimum coefficient of friction required Solid sphere mass m, radius R is $\frac{5}{13}\tan\theta$



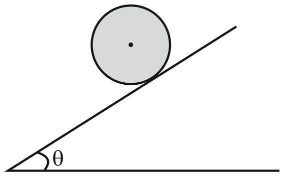
(B) (Q) Minimum coefficient of friction

required Cylindrical shell of radii R and 2R mass m is $\frac{1}{3}\tan\theta$

(C) 

Spherical shell mass = *m* radii = *R*, 2*R*

(R) Acceleration of centre is $\frac{5}{7} g \sin\theta$

(D) 

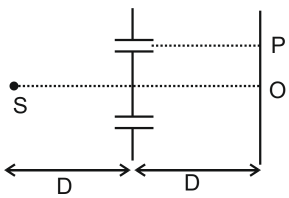
Disc, mass *m* radius *R*

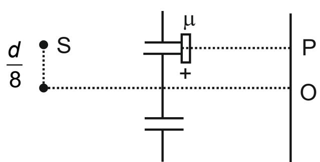
(S) Acceleration of centre is $\frac{8}{13} g \sin\theta$

(T) Frictional force is $\frac{31}{101} mg \sin\theta$

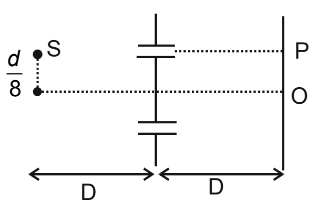
20. Column-I contains cases of modified YDSE where $D = 1.5\ m$, $d = 1$ mm and λ (in air) = 500 nm. Maximum intensity on screen is I_0. O and P are points on screen. Match the entries of two columns.

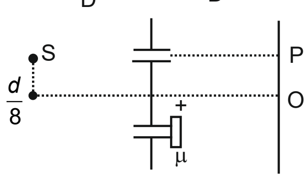
Column-I

(A) 

(B) 

$(\mu - 1)t = \frac{5\lambda}{12}$

(C) 

(D) 

$(\mu - 1)t = \frac{\lambda}{3}$

Column-II

(P) Intensity at O is $\frac{3I_0}{4}$

(Q) Intensity at P is $\frac{I_0}{2}$

(R) Intensity at O is I_0

(S) Intensity at P is $\frac{I_0}{4}$

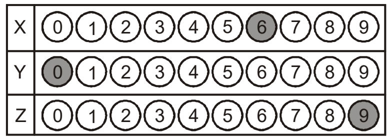
(T) Intensity at O is zero

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. Consider the given aldohexose

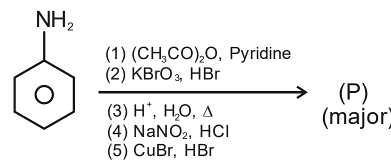
$$\begin{array}{l} CHO \\ | \\ CH_2 \\ | \\ CHOH \\ | \\ CHOH \\ | \\ CHOH \\ | \\ CH_2OH \end{array}$$

The given aldohexose exists in it D-form and is allowed to undergo cyclisation to give its form pyranose form. How many stereoisomers are formed?

22. A radioactive compound undergoes first order decomposition. The time taken for its activity to become 1/8 and 1/10 of its initial concentration are t_1 and t_2 respectively. The ratio $\frac{t_2}{t_1}$ can be expressed as $\frac{10}{x}$.

What is the value of x?

23. Consider the given reaction sequence



The number of bromine atoms present in 1 molecule of compounds (P) is

24. How many geometrical isomers are possible for the hexa-coordinated complex$[CoCl_2(\textbf{gly})_2]^-$?

$$gly \equiv H_2N-CH_2-\overset{\overset{\displaystyle O}{||}}{C}-O^-$$

25. Conductance of 0.2 M solution of an electrolyte was found to be 0.02 S. The specific conductance of the solution was found to be 1.4 Sm^{-1}. If the resistance of the 0.5 M solution of same electrolyte is 280 Ω, then the molar conductivity of the 0.5 M solution of the electrolyte is $(x \times 10^{-y})$ S m^2mol^{-1} when expressed in specific notation. Report the value of (x + y)

26. The maximum number of electrons which have principal quantum number n = 4 and the sum of magnetic quantum number (m) and azimuthal quantum number (l) equal to zero *i.e.* l + m = 0 is

27. How many of the given compounds are amphoteric?

Cr_2O_3, BeO, SnO, SnO_2, ZnO, Al_2O_3, PbO, PbO_2, B_2O_3

28. 0.1 molal solution of a complex represented as $CoCl_3.xNH_3$ shows a depression in freezing point equal to 0.558 K. If the complex is hexa-coordinated and there is no NH_3 outside the coordination sphere, then find the value of x. (K_f of H_2O = 1.86 K $molal^{-1}$)

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. Upon heating $KClO_3$ in presence of catalytic amount of MnO_2, a gas W is formed. Excess of W reacts with white phosphorus to give X. Reaction of conc. HNO_3 with X produce Y and Z

$$KClO_3 \xrightarrow[MnO_2]{\Delta} \underset{(Gas)}{W} \xrightarrow[(White)]{P_4} X \xrightarrow{HNO_3} Y + \underset{(N\ containing)}{Z}$$

Select the correct option(s).

(A) W is ozone

(B) X is P_4O_{10}

(C) Y is H_3PO_3

(D) Z is N_2O_5

30. Which of the following is correct about the diffusion coefficient of an ideal gas?

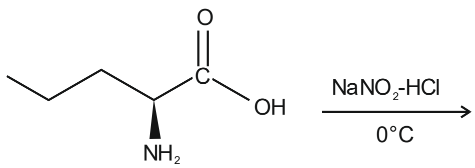
(A) It is proportional to mean free path of the gas

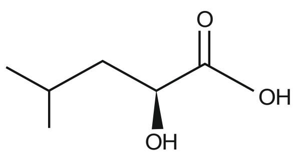
(B) It is inversely proportional to mean free path

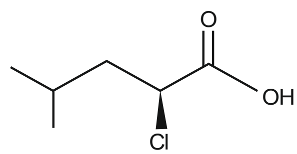
(C) It is proportional to mean speed of the gas

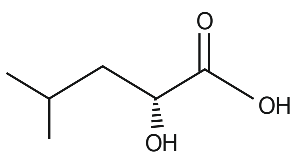
(D) It is inversely proportional to mean speed of the gas

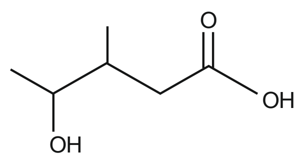
31. The major product of the given reaction is



(A) 

(B) 

(C) 

(D) 

32. Select the correct statement(s) about the preparation of amines through Ammonolysis of alkyl halides.

(A) Ammonolysis can produce primary, secondary and tertiary amines

(B) The order of reactivity of halide follows the order R – I > R – Br > R – Cl in Ammonolysis

(C) If Ammonia is taken in excess then major product is primary amine

(D) If alkyl halide is taken in excess, then major product is quaternary ammonium salt

33. Consider the given species:

N_2, O_2^-, C_2 and Be_2^+

Select the correct statement(s).

(A) Ionisation increases bond order in two of these species

(B) Ionisation decreases bond order in two of these species

(C) Two of these species have antibonding molecular orbital as LUMO

(D) Three of these species have antibonding molecular orbital as LUMO

34. Cr^{2+} and Mn^{3+} both exhibit d^4 configuration. Which of the following is correct about their oxidising or reducing nature?

(A) Cr^{2+} acts as reducing agent

(B) Cr^{2+} acts as oxidising agent

(C) Mn^{3+} acts as reducing agent

(D) Mn^{3+} acts as oxidising agent

35. Select the correct statement(s) from the following

(A) Frenkel defect is non-stoichiometric defect

(B) Schottky defect increases the conductivity

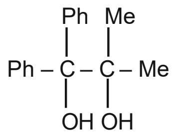
(C) Impurity defect always increases the density in ionic solids

(D) Metal excess defect is a non-stoichiometric defect

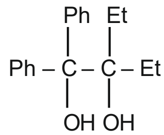
36. Which of the given statement(s) is/are correct?

(A) Benzaldehyde gives positive Fehling's test
(B) Benzaldehyde gives positive Tollen's test
(C) Benzoin gives positive Tollen's test
(D) Acrylaldehyde gives positive Tollen's test

37. A mixture of two Pinnacols (P) and (Q) are subjected to reaction with conc. H_2SO_4

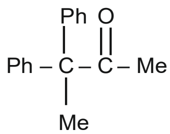


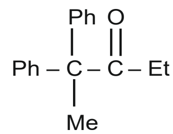
(P)

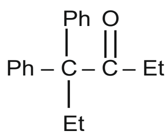


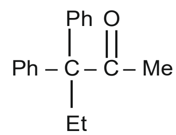
(Q)

The products obtained are

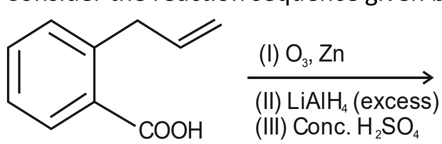
(A) 

(B) 

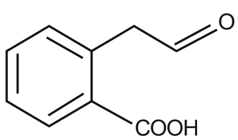
(C) 

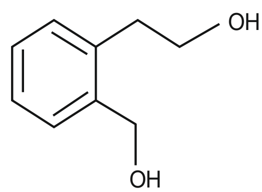
(D) 

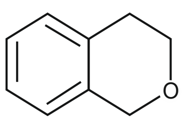
38. Consider the reaction sequence given below

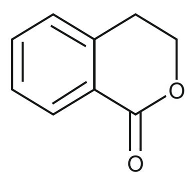


Which of the given compounds are formed during the course of the reaction?

(E) 

(B) 

(C) 

(D) 

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)

39. Match the ores or mineral given in Column-I to the properties on operations given in Column-II

Column-I	**Column-II**
(A) Siderite	(P) Carbonate ore
(B) Chromite	(Q) Sulphide ore
(C) Cryolite	(R) Oxide ore
(D) Argentite	(S) Contains more than one type of metal ion
	(T) Froth floatation must be done during extraction

40. Column-I contains certain cells while Column-II contains the properties associated with these cells. Match appropriately

Column-I	**Column-II**
(A) $Zn\left\|\underset{(0.1\,M)}{Zn^{2+}}\right\|\left\|\underset{(0.1\,M)}{Mg^{2+}}\right\|Mg$	(P) $E^{\circ}_{cell} > 0$
(B) $Ag\left\|\underset{1M}{Ag^{+}}\right\|\left\|\underset{1\,M}{Cl^{-}}\right\|AgCl\|\ Ag$	(Q) $E^{\circ}_{cell} = 0$
(C) $Pt\left\|\underset{1\,atm}{H_2}\right\|\underset{pH\,=\,2}{H^{+}}\left\|\right\|\underset{pH\,=\,1}{H^{+}}\left\|\underset{1\,atm}{H_2}\right\|Pt$	(R) $E_{cell} > 0$
(D) $Pt\left\|\underset{1\,atm}{Cl_2}\right\|\underset{(1\,M)}{Cl^{-}}\left\|\right\|\underset{(1\,M)}{Cl^{-}}\left\|\underset{0.5\,atm}{Cl_2}\right\|Pt$	(S) $E_{cell} < 0$
	(T) $E^{\circ}_{cell} < 0$

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

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

41. Eccentricity of an ellipse of minimum area circumscribing two circle of equal radius *r* touching externally is e , then $9e^2$ is equal to

42. Let $\vec{r}$ and $\vec{s}$ be unit vectors. If $\vec{t}$ is a vector such that $\vec{t}+\left(\vec{t}\times\vec{r}\right)=\vec{s}$, the maximum value of the volume of parallelepiped formed by $\vec{r}, \vec{s}$ and $\vec{t}$ is $\frac{3}{2k}$, then k is equal to

43. With usual notation in ΔABC, the numerical value of $\left(\frac{a+b+c}{r_1+r_2+r_3}\right)\left(\frac{a}{r_1}+\frac{b}{r_2}+\frac{c}{r_3}\right)$ is

44. Let $f:(0,\infty)\to(0,\infty)$ be a function differentiable at x = 3 and satisfying $f(3)=3f'(3)$ if the value of $\lim\limits_{x\to\infty}\left(\frac{f\left(3+\frac{3}{x}\right)}{f(3)}\right)^x$ is L then [L] is equal to (where [k] represents greatest integer function).

45. If the area bounded by the curve $y=x^2-x$ and the lines y=mx and y=nx is $\frac{37}{6}(m>n, m, n\in N)$ then the value of (m + n) is

46. The chord of circle $x^2+y^2-6x-8y=0$ passing through (0,0) and having positive slope, subtends an angle $\tan^{-1}\left(\frac{5}{4}\right)$ at the point where the circle meets the positive y-axis has the equation ax+by=0 then |3a + b| is equal to (where a, b are coprimes)

47. Common tangents are drawn to parabola $y^2=4x$ and the ellipse $3x^2+8y^2=48$ touching the parabola at A and B and ellipse at C and D. Let S_1 and S_2 represents area of circles with AB and CD as diameters respectively then $\frac{9}{16}\left(\frac{S_1}{S_2}\right)$ is equal to

48. If a chord PQ of hyperbola xy=4 is normal at the point P, subtending an angle α at origin O, then the value of $\left|\frac{\sin(\alpha-\beta)}{\sin(\alpha+\beta)}\right|$ (Where $\angle OPQ=\beta$) is equal to

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. In a game a person P at (x, y) can Jump to any one of the following points relatively (x+2,y), (x+4, y), (x,y+2), (x, y+4). If P is at (1,1) then the number of ways to reach the point

(A) (5,5) is 14

(B) (5,5) is 24

(C) (7,8) is 0

(D) (9,9) through (5,5) is 196

50. Let $A=[a_{ij}]_{3\times3}$ be a matrix with the elements either 0 (or) 1 and $S_i=\sum_{k=1}^{3}a_{ik}$ and $t_i=\sum_{k=1}^{3}a_{ki}$ If the probability of that the product $S_1S_2S_3t_1t_2t_3$ is an odd number, is $\frac{m}{n}$ then (m, n are coprimes)

(A) m + n = 33

(B) m + n=32

(C) number of divisors of mn= 6

(D) number of divisors of mn=12

51. If $I_m = \int_0^{m\pi} |\sin x| e^{\cos 4x} dx$

and $S_n = \int_0^{n\pi} x |\cos x| e^{\cos 4x} dx$ where $m, n \in N$ ([k] represents greatest integer function) then

(A) $\frac{S_{10}}{I_{10}} = \frac{S_{100}}{I_{1000}}$ (B) $\frac{S_{10}}{I_{10}} \neq \frac{S_{100}}{I_{1000}}$

(C) $\sin\left(\frac{S_{12}}{I_8}\right) = 0$ (D) $\sin\left(\frac{I_{12}}{I_8}\right) = \frac{1}{2}$

52. If the equation

$\left(2+\sin^2 x\right)^2 - (a-3)\left(2+\sin^2 x\right)\left(1+\sin^2 x\right) + (a-4)\left(1+\sin^2 x\right)^2 = 0$ has atleast one real root then the complete set of values of a is $[\alpha, \beta]$ then

(A) $\alpha + \beta = 11$ (B) $\beta - \alpha = \frac{1}{2}$

(C) $\alpha + \beta = \frac{23}{2}$ (D) $\beta - \alpha = 1$

53. If f(x) and g(x) are functions such that f(x+y) $= f(x)g(y) + g(x)f(y)$ then $\begin{vmatrix} f(\alpha) & g(\alpha) & f(\alpha+\theta) \\ f(\beta) & g(\beta) & f(\beta+\theta) \\ f(\gamma) & g(\gamma) & f(\gamma+\theta) \end{vmatrix}$ is independent of (where $f(\theta).\ g(\theta) \neq 0$)

(A) α (B) β

(C) γ (D) θ

54. Let $f: R \to R$ be a function defined by $f(x) = \begin{cases} \left[\left(x^2 + \sqrt{x^2+x+1}\ .\text{sgn}(x)\right)^{1/3}\right] & \text{if } [x] \le 1 \\ 0 & \text{if } [x] \ge 2 \end{cases}$ where [k] represents greatest integer function and sgn(x) represents signum function. If $\int_{-1}^{2} \frac{f(x^2).\sin x}{2+f(x+3)} dx = k \sin\alpha \sin\beta$, such that $\alpha > \beta$ then

(A) $f(k)f(\alpha) = 1$ (B) $4\alpha\beta = 1$

(C) $\alpha\beta = 4$ (D) $\beta(f(2\alpha)) = 0$

55. Let $f(x) = \sin x + ax + b$. Then $f(x) = 0$ has

(A) Only one real root which is positive if a > 1, b < 0

(B) Only one real root which is negative if a > 1, b > 0

(C) Only one real root which is negative if a < –1, b < 0

(D) Only one real root which is negative if a > 1, b < 0

56. Let $S = \sum_{k=1001}^{3001}\left(\frac{1}{k}\right)$, then

(A) S > 1

(B) S < 1

(C) $S > \frac{4}{3}$

(D) $S < \frac{4}{3}$

57. Let N = $2^2 \times 3^3 \times 7^4$, then

(A) Number of factors of N^2 which are less than N and are not the factors of N is 98

(B) Number of factors of N Which are of the form 4K + 1, K $\in$ N is 9

(C) Number of factors of N which are multiples of 54 is 10

(D) Numbers of factors of N which are of the form 4K + 1, K $\in$ N is 8

58. If the normal at any given point P (θ) on the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ meets its auxiliary circle at Q and R such that $\angle QOR = 90°$. O is centre of ellipse, then

(A) $2\left(a^2-b^2\right)^2 = a^4\sec^2\theta + a^2b^2\operatorname{cosec}^2\theta$

(B) $a^4+5a^2b^2+2b^4 = a^4\tan^2\theta + a^2b^2\cot^2\theta$

(C) $a^4+5a^2b^2+2b^4 > 2a^3b$

(D) $a^4+2b^4 \ge 5a^2b^2+2a^3b$

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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) Let $\vec{a} = i + j + k, \vec{b} = x\hat{i} + y\hat{j} + z\hat{k}$, where x,y,z ∈{–3,–2,–1,0,1,2} Then the number of possible vectors $\vec{b}$ such that $\vec{a}\vec{b}=0$ is	(P) $\frac{9}{16}$
(B) Let A and B are the interior points on the sides QR and RS of parallelogram PQRS and $\overline{QA} = 4\overline{AR}$ and $\overline{RB} = 4\overline{BS}$ If the line joining A and B intersects the diagonal PR at G such that $25\overline{PG} = \lambda\overline{PR}$, then λ equal to	(Q) 15
(C) If $\left\|\overline{AB}\times\overline{CD}+\overline{BC}\times\overline{AD}+\overline{CA}\times\overline{BD}\right\| = K.\Delta$ where A, B, C, D be any Four points and Δ being the area of ΔABC then K^2 equal to	(R) 25
(D) If $\bar{r} = xi + yj + zk; x,y,z > 0$ such that $\bar{r}.(i+j+k)=3$, then the Least value of $\frac{10x}{3-x}+\frac{10y}{3-y}+\frac{10z}{3-z}$ is	(S) 21
	(T) 16

60. Suppose f is a differential function satisfying the conditions $f(x + y) = f(x) + f(y) - xy$ and $f'(0) = 1$ and y=g(x) be the solution of the differential equation $x^2y\frac{d^2y}{dx^2}+\left(x\frac{dy}{dx}-y\right)^2=0$, such that $g(x)\geq 0\ \forall x\in(-\infty,0]\cup[1,\infty)$ and passing through (1, 0) and (2,1). then

Column-I	**Column-II**
(A) the number of points of nondifferentiability of y=|f(|x|)| is equal to	(P) $\frac{2}{3}$
(B) the value of g(0) is	(Q) 3
(C) the number of solutions of $\sqrt{f(x)}=g(x)$ is equal to	(R) 2
(D) the area bounded by $y=f(x)$ and $x-\text{axis}$ is	(S) 1
	(T) 0

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