

Test Date: 12/04/2020



Aakash

Medical | IIT-JEE | Foundations

(Divisions of Aakash Educational Services Limited)

Phase-III

B

CODE

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

Time: 3 hrs

FINAL TEST SERIES (ONLINE)

MM : 186

for JEE (Advanced)-2020

Test - 10 (Paper - 2)_Actual Pattern-2019

Topics covered:

- Physics** : System of Particles and Rotational Motion, Gravitation, Mechanical Properties of Solids, Mechanical Properties of Fluids
- Chemistry** : Thermodynamics, Equilibrium, Redox Reactions, Hydrogen, The s-Block Elements, P-Block Elements (XI syllabus)
- Mathematics**: Sequences and Series (Including Exponential & Logarithmic Series), Trigonometric Functions (Transformation Formulae, Trigonometric Equations, Properties of Triangle, Height & Distance)

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 three parts (**Physics, Chemistry and Mathematics**). Each part has three sections.
 - (ii) **Section-1:** This section contains **8** multiple choice questions which have one or more correct answer(s). Each question carries **+4** marks for correct answer and **-1** mark 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 **6** questions. The answer to each of the questions 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 **Two** List-Match sets. Each List-Match set has **Two** Multiple Choice Questions. **List-I has Four** entries (I), (II), (III) and (IV) and **List-II** has **Six** entries (P), (Q), (R), (S), (T) and (U). **Four** options are given in each Multiple Choice Question based on **List-I and List-II** and **Only one** of these four options satisfies the condition asked in the Multiple Choice Question. Each question carries **+3 marks** for correct answer and **-1 mark** for wrong answer.

PART – I: PHYSICS

SECTION - 1

One or More Options Correct Type

This section contains 8 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D), out of which **one or more is/are correct**.

1. A planet of mass M moves around the sun along an ellipse so that its minimum distance from sun is equal to R and maximum distance to $3R$. Choose the correct statement(s).

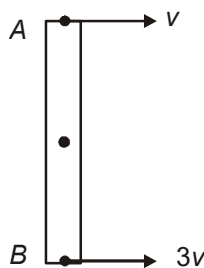
(A) Maximum speed of planet would be $\sqrt{\frac{3GM_s}{2R}}$

(B) Areal velocity of planet would be $\sqrt{\frac{3GM_s R}{8}}$

(C) Time period of planet would be $\frac{2\pi}{\sqrt{GM_s}}(2R)^{\frac{3}{2}}$

(D) Areal velocity remain constant as planet moves from apogee to perigee

2. A uniform rod of mass m and length l is shown in figure with velocity of its ends as shown. Choose the correct statement/s.



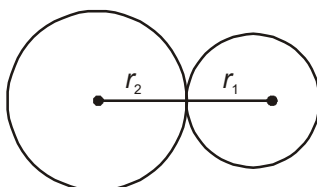
(A) Angular velocity of rod would be $\left(\frac{2v}{l}\right)$ anticlockwise

(B) Kinetic energy of rod would be $\frac{13}{6}mv^2$

(C) Acceleration of end A would be $\frac{2v^2}{l}$

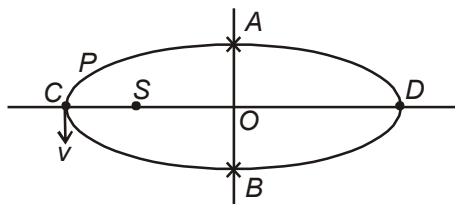
(D) Tension at middle of rod would be $\frac{mv^2}{l}$

3. Two horizontal discs of different radii are free to rotate about central vertical axis. One is given some angular velocity, the other is stationary. Their rims are now brought in contact. There is friction between the rims.



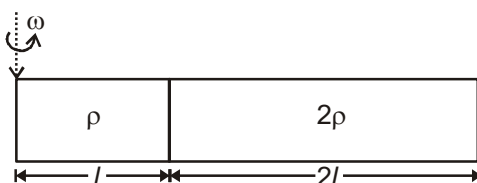
- (A) The force of friction between the rims will disappear when the discs rotate with equal angular speeds
- (B) The force of friction between the rims will disappear when they have equal linear velocities at the point of contact
- (C) The angular momentum of the system will be conserved
- (D) The rotational kinetic energy of the system will not be conserved

4. A planet P is moving along the elliptical orbit, about sun S , as shown, passing with the speed V at point C . Evaluate the correct statement. $SC = 2R, SD = 4R$



- (A) Time taken from C to D is $\frac{3\pi R}{2V}$ (B) Time taken from C to D is $\frac{2\pi R}{V}$
 (C) Speed at point A is $\frac{V}{\sqrt{2}}$ (D) Speed at point D is $\frac{V}{2}$

5. A thin tube, containing two immiscible liquids, of densities ρ and 2ρ , rotate with an angular velocity $\omega = \sqrt{\frac{g}{l}}$. Let P_x be the pressure at a distance x from axis of rotation

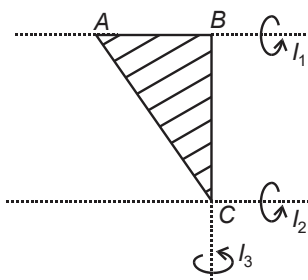


- (A) $P_l - P_r = \frac{\rho g l}{2} - \frac{\rho g r^2}{2l}$ (for $r \leq l$) (B) $P_l - P_r = \frac{\rho g l}{2} - \frac{\rho g r^2}{l}$ (for $r \leq l$)
 (C) $P_{3l} - P_r = 9\rho g l - \rho g \frac{r^2}{l}$, (for $l < r \leq 3l$) (D) $P_{3l} - P_r = 9\rho g l - \frac{\rho g r^2}{2l}$, (for $l < r \leq 3l$)

6. A uniform rod is lying on the horizontal table with $\frac{3}{4}$ th of its length out of the edge of the table. Small spheres each of mass one hundredth of mass of the rod, strike at the free end, vertically upward with the speed of $\frac{100}{3}$ m/s, maintaining rod just in equilibrium. If sphere comes to rest after collision. ($g = 10$ m/s²)

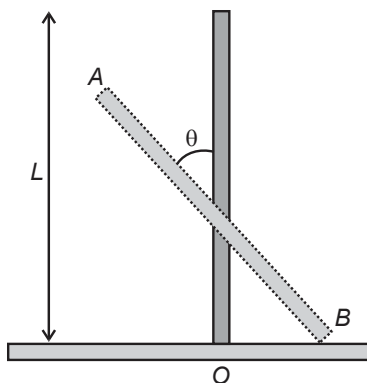
- (A) Minimum rate, of striking required, is 8 per second
 (B) Minimum rate, of striking required, is 10 per second
 (C) Maximum rate, of striking required, is 15 per second
 (D) Maximum rate, of striking required, is 18 per second

7. Moment of inertia of right triangular uniform plate about the given axis are shown as I_1, I_2 and I_3 . Evaluate the correct relation(s). Given $BC = 2AB$



- (A) $2(I_1 + 2I_3) = I_2$ (B) $I_1 : I_2 : I_3 = 4 : 12 : 1$
 (C) $I_1 = \frac{I_2}{3}$ (D) $I_1 + I_2 = 8I_3$

8. A rigid uniform bar AB of length L is slipping from its vertical position on a frictionless floor (as shown in the figure). At some instant of time. The angle made by the bar with the vertical is θ . Which of the following statements about its motion is/are correct?



- (A) The midpoint of the bar will fall vertically downward
- (B) The trajectory of the point A is a parabola
- (C) Instantaneous torque about the point in contact with the floor is proportional to $\sin \theta$
- (D) When the bar makes an angle θ with the vertical. The displacement of its midpoint from the initial position is proportional to $(1 - \cos \theta)$

SECTION - 2

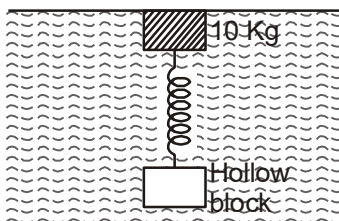
Integer Value Correct Type

This section contains 6 questions. The answer to each of the questions 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.

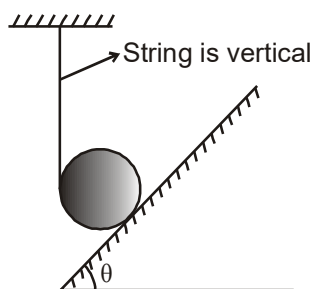
X	① ② ③ ④ ⑤ ⑥ ● ⑧ ⑨ ① ② ③ ④ ⑤ ● ⑦ ⑧ ⑨
Y	● ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ● ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨
Z	● ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ●

9. Two particles of mass 1 kg and 2 kg move towards each other under the mutual force of attraction when relative velocity of approach is 2 m/s, then centre of mass has velocity 1 m/s, the velocity in m/s of centre of mass when their relative velocity is 3 m/s is
10. A particle is projected with initial velocity of 20 m/s at an angle of 60° with horizontal. The angular velocity of particle with respect to point of projection when it is at its maximum height is $\frac{2}{n}$ rad/s. Value of n is ____
 ($g = 10 \text{ m/s}^2$)
11. A glass rod of diameter $d_1 = 1.5 \text{ mm}$ is inserted symmetrically into a glass capillary with inside diameter $d_2 = 2.0 \text{ mm}$. If the whole arrangement is vertically oriented and brought in contact with the surface of water in a tank, the height raised by the water in the capillary is $n \text{ mm}$. The value of n is ____ (Take surface tension of water = 0.07 N/m, density of water = 1 g/cc)

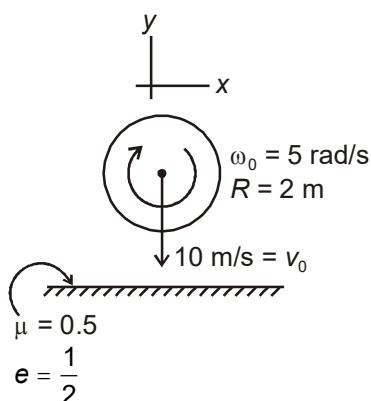
12. A block of mass 10 kg connected to another hollow block of same size and negligible mass, by a spring of spring constant 500 N/m, floats in water as shown in the figure. The compression (in cm) in the spring is



13. A string is wrapped around a cylinder of mass M and is resting on a rough incline of angle of inclination $\theta = 30^\circ$, as shown in the figure. The tension in the string, such that the cylinder does not slide and also not rotate is $\frac{Mg}{n}$. The value of n is _____



14. A disc hits a floor in elastically as shown in the figure. Find speed of the disc in horizontal direction just after the collision (in m/s).



SECTION - 3

Matching Lists Type

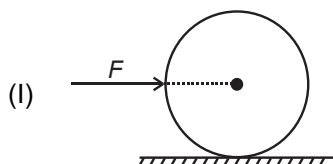
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Answer Q. 15 and Q. 16 by appropriately matching the lists based on the information given in the paragraph.

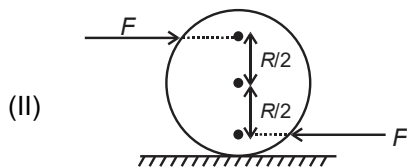
A ring of mass M , radius R is placed on rough horizontal surface. Horizontal forces act on the ring as shown in List-I. Magnitude of quantities are given in List-II. If ring rolls without slipping, then match the entries.

List-I

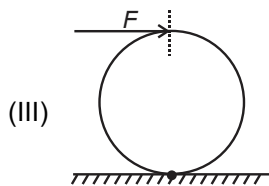
List-II



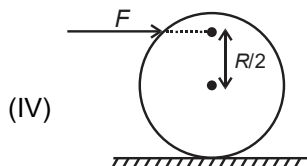
(P) 1



(Q) 2



(R) $\frac{1}{3}$



(S) $\frac{1}{2}$

(T) $\frac{3}{2}$

(U) Zero

15. If acceleration of ring shown in entry-I is a_0 , then the acceleration in different situation in terms of a_0 as listed will be

(A) I \rightarrow P; II \rightarrow R; III \rightarrow Q; IV \rightarrow T

(B) I \rightarrow P; II \rightarrow Q; III \rightarrow P; IV \rightarrow T

(C) I \rightarrow P; II \rightarrow P; III \rightarrow Q; IV \rightarrow T

(D) I \rightarrow P; II \rightarrow S; III \rightarrow Q; IV \rightarrow T

16. If friction force acting on the ring in case of entry-I is f_0 , then the friction force in different situation in terms of f_0 as listed will be

(A) I \rightarrow P; II \rightarrow P; III \rightarrow Q; IV \rightarrow S

(B) I \rightarrow P; II \rightarrow Q; III \rightarrow S; IV \rightarrow U

(C) I \rightarrow P; II \rightarrow R; III \rightarrow U; IV \rightarrow S

(D) I \rightarrow P; II \rightarrow P; III \rightarrow U; IV \rightarrow S

Answer Q. 17 and Q. 18 by appropriately matching the lists based on the information given in the paragraph.

A satellite is projected tangentially with velocity v_0 at height R above the surface of earth. If M, R be mass of earth and radius respectively then match the entries in List-I with List-II

List-I

List-II

(I) If maximum velocity during motion is v_1 , then $\frac{v_1}{v_0}$ is

(P) 1

(II) If minimum velocity during motion is v_2 , then $\frac{v_2}{v_0}$ is

(Q) $\frac{1}{2}$

(III) If time period is T_0 , then value of $\frac{\pi R}{v_0 T_0}$ is

(R) 2

(IV) Radius of curvature at point of projection r_1 .

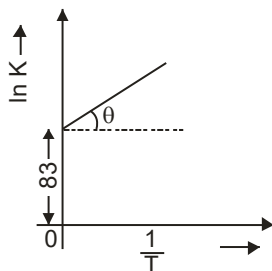
(S) $\frac{1}{4}$

Value of $\frac{r_1}{R}$ is

(T) $\frac{\sqrt{2}}{3}$

(U) $\frac{4}{3}$

23. Consider the graph for the reaction $Q \rightleftharpoons P$. (Take $R = 8.3 \text{ J/mol K}$) if $\theta = \tan^{-1}(5)$



Correct statement(s) is/are

- (A) $\Delta H = -41.5 \text{ kJ}$ (B) $\Delta H = 20.75 \text{ kJ}$
 (C) $\Delta H = 41.5 \text{ kJ}$ (D) $\Delta S = 688.9 \text{ J K}^{-1}$
24. The correct statement(s) or the order with the property indicated is/are (where X is halide)
 (A) GeX_4 is less stable than GeX_2 (B) PbX_2 is more stable than PbX_4
 (C) GeX_4 is more stable than GeX_2 (D) $\text{C} > \text{Si} > \text{Ge} > \text{Sn} > \text{Pb}$ (first ionisation energy)
25. The correct statement(s) is/are
 (A) Bond dissociation energy of D_2 is more than bond dissociation energy of H_2
 (B) Bond dissociation energy of H_2 is more than bond dissociation energy of D_2
 (C) Boiling point of H_2O_2 is more than boiling point of normal water
 (D) Viscosity of heavy water is more than viscosity of normal water at 25°C
26. $a\text{Cu} + b\text{HNO}_3 \rightarrow c\text{NO} + d\text{Cu}(\text{NO}_3)_2 + e\text{H}_2\text{O}$

Then the value of stoichiometric coefficients a, b and c if reaction is balanced with smallest whole number integers

- (A) $a = 3$ (B) $b = 4$
 (C) $b = 8$ (D) $c = 2$

SECTION - 2

Integer Value Correct Type

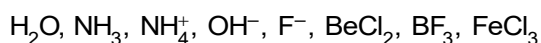
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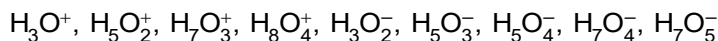
X	0 1 2 3 4 5 6 7 8 9
	0 1 2 3 4 5 6 7 8 9
Y	0 1 2 3 4 5 6 7 8 9
	0 1 2 3 4 5 6 7 8 9
Z	0 1 2 3 4 5 6 7 8 9
	0 1 2 3 4 5 6 7 8 9

27. $6.023 \times 10^X \text{ OH}^-$ ions are present in 1 ml solution of $\text{pH} = 1$ at 298 K. The value of X is

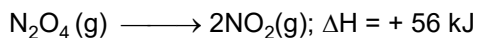
28. If number of Lewis base present in given compounds are X, then the value of X^2 is



29. Among the given species, how many are not having any existence?



30. 1 mole N_2O_4 gas is taken in a closed container of one litre. N_2O_4 gas completely changes into NO_2 gas. The gases deviate appreciable from ideal behaviour. If pressure changes from 40 atm to 80 atm during this change, then find out the magnitude of ΔE (in kJ) at 500 K. (Take 1 L atm = 0.1 kJ).



31. Molar heat capacity of water at constant pressure P is $90 \text{ JK}^{-1} \text{ mol}^{-1}$. When 1.0 kJ of heat is supplied to 100 g of water which is free to expand, increase in temperature of water is _____ K.

32. Number of oxygen shared per tetrahedron unit of cyclic Silicate is $\frac{x}{12}$ then x is _____.

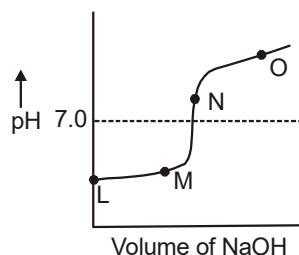
SECTION - 3

Matching Lists Type

This section contains **Two** List-Match sets. Each List-Match set has **Two** Multiple Choice Questions. **List-I** has **Four** entries (I), (II), (III) and (IV) and **List-II** has **Six** entries (P), (Q), (R), (S), (T) and (U). **Four** options are given in each Multiple Choice Question based on **List-I** and **List-II** and **Only one** of these four options satisfies the condition asked in the Multiple Choice Question.

Answer Question 33 and 34 by appropriately matching the list.

In the titration of Benzoic acid with sodium hydroxide, the following graph was obtained. Match the points L to O represented in graph with the properties mentioned in List II



List-I

I. L

II. M

III. N

IV. O

List-II

(P) $\text{pH} = 7 + \frac{\text{pK}_a}{2} + \frac{\log c}{2}$

(Q) $\text{pH} = \frac{\text{pK}_a}{2} + \frac{\log c}{2}$

(R) $\text{pH} = 14 - (-\log[\text{NaOH}])$

(S) $\text{pH} = \text{pK}_a + \log \frac{[\text{Salt}]}{[\text{Acid}]}$

(T) Only NaOH is present along with salt

(U) Only Benzoic acid is present

33. Which of the following is correct match for (I) and (II) ?

(A) I \rightarrow Q, U

(B) I \rightarrow Q, R

(C) II \rightarrow Q, U

(D) II \rightarrow P, S

34. Which of the following is correct match for (III) and (IV) ?

(A) III \rightarrow P, R

(B) III \rightarrow Q

(C) IV \rightarrow R, U

(D) IV \rightarrow R, T

Answer Question 35 and 36 by appropriately matching the list.

List I contains some thermodynamic values while List II contains some processes.

Match the following Lists.

List-I

I. $\Delta S_{\text{system}} > 0$

II. $\Delta S_{\text{system}} < 0$

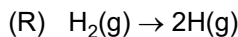
III. $\Delta H > 0$

IV. $\Delta H < 0$

List-II

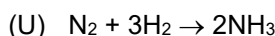


(Q) 1 mol of monoatomic ideal gas expands in vacuum at constant temperature of 300 K



(S) Condensation of 1 mol of H_2O at 370.15 K and 1 atm

(T) Reversible compression of 1 mol of ideal gas at constant temperature of 300 K from 10 L to 3 L



35. Which of the following is correct match for (I) and (II) ?

(A) I \rightarrow P, Q, R; II \rightarrow S, T, U

(B) I \rightarrow Q, R, S; II \rightarrow S, T, U

(C) I \rightarrow Q, R, U; II \rightarrow S, T

(D) I \rightarrow P, Q; II \rightarrow R, S, T

36. Which of the following is correct match for (III) and (IV) ?

(A) III \rightarrow R; IV \rightarrow P, S, T

(B) III \rightarrow R; IV \rightarrow P, S, U

(C) III \rightarrow R; IV \rightarrow P, R, S

(D) III \rightarrow Q; IV \rightarrow P, S, U

PART – III: MATHEMATICS

SECTION - 1

One or More Option Correct Type

This section contains 8 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D), out of which **one or more is/are correct**.

37. Which of the following options are correct?

(A) $\cot 7.5^\circ = \sqrt{2} + \sqrt{3} + \sqrt{4} + \sqrt{6}$

(B) $\tan 142.5^\circ = 2 + \sqrt{2} - \sqrt{3} - \sqrt{6}$

(C) $\sin 27^\circ = \frac{\sqrt{5+\sqrt{5}} - \sqrt{3-\sqrt{5}}}{4}$

(D) $\sin \frac{\pi}{7} \cdot \sin \frac{2\pi}{7} \cdot \sin \frac{3\pi}{7} = \frac{\sqrt{7}}{8}$

38. Three numbers in A.P. with common difference d are removed from first n natural numbers and average of remaining number is found to be $\frac{43}{4}$ then ordered pair (n, d) can be

(A) (19, 5)

(B) (19, 2)

(C) (23, 5)

(D) (19, 8)

39. Which of the following options are correct?

(A) $\frac{1}{4} + \frac{1.3}{4.6} + \frac{1.3.5}{4.6.8} + \dots \text{to } \infty = 1$

(B) $\frac{1.3}{2} + \frac{3.5}{2^2} + \frac{5.7}{2^3} + \frac{7.9}{2^4} + \dots \text{to } \infty = 23$

(C) $\frac{1}{1.4.7} + \frac{1}{4.7.10} + \frac{1}{7.10.13} + \dots \text{to } \infty = \frac{1}{24}$

(D) $\sum_{r=1}^n r(r+1)(r+2)(r+3) = \frac{n(n+1)(n+2)(n+3)(n+4)}{5}$

40. A sequence $a_1, a_2, \dots, a_n, \dots$ of integers is defined by $a_{n+1} = a_n^2 - a_n + 1$ and $a_1 = 2$, then

(A) a_n is a prime number $\forall n \in \mathbb{N}$

(B) a_n is an odd number $\forall n \in \mathbb{N}, n \geq 2$

(C) HCF of $(a_i, a_j) = 1$ for $i \neq j, i, j \in \mathbb{N}$

(D) HCF of $(a_i, a_{i+2}) = 2 \forall i \in \mathbb{N}$

41. Let $f(x) = \cos(a_1 + x) + \frac{1}{2}\cos(a_2 + x) + \frac{1}{2^2}\cos(a_3 + x) + \dots + \frac{1}{2^{n-1}}\cos(a_n + x)$, where $a_1, a_2, \dots, a_n \in \mathbb{R}$. If $f(x_1) = f(x_2) = 0$, then $|x_2 - x_1|$ may be equal to

(A) π

(B) 2π

(C) 3π

(D) $\frac{\pi}{2}$

42. For $0 < \theta < \frac{\pi}{2}$, the solution of $\sum_{m=1}^6 \operatorname{cosec}\left(\theta + \frac{(m-1)\pi}{4}\right) \cdot \operatorname{cosec}\left(\theta + \frac{m\pi}{4}\right) = 4\sqrt{2}$ is/are

(A) $\frac{\pi}{4}$

(B) $\frac{\pi}{6}$

(C) $\frac{\pi}{12}$

(D) $\frac{5\pi}{12}$

43. Which of the following options are correct?

(A) If the in-circle of $\triangle ABC$ passes through the circumcentre then $\cos A + \cos B + \cos C = \sqrt{2}$

(B) In a triangle ABC if euler line is parallel to side BC , then $\tan B \cdot \tan C = 3$

(C) If in a triangle ABC $2\tan A \cdot \tan B = 9$, then $\triangle ABC$ will be always equilateral

(D) If $\cot A + \cot B + \cot C = \sqrt{3}$ in a $\triangle ABC$ then $\triangle ABC$ will be always equilateral

44. In a $\triangle ABC$, $BC = 2$, $CA = \sqrt{3} + 1$ and $\angle C = 60^\circ$. Feet of the perpendicular from A, B and C on the opposite sides BC, CA and AB are D, E and F respectively and are concurrent at P . then which of the following is / are true

(A) Radius of the circle circumscribing the $\triangle DEF$ is $\frac{1}{\sqrt{2}}$

(B) Area of the $\triangle DEF$ is $\frac{\sqrt{3}}{4}$

(C) Radius of the circle inscribed in the $\triangle DEF$ is $\frac{\sqrt{6} - \sqrt{2}}{8}$

(D) $\sin D + \sin E + \sin F = \frac{3 + \sqrt{3}}{2}$

SECTION - 2

Integer Value Correct Type

This section contains 6 questions. The answer to each of the questions 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	0 1 2 3 4 5 6 ● 8 9
	0 1 2 3 4 5 ● 7 8 9
Y	● 1 2 3 4 5 6 7 8 9
	● 1 2 3 4 5 6 7 8 9
Z	● 1 2 3 4 5 6 7 8 9
	0 1 2 3 4 5 6 7 8 ●

45. Given a parallelogram whose acute angle is 60° , if the squares of length of the diagonals are in ratio 1 : 3, then $\frac{a}{b}$ is (where a, b are the length of the sides)
46. In a triangle ABC , the foot of the perpendicular from A divides the opposite side into parts of lengths 3 and 17 and $\tan A = \frac{11}{3}$. Let a ΔPQR is a right angle triangle (right angle at Q) such that $\angle A = \angle P$ and $PQ = 3$ units, the $\left[\frac{\text{Area}(ABC)}{\text{Area}(PQR)} \right]$ is _____ (where $[.]$ denotes the greatest integer function)
47. ABC is an acute angle triangle, $\angle A = 30^\circ$. H is the orthocentre and M is the midpoint of BC . On the line HM a point T is taken such that $HM = MT$. If $BC = 4$ cm, then the length of AT is _____
48. Set $a, b, \in [-\pi, \pi]$ such that $\cos(a - b) = 1$ and $\cos(a + b) = \frac{1}{e}$. The number of pairs (a, b) satisfying the above system of equation is
49. Number of solutions of $2^{\sin|x|} = 4^{|\cos|x|}$ in the interval $[-\pi, \pi]$ is equal to
50. In an acute angle ΔABC value of $[\sin A + \sin B + \sin C]$ is always equal to (where $[]$ denotes greatest integer function)

SECTION - 3

Matching Lists Type

This section contains **Two** List-Match sets. Each List-Match set has **Two** Multiple Choice Questions. **List-I has Four** entries (I), (II), (III) and (IV) and **List-II has Six** entries (P), (Q), (R), (S), (T) and (U). **Four** options are given in each Multiple Choice Question based on **List-I and List-II** and **Only one** of these four options satisfies the condition asked in the Multiple Choice Question.

Answer Question 51 and 52 by appropriately matching the list.

Match the following

- | List-I | List-II |
|------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| I. Number of triangle to which an acute angle triangle ABC can act as a pedal triangle is | (P) 3 |
| II. DEF is a pedal triangle of ABC , If R_1 and R_2 are circumradius of ΔDEF and ΔABC respectively then $\frac{R_2}{R_1}$ is | (Q) 2 |

III. Three points D, E, F are taken on side BC , CA and AB such that AD, BE and CF are concurrent then $\frac{BD.CE.AF}{DC.AE.FB}$ is equal to (R) 4

IV. $\frac{3}{2} \left(1 - \frac{r_1}{r_2}\right) \left(1 - \frac{r_1}{r_3}\right)$ is (where r_1, r_2, r_3 are radii of excircles of $\triangle ABC$ which is right angled at A) (S) 1 (T) 5

51. Which of the following is only correct combination?

- (A) I \rightarrow R (B) I \rightarrow Q
 (C) II \rightarrow S (D) II \rightarrow P

52. Which of the following is only correct combination?

- (A) III \rightarrow R (B) III \rightarrow Q
 (C) IV \rightarrow P (D) IV \rightarrow S

Answer Question 53 and 54 by appropriately matching the list.

Natural numbers are distributed into brackets $\{1\}, \{2, 3\}, \{4, 5, 6\}, \{7, 8, 9, 10\}, \dots, n^{\text{th}}$. Bracket contains n elements. Now match the following.

List-I

- I. Sum of elements of 50th bracket
 II. First element of 2009th bracket
 III. Last element of 2007th bracket
 IV. Average of middle two elements of 2008th bracket is λ then $[\lambda]$ is ____
 Where $[\cdot]$ is G.I.F

List-II

- (P) 2017037
 (Q) 2016032
 (R) 2015028
 (S) 62525

53. Which of the following is only correct combination?

- (A) I \rightarrow P (B) I \rightarrow Q
 (C) II \rightarrow P (D) II \rightarrow R

54. Which of the following is only correct combination?

- (A) III \rightarrow Q (B) III \rightarrow S
 (C) IV \rightarrow P (D) IV \rightarrow Q



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FINAL TEST SERIES (ONLINE)

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Test -10 (Paper - 2)

ANSWERS

PHYSICS

1. (A, B, C, D)
2. (A, B, C)
3. (B, D)
4. (C, D)
5. (A, C)
6. (B, C)
7. (A, B, C)
8. (A, C, D)
9. (01)
10. (07)
11. (56)
12. (10)
13. (03)
14. (05)
15. (C)
16. (D)
17. (C)
18. (D)

CHEMISTRY

19. (A, B)
20. (A, B)
21. (A, B, C, D)
22. (B)
23. (D)
24. (B, C)
25. (A, C, D)
26. (A, C, D)
27. (07)
28. (16)
29. (03)
30. (52)
31. (02)
32. (24)
33. (A)
34. (D)
35. (A)
36. (B)

MATHEMATICS

37. (A, B, C, D)
38. (A, B)
39. (A, B, C, D)
40. (B, C)
41. (A, B, C)
42. (C, D)
43. (A, B, C, D)
44. (A, B, C, D)
45. (01)
46. (06)
47. (08)
48. (04)
49. (04)
50. (02)
51. (A)
52. (C)
53. (C)
54. (D)

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for **JEE (Advanced)-2020**
Test - 10 (Paper - 2)

ANSWERS & SOLUTIONS

PART - I : PHYSICS

1. Answer (A, B, C, D)

$$a - ae = R$$

$$a + ae = 3R$$

$$2a = 4R$$

$$a = 2R$$

$$2R(1 - e) = R$$

$$1 - e = \frac{1}{2}$$

$$e = \frac{1}{2}$$

$$V_{\max} = \sqrt{\frac{Gm}{a} \left(\frac{1+e}{1-e} \right)} = \sqrt{\frac{3Gm}{2R}}$$

$$\text{Areal velocity} = \frac{r_{\min} V_{\max}}{2} = \sqrt{\frac{3GmR}{8}}$$

$$\text{Time period } T = \frac{2\pi}{\sqrt{Gms}} (2R)^{\frac{3}{2}}$$

2. Answer (A, B, C)

$$\omega = \frac{3v - v}{l} = \frac{2v}{l}$$

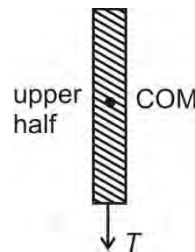
$$V_{\text{com}} = 2V$$

$$\text{KE} = \frac{1}{2}mv^2_{\text{COM}} + \frac{1}{2}I_c\omega^2_c$$

$$= \frac{1}{2}m \times 4v^2 + \frac{1}{2} \times \frac{ml^2}{12} \times \frac{4v^2}{l^2}$$

$$= mv^2 \left[2 + \frac{1}{6} \right] = \frac{13}{6}mv^2$$

$$a_A = \omega^2 r = \frac{4v^2}{l^2} \times \frac{l}{2} = \frac{2v^2}{l}$$



$$T = \frac{m}{2} \omega^2 \times \frac{l}{4}$$

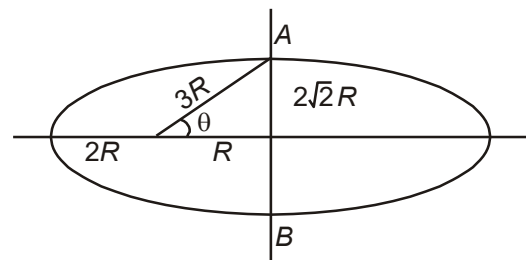
$$= \frac{m}{2} \times \frac{4v^2}{l^2} \times \frac{l}{4}$$

$$= \frac{mv^2}{2l}$$

3. Answer (B, D)

Friction force will act till there is relative motion at point of contact.

4. Answer (C, D)



$$\text{Area of the half ellipse} = \frac{\pi(2\sqrt{2}R)3R}{2}$$

$$= 3\sqrt{2}\pi R^2$$

$$\text{Areal speed} = \frac{\text{Angular momentum}}{2m} = \frac{2mvR}{2m}$$

$$= \frac{mvR}{m} \Rightarrow \frac{3\sqrt{2} \pi R}{2} = vR$$

$$t = \frac{3\sqrt{2} \pi R}{v}$$

v' speed at A, $(mv' \sin\theta)3R = mv(2R)$

$$\Rightarrow v = \frac{v}{\sqrt{2}} \quad \left[\therefore \sin\theta = \frac{2\sqrt{2}}{3} \right]$$

At D, $mv \times 2R = mv_D \times 4R \Rightarrow v_D = \frac{v}{2}$

5. Answer (A, C)

For $r < l$

$$dp \times A = dm \cdot \omega^2 r = A dr \rho \cdot \omega^2 r$$

$$dp = \rho \omega^2 r dr$$

$$\int_{P_l}^{P_r} dp = \rho \omega^2 \int_{r=l}^{r=r} r dr$$

$$\Rightarrow P_r - P_l = \rho \omega^2 \left[\frac{r^2}{2} - \frac{l^2}{2} \right]$$

$$= \rho \times \frac{g}{l} \left[\frac{r^2}{2} - \frac{l^2}{2} \right]$$

$$\frac{P}{at l} - \frac{P}{atr} = \frac{\rho g l}{2} - \frac{\rho g r^2}{2l}$$

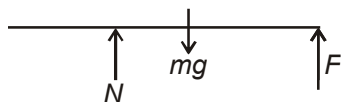
For $l < r < 2l$

$$\frac{P}{at 3l} - \frac{P}{atr} = \frac{\rho \omega^2 l^2}{2l} + 2\rho \omega^2 r dr \Big|_{r=r}^{r=3l}$$

$$= \frac{\rho \omega^2 l^2}{2} + 2\rho \omega^2 \left[\frac{9l^2}{2} - \frac{r^2}{2} \right]$$

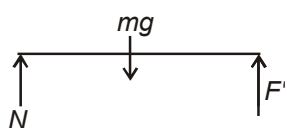
$$= \frac{\rho \omega^2 l^2}{2} + \rho \omega^2 (9l^2 - r^2)$$

6. Answer (B, C)



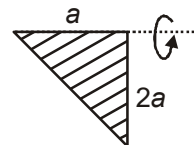
$$F \left(\frac{3l}{4} \right) = \frac{m}{100} \times \frac{100}{3} \times n_1 \times \frac{3l}{4} = mg \frac{l}{4}$$

$$n_1 = 10$$



$$\frac{m}{100} \times \frac{100}{3} n_2 \times l = m \times 10 \times \frac{l}{2} \quad n_2 = 15$$

7. Answer (A, B, C)



$$I_1 = \frac{4ma^2}{6}$$

$$I_2 = \frac{2}{2} \times \frac{(2m)(2a)^2}{36} - \frac{4ma^2}{6} = 2ma^2$$

$$I_3 = \frac{ma^2}{6}$$

8. Answer (A, C, D)

There is no horizontal force on rod during its motion

\Rightarrow C.M. will fall vertically downwards

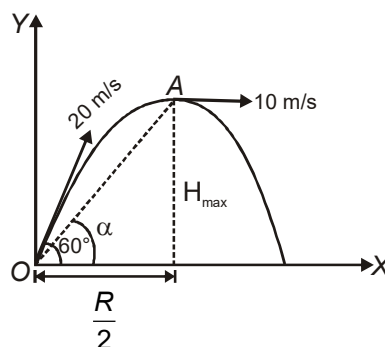
Net torque about point B (on the ground) = $mgL \sin\theta$

$$\text{Displacement mid-point} = \frac{L}{2} - \frac{L}{2} \cos\theta$$

9. Answer (01)

Velocity of CM does not change.

10. Answer (07)

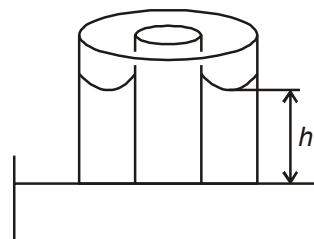


$$\text{Here, } \omega = \frac{10 \sin\alpha}{OA} = \frac{10}{\sqrt{525}} \times \frac{15}{\sqrt{525}}$$

$$\Rightarrow \frac{150}{525}$$

$$\Rightarrow \frac{2}{7} \text{ rad/s}$$

11. Answer (56)

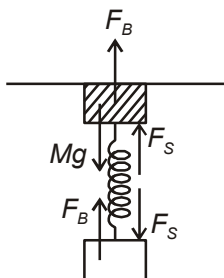


Surface tension force = Weight of liquid in capillary

$$\Rightarrow \sigma \cdot 2\pi(r_1 + r_2) = \pi(r_2^2 - r_1^2)h\rho g$$

$$\Rightarrow h = \frac{2\sigma}{(r_2 - r_1)\rho g} = 5.6 \text{ cm}$$

12. Answer (10)



Solid $F_B + F_S = Mg$... (i)

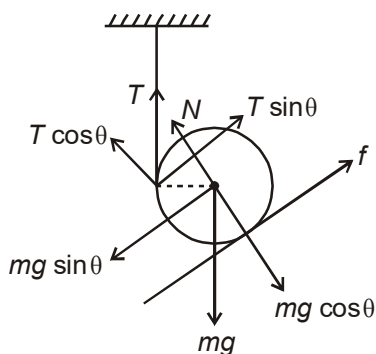
Hollow $F_B = F_S$... (ii)

$$\Rightarrow 2F_S = Mg$$

$$\Rightarrow 2kx = Mg$$

$$\Rightarrow x = \frac{Mg}{2k} = \frac{100}{2 \times 500} = 0.1 \text{ m}$$

13. Answer (03)



Translation

$$T \sin \theta + f = mg \sin \theta$$
 ... (i)

$$N + T \cos \theta = mg \cos \theta$$
 ... (ii)

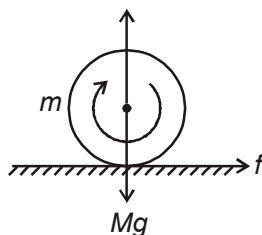
Rotation (about the centre)

$$T \cdot R = f \cdot R$$
 ... (iii)

$$\Rightarrow f = T, \text{ putting in (i)}$$

$$T = \frac{mg \sin \theta}{1 + \sin \theta}$$

14. Answer (05)



$$v_y = -eu_y$$

$$= -\frac{1}{2} \times (-10)$$

$$= +5 \text{ m/s}$$

$$\Rightarrow J_N = mv_y - mu_y = 15 \text{ m kg m/s}$$

Assuming the disc keeps skidding during contact

$$(J_f)_{\text{max}} = \mu J_N = 0.5 \times 15 \text{ m} = 7.5 \text{ m kg m/s}$$

However J_f required to stop rotation

$$J_f R = \frac{1}{2} m R^2 \omega - 0$$

$$\Rightarrow J_f = 5 \text{ m}$$

$$J_f = mu_x - mu_x$$

$$\Rightarrow u_x = 5 \text{ m/s}$$

$$\Rightarrow \vec{u} = 5\hat{i} + 5\hat{j} \text{ m/s}$$

15. Answer (C)

16. Answer (D)

Solution For Qs. Nos. 15 and 16

About IAOR

$$F \cdot h + f \cdot R = MR^2 \alpha$$

$$a = R \alpha$$

$$F - f = Ma$$

17. Answer (C)

18. Answer (D)

Solution For Qs. Nos. 17 and 18

$$T = \frac{\pi ab}{\text{Areal velocity}}$$

$$\text{Areal velocity} = \frac{L}{2m}$$

$$\frac{1}{2} m v_1^2 - \frac{GMm}{r_1} = \frac{1}{2} m v_2^2 - \frac{GMm}{r_2}$$

$$v_1 r_1 = v_2 r_2$$

PART – II : CHEMISTRY

19. Answer (A, B)

$$\Delta H = \Delta U + \Delta(PV)$$

At fixed volume

$$\Delta H = \Delta U + V \Delta P \quad \dots (A)$$

From van der Waals gas equation

$$P = \frac{RT}{V_M - b} - \frac{a}{V_M^2}$$

$$\Delta P = \frac{R\Delta T}{V_M - b}$$

$$\therefore \boxed{\Delta H = \Delta U + \frac{RV\Delta T}{V_M - b}}$$

20. Answer (A, B)

$$q_p = I \times v \times t$$

$$= 0.232 \times 12 \times 650 = 1.81 \text{ kJ}$$

$$\Delta H_{\text{vap}} \text{ molar enthalpy} = \frac{102}{1.871} \times 1.81$$

$$= 98.7 \text{ kJ mol}^{-1}$$

$$\Delta U_{\text{vap}} = \Delta H_{\text{vap}} - \Delta n_g RT$$

$$= 98.7 - [8.314 \times 351/1000]$$

$$= 95.8 \text{ kJ mol}^{-1}$$

21. Answer (A, B, C, D)

$$\text{CO}^+ \text{ B.O} = 3.5$$

$$\text{CO}^{2+} \text{ B.O} = 2.5$$

$$\text{CO B.O} = 3$$

Thermal stability of carbonate increases down the group

22. Answer (B)

$$K_{\text{sp}} = 4S^3$$

23. Answer (D)

$$\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ = -RT \ln K$$

$$\ln K = \frac{\Delta S^\circ}{R} + \frac{(-\Delta H^\circ)}{RT}$$

24. Answer (B, C)

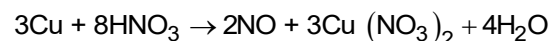
Inert pair effect: $\text{Pb}^{+2} > \text{Pb}^{+4}$ (stability)

$\text{C} > \text{Si} > \text{Ge} > \text{Pb} > \text{Sn}$ (1st I.E)

25. Answer (A, C, D)

Viscosity of heavy water is more than normal water

26. Answer (A, C, D)



27. Answer (07)

$$\text{pH} = 1$$

$$\text{pOH} = 13$$

$$[\text{OH}^-] = 10^{-13} \text{ M}$$

$$= 10^{-13} \text{ moles in one litre}$$

$$\Rightarrow 10^{-13} \text{ moles in 1000 ml}$$

$$\Rightarrow 10^{-16} \text{ moles in 1 ml}$$

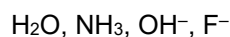
$$n_{\text{OH}^-} = 10^{-16}$$

$$\text{Number of OH}^- \text{ ions} = 6.023 \times 10^{23} \times 10^{-16}$$

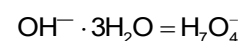
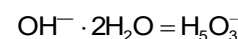
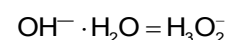
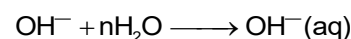
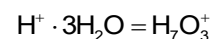
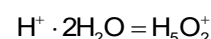
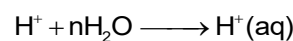
$$= 6.023 \times 10^7$$

$$\therefore x = 7$$

28. Answer (16)



29. Answer (03)



30. Answer (52)

$$\Delta H = \Delta E + V\Delta P \text{ at constant volume}$$

$$\Delta E = \Delta H - V\Delta P$$

$$= 56 - 1 \times (80 - 40) \times 0.1$$

$$= 56 - 40 \times 0.1$$

$$= 56 - 4$$

$$= 52 \text{ kJ}$$

31. Answer (02)

$$q = mC_v \Delta T$$

$$1000 = \frac{100}{18} \times 90(\Delta T)$$

$$\Delta T = \frac{1000 \times 18}{100 \times 90} = 2 \text{ K}$$

32. Answer (24)

$$\frac{X}{12} = 2$$

$$X = 24$$

33. Answer (A)

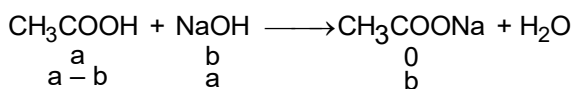
34. Answer (D)

Solution of Qs. Nos. 33 and 34

At point L only weak acid is present, Hence,

$$\text{pH} = \frac{\text{pK}_a}{2} + \frac{\log c}{2}$$

At point M base added is a limiting reagent hence, the solution in the flask is a buffer solution.



Only CH₃COOH and CH₃COONa are present in the titration flask which is an acidic buffer and

$$\text{pH} = \text{pK}_a + \log \frac{[\text{Salt}]}{[\text{Acid}]}$$

At point N i.e. neutralisation point, salt would be present and

$$\text{pH} = 7 + \frac{\text{pK}_a}{2} + \frac{\log c}{2}$$

At point O base is present in excess.

$$\text{So, pOH} = -\log [\text{NaOH}]$$

$$\text{pH} = 14 - \text{pOH}$$

35. Answer (A)

36. Answer (B)

Solution for Qs. Nos. 35 and 36

$$\Delta S > 0 \quad \text{P, Q and R}$$

$$\Delta H = 0 \quad \text{for isothermal ideal process}$$

PART – III : MATHEMATICS

37. Answer (A, B, C, D)

$$\cot 7.5^\circ = \frac{1 + \cos 15}{\sin 15}$$

$$\tan 142.5^\circ = \frac{\sin 285}{1 + \cos 285}$$

$$\sin 27^\circ = \frac{\sqrt{1 + \sin 54} - \sqrt{1 - \sin 54}}{2}$$

$$\sin \frac{\pi}{7} \cdot \sin \frac{2\pi}{7} \cdot \sin \frac{3\pi}{7} \dots \sin \frac{6\pi}{7} = \frac{7}{26}$$

38. Answer (A, B)

Let removed numbers are $a - d, a, a + d$

sum of removed numbers = $3a$

$$\Rightarrow 6 \leq 3a \leq 3n - 3$$

$$\Rightarrow 2a \leq a \leq n - 1 \quad \dots(i)$$

$$\text{Also } 3a = \frac{n(n+1)}{2} - \frac{43}{4}(n-3)$$

$$a = \frac{2n^2 - 41n + 129}{12} \quad \dots(ii)$$

from (i) and (ii)

$$17.5 \leq n \leq 23.5 \quad n \in N$$

$$n = 18, 19, 20, 21, 22, 23$$

for $a \in N, n$ must be odd

$\Rightarrow n$ may be 19, 21, 23

when $n = 19, a = 6, d$ can be 2 or 5

when $n = 21 \quad a \notin N$ not possible

when $n = 23 \quad a \notin N$ not possible.

39. Answer (A, B, C, D)

$$(A) \quad Tr = \frac{1.3.5 \dots (2r-1)}{4.6.8 \dots 2(r+1)} [2(r+1) - (2r+1)]$$

(B) By applying A.G. P concept

$$(C) \quad 6Tr = \frac{(3r+4) - (3r-2)}{(3r-2)(3r+1)(3r+4)}$$

$$(D) \quad 5Tr = r(r+1)(r+2)(r+3)[(r+4) - (r-1)]$$

40. Answer (B, C)

$$A_{n-1} = a_1 a_2 \dots a_{n-1}$$

41. Answer (A, B, C)

$$f(x) = \left(\cos a_1 + \frac{\cos a_2}{2} + \dots + \frac{\cos a_n}{2^{n-1}} \right)$$

$$\cos x - \left(\frac{\sin a_1}{1} + \frac{\sin a_2}{2} + \dots + \frac{\sin a_n}{2^{n-1}} \right) \sin x$$

$$\Rightarrow f(x) = A \cos x - B \sin x$$

$$\text{Now, } f(x_1) = f(x_2) = 0$$

$$\Rightarrow \begin{cases} A \cos x_1 - B \sin x_1 = 0 \\ A \cos x_2 - B \sin x_2 = 0 \end{cases}$$

$$\Rightarrow \tan x_1 = \tan x_2$$

$$\Rightarrow x_1 = n\pi + x_2 \Rightarrow x_1 - x_2 = n\pi$$

42. Answer (C, D)

$$\sum_{m=1}^6 \frac{\sin \left\{ \left(\theta + \frac{m\pi}{\theta} \right) - \left(\theta + \frac{(m-1)\pi}{\theta} \right) \right\}}{\sin \left(\theta + \frac{m\pi}{4} \right) \cdot \sin \left(\theta + \frac{(m-1)\pi}{\theta} \right)}$$

$$\Rightarrow \cot \theta - \cot \left(\theta + \frac{\pi}{4} \right) + \cot \left(\theta + \frac{\pi}{4} \right) - \cot \left(\theta + \frac{6\pi}{\theta} \right) = 4$$

$$\Rightarrow \cot \theta + \tan \theta = 4$$

$$\theta = \frac{\pi}{12} \text{ or } \frac{5\pi}{12}$$

43. Answer (A, B, C, D)

$$\sqrt{R^2 - 2Rr} = r$$

By solving this we get

$$\cos A + \cos B + \cos C = \sqrt{2}$$

44. Answer (A, B, C, D)

$$a = 2; b = \sqrt{3} + 1 \quad \angle C = \frac{\pi}{3}$$

DEF is pedal triangle of ABC

For triangle DEF, circumradius = $\frac{R}{2}$

In radius = $2R \cos A \cos B \cos C$ and area

$$= \frac{1}{2} R^2 \sin 2A \sin 2B \sin 2C$$

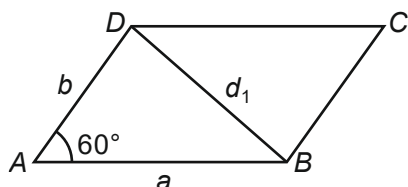
$$\angle A = 45^\circ \quad \angle B = 75^\circ$$

$$\angle C = 60^\circ \quad R = \sqrt{2}$$

$$\angle D = 90^\circ \quad \angle E = 30^\circ$$

$$\angle F = 60^\circ$$

45. Answer (01)



Applying cosines rule in $\triangle ABD$ and $\triangle BCD$, we get $2a^2 + 2b^2 = d_1^2 + d_2^2$, where d_1, d_2 are length of diagonals ($d_1 < d_2$) given $d_2^2 = 3d_1^2$

$$\Rightarrow a^2 + b^2 = 2d_1^2$$

$$\text{also } ab = d_1^2 \quad \dots(i)$$

$$\Rightarrow a^2 + b^2 + 2ab = 3ab + d_1^2 = 4d_1^2$$

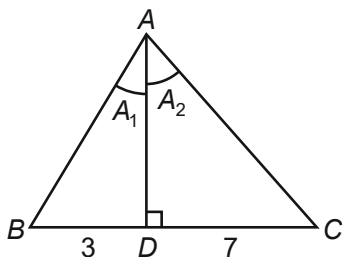
$$\Rightarrow (a + b)^2 = 4d_1^2$$

$$\Rightarrow a + b = 2d_1 \quad \dots(ii)$$

using (i) and (ii), we get

$$a = b = d_1 \text{ i.e. } \frac{a}{b} = 1$$

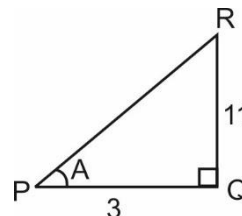
46. Answer (06)



$$\tan A = \tan(A_1 + A_2)$$

$$\Rightarrow AD = 11$$

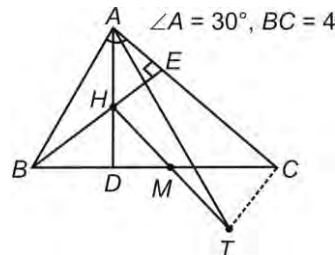
hence the area of $\triangle ABC = \frac{1}{2} \times 11 \times 20 = 110$



$$\Rightarrow \text{Area of } PQR = \frac{1}{2} \times 11 \times 3.$$

$$\left[\frac{\text{Area}(ABC)}{\text{Area}(PQR)} \right] = 6$$

47. Answer (08)



$\triangle BMH$ and $\triangle CMT$ are similar, $\angle MBH = \angle MCT$

$$\Rightarrow BH \parallel CT, CT \perp AC \text{ and } CT = BH$$

$$\text{Now, } AT^2 = TC^2 + AC^2 = BH^2 + AC^2$$

$$= BD^2 \operatorname{cosec}^2 C + AD^2 \operatorname{cosec}^2 C$$

$$= \frac{AB^2}{\sin^2 C} = \frac{a^2}{\sin^2 A} = 16 \times 4 = 64$$

$$\Rightarrow AT = 8$$

48. Answer (04)

$$\because \cos(a - b) = \cos 0$$

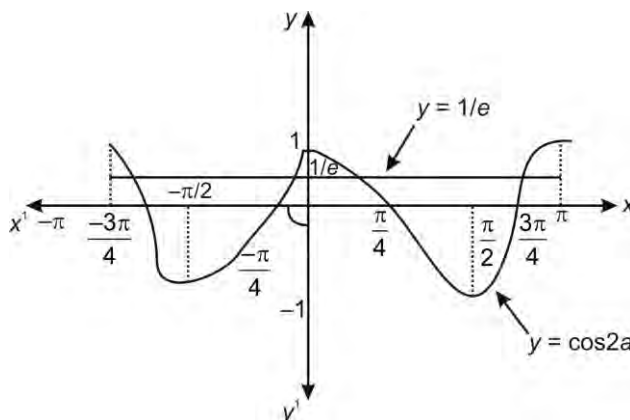
$$\therefore a - b = 2n\pi, n \in I$$

$$a - b = -2\pi, 0, 2\pi$$

$$\therefore a + b = 2\pi + 2a, 2a, 2a - 2\pi$$

$$\therefore \cos(a + b) = \cos 2a, \cos 2a, \cos 2a = \frac{1}{e}$$

$$y = \cos 2a = \frac{1}{e}$$

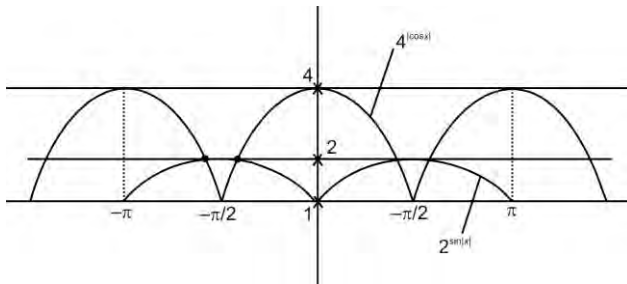


Hence, number of solutions is 4.

49. Answer (04)

Number of solution of the equation is the number of intersection points of graphs

$2^{\sin|x|}$ and $4^{|\cos x|}$ in $[-\pi, \pi]$



There are 4 intersection points in $[-\pi, \pi]$.

50. Answer (02)

By function inequality in acute angle ΔABC $2 < \sin A + \sin B + \sin C \leq \frac{3\sqrt{3}}{2}$

51. Answer (A)

(I) ABC is pedal triangle of acute angle $|_1|_2|_3$ and of obtuse angled triangle $||_1|_2, ||_2|_3$ and $||_3|_1$

(II) $\frac{R_2}{R_1} = 2$

(III) In ΔABC if AD, BE and CF are concurred and if

$$\frac{BD}{DC} = \frac{\mu}{\beta} \text{ and } \frac{CE}{AB} = \frac{\beta}{\gamma}$$

$$\text{Then } \frac{AF}{FB} = \frac{\gamma}{\alpha}$$

$$\Rightarrow BD \cdot CE \cdot AF = DC \cdot AE \cdot FB$$

$$(IV) \frac{3}{2} \left(1 - \frac{s-b}{s-a}\right) \left(1 - \frac{s-c}{s-a}\right)$$

52. Answer (C)

(I) ABC is pedal triangle of acute angle $|_1|_2|_3$ and of obtuse angled triangle $||_1|_2, ||_2|_3$ and $||_3|_1$.

(II) $\frac{R_2}{R_1} = 2$

(III) In ΔABC if AD, BE and CF are concurred and if

$$\frac{BD}{DC} = \frac{\mu}{\beta} \text{ and } \frac{CE}{AB} = \frac{\beta}{\gamma}$$

$$\text{Then } \frac{AF}{FB} = \frac{\gamma}{\alpha}$$

$$\Rightarrow BD \cdot CE \cdot AF = DC \cdot AE \cdot FB$$

$$(IV) \frac{3}{2} \left(1 - \frac{s-b}{s-a}\right) \left(1 - \frac{s-c}{s-a}\right)$$

53. Answer (C)

$$(I) x^4 + 6x^2 + 25 = 0$$

$$\Rightarrow x^2 = -3 \pm 4i$$

$$\Rightarrow x = \pm 1 \pm 2i$$

$$\text{Take } 1 + 2i, 1 - 2i$$

$$x^2 - 2x + 5 = 0, \quad b = -2$$

$$c = 5$$

It divides other

$$f(1) = 1 - 2 + 5 = 4$$

$$(II) \int_0^1 \frac{d}{dx} ((x+1)(x+2) \dots (x+n))$$

$$dx = (n+1)!$$

$$\Rightarrow \lambda = 1$$

$$(III) \text{LHS} \leq 2, \text{RHS} \geq 2$$

$$\Rightarrow \text{LHS} = \text{RHS} = 1$$

$$\Rightarrow x = 1$$

$$\Rightarrow \text{Number of solutions} = 1$$

54. Answer (D)

$$\text{Sum of } n^{\text{th}} \text{ bracket} = \frac{n}{2}(n^2 + 1)$$

$$\text{Last element of } n^{\text{th}} \text{ bracket} = \frac{n(n+1)}{2}$$

$$\text{First element of } n + 1^{\text{th}} \text{ bracket} = \frac{n(n+1)}{2} + 1$$

□□□