FIITJEE

JEE (Advanced)-2018

ALL INDIA TEST SERIES

FULL TEST – VII

Paper 1

Time Allotted: 3 Hours **Maximum Marks: 183**

- Please read the instructions carefully. You are allotted 5 minutes specifically for this purpose.
- You are not allowed to leave the Examination Hall before the end of the test.

INSTRUCTIONS

A. General Instructions

1. Attempt ALL the questions. Answers have to be marked on the OMR sheets.
2. This question paper contains Three Parts.
3. **Part-I** is Physics, **Part-II** is Chemistry and **Part-III** is Mathematics.
4. Each part is further divided into Two sections: **Section-A & Section-C**
5. Rough spaces are provided for rough work inside the question paper. No additional sheets will be provided for rough work.
6. Blank Papers, clip boards, log tables, slide rule, calculator, cellular phones, pagers and electronic devices, in any form, are not allowed.

B. Filling of OMR Sheet

1. Ensure matching of OMR sheet with the Question paper before you start marking your answers on OMR sheet.
2. On the OMR sheet, darken the appropriate bubble with black pen for each character of your Enrolment No. and write your Name, Test Centre and other details at the designated places.
3. OMR sheet contains alphabets, numerals & special characters for marking answers.

C. Marking Scheme For All Three Parts.

1. ***Section-A (01– 07, 19 – 25, 37 - 43)*** *contains 21 multiple choice questions which have* ***one or more than one correct*** *answer. Each question carries* ***+4 marks*** *for correct answer and* ***–2 marks*** *for wrong answer*
   Partial Marks **+1** for each correct option provided no incorrect options is selected.

   Section-A (08 – 13, 26 – 31, 44 - 49) *contains 18 questions. Each of 2 Tables with 3 Columns and 4 Rows has three questions. Column 1 will be with 4 rows designated (I), (II), (III) and (IV). Column 2 will be with 4 rows designated (i), (ii), (iii) and (iv). Column 3 will be with 4 rows designated (P), (Q), (R) and (S).*
   Each question has ***only one correct*** *answer and carries* ***+3 marks*** *for correct answer and* ***–1 mark*** *for wrong answer.*

2. ***Section-C (14 – 18, 32 – 36, 50 - 54)*** *contains 15 Numerical based questions with answer as numerical value from* ***0 to 9*** *and each question carries* ***+3 marks*** *for correct answer. There is no negative marking.*

Name of the Candidate	
Enrolment No.	

Useful Data

PHYSICS

Acceleration due to gravity	$g = 10\ m/s^2$
Planck constant	$h = 6.6 \times 10^{-34}$ J-s
Charge of electron	$e = 1.6 \times 10^{-19}$ C
Mass of electron	$m_e = 9.1 \times 10^{-31}$ kg
Permittivity of free space	$\varepsilon_0 = 8.85 \times 10^{-12}\ C^2/N\text{-}m^2$
Density of water	$\rho_{water} = 10^3\ kg/m^3$
Atmospheric pressure	$P_a = 10^5\ N/m^2$
Gas constant	$R = 8.314\ J\ K^{-1}\ mol^{-1}$

CHEMISTRY

Gas Constant	R	=	$8.314\ J\ K^{-1}\ mol^{-1}$
		=	0.0821 Lit atm $K^{-1}\ mol^{-1}$
		=	$1.987 \approx 2$ Cal $K^{-1}\ mol^{-1}$
Avogadro's Number	N_a	=	6.023×10^{23}
Planck's constant	h	=	6.625×10^{-34} J·s
		=	6.625×10^{-27} erg·s
1 Faraday		=	96500 coulomb
1 calorie		=	4.2 joule
1 amu		=	1.66×10^{-27} kg
1 eV		=	1.6×10^{-19} J

Atomic No: H=1, He = 2, Li=3, Be=4, B=5, C=6, N=7, O=8, N=9, Na=11, Mg=12, Si=14, Al=13, P=15, S=16, Cl=17, Ar=18, K =19, Ca=20, Cr=24, Mn=25, Fe=26, Co=27, Ni=28, Cu = 29, Zn=30, As=33, Br=35, Ag=47, Sn=50, I=53, Xe=54, Ba=56, Pb=82, U=92.

Atomic masses: H=1, He=4, Li=7, Be=9, B=11, C=12, N=14, O=16, F=19, Na=23, Mg=24, Al = 27, Si=28, P=31, S=32, Cl=35.5, K=39, Ca=40, Cr=52, Mn=55, Fe=56, Co=59, Ni=58.7, Cu=63.5, Zn=65.4, As=75, Br=80, Ag=108, Sn=118.7, I=127, Xe=131, Ba=137, Pb=207, U=238.

Physics

PART – I

SECTION – A
(One or More than one correct type)

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

1. In a cylindrical room of radius 'r', A particle is projected at angle 'α' with horizontal from center of room floor. It was observed that particle returns to point of projection after three elastic collisions with walls and ceiling. If the particle remains in air for time 'T', then speed of projection is

(A) $\frac{3r}{T\cos\alpha}$ (B) $\frac{4r}{T\cos\alpha}$

(C) $2\sqrt{\frac{gr}{\sin 2\alpha}}$ (D) $> 2\sqrt{\frac{gr}{\sin 2\alpha}}$

2. Students I_1, I_2, I_3 and I_4 perform an experiment for measuring the acceleration due to gravity (g) using a simple pendulum, they use different lengths of the pendulum and record time for different number of oscillations. The observations are shown in table. Least count for length = 0.1 cm, least count for time is 1 sec.

Students	Length of pendulum (cm)	No. of oscillations (n)	Time period of pendulum (s)
I_1	100.0	20	20
I_2	400.0	10	40
I_3	100.0	10	20
I_4	400.0	20	40

If P_1, P_2, P_3 and P_4 are % error in g for students I_1, J_1, J_3 and I_2 respectively then

(A) $P_1 = P_3$ (B) P_3 is maximum

(C) P_4 is minimum (D) $P_2 = P_4$

3. A long thin non-conducting cylindrical pipe having surface charge density 'σ', radius 'R' rotating with angular velocity $\omega = kt$ about its axis, where k is a positive constant. Which of the following statement is/are correct for inside region of pipe?

(A) Magnetic and electric field are uniform throughout region and do not vary with time.

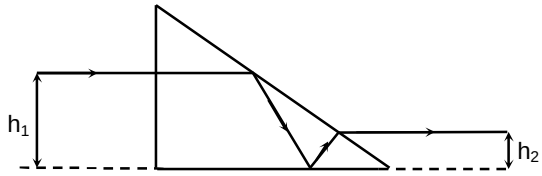
(B) Magnetic field is constant throughout region but vary with time and electric field is not constant throughout region and independent of time.

(C) Magnetic field is not constant throughout region but independent of time and electric field is constant throughout region and vary with time.

(D) Energy density (u) due to magnetic field varies with time as $u = bt^2$. (Where b is positive constant)

Space for Rough work

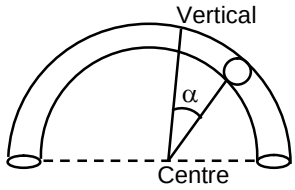
4. A right angle prism of refractive index 'μ' has TIR at two points as shown in diagram, then $\frac{h_1}{h_2}$ is



(A) $\frac{\sin\theta}{\sin 3\theta}$ (B) $\frac{2\mu}{(1+\mu)}$

(C) $\frac{\cos\theta}{\cos 3\theta}$ (D) $\frac{\mu}{(1+2\mu)}$

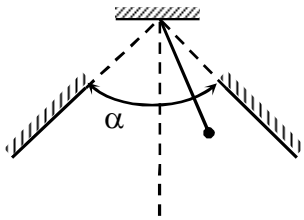
5. A semicircular glass tube filled with water containing an air bubble is sealed at its ends. The tube is held with its plane vertical and made to move in its plane with a constant acceleration, the bubble stays aside of the highest point as shown, than acceleration vector of the tube



(A) It points towards the left
(B) It points towards the right
(C) Its magnitude is g tan α
(D) It magnitude is g cot α

6. The internal energy U of an ideal gas depends on pressure P and Volume V of the gas according to equation U = 3PV, which of the following conclusion can you make regarding the gas
(A) The gas is not a mono-atomic gas
(B) The gas can be a di-atomic gas
(C) The gas can be a tri-atomic gas
(D) Molar specific heat of the gas in an isobaric process is 4R

7. A simple pendulum initially oscillating simple harmonically with angular amplitude α and time period T_0 is symmetrically confined between two rigid fixed planes P and Q making angle 'α' with each other as shown in figure. [Assume 'α' is small]



(A) If collision at both walls are elastic then time period is $\frac{T_0}{2}$
(B) If collision at both walls are inelastic then time period is T_0
(C) If collision at one wall is elastic and at other is inelastic, then 1 time period is T_0
(D) If collision at one wall is elastic and at other is inelastic, then 1 time period will be less than T_0.

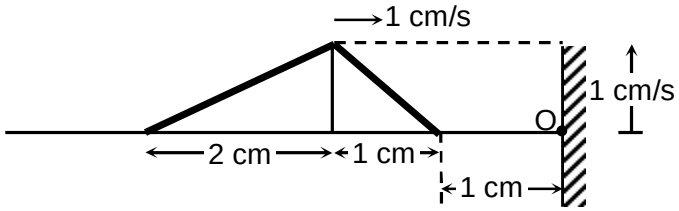
Space for Rough work

(Matching type - Single Correct Option)

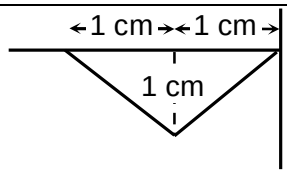
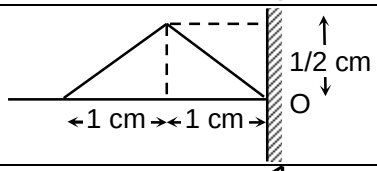
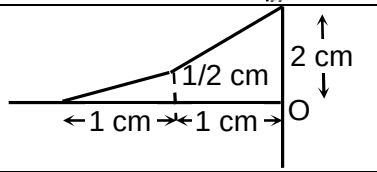
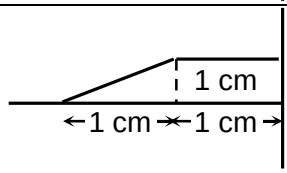
This section contains **SIX** questions of matching type. The section contains **TWO** tables (each having 3 columns and 4 rows). Based on each table, there are **THREE** questions. Each question has **FOUR** options (A), (B), (C), and (D). **ONLY ONE** of these four options is correct.

Answer questions 8, 9 and 10 by appropriately matching the information given in the three columns of the following table.

A triangular wave pulse travelling on an elastic string along positive x-axis toward 'O' is as shown in figure at t = 0.



Answer the following questions based on the matrix below. Here, Column 1 shows different cases, Column 2 shows superimposed pulse of incident and reflected pulses while Column 3 shows speed of particle P at distance x = 0.5 cm from O towards left.

Column 1	Column 2		Column 3
(I) If O is free end, then at t = 2 sec.	(i)		(P) V_P = 1 cm/sec down
(II) If O is rigid end, then at t = 2 sec.	(ii)		(Q) V_P = 1.5 m/s up
(III) If O is free end, then at t = 3 sec.	(iii)		(R) V_P = 0.5 m/s down
(IV) If O is rigid end, then at t = 3 sec.	(iv)		(S) V_P = 0 m/s

8. Which of the following is correct sequential combination of Column 1 with Column 2.
(A) (ii), (iii), (i), (iv) (B) (iii), (ii), (iv), (i)
(C) (i), (iii), (ii), (iv) (D) (iv), (iii), (ii), (i)

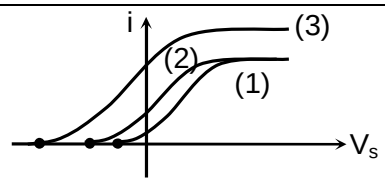
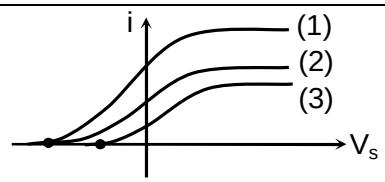
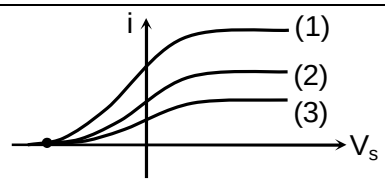
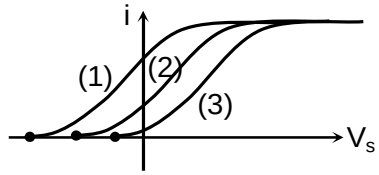
Space for Rough work

9. Which of the following is correct sequential combination of Column 1 with Column 3.
(A) QRPS (B) PQRP
(C) QQRP (D) PQRP

10. Which of the following is correct sequential combination of Column 2 with Column 3.
(A) PQRS (B) QPPR
(C) SPQR (D) SRQP

Answer questions 11, 12 and 13 by appropriately matching the information given in the three columns of the following table.

Three radiations are incident on a metal surface having threshold frequency less then frequencies of the three incident radiations. If I represents intensity, k is maximum kinetic energy, i photoelectric current and V stopping potential, answer the following questions, based on given matrix.

Column 1		Column 2		Column 3	
(I)	$I_1 > I_2 > I_3$ $f_1 = f_2 = f_3$	(i)	$k_1 < k_2 < k_3$	(P)	
(II)	$I_1 = I_2 = I_3$ $f_1 > f_2 > f_3$	(ii)	$k_1 > k_2 > k_3$	(Q)	
(III)	$I_1 > I_2 > I_3$ $f_1 = f_2 > f_3$	(iii)	$k_1 = k_2 > k_3$	(R)	
(IV)	$I_1 = I_2 < I_3$ $f_1 < f_2 < f_3$	(iv)	$k_1 = k_2 = k_3$	(S)	

11. Which of the following is correct sequential combination of Column 1 with Column 2.
(A) (iv), (ii), (i), (iii) (B) (ii), (i), (iii), (iv)
(C) (iii), (ii), (i), (iv) (D) (iv), (ii), (iii), (i)

Space for Rough work

12. Which of the following is correct sequential combination of Column 1 with Column 3.
(A) PQSR (B) QSPR
(C) RSQP (D) QPRS

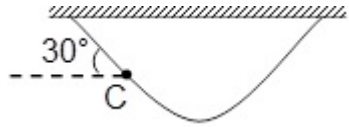
13. Which of the following is correct sequential combination of Column 2 with Column 3.
(A) PQRS (B) PSQR
(C) QSPR (D) SPQR

SECTION – C
(Single digit integer type)

This section contains **FIVE** questions. The answer to each question is a single Digit integer ranging from 0 to 9, both inclusive.

14. A rod of length l, cross-sectional area A and Young's modulus Y is subjected to two forces 'F' and '2F' at its two ends. The heat generated in the rod is found to be $\frac{(10a+b)F^2\ell}{12AY}$. Find a + b.
[a, b : Positive integers]

15. A rope is hanging vertically, with its two ends fixed to walls at same horizontal level (as shown). Tension at the bottom most point is 90 N. If the mass/unit length of rope is 4 kg/m, find radius of curvature (in metres) at point 'C'. [Take g = 10 m/s^2]



16. A source of frequency 1800 Hz is moving on a line, with speed 30 m/s. An observer is standing at a point far distant from the line. The wavelength of sound received by the observer when the source is nearest to the observer, is n/11 metres. Find 'n' (speed of sound in air = 330 m/s)

17. Rain drops of some initial mass start falling from rest. In their way, they gain mass from clouds with a rate proportional to the product of their instantaneous mass and instantaneous velocity, the proportionally constant being 2.5 SI units. Find the terminal velocity attained by drops (in m/s). Take g = 10 m/s^2.

18. A sinusoidal wave of wavelength 'λ', amplitude 'A' and angular frequency 'ω' travels on a string of mass/unit length 'μ'. The energy of wave in one wavelength is equal to $\frac{\mu\omega^2A^2\lambda}{b}$. Find 'b'.

Space for Rough work

Chemistry

PART – II

SECTION – A
(One or More than one correct type)

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

19. $\underset{(s)}{CaCO_3} \rightleftharpoons \underset{(s)}{CaO} + \underset{(g)}{CO_2}$

Above equilibrium was established in close container. Which of the following will shift equilibrium towards right?

(A) Decrease in pressure
(B) Addition of $CaCO_3$
(C) Addition of N_2 at constant volume
(D) Increase in temperature

20. Ground state electronic configuration of P atom can be represented as

(A) $[Ne]$ 3s: $\uparrow\downarrow$ 3p: $\uparrow\ \uparrow\ \uparrow$
(B) $[Ne]$ 3s: $\uparrow\downarrow$ 3p: $\uparrow\ \downarrow\ \uparrow$
(C) $[Ne]$ 3s: $\uparrow\downarrow$ 3p: $\uparrow\ \downarrow\ \downarrow$
(D) $[Ne]$ 3s: $\uparrow\downarrow$ 3p: $\downarrow\ \downarrow\ \downarrow$

21. Which of the following molecules have intermolecular hydrogen bonds?

(A) NaH_2PO_2
(B) NaH_2PO_4
(C) H_3BO_3
(D) $(CH_3)_3BO_3$

22. When a hydrophilic sol like gelatine is subjected to electric field, the sol particles move
(A) towards cathode at pH less than the iso-electric point
(B) towards anode at pH greater than the iso-electric point
(C) in both direction at iso-electric pH
(D) in neither direction at iso-electric pH

23. Sodium nitrate decomposes above 800ºC to give

(A) N_2
(B) O_2
(C) NO_2
(D) Na_2O

Space for Rough work

24. NH_3 and its salts are identified by

(A) K_2HgI_4 and KOH (B) $HgCl_2 + KI(\text{excess}) + KOH$

(C) $HgCl_2 + KI(\text{excess}) + NH_4OH$ (D) $Hg_2Cl_2 + \text{excess of } NH_4OH$

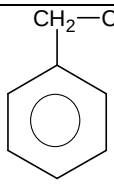
25. A freshly prepared aqueous solution of $Pd(NH_3)_2Cl_2$ does not conduct electricity. It suggests that

(A) the structure of the compound involves covalent bonding only
(B) the chlorine atoms must be in coordination sphere
(C) the van't Hoff factor of the compound would be unity
(D) on adding excess of aqueous $AgNO_3$ to 0.1 L of 0.1 M solution of the compound 0.02 moles of $AgCl_{(s)}$ would be obtained

(Matching type - Single Correct Option)

This section contains **SIX** questions of matching type. The section contains **TWO** tables (each having 3 columns and 4 rows). Based on each table, there are **THREE** questions. Each question has **FOUR** options (A), (B), (C), and (D). **ONLY ONE** of these four options is correct.

Answer questions 26, 27 and 28 by appropriately matching the information given in the three columns of the following table.

Column 1 **Reactant**	**Column 2** **Reagent**	**Column 3** **Observation**
(I) But-1-yne	(i) $NaOH/I_2$	(P) Red ppt
(II) 	(ii) $\left[Ag(NH_3)_2\right]NO_3$	(Q) White ppt
(III) Acetone	(iii) $ZnCl_2 + HCl$	(R) Yellow solution
(IV) Benzaldehyde	(iv) Fehling solution	(S) Silver Mirror

26. For Tollens test the only correct combination is

(A) (IV) (ii) (S) (B) (I) (ii) (Q)

(C) (III) (ii) (S) (D) (IV) (iii) (Q)

Space for Rough work

27. Which combination gives red ppt?
(A) (I) (i) (B) (IV) (iv)
(C) (II) (ii) (D) (II) (iv)

28. Which of the following does not represent oxidation of column I compound?
(A) (I) (iv) (B) (II) (ii)
(C) (IV) (ii) (D) (III) (i)

Answer questions 29, 30 and 31 by appropriately matching the information given in the three columns of the following table.

Column 1 **Crystal system**	**Column 2** **Axial length & angle**	**Column 3** **Type of unit cell**
(I) Cube	(i) $a \neq b \neq c$ $\alpha = \beta \neq \gamma$	(P) Primitive, end centered
(II) Orthorhombic	(ii) $a = b = c$ $\alpha = \beta = \gamma$	(Q) Primitive, face centered & body centered
(III) Triclinic	(iii) $a \neq b \neq c$ $\alpha \neq \beta \neq \gamma$	(R) Only Primitive
(IV) Monoclinic	(iv) $a \neq b \neq c$ $\alpha = \beta = \gamma$	(S) Primitive, Face centered, body centred & end centered

29. Which of the following combination is correct?
(A) (I), (ii) (S) (B) (II) (ii) (Q)
(C) (II), (iv) (S) (D) (III), (ii), (R)

30. Which of the following combination is incorrect?
(A) (I) (ii) (B) (III) (iii)
(C) (IV) (i) (D) (II) (ii)

31. All four types of unit cells are observed in
(A) Cube (B) Orthorhombic
(C) Triclinic (D) Monoclinic

Space for Rough work

SECTION – C
(Single digit integer type)

This section contains **FIVE** questions. The answer to each question is a single Digit integer ranging from 0 to 9, both inclusive.

32. In acidic medium 4 mole of $KMnO_4$ quantitatively oxidise x mole of SnC_2O_4. The value of x is

33. The number of triangular faces present in truncated tetrahedron is

34. The number of neutrons accompanying the formation of $^{140}_{54}Xe$ & $^{92}_{38}Sr$ from adsorption of a slow neutron by $^{235}_{92}U$ followed by nuclear fission is

35. The total no. of aromatic compounds possible with molecular formula C_8H_{10} are

36. How many molecules of acetone will form mesitylene through aldol condensation?

Space for Rough work

Mathematics

PART – III

SECTION – A
(One or More than one correct type)

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

37. Tangent's are drawn to parabola $y^2 = 16x$ at the point's A, B and C such that three tangents form a triangle PQR. If θ_1, θ_2 and θ_3 be the inclinations of these tangents with the axis of x such that their cotangents form an A.P. with common difference 3. Then which of following are correct:
(A) Area of ΔPQR is 432 (B) Area of ΔABC is 832
(C) Area of ΔPQR is 416 (D) Area of ΔABC is 864

38. Let A, B, C be three sets of complex number as defined below
$A = \{z : |z+1| \le 2 + Re(z)\}$,
$B = \{z : |z-1| \ge 1\}$ and
$C = \left\{z : \left|\frac{z-1}{z+1}\right| \ge 1\right\}$
Then which of following are correct
(A) AREA of region bounded by $A \cap B \cap C$ is $\sqrt{3}$
(B) AREA of region bounded by $A \cap B \cap C$ is $2\sqrt{3}$
(C) The real part of the complex no. in region $A \cap B \cap C$ and having maximum amplitude is $\frac{-3}{2}$
(D) The number of point is having internal coordinates in region $A \cap B \cap C$ is 7.

39. Let $A = \begin{bmatrix} 3x^2 \\ 1 \\ 6x \end{bmatrix}$, $B = [a \ b \ c]$
$C = \begin{bmatrix} (x+2)^2 & 5x^2 & 2x \\ 5x^2 & 2x & (x+2)^2 \\ 2x & (x+2)^2 & 5x^2 \end{bmatrix}$ be three given matrices,
where a, b, c and $x \in R$ given $t_r(AB) = t_r(c) \ \forall \ x \in R$, where $t_r(A)$ denote trace of A.
Then which of following are correct
(A) $a+b+c = 7$
(B) if $\int_0^\infty \frac{\ln x}{cx^2+ax+b}dx = \frac{\pi \ln p}{\sqrt{q}}$ where p and q are coprime then $p+q = 29$
(C) $a+b+c = 6$
(D) If $\int_0^\infty \frac{\ln x}{cx^2+ax+b}dx = \frac{\pi \ln p}{\sqrt{q}}$ where p and q are coprime are $p+q = 27$

Space for Rough work

40. Let n be an integer $n \geq 3$. let $p_1, p_2, ...p_n$ be a regular n-sided polygon inscribed in a circle. Three points p_i, p_j, p_k are randomly chosen, where i, j, k are district integer's between 1 and n.

If p(n) denotes probability that $\Delta p_i p_j p_k$ is obtuse angle triangle then which of the following are correct ?

(A) $p(5) = \frac{1}{2}$ (B) $p(8) = \frac{3}{7}$

(C) $p(6) = \frac{3}{10}$ (D) $p(7) = \frac{1}{2}$

41. Let $g : R \to \{4\}$ be a function given by $g(x) = x^3(f'(t) - 2) + x^2 f''(t) + 4x(f(0) + 6) + 4$ and h(x) is defined as

$$h(x) = \begin{cases} \int_0^x |f(t) - 2| dt, & 0 \leq x \leq 6 \\ (x-6)^2 + 20 : & 6 < x \leq 12 \end{cases}$$

Then choose correct statement's

(A) $h(3) = 15$ (B) range of h(x) is [0, 56]

(C) h(x) is not continuous at $x = 4$ (D) h(x) is not differentiate at $x = 6$

42. $f : R \to R$ and $g : R \to R$ are two function such that

$f(x) = 3x - \sin\left(\frac{\pi x}{2}\right), g(x) = x^3 + 2x - \sin\left(\frac{\pi x}{2}\right)$ then choose correct statements

(A) $\frac{d}{dx}\left(f^{-1}\left(g^{-1}(x)\right)\right)$ at $x = -12$ is $\frac{2}{3(28 + \pi)}$

(B) $\frac{d}{dx}\left(f^{-1}\left(g^{-1}(x)\right)\right)$ at $x = -12$ is $\frac{2}{3(28 - \pi)}$

(C) The area bounded by $y = f^{-1}(x)$ and $y = g^{-1}(x)$ is 1

(D) The area bounded by $y = f^{-1}(x)$ and $y = g^{-1}(x)$ is $\frac{1}{2}$

Space for Rough work

43. In a ΔABC if median from B and C are perpendicular, then the value of $\cot B + \cot C$ cannot be

(A) $\frac{1}{2}$ (B) $-\frac{1}{2}$

(C) $\frac{2}{3}$ (D) $-\frac{2}{3}$

(Matching type - Single Correct Option)

This section contains **SIX** questions of matching type. The section contains **TWO** tables (each having 3 columns and 4 rows). Based on each table, there are **THREE** questions. Each question has **FOUR** options (A), (B), (C), and (D). **ONLY ONE** of these four options is correct.

Answer questions 44, 45 and 46 by appropriately matching the information given in the three columns of the following table.

For the quadratic polynomial $f(x) = ax^2 + bx + c$ where $a,b,c \in R$ and $a > 0, D = b^2 - 4ac$

Column-1: Contains the information about curve $y = |f|x||$ behaviour on different condition of a, b, c and D.

Column-2: Contains number of points where curves $y = |f|x||$ are not differentiable.

Column-3: Contains number of roots of curves $y = |f(|x|)|$.

	Column-1		Column-2		Column-3
(I)	D>0, b<0 and c>0	(i)	1	(P)	1
(II)	D>0, b<0 and c<0	(ii)	2	(Q)	2
(III)	D<0 $b \neq 0$ and c>0	(iii)	3	(R)	4
(IV)	D>0 b = 0 and c<0	(iv)	5	(S)	0

44. Which of following option is only correct combination

(A) (I)(iv)(R) (B) (III)(iii)(S) (C) (II)(i)(Q) (D) (IV)(ii)(R)

45. Which of following is only correct combination

(A) (III)(iii)(R) (B) (II)(iii)(Q) (C) (IV)(ii)(R) (D) (I)(iii)(R)

46. Which of following is only incorrect combination

(A) (I)(iv)(R) (B) (II)(iii)(Q) (C) (III)(i)(S) (D) (IV)(ii)(R)

Space for Rough work

Answer questions 47, 48 and 49 by appropriately matching the information given in the three columns of the following table.

If three planes are given

$S_1 : 2x + 3y + 4z = 9$

$S_2 : 4x + 5y + 6z = 15$

$S_3 : y + az = b$

And two lines are given

$L_1 : \bar{r} = (\hat{i} + a_1\hat{j} + \hat{k}) + \lambda(b_1\hat{i} + b_2\hat{j} + \hat{k})$

$L_2 : \bar{r} = \mu(\hat{i} + \hat{j} + \hat{k})$

Where line L_1 is contained in S_1, S_2 and S_3

Then

	Column-1		Column-2		Column-3
(I)	$b_1 - b_2$ is -3	(i)	Acute angle between S_1&S_3 is $\cos^{-1}\left(\frac{11}{\sqrt{145}}\right)$	(P)	Image of a pt. (0, 0, 0) w.r.t S_3 is $\left(0, \frac{6}{\sqrt{5}}, \frac{12}{\sqrt{5}}\right)$
(II)	$a_1 + a$ is 3	(ii)	Acute angle between L_2& S_3 is $\cos^{-1}\left(\frac{\sqrt{3}}{\sqrt{5}}\right)$	(Q)	Image of point (0, 0, 0) w.r.t line L_1 is (1, 1, 1)
(III)	$b + b_1 + b_2$ is 2	(iii)	Distance between L_1& L_2 is zero	(R)	Distance of point (0, 0,0) from S_1 measured parallel to L_2 is $\frac{9}{\sqrt{29}}$
(IV)	$\int_{b_2}^{b_1} \{x\}\,dx$ is $\frac{1}{2}$ where { } represent fractional part	(iv)	Acute angle between L_2& S_1 is $\sin^{-1}\left(\frac{3\sqrt{3}}{\sqrt{29}}\right)$	(S)	Distance of a point (1, 0, 0) from S_3 measured || to L_2 is $\sqrt{3}$.

47. Which of following in only correct combination
(A) (I)(iii)(Q) (B) (II)(iii)(P) (C) (III)(ii)(S) (D) (IV)(iv)(R)

48. Which of following is correct combination
(A) (III)(iv)(S) (B) (III)(ii)(P) (C) (IV)(i)(P) (D) (II)(iii)(R)

49. Which of following is incorrect combination.
(A) (II)(i)(P) (B) (III)(iii)(S) (C) (III)(iv)(R) (D) (III)(iii)(P)

Space for Rough work

SECTION – C
(Single digit integer type)

This section contains **FIVE** questions. The answer to each question is a single Digit integer ranging from 0 to 9, both inclusive.

50. Let S_n and Δ_n be the sum of first n terms of 2A.P's, whose rth term are T_r and t_r respectively.
If $\frac{S_n}{\Delta_n}=\frac{2n+5}{3n+2}$ then $\frac{T_{11}}{t_{10}}=\frac{m_1}{m_2}$ where m_1 and m_2 are coprime. Find the value of $\frac{m_2-m_1}{2}=$

51. Let $f:A\to B$ be any function where A is set containing the positive integral solution of the inequality $\cos ec^{-1}(\text{cosec}\,2)>x^2-3x$ and B is the set of all divisors of natural number 4020.
If $f(i)\le f(j)\,\forall i<j$. if total no of function from A to B is λ. Then the $\lambda-2598$ equal to

52. If the set of values of parameter α so that point $P\left(\alpha,\frac{1}{1+\alpha^2}\right)$ does not lie outside the triangle formed by lines $L_1:15y=x+1$, $L_2:78y=118-23x$ and $L_3:y+2=0$ is [a, b]
Then $a+b=$

53. The pages of a book are numbered from 1 to n. when the page numbers of the book were added together one of the page number was added twice, resulting in the incorrect sum of 1986.
If the number on the page that was added twice is λ, then $\lambda-30$ is.

54. The ratios of the lengths of sides BC and AC of ΔABC to the radius of circumscribed circle are equal to 2 and $\frac{3}{2}$ respectively. If the ratio of the lengths of the bisectors of the interior angles B and C is $\frac{\alpha(\sqrt{\alpha}-1)}{\beta\sqrt{\gamma}}$ where $\alpha,\beta,\gamma\in N$ Then find value of $\frac{(\alpha+\beta+\gamma)}{2}$:

Space for Rough work

FIITJEE

JEE(Advanced)-2018

ALL INDIA TEST SERIES

ANSWERS, HINTS & SOLUTIONS

FULL TEST – VII
PAPER-1

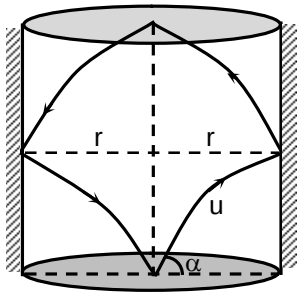
Q. No.	PHYSICS	Q. No.	CHEMISTRY	Q. No.	MATHEMATICS
1.	**B, D**	19.	**A, D**	37.	**A, D**
2.	**B, C**	20.	**A, D**	38.	**B, C**
3.	**B, D**	21.	**B, C**	39.	**A, B**
4.	**A, D**	22.	**A, B, D**	40.	**A, B, C**
5.	**B, C**	23.	**A, B, D**	41.	**A, B, D**
6.	**A, C, D**	24.	**A, B**	42.	**A, D**
7.	**B, C**	25.	**A, B, C**	43.	**A, B, D**
8.	**B**	26.	**A**	44.	**A**
9.	**A**	27.	**D**	45.	**B**
10.	**D**	28.	**A**	46.	**D**
11.	**D**	29.	**C**	47.	**B**
12.	**C**	30.	**D**	48.	**A**
13.	**B**	31.	**B**	49.	**C**
14.	**4**	32.	**5**	50.	**6**
15.	**3**	33.	**4**	51.	**2**
16.	**2**	34.	**4**	52.	**7**
17.	**2**	35.	**4**	53.	**3**
18.	**2**	36.	**3**	54.	**9**

Physics

PART – I

SECTION – A

1. B, D



During collision u_x will not change and range will be 4r.

$\therefore \quad 4r = (u\cos\alpha)T$

$\Rightarrow \quad u = \dfrac{4r}{T\cos\alpha}$

As particle will not be able to reach highest position of standard projectile path.

$\dfrac{2u\sin\alpha}{g} > T \quad \Rightarrow \dfrac{2u\sin\alpha}{g} > \dfrac{4r}{u\cos\alpha}$ From (1)

$\Rightarrow \quad u > 2\sqrt{\dfrac{gr}{\sin 2\alpha}}$

2. B, C

$T = 2\pi\sqrt{\dfrac{\ell}{g}} \Rightarrow g \propto \ell T^2$

$\Rightarrow \quad \dfrac{\Delta g}{g} = \left(\dfrac{\Delta\ell}{\ell} + \dfrac{2\Delta T}{T}\right)$

Therefore $P = \left(\dfrac{\Delta\ell}{\ell} + \dfrac{2\Delta T}{T}\right)100\%$

$\Rightarrow \quad P_1 = \left(\dfrac{0.1}{100} + \dfrac{2(1)}{400}\right)\times 100 = 0.6\%$

$P_2 = \left(\dfrac{0.1}{400} + \dfrac{2(1)}{400}\right)\times 100 = 0.42\%$

$P_3 = \left(\dfrac{0.1}{100} + \dfrac{2(1)}{200}\right)\times 100 = 1.1\%$

$P_4 = \left(\dfrac{0.1}{400} + \dfrac{2(1)}{800}\right)\times 100 = 0.28\%$

3. B, D

$B = \dfrac{\mu_0 I}{\ell} = \dfrac{\mu_0}{\ell}\left[(\sigma)\dfrac{(2\pi R)\ell\omega}{2\pi}\right]$

$= \mu_0\sigma R\omega$

$= \mu_0\sigma Rkt \Rightarrow B \ \alpha \ 't'$

Consider loop of radius 'r' $r < R$

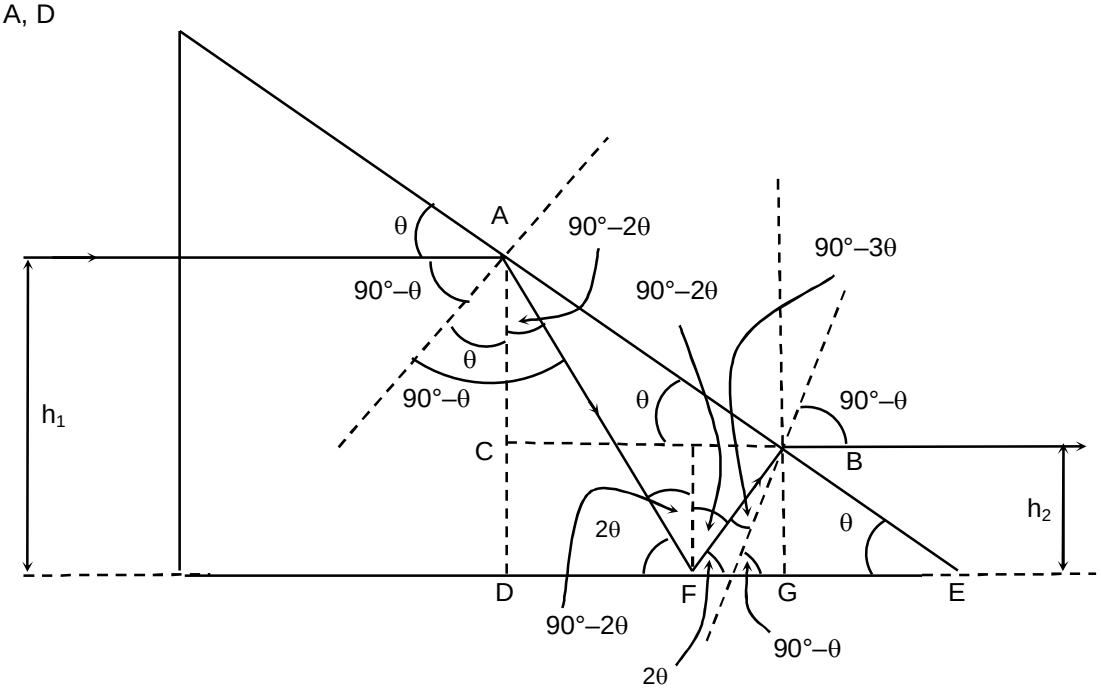
$E(2\pi r) = \pi r^2 \dfrac{dB}{dt}$

$E = \dfrac{r}{2}(\mu_0\sigma Rk) \qquad E \propto r$

For,

Energy density $= \dfrac{B^2}{2\mu_0}$

4. A, D



$AC = h_1 - h_2$

$$\tan\theta = \frac{AC}{CB}$$

$$= \frac{h_1 - h_2}{DF + FG}$$

$$\tan\theta = \frac{h_1 - h_2}{h_1\cot 2\theta + h_2\cot 2\theta}$$

$$\Rightarrow \quad \frac{\tan\theta}{\tan 2\theta} = \frac{h_1 - h_2}{h_1 + h_2}$$

$$\Rightarrow \quad \frac{h_1}{h_2} = \frac{\sin\theta}{\sin 3\theta}$$

$$\Rightarrow \quad \frac{h_2}{h_1} = \frac{\sin 3\theta}{\sin\theta} = 4\cos^2\theta - 1 \qquad (1)$$

Using Snel's law at 'B'

$$\mu\sin(90° - 3\theta) = \sin(90° - \theta)$$

$$\Rightarrow \quad \frac{1}{\mu} = \frac{\cos 3\theta}{\cos\theta} = 4\cos^2\theta - 3 \qquad (2)$$

From (1) and (2) $\dfrac{h_1}{h_2} = \dfrac{\mu}{1+2\mu}$

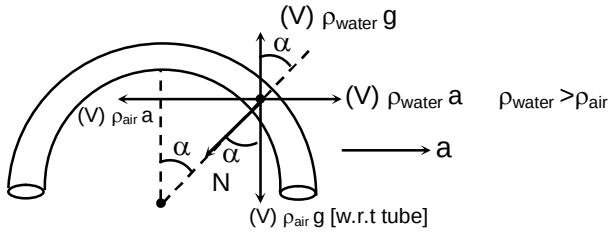
5. B, C

Use condition of equilibrium

$N\cos\alpha = v(\rho_{water} - \rho_{air})g$

$N\sin\alpha = V(\rho_{water} - \rho_{air})a$

$$\Rightarrow \quad \tan\alpha = \frac{a}{g}$$



6. A, C, D

$U = 3PV$

$nC_vT = 3PV$

$\Rightarrow \quad \gamma = \frac{4}{3}$

Tri-atmoic gas

$C_p = \frac{\gamma R}{\gamma - 1}$

$\Rightarrow \quad C_p = 4R$

7. B, C

Block will move between $\frac{-\alpha}{2} \& \frac{\alpha}{2}$.

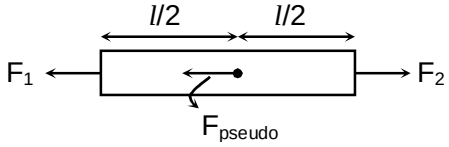
$T = 4\left(\frac{T_0}{6}\right) = \frac{2}{3}T_0$

If collision with atleast one wall is inelastic then amplitude will reduce and time period will remain same as T_0.

8. B
9. A
10. D
11. D
12. C
13. B

SECTION – C

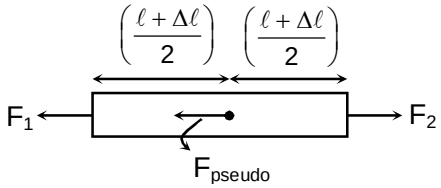
14. 4



From this frame, $W_{pseduo} = 0$

$W_1 = F_1 \times \left(\frac{\Delta \ell}{2}\right)$

And $W_2 = F_2 \times \left(\frac{\Delta \ell}{2}\right)$



Thus, w.e.f. from COM frame

$W_1 + W_2 + W_{pseudo} = U + \kappa + \Delta$ [$\therefore$ k will remains zero finally from COM frame]

$\Rightarrow \quad W_1 + W_2 = U + \Delta$

$\Rightarrow \quad F_1.\frac{\Delta \ell}{2} + F_2.\frac{\Delta \ell}{2} = U + \Delta$

$\Rightarrow \quad (F_1 + F_2)\frac{\Delta \ell}{2} = U + \Delta$

So, Let's calculates heat now

$$\frac{1}{2}\left[(F_1+F_2)\frac{(F_1+F_2)\ell}{2AY}\right]=\frac{(F_1^2+F_2^2+F_1F_2)\ell}{6AY}+\Delta$$

$$\Rightarrow \quad \Delta=\frac{(F_1^2+F_2^2+4F_1F_2)\ell}{12AY}$$

Putting $F_1 = F$; $F_2 = 2F$, we get $\Delta=\frac{13F^2\ell}{12AY}$

$\Rightarrow$ a = 1; b = 3

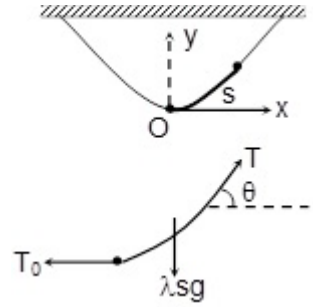
$\Rightarrow$ a + b = 4

15. 3

$T\sin\theta=\lambda sg$ . ...(1)

$T\cos\theta=T_0$ ....(2)

(i) and (ii) $\Rightarrow \tan\theta=\lambda sg/T_0 \quad \Rightarrow \quad S=\left(\frac{T_0}{\lambda g}\right)\tan\theta.$



R.O.C. $=\frac{ds}{d\theta}$

$$\Rightarrow \quad R=\left(\frac{T_0}{\lambda g}\right)\sec^2\theta$$

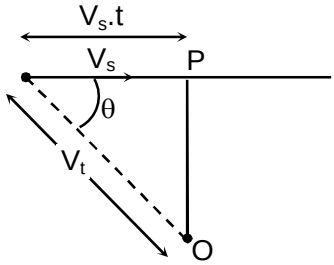
Putting $T_0 = 90$; $\lambda = 4; g = 10$ and $\theta = 30°$

R = 3 m

16. 2

The observer will hear sound, which has been emitted when source is slightly before point P.

Distance between two consecutive pubes emitted towards observer is $\frac{V-V_s\cos\theta}{f}$, as shown below.



$$\Rightarrow \lambda'=\frac{V-V_s\cos\theta}{f}$$

Putting $\cos\theta=\frac{V_s}{V}$

We get $\lambda'=\frac{V^2-V_s^2}{Vf}$

Putting the given values we get

$\lambda'=\frac{2}{11}$m

Hence n = 2

17. 2

$$mv+(m+\Delta m)g\Delta t=(m+\Delta m)(v+\Delta v)$$

$$\Rightarrow \quad mv+mg\Delta t+\Delta mg\Delta t=mv+m\Delta v+\Delta m.v+\Delta m.\Delta v$$

$$\Rightarrow \quad mg\Delta t+\Delta mg\Delta t=m\Delta v+\Delta m.v+\Delta m.\Delta v \qquad ....(1)$$

Also, $\frac{\Delta m}{\Delta t}=kmv$ (given)

$\Rightarrow \quad \Delta m=kmv\Delta t$ Putting in (1)

We get $mg\Delta t+kmvg\Delta t^2=m\Delta v+kmv^2\Delta t+kmv\Delta t.\Delta v$

$\Rightarrow \quad mg\Delta t=m\Delta v+kmv^2\Delta t$ (Neglecting second differentials)

$\Rightarrow \quad \Delta v = (g - kv^2)\Delta t \quad \Rightarrow \quad \frac{\Delta v}{\Delta t} = g - kv^2$

$\Rightarrow \quad \frac{dv}{dt} = g - kv^2$

At terminal velocity $g - kv^2 = 0$

$\Rightarrow \quad v = \sqrt{\frac{g}{k}}$

Putting g = 10; k = 2.5 $\Rightarrow$ v = 2 m/s

18. 2

Let $y = A\sin(\omega t - kx)$

P.E. stored in small element dx is

$dU = \frac{T}{2}\left(\frac{\partial y}{\partial x}\right)^2 .dx = \frac{\mu v^2}{2}\left(\frac{\partial y}{\partial x}\right)^2 dx$

$= \frac{\mu}{2}\left[v.\frac{\partial y}{\partial x}\right]^2 dx$

Since, $\frac{\partial y}{\partial t} = -v\frac{\partial y}{\partial x}$

Hence, $dU = \frac{\mu}{2}.\left(\frac{\partial y}{\partial t}\right)^2 dx$

Also, KE stored in small element 'dx' is

$dK = \frac{1}{2}(\mu dx)\left(\frac{\partial y}{\partial t}\right)^2$

$\Rightarrow$ Total energy dE = dU + dK = $\mu\left(\frac{\partial y}{\partial t}\right)^2 dx$

$\frac{\partial y}{\partial t} = A\omega\cos(\omega t - kx)$

$\Rightarrow \quad dE = \mu\omega^2 A^2\cos^2(\omega t - kx)dx$

$\Rightarrow \quad E = \mu\omega^2 A^2 \int_{x=0}^{\lambda} \cos^2(\omega t - kx)dx = \frac{\mu\omega^2 A^2\lambda}{2}$

Hence b = 2

Chemistry

PART – II

SECTION – A

19. AD
Addition of $CaCO_3$ does not affect equilibrium as it is solid and inert gas addition at constant volume also does not affect the equilibrium but as reaction is endothermic and gaseous Stoichiometry of product is more than reactants that's why A and D are correct

20. AD
Both A and D are correct as both follows Hund's rule and B, C do not

21. BC
H-atom in NaH_2PO_2 is bonded with P (less electronegative), cannot involve in H-bonding and so also $(CH_3)_3BO_3$

22. ABD
At pH < isoelectric pH, $-NH_2$ group is protonated to $-\overset{+}{N}H_3$ and the sol is positively charged. At pH > isoelectric pH, –COOH is deprotonated to $-COO^-$ and the sol is negatively charged. At isoelectric pH both groups are equally ionised, the sol particles carry no net charge.

23. ABD
Sodium nitrate on decomposition upto 500ºC gives $NaNO_2$ and oxygen
$2NaNO_3 \xrightarrow{\Delta} 2NaNO_2 + O_2 \uparrow$
While at higher temperature (i.e. above to 800ºC), $NaNO_2$ further decomposes into Na_2O, N_2 and O_2.
$2NaNO_2 \xrightarrow{800°C} Na_2O + 3/2O_2 \uparrow + N_2 \uparrow$

24. AB
$[K_2HgI_4 + KOH]$ and $[HgCl_2 + KI(\text{excess}) + KOH]$ are Nessler's reagent which gives brown precipitate of $H_2N-Hg-O-Hg-I$ (iodide of Million's base).

25. ABC
Since there are no ions involved in this compound, the Cl^- atoms are covalently bonded to Pd in the coordination sphere
(d) No precipitate of AgCl would be formed as chlorine atoms are non-ionisable.

26. A
Tollen's test is given by all type of aldehyde by action of ammonical silver nitrate and observation is formation of silver mirror

27. D
Red ppt is observed by action of Fehling solution on aliphatic aldehyde

28. A
Tollen's test, Fehling's test and Haloform test all three involve oxidation of organic compound but action of Fehling solution on terminal alkynes do not

29. C

30. D

31. B

Sol. (29 to 31)

Crystal system	Axial length & angle	Type of unit cell
Cube	$a = b = c$ $\alpha = \beta = \gamma$	Primitive, face centred & body centered
Orthorhombic	$a \neq b \neq c$ $\alpha = \beta = \gamma$	Primitive, Face centred, body centered & end centered
Triclinic	$a \neq b \neq c$ $\alpha \neq \beta \neq \gamma$	Only Primitive
Monoclinic	$a \neq b \neq c$ $\alpha = \beta \neq \gamma$	Primitive, End centred

SECTION – C

32. 5

Moles ($KMnO_4$) $\times$ 5 = mole (SnC_2O_4) $\times$ 4 (n factor of SnC_2O_4)

$SnC_2O_4 \xrightarrow{KMnO_4} Sn^{4+} + CO_2$

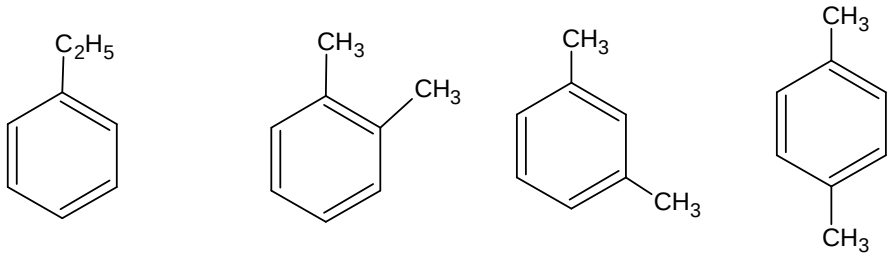
33. 4

One triangular face will be found in place of each corner of tetrahedron

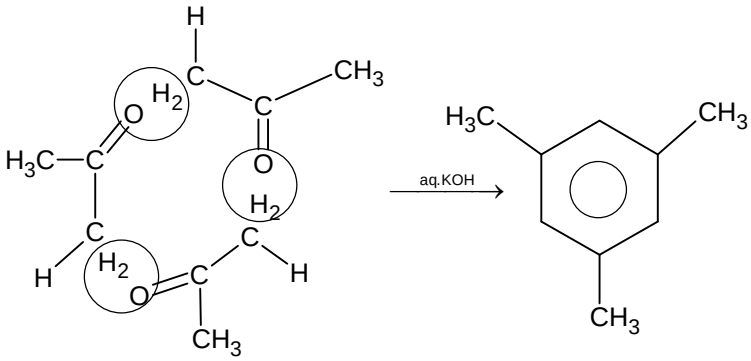
34. 4

$^{235}_{92}U + ^{1}_{0}n \rightarrow {}^{140}_{54}Xe + {}^{92}_{38}Sr + 4^{1}_{0}n$

35. 4



36. 3



Mathematics

PART – III

SECTION – A

37. A, D

Sol. $y^2 = 16x \Rightarrow a = 4$

Slope of tangents at t is $\frac{1}{t}$

$\tan\theta_1 = \frac{1}{t_1}$, $\tan\theta_2 = \frac{1}{t_2}$; $\tan\theta_3 = \frac{1}{t_3}$

t_1, t_2, t_3 are in A. P. with $d = 3$

$t_2 - t_1 = 3$

$t_3 - t_2 = 3$

Area of $\Delta PQR = \frac{1}{2}\begin{vmatrix} at_1t_2 & a(t_1+t_2) & 1 \\ at_2t_3 & a(t_2+t_3) & 1 \\ at_3t_1 & a(t_3+t_1) & 1 \end{vmatrix}$

$= a^2d^3 = 16 \times 27 = 432$

Area of ΔABC is $= 2.\Delta PQR$

= 864.

38. B, C

Sol. For. A, $|z+1| \le 2 + Re(z)$

$\Rightarrow y^2 \le 2\left(x + \frac{3}{2}\right)$

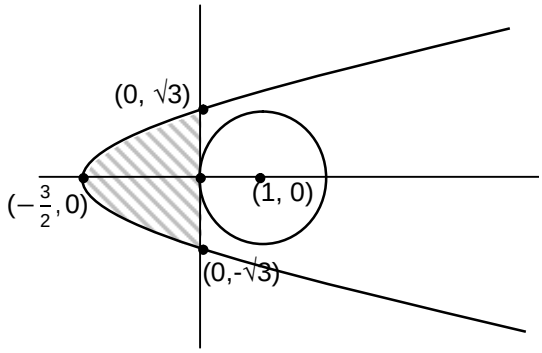
For B, $|z-1| \ge 1 \qquad \Rightarrow (x-1)^2 + y^2 \ge 1$

For C

$|z-1|^2 \ge |z+1|^2$

$\Rightarrow (z-1)(\bar{z}-1) \ge (z+1)(\bar{z}+1)$

$\Rightarrow z + \bar{z} \le 0 \qquad \Rightarrow x \le 0$



B. Required area $2\int_{-\frac{3}{2}}^{0}\sqrt{2(x+\frac{3}{2})}\,dx = 2\sqrt{3}$

C. $z = -\frac{3}{2} + i0$ is complex number in region $A \cap B \cap C$ having max amplitude

D. $(-1,0),(-1,1),(-1,-1),(0,0),(0,1)(0,-1)$, are point but $z = -1$ is not in domain of C

so total points 5

39. A, B

Sol. $AB = \begin{bmatrix} 3ax^2 & 3bx^2 & 3cx^2 \\ a & b & c \\ 6ax & 6bx & 6cx \end{bmatrix}$

Now $t_r(AB) = t_r(c)$

$\Rightarrow 3ax^2 + b + 6cx = (x+2)^2 + 2x + 5x^2 : \forall x \in R$

$a = 2, c = 1, b = 4$

$$I=\int_0^{\infty}\frac{\ln x}{x^2+2x+4}dx$$

Put $x=2t$

$dx=2dt$

$$=\int_0^{\infty}\frac{\ln(2t)}{4t^2+4t+4}.2dt$$

$$=\int_0^{\infty}\frac{2.\ln 2}{4(t^2+t+1)}dt+\int_0^{\infty}\frac{2\ln t}{4(t^2+t+1)}dt$$

Put $t=\frac{1}{y}$ in second Integral we get zero

$$=\frac{1}{2}\int_0^{\infty}\frac{\ln 2}{t^2+t+1}dt+0$$

$$=\frac{\pi\ln 2}{3\sqrt{3}}$$

$p=2,q=27$

$p+q=29$

40. A, B, C

Sol. $\text{Probability}=\frac{3(n-4)}{4(n-1)}$: If n is even

$\text{Probability}=\frac{3(n-3)}{4(n-2)}$: If n is odd

41. A, B, D

Sol. $g(x)=4$

$x^3\left(f'(t)-2\right)+x^2f''(t)+4x\left(f(0)+6\right)+4=4$ for $\forall x$

$\Rightarrow x^3(f'(t)-2)+x^2f''(t)+4x(f(0)+6)=0$ for $\forall x$

Hence $f'(t)-2=0$ and $f''(t)=0$

and $f(0)+6=0\Rightarrow f(0)=-6$

So, $f(t)=2t-6$

$$h(x)=\begin{cases}-x^2+8x & ;0\le x<4\\ x^2-8x+32 & ;4\le x\le 6\\ (x-6)^2+20 & ;6<x\le 12\end{cases}$$

42. A, D

Sol. $(A)\left(f^{-1}g^{-1}(x)\right)=\left(g(f(x))\right)^{-1}$

$$\frac{d}{dx}\left(f^{-1}g^{-1}(x)\right)\Big|_{\text{at } x=-12}=\frac{1}{\frac{d}{dx}\left(gof(x)\right)_{\text{at } x=-1}}$$

(D) Area will be same as bounded by $y=f(x),y=g(x)$

$$\Rightarrow\int_{-1}^{1}\left|x^3-x\right|dx=\frac{1}{2}$$

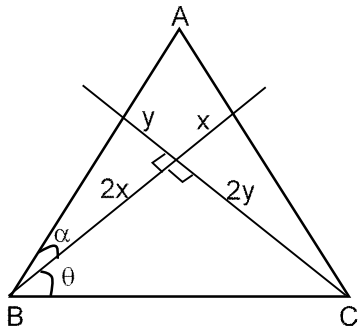
43. A, B, D

Sol. $\tan\theta = \frac{2y}{2x} = \frac{y}{x}$

$\tan\alpha = \frac{y}{2x}$

$\tan B = \frac{\frac{y}{x} + \frac{y}{2x}}{1 - \frac{y^2}{2x^2}} = \frac{3xy}{2x^2 - y^2}$

$\cot B = \frac{2x^2 - y^2}{3xy}$;



Similarly,

$\cot C = \frac{2y^2 - x^2}{3xy}$

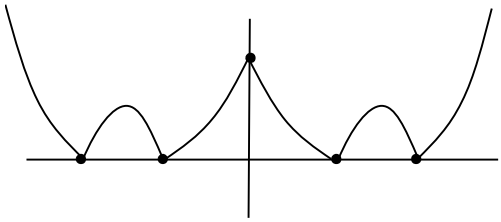
$\cot B + \cot C = \frac{x^2 + y^2}{3xy} \geq \frac{2}{3}$

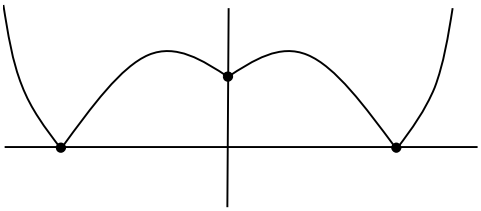
44. A

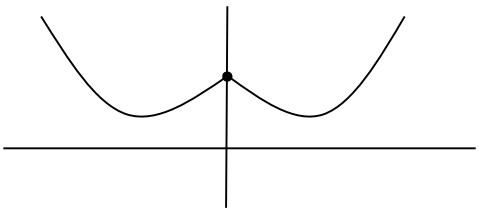
45. B

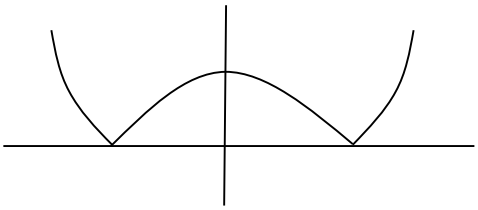
46. D

Sol.

I.  4 roots, 5 points not derivative

II.  2 roots, 3 points not derivative

III.  No root's, 1 point of non-derivative

IV.  2 roots, 2 points non-derivative

47. B
48. A
49. C

Sol. Point $(1, a_1, 1)$ lies on s_1 and s_2

$2+3a_1+4=9 \Rightarrow a_1=1$

$(b_1,b_2,1)$ is $\perp$ to normal of planes s_1, s_2 and s_3

$2b_1+3b_2+4=0$

$4b_1+5b_2+6=0$

$\Rightarrow b_1=1, b_2=-2, a=2, b=3$

SECTION – C

50. 6

Sol. $\frac{S_n}{\Delta_n}=\frac{2n+5}{3n+2}=\lambda$

$S_n=\lambda n(2n+5) : \Delta_n=\lambda n(3n+2)$

$T_n=S_n-S_{n-1} : t_n=\Delta_n-\Delta_{n-1}$

$T_n=\lambda(4n+3) : t_n=\lambda(6n-1)$

$T_{11}=\lambda(47)$

$t_{10}=\lambda(59)$

$\frac{T_{11}}{t_{10}}=\frac{47}{59}=\frac{m_1}{m_2}$

$\frac{m_2-m_1}{2}=\frac{59-47}{2}=6$

51. 2

Sol. $\text{cosec}^{-1}(\text{cosec}2) > x^2-3x$

$\pi-2>x^2-3x$ give integral solution of 1,2, 3.

$4020=2^2.3.5.67$ given 24 divisors'

Now, $f(i)\le f(j)\ \forall i<j$

${}^{24+2}C_3=2600$

52. 7

Sol. $P\left(\alpha,\frac{1}{1+\alpha^2}\right)$ lie on

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

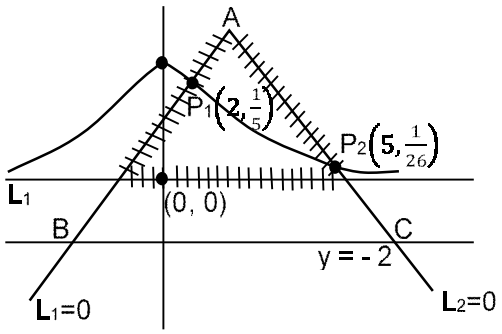
On solving $y=\frac{1}{1+x^2}$ with L_1

$P_1\left(2,\frac{1}{5}\right)$ ...(1)

And with L_2, $P_2\left(5,\frac{1}{26}\right)$ ...(2)

From (1) and (2)

$2\le\alpha\le 5$



53. 3

Sol. Let k be number of page that was counted twice then $0 < K < n+1$

$0+1+2+3+.....n < 1986 < 1+2+....(n+1)$

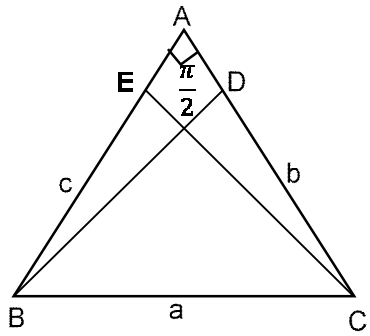
$n(n+1) < 3972 < (n+1)(n+2)$

On solving $n = 62$

So, $k = 1986 - \frac{62\times 63}{2} = 1986 - 1953 = 33$

54. 9

Sol. We have $\frac{a}{R} = 2 : \frac{b}{R} = \frac{3}{2}$



$\frac{2R\sin A}{R} = 2$

$\sin A = 1 \Rightarrow \angle A = \frac{\pi}{2}$

And $\sin B = \frac{3}{4}$

$c^2 = 4R^2 - \frac{9R^2}{4}$

$\Rightarrow c = \frac{\sqrt{7}}{2}R$

$l_1 = \frac{2ac}{a+c}\cos\frac{B}{2}$

$l_2 = \frac{2ab}{a+b}\cos\frac{C}{2}$

$\frac{l_1}{l_2} = \left(\frac{a+b}{a+c}\right)\frac{c}{b}.\sqrt{\frac{1+\cos B}{1+\cos C}}$

$= \frac{c(a+b)}{b(a+c)}.\sqrt{\frac{1+\frac{c}{a}}{1+\frac{b}{a}}}$

$= \frac{c}{b}.\sqrt{\frac{a+b}{a+c}}$

Now put,

$a = 2R,$

$b = \frac{3}{2}R,$

$c = \frac{\sqrt{7}}{2}R$

$\frac{l_1}{l_2} = \frac{7}{3}\left(\sqrt{\frac{4-\sqrt{7}}{16-7}}\right) = \frac{7}{9}.\sqrt{\frac{8-2\sqrt{7}}{2}} = \frac{7}{9.\sqrt{2}}(\sqrt{7}-1)$