Mock Paper (Main) Paper- 1

This booklet contains 16 printed pages
इस पुस्तिका में मुद्रित पृष्ठ 16 हैं।

PAPER – 2 : PHYSICS, CHEMISTRY & MATHEMATICS
प्रश्नपुस्तिका – 2 : भौतिक विज्ञान, रसायन विज्ञान तथा गणित

Do not open this Test Booklet until you are asked to do so.
इस परीक्षा पुस्तिका को तब तक न खोलें जब तक कहा न जाए।

Read carefully the Instructions on the Back Cover of this Test Booklet.
इस परीक्षा पुस्तिका के पिछले आवरण पर दिए गए निर्देशों को ध्यान से पढ़ें।

Important Instructions :	***महत्वपूर्ण निर्देश :***
1. Immediately fill in the particulars on this page of the Test Booklet with *Blue/Black Ball Point Pen. Use of pencil is strictly prohibited.*	**1.** परीक्षा पुस्तिका के इस पृष्ठ पर आवश्यक विवरण नीले / काले बॉल प्वाइंट पेन से तत्काल भरें। पेन्सिल का प्रयोग बिल्कुल वर्जित है।
2. The answer sheet is kept inside this Test Booklet. When you are directed to open the Test Booklet, take out the Answer Sheet and fill in the particulars carefully.	**2.** उत्तर पत्र इस परीक्षा पुस्तिका के अन्दर रखा है। जब आपको परीक्षा पुस्तिका खोलने को कहा जाए, तो उत्तर पत्र निकाल कर सावधानीपूर्वक विवरण भरें।
3. The Test is of **3 hours** duration.	**3.** परीक्षा की अवधि **3 घंटे** है।
4. The Test Booklet consists of **90** questions. The maximum marks are **360.**	**4.** इस परीक्षा पुस्तिका में **90** प्रश्न हैं। अधिकतम अंक **360** हैं।
5. There are ***three*** parts in the question paper A, B, C consisting of **Physics, Chemistry and Mathematics** having 30 questions in each part of equal weightage. Each question is allotted **4 (four)** marks for correct response.	**5.** इस परीक्षा पुस्तिका में ***तीन*** भाग A, B, C हैं, जिसके प्रत्येक भाग में **भौतिक विज्ञान, रसायन विज्ञान** एवं **गणित** के 30 प्रश्न हैं और सभी प्रश्नों के अंक समान हैं। प्रत्येक प्रश्न के सही उत्तर के लिए **4 (चार) अंक** निर्धारित किये गये हैं।
6. *Candidates will be awarded marks as stated above in instruction No. 5 for correct response of each question. ¼* ***(one fourth) marks will be deducted for indicating incorrect response of each question.*** *No deduction from the total score will be made if no response is indicated for an item in the answer sheet.*	**6.** *अभ्यर्थियों को प्रत्येक सही उत्तर के लिए उपरोक्त निर्देशन संख्या 5 के निर्देशानुसार मार्क्स दिये जायेंगे।* ***प्रत्येक प्रश्न के गलत उत्तर के लिये 1/4 वां भाग काट लिया जायेगा।*** *यदि उत्तर पत्र में किसी प्रश्न का उत्तर नहीं दिया गया हो तो कुल प्राप्तांक से कोई कटौती नहीं की जायेगी।*
7. There is only one correct response for each question. Filling up more than one response in any question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instruction 6 above.	**7.** प्रत्येक प्रश्न का केवल एक ही सही उत्तर है। एक से अधिक उत्तर देने पर उसे गलत माना जायेगा और उपरोक्त निर्देश 6 के अनुसार अंक काट लिये जायेंगे।
8. Use ***Blue/Black Ball Point Pen only*** for writing particulars/ marking responses on ***Side-1*** and ***Side-2*** of the Answer Sheet. ***Use of pencil is strictly prohibited.***	**8.** उत्तर पत्र के **पृष्ठ–1** एवं **पृष्ठ–2** पर वांछित विवरण एवं उत्तर अंकित करने हेतु **केवल नीले/काले बॉल प्वाइंट पेन** का ही प्रयोग करें। **पेन्सिल का प्रयोग बिल्कुल वर्जित है।**
9. No candidate is allowed to carry any textual material, printed or written, bits of papers, pager, mobile phone, any electronic device etc. except the Admit Card inside the examination hall/room.	**9.** परीक्षार्थी द्वारा परीक्षा कक्ष/हॉल में प्रवेश कार्ड के अलावा किसी भी प्रकार की पाठ्य सामग्री, मुद्रित या हस्तलिखित, कागज की पर्चियाँ, पेजर, मोबाइल फोन या किसी भी प्रकार के इलेक्ट्रॉनिक उपकरणों या किसी अन्य प्रकार की सामग्री को ले जाने या उपयोग करने की अनुमति नहीं है।
10. Rough work is to be done on the space provided for this purpose in the Test Booklet only. This space is given at the bottom of each page of booklet.	**10.** रफ कार्य परीक्षा पुस्तिका में केवल निर्धारित जगह पर ही कीजिए। यह जगह प्रत्येक पृष्ठ पर नीचे की ओर और दी गई है।
11. On completion of the test, the candidate must hand over the Answer Sheet to the Invigilator on duty in the Room/Hall. ***However, the candidates are allowed to take away this Test Booklet with them.***	**11.** परीक्षा समाप्त होने पर, परीक्षार्थी कक्ष/हॉल छोड़ने से पूर्व उत्तर पत्र कक्ष निरीक्षक को अवश्य सौंप दें। **परीक्षार्थी अपने साथ इस परीक्षा पुस्तिका को ले जा सकते हैं।**
12. Do not fold or make any stray mark on the Answer Sheet.	**12.उत्तर पत्र को न मोड़ें एवं न ही उस पर अन्य निशान लगाएँ।**

Name of Candidate (in Capital letters) : .....
परीक्षार्थी का नाम (बड़े अक्षरों में) :
Roll Number : in figures
अनुक्रमांक : अंकों में
: in words .....
: शब्दों में
Examination Centre Number :
परीक्षा केन्द्र नम्बर :
Name of Examination Centre (in Capital letters) : .....
परीक्षा केन्द्र का नाम (बड़े अक्षरों में) :
Candidate's Signature : .....
परीक्षार्थी के हस्ताक्षर :

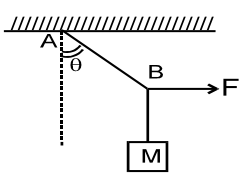
1. Invigilator's Signature : .....
निरीक्षक के हस्ताक्षर :
2. Invigilator's Signature : .....
निरीक्षक के हस्ताक्षर :

TEST SYLLABUS

Physics	**: -**	NLM & Friction & Dynamics of Horizontal Circular Motion
Chemistry	**: -**	Redox Reactions, Mole Concept – 02 (Stoichiometry and Stoichiometric Calculations)
Mathematics	**: -**	Trigonometric Equations & Inequalities, Complex Numbers

PART A – PHYSICS

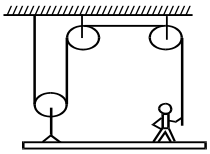
1. A mass M is suspended by a rope from a rigid support at A as shown in figure. Another rope is tied at the end B, and it is pulled horizontally with a force F. If the rope AB makes an angle θ with the vertical, then the tension in the string AB is :



(A) F sin θ (B) F/sin θ

(C) F cos θ (D) F/cos θ

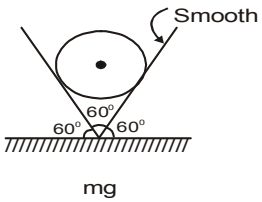
2. A 40 kg person stands on a 20 kg platform. He pulls on the rope which is attached to the platform via the frictionless pulleys as shown in the fig. The platform moves upwards at a steady rate if the force with which the person pulls the rope is



(A) 500 N (B) 250 N

(C) 200 N (D) 600 N

3. A cylinder of weight w is resting on a V-groove as shown in figure.



Calculate normal reactions between the cylinder and one inclined wall.

(A) ω (B) $\frac{\omega}{2}$

(C) $\frac{\omega}{3}$ (D) 0

4. A balloon of gross weight w, newton is rising vertically upwards with a constant acceleration $a(<g)$. The magnitude of the force by air is:

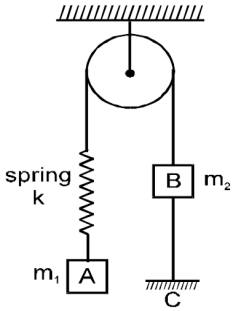
(A) w (B) $w\left(1+\frac{a}{g}\right)$

(C) $w\left(1-\frac{a}{g}\right)$

(D) $w\frac{a}{g}$

FOR ROUGH WORK

5. In the system shown in the figure $m_1 > m_2$. System is held at rest by thread BC. Just after the thread BC is burnt:



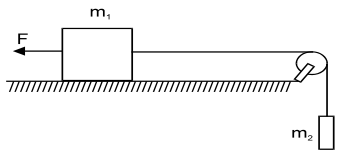
(A) acceleration of m_2 will be downwards

(B) magnitude of acceleration of both blocks will be equal to $\left(\frac{m_1 - m_2}{m_1 + m_2}\right) g$.

(C) Acceleration of m_1 will be equal to zero

(D) Magnitude of acceleration of two blocks will be non-zero and unequal.

6. A constant force $F = m_2 g$ is applied on the block of mass m_1 as shown in figure. The string and the pulley are light and the surface of the table is smooth. Find the acceleration of m_1.

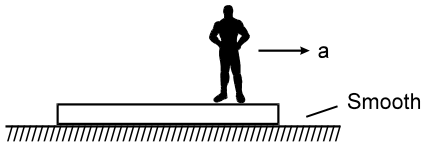


(A) $\frac{m_2 g}{m_1 + m_2}$ (B) Zero

(C) $\frac{m_2 g}{2(m_2 + m_1)}$

(D) $\frac{m_1 g}{m_1 + m_2}$

7. A man of mass 60 Kg standing on a platform of mass 30 Kg jumps horizontally with an acceleration $6 m/s^2$. Find the acceleration of platform.



(A) $6 m/s^2$

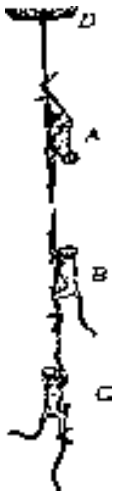
(B) $3 m/s^2$

(C) $12 m/s^2$

(D) None

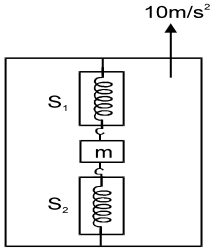
FOR ROUGH WORK

8. Three monkeys A, B and C with masses of 10, 15 & 8 Kg respectively are climbing up & down the rope suspended from D. At the instant represented, A is descending the rope with an acceleration of 1 m/s^2 & C is pulling himself up with an acceleration of 1.5 m/s^2. Monkeys B is climbing up with a constant speed of 0.8 m/s. Treat the rope and monkeys as a complete system & calculate the tension T in the rope at D. (g = 10 m/s^{-2})



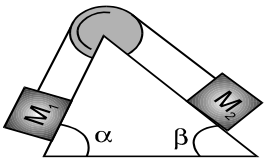
(A) 322 N (B) 330 N
(C) 332 N (D) None

9. Reading shown in two spring balances S_1 and S_2 is 90 kg and 30 kg respectively and lift is accelerating upwards with acceleration 10 m/s^2. The mass is stationary with respect to lift. Then the mass of the block will be :



(A) 60 kg (B) 30 kg
(C) 120 kg (D) None of these

10. Two masses M_1 and M_2 are attached to the ends of a string which passes over a pulley attached to the top of a double inclined plane of angles of inclination α and β. If $M_2 > M_1$, the acceleration a of the system is given by:



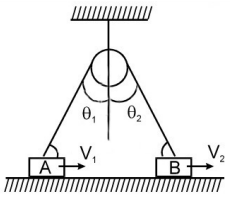
(A) $\frac{M_2 g(\sin\beta)}{M_1 + M_2}$ (B) $\frac{M_1 g(\sin\alpha)}{M_1 + M_2}$

(C) $\left(\frac{M_2 \sin\beta - M_1 \sin\alpha}{M_1 + M_2}\right) g$

(D) zero

FOR ROUGH WORK

11. In the figure shown, blocks A and B move with velocities v_1 and v_2 along horizontal direction. Find the ratio of $\frac{v_1}{v_2}$.



(A) $\frac{\cos\theta_2}{\cos\theta_1}$ (B) $\frac{\sin\theta_2}{\sin\theta_1}$

(C) $\frac{\cos\theta_1}{\cos\theta_2}$ (D) $\frac{\sin\theta_1}{\sin\theta_2}$

12. Out of the following given statements, mark out the incorrect:

(A) Static friction is always greater than the kinetic friction.

(B) Coefficient of static friction is always greater than the coefficient of kinetic friction.

(C) Limiting friction is always greater than the kinetic friction.

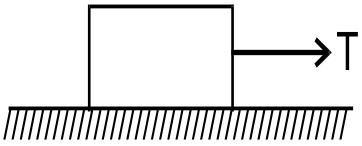
(D) Limiting friction is never less than the static friction.

13. A force of 980 N is require to just start moving a body of mass 200 kg over ice. The coefficient of static friction is:

(A) 0.6 (B) 0.4

(C) 0.5 (D) 0.1

14. In the figure shown, a block of weight 10 N resting on a horizontal surface. The coefficient of static friction between the block and the surface $\mu_S = 0.4$. A force of 3.5 N will keep the block in uniform motion, once it has been set in motion. A horizontal force of 3 N is applied to the block, then the block will:



(A) Move over the surface with constant velocity

(B) Move having accelerated motion over the surface

(C) Not move

(D) First will move with a constant velocity for some time and then will have accelerated motion

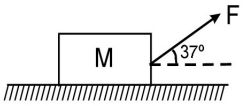
FOR ROUGH WORK

15. A fireman of mass 60 kg slides down a pole. He is pressing the pole with a force of 600 N. The coefficient of friction between the hands and the pole is 0.2, with what acceleration will the fireman slide down ($g = 10\ m/s^2$):

(A) $1\ m/s^2$ (B) $8\ m/s^2$

(C) $10\ m/s^2$ (D) $5\ m/s^2$

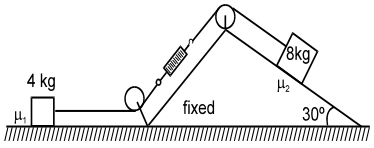
16. A block of mass M = 5 kg is resting on a rough horizontal surface for which the coefficient of friction is 0.2. When a force F = 40 N is applied, the acceleration of the block will be ($g = 10\ m/s^2$):



(A) $5.73\ m/sec^2$ (B) $5\ m/sec^2$

(C) $5.36\ m/sec^2$ (D) $6\ m/sec^2$

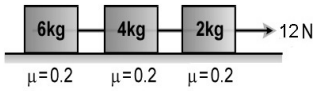
17. The reading of spring balance is 32 N and the accelerations of both the blocks is $0.5 m/s^2$. Then μ_2 will be :



(A) 0.06 (B) 0.01

(C) 0.1 (D) 0.6

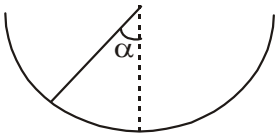
18. In the arrangement shown tension in the string connecting 4kg and 6kg masses is



(A) 8N (B) 12N

(C) 0N (D) 4N

19. An insect crawls up a hemispherical surface very slowly (see figure). The coefficient of friction between the insect and the surface is $\frac{1}{\sqrt{3}}$. If the line joining the centre of the hemispherical surface to the insect makes an angle α with the vertical, the maximum possible value of α is given by:

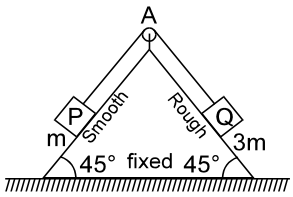


(A) 60° (B) 45°

(C) 30° (D) None

FOR ROUGH WORK

20. A fixed wedge with both surface inclined at 45^0 to the horizontal as shown in the figure. A particle P of mass m is held on the smooth plane by a light string which passes over a smooth pulley A and attached to a particle Q of mass 3m which rests on the rough plane. The system is released from rest. Given that the acceleration of each particle is of magnitude $\frac{g}{5\sqrt{2}}$ then the tension in the string is–



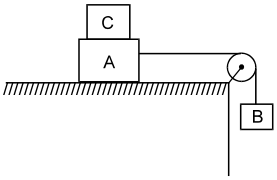
(A) mg

(B) $\frac{6mg}{5\sqrt{2}}$

(C) $\frac{mg}{2}$

(D) $\frac{mg}{4}$

21. Two masses A and B of 10 kg and 5 kg respectively are connected with a string passing over a frictionless pulley fixed at the corner of a table as shown. The coefficient of static friction of A with table is 0.2. The minimum mass of C that may be placed on A to prevent it from moving is



(A) 15 kg (B) 10 kg

(C) 5 kg

(D) 12 kg

22. A particle of small mass m is joined to a very heavy body by a light string passing over a light pulley. Both bodies are free to move. The acceleration of the blocks will be -

(A) g

(B) 2g

(C) $\frac{1}{2}g$

(D) $<< g$

FOR ROUGH WORK

23. A circular road of radius r is banked for a speed v = 40 km/hr. A car of mass attempts to go on the circular road. The friction coefficient between the tyre and the road is negligible.

(A) The car cannot make a turn without skidding.

(B) If the car turns at a speed less than 40 km/hr, it will not slip down

(C) If the car turns at the current speed of 40 km/hr, the force by the road on the car is equal to $\frac{mv^2}{r}$.

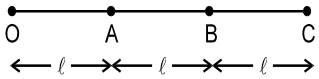
(D) If the car turns at the correct speed of 40 km/hr, the force by the road on the car is greater than mg as well as greater than $\frac{mv^2}{r}$.

24. A particle of mass m begins to slide down a fixed smooth sphere from the top. What is its tangential acceleration when it breaks off the sphere?

(A) $\frac{2g}{3}$ (B) $\frac{\sqrt{5}g}{3}$

(C) g (D) $\frac{g}{3}$

25. Three identical particles are joined together by a thread as shown in figure. All the three particles are moving on a smooth horizontal plane about point O. If the velocity of the outermost particle is v_0, then the ratio of tensions in the three sections of the string is:



(A) 3 : 5 : 7 (B) 3 : 4 : 5

(C) 7 : 11 : 6 (D) 3 : 5 : 6

26. A fireman wants to slide down a rope. The rope can bear a tension of $\frac{1}{2}$ the of the weight of the man. With what minimum acceleration should the fireman slide down:

(A) $\frac{g}{3}$ (B) $\frac{g}{6}$

(C) $\frac{g}{4}$ (D) $\frac{g}{2}$

FOR ROUGH WORK

27. A particle of mass m is observed from an inertial frame of reference and is found to move in a circle of radius r with a uniform speed v. The centrifugal force on it is

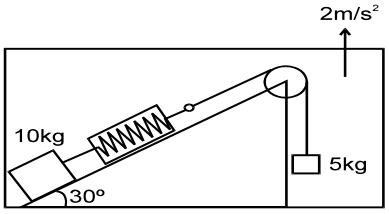
(A) $\frac{mv^2}{r}$ towards the centre

(B) $\frac{mv^2}{r}$ away from the centre

(C) $\frac{mv^2}{r}$ along the tangent through the particle

(D) zero

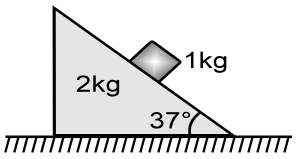
28. In the figure the reading of the spring balance will be : [g = 10 m/s^2]



(A) 70 N (B) 60 N

(C) 50 N (D) 40 N

29. Figure shows a wedge of mass 2kg resting on a frictionless floor. A block of mass 1 kg is kept on the wedge and the wedge is given an acceleration of 7.5 m/sec^2 towards right. Then :



(A) block will remain stationary w.r.t. wedge

(B) the block will have an acceleration of 1 m/sec^2 w.r.t. the wedge

(C) normal reaction on the block is 11 N

(D) net force acting on the wedge is 2 N

30. A body of mass M is kept on a rough horizontal surface (friction coefficient = μ). A person is trying to pull the body by applying a horizontal force but the body is not moving. The force by the surface on A is F where

(A) F = Mg (B) $F = \mu Mg$

(C) $Mg \le F \le Mg\sqrt{1+\mu^2}$

(D) $Mg \ge F \ge Mg\sqrt{1-\mu^2}$

END OF PHYSICS PORTION

FOR ROUGH WORK

PART B – CHEMISTRY

31. 4.2 g $MgCO_3$ on heating leaves behind a residue weighing 4.0 g carbon dioxide released into the atmosphere at S.T.P. will be-

(A) 2.24 L (B) 4.48 L

(C) 1.12 L (D) 0.56 L

32. In the reaction

$Cu + HNO_3 \rightarrow Cu^{+2} + NO + H_2O$

what is the equivalent weight of HNO_3? if molecular weight of HNO_3 is M -

(A) M (B) $\frac{M}{3}$

(C) $3M$ (D) $\frac{4}{3}M$

33. 5 moles of A, 6 moles of Z and mixed with sufficient amount of C to produce final product F. How many maximum moles of 'F' can be produced as per the given sequence of reaction ?

$A + 2Z \rightarrow B$; $B + C \rightarrow Z + F$

(A) 3 (B) 2

(C) 4 (D) 5

34. The normality of 10% (weight/volume) acetic acid is -

(A) 1 N (B) 10 N

(C) 1.67 N (D) 0.83 N

35. The molarity of pure water is :

(A) 55.6 (B) 50

(C) 100 (D) 18

36. To neutralise 20 mL of M/10 NaOH, the volume of M/20 HCl needed is :

(A) 10 mL (B) 30 mL

(C) 40 mL (D) 20 mL

37. The number of mole of KCl in 1000 mL of 3 molar solution is:

(A) 1.5 (B) 3.0

(C) 1.0 (D) 4.0

38. A certain compound has the molecular formula X_4O_6. If 10 gm of compound contain 6.06 gm of X, the atomic mass of X is -

(A) 32 amu

(B) 37 amu

(C) 42 amu

(D) 48 amu

FOR ROUGH WORK

39. If 0.5 moles of $BaCl_2$ is mixed with 0.2 moles of Na_3PO_4, the maximum moles of $Ba_3(PO_4)_2$ obtained is –

(A) 0.2 (B) 0.5

(C) 0.3 (D) 0.1

40. The normality of "10 volume" H_2O_2 solution is–

(A) 1 (N) (B) 1.785 (N)

(C) 3.4 (N) (D) 17 (N)

41. Mole fraction of CH_3OH in mixture containing CH_3OH and C_2H_5OH is 0.5. Hence mass percentage of CH_3OH in the mixture is –

(A) 41% (B) 59%

(C) 50% (D) 25%

42. 0.078 g of hydrocarbon occupy 22.4 ml of volume at 1 atm and 0ºC. The empirical formula of the hydrocarbon is CH. The molecular formula is -

(A) C_2H_2

(B) C_4H_4

(C) C_6H_6

(D) C_8H_8

43. The mass of Mg_3N_2 produced if 48 g of Mg metal is reacted with 34 g NH_3 gas is -

$3\ Mg + 2\ NH_3 \longrightarrow Mg_3N_2 + 3H_2$

(A) $\frac{200}{3}$ (B) $\frac{100}{3}$

(C) $\frac{400}{3}$ (D) $\frac{150}{3}$

44. NH_3 is produced according to the following reaction : $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$

In an experiment 0.25 mol of NH_3 is formed when 0.5 mol of N_2 is reacted with 0.5 mol of H_2. What is % yield?

(A) 75% (B) 50% (C) 33% (D) 25%

45. The number of oxygen atoms in 1.58 g of $KMnO_4$ is - [K = 39, Mn = 55]

(A) 6.02×10^{21} (B) 2.4×10^{22}

(C) 1.4×10^{22} (D) 3.0×10^{20}

46. Phosphine (PH_3) decomposes to produce $P_4(g)$ and H_2 (g). What would be the change in volume when 200 ml of PH_3 (g) is completely decomposed?

(A) 50 ml (B) 350 ml

(C) 75 ml (D) 150 ml

FOR ROUGH WORK

47. Two volumes of ammonia, on dissociation gave one volume of nitrogen and three volumes of hydrogen. How much hydrogen will be obtained from the dissociation of 20 litre of NH_3?

(A) 30 litre (B) 10 litre

(C) 15 litre (D) 20 litre

48. Which one can act as oxidising & reducing agent both-

(A) HNO_2 (B) HNO_3

(C) H_2SO_4 (D) $KMnO_4$

49. In which of the following species the oxidation state of Cr is not equal to +6?

(A) CrO_5 (B) K_2CrO_4

(C) K_2CrO_7

(D) Cr_2O_3

50. Which of the following cannot work as oxidising agent

(A) O_2 (B) $KMnO_4$

(C) HNO_3

(D) Metals

51. In the reaction

$HAsO_2 + Sn^{2+} \rightarrow As + Sn^{4+} + H_2O$ reducing agent is:

(A) Sn^{2+} (B) Sn^{4+}

(C) As (D) $HAsO_2$

52. How many moles of $K_2Cr_2O_7$ can be reduced by 3 mole of Sn^{2+}

(A) 6 (B) 3

(C) 2/3 (D) 1

53. $2MnO_4^- + 5H_2O_2 + 6H^+ \rightarrow 2\ Mn^{+2} + 5O_2 + 8z$

.

In this reaction Z is-

(A) $Mn(OH)_2$ (B) H_2O

(C) OH^- (D) H_3O^+

54. In the balanced chemical reaction,

$IO_3^- + a\ N_2H_4 + b\ HCl \longrightarrow N_2 + c\ \ ICl_2^- + d\ H_2O$

a, b, c and d respectively correspond to:

(A) 2, 2, 1, 5

(B) 1, 4, 2, 4

(C) 1, 2, 1, 3

(D) 2, 2, 1, 3

FOR ROUGH WORK

55. Match List I with List II and select the correct answer using the codes given below the lists

List I (Compound)	List II (Oxidation state of *N*)
(A) NO_2	(1) + 5
(B) HNO	(2) + 4
(C) HCN	(3) – 3
(D) HNO_3	(4) + 1

Codes :

(A)	A	B	C	D	(B)	A	B	C	D
	2	3	4	1		3	1	2	4
(C)	A	B	C	D	(D)	A	B	C	D
	2	4	1	3		2	4	3	1

56. Oxidation number of oxygen in (C_3O_2) is

(A) – 2 (B) – 1

(C) – 1/2 (D) $-\frac{1}{4}$

57. In which of the following compounds, is the oxidation number of iodine is fractional

(A) IF_3 (B) HF

(C) I_3^- (D) IF_7

58. Which of the following can act as an acid and as a base

(A) $HClO_3$ (B) $H_2PO_4^-$

(C) H_2S (D) H_2SO_4

59. Oxidation number of S in H_2SO_5 is:

(A) +6 (B) +8

(C) +5 (D) +4

60. In which of the following compounds, the oxidation state of I-atom is highest-

(A) KI_3 (B) KIO

(C) KIO_3 (D) IF_7

END OF CHEMISTRY PORTION

FOR ROUGH WORK

PART C – MATHEMATICS

61. General solution of $\tan 5\theta = \cot 3\theta$ is

(A) $\theta = \frac{n\pi}{8} + \frac{\pi}{14}$ (B) $\theta = \frac{n\pi}{8} + \frac{\pi}{16}$

(C) $\theta = \frac{n\pi}{8} + \frac{\pi}{2}$ (D) $\theta = \frac{n\pi}{8} + \frac{\pi}{8}$

62. The value of

$$\cos y \cos\left(\frac{\pi}{2}+x\right) - \cos\left(\frac{\pi}{2}+y\right)\cos x$$

$$+\sin y \cos\left(\frac{\pi}{2}+x\right) - \cos x \sin\left(\frac{\pi}{2}-y\right)$$

is zero if :

(A) $x = n\pi + \frac{\pi}{4} + y$ (B) $y = 4\pi + \frac{\pi}{4} + x$

(C) $x = y$ (D) $x = n\pi - \frac{\pi}{4} + y$

63. If $\sin^2\theta - 2\cos\theta + \frac{1}{4} = 0,$ then the number of values of θ in $[0, 5\pi]$ is:

(A) 3 (B) 4

(C) 5 (D) 6

64. The solution of the equation

$\sec\theta - \operatorname{cosec}\theta = \frac{4}{3}$ is

(A) $\frac{1}{2}\left[n\pi + (-1)^n \sin^{-1}\left(\frac{3}{4}\right)\right]$

(B) $n\pi + (-1)^n \sin^{-1}\left(\frac{3}{4}\right)$

(C) $\frac{n\pi}{2} + (-1)^n \sin^{-1}\left(\frac{3}{4}\right)$

(D) None of these

65. The general solution of the equation $2^{\cos 2x} + 1 = 3.2^{-\sin^2 x}$ is

(A) $n\pi$ (B) $n\pi + \pi$

(C) $n\pi - \pi$ (D) None of these

66. The solution of the equation $\cos^2\theta + \sin\theta + 1 = 0,$ lies in the interval

(A) $(-\pi, 0)$ (B) $\left(\frac{\pi}{4}, \frac{3\pi}{4}\right)$

(C) $\left(\frac{3\pi}{4}, \frac{5\pi}{4}\right)$ (D) $\left(\frac{\pi}{2}, \pi\right)$

FOR ROUGH WORK

67. The solution set of the system of equations $x+y=\frac{2\pi}{3}, \cos x+\cos y=\frac{1}{2}$, where x and y are real in is:

(A) A finite non-empty set

(B) Null set

(C) Infinite (D) None of these

68. The smallest positive root of the equation $\tan x+x=0$ lies on

(A) $\left(0,\frac{\pi}{2}\right)$ (B) $\left(\frac{\pi}{2},\pi\right)$

(C) $\left(\pi,\frac{3\pi}{2}\right)$ (D) $\left(\frac{3\pi}{2},2\pi\right)$

69. The most general value of θ which will satisfy both the equations $\sin\theta=-\frac{1}{2}$ and $\tan\theta=\frac{-1}{\sqrt{3}}$ is

(A) $2n\pi-\frac{\pi}{6}$ (B) $n\pi+\frac{\pi}{6}$

(C) $2n\pi\pm\frac{\pi}{6}$ (D) None of these

70. General solution of $(1-4\cos^2\theta)^2+(3\cot^2\theta-1)^2=0$ is

(A) $n\pi+\frac{\pi}{6}$ (B) $2n\pi+\frac{11\pi}{6}$

(C) $2n\pi+\frac{7\pi}{6}$ (D) None of these

71. The smallest value of θ satisfying $\sqrt{3}(\cot\theta+\tan\theta)=-4$ is

(A) $\frac{-2\pi}{3}$ (B) $\frac{-\pi}{3}$

(C) $\frac{-\pi}{6}$ (D) $\frac{-\pi}{12}$

72. If $\sin 5x+\sin 3x+\sin x=0$, then the value of x other than 0 lying between $0\le x\le\frac{\pi}{2}$ is

(A) $\frac{\pi}{6}$ (B) $\frac{\pi}{12}$

(C) $\frac{\pi}{3}$ (D) $\frac{\pi}{4}$

73. The number of values of θ satisfying $\sin 7\theta=\sin 4\theta-\sin\theta$ and $0<\theta<\frac{\pi}{2}$ are

(A) 0 (B) 1 (C) 2 (D) 3

FOR ROUGH WORK

74. If $3\sin 2\theta = 2\sin 3\theta$ and $0 < \theta < \pi$, then value of $\sin\theta$ is

(A) $\frac{\sqrt{2}}{3}$ (B) $\frac{\sqrt{3}}{\sqrt{5}}$ (C) $\frac{\sqrt{15}}{4}$ (D) $\frac{\sqrt{2}}{\sqrt{5}}$

75. If $4\sin^2 x - 8\sin x + 3 \le 0,\ 0 \le x \le 2\pi$, then the solution set for x is

(A) $\left[0, \frac{\pi}{6}\right]$ (B) $\left[0, \frac{5\pi}{6}\right]$

(C) $\left[\frac{5\pi}{6}, 2\pi\right]$ (D) $\left[\frac{\pi}{6}, \frac{5\pi}{6}\right]$

76. If $\left(\frac{1+i}{1-i}\right)^m = 1$, then the least integral value of m is

(A) 2 (B) 4

(C) 8 (D) None of these

77. If $z = x + iy$ and $z^{\frac{1}{3}} = p - iq$, then $\left(\frac{x}{p} - \frac{y}{q}\right) \Big/ \left(p^2 - q^2\right)$ is equal to:

(A) -2 (B) -1 (C) 4 (D) 2

78. Solving $3 - 2yi = 9^x - 7i$, where $i^2 = -1$, for real x and y, we get

(A) $x = 0.5,\ y = 3.5$ (B) $x = 5,\ y = 3$

(C) $x = \frac{1}{2},\ y = 7$ (D) $x = 0, y = \frac{3+7i}{2i}$

79. Multiplicative inverse of additive inverse the non-zero complex number $x + iy$ $(x, y \in R)$ is

(A) $\frac{x}{x+y} - \frac{y}{x+y}i$ (B) $\frac{x}{x^2+y^2} - \frac{y}{x^2+y^2}i$

(C) $-\frac{x}{x^2+y^2} + \frac{y}{x^2+y^2}i$

(D) $\frac{x}{x+y} + \frac{y}{x+y}i$

80. If $z = 3 + 5i$, then $z^3 - \bar{z} + 198 =$

(A) $-3 - 5i$ (B) $-3 + 15i$

(C) $3 + 5i$ (D) $3 + 15i$

81. If $\frac{2z_1}{3z_2}$ is a purely imaginary number, then $\left|\frac{z_1 - z_2}{z_1 + z_2}\right|$ is equal to

(A) 3/2 (B) 1 (C) 2/3 (D) 4/9

FOR ROUGH WORK

82. If $|z+4| \le 5$, then the greatest and the least value of $|z+1|$ are

(A) $6, -6$ (B) $6, 0$ (C) $8, 2$ (D) $8, 0$

83. If $z = 1 - \cos\alpha - i\sin\alpha$, then $amp\ z =$

(A) $\frac{-\pi}{2} + \frac{\lambda}{2}$ (B) $-\frac{\alpha}{2}$

(C) $\frac{\pi}{2} + \frac{\alpha}{2}$ (D) $\frac{\pi}{2} - \frac{\alpha}{2}$

84. If $arg\, z < 0$ then $arg(-z) - arg(z)$ is equal to

(A) π (B) $-\pi$ (C) $-\frac{\pi}{2}$ (D) $\frac{\pi}{2}$

85. Let z be a purely imaginary number such that Im $(z) > 0$, then $arg\ (z)$ is equal to

(A) π (B) $\frac{\pi}{2}$ (C) 0 (D) $-\frac{\pi}{2}$

86. Given $z = (1 + i\sqrt{3})^{200}$, then $\frac{\text{Re}(z)}{\text{Im}(z)}$ equals

(A) 2^{100} (B) 2^{50} (C) $\frac{1}{\sqrt{3}}$ (D) $\frac{-1}{\sqrt{3}}$

87. We express $\frac{(\cos 2\theta - i\sin 2\theta)^4 (\cos 4\theta + i\sin 4\theta)^{-5}}{(\cos 3\theta + i\sin 3\theta)^{-2} (\cos 3\theta - i\sin 3\theta)^{-9}}$ in the form of $x + iy$, we get

(A) $\cos 49\theta - i\sin 49\theta$

(B) $\cos 23\theta - i\sin 23\theta$

(C) $\cos 49\theta + i\sin 49\theta$

(D) $\cos 21\theta + i\sin 21\theta$

88. The two numbers such that each one is square of the other, are

(A) ω, ω^3 (B) $-i, i$ (C) $-1, 1$ (D) ω, ω^2

89. If $\omega (\neq 1)$ is a cube root of unity and $(1+\omega^2)^{17} = A + B\omega$, then A and B are respectively, the numbers

(A) 0, 1 (B) 0, –1

(C) 1, 1 (D) – 1, 1

90. If cube root of 1 is ω, then the value of $(3 + \omega + 3\omega^2)^6$ is :

(A) 0 (B) 64

(C) 64ω (D) $64\omega^2$

END OF TEST PAPER

FOR ROUGH WORK

Read the following instructions carefully :	*निम्नलिखित निर्देश ध्यान से पढ़े :*
1. The candidates should fill in the required particulars on the Test Booklet and Answer Sheet ***(Side-1)*** with ***Blue/Black Ball Point Pen.***	1. परीक्षार्थियों को परीक्षा पुस्तिका और उत्तर पत्र **(पृष्ठ–1)** पर वांछित विवरण ***नीले/काले बॉल प्वाइंट पेन*** से ही भरना है।
2. For writing/marking particulars on ***Side-2*** of the Answer Sheet, use ***Blue/Black Ball Point Pen only.***	2. उत्तर पत्र के **(पृष्ठ–2)** पर विवरण लिखने/अंकित करने के लिए ***केवल नीले/काले बॉल प्वाइंट पेन*** का प्रयोग करें।
3. The candidates should not write their Roll Numbers anywhere else (except in the specified space) on the Test Booklet/Answer Sheet.	3. परीक्षा पुस्तिका/उत्तर पत्र पर निर्धारित स्थान के अलावा परीक्षार्थी अपना अनुक्रमांक अन्य कहीं नहीं लिखें।
4. Out of four options given for each question, only one option is the correct answer.	4. प्रत्येक प्रश्न के लिये दिये गये चार विकल्पों में से केवल एक विकल्प सही है।
5. For each ***incorrect response, one-fourth (1/4)*** of the total marks allotted to the question would be deducted from the total score. ***No deduction*** from the total score, however, will be made ***if no response*** is indicated for an item in the Answer Sheet.	5. प्रत्येक ***गलत उत्तर*** के लिए उस प्रश्न के लिए निर्धारित कुल अंकों में से ***एक–चौथाई*** **(1/4)** अंक कुल योग में से काट लिए जाएँगे। यदि उत्तर पत्र में किसी प्रश्न का कोई ***उत्तर नहीं*** दिया गया है, तो कुल योग में से कोई ***अंक नहीं काटे*** जाएँगे।
6. Handle the Test Booklet and Answer Sheet with care, *as under no circumstances (except for discrepancy in Test Booklet Code and Answer Sheet Code), another set will be provided.*	6. परीक्षा पुस्तिका एवं उत्तर पत्र का ध्यानपूर्वक प्रयोग करें *क्योंकि किसी भी परिस्थिति में (केवल परीक्षा पुस्तिका एवं उत्तर पत्र के संकेत में भिन्नता की स्थिति को छोड़कर), दूसरी परीक्षा पुस्तिका उपलब्ध नहीं करायी जाएगी।*
7. The candidates are not allowed to do any rough work or writing work on the Answer Sheet. All calculations/writing work are to be done in the space provided for this purpose in the Test Booklet itself, marked 'Space for Rough Work'. This space is given at the bottom of each page of booklet.	7. उत्तर पत्र पर कोई भी रफ कार्य या लिखाई का काम करने की अनुमति नहीं है। सभी गणना एवं लिखाई का काम, परीक्षा पुस्तिका में निर्धारित जगह जो कि रफ कार्य के लिए जगह द्वारा नामांकित है, पर ही किया जाएगा। यह जगह प्रत्येक पृष्ठ पर नीचे की ओर दी गई है।
8. On completion of the test, the candidates must hand over the Answer Sheet to the invigilator on duty in the Room/Hall. **However, the candidates are allowed to take away this Test Booklet with them.**	8. परीक्षा समपन्न होने पर, परीक्षार्थी कक्ष/हॉल छोड़ने से पूर्व उत्तर पत्र कक्ष निरीक्षक को अवश्य सौंप दें। **परीक्षार्थी अपने साथ इस परीक्षा पुस्तिका को ले जा सकते हैं।**
9. Each candidate must show on demand his/her Admit Card to the invigilator.	9. पूछे जाने पर प्रत्येक परीक्षार्थी निरीक्षक को अपना प्रवेश कार्ड दिखाएँ।
10. No candidate, without special permission of the Superintendent or Invigilator, should leave his/her seat.	10. अधीक्षक या निरीक्षक की विशेष अनुमति के बिना कोई परीक्षार्थी अपना स्थान न छोड़ें।
11. The candidates should not leave the Examination Hall without handing over their Answer Sheet to the Invigilator on duty and sign the Attendance Sheet again. Cases where a candidate has not signed the Attendance Sheet a second time will be deemed not to have handed over the Answer Sheet and dealt with as an unfair means case. **The candidates are also required to put their left hand THUMB impression in the space provided in the Attendance Sheet.**	11. कार्यरत निरीक्षक को अपना उत्तर पत्र दिए बिना एवं उपस्थिति पत्र पर दुबारा हस्ताक्षर किए बिना कोई परीक्षार्थी परीक्षा हॉल नहीं छोड़ेंगे। यदि किसी परीक्षार्थी ने दूसरी बार उपस्थिति पत्र पर हस्ताक्षर नहीं किए तो यह माना जाएगा कि उसने उत्तर पत्र नहीं लौटाया है जिसे अनुचित साधन प्रयोग श्रेणी में माना जाएगा। **परीक्षार्थी अपने बायें हाथ के अंगूठे का निशान उपस्थिति पत्र में दिए गए स्थान पर अवश्य लगाएँ।**
12. Use of Electronic/Manual Calculator and any Electronic Item like mobile phone, pager etc. is prohibited.	12. इलेक्ट्रॉनिक/हस्तचालित परिकलक एवं मोबाइल फोन, पेजर इत्यादि जैसे किसी इलेक्ट्रॉनिक उपकरण का प्रयोग वर्जित है।
13. The candidates are governed by all Rules and Regulations of the **CatalyseR** with regard to their conduct in the Examination Hall. All cases of unfair means will be dealt with as per Rules and Regulations of the **CatalyseR**.	13. परीक्षा हॉल में आचरण के लिए परीक्षार्थी केटेलाइज़र के सभी नियमों एवं विनियमों द्वारा नियमित होंगे। अनुचित साधन प्रयोग के सभी मामलों का फैसला केटेलाइज़र के नियमों एवं विनियमों के अनुसार होगा।
14. No part of the Test Booklet and Answer Sheet shall be detached under any circumstances.	14. किसी भी स्थिति में परीक्षा पुस्तिका तथा उत्तर पत्र का कोई भी भाग अलग नहीं किया जाएगा।
15. **Candidates are not allowed to carry any textual material, printed or written, bits of papers, pager, mobile phone, electronic device or any other material except the Admit Card inside the examination hall/room.**	15. **परीक्षार्थी द्वारा परीक्षा कक्ष/हॉल में प्रवेश कार्ड के अलावा किसी भी प्रकार की पाठ्य सामग्री, मुद्रित या हस्तलिखित, कागज की पर्चियाँ, पेजर, मोबाइल फोन या किसी भी प्रकार के इलेक्ट्रॉनिक उपकरणों या किसी अन्य प्रकार की सामग्री को ले जाने या उपयोग करने की अनुमति नहीं है।**

Mock Paper(MAIN) PAPER – 1 (XI) & SOLUTIONS

PART A - PHYSICS

Sol.1. (B)	**Sol.2. (C)**	**Sol.3.(B)**	**Sol.4.(B)**	**Sol.5.(C)**
Sol.6. (B)	**Sol.7. (C)**	**Sol.8.(C)**	**Sol.9.(B)**	**Sol.10. (C)**
Sol.11. (B)	**Sol.12. (A)**	**Sol.13. (C)**	**Sol.14. (C)**	**Sol.15. (B)**
Sol.16. (A)	**Sol.17. (A)**	**Sol.18. (A)**	**Sol.19. (C)**	**Sol.20. (B)**
Sol.21. (A)	**Sol.22. (A)**	**Sol.23. (D)**	**Sol.24. (A)**	**Sol.25. (D)**
Sol.26. (D)	**Sol.27. (D)**	**Sol.28. (B)**	**Sol.29. (A)**	**Sol.30. (C)**

PART B - CHEMISTRY

Sol.31. (C) $MgCO_3 \rightarrow MgO + CO_2$. Thus 84 g $MgCO_3$ give 22.4 L CO_2 at S.T.P. Hence 4.2 g will give 1.12 L CO_2 at S.T.P.

Sol.32. (C) $NO_3^- \rightarrow NO$ $N^{+5} \rightarrow N^{+2}$ change = 3 n factor of per mole HNO_3 = 3

Sol.33. (A) Net reaction is :

$A + 2Z + C \rightarrow Z + F$

As per the given information Z is the L. R.

$\therefore$ The no. of moles of F produced = $\frac{1}{2}$ × 6 = 3

Sol.34. (C) N=10 X 10 X 1/60=1.67

Sol.35. (A) $Molarity = \frac{1000}{18\times1} = 55.55\frac{mole}{\ell}.$

Sol.36. (C) $M_1V_1 = M_2V_2$ $\frac{1}{10}\times 20 = \frac{1}{20}\times V$ $V = 40\,ml$

Sol.37. (B) In 1 L of solution number of moles of KCl is 3. Hence in 1000 ml there are 3 moles of KCl

Sol.38. (B) Let atomic mass of X = x $\frac{4x}{4x+96} = \frac{6.06}{10}$ or x = 36.9 amu

Sol.39. (D) $3BaCl_2 + 2Na_3PO_4 \longrightarrow Ba_3(PO_4)_2 + 6NaCl$

The limiting reactant is Na_3PO_4, the no. of moles of $Ba_3(PO_4)_2$ produced = $\frac{0.2}{2}$ = 0.1 mole

Sol.40. (B) $P = \frac{17}{56}\times V$ $N = \frac{17\times10\times10\times2}{56\times34} = 1.785$

Sol.41. (A)

1 mole mixture $\begin{cases} CH_3OH = 0.5 \text{ mol} = 1/2 \times 32 = 16 \text{ gm} \\ C_2H_5OH = 0.5 \text{ mol} \equiv 1/2 \times 46 = 23 \text{ gm} \end{cases}$

mass % CH_3OH = $\frac{16}{39}$ × 100 = 41%

Sol.42. (C) $\frac{w}{M} = \frac{1\times 22.4\times 10^{-3}}{22.4}$ M = 78 g n = $\frac{78}{13}$ = 6 ∴ MF = $(CH)_6$ or C_6H_6

Sol.43. (A) $3Mg + 2NH_3 \longrightarrow Mg_3N_2 + 3H_2$

mole $\frac{48}{24} = 2$ $\frac{34}{17} = 2$

∴ mass of $Mg_3N_2 = \frac{1}{3} \times 2 \times (3 \times 24 + 28) = \frac{200}{3}$

Sol.44. (A) % yield = $\frac{\text{Produced mol of } NH_3 \times 100}{\text{max. possible produced mole of } NH_3} = \frac{0.25}{0.5\times\frac{2}{3}} \times 100 = 75\%$

Sol.45. (B) Oxygen atoms = $\frac{1.58}{158} = 2.4 \times 10^{23}$

Sol.46. (D) $4PH_3 \longrightarrow P_4 + 6H_2$

$200ml$

$0\,ml$ $\frac{200}{4}$ $\frac{6}{4}\times 200$

$50\,ml$ $300\,ml$

Change in volume $= 350 - 200 = 150\,ml.$

Sol.47. (A) $2NH_3 \longrightarrow N_2 + 3H_2$

$20\,L$

$0\,L$ $\frac{1}{2}\times 20$ $\frac{3}{2}\times 20$

$10L$ $30L$

Sol.48. (A) In HNO_2, oxidation number of N is $+3$. It can be oxidized or reduced to $+5$ or -3 respectively.

Sol.49. (D)

CrO_5	Cr	+6
K_2CrO_4	Cr	+6
$K_2Cr_2O_7$	Cr	+6
Cr_2O_3	Cr	+3

Sol.50. (D) Metals are reducing agents, as easily loss $e^{-1}D$

Sol.51. (A) As $Sn^{++} \longrightarrow Sn^{+4}$ is oxidation of Sn^{++}. It works as reducing agent.

Sol.52. (D) $K_2Cr_2O_7 + Sn^{+2} \longrightarrow Cr_2O_3 + Sn^{+4}$

gm eq. of $K_2Cr_2O_7$ = gm eq. of Sn^{+2}

$n\times 6 = 3\times 2 \quad n = 1$

n factor of $K_2Cr_2O_7 = 6$ n factor of $Sn^{+2} = 2$

Sol.53. (B) By balancing reaction we get –

$$2MnO_4^- + 5H_2O_2 + 6H^+ \longrightarrow 2Mn^{+2} + 5O_2 + 8H_2O$$

Sol.54. (C) $IO_3^- + a\,N_2H_4 + b\,HCl \longrightarrow N_2 + c\;\; ICl_2^- + d\,H_2O$

By balancing we get

$$IO_3^- + N_2H_4 + 2\,HCl \longrightarrow N_2 + ICl_2^- + 3\,H_2O$$

Sol.55. (D)

NO_2	$+4$
HNO	$+1$
HCN	-3
HNO_3	$+5$

Sol.56. (A) C_3O_2 $\quad O=C=C=C=O$ $\quad O.N.=-2$ for oxygen.

Sol.57. (C) I_3^- $\quad 3x=-1$ $\quad x=-\dfrac{1}{3}$

Sol.58. (B) $H_2PO_4^-$ can act as acid and base.

(Acid) $\quad H_2PO_4^- \longrightarrow HPO_4^{-2} + H^+$

(Base) $\quad H^+ + H_2PO_4^- \longrightarrow H_3PO_4$

Sol.59. (A) H_2SO_5 $\quad 2(+1)+x+5(-2)=0$ $\quad x=+8$

But in H_2SO_5 two oxygens are of peroxide linkage. So, H_2SO_5

$$2(+1)+x+3(-2)+2(-1)=0 \qquad x=+6$$

Sol.60. (D) **In** KI_3 $\quad O.N.=-\dfrac{1}{3}$

KI_0 $\quad O.N.=+1$

KI_3 $\quad O.N.=+5$

IF_7 $\quad O.N.=+7$

PART C - MATHEMATICS

Sol.61. (B)

$\tan 5\theta = \tan\left(\frac{\pi}{2} - 3\theta\right)$ Maths sol

$5\theta = n\pi + \frac{\pi}{2} - 3\theta \Rightarrow 8\theta = n\pi + \frac{\pi}{2}$

$\theta = \frac{n\pi}{8} + \frac{\pi}{16}$

Sol.62. (B)

$$-\cos y \sin x + \sin y \cos x - \sin y \sin x - \cos x \cos y = 0$$

$$\sin(y-x) - \cos(y-x) = 0$$

$$\tan(y-x) = 1 \Rightarrow y - x = n\pi + \frac{\pi}{4}$$

$$y = n\pi + x + \frac{\pi}{4}$$

Sol.63. (C)

$$\sin^2\theta - 2\cos\theta + \frac{1}{4} = 0$$

$$1 - \cos^2\theta - 2\cos\theta + \frac{1}{4} = 0$$

$$4\cos^2\theta + 8\cos\theta - 5 = 0$$

$$(2\cos\theta - 1)(2\cos\theta + 5) = 0$$

$\cos\theta = \frac{1}{2} \Rightarrow$ 5 solutions in $[0, 5\pi]$

Sol.64. (A)

$$\sec\theta - \operatorname{cosec}\theta = \frac{4}{3}$$

$$\frac{\sin\theta - \cos\theta}{\cos\theta \sin\theta} = \frac{4}{3}$$

$$9(\sin\theta - \cos\theta)^2 = (4\sin\theta\cos\theta)^2$$

$$9(1 - \sin 2\theta) = 4\sin^2 2\theta$$

$$4\sin^2 2\theta + 9\sin 2\theta - 9 = 0$$

$$(4\sin 2\theta - 3)(\sin\theta + 3) = 0$$

$$\sin 2\theta = \frac{3}{4}$$

$$2\theta = n\pi + (-1)^n \sin^{-1}\left(\frac{3}{4}\right)$$

$$\theta = \frac{1}{2}\left[n\pi + (-1)^n \sin^{-1}\left(\frac{3}{4}\right)\right]$$

Sol.65. (A)

$$2^{\cos 2x} + 1 = 3.2^{-\sin^2 x}$$

$$2^{1-2\sin^2 x} + 1 = 3.2^{-\sin^2 x}$$

let $2^{-\sin^2 x} = y$

$$2.y^2 + 1 = 3y \Rightarrow 2y^2 - 3y + 1 = 0$$

$$(2y-1)(y-1) = 0$$

$y = \frac{1}{2}$ or $y = 1$

$2^{-\sin^2 x} = 2^{-1}$ or $2^{-\sin^2 x} = 1$

$\sin^2 x = 1$ $\qquad$ $\sin^2 x = 0$

$x = n\pi \pm \frac{\pi}{2}$ $\qquad$ $x = n\pi$

Sol.66. (A)

$$\cos^2\theta + \sin\theta + 1 = 0$$

$$1 - \sin^2\theta + (1 + \sin\theta) = 0$$

$$(1-\sin\theta)(1+\sin\theta) + (1+\sin\theta) = 0$$

$$(1+\sin\theta)(1-\sin\theta+1) = 0$$

$\sin\theta = -1 \Rightarrow \theta = -\frac{\pi}{2}$

which lies in $(-\pi, 0)$

Sol.67. (C)

(C) $x + y = \frac{2\pi}{3}$ ——— (1)

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

$$2\cos\left(\frac{x+y}{2}\right)\cos\left(\frac{x-y}{2}\right) = \frac{1}{2}$$

$$2\cos\left(\frac{\pi}{3}\right)\cos\left(\frac{x-y}{2}\right) = \frac{1}{2}$$

$$\cos\left(\frac{x-y}{2}\right) = \frac{1}{2}$$

$$\frac{x-y}{2} = 2n\pi \pm \frac{\pi}{3}$$

$x - y = 4n\pi \pm \frac{2\pi}{3}$ ——— (2)

From (1) & (2) we get infinite values of x & y for $n \in Z$.

Sol.68. (B) Check through graphs of $y = \tan x$ & $y = -x$.

Sol.69. (A) $\sin\theta = -\frac{1}{2} \& \tan\theta = -\frac{1}{\sqrt{3}}$ Both –ve in in 6th quadrarent at $\frac{-\pi}{6}$ $\theta = 2n\pi - \frac{\pi}{6}$.

Sol.70. (D)

$1 - 4\cos^2\theta = 0$ & $3\cot^2\theta - 1 = 0$

$\cos^2\theta = \frac{1}{4}$ & $\cot^2\theta = \frac{1}{3}$

$\theta = n\pi \pm \frac{\pi}{3}$

Sol.71. (B)

$\sqrt{3}\left(\tan\theta + \frac{1}{\tan\theta}\right) = -4$

$\sqrt{3}\tan^2\theta + 4\tan\theta + \sqrt{3} = 0$

$\Rightarrow \tan\theta = -\sqrt{3}$ or $-\frac{1}{\sqrt{3}}$

$\Rightarrow \theta = -\frac{\pi}{3}$

Sol.72. (C)

$\sin 5x + \sin 3x + \sin x = 0$

$(\sin 5x + \sin x) + \sin 3x = 0$

$2\sin 3x \cdot \cos 2x + \sin 3x = 0$

$\sin 3x = 0$ or $\cos 2x = -\frac{1}{2}$

Sol.73. (C)

$\sin 7\theta + \sin\theta = \sin 4\theta$

$2\sin 4\theta \cos 3\theta = \sin 4\theta$

$\sin 4\theta = 0$ or $\cos 3\theta = \frac{1}{2}$

$\theta = \frac{\pi}{4}$ $\theta = \frac{\pi}{9}$

Sol.74. (C)

$3(2\sin\theta\cos\theta) = 2(3\sin\theta - 4\sin^3\theta)$

$3\cos\theta = 3 - 4\sin^2\theta$

$3(\cos\theta - 1) = -4(1 - \cos^2\theta)$

$3(1 - \cos\theta) = 4(1 - \cos\theta)(1 + \cos\theta)$

$1 - \cos\theta \neq 0 \Rightarrow 3 = 4(1 + \cos\theta)$

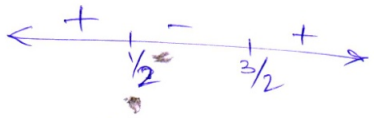
$\cos\theta = -\frac{1}{4}$

$\sin\theta = \frac{\sqrt{15}}{4}$

Sol.75. (D)

$4\sin^2\theta - 8\sin\theta + 3 \le 0$

$(2\sin\theta - 3)(2\sin\theta - 1) \le 0$



$\sin\theta \ge \frac{1}{2} \Rightarrow \theta \in \left[\frac{\pi}{6}, \frac{5\pi}{6}\right]$

Sol.76. (B)

$\left(\frac{1+i}{1-i} \times \frac{1+i}{1+i}\right)^m = 1$

$\left(\frac{1+i^2+2i}{1+1}\right)^m = 1$

$i^m = 1 \Rightarrow m = 4$

Sol.77. (C)

$z^{1/3} = p - iq$

$z = (p-iq)^3$

$x + iy = p^3 - i^3q^3 - 3p^2iq + 3pi^2q^2$

$x + iy = p^3 + iq^3 - 3p^2qi - 3pq^2$

$x = p^3 - 3pq^2 \Rightarrow \frac{x}{p} = p^2 - 3q^2$

$y = q^3 - 3p^2q \Rightarrow \frac{y}{q} = q^2 - 3p^2$

$\frac{x}{p} - \frac{y}{q} = 4p^2 - 4q^2$

$\left(\frac{x}{p} - \frac{y}{q}\right)/(p^2 - q^2) = 4$

Sol.78. (A)

$3 - 2yi = g^x - 7i$

$g^x = 3 \Rightarrow x = \frac{1}{2}$

$-2y = -7 \Rightarrow y = \frac{7}{2}$

Sol.79. (C)

(2) Multiplicative inverse of additive inverse of $x+iy$ is $\frac{-1}{x+iy}$

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

Sol.80. (C)

$$z = 3+5i \Rightarrow \bar{z} = 3-5i$$

$$z^3 = 3^3 + (5i)^3 + 3\times3\times5i(3+5i)$$

$$z^3 = 27 - 125i + 135i - 225$$

$$z^3 = -198 + 10i$$

$$z^3 - \bar{z} + 198 = -198 + 10i - 3 + 5i + 198$$

$$= -3 + 15i$$

Sol.81. (B)

Let $\frac{2z_1}{3z_2} = ki \Rightarrow \frac{z_1}{z_2} = \frac{3ki}{2}$

$$\left|\frac{z_1 - z_2}{z_1 + z_2}\right| = \left|\frac{\frac{z_1}{z_2} - 1}{\frac{z_1}{z_2} + 1}\right| = \left|\frac{\frac{3ki}{2} - 1}{\frac{3ki}{2} + 1}\right|$$

$$\left|\frac{3ki - 2}{3ki + 2}\right| = 1$$

Sol.82. (C)

(3) Use triangle inequality

$$|z_1| - |z_2| \le |z_1 + z_2| \le |z_1| + |z_2|$$

$$|z+4| + |-3| \le |z+1| \le |z+4| + |-3|$$

$$2 \le |z+1| \le 8$$

Sol.83. (A)

$$z = 1 - \cos\alpha - i\sin\alpha$$

$$z = 2\sin^2\frac{\alpha}{2} - 2i\sin\frac{\alpha}{2}\cos\frac{\alpha}{2}$$

$$z = 2\sin\frac{\alpha}{2}\left[\sin\frac{\alpha}{2} - i\cos\frac{\alpha}{2}\right]$$

$$z = 2\sin\frac{\alpha}{2}\left[\cos\left(\frac{\pi}{2} - \frac{\alpha}{2}\right) - i\sin\left(\frac{\pi}{2} - \frac{\alpha}{2}\right)\right]$$

~~4th~~ Point is in 4th quadrant

$$\text{Arg}(z) = -\frac{\pi}{2} + \frac{\alpha}{2}$$

Sol.84. (A)

$$\arg(z) < 0$$
$$\Rightarrow \arg(-z) - \arg(z) = \pi$$

Sol.85. (B) This is obvious.

Sol.86. (D)

$$z = (1+i\sqrt{3})^{200}$$
$$z = \left[2\left(\cos\frac{\pi}{3} + i\sin\frac{\pi}{3}\right)\right]^{200}$$
$$z = 2^{200}\left[\cos\left(\frac{200\pi}{3}\right) + i\sin\left(\frac{200\pi}{3}\right)\right]$$
$$z = 2^{200}\left[\cos\left(67\pi - \frac{\pi}{3}\right) + i\sin\left(67\pi - \frac{\pi}{3}\right)\right]$$
$$z = 2^{200}\left[-\cos\frac{\pi}{3} + i\sin\frac{\pi}{3}\right]$$
$$\frac{Re(z)}{Im(z)} = -\frac{1}{\sqrt{3}}$$

Sol.87. (A)

$$\frac{(e^{-i2\theta})^4 \times (e^{i4\theta})^{-5}}{(e^{i3\theta})^{-2} \times (e^{-i3\theta})^{-9}}$$

$$e^{-i49\theta} = \cos 49\theta - i\sin 49\theta$$

Sol.88. (D) This is obvious

Sol.89. (B)

$$1+\omega+\omega^2 = 0 \Rightarrow 1+\omega^2 = -\omega$$
$$(-\omega)^{17} = -\omega^{17} = -\omega^2 = 1+\omega$$
$$1+\omega = A+B\omega$$
$$\Rightarrow A = 1 = B$$

Sol.90. (B)

$$1+\omega+\omega^2 = 0$$
$$[3(1+\omega^3+\omega)]^6$$
$$[-3\omega+\omega]^6 = [-2\omega]^6$$
$$64\omega^6 = 64$$

END OF SOLUTIONS