

PHYSICS, CHEMISTRY & MATHEMATICS**CPT2 - 1****CODE:****PAPER - 1****Time Allotted: 3 Hours****Maximum Marks: 240**

- 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

Caution: Question Paper CODE as given above MUST be correctly marked in the answer OMR sheet before attempting the paper. Wrong CODE or no CODE will give wrong results.

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 HB pencil for each character of your Enrolment No. and write in ink 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.

- (i) **Section-A (01 – 07)** contains 7 multiple choice questions which have only one correct answer. Each question carries **+3 marks** for correct answer and **– 1 mark** for wrong answer.

Section-A (08 – 11) contains 4 multiple choice questions which have one or more than one correct answer. Each question carries **+4 marks** for correct answer. There is no negative marking.

Section-A (12 – 16) contains 2 paragraphs. Based upon paragraph, 2 and 3 multiple choice questions have to be answered. Each question has only one correct answer and carries **+3 marks** for correct answer and **– 1 mark** for wrong answer.

- (ii) **Section-C (01 – 07)** contains 7 Numerical based questions with single digit integer as answer, ranging from 0 to 9 and each question carries **+4 marks** for correct answer. There is no negative marking.

Name of the Candidate : _____

Batch : _____ **Date of Examination :** _____

Enrolment Number : _____

USEFUL DATA

PHYSICS		CHEMISTRY	
Acceleration due to gravity	: $g = 10 \text{ m/s}^2$	Gas Constant	R = $8.314 \text{ J K}^{-1} \text{ mol}^{-1}$
Planck constant	: $h = 6.6 \times 10^{-34} \text{ J-s}$		= 0.0821 Lit atm
Charge of electron	: $e = 1.6 \times 10^{-19} \text{ C}$	$\text{K}^{-1} \text{ mol}^{-1}$	
Mass of electron	: $m_e = 9.1 \times 10^{-31} \text{ kg}$		= 1.987 ≈ 2 Cal
Permittivity of free space	: $\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2 / \text{N-m}^2$	$\text{K}^{-1} \text{ mol}^{-1}$	
Density of water	: $\rho_{\text{water}} = 10^3 \text{ kg/m}^3$	Avogadro's Number N_a	= 6.023×10^{23}
Atmospheric pressure	: $P_a = 10^5 \text{ N/m}^2$	Planck's constant h	= $6.625 \times 10^{-34} \text{ J.s}$
Gas constant	: R = 8.314 J		= $6.625 \times 10^{-27} \text{ erg.s}$
$\text{K}^{-1} \text{ mol}^{-1}$		1 Faraday	= 96500 coulomb
		1 calorie	= 4.2 joule
		1 amu	= $1.66 \times 10^{-27} \text{ kg}$
		1 eV	= $1.6 \times 10^{-19} \text{ J}$
Atomic No:	H = 1, He = 2, Li = 3, Be = 4, B = 5, C = 6, N = 7, O = 8, F = 9, Ne = 10, 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, Si = 28, Al = 27, 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.		

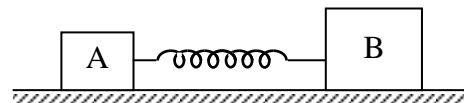
PART I: PHYSICS

SECTION – A

(Single Correct Answer Type)

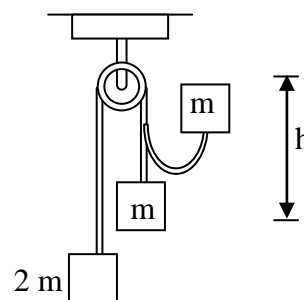
This section contains **7 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

1. Two blocks A and B of mass m and $2m$ are connected by a massless spring of force constant k . They are placed on a smooth horizontal plane. Spring is stretched by an amount x and then released. The relative velocity of the blocks when the spring comes to its natural length is



- (A) $\left(\sqrt{\frac{3k}{2m}}\right)x$ (B) $\left(\sqrt{\frac{2k}{3m}}\right)x$
 (C) $\sqrt{\frac{2kx}{m}}$ (D) $\sqrt{\frac{3km}{2x}}$

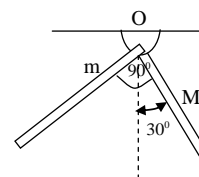
2. A mass $2m$ rests on a horizontal table. It is attached to a light inextensible string which passes over a smooth pulley and carries a mass m at the other end. If the mass m is raised vertically through a distance h and is then dropped, then the speed with which the mass $2m$ begins to rise is



- (A) $\sqrt{2gh}$ (B) $\frac{\sqrt{2gh}}{3}$
 (C) $\frac{\sqrt{gh}}{2}$ (D) \sqrt{gh}

3. A balloon has $2g$ of air. A small hole is pierced into it. The air comes out with relative velocity 4 m/s. If the balloon shrinks completely in 2.5 s, the average force acting on the balloon is
- (A) 0.008 N (B) 0.0032 N
 (C) 8 N (D) 3.2 N

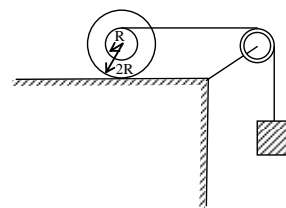
4. Two uniform rods of equal length but different masses are rigidly joined to form an L-shaped body, which is then pivoted as shown. If in equilibrium the body is in the shown configuration, ratio M/m will be



- (A) 2 (B) 3
 (C) $\sqrt{2}$ (D) $\sqrt{3}$

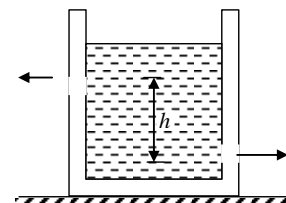
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5. In the figure shown mass of both the spherical body and block is m . Moment of inertia of the spherical body about centre of mass is $2mR^2$. The spherical body rolls on the horizontal surface. There is no slipping at any surfaces in contact. The ratio of kinetic energy of the spherical body to that of block is
 (A) $3/4$ (B) $1/3$
 (C) $2/3$ (D) $1/2$



6. A metallic wire of density ρ floats horizontally in water. The maximum radius of the wire so that the wire may not sink will be (surface tension of water = T and angle of contact $\theta = 0^\circ$).
 (A) $\sqrt{\frac{2T}{\pi\rho g}}$ (B) $\sqrt{\frac{4T}{\rho g}}$
 (C) $\sqrt{\frac{T}{\pi\rho g}}$ (D) $\sqrt{\frac{T\rho}{\pi g}}$

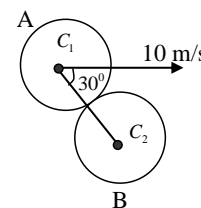
7. There are two identical small holes of area of cross - section a on the opposite sides of a tank containing a liquid of density ρ . The difference in height between the holes is h . Tank is resting on a smooth horizontal surface. Horizontal force which will have to be applied on the tank to keep it in equilibrium is
 (A) $gh\rho a$ (B) $\frac{2gh}{\rho a}$
 (C) $2gh\rho a$ (D) $\frac{\rho gh}{a}$



SECTION – A
(Multi Correct Answer Type)

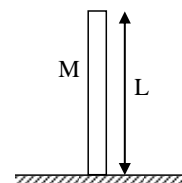
This section contains **4 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE or MORE THAN ONE is/are correct**.

8. A ball A collides elastically with another identical ball B with velocity 10 m/s at an angle of 30° from the line joining their centres C_1 and C_2 . Select the correct alternative(s).
 (A) Velocity of ball A after collision is 5 m/s
 (B) Velocity of ball B after collision is $5\sqrt{3}$ m/s
 (C) Both the balls move at right angles after collision
 (D) Kinetic energy will not be conserved here, because collision is not head on

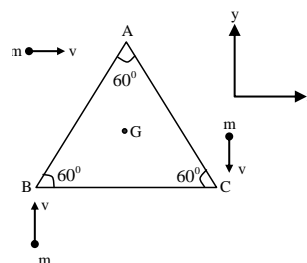


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9. A uniform rod of mass M and length L is held vertically on a smooth horizontal surface. When the rod is released, choose the correct alternative(s).
- (A) the centre of mass of the rod accelerates in the vertical direction
 (B) initially, the magnitude of the normal reaction is Mg
 (C) When the rod becomes just horizontal, the magnitude of the normal reaction becomes $Mg/2$
 (D) When the rod becomes just horizontal, the magnitude of the normal reaction becomes $Mg/4$

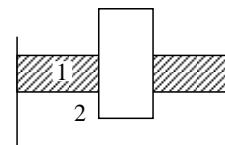


10. A triangle block ABC of mass m and side $2a$ lies on a smooth horizontal plane as shown. Three point masses of mass m each strike the block at A, B and C with speeds v as shown. After the collision the particles come to rest. Select the correct alternative(s).



- (A) the centre of mass of ABC remains stationary after collision
 (B) the centre of mass of ABC moves with a velocity v along x - axis after collision
 (C) the triangular block rotates with an angular velocity $\omega = \frac{2\sqrt{3}mva}{I}$ about its centre of mass (here, I is the moment of inertia of triangular block about its centroidal axis perpendicular to plane)
 (D) A point lying at a distance of $\left(\frac{I}{2\sqrt{3}ma}\right)$ from G on perpendicular bisector of BC (below G) is at rest just after collision.

11. A cylinder is floating in two liquids as shown in figure. Choose the correct options
- (A) net force on cylinder by liquid 1 is zero
 (B) net force on cylinder by liquid 1 is non zero
 (C) net force on cylinder by liquid 2 is equal to the upthrust
 (D) net force on cylinder by liquid 2 is more than the upthrust



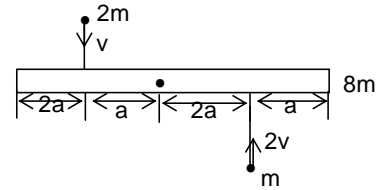
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SECTION – A
(Paragraph Type)

This section contains 2 paragraphs. Based upon the first paragraph **2 multiple choice questions** and based on the second paragraph **3 multiple choice questions** have to be answered. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

Comprehension 1:

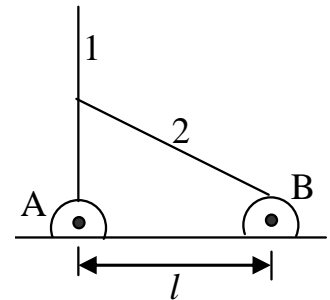
A uniform bar of length $6a$ and mass $8m$ lies on a smooth horizontal table. Two point masses m and $2m$ moving in the same horizontal plane with speed v and $2v$ respectively, strike the bar as shown in figure and stick to the bar after collision.



12. Calculate the velocity of the centre of mass in m/s
 (A) 0 (B) 5
 (C) 8 (D) 2
13. Calculate the angular velocity about centre of mass in rad/sec
 (A) $v/5a$ (B) $3v/5a$
 (C) $v/7a$ (D) $2v/5a$

Comprehension 2:

Two rod 1 and 2 are released from rest as shown in figure. Given: $l_1 = 4l, m_1 = 2m, l_2 = 2l$ and $m_2 = m$. There is no friction between the two rods. If α be the angular acceleration of rod 1 just after the rods are released. Then



14. What is the normal reaction between the two rods at this instant?
 (A) $16\sqrt{3}ml\alpha$ (B) $\frac{4ml\alpha}{\sqrt{3}}$
 (C) $\frac{32ml\alpha}{3\sqrt{3}}$ (D) $12\sqrt{3}ml\alpha$
15. What is the horizontal force on rod 1 by hinge A at this instant?
 (A) $\left(\frac{32-12\sqrt{3}}{3\sqrt{3}}\right)ml\alpha$ (B) $\left(\frac{16-2\sqrt{3}}{\sqrt{3}}\right)ml\alpha$
 (C) $(14+2\sqrt{3})ml\alpha$ (D) $\sqrt{3}ml\alpha$

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16. What is initial angular acceleration of rod 2 in term of the given parameters in the question?

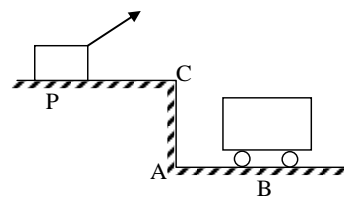
- (A) $\left[\frac{2\sqrt{3}g}{2l} + 2\sqrt{3}\alpha \right]$ (B) $\left[\frac{2\sqrt{3}g}{l} - \sqrt{3}\alpha \right]$
 (C) $\left[\frac{6\sqrt{3}g}{8l} + 5\sqrt{3}\alpha \right]$ (D) $\left[\frac{3\sqrt{3}g}{8l} - \frac{8}{\sqrt{3}}\alpha \right]$

SECTION – C
Integer Answer Type

This section contains **7 questions**. The answer to each of the questions is a **single-digit integer**, ranging from 0 to 9.

1. A block of mass $M = 1\text{kg}$ lies on a smooth horizontal floor. A bullet of mass 0.1kg is fired horizontally with a velocity $u = 110\text{m/s}$ and gets embedded in the block. The combined mass is set into motion and encounters a rough inclined plane of inclination 37° and length $l=1.8\text{m}$ in its path. It starts moving up the inclined plane ($\mu_k = 0.5$), reaches the topmost point and finally lands on the horizontal floor. Assuming that the mass is not jerked when it starts up on the inclined plane, the horizontal distance covered by the combined mass while it is not in contact with the horizontal floor is (approximately in m)

2. A car P is moving with a uniform speed of $5\sqrt{3}\text{ m/s}$ towards a carriage of mass 9kg at rest kept on the rails at a point B as shown. The height AC is 120m . Cannon balls of 1kg are fired from the car with an initial velocity 100m/s at an angle 30° with the horizontal. The first cannon ball hits the carriage after a time t_0 and sticks to it.



At t_0 , the second cannon ball is fired. Assume that the resistive force between the rails and the carriage is constant and ignore the vertical motion of the carriage throughout. The second ball also hits the carriage and sticks to it. If the horizontal velocity of the carriage just after the second impact is $\frac{100\sqrt{k}}{11}$, then k is?

3. A simple pendulum is suspended from a peg on a vertical wall. The pendulum is pulled away from the wall to a horizontal position and released as shown in the figure. The ball hits the wall, the coefficient of restitution being $\frac{2}{\sqrt{5}}$. The minimum number of collisions after which the amplitude of oscillation becomes less than 60° is?

Space for rough work

4. A small disc and a thin uniform rod of length L , whose mass is n times greater than the mass of the disc, lie on a smooth horizontal plane. The disc is set in motion, in horizontal direction and perpendicular to the rod, with velocity v , after which it elastically collides with the end of the rod. The value of n for which the velocity of the disc after the collision be equal to zero is
5. Two wooden discs, one with radius 2cm and mass 1kg and the other with radius 4cm and mass 2kg are welded together coaxially and mounted on a frictionless axis through their common centre. A light string is wrapped around the edge of the smaller disc, and a 3kg block is suspended from the free end of the string. The acceleration of the block after it is released is (in ms^{-2})
6. The side wall of a wide vertical cylindrical vessel of height $h=75\text{cm}$ has a narrow vertical slit running all the way down to the bottom of the vessel. The length of the slit is $l = 50\text{cm}$ and the width $b = 1\text{mm}$. With the slit closed, the vessel is filled with water. The resultant force of reaction of water flowing out of the vessel immediately after the slit is opened is (in N)
7. A container of large uniform cross-sectional area A resting on a horizontal surface holds two immiscible, non-viscous and incompressible liquids of densities d and $2d$, each of height $\frac{H}{2}$. The lower density liquid is open to the atmosphere having pressure P_0 . A homogenous solid cylinder of length $L(L < \frac{H}{2})$ and cross-sectional area $\frac{A}{5}$ is immersed such that it floats with its axis vertical at the liquid-liquid interface with the length $\frac{L}{4}$ in the denser liquid. If the density of the solid D is given by $D = d + \frac{d}{x}$, where x is an integer, then x is

Space for rough work

PART II: CHEMISTRY

SECTION – A

(Single Correct Answer Type)

This section contains **7 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

1. An oleum sample is labelled as 104.5%. In 10 g of this sample, 0.09 gm. of water is added then which is/are incorrect?
 (A) Free SO_3 is 15.86% (in final solution) (B) Final solution has 10.09 gm H_2SO_4
 (C) Free SO_3 in original oleum is 20% (D) Final solution has 8.49 gm H_2SO_4

2. A reaction is taking place in three steps with rate constants k_1 , k_2 & k_3 . If the overall rate constant $k = \frac{k_1 k_3}{k_2}$ and E_a 's are 40, 30 & 20 kJ respectively, the overall E_a required (Assume A same for all) is
 (A) 15 kJ (B) 30 kJ
 (C) 60 kJ (D) 10 kJ

3. Which reactions can be used to prepare diborane?
 I. $\text{NaBH}_4 + \text{BF}_3$ (in ether) \longrightarrow
 II. $\text{NaBH}_4 + \text{I}_2 \longrightarrow$
 III. $\text{BF}_3 + \text{NaH} \longrightarrow$
 (A) I, III (B) I, II
 (C) II, III (D) I, II and III

4. Which are true statements among the following?
 (i) PH_5 and SCl_6 do not exist
 (ii) $p\pi - d\pi$ bonds are present in SO_2
 (iii) SeF_4 and CF_4 have same shape
 (iv) I_3^+ has bent geometry
 (A) (i) (B) (i), (ii) & (iv)
 (C) (i) & (iii) (D) (i), (ii) & (iii)

5. Which of the following is/are incorrect statement?
 (A) All orbitals of the oxygen atom lie at lower energies than the corresponding ones of the carbon atom.
 (B) The 2s-2p energy separation is higher for 'O' than for carbon
 (C) The molecular orbitals of CO are significantly different from those for N_2 .
 (D) CO^+ has lower bond order than CO.

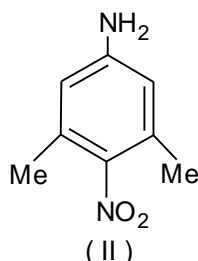
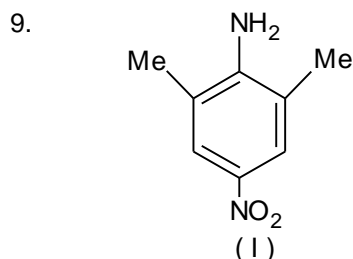
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6. The equilibrium constants K_{p_1} and K_{p_2} for the reactions $X \rightleftharpoons 2Y$ and $Z \rightleftharpoons P + Q$ (all are gases); respectively are in the ratio of 1 : 9. If the degree of dissociation of X and Z be equal then the ratio of total pressure at these equilibria is: (reactions are started with equal moles of X and Z)
- (A) 1 : 9 (B) 1 : 36
(C) 1 : 2 (D) 1 : 3
7. One litre of water is placed in a closed room of $2 \times 10^4 \text{ dm}^3$ capacity containing dry air at 27°C , if the aqueous tension at 27°C is 23.0 mm Hg and density of water is 1.0 g cm^{-3} , then the volume of water that will evaporate is
- (A) 600 cm^3 (B) 442.3 cm^3
(C) 1 L (D) 200 cm^3

SECTION – A
(Multi Correct Answer Type)

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

8. The compounds which can not exist together in aqueous solution is/are
- (A) NaH_2PO_4 & Na_2HPO_4 (B) Na_2CO_3 & NaHCO_3
(C) NaOH & NaH_2PO_4 (D) NaHCO_3 & NaOH



Choose correct statement (s) regarding the above two compounds?

- (A) (I) is more basic than (II)
(B) (I) has more number of resonating structures than (II)
(C) The pK_a (of conjugate acid) value of (I) is greater than that of (II)
(D) In (I), NO_2 group exhibits -I as well as -R effect.
10. HIO_4 absorbs water to form H_5IO_6 . If 96 gm of pure anhydrous HIO_4 absorbs water, its mass increases to 105 gm. Which of the following is/are true for final substance?
- (A) It contains both HIO_4 and H_5IO_6
(B) Half of original HIO_4 is converted to H_5IO_6
(C) HIO_4 has been completely converted to H_5IO_6
(D) Only 25% of original HIO_4 has been converted to H_5IO_6

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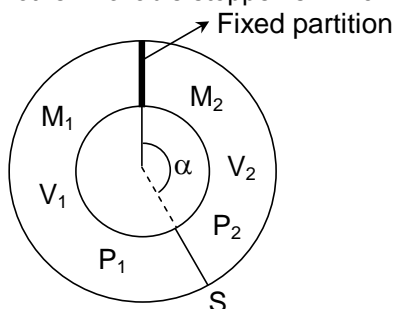
11. Which of the following species do not exist?
 (A) $(\text{BF}_6)^{3-}$ (B) OF_4
 (C) PH_5 (D) SCl_6

SECTION – A
(Paragraph Type)

This section contains 2 paragraphs. Based upon the first paragraph **2 multiple choice questions** and based on the second paragraph **3 multiple choice questions** have to be answered. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

Comprehension 1:

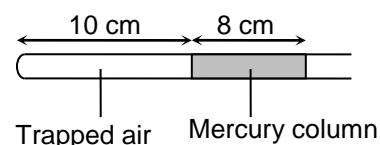
A ring shaped tube contains two ideal gases with molecular weights 32 and 28. Both these gases are separated by one fixed partition and another movable stopper 's' which can move freely without friction inside the ring.



12. If both the gases have same mass, then
 (A) $P_1 + P_2 = 1\text{atm}$ (B) $P_1 = \frac{28}{32} P_2$
 (C) $P_1 = \frac{32}{28} P_2$ (D) $P_1 = P_2$
13. The angle ' α ' shown in figure is (assume masses of both gases to be equal)
 (A) 168° (B) 132°
 (C) 146° (D) 180°

Comprehension 2:

A 10.0 cm column of air is trapped by a column of Hg 8.00 cm long in a capillary tube of uniform bore when the tube is held horizontally in a room at 1 atm pressure.



Space for rough work

14. The length of the air column when the tube is held vertically with open end up, is
 (A) 9.05 cm (B) 11.3 cm
 (C) 8.51 cm (D) 6.15 cm
15. The length of the air column when the tube is held vertically with the open end down, is
 (A) 8.99 cm (B) 11.2 cm
 (C) is equal to length of capillary tube (D) 18 cm
16. The length of the air column when the tube is held at a 45° angle from vertical with the open end up, is
 (A) 8.12 cm (B) 9.27 cm
 (C) 12.05 cm (D) 15.11 cm

SECTION – C
Integer Answer Type

This section contains **7 questions**. The answer to each of the questions is a **single-digit integer**, ranging from 0 to 9.

1. An aqueous solution containing 0.02 mole KIO_3 was treated with 400 ml 0.2 M KI solution, then the volume of hypo (0.2 M) required for titration of liberated I_2 is V ml. The value of $\frac{V}{60}$ is
2. A jar contains a gas and few drops of water. The pressure in the jar is 830 mm of Hg. The temperature of the jar is reduced by 1%. The vapour pressure of water at two temperatures are 30 and 25 mm of Hg. Calculate the new pressure in jar (in atm). Give the answer in terms of nearest integer.
3. 6 litre of a mixture of O_3 and O_2 weigh 10 g at NTP. What volume of O_3 in litre is present in the mixture?
4. A compound exists in the gaseous phase both as monomer (A) and dimer (A_2). The molecular weight of (A) is 48. In an experiment 96 g of the compound was confined in a vessel of volume 33.6 litre and heated to 273°C. Calculate the pressure in atm developed if the compound exists as dimer to the extent of 50% by weight under these conditions.
5. The density of gas X (mol.mass = 60) is 1.4 g/litre at a certain temperature and pressure. Under the same conditions, the density of another gas(Y) is 2.1 g/litre. What is the mass of 0.1 gram molecule of gas 'Y'?
6. An optically active hydrocarbon(X), C_8H_{12} does not react with ammonical AgNO_3 solution and forms an optically inactive hydrocarbon(Y) C_8H_{18} on complete hydrogenation. Treatment of hydrocarbon (X) with sodium and liquid NH_3 (Birch reduction) forms an optically active hydrocarbon (Z), C_8H_{14} . How many allylic hydrogens are present in compound (Z)?
7. Compound (A), $\text{C}_7\text{H}_{15}\text{Cl}$, on dehydrohalogenation forms three alkenes (without considering stereoisomerism) having same molecular formula C_7H_{14} . On reductive ozonolysis the alkenes produce the following compounds:
 CH_3CHO , CH_3COCH_3 , $\text{CH}_3\text{COCH}_2\text{CH}_3$, $\text{CH}_3\text{COCH}(\text{CH}_3)-\text{CH}_3$, HCHO and $\text{CH}_3\text{CH}_2\text{COCH}(\text{CH}_3)-\text{CH}_3$
- $\begin{array}{c} | \\ \text{CH}_3 \end{array}$
 $\qquad\qquad\qquad$
 $\begin{array}{c} | \\ \text{CH}_3 \end{array}$
- How many tertiary carbon atoms are present in one molecule of (A)?

Space for rough work

PART III : MATHEMATICS

SECTION – A

(Single Correct Answer Type)

This section contains **7 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

1. For any two non-zero complex numbers z_1 & z_2 if $z_1\bar{z}_2 + z_2\bar{z}_1 = 0$, then the difference of amplitudes of z_1 & z_2 is

(A) 0	(B) $\frac{\pi}{4}$
(C) $\frac{\pi}{2}$	(D) π

2. The value of the expression $2(1+\omega)(1+\omega^2)+3(2+\omega)(2+\omega^2)+4(3+\omega)(3+\omega^2)+\dots\dots\dots+(n+1)(n+\omega)(n+\omega^2)$, where ω is an imaginary cube root of unity is

(A) $\left[\frac{n(n+1)}{2}\right]^2$	(B) $\left[\frac{n(n+1)}{2}\right]^2 - n$
(C) $\left[\frac{n(n+1)}{2}\right]^2 + n$	(D) $\left[\frac{n(n-1)}{2}\right]^2$

3. Out of 7 gentlemen and 4 ladies a committee of 5 is to be formed. The number of ways in which this can be done so as atleast 3 ladies are always included will be

(A) 84	(B) 90
(C) 85	(D) 91

4. The set of all values of a for which the roots of the equation $(1+a)x^2 - 3ax + 4a = 0$ are always greater than 1, will be

(A) $\left[\frac{-16}{7}, 0\right)$	(B) $\left[\frac{-16}{7}, -1\right)$
(C) $(-1, 2)$	(D) $(-1, 3)$

5. If $x > 1, y > 1, z > 1$ are in G.P., then $\frac{1}{1+\ln x}, \frac{1}{1+\ln y}, \frac{1}{1+\ln z}$ will be in

(A) A.P.	(B) G.P.
(C) H.P.	(D) A.G.P.

Space for rough work

6. C_1 & C_2 are circles of unit radius with centre at $(0, 0)$ and $(1, 0)$ respectively. C_3 is a circle of unit radius, passes through the centres of circles C_1 & C_2 and have its centre above x - axis. equation of the common tangent to C_1 & C_3 will be
- (A) $x - \sqrt{3}y + 2 = 0$ (B) $\sqrt{3}x - y + 2 = 0$
 (C) $\sqrt{3}x - y - 2 = 0$ (D) $x + \sqrt{3}y + 2 = 0$
7. The axis of a parabola is along the $y = x$ and the distance of its vertex from origin is $\sqrt{2}$ and that from its focus is $2\sqrt{2}$. If the vertex and both lie in first quadrant, then the equation of the parabola is
- (A) $(x - y)^2 = (x + y + 2)$ (B) $(x - y)^2 = (x + y - 2)$
 (C) $(x - y)^2 = 4(x + y - 2)$ (D) $(x - y)^2 = 8(x + y - 2)$

SECTION - A

(Multi Correct Answer Type)

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

8. If α and β be the roots of $x^2 - 4x + A = 0$ and γ & δ be the roots of $x^2 - 36x + B = 0$. If $\alpha, \beta, \gamma, \delta$ forms an increasing G.P., then
- (A) $B = 81A$ (B) $A = 3$
 (C) $B = 243$ (D) $A + B = 251$
9. If in a triangle ABC, a, b, c are in A.P. and p_1, p_2, p_3 are the altitudes from the vertices A, B & C respectively, then
- (A) p_1, p_2, p_3 are in A.P. (B) p_1, p_2, p_3 are in H.P.
 (C) $p_1 + p_2 + p_3 \leq \frac{3\Delta}{R}$ (D) $\frac{1}{p_1} + \frac{1}{p_2} + \frac{1}{p_3} \leq \frac{3R}{\Delta}$
10. The equation of straight line passing through the point $(1, 2)$ and equally inclined to the lines $3x - 4y - 5 = 0$ & $12x - 5y + 4 = 0$ will be
- (A) $9x - 7y + 5 = 0$ (B) $7x + 9y - 11 = 0$
 (C) $9x - 7y - 2 = 0$ (D) $7x + 9y - 25 = 0$

Space for rough work

11. If a hyperbola passes through the foci of ellipse $\frac{x^2}{25} + \frac{y^2}{16} = 1$ and its transverse and conjugate axes coincide with the major & minor axes of the ellipse and product of eccentricities is 1, then
- (A) the equation of hyperbola is $\frac{x^2}{9} - \frac{y^2}{16} = 1$
- (B) the equation of the hyperbola is $\frac{x^2}{16} - \frac{y^2}{9} = 1$
- (C) focus of the hyperbola is (5, 0)
- (D) focus of the hyperbola is $(5\sqrt{3}, 0)$

SECTION – A
(Paragraph Type)

This section contains 2 paragraphs. Based upon the first paragraph **2 multiple choice questions** and based on the second paragraph **3 multiple choice questions** have to be answered. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

Comprehension 1:

If x, y, z are sines and p, q, r are cosines of the angles α, β, γ respectively which are in A.P. with common difference $\frac{2\pi}{3}$. Then answer the following questions.

12. The value of $(x + y + z)$ is equal to
- (A) 1 (B) 2
- (C) $p + q + r$ (D) $\frac{3}{2}$
13. The value of $(xy + yz + xz)$ is equal to
- (A) $p + q + r$ (B) $-\frac{3}{4}$
- (C) $(x + y + z)$ (D) $-\frac{3}{8}$

Comprehension 2:

A circle C_1 of radius 2 units rolls on the outside of the circle C_2 touching externally. The equation of C_2 is $x^2 + y^2 + 4x = 0$. Then answer the following questions.

Space for rough work

14. The locus of the centre of outer circle C_1 will be
 (A) $x^2 + y^2 + 4x - 14 = 0$ (B) $x^2 + y^2 + 4x - 12 = 0$
 (C) $x^2 + y^2 + 4x - 8 = 0$ (D) $x^2 + y^2 + 4x - 16 = 0$
15. If the line joining the centres of C_1 & C_2 makes an angle of 60° with x-axis, then the equation of common tangent at the point of contact to them is
 (A) $x + \sqrt{3}y - 2 = 0$ (B) $x + \sqrt{3}y - 1 = 0$
 (C) $x + \sqrt{3}y - 3 = 0$ (D) $x + \sqrt{3}y - 4 = 0$
16. If the line joining the centre of C_1 & C_2 is perpendicular to the x-axis, then equation of the chord of contact of the tangents drawn from centre of C_1 if C_1 lies in IInd quadrant will be
 (A) $y = 2$ (B) $y = 3$
 (C) $y = 1$ (D) $y = 4$

SECTION – C
Integer Answer Type

This section contains **7 questions**. The answer to each of the questions is a **single-digit integer**, ranging from 0 to 9.

1. Four different integers form an increasing A.P. such that one of them is sum of square of the remaining numbers. The largest integer will be _____.
2. If $n \in \mathbb{N}$, then the remainder when $37^{(n+2)} + 16^{(n+1)} + 30^n$ is divided by 7 is _____.
3. If $K = \sin\left(\frac{\pi}{18}\right) \cdot \sin\left(\frac{5\pi}{18}\right) \cdot \sin\left(\frac{7\pi}{18}\right)$, then the value of $16K$ is _____.
4. The radius of the circle passing through foci of the ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$ and having its centre at $(0, 3)$ is _____.
5. The number of common tangents to the circle $x^2 + y^2 + 2x + 8y - 25 = 0$ & $x^2 + y^2 - 4x + 10y + 19 = 0$ will be _____.
6. Tangents are drawn at the ends of the latus rectum of the ellipse $\frac{x^2}{9} + \frac{y^2}{5} = 1$. If A be the area of quadrilateral so formed then $\left(\frac{A}{3}\right)$ is equal to _____.
7. If $\theta = \cot^{-1}7 + \cot^{-1}8 + \cot^{-1}18$, then $\cot \theta$ is equal to _____.

Space for rough work

FIITJEE RESHUFFLING TEST

TWO YEAR CRP PCM (PAPER – I)

PAPER CODE:

DATE: DD.MM.YYYY

ANSWER KEYS

PHYSICS

SECTION – A

- | | | | |
|------------|-------|----------|------------|
| 1. A | 2. B | 3. B | 4. D |
| 5. C | 6. A | 7. C | 8. A, B, C |
| 9. A, B, D | 10. B | 11. A, D | 12. A |
| 13. A | 14. C | 15. A | 16. D |

SECTION – C

- | | | | |
|------|------|------|------|
| 1. 9 | 2. 3 | 3. 4 | 4. 4 |
| 5. 4 | 6. 5 | 7. 4 | |

CHEMISTRY

SECTION – A

- | | | | |
|---------|----------|----------------|---------|
| 1. B | 2. B | 3. D | 4. B |
| 5. D | 6. B | 7. B | 8. C, D |
| 9. B, D | 10. A, B | 11. A, B, C, D | 12. D |
| 13. A | 14. A | 15. B | 16. B |

SECTION – C

- | | | | |
|------|------|------|------|
| 1. 8 | 2. 1 | 3. 2 | 4. 2 |
| 5. 9 | 6. 4 | 7. 2 | |

MATHEMATICS

SECTION – A

- | | | | |
|---------|----------|----------|------------|
| 1. C | 2. C | 3. D | 4. B |
| 5. C | 6. B | 7. D | 8. A, B, C |
| 9. B, D | 10. A, D | 11. A, C | 12. C |
| 13. B | 14. B | 15. A | 16. C |

SECTION – C

- | | | | |
|------|------|------|------|
| 1. 2 | 2. 0 | 3. 2 | 4. 4 |
| 5. 0 | 6. 9 | 7. 3 | |