

PHYSICS, CHEMISTRY & MATHEMATICS

CPT-1

CODE: 123048

PAPER - 2

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

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 Sections**.
3. **Section-I** is Physics, **Section-II** is Chemistry and **Section-III** is Mathematics.
4. All the section can be filled in **PART-A** of OMR.
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 **Blue/Black Ball Point Pen** 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 Only One Part.

- (i) **Part-A (01-07)** – Contains seven (07) multiple choice questions which have **One or More** correct answer.
Full Marks: +4 If only the bubble(s) corresponding to all the correct options(s) is (are) darkened.
Partial Marks: +1 For darkening a bubble corresponding to **each correct option**, provided NO incorrect option is darkened.
Zero Marks: 0 If none of the bubbles is darkened. **Negative Marks: -1** In all other cases.
For example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will result in **+4 marks**; darkening only (A) and (D) will result in **+4 marks**; and darkening (A) and (B) will result in **-1 marks**, as a wrong option is also darkened.
- (ii) **Part-A (08-14)** – Contains seven (07) multiple choice questions which have ONLY ONE CORRECT answer
 Each question carries **+3 marks** for correct answer and **-1 marks** for wrong answer.
- (iii) **Part-A (15-18)** - This section contains Two paragraphs. Based on each paragraph, there are Two multiple choice questions. Each question has only one correct answer and carries **+3 marks** for the correct answer. **There is no negative marking.**

Name of the Candidate : _____

Batch : _____ Date of Examination : _____

Enrolment Number : _____

SECTION - I: PHYSICS

PART – A : (One or more than one Options Correct Type)

This section contains **7 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE** or **MORE THAN ONE** is correct.

1. A man driving a motorcycle, on a horizontal road with 8 km/hr. finds the rain falling vertically. He increases his speed to 12 km/hr and finds the drops make angle 30° with the vertical then

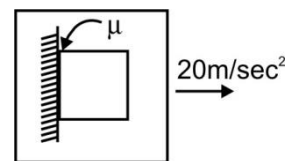
(A) The direction of rain with respect to the road is $\alpha = \cot^{-1}\left(\frac{\sqrt{3}}{2}\right)$

(B) The direction of rain with respect to road is $\alpha = \tan^{-1}\left(\frac{\sqrt{3}}{2}\right)$

(C) The speed of rain with respect to road is $4\sqrt{7}$ km/hr

(D) The speed of rain with respect to road is $7\sqrt{4}$ km/hr

2. Car is accelerating with acceleration of 20 m/sec^2 . A box placed inside the car, has a mass of 10 kg. It is put in contact with the vertical wall as shown. The friction coefficient between the box and the wall is $\mu = 0.6$



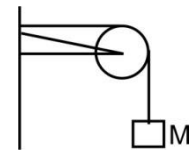
(A) The acceleration of the box will be 20 m/sec^2

(B) The friction force acting on the box will be 100 N

(C) The contact force between the vertical wall and the box will be $100\sqrt{5}$ N

(D) The net contact force between the vertical wall and the box is only of nuclear force type.

3. A string of negligible mass going over a clamped pulley of mass m supports a block of mass M as shown in the figure.



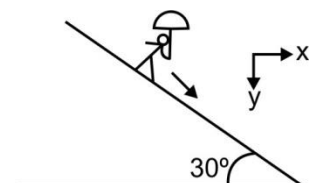
(A) The reaction on the pulley by the clamp is $\sqrt{[(M+m)^2 + M^2]} g$

(B) The reaction on the pulley by the clamp is $\sqrt{[(M+m)^2 + m^2]} g$

(C) The tension in the string is Mg

(D) The tension in the string is $(M + m)g$

4. A man is coming down an incline of angle 30° . When he walks with speed $2\sqrt{3}$ m/sec, he has to keep his umbrella vertical to protect himself from rain. The actual speed of rain is 5 m/sec. If he is at rest and doesn't want to get trenched then



(A) The angle with the vertical at which he should keep his umbrella is $\theta = \tan^{-1}\left(\frac{3}{4}\right)$

(B) The angle with the vertical at which he should keep his umbrella is $\theta = \tan^{-1}\left(\frac{4}{3}\right)$

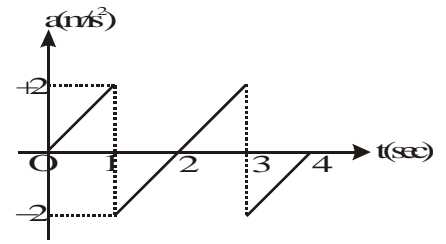
(C) The velocity of rain with respect to the ground is $-3\hat{i} + 4\hat{j}$

(D) The velocity of rain with respect to the ground is $(3\hat{i} + 4\hat{j})$

space for rough work

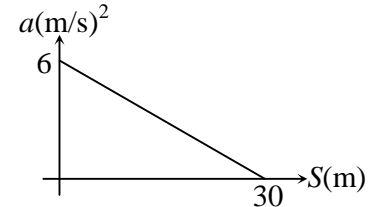
5. Acceleration vs time graph is shown in the figure for a particle moving along a straight line. The particle is initially at rest. Find the time instant(s) when the particle is at rest?

- (A) $t = 0$
 (B) $t = 1$
 (C) $t = 2$
 (D) $t = 4$



6. A train starts from rest at $S = 0$ and is subjected to acceleration as shown

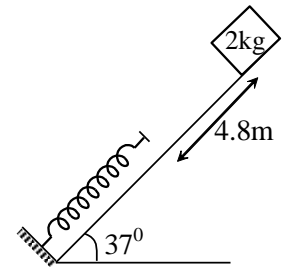
- (A) Change in velocity at the end of 10 m displacement is 50 m/s.
 (B) Velocity of the train for $S = 10$ m is 10 m/s.



- (C) The maximum velocity attained by train is not greater than 14 m/s
 (D) The maximum velocity of the train is between 15 m/s and 16 m/s.

7. Figure shows a massless spring fixed at the bottom end of an inclined of inclination 37° ($\tan 37^\circ = 3/4$). A small block of mass 2 kg start slipping down the incline from a point 4.8 m away from free end of spring. The block compresses the spring by 20 cm, stops momentarily and then rebounds through a distance 1 m up the inclined, then ($g = 10 \text{ m/s}^2$)

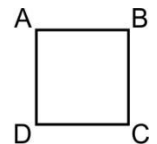
- (A) coefficient of friction between block and inclined is 0.5.
 (B) coefficient of friction between block and inclined is 0.75.
 (C) value of spring constant is 1000 N/m
 (D) value of spring constant is 2000 N/m



Single Correct Answer Type

This section contains **7 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE is correct**.

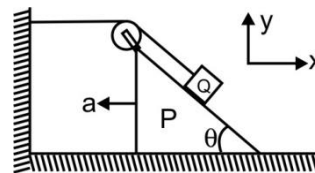
8. Four identical particles are placed at the corners of a square of side l . If at $t = 0$ all the particles starts moving simultaneously with speed v towards each other i.e. A towards B, B towards C and so on. Find the time after which they will combine together



- (A) $\frac{l}{v}$ (B) $\frac{l}{\sqrt{2}v}$ (C) $\frac{\sqrt{2}l}{v}$ (D) $\frac{2l}{v}$

9. Find the acceleration of Q with respect to ground

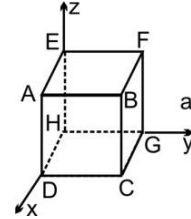
- (A) $(a \cos \theta + a) \hat{i} - a \sin \theta \hat{j}$
 (B) $-(a \cos \theta + a) \hat{i} - a \sin \theta \hat{j}$
 (C) $(a \cos \theta - a) \hat{i} - a \sin \theta \hat{j}$
 (D) $(-a \cos \theta + a) \hat{i} - a \sin \theta \hat{j}$



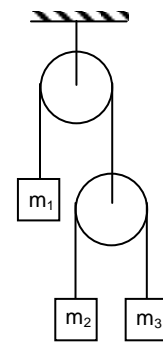
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10. A particle of mass 5 kg starts from origin and move in xy-plane. The velocity of the particle is given by $\vec{v} = 2\hat{i} + 3\sqrt{1-4y}\hat{j}$ where y is the y-coordinate of the position of the particle. Choose the correct statement.
- (A) The average force acting on the particle is 18 N.
 (B) The average force acting on the particle is variable.
 (C) The average force acting on the particle is 90 N.
 (D) No force will act on the particle.

11. A cube of side ℓ is placed as shown in figure. Find the angle between HA and HF
- (A) 90°
 (B) 60°
 (C) $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$
 (D) $\cos^{-1}\left(\sqrt{\frac{2}{3}}\right)$

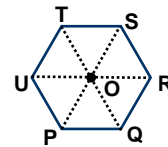


12. In the arrangement, shown below pulleys are massless and frictionless and threads are inextensible, block of mass m_1 will remain at rest if
- (A) $\frac{4}{m_1} = \frac{1}{m_2} + \frac{1}{m_3}$
 (B) $m_1 = m_2 = m_3$
 (C) $\frac{1}{m_1} = \frac{1}{m_2} + \frac{1}{m_3}$
 (D) $\frac{1}{m_3} = \frac{2}{m_2} + \frac{3}{m_1}$



13. A stone is projected with a velocity $20\sqrt{2}$ m/s at an angle of 45° to the horizontal. The magnitude of average velocity of stone during its motion from starting point to its maximum height is (take $g = 10$ m/s²)
- (A) 20 m/s
 (B) $20\sqrt{5}$ m/s
 (C) $5\sqrt{5}$ m/s
 (D) $10\sqrt{5}$ m/s

14. Figure shows regular hexagon PQRSTU. Find the value of $\vec{PQ} + \vec{PR} + \vec{PS} + \vec{PT} + \vec{PU}$.
- (A) \vec{PO}
 (B) $2\vec{PO}$
 (C) $4\vec{PO}$
 (D) $6\vec{PO}$



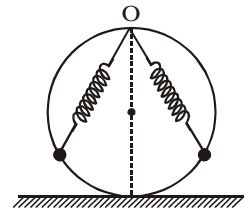
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Paragraph Type

This section contains **2 paragraphs**. Based upon each paragraph, there are **2 questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

Paragraph for Question Nos. 15 to 16

In the adjacent figure, two identical beads of mass m free to slide on a fixed smooth vertical ring are attached to the free ends of two identical light springs of spring constant $k = \frac{(2 + \sqrt{3})mg}{\sqrt{3}R}$.

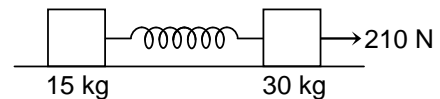


The other ends of the springs are fixed to the highest point O on the ring. Initially beads are at rest and angle between the springs is 60° at the fixed point O. Normal length of each spring is $2R$, where R is the radius of the ring. Beads are initially symmetric w.r.t. the vertical diameter.

15. Normal reaction on one of the bead at initial moment due to ring is
- (A) $\frac{mg}{2}$ (B) $\frac{\sqrt{3}mg}{2}$
 (C) mg (D) zero
16. Relative acceleration between two beads at the initial moment
- (A) $\frac{g}{2}$ vertically away from each other (B) $\frac{g}{2}$ horizontally towards each other
 (C) $\frac{2g}{\sqrt{3}}$ vertically away from each other (D) $\frac{2g}{\sqrt{3}}$ horizontally towards each other

Paragraph for Question Nos. 17 to 18

In the system shown in the figure, the mass 30 kg is pulled by a force of 210 N. Answer the following questions at the instant when the 15 kg mass has acceleration 6 m/s^2 . Assume the spring to be mass less and spring constant is 100 N/m. The surface of ground is smooth.



17. Find the acceleration of 30 kg mass
- (A) 2 m/s^2 (B) 3 m/s^2 (C) 3.4 m/s^2 (D) 4 m/s^2
18. Find the elongation in the string at this instant
- (A) 0.3 m (B) 0.6 m (C) 0.9 m (D) None of these

space for rough work

SECTION - II: CHEMISTRY**PART – A : (One or more than one Options Correct Type)**

This section contains **7 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE or MORE THAN ONE is correct**.

- The correct statements regarding the outermost electron of aluminium atom is/are
(A) they have different azimuthal quantum numbers
(B) the highest energetic electron has zero orbital angular momentum
(C) the electrons are present in degenerate orbitals
(D) two electrons have same spin quantum number
- Which of the following statement(s) is/are correct for the smallest element of the second period of periodic table?
(A) It is the highest electronegative atom of periodic table.
(B) It does not form compound in positive oxidation state.
(C) It needs two electrons in order to have eight electrons in the outermost orbit.
(D) It's r.m.s velocity is higher than the most probable velocity.
- VSEPR theory can be applied to
(A) NH_3 (B) PCl_5 (C) SF_4 (D) BF_3
- Which of the following properties of an ideal gas becomes doubled by increasing the temperature by four times?
(A) Most probable velocity (B) Kinetic energy
(C) Rate of effusion (D) Vapour density
- Which of the following molecule(s) can react with oxygen?
(A) Na_2O (B) BaO (C) KO_2 (D) Li_2O
- Which of the following properties of H_2O_2 is/are higher/greater than that of H_2O ?
(A) Thermal stability (B) Acidic strength (C) Boiling point (D) Bleaching action
- Which of the following characteristics of photoelectric effect increases by increasing the frequency of incident radiation?
(A) Kinetic energy of photoelectrons (B) Threshold energy
(C) Number of photoelectrons (D) Stopping potential

Single Correct Answer Type

This section contains **7 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE is correct**.

- What is the basic principle of Doberneir's periodic table?
(A) Law of octave (B) Law of triad
(C) Law of atomic volume (D) Law of atomic weight
- Which relation is correct between NH_3 and NF_3 ?
(A) Dipole moment: $\text{NF}_3 > \text{NH}_3$ (B) Basic strength: $\text{NH}_3 > \text{NF}_3$
(C) Bond angle : $\text{NF}_3 > \text{NH}_3$ (D) Number of electron pairs: $\text{NH}_3 > \text{NF}_3$

space for rough work

10. A container contains equal mass of H_2 , He, CH_4 and CO_2 gases. What part of the total pressure exerted by CH_4 gas?
- (A) $\frac{16}{179}$ (B) $\frac{21}{146}$ (C) $\frac{11}{147}$ (D) $\frac{19}{142}$
11. Substances painted with $Ca(OH)_2$ becomes bright after sometime. This is due to
 (A) absorption of moisture by $Ca(OH)_2$ (B) efflorescent property of $Ca(OH)_2$
 (C) absorption of CO_2 by $Ca(OH)_2$ (D) evaporation of moisture from $Ca(OH)_2$
12. Conc. H_2SO_4 and conc. HNO_3 are not used for the laboratory preparation of H_2 because of their oxidizing nature. Conc. HCl is not an oxidizing agent, still it is not used because
 (A) it emits chlorine gas during reaction with metals
 (B) it is a bleaching agent
 (C) it contains fumes of HCl gas
 (D) it is weakly dissociated than the dilute acids
13. What is the magnetic quantum number of the orbitals which do not have any angular node?
 (A) 2 (B) 1 (C) Zero (D) -1
14. In which of the following pair of homonuclear molecules, the atoms or central atom undergo identical hybridization?
 (A) P_4 , S_8 (B) O_2 , O_3 (C) P_4 , As_4 (D) all are correct

Paragraph Type

This section contains **2 paragraphs**. Based upon each paragraph, there are **2 questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

Paragraph for Question Nos. 15 to 16

The values of van der Waal's constants a and b of four gases are given as follows:

Gases	'a' in $\text{atm L}^2 \text{mol}^{-2}$	'b' in L mol^{-1}
P	733	0.4
Q	890	0.6
R	720	0.5
S	680	0.3

Answer the following questions on the basis of above write up.

15. Which gas has the strongest intermolecular force of attraction?
 (A) P (B) Q (C) R (D) S
16. Which of the following gas can be easily liquefied?
 (A) P (B) Q (C) R (D) S

Paragraph for Question Nos. 17 to 18

A 20 mL mixture of CO , CH_4 and He gases is exploded by an electric discharge at room temperature with excess oxygen. The volume contraction was found to be 13.0 mL. A further contraction of 14.0 mL occurs when the residual gas is treated with KOH solution.

17. The total volume of CO and CH_4 in the mixture would be
 (A) 18 mL (B) 10 mL (C) 12 mL (D) 14 mL
18. % of CO in the original mixture of gases is
 (A) 20 (B) 40 (C) 50 (D) 70

space for rough work

SECTION - III: MATHEMATICS

PART – A : (One or more than one Options Correct Type)

This section contains **7 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE or MORE THAN ONE is correct**.

1. Let $f_n(\theta) = \tan \frac{\theta}{2} (1 + \sec \theta)(1 + \sec 2\theta)(1 + \sec 4\theta) \dots (1 + \sec 2^{n-1}\theta)$ then
 (A) $f_2\left(\frac{\pi}{16}\right) = 1$ (B) $f_3\left(\frac{\pi}{32}\right) = 1$ (C) $f_4\left(\frac{\pi}{64}\right) = 1$ (D) $f_5\left(\frac{\pi}{128}\right) = 1$

2. If opposite angular points of a square are (3, 4) and (1, -1), then the remaining vertex of square can be:
 (A) $\left(\frac{9}{2}, \frac{1}{2}\right)$ (B) $\left(\frac{1}{2}, \frac{5}{2}\right)$ (C) $\left(-\frac{1}{2}, \frac{5}{2}\right)$ (D) $\left(\frac{9}{2}, -\frac{1}{2}\right)$

3. The circles $x^2 + y^2 = 1$ and $x^2 + y^2 = 2x$
 (A) intersect in two distinct points
 (B) intersect on the line $x = \frac{1}{2}$
 (C) intersect in the points $\left(\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$ and $\left(\frac{1}{2}, -\frac{\sqrt{3}}{2}\right)$
 (D) have a common chord of length $\sqrt{3}$

4. If the area of quadrilateral formed by the tangents from the origin to the circle $x^2 + y^2 + 6x - 10y + c = 0$ and the pair of radii at the points of contact of these tangents to the circle is 8 sq. unit, then the value of c is
 (A) 2 (B) 4 (C) 16 (D) 32

5. If the line $y = mx$ meets the lines $x + 2y - 1 = 0$ and $2x - y + 3 = 0$ at the same point, then m is equal to
 (A) 1 (B) -1 (C) 2 (D) -2

6. A and B are the points (2, 0) and (0, 2) respectively. The coordinates of the point P on the line $2x + 3y + 1 = 0$ are
 (A) (7, -5) if $|PA - PB|$ is maximum (B) $\left(-\frac{1}{5}, -\frac{1}{5}\right)$ if $|PA - PB|$ is maximum
 (C) (7, -5) if $|PA - PB|$ is minimum (D) $\left(-\frac{1}{5}, -\frac{1}{5}\right)$ if $|PA - PB|$ is minimum

7. Equation of a straight line passing through the point of intersection of $x - y + 1 = 0$ and $3x + y - 5 = 0$ are perpendicular to one of them is
 (A) $x + y + 3 = 0$ (B) $x + y - 3 = 0$ (C) $x - 3y - 5 = 0$ (D) $x - 3y + 5 = 0$

space for rough work

Single Correct Answer Type

This section contains **7 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE is correct**.

8. The maximum and minimum value of $\cos^2 \theta - 6 \sin \theta \cdot \cos \theta + 3 \sin^2 \theta + 2$, are respectively
 (A) $2 - \sqrt{10}, 2 + \sqrt{10}$ (B) $4 - \sqrt{10}, 4 + \sqrt{10}$
 (C) $2 + \sqrt{10}, 2 - \sqrt{10}$ (D) $4 + \sqrt{10}, 4 - \sqrt{10}$
9. The least value of the expression $2 \log_{10} x - \log_x 0.01$ is
 (A) 2 (B) 4 (C) 6 (D) 8
10. A ray of light passing through the point (3, 7) reflects on the x-axis at a point A and the reflected ray passes through the point (2, 5), the coordinates of A are
 (A) $\left(\frac{29}{12}, 0\right)$ (B) $\left(\frac{1}{2}, 0\right)$ (C) $\left(-\frac{1}{2}, 0\right)$ (D) $\left(-\frac{29}{12}, 0\right)$
11. If the roots of the quadratic equation $x^2 + px + q = 0$ are $\tan 30^\circ$ and $\tan 15^\circ$, then the value of $2 + q - p$ is
 (A) 1 (B) 2 (C) 3 (D) 0
12. The value of $\cos 12^\circ + \cos 84^\circ + \cos 156^\circ + \cos 132^\circ$ is
 (A) $\frac{1}{8}$ (B) $-\frac{1}{2}$ (C) 1 (D) $\frac{1}{2}$
13. The value of $\int \frac{1 + \sin x}{1 - \sin x} dx$ is
 (A) $2 \tan\left(\frac{x}{2} + \frac{\pi}{4}\right) + C$ (B) $2 \tan\left(\frac{x}{2} + \frac{\pi}{4}\right) + x + C$
 (C) $2 \tan\left(\frac{x}{2} + \frac{\pi}{4}\right) - x + C$ (D) $2 \tan^2\left(\frac{x}{2} + \frac{\pi}{4}\right) - x + C$
14. If $y = a^{\frac{1}{1 - \log_a x}}$ and $Z = a^{\frac{1}{1 - \log_a y}}$, then x is equal to
 (A) $a^{\frac{1}{1 + \log_a z}}$ (B) $a^{\frac{1}{2 + \log_a z}}$ (C) $a^{\frac{1}{1 - \log_a z}}$ (D) $a^{\frac{1}{2 - \log_a z}}$

space for rough work

Paragraph Type

This section contains **2 paragraphs**. Based upon each paragraph, there are **2 questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

Paragraph for Question Nos. 15 to 16

Let $ax + by = 1$ be a chord of the curve $3x^2 - y^2 - 2x + 4y = 0$ intersecting the curve at the points A and B such that AB subtends a right angle at the origin 'O'

15. The value of $a - 2b + 1$ is equal to
(A) 0 (B) 1
(C) 2 (D) -1
16. If a and b are parameters, then $ax + by = 1$ always passes through
(A) (1, 2) (B) (-1, 2)
(C) (1, 1) (D) (1, -2)

Paragraph for Question Nos. 17 to 18

Let α - chord of a circle be that chord of the circle which subtends an angle α at the centre.

17. If $x + y = 1$ is α - chord of $x^2 + y^2 = 1$, then α is equal to
(A) $\frac{\pi}{4}$ (B) $\frac{\pi}{2}$
(C) $\frac{\pi}{6}$ (D) $x + y = 1$ is not a chord
18. Distance of $\frac{2\pi}{3}$ chord of $x^2 + y^2 + 2x + 4y + 1 = 0$ from the centre, is
(A) 1 (B) 2
(C) $\sqrt{2}$ (D) $\frac{1}{\sqrt{2}}$

space for rough work

FIITJEE COMMON TEST

**BATCHES: Two Yr CRP C-XI
PHASE TEST – 1 (PAPER – 2)**

QP Code: 123048

ANSWER KEY

SECTION – I (PHYSICS)

PART-A

- | | | | |
|--------|--------|-------|-------|
| 1. AC | 2. ABC | 3. AC | 4. AD |
| 5. ACD | 6. BC | 7. AC | 8. A |
| 9. C | 10. C | 11. B | 12. A |
| 13. D | 14. D | 15. C | 16. D |
| 17. D | 18. C | | |

SECTION – II (CHEMISTRY)

PART-A

- | | | | |
|-------|--------|---------|-------|
| 1. AD | 2. ABD | 3. ABCD | 4. A |
| 5. AB | 6. BCD | 7. AD | 8. B |
| 9. B | 10. C | 11. C | 12. C |
| 13. C | 14. D | 15. B | 16. D |
| 17. D | 18. C | | |

SECTION – III (MATHEMATICS)

PART-A

- | | | | |
|-------------|--------------|---------|-------|
| 1. ABCD | 2. AC | 3. ABCD | 4. AD |
| 5. <u>B</u> | 6. <u>AD</u> | 7. BD | 8. D |
| 9. B | 10. A | 11. C | 12. B |
| 13. C | 14. C | 15. C | 16. D |
| 17. B | 18. A | | |