

PHYSICS, CHEMISTRY & MATHEMATICS

Pattern - CPT-2

QP CODE:

PAPER - 1

Time Allotted: 3 Hours

Maximum Marks: 186

- 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 & B** 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 All Two Parts.

- (i) **Part-A (01-04)** – Contains Six (04) multiple choice questions which have ONLY ONE CORRECT answer Each question carries **+3 marks** for correct answer and **-1 marks** for wrong answer.
- (ii) **PART-A (05–12)** contains (8) Multiple Choice Questions which have **One or More Than One 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 **+2 marks**; and darkening (A) and (B) will result in **-1 marks**, as a wrong option is also darkened.
- (iii) **Part-B (01-06)** contains six (06) Numerical based questions, the answer of which maybe positive or negative numbers or decimals (e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30) and each question carries **+3 marks** for correct answer. **There is no negative marking.**

Name of the Candidate : _____

Batch : _____ Date of Examination : _____

Enrolment Number : _____

SECTION – I : PHYSICS

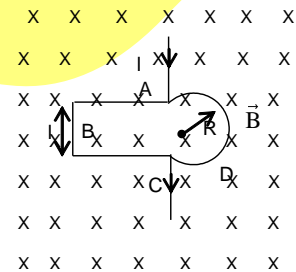
(PART – A)

SECTION – A

(Single Correct Answer Type)

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

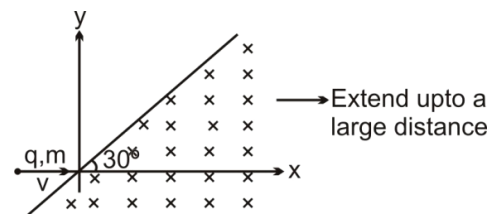
1. In YDSE if intensities of light from two slits are in the ratio of 1:4, the ratio of the intensities at minimum and maxima will be
 (A) 1 : 2 (B) 1 : 3 (C) 1 : 4 (D) 1 : 9
1. D
2. Two coherent sources of intensity ratio 100:1, interfere what is the (approximate) ratio of the intensity between the maxima and minima in the interference pattern?
 (A) 10:1 (B) 5:2 (C) 3:2 (D) 11:9
2. C
3. Energy dissipates in LCR circuit in
 (A) L only (B) C only (C) R only (D) all of these
3. C
4. The figure shows a conducting loop ABCDA placed in a uniform magnetic field perpendicular to its plane. The part ABC is the (3/4)th portion of the square of side length l . The part ADC is a circular arc of radius R . The point A and C are connected to a battery which supply a current I to the circuit. The magnetic force on the loop due to the field B is
 (A) zero (B) $B I l$
 (C) $2 B I R$ (D) $\frac{B I l R}{l + R}$
4. B



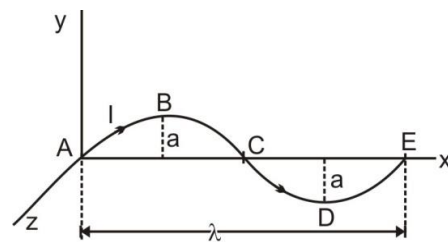
(One or More Than One Options Correct Type)

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

5. A charge particle of charge q and mass m is moving with velocity v as shown in figure in a uniform magnetic field B along $-ve$ z -direction. Select the correct alternative(s):
 (A) Velocity of the particle when it comes out from the magnetic field is $\vec{v} = v \cos 60^\circ \hat{i} + v \sin 60^\circ \hat{j}$
 (B) Time for which the particle was in magnetic field is $\frac{\pi m}{3qB}$
 (C) Distance travelled in magnetic field is $\frac{\pi m v}{2qB}$
 (D) None of these
5. AB

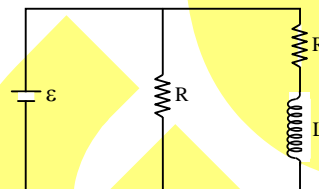


6. A conductor ABCDE, shaped as shown, carries current I . It is placed in the $x - y$ plane with the ends A and E on the x -axis. A uniform magnetic field of magnitude B exists in the region. The force acting on it will be :
- (A) zero, if B is in the x -direction
 (B) λBI in the z -direction, if B is in the y -direction
 (C) λBI in the negative y -direction, if B is in the z -direction
 (D) λaBI , if B is in the x -direction



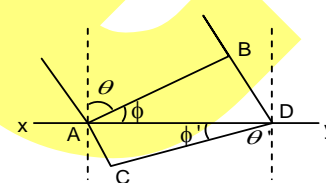
6. **ABC**

7. In the circuit diagram shown:
- (A) time constant is L/R
 (B) time constant is $2L/R$
 (C) steady state current in inductor is $2\varepsilon/R$
 (D) steady state current in inductor is ε/R



7. **AD**

8. In the given diagram a wavefront AB moving in air is incident on a plane glass surface xy . Its position CD after refraction through the glass slab is shown also along with normals drawn at A and D. The refractive index of glass will be equal to :

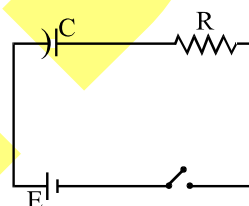


- (A) (BD/AC) (B) (AB/CD)
 (C) $(\sin\phi / \sin\phi')$ (D) $(\cos\theta / \cos\theta')$

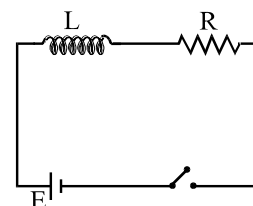
8. **ACD**

9. The switches in figures (a) and (b) are closed at $t = 0$

- (A) The charge on C just after $t = 0$ is EC .
 (B) The charge on C long after $t = 0$ is EC .
 (C) The current in L just after $t = 0$ is E/R .
 (D) The current in L long after $t = 0$ is E/R .



(a)



(b)

9. **BD**

10. A transparent slab of thickness t and refractive index μ is inserted in front of upper slit of YDSE apparatus. The wavelength of light used is λ . Assume that there is no absorption of light by the slab. Select the correct statement(s):

- (A) The intensity of dark fringes will be 0, if slits are identical
 (B) The change in optical path due to insertion of plate is μt
 (C) The change in optical path due to insertion of plate is $(\mu - 1)t$
 (D) For making intensity zero at the centre of screen, then thickness could be $\frac{5\lambda}{2(\mu - 1)}$

10. **AC**

11. The electron in the hydrogen atom make a transition from an excited state to the ground state. Which of the following statement is true?

- (A) Its kinetic energy increases and its potential and total energies decrease
 (B) Its kinetic energy decreases, potential energy increases and its total energy remains the same
 (C) Its kinetic and total energies decrease and its potential energy increases
 (D) Its kinetic potential and total energies decreases

11. **BD**

12. A nucleus splits into two nuclear parts which have their velocities in the ratio of 2 : 1. Then :
- (A) Momentum of both parts are equal and opposite
 (B) The ratio of their nuclear radii $2^{1/3} : 1$
 (C) The ratio of their nuclear radii $1 : 2^{1/3}$
 (D) None of these

12. **AC****(PART – B)****(Integer Type)**

Part-C (01-06) contains six (06) Numerical based questions, the answer of which maybe positive or negative numbers or decimals (e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30) and each question carries **+4 marks** for correct answer and **there will be no negative marking**.

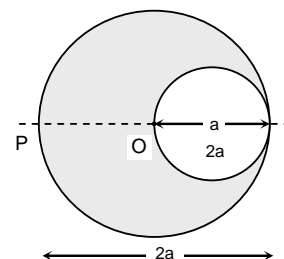
1. A concave mirror of focal length 10 cm and a convex mirror of focal length 15 cm are placed facing each other 40 cm apart. A point object is placed between the mirrors, on their common axis and 15 cm from the concave mirror. Find the position and nature of the image produced by the successive reflections, first at concave mirror and then at convex mirror (in m).

1. **0.06**

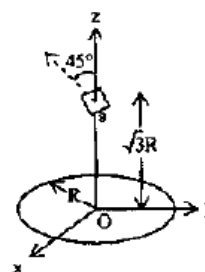
2. A conducting loop of radius R has self-inductance L. A uniform and constant magnetic field B is applied perpendicular to the plane of the loop. Initially current in this loop is zero. The loop is rotated by 180° . The current in the loop after rotation is equal to $\frac{nB\pi R^2}{L}$. Find n.

2. **2**

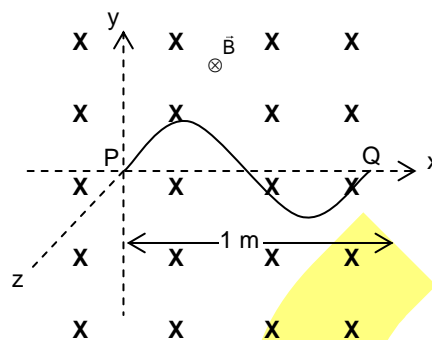
3. A cylindrical cavity of diameter a exists inside a cylinder of diameter 2a as shown in the figure. Both the cylinder and the cavity are infinitely long. A uniform current density J flows along the length. If the magnitude of the magnetic field at the point P is given by $\frac{N}{12}\mu_0 aJ$, then the value of N is :

3. **5**

4. A circular wire loop of radius R is placed in the x-y plane centred at the origin O. A square loop of side a ($a \ll R$) having two turns is placed with its center at $z = \sqrt{3}R$ along the axis of the circular wire loop, as shown in the figure. The plane of the square loop makes an angle of 45° with respect to the z-axis. If the mutual inductance between the loops is given by $\frac{\mu_0 a^2}{2^{p/2} R}$, then the value of p is

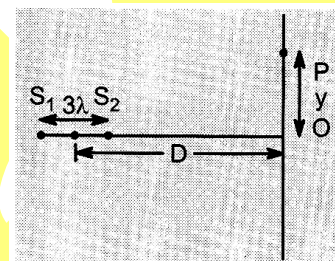
4. **7**

5. A wire forming one cycle of sine curve is moved in $x - y$ plane with velocity $\vec{V} = 3\hat{i} + 2\hat{j}$. There exist a magnetic field $\vec{B} = -3\hat{k}$. Find the motional emf develop across the ends PQ of wire



5. 6

6. Figure shows two coherent microwave source S_1 and S_2 emitting waves of wavelength λ and separated by a distance 3λ . For $\lambda \ll D$ and $y \neq 0$, the minimum value of y for point P to be an intensity maximum is $\frac{\sqrt{m}D}{n}$. Determine the value of $m + n$, if m and n are coprime number.



6. 7

Space For Rough Work

SECTION – II : CHEMISTRY

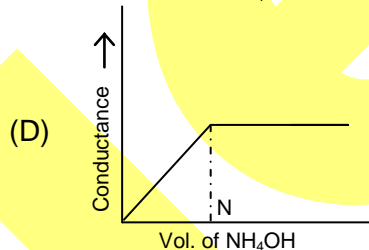
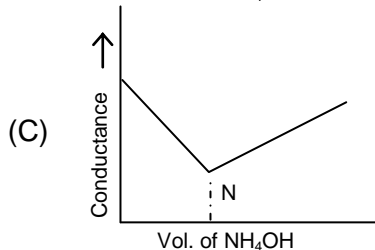
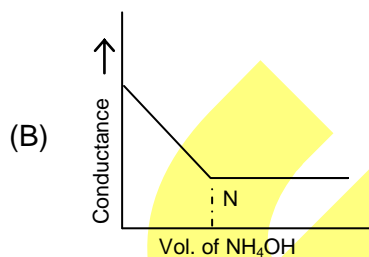
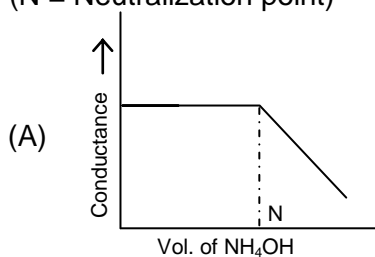
(PART – A)

SECTION – A

(Single Correct Answer Type)

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

1. What is the conductance curve of the reaction between HCl and NH_4OH ?
(N = Neutralization point)



1. B

2. Which of the following is a covalent solid?

(A) Common salt
(C) Graphite

(B) Ice
(D) Washing soda

2. C

3. $2X + Y + 3Z \longrightarrow \text{Product}$

The rate equation of above reaction is

$$\text{Rate} = \frac{k[X]^{1.5}[Y]^2}{[Z]^{0.5}}$$

What is the overall order of the reaction?

(A) 1.5
(C) 3

(B) 3.5
(D) 2

3. C

4. What is the osmotic pressure of 0.2 M $\text{C}_6\text{H}_{12}\text{O}_6$ at 400 K?

(A) 5.686 atm
(C) 5.668 mm of Hg

(B) 6.568 mm of Hg
(D) 6.568 atm

4. D

(One or More Than One Options Correct Type)

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

5. The ionization constant of a weak acid HA is 1.6×10^{-5} and the molar conductivity at infinite dilution of the acid is $380 \times 10^{-4} \text{ S m}^2 \text{ mol}^{-1}$. The cell constant of the electrolytic cell is 0.01 m^{-1} . Choose correct statements if the concentration of the acid is 10^{-2} M .
- (A) The degree of dissociation of the acid is 0.04
 (B) The molar conductance of solution (10^{-2} M) is $15.2 \times 10^{-4} \text{ Sm}^2 \text{ mol}^{-1}$
 (C) The conductance of the cell is 2.56 S
 (D) The resistance of the cell decreases by adding water

5. ABD

6. The characteristic properties of a metallic solid which crystal contains B.C.C unit cell is/are
- (A) the effective number of atoms per unit cell is 2
 (B) closest approach of the atoms takes place along the body diagonal
 (C) packing fraction is maximum among the cubic unit cells
 (D) the edge length $(a) = \frac{r}{2}$ ($r =$ radius of atoms)

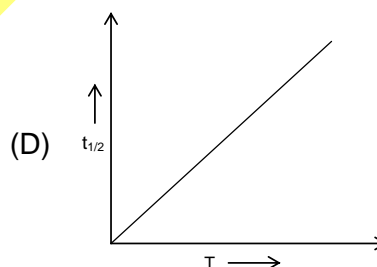
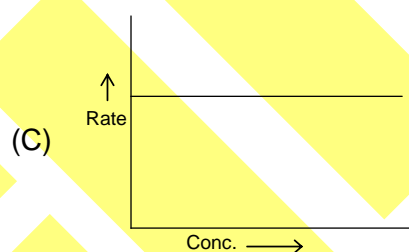
6. AB

7. Two moles of a non-volatile solute was added to 144 g water. The vapour pressure of pure water is 24 mm of Hg at room temperature. Choose the correct statements
- (A) the mole fraction of solute in solution is 0.2
 (B) the vapour pressure of the solution will be 19.2 mm of Hg
 (C) the normal boiling point of the solution will be higher than 100°C
 (D) the freezing point of the solution is higher than 4°C

7. ABC

8. The correct statement(s) regarding a first order reaction is/are

(A) $A_t = A_0 \left(\frac{1}{2}\right)^n$ ($n =$ no. of half-lives) (B) $k = \frac{0.693}{t_{1/2}}$



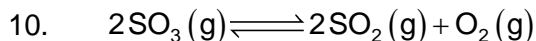
8. AB

9. 10 mL of 0.1 M tribasic acid H_3A is titrated with 0.1 M NaOH solution. Choose correct statement(s) for the titration at second equivalence point

$[K_{a_1} = 10^{-3}, K_{a_2} = 10^{-8}, K_{a_3} = 10^{-12}]$

- (A) The pH of the solution is 10
 (B) The concentration of H^+ ion is 10^{-10} g/L
 (C) The ratio of $\frac{[\text{H}_3\text{A}]}{[\text{A}^{3-}]}$ is 10^{-7}
 (D) The concentration of $[\text{H}_3\text{A}]$ at that point is 0.2 M

9. AC



The degree of dissociation of SO_3 in the above reaction is 0.08. Choose correct statements.

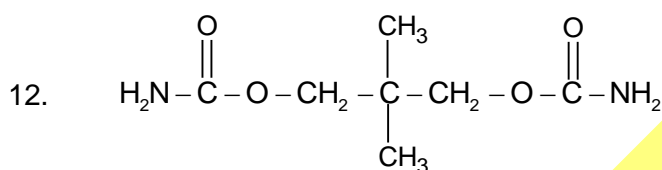
- (A) The initial vapour density will be 40 if only SO_3 is taken for reaction
 (B) The molecular mass of the gaseous mixture at equilibrium is 76.92
 (C) The vapour density of the equilibrium mixture is 36.84
 (D) The degree of dissociation increases by increasing pressure

10. AB

11. Which of the following gas(es) do/does not pollute water?

- (A) O_2 (B) NO_2
 (C) N_2 (D) SO_3

11. AC



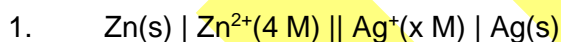
The drug given above is used in controlling

- (A) depression (B) hypertension
 (C) fever (D) acute pain

12. AB

(PART – B)**(Integer Type)**

Part-C (01-06) contains six (06) Numerical based questions, the answer of which maybe positive or negative numbers or decimals (e.g. 6.25, 7.00, -0.33, -30, 30.27, -127.30) and each question carries **+4 marks** for correct answer and **there will be no negative marking**.

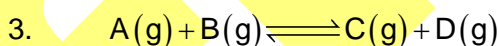


For above electrochemical cell, $E_{\text{Cell}} = E_{\text{Cell}}^0$. What is the value of 'x'?

1. 2

2. What is the maximum value of van't Hoff factor of aluminium sulphate?

2. 5



Initially one mole each of A, B, C and D gases were taken in a 10 litre vessel, what will be the value of equilibrium constant K_c if 50%(mole) of reactants react at equilibrium?

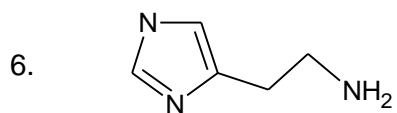
3. 9

4. What is the pH of 0.01 M NaCl solution?

4. 7

5. If the number of carbon atoms present in Saccharin is x and the sum of nitrogen and sulphur atoms present in it is y, what is the value of x/y in decimal form?

5. 3.5



The structure of histamine is given above. The lone pair of how many nitrogen atom(s) is/are delocalised in the molecule?

6. 1

Space For Rough Work

SECTION – III : MATHEMATICS

(PART – A)

SECTION – A

(Single Correct Answer Type)

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

1. The number of integral values of m , for which the x-coordinate of the point of intersection of the lines $3x + 4y = 9$ and $y = mx + 1$ is also an integer, is
 (A) 2 (B) 0
 (C) 4 (D) 1
1. **A**
2. The equation to a pair of opposite sides of a parallelogram are $x^2 - 5x + 6 = 0$ and $y^2 - 6y + 5 = 0$. The equation to its diagonals are
 (A) $x + 4y = 13, y = 4x - 7$ (B) $4x + y = 13, 4y = x - 7$
 (C) $4x + y = 13, y = 4x - 7$ (D) $y - 4x = 13, y + 4x = 7$
2. **C**
3. The line $2x - y + 1 = 0$ is tangent to the circle at the point $(2, 5)$ and the centre of the circle lies on $x - 2y = 4$. the radius of the circle is
 (A) $3\sqrt{5}$ (B) $5\sqrt{3}$
 (C) $2\sqrt{5}$ (D) $5\sqrt{2}$
3. **A**
4. If two normal to the parabola $y^2 = 4ax$ intersect at right angles, then the chord joining their feet passes through a fixed point whose coordinates are
 (A) $(-2a, 0)$ (B) $(a, 0)$
 (C) $(2a, 0)$ (D) None of these
4. **B**

(One or More Than One Options Correct Type)

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

5. Circle(s) touching the x-axis at a distance of 3 units from the origin and having an intercept of length of $2\sqrt{7}$ on the y-axis is(are)
 (A) $x^2 + y^2 - 6x + 8y + 9 = 0$ (B) $x^2 + y^2 - 6x + 7y + 9 = 0$
 (C) $x^2 + y^2 - 6x - 8y + 9 = 0$ (D) $x^2 + y^2 - 6x - 7y + 9 = 0$
5. **AC**
6. The extremities of latus rectum of a parabola are $(1, 1)$ and $(1, -1)$. Then the equation of the parabola can be
 (A) $y^2 = 2x - 1$ (B) $y^2 = 1 - 2x$
 (C) $y^2 = 2x - 3$ (D) $y^2 = 2x - 4$

6. **AC**

7. The points which trisect the line segment joining the points (0, 0) and (9, 12) are
 (A) (3, 4) (B) (8, 6)
 (C) (6, 8) (D) (4, 0)

7. **AC**

8. If two distinct chords of a parabola $y^2 = 4ax$ passing through $(a, 2a)$ are bisected on the line $x + y = 1$, then the length of the latus rectum can be
 (A) 2 (B) 1
 (C) 4 (D) 3

8. **ABD**

9. If the points $(k, 2 - 2k)$, $(1 - k, 2k)$ and $(-k - 4, 6 - 2k)$ be collinear, the possible values of k are
 (A) $-\frac{1}{2}$ (B) $\frac{1}{2}$
 (C) 1 (D) -1

9. **BD**

10. The equation of the circle which touches both the axes and the line $\frac{x}{3} + \frac{y}{4} = 1$ and lies in the first quadrant is $(x - c)^2 + (y - c)^2 = c^2$ where c is
 (A) 1 (B) 2
 (C) 4 (D) 6

10. **AD**

11. If a circle passes through the points of intersection of the coordinate axes with the line $x - \lambda y + 1 = 0$ and $2x - 3y + 2 = 0$, then the value of λ is
 (A) $\frac{2}{3}$ (B) $\frac{3}{2}$
 (C) $-\frac{3}{2}$ (D) 2

11. **AC**

12. The equations of the common tangents to the parabola $y^2 = 8x$ and $x^2 + y^2 - 12x + 4 = 0$ are:
 (A) $y = x + 2$ (B) $y = -x - 2$
 (C) $y = -x + 2$ (D) $y = x - 2$

12. **AB**

(PART – B)**(Integer Type)**

Part-C (01-06) contains six (06) Numerical based questions, the answer of which maybe positive or negative numbers or decimals (e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30) and each question carries **+4 marks** for correct answer and **there will be no negative marking**.

13 The tangent at $(3\sqrt{3}\cos\theta, \sin\theta)$ is drawn to the ellipse $\frac{x^2}{27} + y^2 = 1$. Let θ is the value, such that the sum of intercepts on axes made by the tangent is minimum then $\frac{12\theta}{\pi}$ is _____

13 **2**

14. If $y + b = m_1(x + a)$ and $y + b = m_2(x + a)$ are two tangents to the parabola $y^2 = 4ax$ then $|m_1 m_2| =$

14. **1**

15. Radius of the auxillary circle of $\frac{x^2}{4} + \frac{y^2}{5} = 1$, is given by _____

15. 2.23 (range 2.23 to 2.24)

16. If (α, β) is the image of $(3, 8)$ in the line $x + 3y - 7 = 0$ then the value of $\beta - 7\alpha$ is _____.

16. **3**

17. Number of integral values of 'k' for which the two circles $x^2 + y^2 + 2x + 2ky + 6 = 0$ and $x^2 + y^2 + 2ky + k = 0$ intersect orthogonally is _____

17. **1**

18. If PSQ is the focal chord of the parabola $y^2 = 8x$ such that $SP = 6$. Then the length of PQ is

18. **9**

Space For Rough Work

FIITJEE COMMON TEST

BATCHES:

PHASE TEST-2: PAPER-1

JEE ADVANCED LEVEL

ANSWER KEY

ANSWER KEYS

Physics

Chemistry

Mathematics

