

PHYSICS, CHEMISTRY & MATHEMATICS**QP CODE: 100803****Paper – 2****Time Allotted: 3 Hours****Maximum Marks: 180**

- 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 Four (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 (05–07)** contains (3) 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 option(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)** This section contains **SIX (06)** questions. The answer to each question is a **NON-NEGATIVE INTEGER**. For each question, enter the correct integer corresponding to the answer. Each question carries **+4 marks** for correct answer. **There is no negative marking.**
- (iv) **Part-B (07-10)** This section contains Two paragraphs. Each paragraph having TWO questions Numerical answer type with answer XXXX.XX. For each question, enter the correct numerical value. If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places. Each question carries **+3 marks** for the correct answer. **There is no negative marking.**

Name of the Candidate: _____

Batch: _____ Date of Examination: _____

Enrolment Number: _____

BATCH – NWCMPA425A1-PT-2

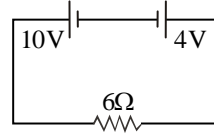
SECTION – I: PHYSICS

(PART – A)

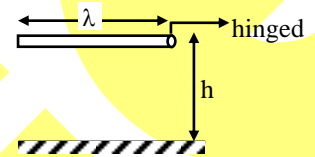
(Single Correct Answer Type)

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 power consumed by the 4V battery is
 (A) 4 W
 (B) 8 W
 (C) 7 W
 (D) cannot be calculated

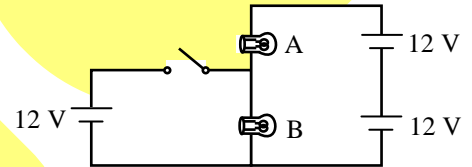


2. A thin rod of mass m and length λ is hinged at one end point which is at a distance h ($h < \lambda$) above the horizontal surface. The rod is released from rest from the horizontal position. If e is the co-efficient of restitution, the angular velocity of rod just after collision will be ($h = 1$ m, $\lambda = 2$ m, $e = 1$)

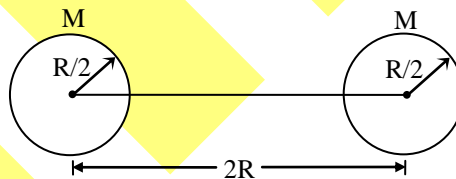


- (A) $\frac{3\sqrt{3g}}{8}$ (B) $\frac{6\sqrt{3g}}{8}$ (C) $\frac{5\sqrt{3g}}{8}$ (D) none of these

3. The light bulbs A & B in the following circuits are identical. When the switch is closed -
 (A) Intensity of bulb A increase
 (B) Intensity of bulb A decrease
 (C) Intensity of bulb B increase
 (D) Nothing changes



4. Two spheres each of mass M and radius $\frac{R}{2}$ are connected with a massless rod of length $2R$ as shown in the figure. What will be the moment of inertia of the system about an axis passing through the centre of one of the spheres and perpendicular to the rod:



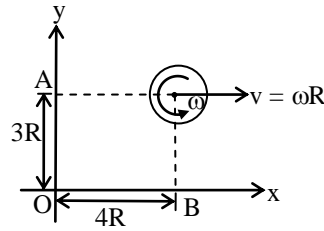
- (A) $\frac{21}{5}MR^2$ (B) $\frac{2}{5}MR^2$ (C) $\frac{5}{2}MR^2$ (D) $\frac{5}{21}MR^2$

Space For Rough Work

(One or More Than One Options Correct Type)

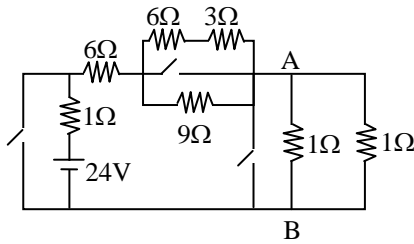
This section contains **3 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE or MORE THAN ONE is correct**.

5. A disc of mass M and radius R moves in the x - y plane as shown in the figure. The angular momentum of the disc at the instant shown is –



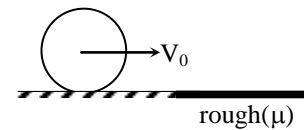
- (A) $\frac{5}{2} mR^2 \omega$ about O
 (B) $\frac{7}{2} mR^2 \omega$ about O
 (C) $\frac{1}{2} mR^2 \omega$ about A
 (D) $4 mR^2 \omega$ about A

- 6.



- (A) When switches are arranged so the current through the battery is minimum, then the $V_A - V_B = 0$ volt.
 (B) When switches are arranged so the current through the battery is minimum, then the $V_A - V_B = 1$ volt.
 (C) When switches are arranged so the current through the battery is maximum, the $V_A - V_B = 0$.
 (D) When switches are arranged so the current through the battery is maximum, then $V_A - V_B = 1$ volt.

7. A ring of mass M and radius R sliding with a velocity v_0 suddenly enters into rough surface where coefficient of friction is μ , as shown:

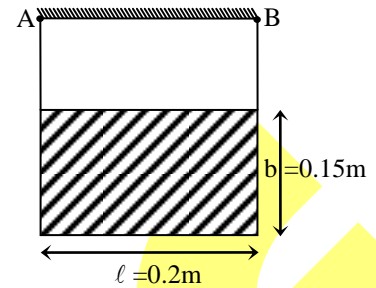


- (A) The ring starts rolling motion when centre of mass becomes stationary
 (B) The ring starts rolling motion when the point of contact becomes stationary
 (C) The time after which the ring starts rolling is $\frac{v_0}{2\mu g}$
 (D) The rolling velocity is $\frac{v_0}{2}$

Space For Rough Work

(PART – B)
(Non – Negative Integer)

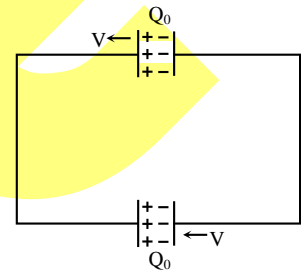
1. A rectangular plate of mass 20 kg is suspended from points A and B as shown. If the pin B is suddenly removed then the angular acceleration in rad/sec^2 of the plate divided by 16 is equal to ($g = 10 \text{ m/s}^2$)



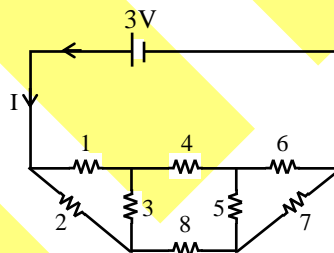
2. A straight infinitely long cylinder of radius $R_0 = 10 \text{ cm}$ is uniformly charged with a surface charge density $\sigma = + 10^{-12} \text{ C/m}^2$. The cylinder serves as a source of electrons, with the velocity of the emitted electrons perpendicular to its surface. Electron velocity must be ... $\times 10^5 \text{ m/s}$ (round off) to ensure that electrons can move away, from the axis of the cylinder to a distance greater than $r = 10^3 \text{ m}$.

3. Two identical capacitors are connected as shown and having initial charge Q_0 . Separation between plates of each capacitor is d_0 . Suddenly the left plate of upper capacitor and right plate of lower capacitor start moving with speed v towards left while other plate of each capacitor remains fixed.

(given $\frac{Q_0 V}{2d_0} = 10 \text{ amp}$). The value of current (in amp) in the circuit is _____ $\times 4$ ampere.

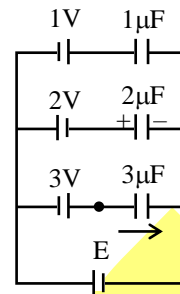


4. Figure show a network of eight resistors numbered 1 to 8, each equal to 2Ω , connected to a 3V battery of negligible internal resistance. The current I in the circuit in ampere is:

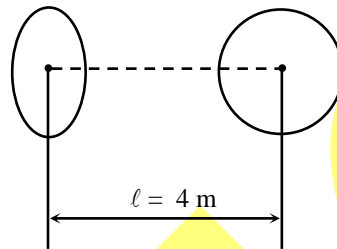


Space For Rough Work

5. In the figure shown, the emf E for which charge on $2\ \mu\text{F}$ capacitor is $4\ \mu\text{C}$ is _____ $\times 17$ volt.



6. A thin ring of radius $R = 3\text{m}$ has been uniformly charged with an amount of $20\ \mu\text{C}$ and placed in relation to a conducting sphere in such a way that the centre of the sphere O , lies on the rings axis at a distance of $\lambda = 4\text{m}$ from the plane of the ring. The potential of the sphere is..... $\times 18 \times 10^3$ volt.



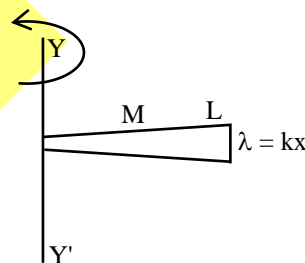
(PART – B)

This section contains Two paragraphs. Each paragraph having TWO questions Numerical answer type with answer XXXX.XX. For each question, enter the correct numerical value. If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.

Paragraph for Question no. 7 to 8

Moment of inertia is a physical term which oppose the change in rotational motion. Moment of inertia depends on distribution of mass, shape of the body as well as distance from the rotational axis. Moment of linear momentum is called angular momentum. If no external torque act on the system then angular momentum of the system remains conserved. Geometrical meaning of angular momentum relates to the areal velocity.

7. Mass M is distributed over the rod of length L . If linear mass density (λ) linearly increases with length as $\lambda = Kx$. The M.I. of the rod about one end perpendicular to rod i.e. (YY') is NKL^2 . The value of 'N' is _____.

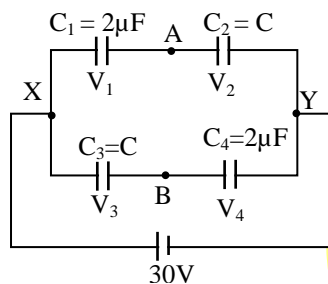


Space For Rough Work

8. A particle of mass m is moving along the line $y = 3x + 5$ with speed v . The magnitude of angular momentum about origin is $\sqrt{N} mv$, then the value of 'N' is _____.

Paragraph for Question no. 9 to 10

The given circuit shows an arrangement of four capacitors. A potential difference 30 V is applied across the combination. It is observed that potentials at points 'A' and 'B' differ by 5V with B at higher potential. Also if a conducting wire is connected between 'A' and 'B', electrons will flow from A to B. Of course, we have not connected any wire actually between A and B, We have described only an 'if' situation.



Let us now connect two more capacitors in the circuit. One of them, C_5 is connected in the parts of circuit between X and A. It could be either in series or in parallel with C_1 . The other, C_6 , is connected between A and B. It is observed whether we increase C_6 or reduce it, equivalent capacitance between X and Y has the same value.

Answer the following questions:

9. Potential difference across C_4 before connecting two more capacitor (in V) is _____.
10. Equivalent capacitance between X and Y before connecting two more capacitor (μF) is _____.

Space For Rough Work

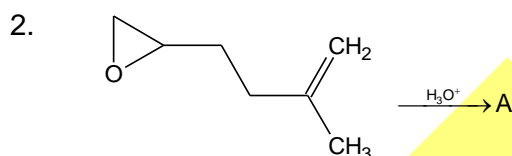
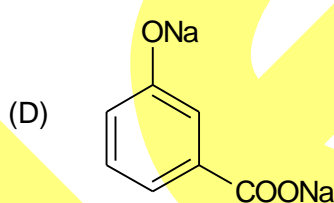
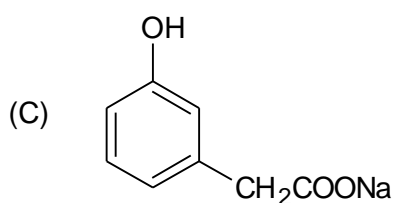
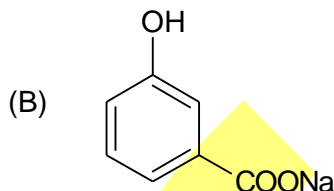
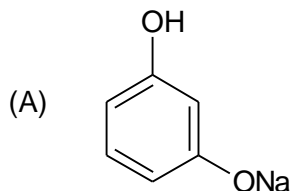
SECTION – II: CHEMISTRY

(PART – A)

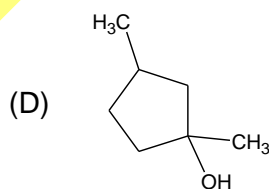
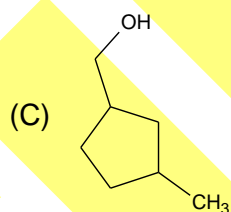
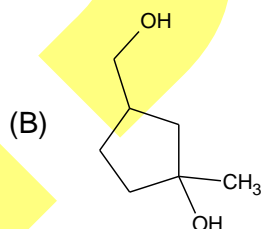
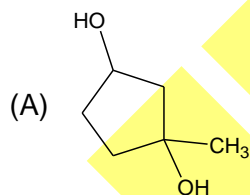
(Single Correct Answer Type)

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. Which of the following substance on heating with sodalime produces phenol?



A is



3. Which isomer of 2-butyne forms precipitate with ammonical AgNO_3 solution?

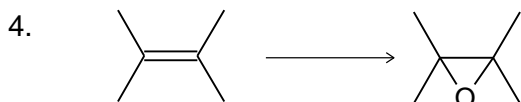
(A) Chain isomer

(B) Functional isomer

(C) Position isomer

(D) Geometrical isomer

Space For Rough Work



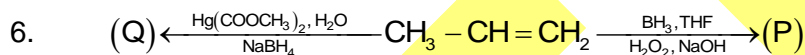
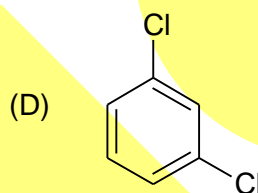
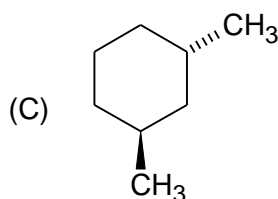
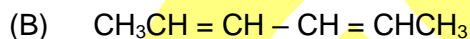
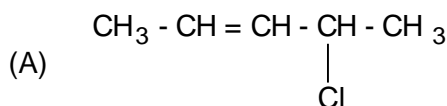
The reagent used in the above reaction, is

- (A) OsO_4 (B) CF_3COOOH
 (C) $\text{MnO}_4^- / \text{OH}^-$ (cold) (D) O_3/Zn

(One or More Than One Options Correct Type)

This section contains **3 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE or MORE THAN ONE is correct**.

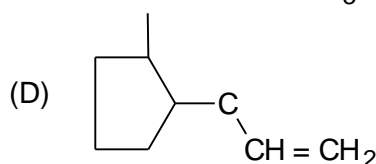
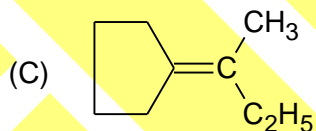
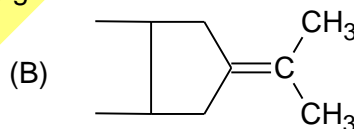
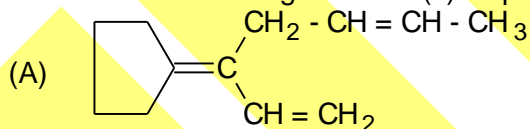
5. Which compound(s) has(ve) more than two stereoisomers?



Choose correct statement(s) regarding the above reaction.

- (A) 'P' and 'Q' contain the same functional group
 (B) Both the products undergo dehydrogenation to form the same compound
 (C) Both the products are position isomers
 (D) Both products on dehydration form the same compound

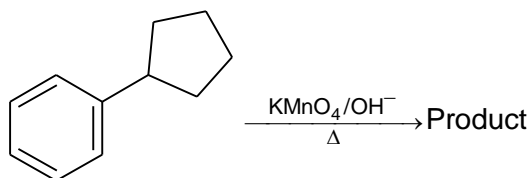
7. Which of the following molecule(s) display(s) geometrical isomerism?



Space For Rough Work

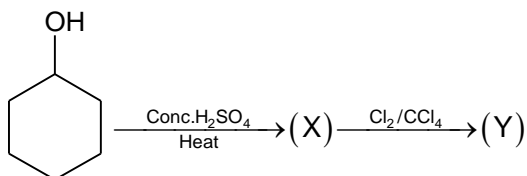
(PART – B)
(Non – Negative Integer)

1.



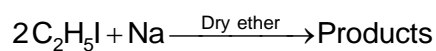
How many carbon atom(s) is/are present in the aromatic product of above reaction?

2.



The molar mass of (Y) in g mol^{-1} unit is

3.

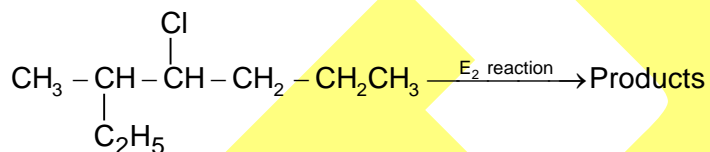


The sum of the number of carbon atoms and hydrogen atoms present in the largest product (product with highest molar mass) of above reaction is

4.

The reaction of the simplest alkyne with $\text{dil. H}_2\text{SO}_4$ in presence of HgSO_4 forms compound(X). if X is the number of sp^3 -hybridised carbon atom and y is the number of sp^2 hybridized carbon atoms present in (X), the value of (x + y) is

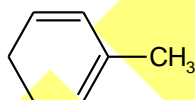
5.



How many alkene(s) including stereoisomers is/are formed in above reaction?

6.

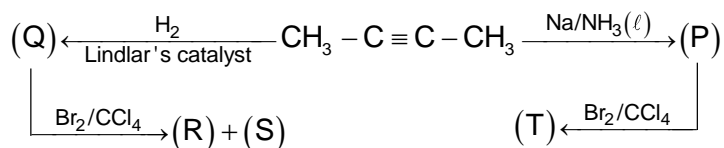
The number of allylic hydrogen in the structure given below is



Space For Rough Work

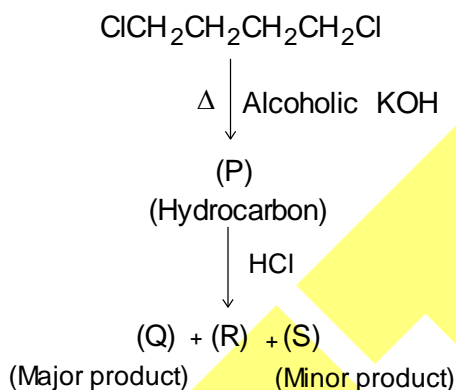
(PART – B)

This section contains Two paragraphs. Each paragraph having TWO questions Numerical answer type with answer XXXX.XX. For each question, enter the correct numerical value. If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.

Paragraph for Question no. 7 to 8

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

- If molar mass of (P) is $X \text{ g mol}^{-1}$, then the value of $\frac{X}{10}$ is
- If the sum of the number of Br atoms present in (R), (S) and (T) is y , what is $\frac{y}{4}$?

Paragraph for Question no. 9 to 10

Answer the following questions on the basis of above reaction.

- If (P) contains 'x' number of sigma bonds and 'y' number of pi-bonds, then the value of $\frac{(x-y)}{2}$ is
- If the number of hydrogen atoms present in compound(Q) is x , what is the value of $\frac{x}{4}$?

Space For Rough Work

SECTION – III: MATHEMATICS

(PART – 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. For the two circles $x^2 + y^2 = 16$ and $x^2 + y^2 - 2y = 0$, there is/are
 (A) one pair of common tangents (B) two pairs of common tangents
 (C) three common tangents (D) no common tangent

2. If $a > 2b > 0$ then the positive value of m for which $y = mx - b\sqrt{1+m^2}$ is a common tangent to $x^2 + y^2 = b^2$ and $(x - a)^2 + y^2 = b^2$ is
 (A) $\frac{2b}{\sqrt{a^2 - 4b^2}}$ (B) $\frac{\sqrt{a^2 - 4b^2}}{2b}$
 (C) $\frac{2b}{a - 2b}$ (D) $\frac{b}{a - 2b}$

3. If the pair of lines $ax^2 - 2xy + by^2 = 0$ and $bx^2 - 2xy + ay^2 = 0$ be such that each pair bisects the angle between the other pair, then $a - b$ is
 (A) 3 (B) - 2
 (C) 1 (D) - 1

4. If the distance between the foci is equal to the minor axis and latus rectum = 4, then equation of the ellipse whose centre is at origin and minor axis is along X-axis, is
 (A) $2x^2 + y^2 = 16$ (B) $3x^2 + 4y^2 = 5$
 (C) $x^2 + 2y^2 = 16$ (D) none of these

(One or More Than One Options Correct Type)

This section contains **3 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE or MORE THAN ONE is correct**.

5. ABC is an equilateral triangle. If the coordinates of two of its vertices are (1,3) and (-2,7), the coordinates of the third vertex can be
 (A) $\left(-\frac{1}{2} + 2\sqrt{3}, 5 + \frac{3\sqrt{3}}{2}\right)$ (B) $\left(-\frac{1}{2} - 2\sqrt{3}, 5 - \frac{3\sqrt{3}}{2}\right)$
 (C) $\left(\frac{1}{2} - 2\sqrt{3}, -5 + \frac{3\sqrt{3}}{2}\right)$ (D) $\left(\frac{1}{2} + 2\sqrt{3}, -5 - \frac{3\sqrt{3}}{2}\right)$

Space For Rough Work

6. The equation of the tangent to the parabola $y^2 = 9x$ which goes through the point (4, 10) is
 (A) $x + 4y + 1 = 0$ (B) $9x + 4y + 4 = 0$
 (C) $x - 4y + 36 = 0$ (D) $9x - 4y + 4 = 0$
7. Solution of the differential equation $\frac{dy}{dx} = \frac{y^2}{x^2}$ is
 (A) $x^3 - y^3 = c$ (B) $x^3 + y^3 = c$
 (C) $x - y = cxy$ (D) $y - x = cxy$

(PART – B)
(Non – Negative Integer)

1. If $4l^2 - 5m^2 + 6l + 1 = 0$, then the line $lx + my + 1 = 0$ touches the circle $x^2 + y^2 - 6x + k = 0$, where $k =$
2. Minimum distance between the curve $y^2 = 4x$ and $x^2 + y^2 - 12x + 31 = 0$ is K then $\frac{K}{\sqrt{5}}$ is _____.
3. The order of the differential equation whose general solution is given by $y = (c_1 + c_2)\sin(3x + c_3) - c_4e^{2x+c_5}$ is
4. If $y = f(x)$ satisfies the equation $\frac{dy}{dx} = \sin 2x + 3y \cot x$ and $f\left(\frac{\pi}{2}\right) = 2$ then $f\left(\frac{\pi}{6}\right)$ is
5. Let $y = g(x)$ be the inverse of a bijective mapping $f : \mathbb{R} \rightarrow \mathbb{R}$ defined as $f(x) = 3x^3 + 2x$. The area bounded by the graph of $g(x)$, the x-axis and the coordinate at $x = 5$ is 'A' then the value of $4A$ is
6. If the area of bounded by $f(x) = \frac{x^3}{3} - x^2 + a$ and the straight lines $x = 0$, $x = 2$ and the x-axis is minimum for $a = p/q$, where p and q are relatively prime, then $p + q$ equals

Space For Rough Work

(PART – B)

This section contains Two paragraphs. Each paragraph having TWO questions Numerical answer type with answer XXXX.XX. For each question, enter the correct numerical value. If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.

Paragraph for Question no. 7 to 8

For ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ foci are given by $(\pm ae, 0)$ if $a > b$ and $e^2 = 1 - \frac{b^2}{a^2}$. For hyperbola

$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ foci are given by $(\pm ae, 0)$ where $e^2 = 1 + \frac{b^2}{a^2}$.

Answer the following questions. (e is eccentricity of the curve)

7. If foci of ellipse $\frac{x^2}{9} + \frac{y^2}{5} = 1$ and of hyperbola $\frac{x^2}{a^2} - y^2 = 1$ coincide then $|a| = \underline{\hspace{2cm}}$.
8. Eccentricity of the hyperbola $4x^2 - y^2 - 4x - 2y = 4$ is

Paragraph for Question no. 9 to 10

A ray of light parallel to axis of parabola gets reflected from its surface and passes through its focus.

9. Point 'P' is chosen on parabola $y^2 = 4x$ such that $SP + PQ$ is least and Q is (7, 5). Find sum of ordinate and abscissa of point P.
10. If for parabola having focus at (3, 2) and equation of tangent at (3, 6) as $x - y + 3 = 0$, directrix is given by $ax + by = 1$ then $5 + a + b$ equals $\underline{\hspace{2cm}}$.

Space For Rough Work

FIITJEE INTERNAL TEST

BATCH: NWCMPA425A1-PT-2

Paper – 2

Code: 100803

JEE ADVANCED LEVEL

ANSWER KEY

ANSWER KEYS

Physics

PART – A

- | | | | |
|-------|-------|--------|------|
| 1. A | 2. D | 3. D | 4. A |
| 5. BC | 6. BC | 7. BCD | |

PART – B

- | | | | |
|---------|----------|---------|--------|
| 1. 3 | 2. 4 | 3. 5 | 4. 1 |
| 5. 2 | 6. 2 | 7. 0.25 | 8. 2.5 |
| 9. 17.5 | 10. 2.34 | | |

Chemistry

PART – A

- | | | | |
|--------|--------|--------|------|
| 1. B | 2. B | 3. C | 4. B |
| 5. ABC | 6. ACD | 7. ABD | |

PART – B

- | | | | |
|--------|----------|--------|--------|
| 1. 7 | 2. 153 | 3. 14 | 4. 2 |
| 5. 6 | 6. 7 | 7. 5.6 | 8. 1.5 |
| 9. 3.5 | 10. 1.75 | | |

Mathematics

PART – A

- | | | | |
|-------|-------|-------|------|
| 1. D | 2. A | 3. B | 4. A |
| 5. AB | 6. CD | 7. CD | |

PART – B

- | | | | |
|------------------------------|------|----------|-------|
| 1. 4 | 2. 1 | 3. 3 | 4. 0 |
| 5. 7 | 6. 5 | 7. 1.73 | |
| 8. 2.24 (range 2.23 to 2.24) | | 9. 11.25 | 10. 4 |