

PHYSICS, CHEMISTRY & MATHEMATICS**QP CODE: 100718****Common Test – 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 – NWCMSW425A1

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 radius of a planet is R_1 and a satellite revolves around it in a circle of radius R_2 . The time period of revolution of satellite is T . Acceleration due to the gravitation of the planet at its surface will be

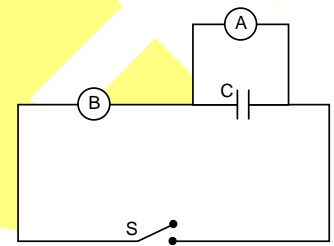
(A) $\frac{4\pi^2 R_2^3}{T^2 R_1^2}$ (B) $\frac{R_2^3}{4\pi^2 T^2 R_1^2}$ (C) $\frac{4\pi^2 R_1^3}{T^2 R_2^2}$ (D) $\frac{R_1^3}{4\pi^2 T^2 R_2^2}$

2. In a uniform electric field, the potential is 10 V at the origin of coordinates, and 8 V at each of the points (1, 0, 0), (0, 1, 0) and (0, 0, 1). The potential at the point (1, 1, 1) will be

(A) 0 (B) 4 V (C) 8 V (D) 10 V

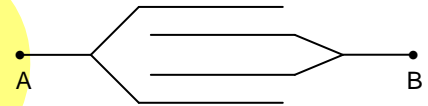
3. A capacitor of capacitance C is connected to two voltmeters A and B. A is ideal, having infinite resistance, while B has resistance R . the capacitor is charged and then the switch S is closed. The readings of A and B will be equal

- (A) at all times
(B) after time RC
(C) after time $RC \ln 2$
(D) only after a very long time



4. Four plates of equal area A are separated by equal distances d and are arranged as shown in figure. The equivalent capacity is

(A) $\frac{2\epsilon_0 A}{d}$ (B) $\frac{3\epsilon_0 A}{d}$ (C) $\frac{3\epsilon_0 A}{2d}$ (D) $\frac{\epsilon_0 A}{d}$



(One or More Than One Options Correct Type)

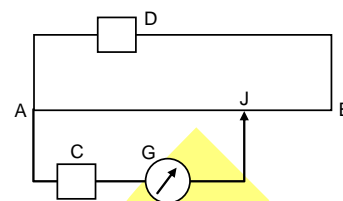
This section contains **3 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE or MORE THAN ONE is correct**.

5. A sky lab of mass m is first launched from the surface of earth (radius R) in a circular orbit of radius $2R$ (from centre of earth) and then it is shifted from this circular orbit to another circular orbit of radius $3R$.

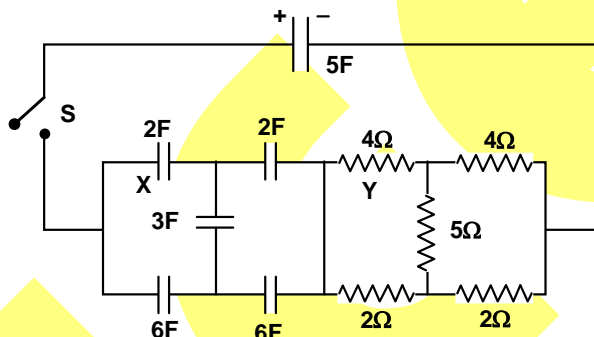
- (A) Minimum energy required to place the lab in first orbit is equal to $\frac{3}{4} mgR$.
(B) Minimum energy required to shift lab from first orbit to second orbit is $\frac{mgR}{12}$.
(C) Energy of sky lab in second orbit is greater than its energy in first orbit.
(D) Energy of sky lab in second orbit is less than its energy in first orbit.

Space For Rough Work

6. The figure shows a potentiometer arrangement. D is the driving cell. C is the cell whose emf is to be determined. AB is the potentiometer wire and G is a galvanometer. J is a sliding contact which can touch any point on AB. Which of the following are essential conditions for obtaining balance?
- (A) The emf of D must be greater than the emf of C.
 (B) Either the positive terminals of both D and C or the negative terminals of both D and C must be joined to A.
 (C) The positive terminals of D and C must be joined to A.
 (D) The resistance of G must be less than the resistance of AB.



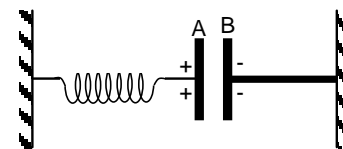
7. A capacitor of capacity 5F is charged by a battery of 2 volt and then connected with 5 uncharged capacitors and 5 resistors with the help of a switch 'S' as shown in the figure. At $t = 0$, switch is closed. Choose the correct option(s).



- (A) Charge on capacitor X at time t is given by $\frac{10}{9} \left(1 - e^{-\frac{27}{160}t} \right)$
 (B) Current in resistor Y at time t is given by $\frac{1}{4} \left(e^{-\frac{27}{160}t} \right)$
 (C) Total energy dissipated in the circuit is $\frac{50}{9}$ J
 (D) Total energy dissipated in the circuit is $\frac{40}{9}$ J

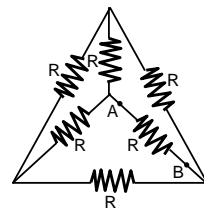
(PART – B)
(Non – Negative Integer)

1. Plate A of a parallel plate air filled capacitor is connected to a spring having force constant k and plate B is fixed. They rest on a frictionless table top as shown in the figure. if a charge $+q$ is placed on plate A and a charge $-q$ on plate B, by how much does the spring expand in equilibrium ($q^2 = 6kA\epsilon_0$)

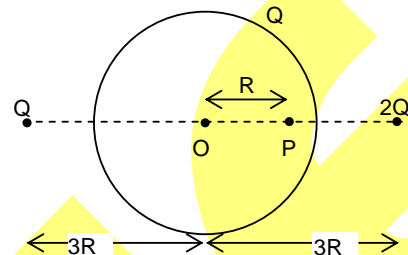


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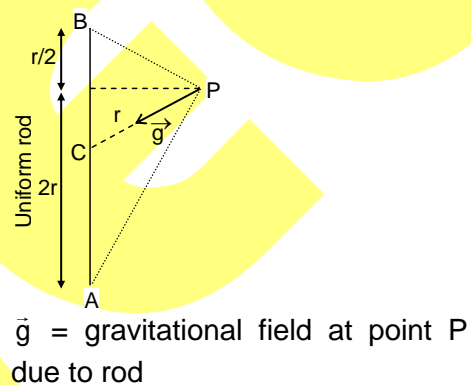
2. Six equal resistances each of $R = 6 \text{ ohm}$, are connected to form the network shown in the figure. The resistance between AB is



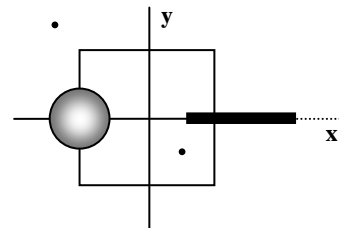
3. A solid conducting sphere of radius $2R$, carrying charge Q is surrounded by two point charge Q and $2Q$ as shown in the figure. If the electric field at point P due to the induced charges on conducting sphere is $\frac{n KQ}{16 R^2}$, $n =$



4. As situation shown in figure, the value of $\frac{\angle APB}{\angle CPB}$. Net gravitational field at point P is along the PC.



5. A disk of radius $a/4$ having a uniformly distributed charge $-(6\epsilon_0)$ Coulombs is placed in the x-y plane with its centre at $(-a/2, 0, 0)$. A rod of length a carrying a uniformly distributed charge $-(8\epsilon_0)$ Coulombs is placed on the x-axis from $x = a/4$ to $x = 5a/4$. Two point charges $+(12\epsilon_0)$ Coulombs and $+(3\epsilon_0)$ Coulombs are placed at $(a/4, -a/4, 0)$ and $(-3a/4, 3a/4, 0)$, respectively. Consider a cubical surface formed by six surfaces $x = \pm a/2, y = \pm a/2, z = \pm a/2$. The electric flux through this cubical surface in SI unit is



6. A battery is made by joining m rows of identical cells in parallel. Each row consists of n cells joined in series. This battery is connected to an external resistance R . Each cell has an internal resistance r and emf E . If $\frac{n}{m} = 2$ and the battery sends a maximum current in R , then $R/r =$

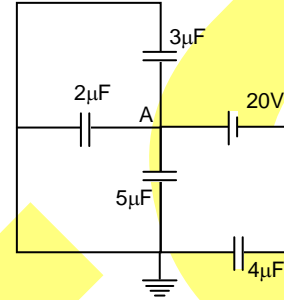
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(PART – B)

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

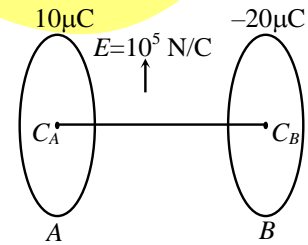
Three capacitors of $2\mu\text{F}$, $3\mu\text{F}$ and $5\mu\text{F}$ are independently charged with batteries of emf's 5V, 20V and 10V respectively. After disconnecting from the voltage sources, these capacitors are connected as shown in figure with their positive polarity plates connected to A and negative polarity plates are earthed. A battery of 20V and an uncharged capacitor of $4\mu\text{F}$ capacitance are connected to the circuit as shown with a switch S.



7. Potential of junction A after closing the switch is $x/7$ Volts, then x is _____.
8. Charge on $4\mu\text{F}$ capacitor after closing the switch is $y/7$ Volts, then y is _____.

Paragraph for Question no. 9 to 10

Two circular rings A and B each of radius $a = 30\text{cm}$ are placed coaxially with their axis horizontal in a uniform electric field $E = 10^5 \text{ N/C}$ directed vertically upward as shown in figure. Distance between centres of the rings A and B (C_A and C_B) is 40 cm. Ring A has positive charge $q_A = 10\mu\text{C}$ and B has a negative charge $q_B = -20\mu\text{C}$. A particle of mass m and charge $q = 10\mu\text{C}$ is released from rest at the centre of ring A. If particle moves along $C_A C_B$, then ($g = 10 \text{ m/s}^2$)



9. Mass of charge particle is (in gm) _____.
10. Work done by electric field, when particle moves from C_A to C_B is (in Joule) _____.

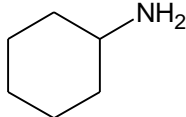
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SECTION – II : CHEMISTRY

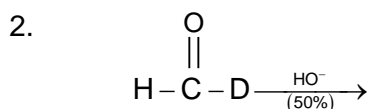
(PART – A)

(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.  is insoluble in
 (A) dilute HCl
 (C) Aq NaOH

- (B) CuSO₄ solution
 (D) C₂H₅OC₂H₅

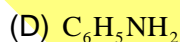
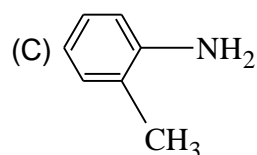
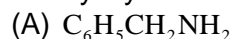


Product of this cannizaro reaction is:

- (A) D-CO₂⁻ + CH₂DOD
 (C) D-CO₂⁻ + CH₂DOH

- (B) D-CO₂⁻ + D-CO₂⁻
 (D) D-CO₂⁻ + CHD₂OH

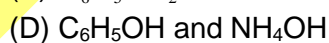
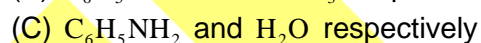
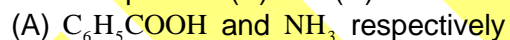
3. Phenyl cyanide on reduction with Na/C₂H₅OH yields



4. Consider the following reaction,



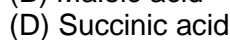
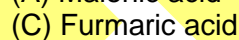
The compounds (B) and (C) are:



(One or More Than One Options Correct Type)

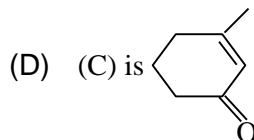
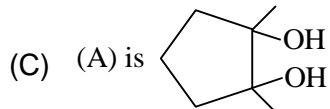
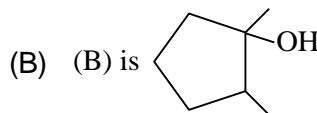
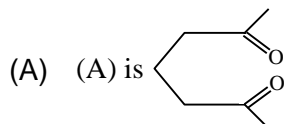
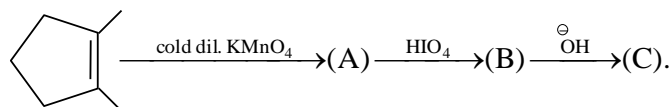
This section contains **3 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE** or **MORE THAN ONE** is correct.

5. Which of the following acids will form cyclic anhydride on heating?



Space For Rough Work

6. In a reaction sequence



7. D-glucose $\xrightleftharpoons{\text{HO}^-}$ A + B; A and B are

(A) D-mannose

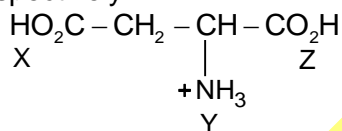
(B) D-fructose

(C) D-allose

(D) D-Idose

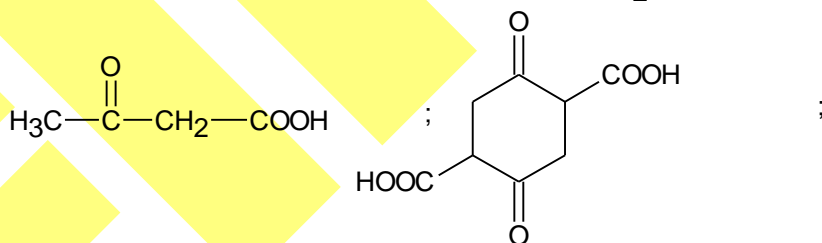
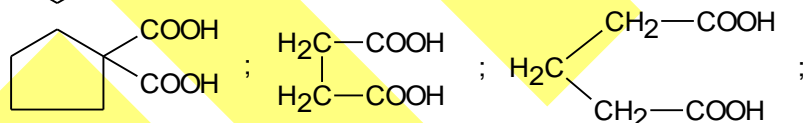
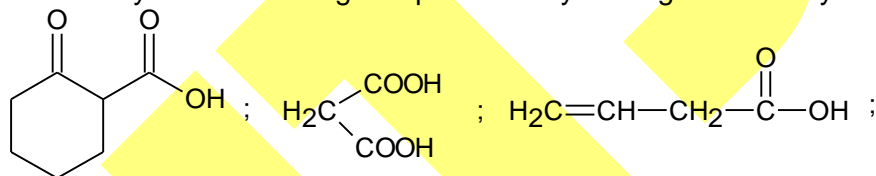
(PART - B)
(Non - Negative Integer)

1. The pK_a values for the three ionizable groups X, Y and Z of glutamic acid are 5, 9 and 3 respectively



The isoelectric point for the amino acid is

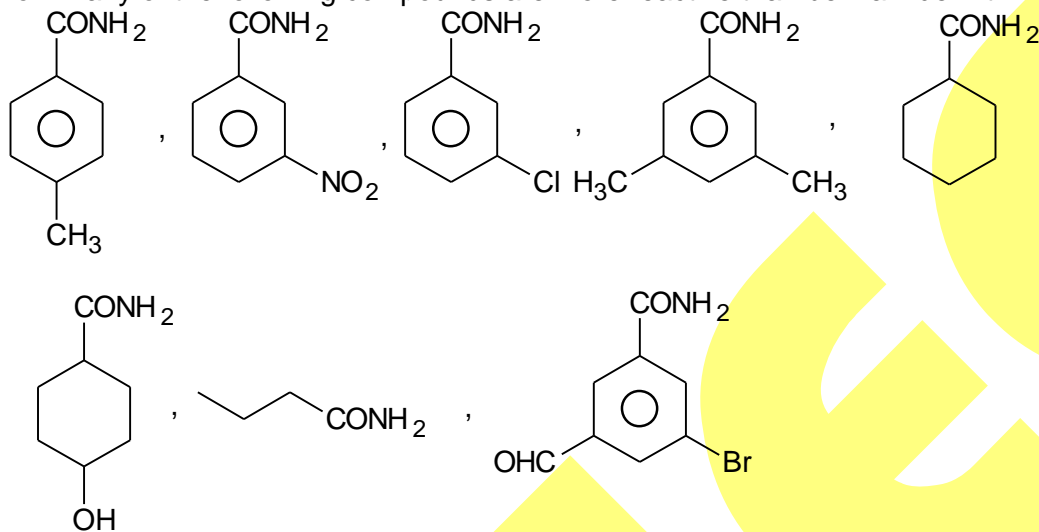
2. How many of the following compounds may undergo decarboxylation only upon heating?



Space For Rough Work

3. An organic compound **P** contains 62.07% carbon and 10.34% hydrogen and rest oxygen. Its vapour density is 29. This compound does not react with sodium metal, but its 2.9 g combines with X g of bromine (to give dibromo addition product). Find out value of (X – Y). [Where Y is total number of possible cyclic isomers of given organic compound P] [Atomic mass: Br = 80]

4. How many of the following compounds are more reactive than benzamide with $\text{Br}_2 + \text{KOH}$



5. $\text{CH}_3\text{COCH}_3 \xrightarrow[\text{Heat}]{\text{Conc. H}_2\text{SO}_4} \text{Product (P)}$

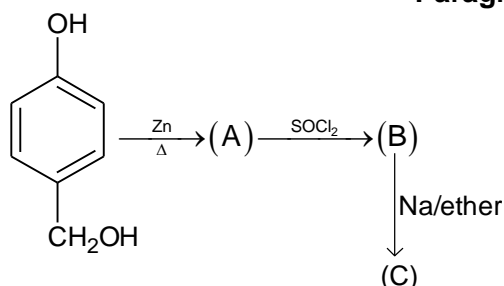
If the number of hydrogen atom(s) present in (P) is 'X', what is the value of $\frac{X}{2}$?

6. A neutral organic compound A (C_4H_6) reacts with Br_2/CCl_4 solution to form a compound B ($\text{C}_4\text{H}_6\text{Br}_2$). A on treatment with acidified KMnO_4 solution yields C ($\text{C}_4\text{H}_6\text{O}_3$). C gives orange ppt with 2, 4 DNPH. C on refluxing with NaHCO_3 evolves a gas. C with NaBH_4 give a new compound D which also produces a gas with NaHCO_3 . Calculate molecular weight of D.

Space For Rough Work

(PART – B)

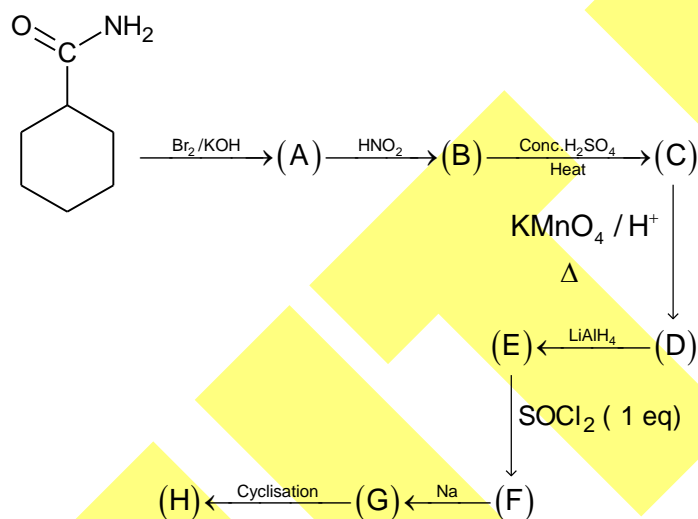
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Paragraph for Question no. 7 to 8

x = Number of monochloro products formed by compound(C) when it reacts with $\text{Cl}_2/h\nu$
 y = Number of monochloro products formed by compound(C) when it reacts with $\text{Cl}_2/\text{FeCl}_3$

7. The value of 'x' is

8. The value of 'y' is

Paragraph for Question no. 9 to 10

x = Number of oxygen atoms in compound(D)
 y = Number of hydrogen atoms in compound(H)

9. The value of x is

10. The value of y is

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. The area of the region bounded by $y = x^2$ and $y = \sqrt{|x|}$ is (in sq. units)

(A) $\frac{1}{3}$ (B) $\frac{2}{3}$ (C) $\frac{1}{6}$ (D) None of these
2. For $f(x) = 1 + x + \int_1^x (\ln^2 t + 2 \ln t) dt$, the value of x at the point where $f'(x) = 0$ is

(A) $\frac{1}{e}$ (B) 0 (C) $\frac{2}{e}$ (D) $1 + \frac{2}{e}$
3. The solution of $\frac{xdy}{x^2 + y^2} = \left(\frac{y}{x^2 + y^2} - 1 \right) dx$ is

(A) $y = x \cot(c - x)$ (B) $\cos^{-1}\left(\frac{y}{x}\right) = -x + c$
 (C) $y = x \tan(c - x)$ (D) $\frac{y^2}{x^2} = x \tan(c - x)$
4. Solve: $\frac{dy}{dx} = (x + y) \ln(x + y) - 1$

(A) $y = e^{ce^x} - x$ (B) $y = c^{ce^x} - x$
 (C) $y = e^{ce^{x^2}} - x$ (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. The value of $\int \frac{\ln\left(\frac{x-1}{x+1}\right)}{x^2-1} dx$ is equal to

(A) $\frac{1}{2} \ln^2 \frac{x-1}{x+1} + C$ (B) $\frac{1}{4} \ln^2 \frac{x-1}{x+1} + C$
 (C) $\frac{1}{2} \ln^2 \frac{x+1}{x-1} + C$ (D) $\frac{1}{4} \ln^2 \frac{x+1}{x-1} + C$

Space For Rough Work

6. Which of the following is/are correct?

(A) $\int_0^{\frac{\pi}{2}} \frac{\cos x}{\cos x + \sin x} dx = \frac{\pi}{4}$

(B) $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{dx}{1 + \sqrt{\tan x}} = \frac{\pi}{6}$

(C) $\int_0^{\frac{\pi}{2}} \cos(\pi \sin^2 x) dx = 0$

(D) $\int_0^a \frac{f(x)}{f(x) + f(a-x)} dx = \frac{a}{2}$

7. The curve amongst the family of curves represented by the differential equation, $(x^2 - y^2)dx + 2xy dy = 0$ which passes through $(1, 1)$, is :

- (A) a circle with centre on the x-axis
 (B) a circle with centre on the y-axis
 (C) a circle with radius = 1
 (D) a circle with radius = 2

(PART – B)
(Non – Negative Integer)

1. If $\int \frac{\sin x}{\sin(x-\alpha)} dx = Ax + B \log \sin(x-\alpha) + C$ then $A^2 + B^2 = \underline{\hspace{2cm}}$

2. The integral $\int_0^{3/2} [x^2] dx$, where $[\]$ denotes the greatest integer function, equals $(k - \sqrt{k})$, then k equals

3. The value of $\int_{-2}^2 |1 - x^2| dx$ is

4. The value of $\int_2^3 \frac{\sqrt{x}}{\sqrt{5-x} + \sqrt{x}} dx$ is $\frac{1}{\lambda}$ then λ equals

5. If $x \frac{dy}{dx} = x^2 + y - 2$, $y(1) = 1$, then $y(2)$ equals _____

6. The area enclosed by the curve $C: y = x\sqrt{9-x^2}$ ($x \geq 0$) and the x-axis 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

Let A_r be the area of the region bounded between the curve $y^2 = (e^{-kr})x$ (where $k < 0, r \in \mathbb{N}$) and the line $y = mx$ (where $m \neq 0$), k and m are some constants.

7. If A_1, A_2, A_3, \dots are in G.P. with common ratio $e^{-\lambda k}$, then λ is

8. $\lim_{n \rightarrow \infty} \sum_{i=1}^n A_i = \frac{1}{48(e^{2k} - 1)}$, then the value of m is:

Paragraph for Question no. 9 to 10

Let $f(x)$ be a continuous function defined on the closed interval $[a, b]$, then

$$\lim_{n \rightarrow \infty} \sum_{r=0}^{n-1} \frac{1}{n} f\left(\frac{r}{n}\right) = \int_0^1 f(x) dx$$

On the basis of above information, answer the following questions.

9. If the value of $\lim_{n \rightarrow \infty} \left\{ \frac{1}{n+1} + \frac{1}{n+2} + \frac{1}{n+3} + \dots + \frac{1}{5n} \right\}$ is $\log k$, then k is

10. The value of $\lim_{n \rightarrow \infty} \left\{ \frac{1^5 + 2^5 + 3^5 + \dots + n^5}{n^6} \right\}$ is

Space For Rough Work

FIITJEE INTERNAL TEST

BATCH: NWCMSW425A1

COMMON TEST-2

Code: 100718

JEE ADVANCED LEVEL

ANSWER KEY

ANSWER KEYS

Physics

PART - A

- | | | | |
|--------|-------|--------|------|
| 1. A | 2. B | 3. A | 4. A |
| 5. ABC | 6. AB | 7. ABD | |

PART - B

- | | | | |
|--------|---------|--------|--------|
| 1. 3 | 2. 3 | 3. 7 | 4. 2 |
| 5. 7 | 6. 2 | 7. 100 | 8. 160 |
| 9. 100 | 10. 3.6 | | |

Chemistry

PART - A

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

PART - B

- | | | | |
|---------|-----------|---------|---------|
| 1. 4 | 2. 6 | 3. 5 | 4. 5 |
| 5. 6 | 6. 104 | 7. 2.00 | 8. 2.00 |
| 9. 4.00 | 10. 12.00 | | |

Mathematics

PART - A

- | | | | |
|-------|--------|-------|------|
| 1. B | 2. A | 3. C | 4. A |
| 5. BD | 6. ACD | 7. AC | |

PART - B

- | | | | |
|---------|----------|---------|---------|
| 1. 1 | 2. 2 | 3. 4 | 4. 2 |
| 5. 2 | 6. 9 | 7. 2.00 | 8. 2.00 |
| 9. 5.00 | 10. 0.17 | | |