

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

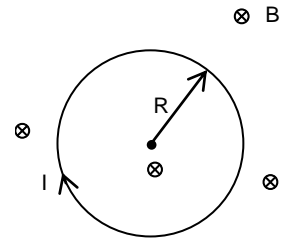
(Single Correct Answer Type)

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. A conducting loop is placed in a magnetic field (uniform) as shown in figure.

For this situation, select out the correct statement

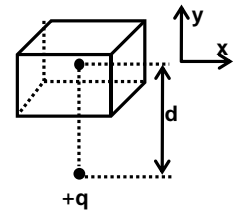
- (A) The force of compression experienced by loop is IRB
 (B) The force of compression experienced by loop is $2IRB$
 (C) The force of expansion experienced by loop is $2IRB$
 (D) The force of expansion experienced by loop is IRB



1. **D**

2. A charge $+q$ is placed at a distance 'd' from the centre of the uncharged metallic cube of side 'a'. The electric field at the centre of the cube due to induced charges on the cube will be

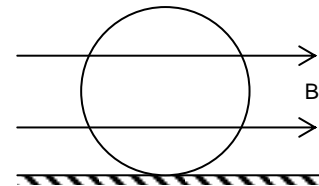
- (A) zero
 (B) $\frac{q}{4\pi\epsilon_0 d^2}(-\hat{j})$
 (C) $\frac{q}{4\pi\epsilon_0 d^2}(\hat{j})$
 (D) $\frac{q}{4\pi\epsilon_0 \left(d - \frac{a}{2}\right)^2}(-\hat{j})$



2. **B**

3. A conducting ring of mass 2 kg and radius 0.5 m is placed on a smooth horizontal plane. The ring carries a current of $I = 4A$. A horizontal magnetic field $B = 10T$, coplanar with ring, is switched on at time $t = 0$ as shown in figure. Then at $t = 0$. Choose the correct statement.

- (A) angular acceleration of the ring is $10\pi \text{ rad s}^{-2}$
 (B) torque on the ring is $20\pi \text{ Nm}$
 (C) angular acceleration of the ring is $80\pi \text{ rad s}^{-2}$
 (D) torque on the ring is $10\pi \text{ Nm}$



3. **D**

4. Electric charge $+q$ is uniformly distributed over the entire length of a ring of radius r rotating with constant angular velocity ω about its own axis. Assuming mass of ring to be m , its magnetic moment to be M and angular momentum to be L . Then choose the correct statement.

- (A) $M = \frac{q\omega r^2}{2}$
 (B) $M = \frac{2q\omega r^2}{5}$
 (C) $\frac{M}{L} = \frac{q}{m}$
 (D) $\frac{M}{L} = \frac{2q}{m}$

4. **A**

(One or More Than One Options Correct Type)

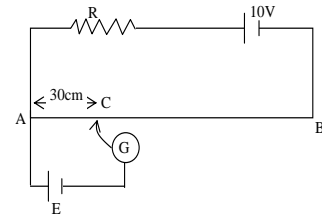
This section contains **8 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE or MORE THAN ONE is correct**.

5. A proton moving with a constant velocity passes through a region of space without any change in its velocity. If E and B represent the electric and magnetic fields respectively, this region of space may have

(A) $E = 0, B = 0$ (B) $E = 0, B \neq 0$ (C) $E \neq 0, B = 0$ (D) $E \neq 0, B \neq 0$

5. **ABD**

6. AB is a potentiometer wire of length 100 cm and its resistance is 10Ω . It is connected in series with a resistance $R = 90\Omega$ and a battery of emf 10V and negligible internal resistance. A source of unknown emf E is balanced by 30 cm length of the potentiometer wire, with jockey position at C.



(A) the value of E is 0.15 V (B) the value of E is 0.30 V
(C) $V_C - V_B = -0.7$ V (D) $V_C - V_B = 0.7$ V

6. **BD**

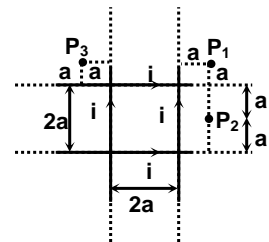
7. Two non-conducting solid spheres of radii R and $2R$, having uniform volume charge densities ρ_1 and ρ_2 respectively, touch each other. The net electric field at a distance $2R$ from the centre of the smaller sphere, along the line joining the centres of the spheres, is zero. The ratio $\frac{\rho_1}{\rho_2}$ can be

(A) -4 (B) $-\frac{32}{25}$ (C) $\frac{32}{25}$ (D) 4

7. **BD**

8. All wire are infinitely long and each wire are insulated with each other, then

(A) The magnitude of magnetic field at point P_1 is zero
(B) The direction of magnetic field at point P_2 is inward
(C) The direction of magnetic field at point P_3 is outward
(D) None of these



8. **ABC**

9. Current flows through a straight cylindrical conductor of radius r . The current is distributed uniformly over its cross-section. The magnetic field at a distance x from the axis of the conductor has magnitude B .

(A) $B = 0$ at the axis. (B) B is proportional to x for $0 \leq x \leq r$.
(C) B is proportional to $\frac{1}{x}$ for $x > r$ (D) B is maximum for $x = r$.

9. **ABCD**

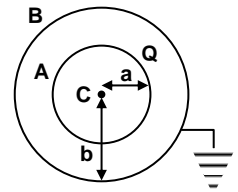
10. A conducting sphere A of radius a , with charge Q , is placed concentrically inside a conducting shell B of radius b . B is earthed. C is the common centre of A and B.

(A) The field at a distance r from C, where $a \leq r \leq b$, is $k \frac{Q}{r^2}$.

(B) The potential at a distance r from C, where $a \leq r \leq b$, is $k \frac{Q}{r}$.

(C) The potential difference between A and B is $kQ \left(\frac{1}{a} - \frac{1}{b} \right)$.

(D) The potential at a distance r from C, where $a \leq r \leq b$, is $kQ \left(\frac{1}{r} - \frac{1}{b} \right)$



10. **ACD**

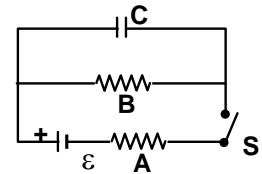
11. In the circuit shown, A and B are equal resistances. When S is closed the capacitor C charges from the cell of emf ε and reaches a steady state.

(A) During charging, more heat is produced in A than in B.

(B) In the steady state, heat is produced at the same rate in A and B.

(C) In the steady state, energy stored in C is $\frac{1}{4} C \varepsilon^2$.

(D) In the steady state, energy stored in C is $\frac{1}{8} C \varepsilon^2$.



11. **ABD**

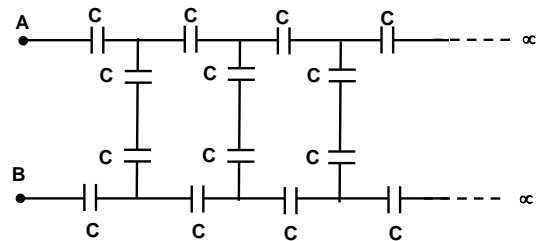
12. The equivalent capacitance of the shown infinite network across A and B, if each capacitor has a capacitance of C , is

(A) $\left(\frac{\sqrt{3}-1}{4} \right) C$

(B) $\left(\frac{\sqrt{3}+1}{4} \right) C$

(C) $\left(\frac{\sqrt{5}-1}{4} \right) C$

(D) None of these



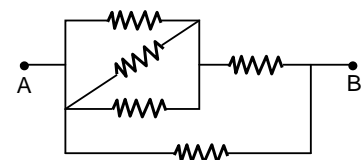
12. **C**

(PART – B)

(Integer Type)

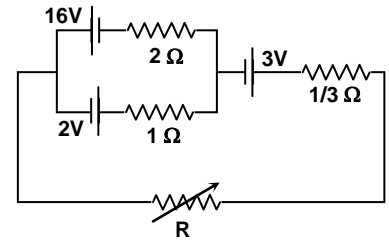
Part-C (01-06) contains six (06) Numerical based questions, the answer of which may be positive or negative numbers or decimals (e.g. 6.25, 7.00, -0.33, -30, 30.27, -127.30) and each question carries **+4 marks** for correct answer and **there will be no negative marking**.

1. Five identical resistance coils are connected in the network as shown in figure and the resistance measured between A and B is 1Ω . Then the individual coils must have a resistance of (in ohms)



1. **1.75**
Range: 1.70 to 1.90

2. Three cells of emf 16V, 2V and 3V and internal resistance 2Ω , 1Ω and $\frac{1}{2}\Omega$ respectively are connected with an unknown resistance R as shown in the figure. What is the value of R such that power developed through R is maximum in steady state condition?

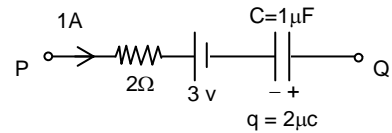


2. **1**

3. An infinite charged sheet has $8.85 \times 10^{-9} \text{ C/m}^2$ surface charge density. How far (in mm) are the equipotential surfaces differing by (2.4)V ?

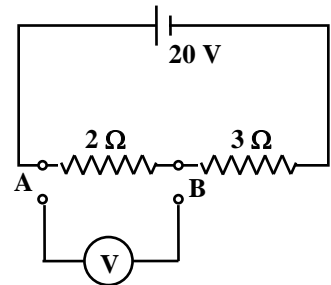
3. **4.8**

4. IF Potential difference (in volt) between points P and Q is V then value of $(8V)/5$ is :



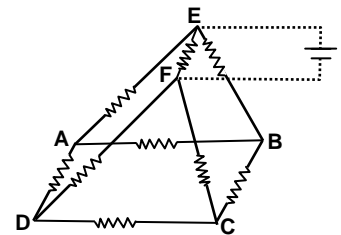
4. **4.8**

5. When a voltmeter, as shown in the figure is connected across a 2Ω resistance, it reads 5 volts. Find the internal resistance of the voltmeter (in ohm).



5. **2**

6. A prism is made of wire mesh with each side having equal resistance R. A battery of 6 V and zero resistance is connected across E and F as shown in the figure. The current in the branch AD, if R is equal to 5Ω is



6. **0.4**

SECTION – II : CHEMISTRY

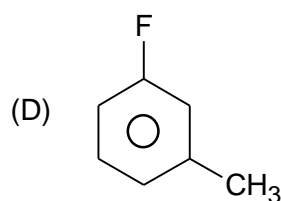
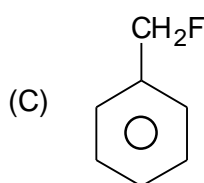
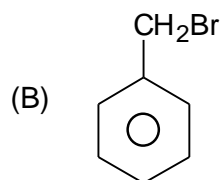
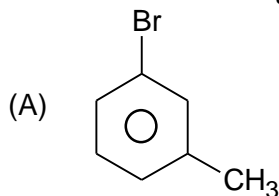
(PART – A)

SECTION – A

(Single Correct Answer Type)

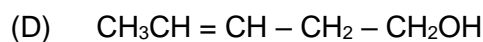
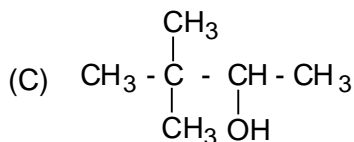
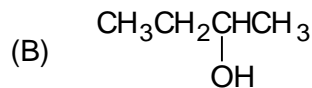
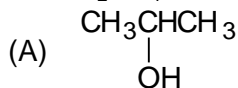
This section contains **4 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

1. Which of the following compound is most reactive towards OH^- ion through $\text{S}_{\text{N}}1$ path?



1. **B**

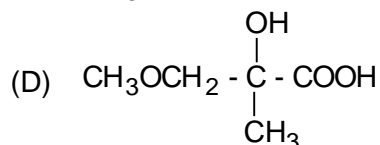
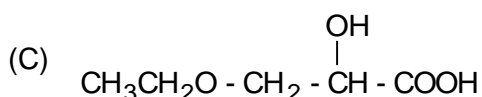
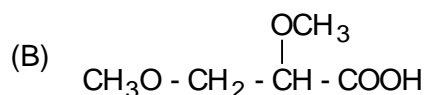
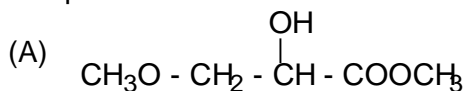
2. Which of the following alcohol forms only one alkene on dehydration reaction with conc. H_2SO_4 ?



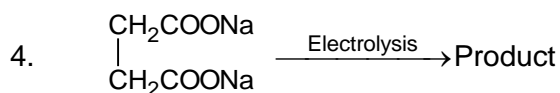
2. **A**

3. $\text{CH}_3\text{O}-\text{CH}_2-\overset{\text{OH}}{\text{CH}}-\text{COOH} \xrightarrow[\Delta]{\text{CH}_2\text{N}_2(1.\text{eq})} \text{Product}$

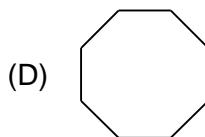
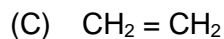
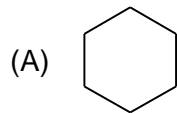
The product of above reaction is:



3. **A**



Which of the following compound can't be formed in above reaction?

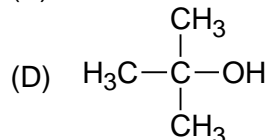
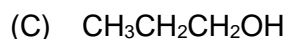
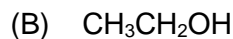
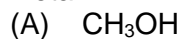


4. **B**

(One or More Than One Options Correct Type)

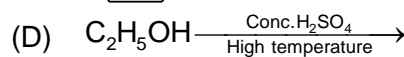
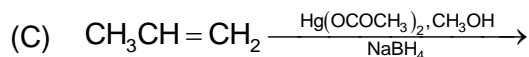
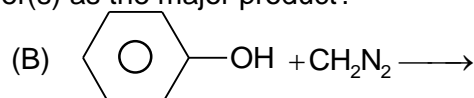
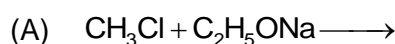
This section contains **8 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE or MORE THAN ONE is correct**.

5. Which of the following alcohol(s) is/are more reactive than $\text{CH}_3\underset{\text{OH}}{\text{CH}}\text{CH}_3$ towards sodium metal?



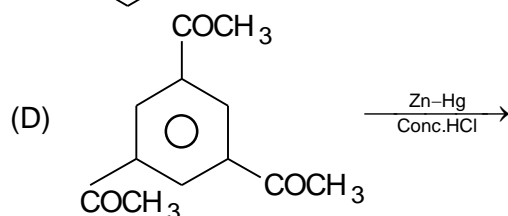
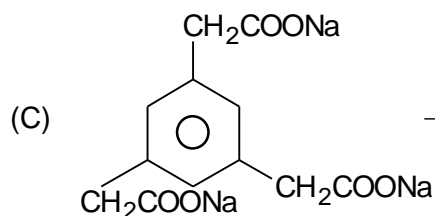
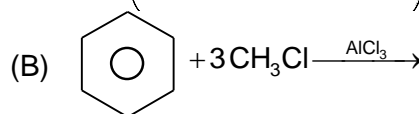
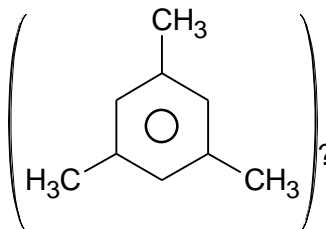
5. **ABC**

6. Which of the following reaction(s) form ether(s) as the major product?



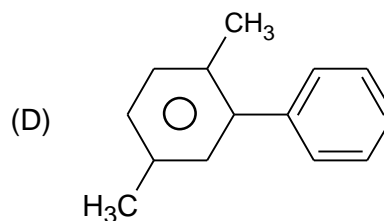
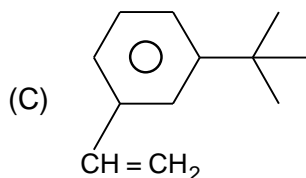
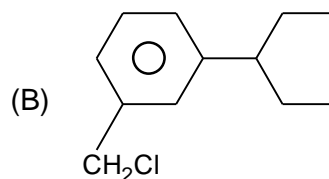
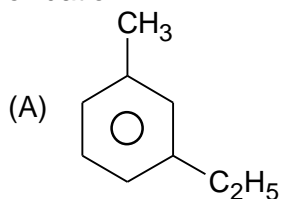
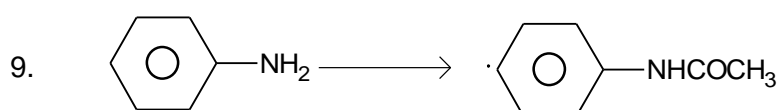
6. **ABC**

7. Which of the following reaction(s) can form mesitylene

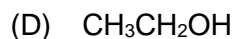
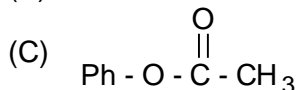
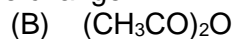
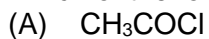
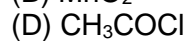
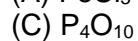
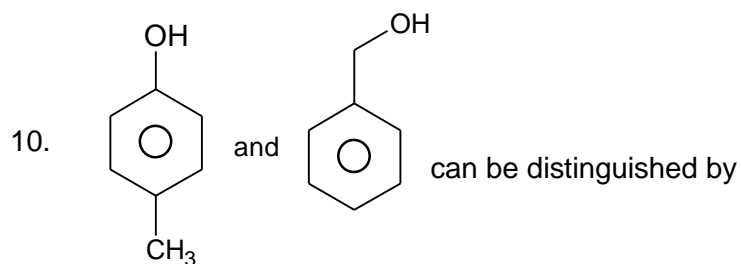
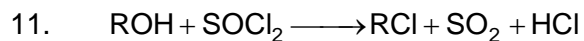


7. **AC**

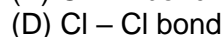
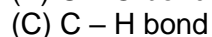
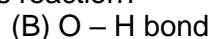
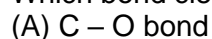
8. Which of the following compound(s) form dicarboxylic acid(s) on alkaline permanganate oxidation?

8. **ADB**

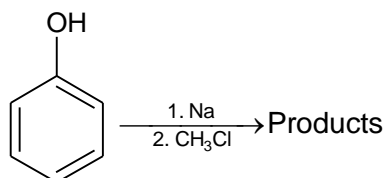
Which of the following can perform the above change?

9. **ABC**10. **AB**

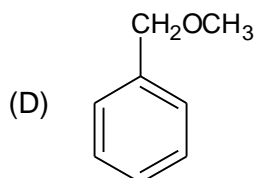
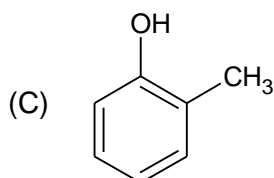
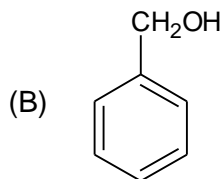
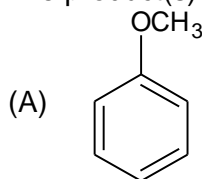
Which bond cleavage(s) take(s) place in this reaction?

11. **AB**

12.



The product(s) of above reaction is/are

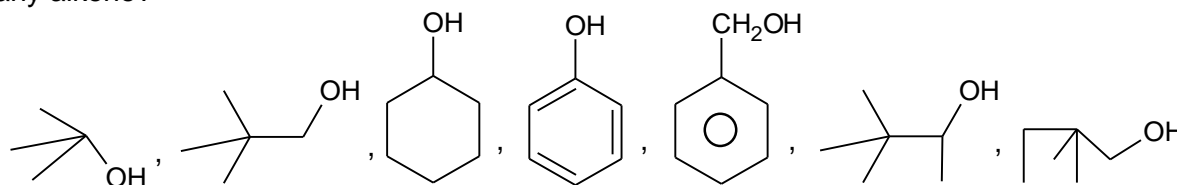


12. AC

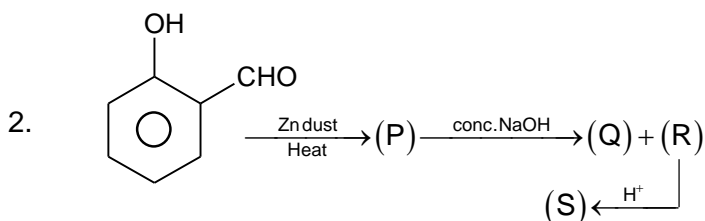
(PART – B)**(Integer Type)**

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. How many of the following alcohol(s) and phenols is/are not formed by hydration of (H₃O⁺) any alkene?

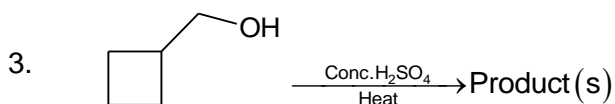


1. 4



How many oxygen atom(s) is/are present in (S)?

2. 2



How many product(s) containing five-membered ring(s) is/are formed in the above reaction? (consider stereoisomers)

3. 1

-
4. The molecular formula of a monocarboxylic acid is $C_5H_{10}O_2$. How many methyl group(s) is/are present in its isomer having the highest value of pK_a ?
4. 3
5. $CH_3CH=CH-CH_2-CHO \xrightarrow{Zn-Hg/Conc.HCl(excess)}$ Product
What is the molar mass of the product of above reaction in $g\ mol^{-1}$ unit?
5. 106.5
6. How many $(CH_3CO)_2O$ molecules is/are required for complete reaction with one molecule of glucose?
6. 5
-

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. If $y = \frac{2x+5}{3x+10}$ and $2\left(\frac{dy}{dx}\right)\left(\frac{d^3y}{dx^3}\right) = k\left(\frac{d^2y}{dx^2}\right)^2$ then $k =$

- (A) 1 (B) 2
(C) 3 (D) 4

1. C

2. If $f(x) = \sin x + \cos x$ and $g(x) = x^2 - 1$ then $g(f(x))$ is

- (A) $\sin 2x$ (B) $\sin x$
(C) $\cos x$ (D) $\cos 2x$

2. A

3. $\lim_{x \rightarrow 0} \frac{\tan 2x - x}{3x - \sin x}$ is equal to

- (A) $\frac{2}{3}$ (B) $\frac{3}{2}$
(C) $-\frac{7}{4}$ (D) $\frac{1}{2}$

3. D

4. $\int (1 - \tan^2 x) dx$ equal to

- (A) $2x - \sin x + c$ (B) $x - \tan x + c$
(C) $2x - \tan x + c$ (D) None

4. C

(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. If $\phi(x) = \int e^{\tan^2 x} \cdot \sin 4x dx$ and $\phi(0) = -2$ then which is/are correct

- (A) $\phi(x)$ is an even function (B) $\phi(x)$ is neither even nor odd
(C) $\phi\left(\frac{\pi}{4}\right) = -\frac{e}{2}$ (D) $\phi\left(\frac{3\pi}{4}\right) = \frac{e}{2}$

5. AC

6. Let $f(x) = \sin\left(\frac{\pi}{x}\right)$ and $D_f = \{x: f(x) > 0\}$. Then D_f contains
- (A) $\left(\frac{1}{3}, \frac{1}{2}\right)$ (B) $\left(\frac{1}{5}, \frac{1}{4}\right)$
 (C) $\left(-1, \frac{-1}{2}\right)$ (D) $\left(-\pi, \frac{-1}{2}\right)$
6. ABC
7. If $f(x)$ is a polynomial function satisfying the condition $f(x) \cdot f\left(\frac{1}{x}\right) = f(x) + f\left(\frac{1}{x}\right)$ and $f(2) = 9$ then:
- (A) $2f(4) = 3f(6)$ (B) $14f(1) = f(3)$
 (C) $9f(3) = 2f(5)$ (D) $f(10) = f(11)$
7. BC
8. If $\int e^{3x} \cos 4x \, dx = e^{3x} (A \sin 4x + B \cos 4x) + C$ then :
- (A) $4A = 3B$ (B) $2A = 3B$
 (C) $3A = 4B$ (D) $4A + 3B = 1$
8. CD
9. Let $f(x) = \begin{cases} 1 + \frac{2x}{\lambda}, & 0 \leq x < 1 \\ \lambda x, & 1 \leq x < 2 \end{cases}$ if $\lim_{x \rightarrow 1} f(x)$ exists, then λ is
- (A) -2 (B) -1
 (C) 1 (D) 2
9. BD
10. Which of the following are true:
- (A) $\sqrt{e^\pi} > \left(\frac{\pi}{2}\right)^e$ (B) $e^\pi > \pi^e$
 (C) $e^3 > 3^e$ (D) $e^2 > 2^e$
10. ABCD
11. Let 'f' be a differentiable function $\forall x \in \mathbb{R}$ where $f(1) = 2$ and $f(3) = 7$ and $f'(x) \geq 2 \forall x \in \mathbb{R}$ then integral value of $f(2)$ can be
- (A) 5 (B) 4
 (C) 3 (D) 2
11. AB
12. For the curve $y = be^{x/a}$, which one of the following is **INCORRECT**
- (A) Length of sub-tangent is constant (B) Length of sub-normal is constant
 (C) Length of tangent is constant (D) Length of normal is constant
12. BCD

(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. If 60 is expressed as sum of two numbers such that the product of one number and square of other number is maximum, then what will be the larger number?
1. 40
2. The value of $\lim_{x \rightarrow 0} \left(\left[100 \frac{x}{\sin x} \right] + \left[99 \frac{\sin x}{x} \right] \right)$ where [] represent greatest integer function –
2. 198
3. If $f, g : \mathbb{R} \rightarrow \mathbb{R}$, $f(x) = (x + 1)^2$, $g(x) = x^2 + 1$ then $(f \circ g) (-3) =$
3. 121
4. If $\lim_{x \rightarrow 0} \frac{1}{x^3} \left(\frac{1}{\sqrt{1+x}} - \frac{1-ax}{1-bx} \right)$ exists and has the value equal to ℓ then value of $\left(\frac{1}{a} - \frac{3}{b} - 32\ell \right)$ is equal to
4. 1
5. Let a real valued function $f(x) = x^4 + 4x^3 - 8x^2 + P$, $P \in \mathbb{R}$. If λ is the least value of P for which $g(x) = |f(x)|$ is differentiable $\forall x \in \mathbb{R}$, then value of $\frac{\lambda}{16}$ is equal to
5. 8
6. Let $f(x) = \frac{1}{\sqrt{6 - [x^2 - 2]}}$, [.] is the greatest integer function, then the number of integral values of x in domain of $f(x)$ is
6. 5

FIITJEE COMMON TEST

BATCHES:

PHASE TEST-2: PAPER-1

JEE ADVANCED LEVEL

ANSWER KEY

ANSWER KEYS

Physics

Chemistry

Mathematics