

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**.

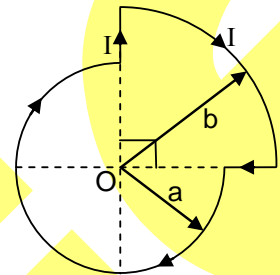
1. The magnetic induction at the point O is:

(A) $\frac{\mu_0 i}{8} \left(\frac{3}{a} + \frac{1}{b} \right)$

(B) $\frac{\mu_0 i}{4} \left(\frac{3}{a} + \frac{1}{b} \right)$

(C) $\frac{\mu_0 i}{8\pi} \left(\frac{3}{a} + \frac{1}{b} \right)$

(D) none of these



1. **A**

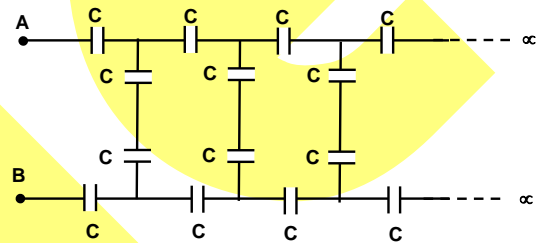
2. The equivalent capacitance of the shown infinite network across A and B, if each capacitor has a capacitance of C, is

(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



2. **C**

3. A wire of length ℓ metres carrying a current I amperes is bent in the form of a circle. The magnitude of the magnetic moment is

(A) $\frac{\ell I^2}{2\pi}$

(B) $\frac{\ell I^2}{4\pi}$

(C) $\frac{\ell^2 I}{2\pi}$

(D) $\frac{\ell^2 I}{4\pi}$

3. **D**

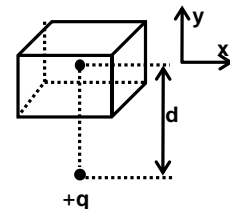
4. A charge +q is placed at a distance 'd' from the centre of the uncharged metallic cube of side 'a'. The electric field at the centre of the cube due to induced charges on the cube will be

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

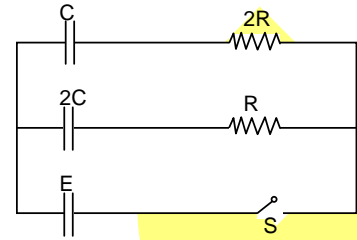


4. **B**

(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. In the circuit shown in figure, switch S is closed at time $t = 0$, Select the correct statement (s)
- (A) Rate of increase of charge is same in both the capacitors
 (B) Ratio of charge stored in capacitors C and 2C at any time t would be 1 : 2
 (C) Time constant of both the capacitors are equal
 (D) Steady state charge in capacitors C and 2C are in the ratio of 1 : 2

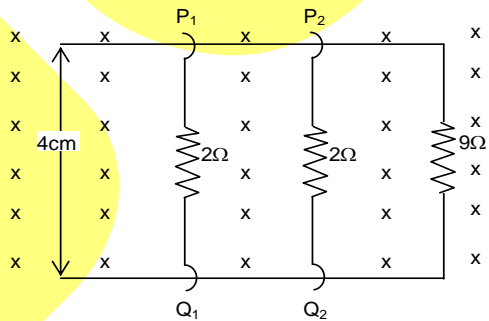


5. **BCD**

6. An emf is produced in a coil, which is not connected to an external voltage source. This can be due to:
- (A) the coil being in a time-varying magnetic field.
 (B) the coil moving in a time-varying magnetic field.
 (C) the coil is moving in constant magnetic field.
 (D) the coil is stationary in external spatially varying magnetic field, which does not change with time.

6. **ABC**

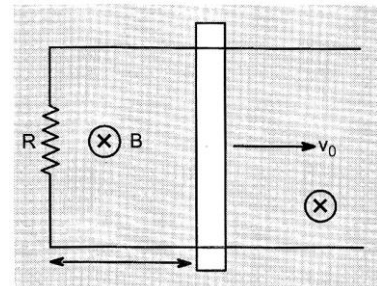
7. In the diagram shown, the identical wires P_1Q_1 and P_2Q_2 are made to slide on the rails with same speed of 5 cm/s. In this region a magnetic field of 1T exists. The electric current in $9\ \Omega$ resistor is



- (A) Zero if both wires slide towards left
 (B) Zero if both wires slide in opposite direction
 (C) 0.2 mA if both wires move towards right
 (D) 0.01 mA if both wires move in opposite direction

7. **BC**

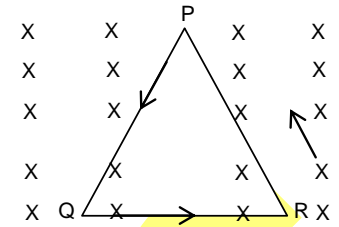
8. A conducting rod of length l is moved at constant velocity v_0 on two parallel, conducting, smooth fixed rails, which are placed in a uniform constant magnetic field B perpendicular to the plane of the rails as shown in figure. A resistance R is connected between the two ends of the rail. Then, which of the following is/are correct?



- (A) The thermal power dissipated in the resistor is equal to the rate of work done by an external person pulling the rod.
 (B) If applied external force is doubled, then a part of the external power increases the velocity of the rod.
 (C) Lenz's law is not satisfied if the rod is accelerated by an external force.
 (D) If resistance R is doubled, then power required to maintain the constant velocity V_0 becomes half.

8. **ABD**

9. An equilateral triangular loop PQR of side l carries a current I in the direction shown. The loop is kept in uniform magnetic field B , directed perpendicular to the plane of triangle PQR as shown in given figure. Net force F and torque τ acting on loop is

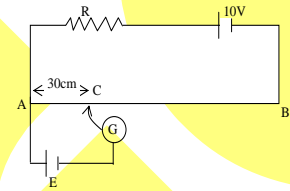


- (A) $F = 0$ (B) $F = \sqrt{3} IlB$ (C) $\tau = 0$

(D) $\tau = \frac{\sqrt{3} I^2 l B}{4}$

9. **AC**

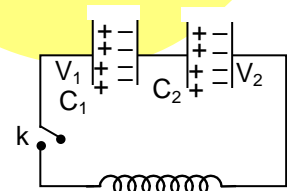
10. AB is a potentiometer wire of length 100 cm and its resistance is 10Ω . It is connected in series with a resistance $R = 90\Omega$ and a battery of emf 10V and negligible internal resistance. A source of unknown emf E is balanced by 30 cm length of the potentiometer wire, with jockey position at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

10. **BD**

11. Two capacitors of capacitance C_1 and C_2 are charged to a potential difference of V_1 and V_2 respectively and are connected to an inductor of inductance L as shown in the figure. Initially key k is open. Now key k is closed and current in the circuit starts increasing. When current in the circuit is maximum



- (A) charge on both the capacitors is same
(B) induced emf in the inductor is zero
(C) potential difference across both the capacitors is same
(D) electrostatic potential energy stored in both the capacitors is same

11. **BC**

12. 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) $E \neq 0, B \neq 0$

12. **ABD**

(PART – B)

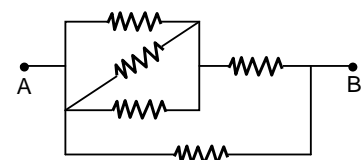
(Integer Type)

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. The current in the coil of self-inductance 3H is increasing according to $I = 2\sin t^2$. Find the amount of energy (in Joules) spent during the period when the current changes 0 to 5 ampere.

1. **37.50**

2. 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)



2. **1.75**

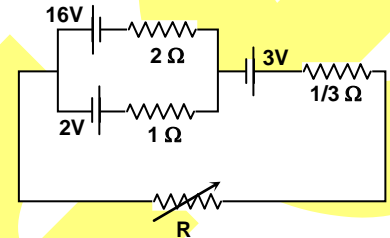
Range: 1.70 to 1.90

3. An inductor of inductance 100 mH is connected across a charged capacitor of capacitance $0.5 \mu\text{F}$ and the resulting LC circuit is set oscillating at its natural frequency. Let Q denote the instantaneous charge on the capacitor and I the current in the circuit. It is found that the maximum value of charge is $200 \mu\text{C}$. When charge = $30 \mu\text{C}$, the value of $\left| \frac{dI}{dt} \right|$ is 10^n As^{-1} .

Find the value of 'n'.

3. **600.00**

4. 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?

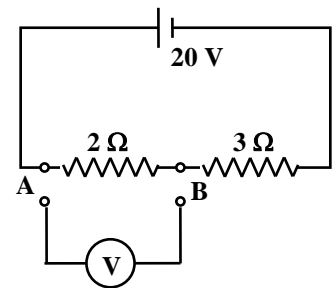


4. **1**

5. A coil, a capacitor and an AC source of rms voltage 24 V are connected in series. By varying the frequency of the source, a maximum rms current of 6A is observed. If coil is connected to a battery of emf 12 volt and internal resistance 4Ω , then current through it in steady state in Amperes is _____

5. **1.50**

6. 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).



6. **2**

Space For Rough Work

SECTION - II : CHEMISTRY

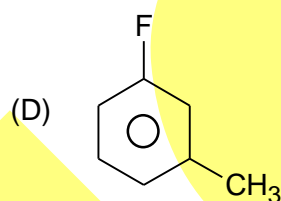
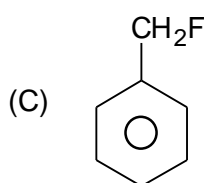
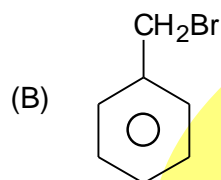
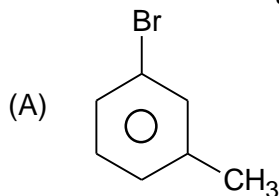
(PART - A)

SECTION - A

(Single Correct Answer Type)

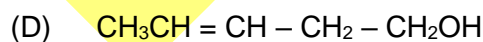
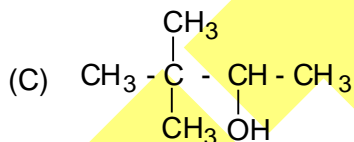
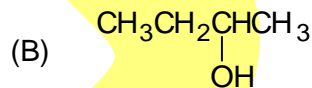
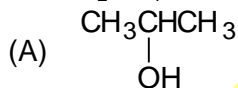
This section contains **4 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

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

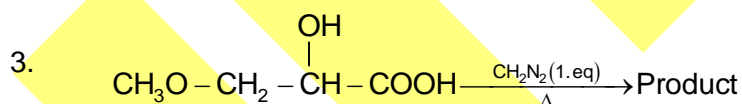


1. B

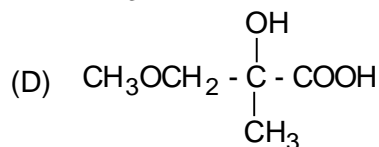
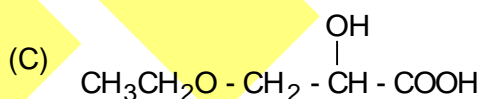
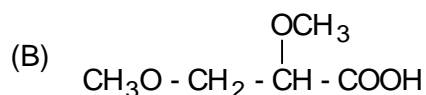
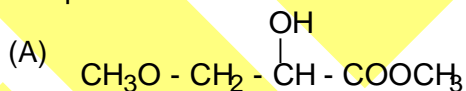
2. Which of the following alcohol forms only one alkene on dehydration reaction with conc. H_2SO_4 ?



2. A

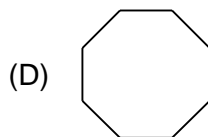
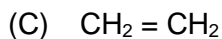
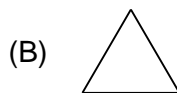
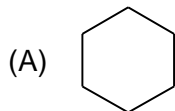


The product of above reaction is:



3. A

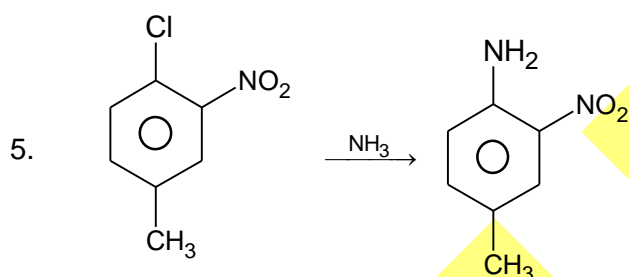
4. $\begin{array}{c} \text{CH}_2\text{COONa} \\ | \\ \text{CH}_2\text{COONa} \end{array} \xrightarrow{\text{Electrolysis}} \text{Product}$
Which is not a product of above reaction?



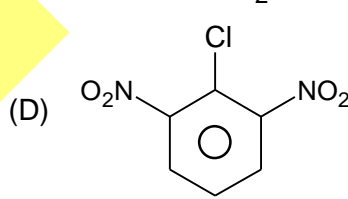
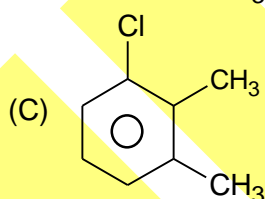
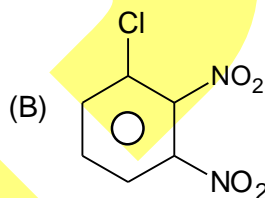
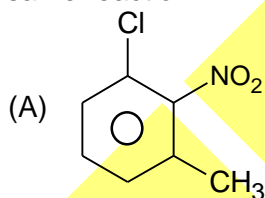
4. B

(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.

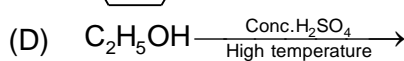
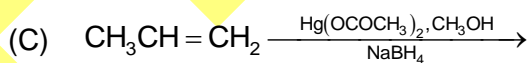
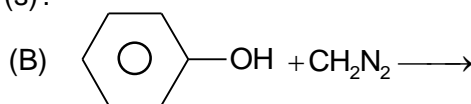
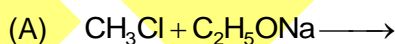


Which of the following compound(s) is/are more reactive than the above reactant for the same reaction?

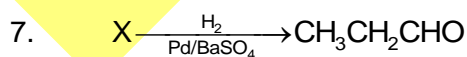


5. ABD

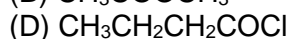
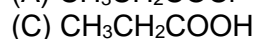
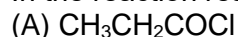
6. Which of the following reaction(s) form ether(s)?



6. ABC



In the reaction reactant 'X' should be



7. **A**

8. $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{COOH}$ and $\text{CH}_3-\overset{\text{CH}_3}{\underset{\text{CH}_3}{\text{C}}}-\text{COOH}$ can be distinguished by

- (A) SOCl_2 (B) $\text{Br}_2/\text{red P}$
 (C) KMnO_4/H^+ (D) $\text{CH}_3\text{OH}/\text{Conc. H}_2\text{SO}_4$

8. **B**

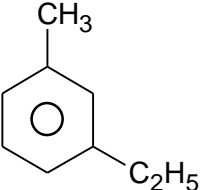
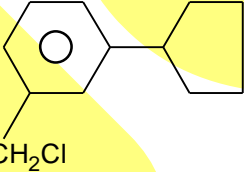
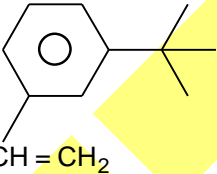
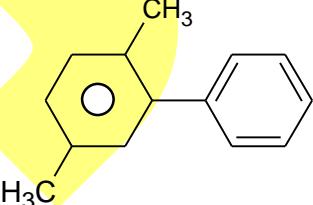
9. $\text{HCOOH} \xrightarrow{\text{SOCl}_2} (\text{P}) \xrightarrow{\text{Heat}} (\text{Q}) + (\text{R})$

The unknown compounds of above reaction is/are

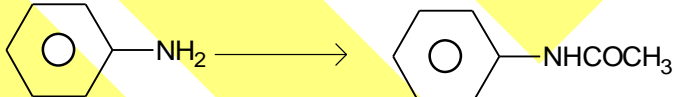
- (A) CO (B) CO_2
 (C) Cl_2 (D) HCl

9. **AD**

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

- (A) 
- (B) 
- (C) 
- (D) 

10. **ABD**

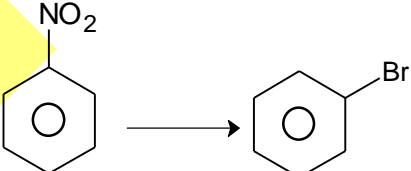
11. 

Which of the following can perform the above change?

- (A) CH_3COCl (B) $(\text{CH}_3\text{CO})_2\text{O}$
 (C)  (D) $\text{CH}_3\text{CH}_2\text{OH}$

11. **ABC**

12. Which of the following reagent(s) as a set is/are used to perform the given change?

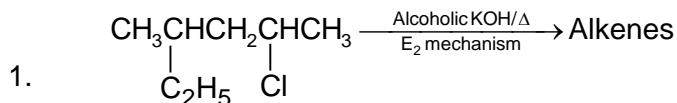


- (A) NaNO_2/HCl (B) Sn/HCl
 (C) H_3PO_2 (D) Br_2/Fe

12. ABCD

(PART – B)**(Integer Type)**

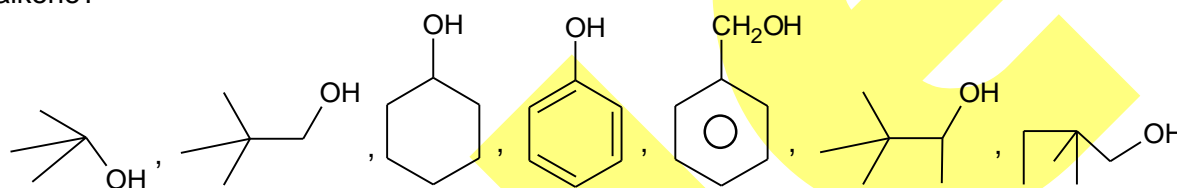
Part-C (01-06) contains six (06) Numerical based questions, the answer of which maybe positive or negative numbers or decimals (e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30) and each question carries **+4 marks** for correct answer and **there will be no negative marking**.



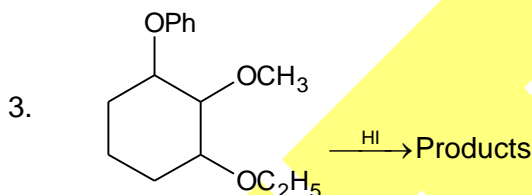
(consider stereoisomers)

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

1. 6

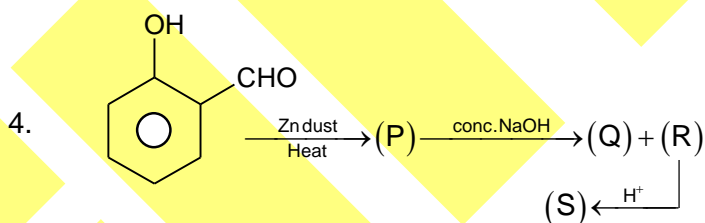
2. Which of the following alcohol(s) and phenols is/are not formed by hydration of (H_3O^+) any alkene?

2. 4



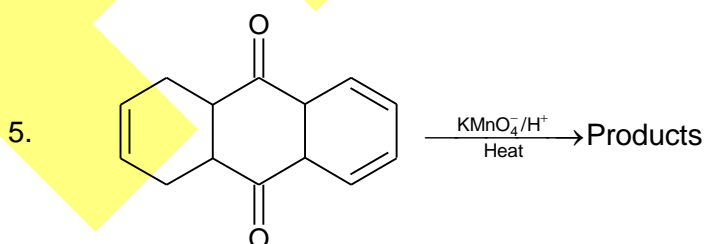
How many maximum number of moles of HI can be consumed by one mole of the above reactant?

3. 7



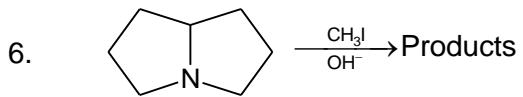
How many carbon atom(s) is/are present in (Q)?

4. 7



How many moles of carbon dioxide gas(es) is/are evolved in the above reaction?

5. 3



How much gram of CH_3I is needed to remove the nitrogen atom as $(\text{CH}_3)_3\text{N}$ from 0.1 mole of the reactant?

[At. Wt of I = 127 g mol^{-1}]

6. 42.6

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. Let \hat{a} and \hat{b} be two-unit vectors such that $\hat{a} + \hat{b}$ is also a unit vector. Then the angle between \hat{a} and \hat{b} is
 (A) 30° (B) 60°
 (C) 90° (D) 120°
1. D
2. The equation of the plane passing through the line of intersection of the planes $x + y + z = 1$ and $2x + 3y - z + 4 = 0$ and parallel to x-axis is
 (A) $y - 3z - 6 = 0$ (B) $y - 3z + 6 = 0$
 (C) $y - z - 1 = 0$ (D) $y - z + 1 = 0$
2. B
3. The solution of $(1 + x^2)dy - xy dx = 0$ is
 (A) $y = c(1 + x^2)$ (B) $y^2 = c(1 + x^2)$
 (C) $y\sqrt{1 + x^2} = c$ (D) None of these
3. B
4. The area bounded by $y = \ln x$, the x-axis and the ordinates $x = 0$ and $x = 1$ is
 (A) 1 (B) $3/2$
 (C) -1 (D) none of these
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. The vector $\frac{1}{3}(2\hat{i} - 2\hat{j} + \hat{k})$ is:
 (A) a unit vector
 (B) makes an angle $\frac{\pi}{3}$ with the vector $2\hat{i} - 4\hat{j} + 3\hat{k}$
 (C) parallel to the vector $-\hat{i} + \hat{j} - \frac{1}{2}\hat{k}$
 (D) perpendicular to the vector $3\hat{i} + 2\hat{j} - 2\hat{k}$
5. ACD

6. $\begin{bmatrix} 2x+1 & 3y \\ 0 & y^3-5y \end{bmatrix} = \begin{bmatrix} x+3 & y^2+2 \\ 0 & -6 \end{bmatrix}$ then

- (A) $x = 2$
(C) $y = 2$

- (B) $x = 3$
(D) $y = 3$

6. AC

7. Let $y = y(x)$ be the solution of the differential equation, $x \frac{dy}{dx} + y = x \log_e x, (x > 1)$. If $2y(2) = \log_e 4 - 1$, then $y(e)$ is equal to:

(A) $y(e) = -\frac{e}{2}$

(B) $y(1) = -\frac{1}{4}$

(C) $y(e) = \frac{e}{4}$

(D) $y(1) = \frac{e^2}{4}$

7. BC

8. If a curve passes through the point $(1, -2)$ and has slope of the tangent at any point (x, y) on it as $\frac{x^2 - 2y}{x}$, then the curve also passes through the point :

(A) $(3, 0)$

(B) $(\sqrt{3}, 0)$

(C) $(1, -2)$

(D) $(-\sqrt{2}, 1)$

8. BC

9. $P(1, 1, 1)$ and $Q(\lambda, \lambda, \lambda)$ are two points in the space such that $PQ = \sqrt{27}$, the value of λ can be

- (A) -4
(C) 2

- (B) -2
(D) 4

9. BD

10. If the system of linear equations,
 $x + y + z = 6$
 $x + 2y + 3z = 10$
 $3x + 2y + \lambda z = \mu$
 has more than two solutions, then

- (A) $\mu - \lambda^2 = 13$
(C) $\mu = 16$

- (B) $\mu - \lambda^2 = 14$
(D) $\mu = 14$

10. AD

11. Let $y = f(x)$ be a real valued function satisfying $x \frac{dy}{dx} = x^2 + y - 2; f(1) = 1$, then

- (A) $f(x)$ is minimum at $x = 1$
(C) $f(3) = 5$

- (B) $f(x)$ is maximum at $x = 1$
(D) $f(2) = 3$

11. AC

12. If the plane $2x - y + 2z + 3 = 0$ has the distances $\frac{1}{3}$ and $\frac{2}{3}$ units from the planes $4x - 2y + 4z + l = 0$ and $2x - y + 2z + m = 0$, respectively, then the maximum value of $l + m$ is equal to

- (A) $l = 8$
(C) $m = 1$

- (B) $l = 4$
(D) $m = 5$

12. ABCD

(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**.

13. The value of k do the following homogenous system of equations passes a non-trivial solution is $x + ky + 3z = 0$, $3x + ky - 2z = 0$, $2x + 3y - 4z = 0$

13. 16.5

14. Let $A = \begin{bmatrix} 5 & 5\alpha & \alpha \\ 0 & \alpha & 5\alpha \\ 0 & 0 & 5 \end{bmatrix}$. If $|A^2| = 25$, then $|\alpha|$ equals

14. 0.2

15. If $3A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & -2 \\ a & 2 & b \end{bmatrix}$ and A is an orthogonal matrix, then the product of a and b is equal to

15. 2

16. If the line, $\frac{x-1}{2} = \frac{y+1}{3} = \frac{z-2}{4}$ meets the plane, $x + 2y + 3z = 15$ at a point P , then the distance of P from the origin is:

16. 4.5

17. Let $A = \begin{bmatrix} x^2 & 6 & 8 \\ 3 & y^2 & 9 \\ 4 & 5 & z^2 \end{bmatrix}$, $B = \begin{bmatrix} 2x & 3 & 5 \\ 2 & 2y & 6 \\ 1 & 4 & 2z-3 \end{bmatrix}$. If $\text{trace } A = \text{trace } B$ then $x + y + z$ is equal to

17. 3

18. The distance of the point having position vector $-\hat{i} + 2\hat{j} + 6\hat{k}$ from the straight line passing through the point $(2, 3, -4)$ and parallel to the vector $6\hat{i} + 3\hat{j} - 4\hat{k}$ is

18. 7

FIITJEE COMMON TEST

BATCHES:

PHASE TEST-2: PAPER-1

JEE ADVANCED LEVEL

ANSWER KEY

ANSWER KEYS

Physics

Chemistry

Mathematics

