FIITJEE Phase Test (JEE-Advanced)

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 :_____

BATCH – NWCM2022E1R+E1W_PT4

SECTION – I : PHYSICS

(PART – A)

SECTION – A

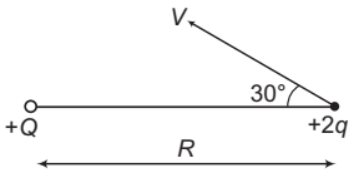
(Single Correct Answer Type)

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 galvanometer of resistance 50Ω is connected to a battery of 3V along with resistance 2950 Ω in series. A full scale deflection of 30 divisions is obtained in the galvanometer. In order to reduce this deflection to 20 divisions, the above series resistance should be
   (A) 4450 Ω (B) 5050 Ω
   (C) 5550 Ω (D) 6050 Ω

1. **A**

2. In the diagram shown, the charge +Q is fixed. Another charge +2q and mass M is projected from a distance R from the fixed charge. Minimum separation between the two charges if velocity becomes $\frac{1}{\sqrt{3}}$ times of the projected velocity, at this moment is (Assume gravity to absent)



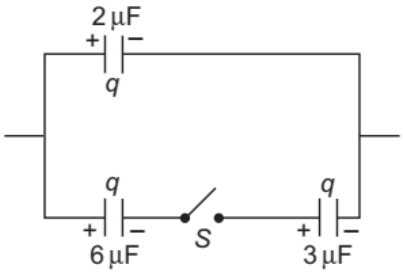
   (A) $\frac{\sqrt{3}}{2}R$ (B) $\frac{1}{\sqrt{3}}R$ (C) $\frac{1}{2}R$ (D) None of these

2. **A**

3. A conductor of length ℓ is placed perpendicular to a horizontal uniform magnetic field B. Suddenly, a certain amount of charge is passed through it, when it is found to jump to a height h. the amount of charge that passes through the conductor is
   (A) $\frac{m\sqrt{gh}}{B\ell}$ (B) $\frac{m\sqrt{gh}}{2B\ell}$ (C) $\frac{m\sqrt{2gh}}{B\ell}$ (D) None of these

3. **C**

4. The flow of charge through switch S if it is closed, is
   (A) zero
   (B) $\frac{q}{4}$
   (C) $\frac{2q}{3}$
   (D) $\frac{q}{3}$



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. Four charges, all of the same magnitude, are placed at the four corners of a square. At the centre of the square, the potential is V and the field is E. By suitable choices of the signs of the four charges, which of the following can be obtained?
   (A) V = 0, E = 0 (B) V = 0, E ≠ 0
   (C) V ≠ 0, E = 0 (D) V ≠ 0, E ≠ 0

5. **ABCD**

6. A conducting sphere of radius R, carrying charge Q, lies concentrically inside an uncharged conducting shell of radius 2R. If they are joined by a metal wire,

(A) $\frac{Q}{3}$ amount of charge will flow from the sphere to the shell.

(B) $\frac{2Q}{3}$ amount of charge will flow from the sphere to the shell.

(C) Q amount of charge will flow from the sphere to the shell.

(D) $k\frac{Q^2}{4R}$ amount of heat will be produced.

6. **CD**

7. A charged particle carrying charge q = 1 μC moves in uniform magnetic field with velocity $v_1 = 10^6$ m/s at angle 45° with x-axis in the x – y plane and experiences a force $F_1 = 5\sqrt{2}$ mN along the negative z-axis. When the same particle moves with velocity $v_2 = 10^6$ m/s along the z-axis, it experiences a force F_2 in y-direction.

(A) Magnetic field $B_0 = 10^{-2}$ T

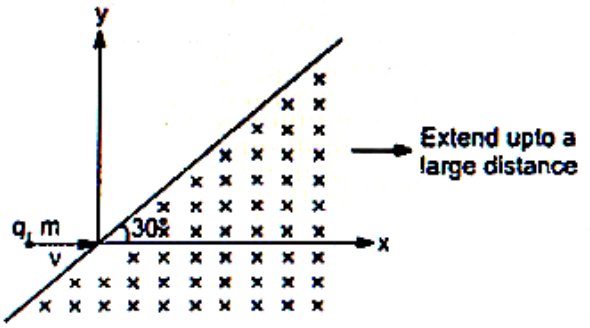
(B) Magnetic field $B_0 = 10$ T

(C) Force $F_2 = 10^{-2}$ N

(D) Force $F_2 = 6$ N

7. **AC**

8. A charge particle of charge q and mass m is moving with velocity v as shown in figure in a uniform magnetic field B along +ve x-direction. Select the correct alternative(s):



(A) Velocity of the particle when it comes out from the magnetic field is $\vec{v} = v\cos 60°\,\hat{i} + v\sin 60°\,\hat{j}$

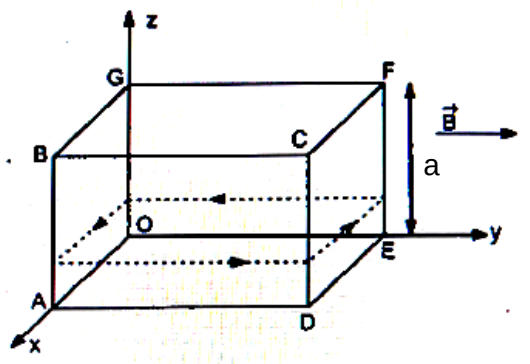
(B) Time for which the particle was in magnetic field is $\frac{\pi m}{3qB}$.

(C) Distance travelled in magnetic field is $\frac{\pi mv}{3qB}$.

(D) None of these

8. **ABC**

9. A wooden cubical block ABCDEFG of mass m and side a is wrapped by a square wire loop of perimeter 4a, carrying current I. The whole system is placed at frictionless horizontal surface in a uniform magnetic field $\vec{B} = B_0\hat{j}$ as shown in figure. In this situation, normal force between horizontal surface and block passes through a point at a distance x from centre. Select the correct statement(s)



(A) The block must not topple if $I < \frac{mg}{aB_0}$

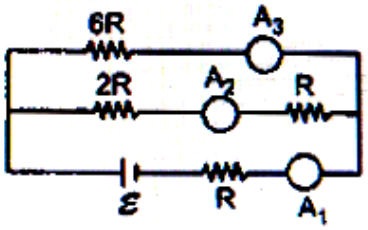
(B) The block must not topple if $I < \frac{mg}{2aB_0}$

(C) $x = \frac{a}{4}$ if $I = \frac{mg}{2aB_0}$

(D) $x = \frac{a}{4}$ if $I = \frac{mg}{4aB_0}$

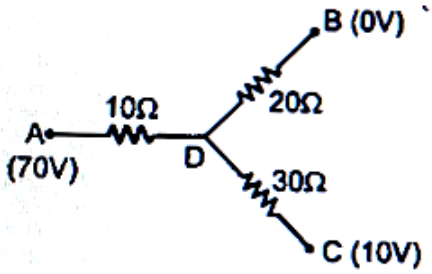
9. **BD**

10. In the given circuit ammeters are ideal then, which of the following statements are true?
(A) Reading of A_3 will be half as shown by A_2
(B) Reading of A_1 will be thrice as shown by A_2
(C) Reading of A_3 will be lowest
(D) Reading of A_1 will be thrice as shown by A_3



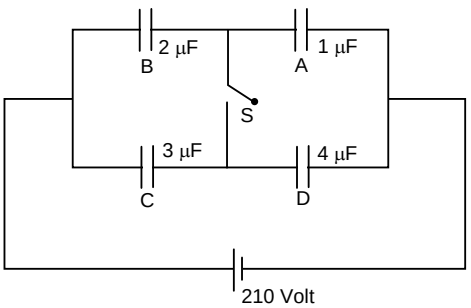
10. **ACD**

11. In the network shown, points, A, B and C are at potentials of 70 V, zero and 10 V respectively.
(A) Point D is at a potential of 40 V:
(B) The currents in the sections AD, DB, DC are in the ratio 3 : 2 : 1.
(C) The currents in the sections AD, DB, DC are in the ratio 1 : 2 : 3.
(D) The network draws a total power of 200 W.



11. **ABD**

12. Consider a network shown in the figure. Initially switch S was open. If switch S is closed now, then
(A) Amount of charge flowing through the switch is 105 μC.
(B) Amount of heat loss is 2.625 mJ.
(C) Final potential difference across all capacitor is 105 volt.
(D) Final charges on capacitors A, B, C, D will be in ratio of 1 : 2 : 3 : 4.



12. **ABCD**

(PART – B)

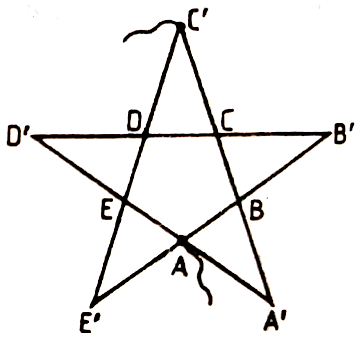
(Integer Type)

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.**

1. What will be magnitude of electric field at point P (–1, 1). Potential of this field on x, y coordinates varies as $V = \frac{1}{4}(x^2 - y^2)$

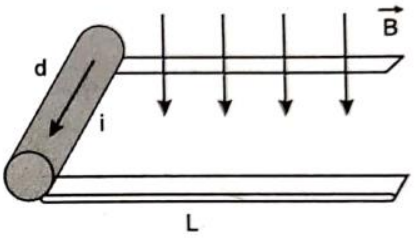
1. **0.50**

2. A five-pointed regular star has been formed from a uniform wire. Calculate the equivalent resistance between points A and C′. Take sin 18° = 1/3 and the resistance of the sections AA′ = A′B = BB′ = …. = r = $\frac{1}{2}\Omega$.



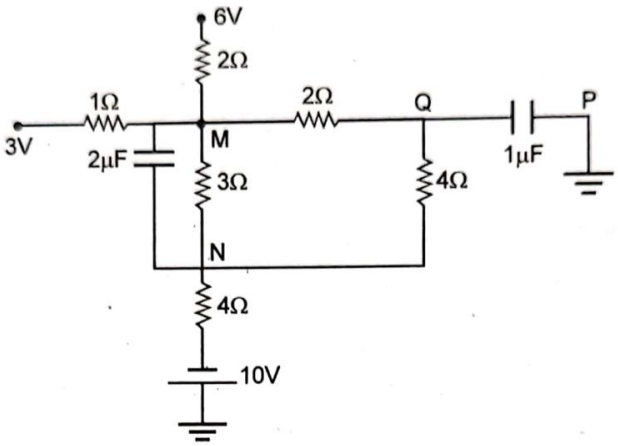
2. **0.50**

3. A rod of mass 0.72 kg and radius 6 cm rests on two parallel rails, that are d = 12 cm apart and L = 45 cm long. The rod carries a current I = 0.9 A (in the direction shown) and rolls along the rails without slipping. If it starts from rest, what is the speed of the rod (in m/s) as it leaves the rails if a uniform magnetic field of magnitude 0.24 T is directed perpendicular to the rod and the rails.



3. **0.15 (range 0.13 to 0.16)**

4. In given network, potential of point N is



4. **–1.60**

5. Two small identical balls having same mass and charge are located on same vertical line at heights h_1 = 30 m and h_2 = 35 m. They are thrown simultaneously with same velocity v = 4 m/sec. in the same direction along the horizontal. The first ball hit the ground at a distance ℓ = 10 meter from the initial vertical line. Height of 2nd ball at the instant first ball strike the ground is (g = 10 m/sec^2)

5. **2.50**

6. Three concentric thin spherical shells are of radii a, b and c (a < b < c). The first and third are connected by a fine wire through a small hole in the second. The second is connected to earth. Find the capacity of the condenser formed in μF. (a : b : c = 1 : 2 : 3, $\frac{1}{4\pi\varepsilon_0} = 9\times10^9$, a = 90 m)

6. **0.11**

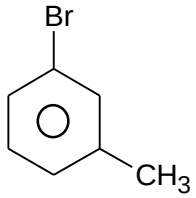
SECTION – II : CHEMISTRY

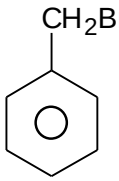
(PART – A)

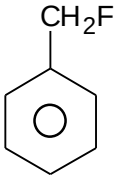
SECTION – A
(Single Correct Answer Type)

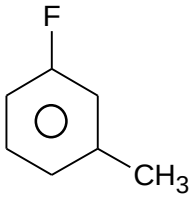
This section contains **4 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct.**

1. Which of the following compound is most reactive towards OH^- ion through S_N1 path?

(A) 

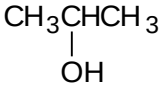
(B) 

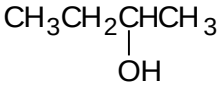
(C) 

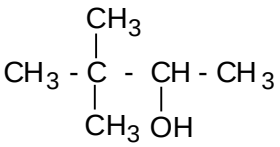
(D) 

1. **B**

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

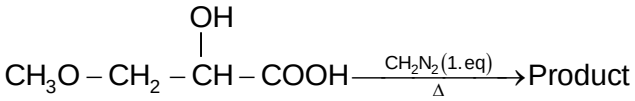
(A) 

(B) 

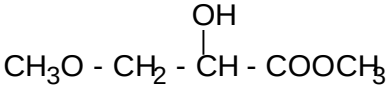
(C) 

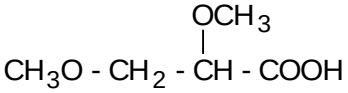
(D) $CH_3CH = CH - CH_2 - CH_2OH$

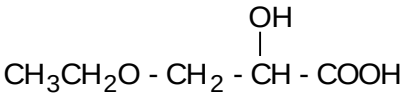
2. **A**

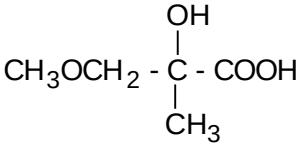
3. 

The product of above reaction is:

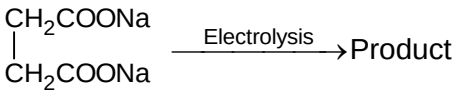
(A) 

(B) 

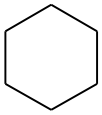
(C) 

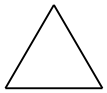
(D) 

3. **A**

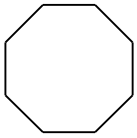
4. 

Which is not an product of above reaction?

(A) 

(B) 

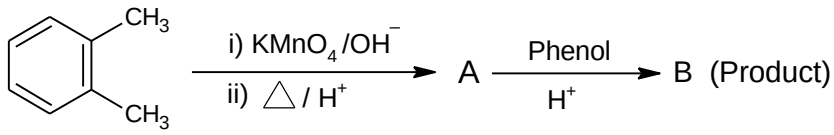
(C) $CH_2 = CH_2$

(D) 

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 is correct regarding product 'B'?

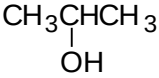
(A) 'B' is colourless in acidic medium

(B) 'B' is pink colour in basic medium

(C) 'B' has Benzenoid form in Basic medium

(D) 'B' exists in Ionic form in Basic medium

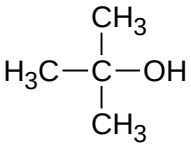
5. **ABD**

6. Which of the following alcohol(s) is/are more reactive than  towards sodium metal?

(A) CH_3OH

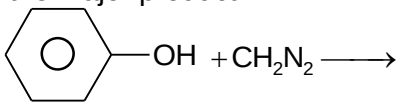
(B) CH_3CH_2OH

(C) $CH_3CH_2CH_2OH$

(D) 

6. **ABC**

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

(A) $CH_3Cl + C_2H_5ONa \longrightarrow$ (B)  $+ CH_2N_2 \longrightarrow$

(C) $CH_3CH = CH_2 \xrightarrow[NaBH_4]{Hg(OCOCH_3)_2, CH_3OH}$ (D) $C_2H_5OH \xrightarrow[\text{High temperature}]{\text{Conc.}H_2SO_4\text{(excess)}}$

7. **ABC**

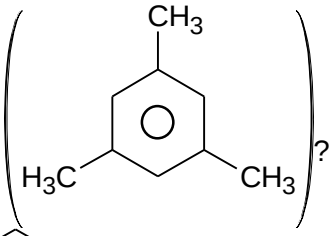
8. $X \xrightarrow[Pd/BaSO_4]{H_2} CH_3CH_2CHO$

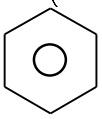
In the reaction reactant 'X' should be

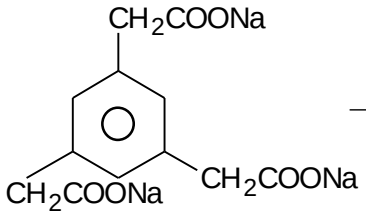
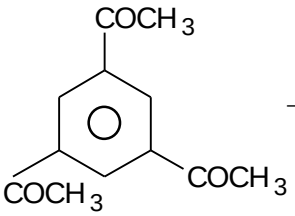
(A) CH_3CH_2COCl (B) CH_3COOCH_3

(C) CH_3CH_2COOH (D) $CH_3CH_2CH_2COCl$

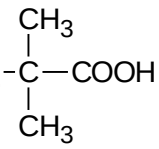
8. **A**

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

(A) $3CH_3COCH_3 \xrightarrow{Conc.H_2SO_4}$ (B)  $+ 3CH_3Cl \xrightarrow{AlCl_3}$

(C)  $\xrightarrow[Heat]{Soda\ lime}$ (D)  $\xrightarrow[Conc.HCl]{Zn-Hg}$

9. **AC**

10. $CH_3CH_2CH_2CH_2COOH$ and  can be distinguished by

(A) $SOCl_2$ (B) Br_2/red P

(C) $KMnO_4/H^+$ (D) $CH_3OH/Conc.H_2SO_4$

10. **B**

11. $HCOOH \xrightarrow{SOCl_2} (P) \xrightarrow{Heat} (Q) + (R)$

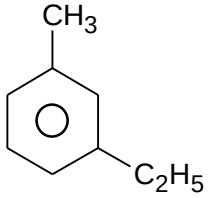
The unknown compounds of above reaction is/are

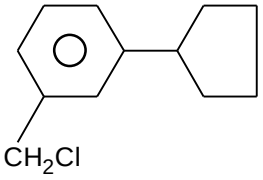
(A) CO (B) CO_2

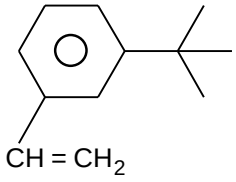
(C) Cl_2 (D) HCl

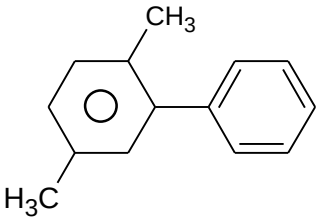
11. **AD**

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

(A) 

(B) 

(C) 

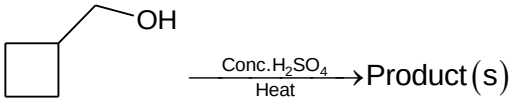
(D) 

12. **ADB**

(PART – B)

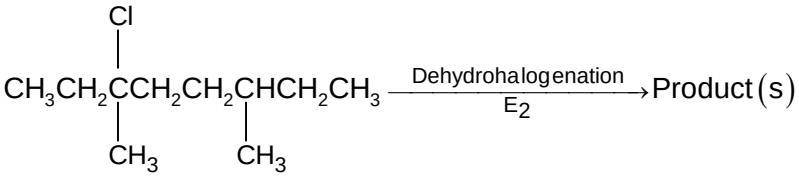
(Integer Type)

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. 

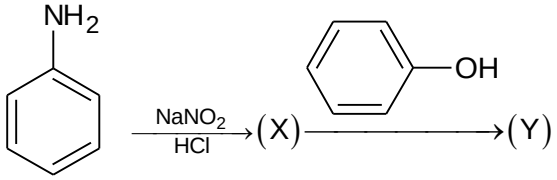
How many product(s) containing five-membered ring(s) is/are formed in the above reaction? (consider stereoisomers)

1. **1**

2. 

If the maximum number of alkene(s) formed in the above reaction is 'X', then $\frac{X}{2}$ is

2. **5**

3. 

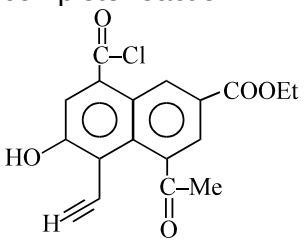
How much pi(π)- bond(s) is/are present in a molecule of (Y)?

3. **7**

4. 4.6 g of a polyhydric alcohol was treated with an excess of methyl magnesium bromide to produce 3.36 litre of CH_4 at STP. Calculate number of –OH group present in the alcohol.
(molecular weight of alcohol = 92)

4. 3

5. How many moles of Grignard reagent can react with one mole of following compound for complete reaction .



5. 7

6. How many carbon atom(s) is/are present in the simplest alkene that can form 12 hyperconjugation structure?

6. 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. If $3\tan^{-1}x + \cot^{-1}x = \pi$, then x is equal to:
   (A) 0 (B) 1
   (C) $\frac{1}{2}$ (D) $\frac{1}{\sqrt{3}}$

1. B

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. If $f(x) = 2x^6 + 3x^4 + 4x^2$ then the derivative $f'(x)$ is
   (A) even (B) odd
   (C) neither even nor odd (D) none

3. B

4. If $\int \left(\sin x + \frac{4}{x} - 2e^x\right)dx = a\cos x + b\ln x + ce^x + D$ than $a + b + c$ is
   (A) 0 (B) 1
   (C) 2 (D) None

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. If the numerical value of $\tan\left(\cos^{-1}\left(\frac{4}{5}\right) + \tan^{-1}\left(\frac{2}{3}\right)\right)$ is $\left(\frac{a}{b}\right)$, where a, b are two positive integers and their H.C.F. is 1
   (A) a + b = 23 (B) a – b = 11
   (C) 3b = a + 1 (D) 2a = 3b

5. ABC

6. The function $f(x) = \begin{cases} 5x - 4, & \text{for } 0 < x \le 1 \\ 4x^2 - 3x, & \text{for } 1 < x < 2 \\ 3x + 4, & \text{for } x \ge 2 \end{cases}$ is
   (A) continuous at $x = 1$ and $x = 2$
   (B) continuous at x = 1 but not derivable at x = 2
   (C) continuous at x = 2 but not derivable at x = 1
   (D) continuous at x = 1 and 2 but not derivable at x = 1 and x = 2

6. AB

7. If $\lim\limits_{x\to 0}(\cos x + a\sin bx)^{\frac{1}{x}} = e^2$, then the possible values of 'a' and 'b' are:

(A) a = 1, b = 2 (B) a = 2, b = 1

(C) $a = 3, b = \frac{2}{3}$ (D) $a = \frac{2}{3}, b = 3$

7. ABCD

8. Let $f(x) = \begin{cases} 1+\frac{2x}{\lambda}, & 0 \le x < 1 \\ \lambda x, & 1 \le x < 2 \end{cases}$ if $\lim\limits_{x\to 1} f(x)$ exists, then λ is

(A) – 2 (B) –1

(C) 1 (D) 2

8. BD

9. 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) $\left(-\pi, \frac{-1}{2}\right)$

9. ABC

10. If $f(x)$ is a polynomial function satisfying the condition $f(x).f\left(\frac{1}{x}\right) = f(x) + f\left(\frac{1}{x}\right)$ and $f(2) = 9$ then:

(A) $2f(4) = 3f(6)$ (B) $14f(1) = f(3)$

(C) $9f(3) = 2f(5)$ (D) $f(10) = f(11)$

10. BC

11. If tangent at point (1, 2) on curve $y = ax^2 + bx + \frac{7}{2}$ be parallel to normal at (–2, 2) on the curve $y = x^2 + 6x + 10$, then

(A) $a = 1$ (B) $a = -1$

(C) $b = \frac{-5}{2}$ (D) $b = \frac{5}{2}$

11. AC

12. If $y = \frac{x^4 + x^2 + 1}{x^2 - x + 1}$ such that $\frac{dy}{dx} = ax + b + c$ then

(A) a = 2 (B) b = 1

(C) c = 0 (D) $c \in R$

12. ABC

(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. $\lim_{x\to 0}\frac{1+x+x^2-e^x}{x^2}$ = k, then k is equal to

1. 0.5

2. $See^2(\tan^{-1}2) + cosec^2(\cot^{-1}3)$ is equal to

2. 15

3. The length of a longest interval in which the function $3\sin x - 4\sin^3 x$ is increasing is $\frac{\pi}{k}$, then k is

3. 3

4. If f, g : R $\to$ R, $f(x) = (x+1)^2$, $g(x) = x^2 + 1$ then (fog) (- 3) =

4. 121

5. $\int \frac{dx}{\sqrt{x}\left(\sqrt{x}+1\right)} = k\ln\left(\sqrt{x}+1\right)+c$ .Then k is

5. 2

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

6. 0.5

Space For Rough Work

FIITJEE COMMON TEST

BATCHES:

PHASE TEST–2: PAPER-1

JEE ADVANCED LEVEL

ANSWER KEY

ANSWER KEYS

Physics

Chemistry

Mathematics