FIITJEE Phase Test (JEE-Advanced)

PHYSICS, CHEMISTRY & MATHEMATICS

Pattern – (CPT-1) | **QP Code: 100881.2** | **PAPER - 2**

Time Allotted: 3 Hours **Maximum Marks: 183**

- 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 Parts.
3. **SECTION–I** is Physics, **SECTION–II** is Chemistry and **SECTION–III** is Mathematics.
4. Each part is further divided into **one part**: **Part – A**
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 HB pencil 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 One Part.

Part–A (01 – 07) contains 07 multiple choice questions which have one or more than one correct answer. Each question will be evaluated according to the following marking scheme.

Full Marks	**: +4**	If only (all) the correct option(s) is (are) chosen;
Partial Marks	**: +3**	If all the four options are correct but ONLY three options are chosen;
Partial Marks	**: +2**	If three or more options are correct but ONLY two options are chosen and both of which are correct;
Partial Marks	**: +1**	If two or more options are correct but ONLY one option is chosen and it is a correct option;
Zero Marks	**: 0**	If none of the options is chosen (i.e. the question is unanswered);
Negative Marks	**: –2**	In all other cases.

Part–A (08 – 14) contains 07 Multiple Choice Questions which have Only One Correct answer. Each question will be evaluated according to the following marking scheme.

Full Marks	**: +3**	If only (all) the correct option(s) is (are) chosen;
Zero Marks	**: 0**	If none of the options is chosen (i.e. the question is unanswered);
Negative Marks	**: –1**	In all other cases.

Part–A (15 – 18) contains 2 Paragraphs. Based upon each paragraph, 2 Multiple Choice Questions have to be answered. Each question has Only One Correct answer and carries **+3 marks** for the correct answer and **0 mark** for a wrong answer.

Name of the Candidate :_____

Batch :_____ **Date of Examination :**_____

Enrolment Number :_____

BATCH – SANKALAP2324PA1B-6B - PHASE-II

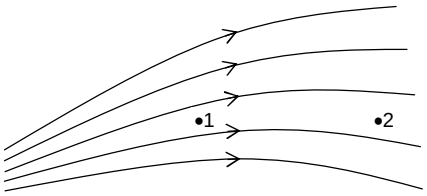
SECTION – I : PHYSICS

PART – A: (Multi Correct Answer Type)

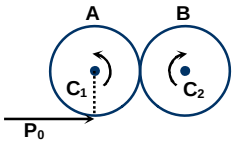
*This section contains **07 multiple choice questions.** Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.*

1. Two concentric metallic shells of radius R and 2R, out of which the inner shell is having charge Q and outer shell is uncharged. If they are connected with a conducting wire. Then,
(A) Q amount of charge will flow from inner to outer shell.
(B) Q/e number of electrons will flow from outer to inner shell, where e charge on electron.
(C) $\frac{KQ^2}{4R}$ amount of heat is produced in the wire
(D) $\frac{KQ^2}{2R}$ amount of heat is produced in the wire.

2. In the given field pattern
(A) $E_1 > E_2$
(B) $E_1 < E_2$
(C) $V_1 > V_2$
(D) $V_1 < V_2$

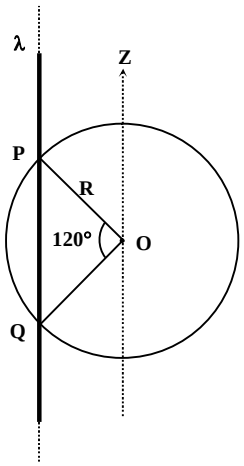


3. Two identical circular discs A and B each of mass m and radius R are placed horizontally on a smooth horizontal surface with their centres fixed to the surface and touching each other as shown. Now, an impulse P_0 is applied to the disc A as shown. If there is no slipping between the discs, then
(A) angular velocity of disc A will be $P_0/2mR$
(B) angular velocity of disc A will be P_0/mR
(C) angular velocity of disc B will be P_0/mR
(D) angular velocity of disc B will be $P_0/4Mr$



Space for rough work

4. An infinitely long thin non-conducting wire is parallel to the z-axis and carries a uniform line charge density λ. It pierces a thin non-conducting spherical shell of radius R in such a way that the arc PQ subtends an angle 120° at the centre O of the spherical shell, as shown in the figure. The permittivity of free space is ε_0. Which of the following statements is (are) true?



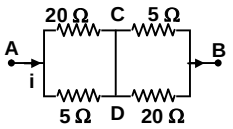
(A) The electric flux through the shell is $\sqrt{3}R\lambda / \varepsilon_0$

(B) The z-component of the electric field is zero at all the points on the surface of the shell

(C) The electric flux through the shell is $\sqrt{2}R\lambda / \varepsilon_0$

(D) The electric field is normal to the surface of the shell at all points

5. When some potential difference is maintained between A and B, currents I enters the network at A and leaves at B.



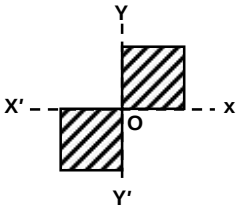
(A) The equivalent resistance between A and B is 8Ω.

(B) C and D are at the same potential.

(C) No current flows between C and D.

(D) Current 3I/5 flows from D to C.

6. Two square plate lie in the x-y plane, as shown in figure. Mass of is plate is m and side is l. then



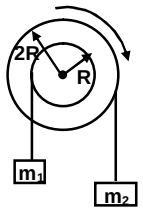
(A) Moment inertia about x axes is $\frac{2}{3}m\ell^2$

(B) Moment inertia about y axes is $\frac{2}{3}m\ell^2$

(C) Moment inertia about z axes is $\frac{8}{3}m\ell^2$

(D) Moment inertia about x axes is $\frac{1}{3}m\ell^2$

7. Two massless and inextensible strings are wound over a pulley at radius R and 2R whose free ends are attached with the blocks of masses m_1 and m_2, respectively, as shown. When the system is released from rest, the pulley starts rotating clockwise without slipping with strings. Then



(A) the relation between the accelerations of the blocks, $a_2 = 2a_1$

(B) the relation between tensions, $T_1 < 2T_2$

(C) the relation between tensions, $T_1 > 2T_2$

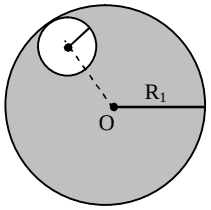
(D) the relation between the masses, $2m_2 > m_1$

Space for rough work

PART – A: (Single Correct Answer Type)

*This section contains **07 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct.***

8. Consider a uniform spherical charge distribution of radius R_1 centred at the origin O. In this distribution, a spherical cavity of radius R_2, centred at P with distance OP = a = $R_1 - R_2$ (see figure) is made. If the electric field inside the cavity at position $\vec{r}$ is $\vec{E}(\vec{r})$, then the correct statement(s) is(are)



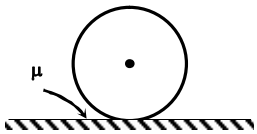
(A) $\vec{E}$ is uniform, its magnitude is independent of R_2 but its direction depends on $\vec{r}$

(B) $\vec{E}$ is uniform, its magnitude depends on R_2 and its direction depends on $\vec{r}$

(C) $\vec{E}$ is uniform, its magnitude is independent of *a* but its direction depends on $\vec{a}$

(D) $\vec{E}$ is uniform and both its magnitude and direction depend on $\vec{a}$

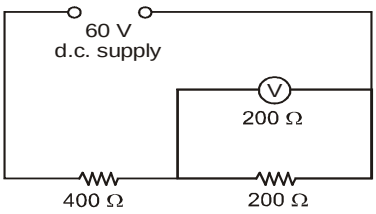
9. A disc of radius r is rotating about its centre with an angular speed ω_0. It is gently placed on a rough horizontal surface. After what time it will be in pure rolling?



(A) $\frac{\omega_0 r}{2\mu g}$ (B) $\frac{\omega_0 r}{3\mu g}$

(C) $\frac{\omega_0 r}{\mu g}$ (D) $\frac{3}{2}\frac{\omega_0 r}{\mu g}$

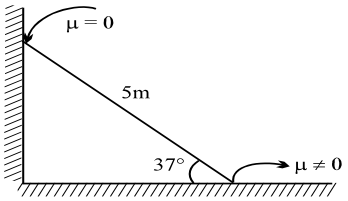
10. A constant 60 V d.c. supply is connected across two resistors of resistance 400 kΩ and 200 kΩ. What is the reading of the voltmeter also of resistance 200 kΩ, when connected across the second resistor as shown in Fig.



(A) 12 v (B) 15 V

(C) 20 V (D) 30 V

11. A 5 m long pole of 3 kg mass is placed against a smooth vertical well as shown in the figure. Under equilibrium condition, if the pole makes an angle of 37° with the horizontal, the frictional force between the pole and horizontal surface is



(A) 20 N (B) 30 N

(C) 20 μN (D) 30 μN

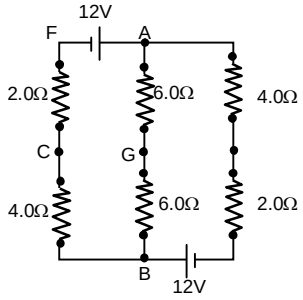
Space for rough work

12. Two identical conducting spheres, having charges of opposite sign, attract each other with a force of 0.108 N when separated by 0.5 m. The spheres are connected by a conducting wire, which is then removed, and thereafter, they repel each other with a force of 0.036 N. The initial charges on the spheres are

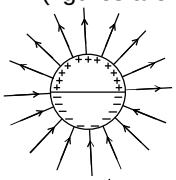
(A) $\pm (5 \times 10^{-6}$ C and 15×10^{-6} C)
(B) $\pm (1.0 \times 10^{-6}$ C and 3.0×10^{-6} C)
(C) $\pm (2.0 \times 10^{-6}$ C and 6.0×10^{-6} C)
(D) $\pm (0.5 \times 10^{-6}$ C and 1.5×10^{-6} C)

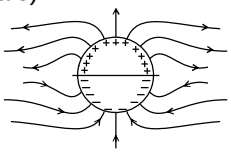
13. In the network shown in the figure, the potential difference (in Volt) across points A and B is

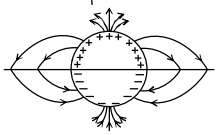
(A) 0
(B) 2
(C) 3
(D) 8

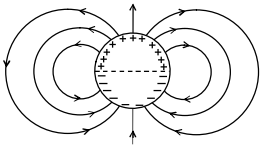


14. A long cylindrical shell carries positive surface charge density σ in the upper half and negative surface charge density $-\sigma$ in the lower half. The electric field lines around the cylinder will look like figure given in: (figures are schematic and not drawn to scale)

(A)


(B)


(C)


(D)


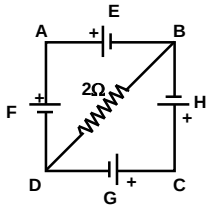
Space for rough work

PART – A: (Paragraph Type)

*This section contains **2 paragraphs.** Based upon the paragraphs **2 multiple choice questions** have to be answered. Each of these questions has 4 choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct.*

Paragraph for Question Nos. 15 and 16

In the circuit shown in fig. E, F, G and H are cells of emf 2, 1, 3 and 1 Volts respectively and their internal resistance are 2, 1, 3 and 1Ω respectively. Calculate



15. The potential difference between B and D and

(A) $\frac{2}{13}$V (B) $\frac{4}{13}$V

(C) $\frac{6}{13}$V (D) $\frac{8}{13}$V

16. The potential difference across the terminals of the cell G.

(A) $\frac{19}{13}$V (B) $\frac{17}{13}$V

(C) $\frac{21}{13}$V (D) $\frac{23}{13}$V

Paragraph for Questions 17 and 18

A uniform rod of mass 300 g and length 50 cm rotates at a uniform angular speed of 2 rad/s about an axis perpendicular to the rod through an end. Calculate

17. The angular momentum of the rod about the axis of rotation,

(A) 0.05 kg-m^2/s (B) 0.15 kg-m^2/s

(C) 1.05 kg-m^2/s (D) 0.25 kg-m^2/s

18. The speed of the centre of the rod and

(A) 25 cm/s (B) 50 cm/s

(C) 75 cm/s (D) 100 cm/s

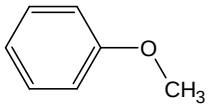
Space for rough work

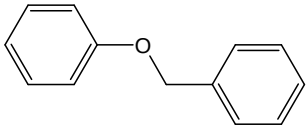
SECTION – II : CHEMISTRY

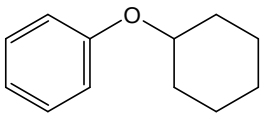
PART – A (More than one type)

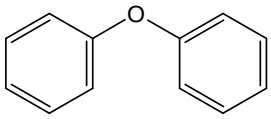
This section contains **7 multiple choice type questions.** Each question has four choices (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct.

1 Which of the following ethers are cleaved by hot conc. HI?

(A) 

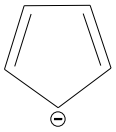
(B) 

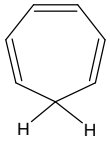
(C) 

(D) 

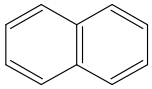
2. Grignard reagents gives alkanes with
(A) phenol (B) ether
(C) alcohol (D) water

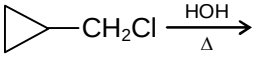
3. Which one of the following substance is/are aromatic?

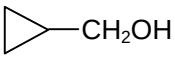
(A) 

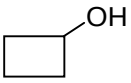
(B) 

(C) 

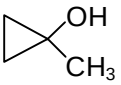
(D) 

4.  Products. Then the possible products are

(A) 

(B) 

(C) $CH_2=CH-CH_2CH_2OH$

(D) 

Space for rough work

5. Colmanite + A $\longrightarrow$ $Na_2B_4O_7$

$Na_2B_4O_7$ + B $\longrightarrow$ H_3BO_3

A and B are respectively.

(A) NaOH and H_2SO_4 (B) Na_2CO_3 and HCl (dil.)

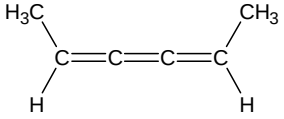
(C) Na_2CO_3 and $NaHCO_3$ (D) NaOH and $NaHCO_3$

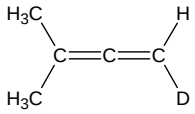
6. The polar molecule(s) among the following is/are

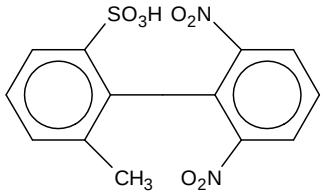
(A) 2, 2-Dimethylpropane (B) trans-2-pentene

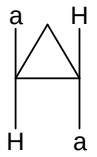
(C) cis-3-Hexene (D) 2, 2, 3, 3-tetramethylbutane

7. Which of the following compounds is/are optically inactive?

(A) 

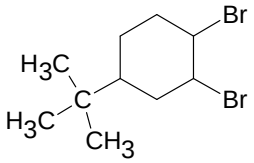
(B) 

(C) 

(D) 

PART – A: (Single Correct Answer Type)

*This section contains **07 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct.***

8. 

if no iodine liberates, what may be the possible reason

(A) inadequate ring size

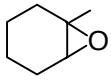
(B) two bromines are in equatorial positions

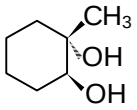
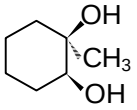
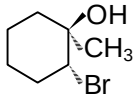
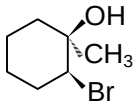
(C) two bromines are in axial positions

(D) steric hindrance of t-butyl group towards attacking I^- ion

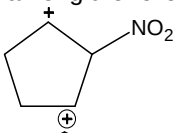
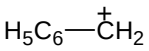
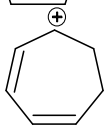
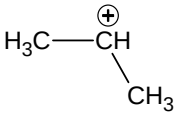
Space for rough work

9. Brominaiton of alkenes is used to distinguish alkenes from
(A) alkynes (B) alkanes
(C) both (A) and (B) (D) none of these

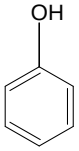
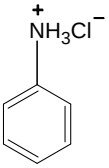
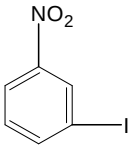
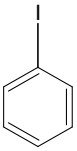
10. A $\xrightarrow{^-OH}$  ; then the best choice for A is

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

11. Which among the following carbocations is least stable?

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

12. $C_6H_6 \xrightarrow{HNO_3/H_2SO_4} A \xrightarrow{ICl} B$
The product B is

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

Space for rough work

13. Find the correct statement:
(A) 2, 4-pentanedione exists more as enol content in hexane than in water
(B) 2,4-pentanedione exists more as enol content in water than in hexane
(C) 2,4-pentanedione is equally stable in water and hexane in keto form
(D) 2,4-pentanediene exists mainly as keto form in water than in hexane

14. The reaction of 4-bromobenzyl chloride with NaCN in ethanol leads to
(A) 4-Bromobenzyl cyanide
(B) 4-Cyanobenzyl chloride
(C) 4-Cyanobenzyl cyanide
(D) 4-Bromo-2-cyanobenzyl chloride

PART – A: (Paragraph Type)

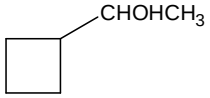
*This section contains **2 paragraphs.** Based upon the paragraphs **2 multiple choice questions** have to be answered. Each of these questions has 4 choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct.*

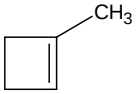
Paragraph for Questions 15 and 16

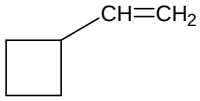
Cyclobutyl bromide when refluxed with magnesium in dry ether formed a compound (A) which on treatment with ethanal followed by acidification with dil. HCl gave another compound (B). Compound (B) has refluxed with an equivalent amount of HBr to form compound C.

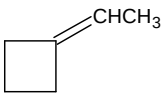
15. Type of reaction involved in the conversion of compound (A) to (B) should be
(A) Nucleophilic substitution
(B) Nucleophilic addition
(C) Electrophilic addition
(D) Electrophilic substitution

16. What will be the structure of the compound B?

(A) 

(B) 

(C) 

(D) 

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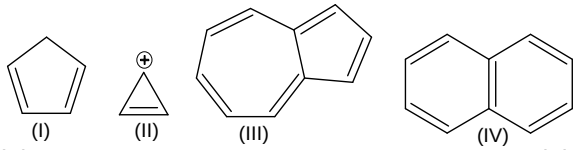
Paragraph for Question Nos. 17 and 18

Aromatic compounds are richer in carbon content then aliphatic ones. The benzene (C_6H_6) contains about 92% of carbon, but cyclohexane (C_6H_{12}) 86% of carbon content, the reason is aromatic compounds are unsaturated and are stable due to their cyclic, conjugated structures. Aromatic compounds follows Huckel's rule of aromaticity. Aromaticity is due to extensive delocalisation of πe^- in a planar ring system.

17. An aromatic compound contains
(A) $4n + 2\ \pi$ electrons
(B) must be planar
(C) cyclic conjugated system
(D) All of the above

18. Which of the following compound is not aromatic?



(A) I
(B) II
(C) both I and II
(D) both III and IV

Space for rough work

SECTION – III : MATHEMATICS

PART – A: (Multi Correct Answer Type)

*This section contains **07 multiple choice questions.** Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.*

1. If the tangents to the parabola $y^2 = 4ax$ at (x_1, y_1), (x_2, y_2) cut at (x_3, y_3), then
   (A) x_1, x_3, x_2 are in A.P. (B) x_1, x_3, x_2 are in G.P.
   (C) y_1, y_3, y_2 are in A.P. (D) y_1, y_3, y_2 are in G.P.

2. The equation of ellipse referred to the axes as the x, y axes respectively which passes through the point (–3, 1) and has the eccentricity $\sqrt{2/3}$ is/are
   (A) $\frac{x^2}{12}+\frac{y^2}{4}=1$ (B) $(x + 2)^2 + 3(y + 1)^2 = 4x + 6y + 19$
   (C) $\frac{x^2}{4}+\frac{y^2}{12}=1$ (D) none of these

3. Let e be the eccentricity of a hyperbola and f(e) be the eccentricity of its conjugate hyperbola, then $\int_1^3 \underbrace{f\,f\,f\cdots f(e)}_{\text{n times}}$ de is equal to
   (A) 4 if n is even (B) 4 if n is odd
   (C) 2 if n is even (D) $2\sqrt{2}$ if n is odd

4. Let g(x) be a function defined on [–1, 1]. If the area of the equilateral triangle with two of its vertices at (0, 0) and [x, g(x)] is $\sqrt{3}/4$, then function g(x) is
   (A) $g(x) = \pm\sqrt{1-x^2}$ (B) $g(x) = \sqrt{1-x^2}$
   (C) $g(x) = -\sqrt{1-x^2}$ (D) $g(x) = \sqrt{1+x^2}$

Space for rough work

5. The normal at a general point (a, b) on a curve makes an angle θ with x-axis which satisfies $b(-a^2 \tan\theta - \cot\theta) = a(b^2 + 1)$. The equation of curve can be

(A) $y = e^{x^2/2} + c$ (B) $\log(ky^2) = x^2$

(C) $y = ke^{x^2/2}$ (D) $x^2 - y^2 = k$

6. P is a point on the parabola $y^2 = 4x$ and Q is a point on the line $2x + y + 4 = 0$. If the line $x - y + 1 = 0$ is the perpendicular bisector of PQ, then the coordinates of P can be

(A) (1, – 2) (B) (4, 4)

(C) (9, – 6) (D) (16, 8)

7. Equation of a tangents to the circle $x^2 + y^2 = 25$ passing through (–2, 11) are

(A) $4x + 3y = 25$ (B) $3x + 4y = 38$

(C) $24x - 7y + 125 = 0$ (D) $7x + 24y = 230$

PART – A: (Single Correct Answer Type)

*This section contains **07 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct.***

8. The angle between the tangents drawn from the origin to the parabola $y^2 = 4a(x - a)$ is

(A) 90º (B) 30º

(C) $\tan^{-1}\frac{1}{2}$ (D) 45º

9. The tangent and normal to the ellipse $x^2 + 4y^2 = 4$ at a point P(θ) on it meet the major axes in Q and R respectively. If QR = 2, the eccentric angle θ of P is

(A) $\sin\theta = 2/3$ (B) $\tan\theta = 1$

(C) $\cos\theta = 2/3$ (D) none of these

10. If e_1, e_2 be respectively the eccentricities of ellipse $9x^2 + 4y^2 = 36$ and hyperbola $9x^2 - 4y^2 = 36$, then

(A) $e_1^2 + e_2^2 > 3$ (B) $e_1^2 + e_2^2 = 2$

(C) $e_1^2 + e_2^2 > 4$ (D) none of these

Space for rough work

11. The area bounded by the curve $|x| = \cos^{-1} y$ and the line |x| = 1 and the x-axis is

(A) cos 1 (B) sin 1

(C) 2 cos 1 (D) 2 sin 1

12. Solution of $\frac{dy}{dx} + 2xy = y$ is

(A) $y = ce^{x-x^2}$ (B) $y = ce^{x^2} - x$

(C) $y = ce^{x}$ (D) $y = ce^{-x^2}$

13. Consider the line $L_1 : 3x - 4y + 1 = 0$ and $L_2 : 5x - 12y - 1 = 0$. Image of $A\left(2, \frac{3}{2}\right)$ under L_1 is B and image of B under L_2 is C. Point B is

(A) $\left(\frac{44}{25}, \frac{91}{50}\right)$ (B) $\left(\frac{44}{25}, \frac{-91}{50}\right)$

(C) $\left(\frac{1}{10}, \frac{-2}{5}\right)$ (D) None of these

14. Three coins of equal radius r touch each other externally, then the radius of circle which touches all the 3 coins

(A) 2r (B) $r + \frac{2r}{\sqrt{3}}$

(C) $r - \frac{2r}{\sqrt{3}}$ (D) $2r - \frac{r}{\sqrt{3}}$

Space for rough work

PART – A: (Paragraph Type)

*This section contains **2 paragraphs.** Based upon the paragraphs **2 multiple choice questions** have to be answered. Each of these questions has 4 choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct.*

Paragraph for Question Nos. 15 and 16

A circle passing through the vertices of ΔABC is known as circumcircle of ΔABC

15. Circumcircle of the ΔABC whose sides are $x = 0$, $y = 0$ and $x + y = 4$
(A) $x^2 + y^2 - 4x - 4y = 0$ (B) $x^2 + y^2 + 4x + 4y = 0$
(C) $x^2 + y^2 + 4x - 4y = 0$ (D) none of these

16. A circle passing through the intersection of lines $x + y = 2$, $xy - 2x - 2y + 4 = 0$
(A) $x^2 + y^2 + 2x + 2y = 0$ (B) $x^2 + y^2 - 2x - 2y = 0$
(C) $x^2 + y^2 + 2x - 2y = 0$ (D) none of these

Paragraph for Question Nos. 17 to 18

For certain curves $y = f(x)$ satisfying $\frac{d^2y}{dx^2} = 6x - 4$, $f(x)$ has local minimum value 5 when $x = 1$

17. Number of critical point for $y = f(x)$ for $x \in [0, 2]$
(A) 0 (B) 1
(C) 2 (D) 3

18. Global minimum value of $y = f(x)$ for $x \in [0, 2]$ is
(A) 5 (B) 7
(C) 8 (D) 9

Space for rough work

FIITJEE INTERNAL TEST

PHYSICS, CHEMISTRY & MATHEMATICS

CPT–1 | **PHASE-II** | **CODE: 100881.2** | **PAPER–2**

ANSWERS

PHYSICS (SECTION–I)

1.	**A, B, C**	2.	**A, C**	3.	**B, C**	4.	**A, B**
5.	**A, B, D**	6.	**A, B**	7.	**A, B, D**	8.	**D**
9.	**B**	10.	**A**	11.	**A**	12.	**B**
13.	**A**	14.	**D**	15.	**A**	16.	**C**
17.	**A**	18.	**B**				

CHEMISTRY (SECTION–II)

1.	**A, B, C**	2.	**A, C, D**	3.	**A, C, D**	4.	**A, B, C, D**
5.	**B**	6.	**B, C**	7.	**A, B, C**	8.	**B**
9.	**B**	10.	**C**	11.	**A**	12.	**C**
13.	**A**	14.	**A**	15.	**B**	16.	**A**
17.	**D**	18.	**A**				

MATHEMATICS (SECTION–III)

1.	**B, C**	2.	**A, B**	3.	**A, D**	4.	**B, C**
5.	**B, C, D**	6.	**A, C**	7.	**A, C**	8.	**A**
9.	**C**	10.	**A**	11.	**D**	12.	**A**
13.	**A**	14.	**B**	15.	**A**	16.	**B**
17.	**C**	18.	**A**				