

JEE-ADVANCE: TEST-04

TEST SERIES

PAPER-I

Time : 3 hrs.

M.M.: 180

TEST CODE - A

TOPIC COVERED :

PHYSICS: Complete XI and XII Syllabus

CHEMISTRY: Complete XI and XII Syllabus

MATHEMATICS: Complete XI and XII Syllabus

ATTENTION: *Kindly ask for the Roll No. from the invigilator to fill in OMR SHEET. Mark the Roll No. & Test code on the answer sheet properly. (No other sheet will be issued)*

GENERAL INSTRUCTIONS :

1. The Test Paper consists of **60** questions
2. There are **Three Subjects (Physics, Chemistry & Mathematics)** in the question paper.
3. **This paper is divided into 3 parts: Physics Section (I), (II) and (III); Chemistry Section (I), (II) and (III) & Mathematics Section (I), (II) and (III).**
 - **Single Choice: Physics Section (I) (1 to 10) Chemistry Section I (16 to 25) and Mathematics Section I (31 to 40), 2 marks for each correct answer and no negative marking for incorrect answer.**
 - **Multiple correct answer type questions : Physics Section (II) (11 to 15) Chemistry Section II (26 to 30) and Mathematics Section II (41 to 45), 4 marks for each correct answer and -1 mark for incorrect answer.**
 - **Integer Type: Physics Section-III (1 to 5); Chemistry Section-III (6 to 10) and Mathematics Section- III (11 to 15), for each question you will be awarded 4 marks if you darken the bubble corresponding to the correct answer and zero mark if no bubbles are darkened. In all other cases, minus one (-1) mark will be awarded.**

Name of the Student : _____

Section : _____

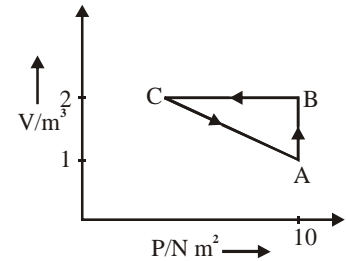
Centre : _____

Invigilator's Signature : _____

SECTION- I: STRAIGHT OBJECTIVE TYPE

This section contains 10 multiple choice questions numbered 1 to 10. Each question has 4 choice (A), (B), (C) and (D), out of which ONLY-ONE is correct

1. An ideal gas is taken through the cycle $A \rightarrow B \rightarrow C \rightarrow A$, as shown in the figure. If the net heat supplied to the gas in the cycle is 5J, the work done by the gas in the process $C \rightarrow A$ is



- (a) -5 J (b) -10 J
 (c) -15 J (d) -20 J

2. A long straight wire along the z -axis carries a current I in the negative z -direction. The magnetic vector field \vec{B} at a point having coordinates (x, y) in the $z = 0$ plane is

- (a) $\left(\frac{\mu_0 I}{2\pi}\right)\frac{(y\hat{i} - x\hat{j})}{(x^2 + y^2)}$ (b) $\left(\frac{\mu_0 I}{2\pi}\right)\frac{(x\hat{i} + y\hat{j})}{(x^2 + y^2)}$ (c) $\left(\frac{\mu_0 I}{2\pi}\right)\frac{(x\hat{j} - y\hat{i})}{(x^2 + y^2)}$ (d) $\left(\frac{\mu_0 I}{2\pi}\right)\frac{(x\hat{i} - y\hat{j})}{(x^2 + y^2)}$

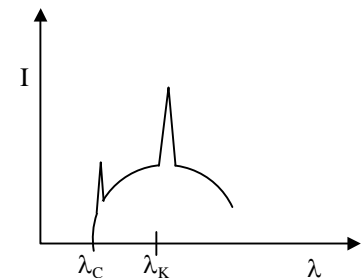
3. Two blocks of masses 10 kg and 4 kg are connected by a spring of negligible mass and placed on a frictionless horizontal surface. An impulse gives a velocity of 14 ms^{-1} to the heavier block in the direction of the lighter block. The velocity of the centre of mass is

- (a) 30 ms^{-1} (b) 20 ms^{-1} (c) 10 ms^{-1} (d) 5 ms^{-1}

4. A siren placed at a railway platform is emitting sound of 5 kHz frequency. A passenger sitting in a moving train A records a frequency of 5.5 kHz while the train approaches the siren. During his return journey in a different train B, he records a frequency of 6.0 kHz while approaching the same siren. The ratio of the velocity of the train B to that of the train A is

- (a) 242 : 252 (b) 2 : 1 (c) 5 : 6 (d) 11 : 6

5. The intensity of X-rays from a Coolidge tube is plotted against wavelength λ as shown in the figure. The minimum wavelength found is λ_C and the wavelength of the K_α line is λ_K . As the accelerating voltage is increased



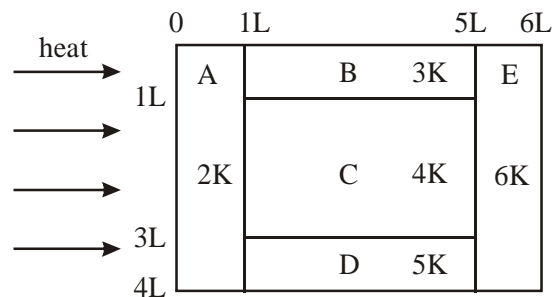
- (a) $\lambda_K - \lambda_C$ increases (b) $\lambda_K - \lambda_C$ decreases
 (c) λ_K increases (d) λ_K decreases

6. The ends of a stretched wire of length L are fixed at $x = 0$ and $x = L$. In one experiment the displacement of the wire is $y_1 = A \sin(\pi x/L) \sin \omega t$ and the energy is E_1 , and in another experiment the displacement is $y_2 = A \sin(2\pi x/L) \sin 2\omega t$ and the energy is E_2 . Then
- (a) $E_2 = E_1$ (b) $E_2 = 2E_1$ (c) $E_2 = 4E_1$ (d) $E_2 = 16E_1$
7. Electrons each having the energy 80 keV are incident on the tungsten target of an X-ray tube. K-shell electrons of tungsten have -72.5 keV energy. The X-rays emitted by the tube contain only
- (a) a continuous X-ray spectrum (bremsstrahlung) with a minimum wavelength of ~ 0.0155 nm
 (b) a continuous X-ray spectrum (bremsstrahlung) with a minimum wavelengths
 (c) the characteristic X-ray spectrum of tungsten
 (d) a continuous X-ray spectrum (bremsstrahlung) with a minimum wavelength of ~ 0.0155 nm and the characteristic X-ray spectrum of tungsten.
8. A long horizontal rod has a bead which can slide along its length and is initially placed at a distance L from one end A of the rod. The rod is set in angular motion about A with a constant angular acceleration α . If the coefficient of friction between the rod and the bead is μ and the gravity is neglected, the time after which the bead starts slipping is
- (a) $\sqrt{\frac{\mu}{\alpha}}$ (b) $\frac{\mu}{\sqrt{\alpha}}$ (c) $\frac{1}{\sqrt{\mu\alpha}}$ (d) infinitesimal
9. The electron in a hydrogen atom makes a transition from an excited state to the ground state. Which of the following statements is true?
- (a) Its kinetic energy increases, and the potential and total energies decrease.
 (b) Its kinetic energy decreases but the potential energy increases, and thus the total energy remains the same.
 (c) Its kinetic and total energies decrease and the potential energy increases.
 (d) Its kinetic, potential and total energies decrease.
10. When an object is placed in front of a concave mirror of focal length f , a virtual image is produced with a magnification of 2. To obtain a real image with a magnification of 2, the object has to be moved by a distance equal to
- (a) $\frac{f}{2}$ (b) $\frac{2f}{3}$ (c) f (d) $\frac{3f}{2}$

SECTION- II: MULTIPLE CORRECT ANSWERS TYPE

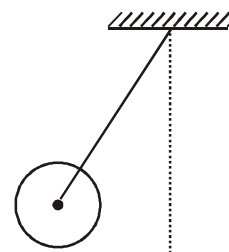
This section contains 5 multiple choice questions numbered 11 to 15. Each question has 4 choice (A), (B), (C) and (D), out of which ONE OR MORE is/are correct

11. A composite block is made of slabs A, B, C, D and E of different thermal conductivities (given in terms of a constant K) and sizes (given in terms of length, L) as shown in the figure. All slabs are of same width. Heat ' Q ' flows only from left to right through the blocks. Then in steady state



- (a) heat flow through A and E slabs are same
- (b) heat flow through slab E is maximum
- (c) temperature difference across slab E is smallest
- (d) heat flow through C = heat flow through B + heat flow through D

12. A metal rod of length ' L ' and mass ' m ' is pivoted at one end. A thin disk of mass ' M ' and radius ' R ' ($< L$) is attached at its centre to the free end to the rod. Consider two ways the disc is attached: (case A) The disc is not free to rotate about its centre and (case B) the disc is free to rotate about its centre. The rod-disc system performs SHM in vertical plane after being released from the same displaced position. Which of the following statement (s) is (are) true?



- (a) Restoring torque in case A = Restoring torque in case B
- (b) Restoring torque in case A < Restoring torque in case B
- (c) Angular frequency for case A > Angular frequency for case B
- (d) Angular frequency for case A < Angular frequency for case B

13. An electron and a proton are moving on straight parallel paths with same velocity. They enter a semi-infinite region of uniform magnetic field perpendicular to the velocity. Which of the following statement (s) is/are true?

- (a) They will never come out of the magnetic field region
- (b) They will come out travelling along parallel paths
- (c) They will come out at the same time
- (d) They will come out at different times.

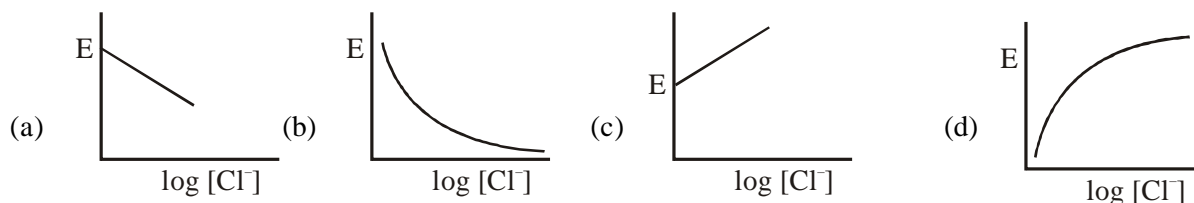
14. A spherical metal shell A of radius R_A and a solid metal sphere B of radius R_B ($< R_A$) are kept far apart and each is given charge $+Q$. Now they are connected by a thin metal wire. Then
- (a) $E_A^{inside} = 0$ (b) $Q_A > Q_B$
- (c) $\frac{\sigma_A}{\sigma_B} = \frac{R_B}{R_A}$ (d) $E_A^{on\ surface} < E_B^{on\ surface}$
15. Which of the following statement(s) is/are correct?
- (a) If the electric field due to a point charge varies as $r^{-2.5}$ instead of r^{-2} , then the Gauss law will still be valid
- (b) The Gauss law can be used to calculate the field distribution around an electric dipole
- (c) If the electric field between two point charges is zero somewhere, then the sign of the two charges is the same
- (d) The work done by the external force in moving a unit positive charge from point A at potential V_A to point B at potential V_B is $(V_B - V_A)$

CHEMISTRY

SECTION- I: STRAIGHT OBJECTIVE TYPE

This section contains 10 multiple choice questions numbered 16 to 25. Each question has 4 choice (A), (B), (C) and (D), out of which ONLY-ONE is correct

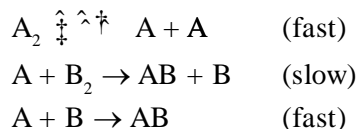
16. One molal solution of a complex of cobalt chloride with NH_3 in water showed an elevation in boiling point equal to 2.08° . Assuming that the complex is completely ionized in the solution, the complex is (K_b for water = $0.52 \text{ K kg mol}^{-1}$)
- (a) $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$ (b) $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$ (c) $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}$ (d) None of these
17. For the calomel electrode, $\text{Hg}, \text{Hg}_2\text{Cl}_2 | \text{Cl}^-(\text{aq})$, electrode potentials measured at different Cl^- ion concentration are plotted against $\log [\text{Cl}^-]$. The variation is correctly represented by the plot



18. The emf of the cell $\text{Zn} | \text{Zn}^{2+} (0.01 \text{ M}) || \text{Fe}^{2+} (0.001 \text{ M}) | \text{Fe}$ at 298 K is 0.2905 volt. Then the value of equilibrium constant for the cell reaction is

- (a) $\frac{0.32}{e^{0.0295}}$ (b) $\frac{0.32}{10^{0.0295}}$ (c) $\frac{0.26}{10^{0.0295}}$ (d) $\frac{0.32}{10^{0.0591}}$

19. A hypothetical reaction, $\text{A}_2 + \text{B}_2 \rightarrow 2\text{AB}$, follows the mechanism as given below:



The overall order of reaction is

- (a) zero (b) 1 (c) $1\frac{1}{2}$ (d) 2

20. Under the same reaction conditions, initial concentration of $1.386 \text{ mol dm}^{-3}$ of a substance becomes half in 40 seconds and 20 seconds through first order and zero order kinetics respectively. Ratio (k_1/k_0) of the rate constants for first order (k_1) and zero order (k_0) of the reactions is

- (a) $0.5 \text{ mol}^{-1} \text{ dm}^3$ (b) 1.0 mol dm^{-3} (c) 1.5 mol dm^{-3} (d) $2.0 \text{ mol}^{-1} \text{ dm}^3$

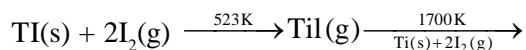
21. According to Freundlich adsorption isotherm, which of the following is correct?

- (a) $\frac{x}{m} \propto p^0$ (b) $\frac{x}{m} \propto p^1$
 (c) $\frac{x}{m} \propto p^{1/n}$ (d) all the above are correct for different ranges of pressure

22. Among the following, surfactant that will form micelles in aqueous solution at the lowest molar concentration at ambient conditions is

- (a) $(\text{CH}_3)_3(\text{CH}_2)_{15}\text{N}^+(\text{CH}_3)_3\text{Br}^-$ (b) $\text{CH}_3(\text{CH}_2)_{11}\text{OSO}_3^-\text{Na}^+$
 (c) $\text{CH}_3(\text{CH}_2)_6\text{COO}^-\text{Na}^+$ (d) $\text{CH}_3(\text{CH}_2)_{11}\text{N}^+(\text{CH}_3)_3\text{Br}^-$

23. Which method of purification is represented by the following equation?



- (a) Cupellation (b) Poling (c) Van arkel (d) Zone refining

24. Bleaching powder contains a salt of an oxoacid as one of its components. The anhydride of that oxoacid is

- (a) Cl_2O (b) Cl_2O_7 (c) ClO_2 (d) Cl_2O_6

25. When Cl_2 gas reacts with hot and concentrated sodium hydroxide solution, the oxidation number of chlorine changes from
- (a) zero to +1 and zero to +5 (b) zero to -1 and zero to +5
(c) zero to -1 and zero to +3 (d) zero to +1 and zero to -3

SECTION- II: MULTIPLE CORRECT ANSWERS TYPE

This section contains 5 multiple choice questions numbered 26 to 30. Each question has 4 choice (A), (B), (C) and (D), out of which ONE OR MORE is/are correct

26. Which of the following can act as bidentate ligands?
- (a) oxalate (b) carbonate (c) sulphate (d) nitrate
27. Which of the following statements are correct when a mixture of NaCl and $\text{K}_2\text{Cr}_2\text{O}_7$ is gently warmed with conc. H_2SO_4 ?
- (a) a deep red vapour is evolved
(b) The vapour when passed into NaOH solution gives yellow solution of Na_2CrO_4
(c) chlorine gas is evolved
(d) chromyl chloride is formed
28. HI cannot be prepared by the action of conc. H_2SO_4 on KI because
- (a) HI is stronger acid than H_2SO_4 (b) H_2SO_4 is an oxidising agent
(c) H_2SO_4 is stronger than HI (d) HI is a strong reducing agent
29. SO_2 acts as a/an
- (a) Bleaching agent (b) Oxidising agent (c) Reducing agent (d) Disinfectant
30. Extraction of metal from the one cassiterite involves
- (a) carbon reduction of an oxide ore (b) self-reduction of a sulphide one
(c) removal of copper impurity (d) Removal of iron impurity

SECTION- I: STRAIGHT OBJECTIVE TYPE

This section contains 10 multiple choice questions numbered 31 to 40. Each question has 4 choice (A), (B), (C) and (D), out of which ONLY-ONE is correct

31. $\sum_{0 \leq i < j \leq n} {}^n C_i$ is equal to
 (a) $n \cdot 2^{n-1}$ (b) $(n+1) \cdot 2^{n-1}$ (c) $(n+1) \cdot 2^n$ (d) none of these
32. $\int_{-\infty}^0 e^x \frac{x}{(x+n)^{n+1}} dx$ is equal to
 (a) $\frac{1}{n^{n+1}}$ (b) $\frac{1}{(n+1)^n}$ (c) $\frac{1}{n^n}$ (d) $\frac{1}{(n+1)^{n+1}}$
33. The circumcentre of the triangle formed by the tangents and the chord of contact from the point $(-1, 4)$ to the parabola $y^2 = 4x$ is
 (a) $(9, 4)$ (b) $(4, 9)$ (c) $(2, 6)$ (d) $(6, 2)$
34. From a point (h, k) , tangents are drawn to $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ such that the chord of contact passes through the point $(0, 0)$, then (h, k) can be
 (a) $(5, 3)$ (b) $(3, 5)$ (c) $(4, -5)$ (d) no such point exists
35. Tangents PA and PB are drawn to the hyperbola $\frac{x^2}{4} - \frac{y^2}{2} = 1$ from $P\left(\frac{1}{\sqrt{2}}, \sqrt{\frac{3}{2}}\right)$, then $\angle APB$ is
 (a) $\pi/2$ (b) $\pi/6$ (c) $\pi/4$ (d) $\pi/3$
36. $f(x) = \begin{cases} x-4, & -4 \leq x \leq 0 \\ 4-x, & 0 < x \leq 4 \end{cases}$ and $g(x) = |f(x)|$, $f \circ g =$
 (a) $x-8$ (b) x (c) $8-x$ (d) none of these
37. The lines $\frac{x-a+d}{\alpha-\delta} = \frac{y-a}{\alpha} = \frac{z-a-d}{\alpha+\delta}$, $\frac{x-b+c}{\beta-\gamma} = \frac{y-b}{\beta} = \frac{z-b-c}{\beta+\gamma}$ are coplanar, and the equation to the plane in which they lie is
 (a) $x+y+z=0$ (b) $x-y+z=0$ (c) $x-2y+z=0$ (d) $x+y-2z=0$

38. The maximum value of $t_1 t_2 t_3$, where $t_1 t_2 t_3 = (1 - t_1)(1 - t_2)(1 - t_3)$ & $0 \leq t_i \leq 1$, is
- (a) $\frac{1}{8}$ (b) $\frac{1}{2}$ (c) $\frac{1}{2\sqrt{2}}$ (d) $\frac{1}{4}$
39. If a circle passes through the point (1, 2) and cuts the circle $x^2 + y^2 = 4$ orthogonally, then the locus of its centre is
- (a) $2x + 4y - 9 = 0$ (b) $2x + 4y - 1 = 0$
(c) $x^2 + y^2 - 3x - 8y + 1 = 0$ (d) $x^2 + y^2 - 2x - 6y - 7 = 0$
40. Which of the following functions is differentiable at $x = 0$?
- (a) $\cos(|x|) + |x|$ (b) $\cos(|x|) - |x|$ (c) $\sin(|x|) - |x|$ (d) $\sin(|x|) + |x|$

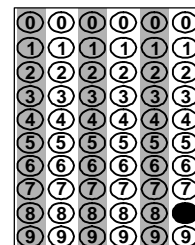
SECTION- II: MULTIPLE CORRECT ANSWERS TYPE

This section contains 5 multiple choice questions numbered 41 to 45. Each question has 4 choice (A), (B), (C) and (D), out of which ONE OR MORE is/are correct

41. If $f(x) = \left(\frac{x}{2+x}\right)^{2x}$, then
- (a) $\lim_{x \rightarrow \infty} f(x) = e^{-6}$ (b) $\lim_{x \rightarrow \infty} f(x) = 2$ (c) $\lim_{x \rightarrow \infty} f(x) = e^{-4}$ (d) $\lim_{x \rightarrow 1} f(x) = 1/9$
42. The $\lim_{x \rightarrow 0} x^8 \left[\frac{1}{x^3} \right]$ (where $[x]$ is greatest integer function) is
- (a) a non zero real number (b) a rational number
(c) an integer (d) zero
43. The function $f(x) = \tan^{-1}x - x$ decreases in the interval
- (a) $(1, \infty)$ (b) $(-1, \infty)$ (c) $(-\infty, \infty)$ (d) $(0, \infty)$
44. The function $y = x/(1 + x^2)$ decreases in the interval
- (a) $(-1, 1)$ (b) $[1, \infty)$ (c) $(-\infty, -1]$ (d) $(-\infty, \infty)$
45. If $I_1 = \int_0^\pi \frac{x \sin x}{1 + \cos^2 x} dx$, $I_2 = \int_0^\pi x \sin^4 x dx$ then $I_1 : I_2 =$
- (a) 3 : 4 (b) 1 : 2 (c) 4 : 3 (d) 2 : 3

SECTION- III: INTEGER ANSWER TYPE

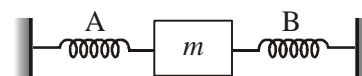
This section contains 15 questions. The answer to each of the question is a single digit integer, ranging from 0 to 9. The bubble corresponding to the correct answer is to be darkened in the ORS. The appropriate bubbles corresponding to the answers to these questions have to be darkened as illustrated in the following example: If answer of question number (1) is 8, then the correct darkening of bubbles will look like the following.



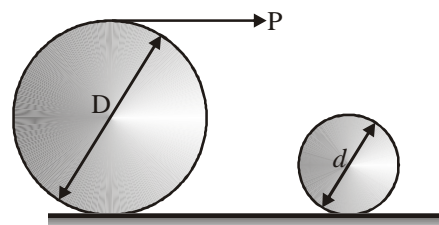
PHYSICS

1. An ideal battery sends a current of 5 A in a resistor. When another resistor of value $10\ \Omega$ is connected in parallel, the current through the battery is increased to 6 A. Find the resistance of the first resistor.
2. The magnification of an object placed in front of a convex lens is +2. The focal length of the lens is 2.9 m. Find the distance by which the object has to be moved to obtain a magnification of -2 (in metres).
3. A ray of light is incident at an angle of 60° on one face of a prism which has an angle of 30° . The ray emerging out of the prism makes an angle of 30° with the incident ray. If the refractive index of the material of the prism is $\mu = \sqrt{a}$, find the value of a .

4. A mass m attached to a spring A has a frequency of 3 Hz and a spring B has a frequency of 4 Hz. When both springs are connected as shown in the figure, find the frequency (in Hz) of oscillation.



5. Two cylindrical rollers of diameters D and d rest on a horizontal plane as shown in the figure. The larger roller wound round with a string is pulled with a horizontal force P . Assuming that the coefficient of friction is μ for all surfaces of contact, find the larger value of μ (in 10^{-1}) as the larger roller can be pulled over the smaller one.



CHEMISTRY

6. How many of the following are thermosetting polymer? Polyester, SBR, bakelite, Polyvinyl acetate, Urea-formaldehyde resin, Melamine-formaldehyde resin, nylon 6, 6 polypropylene, thiokol.
7. How many of the following amines do not evolve N_2 on treatment with $NaNH_2/HCl$?
8. Denticity of ethylenediaminetetraacetate ion is

9. Amongst the following, the number of noble gases which can form interstitial compounds is He, Ne, Ar, Kr, Xe, Rn
10. If potassium ferrocyanide is 75% ionized in the solution, its van't Hoff factor is

MATHEMATICS

11. If the points $(a, 1)$, $(1, b)$ and $(a - 1, b - 1)$ are collinear, α , β , are respectively the arithmetic and geometric means of a and b , then $4\alpha - \beta^2$ is equal to
12. The square of the differences of the slopes of the lines represented by the equation $x^2 (\sec^2\theta - \sin^2\theta) - 2xy \tan \theta + y^2 \sin^2\theta = 0$ is
13. The tangents to the circle $x^2 + y^2 = 3$ which are inclined at an angle of 60° with the x-axis form a rhombus, the length of its sides is
14. Two circles are such that one is inscribed in and the other is circumscribed about a square $A_1 A_2 A_3 A_4$. If the length of each side of the square is a and P , Q are two points respectively on these circles, then $\left| \sum_{i=1}^4 (PA_i)^2 - \sum_{i=1}^4 (QA_i)^2 \right| = Ka^2$, then K is
15. The circles $x^2 + y^2 + 2g_1x - a^2 = 0$ and $x^2 + y^2 + 2g_2x - a^2 = 0$ cut each other orthogonally. If P_1 , P_2 are perpendiculars from $(0, a)$ and $(0, -a)$ on a common tangent of these circles, then $6P_1 P_2 = Ka^2$, then K is **3**

JEE-ADVANCE: TEST-04

TEST SERIES

PAPER-I

Time : 3 hrs.

M.M.: 180

TEST CODE - A

ANSWERS

Physics: Section I to II

- | | | | | | |
|-----------|---------------|-------------|---------|-------------|-----------|
| 1. (a) | 2. (a) | 3. (c) | 4. (b) | 5. (a) | 6. (c) |
| 7. (d) | 8. (a) | 9. (a) | 10. (c) | 11. (a,c,d) | 12. (a,d) |
| 13. (b,d) | 14. (a,b,c,d) | 15. (a,c,d) | | | |

Chemistry: Section I to II

- | | | | | | |
|-------------|---------------|-------------|---------|-------------|-------------|
| 16. (a) | 17. (c) | 18. (b) | 19. (c) | 20. (a) | 21. (d) |
| 22. (a) | 23. (c) | 24. (a) | 25. (b) | 26. (a,b,c) | 27. (a,b,d) |
| 28. (a,b,d) | 29. (a,b,c,d) | 30. (a,c,d) | | | |

Mathematics: Section I to II

- | | | | | | |
|---------------|-----------|---------|---------|-----------|-------------|
| 31. (a) | 32. (c) | 33. (a) | 34. (d) | 35. (a) | 36. (b) |
| 37. (c) | 38. (a) | 39. (a) | 40. (c) | 41. (c,d) | 42. (b,c,d) |
| 43. (a,b,c,d) | 44. (b,c) | 45. (c) | | | |

Section-III (PCM)

- | | | | | | |
|---------|---------|---------|---------|---------|---------|
| 1. (2) | 2. (2) | 3. (3) | 4. (5) | 5. (5) | 6. (3) |
| 7. (0) | 8. (6) | 9. (1) | 10. (4) | 11. (3) | 12. (4) |
| 13. (4) | 14. (1) | 15. (3) | | | |