

FIITJEE INTERNAL TEST

PHYSICS, CHEMISTRY & MATHEMATICS

QP CODE: 101111

Common Test-6

Time Allotted: 3 Hours

Maximum Marks: 180

- 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 Four (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 (05-08)** contains (4) 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 option(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** – This section contains Eight (08) questions numerical based questions. The answer to each question is a **NUMERICAL VALUE**. If the numerical value has more than two decimal places, truncate/round-off the value to **TWO** decimal places. Each question carries **+4 marks** for correct answer. **There is no negative marking.**

Name of the Candidate: _____

Batch: _____ Date of Examination: _____

Enrolment Number: _____

Batches – Two Year CRP(2426) Batches

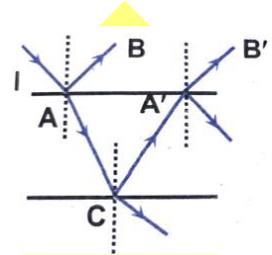
SECTION – I: PHYSICS

(PART – 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 ray of light of intensity I is incident on a parallel glass slab at point A as shown in the figure. It undergoes partial reflection and refraction. At each reflection 25% of incident energy is reflected. The ray AB and A'B' undergo interference. The ratio I_{\max}/I_{\min} is
 (A) 4 : 1
 (B) 8 : 1
 (C) 7 : 1
 (D) 49 : 1



2. In Young's double slit experiment the two slits act as coherent sources of equal amplitude A and wavelength λ . In another experiment with the same set-up the two slits are source of equal amplitude A and wavelength λ , but are incoherent. The ratio of the intensity of light at the midpoint of the screen in the first case to that in second case is
 (A) 1
 (B) 2
 (C) 3
 (D) 4

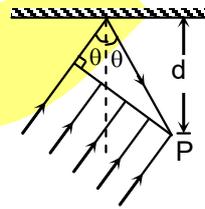
3. A plane wave front of light is incident on a plane mirror. Intensity is maximum at P when

(A) $\cos \theta = \frac{\lambda}{2d}$

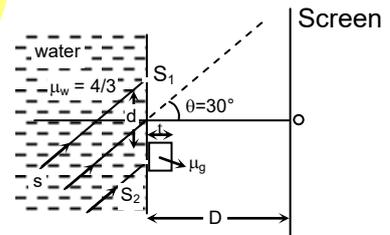
(B) $\cos \theta = \frac{3\lambda}{4d}$

(C) $\sec \theta - \cos \theta = \frac{3\lambda}{4d}$

(D) $\sec \theta - \cos \theta = \frac{\lambda}{2d}$



4. In a YDSE experiment, the two slits are covered with a transparent membrane of negligible thickness which allows light to pass through it but does not allow water. A glass slab of thickness $t = 0.41$ mm and refractive index $\mu_g = 1.5$ is placed in front of one of the slits as shown in the figure. The separation between the slits is $d = 0.30$ mm. The entire space to the left of the slits is filled with water of refractive index $\mu_w = 4/3$.



A coherent light of intensity I and absolute wavelength $\lambda = 5000\text{\AA}$ is being incident on the slits making an angle 30° with horizontal. If screen is placed at a distance $D = 1\text{m}$ from the slits, then the position of central maxima will be

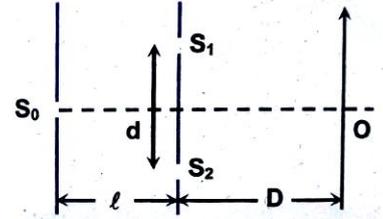
- (A) 0.58 cm above the central line of slits
 (B) 0.58 cm below the central line of slits
 (C) 1.66 cm above the central line of slits
 (D) 1.66 cm below the central line of slits

Space For Rough Work

(One or More Than One Options Correct Type)

This section contains **4 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 figure shows a schematic diagram of Young's double slit experiment. Given $D \ll \ell$, $d \ll D$, $\lambda/D \ll 1$. Which of the following is/are a right statement about the wavelength of light used?



- (A) Larger the wavelength, larger will be the fringe width.
 (B) If white light is used, violet colour forms its first maxima closest to the central maxima.
 (C) The central maxima of all wavelengths coincide.
 (D) Smaller the wavelength, smaller will be the fringe width.

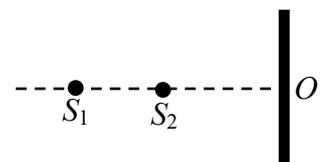
6. In Young's double slit experiment, double slit of separation 0.1 cm is illuminated by white light. A coloured interference pattern is formed on a screen 100 cm away. If a pin hole is located on this screen at a distance of 2 mm from the central fringe, the wavelength in the visible spectrum which will be absent in the light transmitted through the pin-hole are

- (A) 5714 Å (B) 4444 Å (C) 5500 Å (D) 4500 Å

7. Two coherent waves represented by $y_1 = A \sin\left(\frac{2\pi x_1}{\lambda} - \omega t + \frac{\pi}{4}\right)$ and $y_2 = A \sin\left(2\pi \frac{x_2}{\lambda} - \omega t + \frac{\pi}{6}\right)$ are superposed. The two waves will produce

- (A) constructive interference at $(x_1 - x_2) = \frac{11}{24} \lambda$
 (B) constructive interference at $(x_1 - x_2) = \frac{23}{24} \lambda$
 (C) destructive interference at $(x_1 - x_2) = \frac{23}{24} \lambda$
 (D) destructive interference at $(x_1 - x_2) = \frac{11}{24} \lambda$

8. Two monochromatic and coherent point sources of light of wavelength λ are placed on the dotted line in front of an finite screen. The source emit waves in phase with each other. The distance between S_1 and S_2 is d while their distance from the screen is much larger. Then



- (A) If $d = 7\lambda/2$, O will be a minima
 (B) If $d = 4.3 \lambda$, there will be a total of 8 minima on screen
 (C) If $d = 7 \lambda$, O will be a maxima
 (D) If $d = \lambda$, there will be only one maxima on the screen

Space For Rough Work

(PART – B)

This section contains **Eight (08)** numerical based questions. The answer to each question is a NUMERICAL VALUE. If the numerical value has more than two decimal places, truncate/round-off the value to TWO decimal places.

1. In YDSE experiment if the screen is shifted by a distance of 0.5 m away from the slit, the position of 3rd maxima is 3×10^{-4} m. If the distance between the slits is 2×10^{-3} m and the wavelength used in the experiment is 100 nm then find the value of 'n'.
2. The intensity of the light coming from one of the slits in a Young's double slit experiment is four times the intensity from the other slit. Find the ratio of the maximum intensity to the minimum intensity in the interference fringe pattern observed.
3. The maximum intensity in Young's double slit experiment is I_0 . Distance between the slits is $d = 5\lambda$, where λ is the wavelength of monochromatic light used in the experiment. What will the ratio of the intensity of central maxima to the intensity of light in front of one of the slits on a screen at a distance $D = 10d$? (Assuming $D \gg d$)
4. In a Young's double-slit experiment, the slits are 2 mm apart and are illuminated with a mixture of two wavelengths $\lambda = 750$ nm and $\lambda' = 900$ nm. At what minimum distance (in mm) from the common central bright fringe on a screen 4m from the slits will a bright fringe from one interference pattern coincide with a bright fringe from the other?
5. In a Fraunhofer diffraction experiment at a single slit using a light of wavelength 400 nm, the first minimum is formed at an angle 30° . The direction θ of the first secondary maximum is $\sin^{-1}\left(\frac{k}{4}\right)$. Find the value of 'k'.
6. Fringes are produced using light of wavelength $\lambda = 4800 \text{ \AA}$ in a double-slit experiment. One of the slits is covered by a thin plate of glass of refractive index 1.4 and other slit by another plate of glass of double the thickness and of refractive index 1.7. During this process, the central bright fringe shifts to a position originally occupied by the fifth bright fringe from the centre. If the thickness of thin glass plate is $4n \times 10^{-7}$ m, then $n =$
7. On introducing a thin sheet of mica (thickness 12×10^{-5} cm) in path of one of the interfering beams in Young's double slit experiment, the central fringe is shifted through a distance equal to the spacing between successive bright fringes. Find the double of the refractive index of mica is (wavelength of light used $\lambda = 6 \times 10^{-5}$ cm).
8. In Young's double slit experiment, the slits are 0.5 mm apart and interference is observed on a screen placed at a distance of 100 cm from the slits. It is found that the 9th bright fringe is at a distance of 8.835 mm from the 2nd dark fringe from the centre of fringe pattern. If the wavelength of light used is $2.945n \times 10^{-7}$ m, then $n =$

Space For Rough Work

SECTION – II: CHEMISTRY

(PART – 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**.

- Arrange the following complexes in order of increasing wavelength of visible light absorbed by them:
 (i) $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$ (ii) $[\text{Cr}(\text{en})_3]^{3+}$
 (iii) $[\text{Cr}(\text{CN})_6]^{3-}$ (iv) $[\text{Cr}(\text{NH}_3)_6]^{3+}$
 (A) $i < iii < iv < ii$ (B) $iii < ii < iv < i$
 (C) $ii < i < iv < iii$ (D) $i < ii < iv < iii$
- Identify the wrong statement among the following
 (A) AgCl is soluble in saturated solution of NaCl
 (B) AgI is soluble in saturated solution of KCN
 (C) AgI is soluble in saturated solution of NaCl
 (D) AgCl is soluble in saturated solution of KI forming insoluble AgI
- Lanthanide like contraction is most prominent in
 (A) 3d transition series (B) Lanthanide series
 (C) Actinide series (D) 4d transition series
- Consider the following options which are the correct experimental observations of $[\text{Ni}(\text{H}_2\text{O})_6]\text{SO}_4$. Which of the following is not possible to explain by valence bond theory
 (A) it has six metal-ligand coordinate bonds
 (B) geometry of Ni^{2+} complex is octahedral
 (C) total six Ni – O linkages are there
 (D) it is a green solution that becomes blue when reacted with excess $\text{NH}_3(\text{aq})$

(One or More Than One Options Correct Type)

This section contains **4 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 ion(s) maintain an identical d-orbital configuration while forming octahedral complexes with strong field as well as weak field ligands according to crystal field theory?
 (A) Fe^{2+} (B) Co^{2+} (C) Ni^{2+} (D) Zn^{2+}
- Which ions are oxidized by MnO_4^- ion in acidic medium?
 (A) Fe^{3+} (B) Pb^{2+} (C) SO_3^{2-} (D) HS^-

Space For Rough Work

7. Which of the following complex(es) exhibit(s) geometrical isomerism?
(A) $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$ (B) $[\text{Cr}(\text{NH}_3)_4(\text{CN})_2]\text{Cl}$
(C) $[\text{Pt}(\text{gly})_2]$ (D) $[\text{Cr}(\text{en})_3]^{3+}$
8. Reaction of FeCl_3 with H_2S produces
(A) Fe_2S_3 (B) FeCl_2 (C) S (D) HCl

(PART – B)

This section contains **Eight (08)** numerical based questions. The answer to each question is a NUMERICAL VALUE. If the numerical value has more than two decimal places, truncate/round-off the value to TWO decimal places.

1. The stable oxidation state of cerium is +x, what is the value of x?
2. How many of the following statements are correct?
(i) Mg^{2+} ion form more stable complex with EDTA as compared to Ca^{2+}
(ii) C_{60} contains 12-five membered rings
(iii) $\text{Fe}(\text{CO})_5$ has square pyramidal shape.
(iv) Lanthanum form stable hydroxide in +4 state
(v) $[\text{Cr}(\text{NH}_3)_6]^{3+}$ contains back $d\pi\text{-}p\pi$ bond
3. The formula of a complex is $\text{Fe}(\text{H}_2\text{O})_4(\text{CN})_2\text{Cl}$. What is the sum of the number of ionization and linkage isomers possible for the octahedral complex?
4. Find the number of compounds in which cation is oxidized by anion on heating FeSO_4 , NH_4NO_2 , NH_4NO_3 , $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$, NaN_3 , FeCl_3
5. In neutral or faintly alkaline medium permanganate oxidizes thiosulphate almost quantitatively to sulphate. The number of electrons involved in the oxidation of sulphur atom that is oxidized.
6. What is the effective atomic number of Nickel in $\text{Ni}(\text{CO})_4$?
[At No. of Ni = 28]
7. The magnetic moment to the nearest integer of the complex compound $[\text{Cr}(\text{H}_2\text{O})_6][\text{Cr}(\text{CN})_6]$ in which chromium atom in both cation and anion is in same oxidation state is
8. How many 3d atomic orbitals of manganese contain electrons of Mn in $[\text{Mn}(\text{CN})_6]^{4-}$ according to valence bond theory?

Space For Rough Work

SECTION – III: MATHEMATICS

(PART – 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**.

- The order and degree of the following differential equation $\left[1 + \left(\frac{dy}{dx}\right)^2\right]^{5/2} = \frac{d^3y}{dx^3}$ are respectively
 (A) 3, 2 (B) 3, 10 (C) 2, 3 (D) 3, 4
- Let $f(x)$ be a differentiable function satisfying $f'(x) = f(x)$ with $f(0) = 1$ and $g(x)$ satisfies $f(x) + g(x) = e^x(x+1)^2$. If $\int_0^1 f(x)g(x)dx = ae^2 + b$, then the value of $(a+b)$ is
 (A) 1 (B) 2 (C) 3 (D) 4
- If $[(\vec{a} \times \vec{b}) \times (\vec{b} \times \vec{c}) \quad (\vec{b} \times \vec{c}) \times (\vec{c} \times \vec{a}) \quad (\vec{c} \times \vec{a}) \times (\vec{a} \times \vec{b})] = m[\vec{a} \quad \vec{b} \quad \vec{c}]^n$ then $m+n =$
 (A) 0 (B) 1 (C) 2 (D) 4
- If $A(3, -2, -1)$, $B(1, 3, 4)$, $C(2, 1, -2)$, $O(0, 0, 0)$ distance of A from the plane of $\triangle OBC$ is
 (A) 0 (B) 1 (C) 2 (D) 3

(One or More Than One Options Correct Type)

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

- If $\vec{p} = a\hat{i} + b\hat{j} + c\hat{k}$ and $\vec{q} = b\hat{i} + c\hat{j} + a\hat{k}$ where a, b, c direction cosines of a line then angle between \vec{p} and \vec{q} can be
 (A) $\frac{\pi}{4}$ (B) $\frac{\pi}{3}$ (C) $\frac{4\pi}{3}$ (D) $\frac{2\pi}{3}$
- The solution of $\frac{dy}{dx} + x = xe^{(n-1)y}$ is:
 (A) $\frac{1}{n-1} \log\left(\frac{e^{(n-1)y} - 1}{e^{(n-1)y}}\right) = \frac{x^2}{2} + c$ (B) $e^{(n-1)y} = ce^{(n-1)y + (n-1)\frac{x^2}{2}} + 1$
 (C) $\log\left(\frac{e^{(n-1)y} - 1}{(n-1)e^{(n-1)y}}\right) = x^2 + c$ (D) $x^{(n-1)y} = ce^{(n-1)y\frac{2}{2+x}} + 1$

Space For Rough Work

7. Let $|\vec{a}| = |\vec{b}| = 2$ and $|\vec{c}| = 1$. Also $(\vec{a} - \vec{c}) \cdot (\vec{b} - \vec{c}) = 0$. Then
- (A) $|\vec{a} - \vec{b}|^2 + 2\vec{c} \cdot (\vec{a} + \vec{b}) = 7$ (B) $|\vec{a} + \vec{b} - \vec{c}|^2 = 7$
 (C) $|\vec{a} - \vec{b}|^2 + 2\vec{c} \cdot (\vec{a} + \vec{b}) = 10$ (D) $|\vec{a} + \vec{b} - \vec{c}|^2 = 8$
8. A curve $y = f(x)$ passes through (1, 1) and tangent at P (x, y) cuts the x – axis and y – axis at A and B respectively such that BP : AP = 3 : 1, then
- (A) Equation of curve is $x \frac{dy}{dx} - 3y = 0$ (B) Normal (1, 1) is $x + 3y = 4$
 (C) Curve passes through $\left(2, \frac{1}{8}\right)$ (D) Equation of curve is $x \frac{dy}{dx} + 3y = 0$

(PART – B)

This section contains **Eight (08)** numerical based questions. The answer to each question is a NUMERICAL VALUE. If the numerical value has more than two decimal places, truncate/round-off the value to TWO decimal places.

1. Let f be a real valued differentiable function on \mathbb{R} (the set of all real numbers) such that $f(1) = 1$. If the y – intercept of the tangent at any point P (x, y) on the curve $y = f(x)$ is equal to the cube of the abscissa of P, then the value of $f(-3)$ is equal to
2. Let $|\vec{a}| = \sqrt{3}$, $|\vec{b}| = 1$, $|\vec{c}| = 2$ and $\vec{a} \times (\vec{a} \times \vec{c}) + 3\vec{b} = \vec{0}$, then $|\vec{a} \times \vec{c}|^2$ equals
3. For the differential equation $y dx + y^2 dy = x dy$; $x \in \mathbb{R}$, $y > 0$, $y = y(x)$, $y(1) = 1$, then $y(-3)$ is
4. If \vec{a} and \vec{b} are two orthogonal vectors of equal magnitude such that $|3\vec{a} + 4\vec{b}| + |4\vec{a} - 3\vec{b}| = 20$, then the value of $|(\vec{a} \times \vec{b}) \times \vec{a}|$ is equal to
5. If points P, Q and R have position vectors $\vec{r}_1 = 3\hat{i} - 2\hat{j} - \hat{k}$, $\vec{r}_2 = \hat{i} + 3\hat{j} + 4\hat{k}$ and $\vec{r}_3 = 2\hat{i} + \hat{j} - 2\hat{k}$ respectively, relative to an origin O, then find the distance of P from the plane OQR.
6. The number of solution (s) of $y' = \frac{y+1}{x-1}$, $y(1) = 2$ is
7. If $\vec{a} = 2\hat{i} + 2\hat{j} + 4\hat{k}$, $\vec{b} = -\hat{i} + 2\hat{j} + \hat{k}$ and $\vec{c} = 3\hat{i} + \hat{j}$, then $\vec{a} + t\vec{b}$ is perpendicular to \vec{c} . If t is equal to
8. A vector \vec{a} has components $2p$ and 1 with respect to a rectangular Cartesian system. This system is rotated through a certain angle about the origin in the counter clockwise sense. If with respect to the new system, \vec{a} has components $p + 1$ and 1, then number of values of p is

Space For Rough Work

FIITJEE INTERNAL TEST

BATCHES – Two Year CRP(2426) Batches

Common Test – 6

Code: 101111

JEE ADVANCED

ANSWER KEY

ANSWER KEYS

Physics

PART – A

- | | | | |
|---------|-------|-------|-------|
| 1. D | 2. B | 3. B | 4. D |
| 5. ABCD | 6. AD | 7. BD | 8. CD |

PART – B

- | | | | |
|------|------|------|------|
| 1. 4 | 2. 9 | 3. 2 | 4. 9 |
| 5. 3 | 6. 6 | 7. 3 | 8. 2 |

Chemistry

PART – A

- | | | | |
|-------|-------|--------|--------|
| 1. B | 2. C | 3. C | 4. D |
| 5. CD | 6. CD | 7. ABC | 8. BCD |

PART – B

- | | | | |
|------|-------|------|------|
| 1. 4 | 2. 2 | 3. 5 | 4. 4 |
| 5. 8 | 6. 36 | 7. 7 | 8. 3 |

Mathematics

PART – A

- | | | | |
|--------|-------|-------|-------|
| 1. A | 2. A | 3. D | 4. D |
| 5. ABC | 6. AB | 7. BC | 8. CD |

PART – B

- | | | | |
|------|------|------|------|
| 1. 9 | 2. 3 | 3. 3 | 4. 8 |
| 5. 3 | 6. 0 | 7. 8 | 8. 2 |