PHYSICS, CHEMISTRY & MATHEMATICS

QP CODE: 101110   **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.

BATCHES – PANINI426-G1 & PANINI426XII-1

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 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 –** 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:** _____

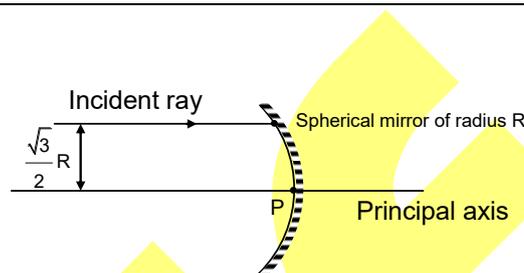**Enrolment Number:** _____

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. As situation shown in figure, the angle of deviation of the ray when the ray is moving away from the mirror

    (A) 120°

    (B) 90°

    (C) 180°

    (D) none of these

2. The resistivity of a semiconductor
    (A) increases as the temperature increases
    (B) decreases as the temperature increases
    (C) remains constant even when temperature varies
    (D) none of the above

3. A mirror of parabolic shape as shown in figure the equation of mirror surface is $y^2 = 8x$. An inclined ray of inclination 15° is incident on the mirror at a point (2, 4). The co-ordinate of the point of the intersection of x-axis and reflected ray will be

    (A) $4\sqrt{3} - 6$

    (B) $2 - \sqrt{3}$

    (C) 1

    (D) none of these
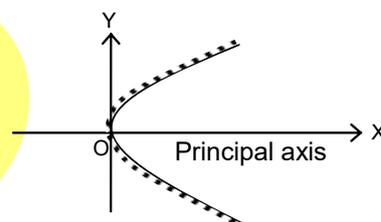
4. In N – type semiconductor:
    (A) electrons are majority carriers while holes are minority carriers
    (B) electrons are minority carriers while holes are majority carriers
    (C) both electrons as well as holes are majority carriers
    (D) both electrons as well as holes are minority carriers

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.   Which of the following may from a real image for the real object?
        (A) convex lens   (B) plano convex lens
        (C) convex mirror   (D) concave mirror

6.   Given figure gives a system of logical gates. From the study of truth table it can be found that to produce a high output (1) at R, we must have:
        (A) X = 0, Y = 1
        (B) X = 1, Y = 1
        (C) X = 1, Y = 0
        (D) X = 0, Y = 0
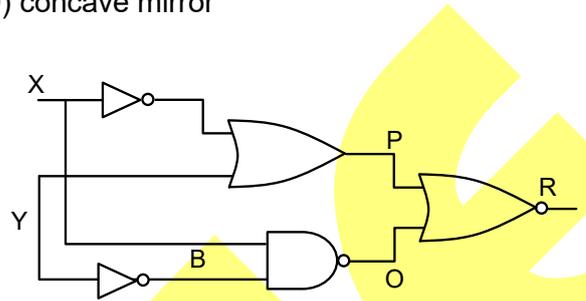
7.   If x–y plane is the reflecting surface and ray of light in the direction of $\hat{a}$ as shown in figure. Then the reflected ray will be represented by
        (A) $\hat{a} - 2(\hat{a} \cdot \hat{n})\hat{n}$, if normal $\hat{n}$ is along the $(-\hat{k})$
        (B) $\hat{a} - 2(\hat{a} \cdot \hat{n})\hat{n}$, if normal $\hat{n}$ is along the $(\hat{k})$
        (C) $\hat{a} + 2(\hat{a} \cdot \hat{n})\hat{n}$, if normal $\hat{n}$ is along the $(-\hat{k})$
        (D) $\hat{a} + 2(\hat{a} \cdot \hat{n})\hat{n}$, if normal $\hat{n}$ is along the $(\hat{k})$
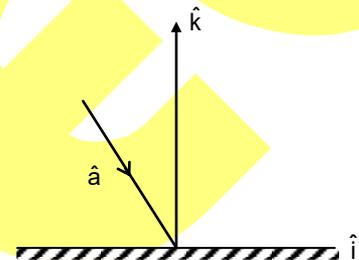

8.   A ball is projected with initial speed v at a distance 20 cm from pole of a concave mirror as shown in the figure. Speed of image can be
        (A) 2V
        (B) 3 V
        (C) 5 V
        (D) 10 V
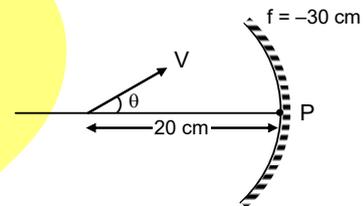
(PART – B)

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.   A ray of light from a denser medium strikes a rarer medium at angle of incidence i. The reflected and refracted rays make an angle of 90° with each other. If the angles of reflection and refraction are r & r′ respectively. If the critical angle is n sin⁻¹ tan i then find the value of 'n'.
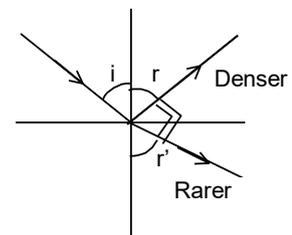

Space For Rough Work

2. If x and y be the distances of the object and image formed by a concave mirror from its focus and f be the focal length then $xy = f^n$ then find the value of 'n'.

3. The sun (diameter d) subtends an angle θ radians at the pole of a concave mirror of focal length f. If the diameter of the image of the sun formed by the mirror is $\theta^n f$ then find the value of 'n'.

4. A ray of light incident normally on face AB of an isosceles prism as shown in figure. The square of least value of the refractive index the prism must have
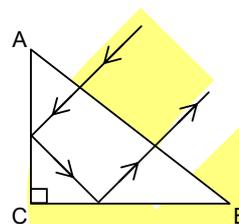
5. A concave mirror of focal length 10 cm and a convex mirror of focal length 15 cm are placed facing each other 40 cm apart. A point object is placed between the mirrors, on their common axis and 15 cm from the concave mirror. Find the distance (in cm) between image and convex mirror. If the image produced by the successive reflections, first at concave mirror and then at convex mirror.

6. A quarter cylinder of radius R and refractive index 1.5 is placed on two sides a table. A point object P is kept at a distance of mR from it. If the value of m for which a ray from P will emerge parallel to the table as shown in figure, is $\dfrac{x}{3}$, then x = (the distance between two half is 0.01 cm)
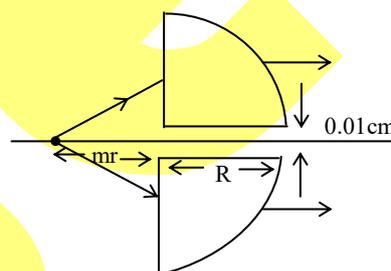
7. A vessel of height 10m is filled with a liquid of refractive index 3/2. Find the height upto which a liquid should be filled so that filled portion of vessel and empty portion seems of equal height.

8. A plane mirror of length 2 m is kept along the line y = -x as shown in the figure. An insect having velocity of $4\hat{i}$ cm/s is moving along the x-axis. The time span for which the insect can see its image is $\dfrac{100\sqrt{2}}{n}$ sec then 'n' is

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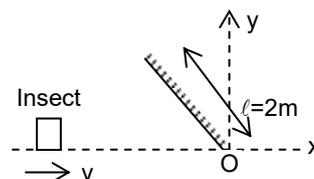
Space For Rough Work

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.**

1. Which of the following can acts as a antiseptic as well as disinfectants?
    (A) Phenol   (B) Iodine in alcohol   (C) Aspirin   (D) Furacine

2. Which d-orbitals of a metal ion form sigma bonds with ligands in octahedral complexes?
    (A) d_{xy}, d_{yz}, d_{xz} (B) d_{xz}, d_{yz}, d_{z^2} (C) $d_{x^2-y^2}$, d_{z^2} (D) d_{xy}, $d_{x^2-y^2}$

3. Which octahedral complex has non-zero dipole moment?
    (A) $[CrCl_6]^{3-}$ (B) $[Cr(H_2O)_6]^{3+}$ (C) $[Cr(OH)_6]^{3-}$ (D) $[Cr(CN)_6]^{3-}$

4. Transition elements form a large number of compounds because
    (A) they are good catalysts.
    (B) they exhibit a large number of oxidation states.
    (C) they do not attain the electronic configuration of their nearest noble gases in their compounds.
    (D) their powder form occupy a large surface area.

(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 correct statement(s) regarding complex $[Cu(NH_3)_4(H_2O)_2]^{2+}$ is/are
    (A) it shows geometrical isomerism.
    (B) the Cu-N bond is stronger than the Cu – O bond.
    (C) upon heating the initial products formed are $[Cu(NH_3)_4]^{2+}$ and H_2O.
    (D) if it is crystallized as the salt of SO_4^{2-} ions, the colour of crystal will change from blue to white.

6. Which of the following metal ion(s) contain(s) electron(s) in their e_g orbitals in their octahedral complex with strong field ligands?
    (A) Co^{2+} (B) Ni^{2+} (C) Cr^{3+} (D) Mn^{2+}

7. Which of the following is a narcotic analgesic drug?
    (A) Morphine   (B) Aspirin   (C) Valium   (D) Codein

8. The outermost orbit electronic configuration of Ce^{3+} is $4f^1$ and that of Tb^{3+} is $4f^8$. Choose the correct statement(s)
   (A) Ce^{3+} is a better oxidizing agent than a reducing agent
    (B) Tb^{3+} is a better reducing agent than oxidizing agent
    (C) Ce^{3+} can easily form Ce^{4+} than formation of Tb^{4+} by Tb^{3+}
    (D) Ce^{4+} is more stable than Tb^{4+} as for as electronic configuration is concerned

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. The d-orbital electronic configuration of a metal ion in it's octahedral chloro complex is $t_{2g}^4 e_g^2$. How many electrons will be present in the t_{2g} orbital of the metal ion in it's complex with CN^- ions with coordination number equal to six?

2. How many octahedral hydrate isomer(s) is/are possible with formula $CoCl_2Br6H_2O$?

3. How many of the following complex(es) has(ve) zero CFSE? (Assume all are weak ligand field complexes)
    $[Fe(H_2O)_6]^{3+}$, $[Ti(H_2O)_6]^{4+}$, $[Cr(H_2O)_6]^{3+}$, $[Co(H_2O)_6]^{4+}$, $[Zn(H_2O)_4]^{2+}$, $[CoCl_4]$, $[Fe(CN)_6]^{2-}$, $[Cu(CN)_4]^{3-}$, $[Cd(H_2O)_6]^{2+}$

4. According to crystal field theory the electronic configuration of a metal atom in it's octahedral carbonyl is $t_{2g}^6 e_g^2$. How many maximum number of electrons of the metal atom is/are engaged in back π-bonding with the ligand(from metal $\rightarrow$ ligand)?

5. The total number of asymmetric carbon atoms in steroidal hormone, testosterone is
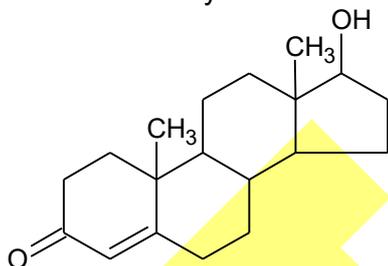
6. The structure of aspartame is given below

$$Ph-CH_2-\underset{\underset{COOCH_3}{|}}{CH}-NH-\overset{\overset{O}{||}}{C}-\underset{\underset{NH_2}{|}}{CH}-CH_2-COOH$$
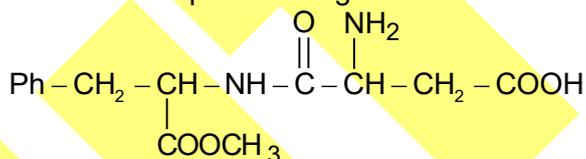
    If x = Number of dipolar ions formed by aspartame, considering stereoisomerism and
    y = Number of non-bonding electron pairs present in the dipolar structure, what is the value of (x + y)?

7. The number of chlorine atoms in bithionol is

8. The number of chiral centres in penicillin is

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.**

1. Consider Maximize $z = -2x - 3y$ subject to $\dfrac{x}{2} + \dfrac{y}{3} \le 1; \dfrac{x}{3} + \dfrac{y}{2} \le 1; x, y \ge 0$. The max. value of z is

    (A) 0   (B) 4   (C) 9   (D) 6

2. A variable plane forms a tetrahedron of constant volume $64K^3$ with the coordinate planes and the origin, then locus of the centroid of the tetrahedron is

    (A) $x^3 + y^3 + z^3 = 6K^2$ (B) $xyz = 6k^3$

    (C) $x^2 + y^2 + z^2 = 4K^2$ (D) $x^{-2} + y^{-2} + z^{-2} = 4k^{-2}$

3. The equation of the plane containing the line $\dfrac{x+1}{-3} = \dfrac{y-3}{2} = \dfrac{z+2}{1}$ and the point (0, 7, –7) is

    (A) $x + y + z = 1$ (B) $x + y + z = 2$

    (C) $x + y + z = 0$ (D) none of these

4. Let L be the line of intersection of the plane $2x + 3y + z = 1$ and $x + 3y + 2z = 2$. If L makes an angle α with the positive x – axis, then $\cos \alpha$ equals

    (A) $\dfrac{1}{\sqrt{3}}$ (B) $\dfrac{1}{2}$ (C) 1   (D) $\dfrac{1}{\sqrt{2}}$

(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. Let $\vec{a}, \vec{b}, \vec{c}$ be three vectors such that $\vec{a}.\vec{a} = \vec{b}.\vec{b} = \vec{c}.\vec{c} = 3$ and

    $\left|\vec{a} + \vec{b} - \vec{c}\right|^2 + \left|\vec{b} + \vec{c} - \vec{a}\right|^2 + \left|\vec{c} + \vec{a} - \vec{b}\right|^2 = 36$, then

    (A) $\vec{a}.\vec{b} + \vec{b}.\vec{c} + \vec{c}.\vec{a} = \dfrac{-9}{2}$ (B) $\vec{a}, \vec{b}, \vec{c}$ are coplanar vectors

    (C) $\vec{a} \times \vec{b} = \vec{b} \times \vec{c} = \vec{c} \times \vec{a} \ne 0$ (D) $\vec{a}, \vec{b}, \vec{c}$ represent the sides of triangle

Space For Rough Work

6.   If $\vec{a} = x\hat{i} + y\hat{j} + z\hat{k}, \vec{b} = y\hat{i} + z\hat{j} + x\hat{k}$ and $\vec{c} = z\hat{i} + x\hat{j} + y\hat{k}$ then $\vec{a} \times (\vec{b} \times \vec{c})$ is:

(A) parallel to $(y - z)\hat{i} + (z - x)\hat{j} + (x - y)\hat{k}$

(B) orthogonal to $\hat{i} + \hat{j} + \hat{k}$

(C) orthogonal to $(y + z)\hat{i} + (z + x)\hat{j} + (x + y)\hat{k}$

(D) orthogonal to $x\hat{i} + y\hat{j} + z\hat{k}$

7.   The equation of a plane bisecting the angle between the plane $2x - y + 2z + 3 = 0$ and $3x - 2y + 6z + 8 = 0$ is
(A) $5x - y - 4z - 45 = 0$ (B) $5x - y - 4z - 3 = 0$
(C) $23x - 13y + 32z + 45 = 0$ (D) $23x - 13y + 32z + 5 = 0$

8.   A line ℓ passing through the origin is perpendicular to the lines
$\ell_1 : (3 + t)\hat{i} + (-1 + 2t)\hat{j} + (4 + 2t)\hat{k}, -\infty < t < \infty$
$\ell_2 : (3 + 2s)\hat{i} + (3 + 2s)\hat{j} + (2 + s)\hat{k}, -\infty < s < \infty$
Then, the coordinate(s) of the point(s) on ℓ_2 at a distance of $\sqrt{17}$ from the point of intersection of ℓ and ℓ_1 is (are)

(A) $\left(\dfrac{7}{3}, \dfrac{7}{3}, \dfrac{5}{3}\right)$ (B) $(-1, -1, 0)$ (C) $(1, 1, 1)$ (D) $\left(\dfrac{7}{9}, \dfrac{7}{9}, \dfrac{8}{9}\right)$

(**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.   A whole sale merchant wants to start the business of cereal with Rs. 24000. Wheat is Rs. 400 per quintal and rice is Rs. 600 per quintal. He has capacity to store 200 quintal cereal. He earns the profit Rs. 25 per quintal on wheat and Rs. 40 per quintal on rice. If he stores x quintal rice and y quintal wheat, then for maximum profit, the objective function is $ax + by$ then the value of $a - b$ is _____

2.   Two lines $L_1 : x = 5, \dfrac{y}{3 - \alpha} = \dfrac{z}{-2}$ and $L_2 = x = \alpha, \dfrac{y}{-1} = \dfrac{z}{2 - \alpha}$ are coplanar. Then sum of values that α can take is

3.   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

Space For Rough Work

4.   If $\left|\vec{a}\right| = \left|\vec{b}\right| = \left|\vec{c}\right| = 2$ and $\vec{a}.\vec{b} = \vec{b}.\vec{c} = \vec{c}.\vec{a} = 2$, then $\left[\vec{a}\ \ \vec{b}\ \ \vec{c}\right]\cos 45^{\circ}$ is equal to

5.   If $\vec{a}$ and $\vec{b}$ are two orthogonal vectors of equal magnitude such that $\left|3\vec{a} + 4\vec{b}\right| + \left|4\vec{a} - 3\vec{b}\right| = 20$, then the value of $\left|\left(\vec{a} \times \vec{b}\right) \times \vec{a}\right|$ is equal to

6.   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.

7.   The number of real values of k for which the lines $\dfrac{x}{1} = \dfrac{y-1}{k} = \dfrac{z}{-1}$ and $\dfrac{x-k}{2k} = \dfrac{y-k}{3k-1} = \dfrac{z-2}{k}$ are coplanar, is

8.   Let $\vec{a} = -\hat{i} + \hat{j} + \hat{k}$ and $\vec{b} = 2\hat{i} + \hat{k}$, and vector $\vec{c}$ satisfying the conditions
      (i) vector $\vec{c}$ is a coplanar with $\vec{a}$ and $\vec{b}$
      (ii) vector $\vec{c}$ is perpendicular to $\vec{b}$ and
      (iii) $\vec{a}.\vec{c} = 7$
      Find the value of $2\left|\vec{c}\right|^2$.

Space For Rough Work

FIITJEE INTERNAL TEST

BATCHES – PANINI426-G1 & PANINI426XII-1

Common Test – 6
Code: 101110
JEE ADVANCED
ANSWER KEY

ANSWER KEYS

Physics

PART – A

1.	C	2.	B	3.	A	4.	A
5.	ABD	6.	C	7.	AB	8.	BC

PART – B

1.	1	2.	2	3.	1	4.	2
5.	6	6.	4	7.	6	8.	2

Chemistry

PART – A

1.	A	2.	C	3.	C	4.	B
5.	ABC	6.	AB	7.	AD	8.	BCD

PART – B

1.	6	2.	6	3.	7	4.	6
5.	6	6.	16	7.	4	8.	3

Mathematics

PART – A

1.	A	2.	B	3.	C	4.	A
5.	ABCD	6.	ABCD	7.	BC	8.	BD

PART – B

1.	15	2.	5	3.	3	4.	4
5.	8	6.	3	7.	1	8.	35